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DEDICATION AND ACKNOWLEDGMENTS

This book is dedicated to Jackson L. Cartter, Edgar E. Hartwig, Richard L. Bernard, Reid T. Milner; and to all of America’s early soybean breeders, geneticists, and soybean disease specialists.

Part of the enjoyment of writing a book lies in meeting people from around the world who share a common interest, and in learning from them what is often the knowledge or skills acquired during a lifetime of devoted research or practice. We wish to give deepest thanks...

Of the many libraries and librarians who have been of great help to our research over the years, several stand out:

University of California at Berkeley: John Creaser, Lois Farrell, Norma Kobzina, Ingrid Radkey.

Northern Regional Library Facility (NRLF), Richmond, California: Martha Lucero, Jutta Wiemhoff, Scott Miller, Virginia Moon, Kay Loughman.

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National Agricultural Library: Susan Chapman, Kay Derr, Carol Ditzler, John Forbes, Winnifred Gelenter, Henry Gilbert, Kim Hicks, Ellen Knollman, Patricia Krug, Sarah Lee, Veronica Lefebvre, Julie Mangin, Ellen Mann, Josephine McDowell, Wayne Olson, Mike Thompson, Tanner Wray.


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We would also like to thank our co-workers and friends at Soyinfo Center who, since 1984, have played a major role in collecting the documents, building the library, and producing the SoyaScan database from which this book is printed:

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Special thanks to: Tom and Linda Wolfe of Berwyn Park, Maryland; to Lorenz K. Schaller of Ojai, California; and to Wayne Dawson (genealogist) of Tucson, Arizona.

For outstanding help on this Regional Soybean Laboratory book we thank: Richard L. Bernard, Jackson L. Cartter, R.W. Howell, Ted Hymowitz, and Martin G. Weiss.

Finally our deepest thanks to Tony Cooper of San Ramon, California, who has kept our computers up and running since Sept. 1983. Without Tony, this series of books on the Web would not have been possible.

This book, no doubt and alas, has its share of errors. These, of course, are solely the responsibility of William Shurtleff.

This bibliography and sourcebook was written with the hope that someone will write a detailed and well-documented history of this subject.
INTRODUCTION

Brief chronology/timeline of the U.S. Regional Soybean Industrial Products Laboratory (Urbana, Illinois)

The U.S. Regional Soybean Laboratory pioneered in soybean breeding and cooperative uniform testing to produce improved soybean varieties in the United States. Most of this work took place during World War II when the U.S. relied on the soybean to replace imported oils and fats that were no longer available.

The laboratory learned how to gradually increase the oil content of its best soybean varieties through breeding. Since soybeans are sensitive to photoperiod, cooperative testing was used as a new, precise tool to identify which varieties gave the best soybean yields in which geographical areas. The Laboratory developed the modern basic concept of “Maturity Groups.”

By studying new soybean diseases, in part the result of intensive soybean cultivation, disease specialists worked with soybean breeders to find varieties that were resistant to these diseases, and to breed this resistance into new varieties. The result was a steady stream, year after year, of improved soybean varieties for both northeast and the southern U.S. states.

1933 March 4 – Henry A. Wallace (D), Iowa, becomes U.S. Secretary of Agriculture under President Franklin D. Roosevelt (1933-1945).

1935 June 29 – The Bankhead-Jones Act is enacted during the Great Depression. Also known as the Agricultural Research Act, it was: “An Act to provide for research into basic laws and principles relating to agriculture and to provide for the further development of cooperative agricultural extension work and the more complete endowment and support of land-grant colleges.”

1936 Feb. 7 – U.S. Regional Soybean Industrial Products Laboratory is founded at a meeting in Chicago, Illinois; it will be located at the University of Illinois, Urbana, Illinois using funds from the Bankhead-Jones Act. It is the third of a series of laboratories initiated under the Bankhead-Jones Act.

The Soybean Laboratory as originally set up was a cooperation between the Bureau of Plant Industry, Soils, and Agricultural Engineering; the Bureau of Agricultural and Industrial Chemistry; and the experiment stations of the 12 states of the North Central region.

It is divided into two main groups: the Analytical (also called industrial utilization or chemical research) and the Agronomic division. Its mission is to do the first organized U.S. research on industrial uses of soybeans. Housed in the “Old Agricultural Building” at the University of Illinois, it is formed by a formal cooperative agreement between USDA and 12 state agricultural experiment stations and agricultural colleges from the North Central Region. William Morse had encouraged this type of cooperative program for many years. Before 1936 (starting in about 1905 in Nebraska) “cooperative work” or “cooperative experiments” generally referred to an agricultural experiment station sending soybean varieties and growing instructions to applicants in its state, together with a form that the station asked the farmers to fill out and send back after they had harvested the different varieties. After 1936, the soybean varieties were sent to many more farmers in all of the cooperating states (Cartter.1947. Soybean Digest. Aug. p. 12-14, 17).

1936 April 26 – Inaugural meeting of the “Regional Soybean Industrial Products Laboratory” on 22 April 1936, is held at the University of Illinois, Urbana, Illinois.

1936 July 1 – The systematic research program begins at the Regional Soybean Laboratory (Nation’s Business. Sept., p. 24-26, 94).

“Work during the first few years was devoted to fundamental studies on the methods of breeding soybeans and on exploring the factors affecting accuracy of nursery trials” (Cartter.1947. Soybean Digest. Aug. p. 12-14, 17).

1936 – Jackson L. Cartter is made head of the agronomic section of the U.S. Regional Soybean Industrial Products Laboratory, Urbana, Illinois, where he supervises agronomic, physiologic, and genetic studies of the soybean in 12 North Central states (Soybean Digest. Jan. 1946. p. 26).

1940 Sept. 5 – Claude R. Wickard (D), Indiana, becomes U.S. Secretary of Agriculture under President Franklin D. Roosevelt (1933-1945).

1940 Dec. 16 – The Northern Regional Research Laboratory begins operation at Peoria, Illinois. It was established in 1938 as part of the Agricultural Adjustment Act (AAA, spearheaded by Franklin D. Roosevelt and Henry A. Wallace as part of the New Deal). The AAA called for the establishment of four regional research laboratories to develop new uses and new markets for farm crops. For the next 75+ years the NRRL in Peoria is deeply involved with important research on soybeans and soyfoods (including tofu, tempeh and miso).

1942 July 1 – The analytical (also called industrial utilization or chemical research) division, one of two departments of the Regional Soybean Industrial Products Laboratory at Urbana, Illinois, is moved to the NRRL at Peoria. But the agronomic (breeding and culture) division of the USDA experiments is to remain at its present location in Urbana with its field of work greatly expanded. It is under the USDA Bureau of Plant Industry.

As a result of this change the U.S. Regional Soybean Laboratory at Urbana was able to extend the cooperative breeding and research studies to the agricultural experiment stations of 12 Southern States (Lambert 1947, p. 5).

The uniform variety tests have been conducted by the State agricultural experiment stations in Ohio, Indiana, Illinois, Iowa, and Missouri since the beginning of the cooperative program in 1936, and all of the North Central States have cooperated in this work since 1942 (Lambert 1947, p. 5).

1942 – Jackson L. Cartter is appointed Agronomist in charge at the U.S. Regional Soybean Industrial Products Laboratory (Urbana).

1943 – “The southern soybean program conducted in cooperation with the U.S. Regional Soybean Laboratory and the 12 Southern States began with the 1943 growing season” (RSLM No. 133, April 1946).

1942-1946 – The modern concept of a “maturity group” and of the designation of maturity groups as 0 to VIII etc. evolves out of the cooperative work of the U.S. Regional Soybean Industrial Products Laboratory. The actual term “maturity groups” is first used in Feb. 1946 in RSLM No. 131.

1942-1943 – “The greatly increased demand for vegetable oils because of wartime needs resulted in the expansion of the research facilities of the U.S. Regional Soybean Laboratory during the winter of 1942-43 to include in the cooperative soybean program the 12 southern states along with the original 12 states of the North Central region.

Headquarters for the southern region are located at the Delta Branch Experiment Station at Stoneville, Mississippi (Henson 1945, p. 47, 60; Henson & Carr, 1946, p. 3).

1943 Feb. 13 – The Bureau of Agricultural and Industrial Chemistry is established pursuant to Executive Order 9069 to include the four regional research laboratories and some divisions of the former Bureau of Agricultural Chemistry and Engineering (Baker 1963, p. 471).

1943 – The soybean variety Lincoln is released jointly by the University of Illinois, USDA, and several other universities. It “was the first variety to be cooperatively released under the agreement of 1936” (Howell 1984).

Other important varieties developed by the cooperative breeding and testing program include Hawkeye, Earlyana, Adams, Monroe, and many others (Soybean News. 1949. Dec., p. 4).

1943 – The early breeding work of the Regional Soybean Laboratory has already resulted in the development of such varieties as Dunfield, Illini, Manchu, Richland, and many others.

“Most of the crosses that are being developed through the cooperative program are made at four or five breeding centers and the better of the segregating plant populations are distributed in an early stage to all the interested experiment stations so that further selection can be done in the area for which the strains are being developed (Cartter 1947, p. 12).

1944 – Funds are made available by Congress for research on soybean diseases, through the USDA Bureau of Plant Industry. This happened largely because of the lobbying efforts of soybean producers and crushers (Cartter 1947, p. 14).

1945 June 30 – Clinton P. Anderson (D), New Mexico, becomes U.S. Secretary of Agriculture under President Harry S. Truman (1945-1953).

1946 Aug. 14 – The federal Research and Marketing Act becomes law making new and greatly expanded funds
available to USDA, especially for marketing research. Some is allocated to basic research on improving the flavor stability of soybean oil. Some is used to study potential markets for soybeans and soy products in Europe.


1948 – Dr. Edgar E. Hartwig assumes the role of coordinator of the soybean testing and evaluation program in the South (Soybean Digest. 1971. July, p. 15).

1949 – The USDA germ plasm/germplasm collection opens at The U.S. Regional Soybean Industrial Products Laboratory (Urbana, Illinois), however it was being assembled for the past 5-10 years by Jackson L. Cartter and L.F. Williams of the Soybean Lab. It began with a collection soybean introductions (largely from East Asia) and selections to serve as a foundation stock. In 1951 Edgar E. Hartwig became curator of the southern soybean germplasm collection located at Stoneville, Mississippi (Bernard et al. 1987, p. 1; Hymowitz 1998, interview).


He was a member of the Council of Twelve of the Church of Jesus Christ of the Latter-day Saints (Mormon) at the time he was appointed.

1954 – Herbert Johnson says that this rapid expansion in soybean production created new problems with diseases and insects, cultural and fertilization practices, and varieties, and our research effort has not kept pace with the increase in production problems.

1954 – Herbert W. Johnson takes over as leader of Soybean Investigations at USDA after Martin G. Weiss retires. He continued in this position until 1964. Next to Wm. Morse, Herbert Johnson “probably had the greatest influence on the development of soybean research.” During this period “the soybean cyst nematode was found for the first time in the United States, the first disease-resistant soybean varieties were developed, and a significant increase in the size and scope of soybean research staffs occurred, including the beginnings of the major increase in research on soybean physiology” (Howell 1984, p. 129).

1961 Jan. 21 – Orville L. Freeman (D), Minnesota, becomes U.S. Secretary of Agriculture under President John F. Kennedy (1961-1963) and then under Lyndon B. Johnson (1963-1969).

1961 Oct. – An article by Robert W. Howell and Richard L. Bernard, in the Sept/Oct. issue of Crop Science (p. 311-13), states: This is: “Publication No. 351 of the U.S. Regional Soybean Laboratory, Urbana, Illinois.” Both authors are soybean scientists at this very important laboratory.

1964 – Twenty scientists are now located in 8 states engaged in soybean production investigations in the USDA. Dr. Robert W. Howell (Urbana, Illinois) has been named leader of soybean investigations for the Crops Research Division, of USDA's Agricultural Research Service; a plant physiologist, he succeeds Herbert W. Johnson.

1967 – Soybeans are now the No. 1 U.S. cash crop. This could never have happened without ongoing help from the USDA, and State agricultural colleges and their experiment stations (Simerl 1967, p. 12-13).


The Uniform Soybean Test reports continue (to the present) but they do not mention the U.S. Regional Soybean Lab. They are organized and published by the USDA.


We wonder what happened to all the RSLM numbers between No. 251 and No. 775.

1980s early – At about this time the U.S. Regional Soybean Industrial Products Laboratory (Urbana, Illinois) ceased to exist, but it was never formally closed. Much of the work was transferred to the University of Ohio. At this time, Dr. Richard Bernard salvaged many of the files, and stored them at the University of Illinois South Farm (Bernard 1997, interview).
ABOUT THIS BOOK

This is the most comprehensive book ever published about the history of the U.S. Regional Soybean Laboratory. It has been compiled, one record at a time over a period of 35 years, in an attempt to document the history of this ancient and interesting food. It is also the single most current and useful source of information on this subject.

This is one of more than 100 books compiled by William Shurtleff and Akiko Aoyagi, and published by the Soyinfo Center. It is based on historical principles, listing all known documents and commercial products in chronological order. It features detailed information on:

- 37 different document types, both published and unpublished.
- 640 published documents - extensively annotated bibliography. Every known publication on the subject in every language.
- 50 unpublished archival documents.
- 13 original Soyinfo Center interviews and overviews never before published, except perhaps in our books.

Thus, it is a powerful tool for understanding the development of this subject from its earliest beginnings to the present.

Each bibliographic record in this book contains (in addition to the typical author, date, title, volume and pages information) the author’s address, number of references cited, original title of all non-English language publications together with an English translation of the title, month and issue of publication, and the first author’s first name (if given). For most books, we state if it is illustrated, whether or not it has an index, and the height in centimeters.

All of the graphics (labels, ads, leaflets, etc) displayed in this book are on file, organized by subject, chronologically, in the Soyinfo Center’s Graphics Collection.

For commercial soy products (CSP), each record includes (if possible) the product name, date of introduction, manufacturer’s name, address and phone number, and (in many cases) ingredients, weight, packaging and price, storage requirements, nutritional composition, and a description of the label. Sources of additional information on each product (such as advertisements, articles, patents, etc.) are also given.

A complete subject/geographical index is also included.
ABBREVIATIONS USED IN THIS BOOK

A&M = Agricultural and Mechanical
Agric. = Agricultural or Agriculture
Agric. Exp. Station = Agricultural Experiment Station
ARS = Agricultural Research Service
ASA = American Soybean Association
Assoc. = Association, Associate
Asst. = Assistant
Aug. = August
Ave. = Avenue
Blvd. = Boulevard
bu = bushel(s)
ca. = about (circa)
cc = cubic centimeter(s)
Chap. = Chapter
cm = centimeter(s)
Co. = company
Corp. = Corporation
Dec. = December
Dep. or Dept. = Department
Depts. = Departments
Div. = Division
Dr. = Drive
E. = East
ed. = edition or editor
e.g. = for example
Exp. = Experiment
Feb. = February
fl oz = fluid ounce(s)
ft = foot or feet
gm = gram(s)
ha = hectare(s)
i.e. = in other words
Inc. = Incorporated
incl. = including
Illustr. = Illustrated or Illustration(s)
Inst. = Institute
J. = Journal
J. of the American Oil Chemists’ Soc. = Journal of the American Oil Chemists’ Society
Jan. = January
kg = kilogram(s)
km = kilometer(s)
Lab. = Laboratory
Labs. = Laboratories
lb = pound(s)
Ltd. = Limited
mcg = microgram(s)
mg = milligram(s)
ml = milliliter(s)
mm = millimeter(s)
N. = North
No. = number or North
Nov. = November
Oct. = October
oz = ounce(s)
p. = page(s)
photo(s) = photograph(s)
P.O. Box = Post Office Box
Prof. = Professor
psi = pounds per square inch
R&D = Research and Development
Rd. = Road
Rev. = Revised
RPM = revolutions per minute
S. = South
SANA = Soyfoods Association of North America
Sept. = September
St. = Street
tonnes = metric tons
trans. = translator(s)
Univ. = University
USB = United Soybean Board
USDA = United States Department of Agriculture
Vol. = volume
V.P. = Vice President
°C = degrees Celsius (Centigrade)
°F = degrees Fahrenheit
>= greater than, more than
<= less than
HOW TO MAKE THE BEST USE OF THIS DIGITAL BOOK - THREE KEYS

1. Read the Introduction and Chronology/Timeline located near the beginning of the book; it contains highlights and a summary of the book.

2. Search the book. The KEY to using this digital book, which is in PDF format, is to SEARCH IT using Adobe Acrobat Reader: For those few who do not have it, Google: Acrobat Reader - then select the free download for your type of computer.

Click on the link to this book and wait for the book to load completely and the hourglass by the cursor to disappear (4-6 minutes).

Type [Ctrl+F] to “Find.” A white search box will appear near the top right of your screen.
Type in your search term, such as Carter or North Carolina.
You will be told how many times this term appears, then the first one will be highlighted.
To go to the next occurrence, click the down arrow, etc.

3. Use the indexes, located at the end of the book. Suppose you are looking for all records about tofu. These can appear in the text under a variety of different names: bean curd, tahu, doufu, to-fu, etc. Yet all of these will appear (by record number) under the word “Tofu” in the index. See “How to Use the Index,” below. Also:

Chronological Order: The publications and products in this book are listed with the earliest first and the most recent last. Within each year, references are sorted alphabetically by author. If you are interested in only current information, start reading at the back, just before the indexes.

A Reference Book: Like an encyclopedia or any other reference book, this work is meant to be searched first - to find exactly the information you are looking for - and then to be read.

How to Use the Index: A subject and country index is located at the back of this book. It will help you to go directly to the specific information that interests you. Browse through it briefly to familiarize yourself with its contents and format.

Each record in the book has been assigned a sequential number, starting with 1 for the first/earliest reference. It is this number, not the page number, to which the indexes refer. A publication will typically be listed in each index in more than one place, and major documents may have 30-40 subject index entries. Thus a publication about the nutritional value of tofu and soymilk in India would be indexed under at least four headings in the subject and country index: Nutrition, Tofu, Soymilk, and Asia, South: India.

Note the extensive use of cross references to help you: e.g. “Bean curd. See Tofu.”

Countries and States/Provinces: Every record contains a country keyword. Most USA and Canadian records also contain a state or province keyword, indexed at “U.S. States” or “Canadian Provinces and Territories” respectively. All countries are indexed under their region or continent. Thus for Egypt, look under Africa: Egypt, and not under Egypt. For Brazil, see the entry at Latin America, South America: Brazil. For India, see Asia, South: India. For Australia see Oceania: Australia.

Most Important Documents: Look in the Index under “Important Documents -.”

Organizations: Many of the larger, more innovative, or pioneering soy-related companies appear in the subject index – companies like ADM / Archer Daniels Midland Co., AGP, Cargill, DuPont, Kikkoman, Monsanto, Tofutti, etc. Worldwide, we index many major soybean crushers, tofu makers, soymilk and soymilk equipment manufacturers, soyfoods companies with various products, Seventh-day Adventist food companies, soy protein makers (including pioneers), soy sauce manufacturers, soy ice cream, tempeh, soy nut, soy flour companies, etc.


Soyfoods: Look under the most common name: Tofu, Miso, Soymilk, Soy Ice Cream, Soy Cheese, Soy Yogurt, Soy Flour, Green Vegetable Soybeans, or Whole Dry Soybeans. But note: Soy Proteins: Isolates, Soy Proteins: Textured Products, etc.

Industrial (Non-Food) Uses of Soybeans: Look under “Industrial Uses ...” for more than 17 subject headings.
Pioneers - Individuals: Laszlo Berczeller, Henry Ford, Friedrich Haberlandt, Artemy A. Horvath, Englebert Kaempfer, Mildred Lager, William J. Morse, etc. Soy-Related Movements: Soyfoods Movement, Vegetarianism, Health and Dietary Reform Movements (esp. 1830-1930s), Health Foods Movement (1920s-1960s), Animal Welfare/Rights. These are indexed under the person’s last name or movement name.

Nutrition: All subjects related to soybean nutrition (protein quality, minerals, antinutritional factors, etc.) are indexed under Nutrition, in one of more than 70 subcategories.

Soybean Production: All subjects related to growing, marketing, and trading soybeans are indexed under Soybean Production, e.g., Soybean Production: Nitrogen Fixation, or Soybean Production: Plant Protection, or Soybean Production: Variety Development.

Other Special Index Headings: Browsing through the subject index will show you many more interesting subject headings, such as Industry and Market Statistics, Information (incl. computers, databases, libraries), Standards, Bibliographies (works containing more than 50 references), and History (soy-related).

Commercial Soy Products (CSP): See “About This Book.”

SoyaScan Notes: This is a term we have created exclusively for use with this database. A SoyaScan Notes Interview contains all the important material in short interviews conducted and transcribed by William Shurtleff. This material has not been published in any other source. Longer interviews are designated as such, and listed as unpublished manuscripts. A transcript of each can be ordered from Soyinfo Center Library. A SoyaScan Notes Summary is a summary by William Shurtleff of existing information on one subject.

“Note:” When this term is used in a record’s summary, it indicates that the information which follows it has been added by the producer of this database.

Asterisks at End of Individual References:
1. An asterisk (*) at the end of a record means that Soyinfo Center does not own that document. Lack of an asterisk means that Soyinfo Center owns all or part of the document.
2. An asterisk after eng (eng*) means that Soyinfo Center has done a partial or complete translation into English of that document.
3. An asterisk in a listing of the number of references [23* ref] means that most of these references are not about soybeans or soyfoods.

Documents Owned by Soyinfo Center: Lack of an * (asterisk) at the end of a reference indicates that the Soyinfo Center Library owns all or part of that document. We own roughly three fourths of the documents listed. Photocopies of hard-to-find documents or those without copyright protection can be ordered for a fee. Please contact us for details.

Document Types: The SoyaScan database contains 135+ different types of documents, both published (books, journal articles, patents, annual reports, theses, catalogs, news releases, videos, etc.) and unpublished (interviews, unpublished manuscripts, letters, summaries, etc.).

Customized Database Searches: This book was printed from SoyaScan, a large computerized database produced by the Soyinfo Center. Customized/personalized reports are “The Perfect Book,” containing exactly the information you need on any subject you can define, and they are now just a phone call away. For example: Current statistics on tofu and soymilk production and sales in England, France, and Germany. Or soybean varietal development and genetic research in Third World countries before 1970. Or details on all tofu cheesecakes and dressings ever made. You name it, we’ve got it. For fast results, call us now!

BIBLIO: The software program used to produce this book and the SoyaScan database, and to computerize the Soyinfo Center Library is named BIBLIO. Based on Advanced Revelation, it was developed by Soyinfo Center, Tony Cooper and John Ladd.

History of Soybeans and Soyfoods: Many of our digital books have a corresponding chapter in our forthcoming scholarly work titled History of Soybeans and Soyfoods (4 volumes). Manuscript chapters from that book are now available, free of charge, on our website, www.soyinfocenter.com and many finished chapters are available free of charge in PDF format on our website and on Google Books.

About the Soyinfo Center: An overview of our publications, computerized databases, services, and history is given on our website.

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IMPROVEMENT and INDUSTRIAL UTILIZATION of SOYBEANS

Research under the Soybean Laboratory Program

Miscellaneous Publication No. 623

U. S. DEPARTMENT OF AGRICULTURE
The Delta Experiment Station at Stoneville, Miss., where the breeding work of the Southeastern states is centered.
HISTORY OF U.S. REGIONAL SOYBEAN LABORATORY


   • Summary: “I am asking you to serve as a committee–upon which I expect to serve ex officio whenever possible—to prepare for the Executive Committee of the Experiment Station a reply to a letter received from Mr. [James T.] Jardine, Chief of the Office of Experiment Stations, a copy of which is attached.

   “Because of the numerous proposals already in the hands of the United States Department of Agriculture, it will be desirable for the committee to act as promptly as possible and without attempt to go into minute details. Your cooperation in this matter will be greatly appreciated.

   “P.S. For the information of the committee I might explain that Mr. Jardine’s letter is in answer to a letter which the Director of the Experiment Station sent to Secretary Wallace, requesting the establishment of a regional soybean research laboratory. H.W.M. cc Executive Committee” [of the experiment station].

   Note 1. This is the earliest document seen (Feb. 2017) concerning the U.S. Regional Soybean Industrial Products Laboratory (although that exact term is not used; established in March 1936, Urbana, Illinois).


   Note 2. James T. Jardine (lived 1881-1954) was director of the Oregon Agricultural Experiment Station just before becoming chief of USDA’s Office of Experiment Stations. His brother, William M. Jardine of Kansas, was secretary of agriculture (1925-29) under President Calvin Coolidge.

   Address: Dean, College of Agriculture, Univ. of Illinois.


   • Summary: “This is just a personal note regarding the report of the Committee on the establishment of a Regional Soybean Research Laboratory at the University of Illinois. In this respect we want to pay tribute to Dr. H.H. Mitchell and Doctor Sybil Woodruff in the preparation of the material. I have never had any question about our (Footnote: The entire staff) ability to cooperate, but am more confident than ever that we can carry out such a project as a regional soybean laboratory in the most satisfactory and enjoyable fashion.

   “Doctor L.H. Smith has worked with the Committee. He has been very helpful and I would like to recognize his assistance in this sort message to you.”


   • Summary: The cover letter states: “We are submitting, herewith, the report of the Committee on the Proposed Regional Soybean Research Laboratory.

   “This report has been revised in accordance with your suggestions and I think now it is ready for your further consideration.

   “Doctor Mitchell emphasizes the importance of calling attention to the use of the money which is accumulating. It is important that we arrange our budget so that we can use this little extra fund for supplies and equipment, and some wages if possible.”


   “Your committee appointed to consider a proposed research program for a Regional Soybean Research Laboratory at the University of Illinois wishes to present its report for consideration. A preliminary statement in the way of an introduction is first presented. This is followed by Part One which deals with a full-rounded, coordinated program on soybean research under the title of ‘A comprehensive soybean research program.’ This part is organized under the following sections:

   “I. Production and breeding. II. Physiology and pathology. III. Chemistry. IV. Utilization as feed and food. V. Technology. VI. Economic aspects.

   “The committee had no thought that all these phases could be attacked immediately, but a full outline is presented in order to give a clear picture of a full-rounded research program on soybeans.

   “Part Two is entitled ‘Proposals for the first year’s work of the regional soybean research laboratory’”


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• **Summary:** “Doctor Knight, Chief of the Bureau of Chemistry and Soils of the U.S. Department of Agriculture, Doctor Jardine, Chief of the Office of Experiment Stations, and Mr. Richey, Chief of the Bureau of Plant Industry have asked the directors of the Corn-Belt States to confer with them in Chicago on February 7, with reference to a regional soybean laboratory.

“Apparently the location of this laboratory has not been settled, only that there is to be such a laboratory. Doctor Knight is expecting that the directors of the various stations will come prepared to say what facilities the experiment stations are in a position to offer should the laboratory be located at one of the institutions. Incidentally, it will be asked what facilities including funds, equipment, and personnel are now being used in such research at the various institutions. I, therefore, will appreciate it if your committee will set up in brief such information as may be available bearing on these two topics. I would prefer to have such facilities as we may have to offer understated rather than overstated, as I have no desire to overurge the location of the laboratory here.

“I shall appreciate your continued cooperation in this matter.

“cc Professor Rusk, Miss Wardall”


• **Summary:** A table (p. 1) gives a summary of estimated expenditures for soybean research now under way at the Illinois Agricultural Experiment Station. There are 4 projects under way in the area of agronomy ($8,862), 4 in animal husbandry ($4,950), 1 in dairy husbandry ($900), and 1 in home economics ($2,181). Total expenses: $16,893. For each is itemized the expenses for salaries, wages, equipment, and land. Pages 3-6 itemize these expenditures by project number.

Note: At a meeting held 4 days later, on Feb. 7, 1936, in Chicago, the formal cooperative agreement establishing the U.S. Regional Soybean Industrial Products Laboratory was formulated (Cartter 1956, p. 61).


• **Summary:** “Twelve Northern Central States and the U.S. Department of Agriculture have opened a cooperative soybean industrial research laboratory at Urbana, Ill. This development follows the biggest production jump in the history of this crop in America. The states are Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Nebraska, Kansas, Missouri and the Dakotas.

“Three immediate objectives of the new laboratory are: improvement of present industrial uses and development of new industrial uses for soybeans; more facts on the effects of different processes on the quality and quantity of soybean products; and facilities for testing different varieties as to adaptability for industrial use. On experimental plots nearby, plant breeders hope to grow new varieties even better suited to industrial demands.

“Soybean acreage has more than doubled in the last few years... Reasons for this increase—in addition to the demand for beans for food, feed and industrial uses—are immunity of soy to chinch bugs and other pests, good prices compared with other grain crops, drought resistance and high seed yield.

“The laboratory will be in charge of Dr. O.E. May of the Bureau of Chemistry and Soils. Breeding work will be under the direction of W.J. Morse of the Bureau of Plant Industry.”

“A question the new laboratory will study is why the same soy varieties growing under varying soil and climatic conditions show a range of 12 to 26 percent in oil and 28 to 54 percent in protein. For paints, varieties having an oil high in ‘iodine number’ are desirable. For food purposes an oil low in ‘iodine number’ is better.”

“The laboratory is located at the University of Illinois because Illinois is in the heart of the northern soybean area where the yellow oil varieties like the Manchus are produced; because space for housing the laboratory was available there; and because that state is the largest producer of soybean seed.”

A illustration titled “The Many-sided Soybean” shows uses of soybean meal (plastics, stock feed, food) and soybean oil (floor covering, paint and cooking).

Note: Interest in soybean plastics increased in 1942 at the start of World War II. It was hoped that they might serve as an alternative to metal, which was now in short supply and being conserved for wartime uses. Address: Washington, DC.


• **Summary:** “New laboratory opens: The Department of Agriculture and 12 North Central States have opened a cooperative soybean industrial research laboratory at Urbana, Illinois.” According to the USDA, this development follows
the biggest jump in soybean production in U.S. history.

The new laboratory will be under the direction of Dr. O.E. May, Bureau of Chemistry and soils. “Breeding work will be under the direction of W.J. Morse, Bureau of Plant Industry.” Morse deserves much of the credit for developing soybeans into a major U.S. crop. A few years ago he spent several years in the Orient searching for better soybean varieties.

The names of the 12 co-operating states are given.

Note: The breeding work was not under the direction of W.J. Morse.

• Summary: “To follow the march of the versatile soybean, America’s fastest growing crop, the Department of Agriculture, with the cooperation of twelve North Central States, has established a soybean research laboratory at the University of Illinois at Urbana.

“There Federal scientists will try to uncover new industrial uses for soybeans, assemble more facts on the effects of different processes on the quality and quantity of soybean products, and test different varieties to determine their adaptability for industrial use.”

“What are the reasons for the boom in soybeans? In addition to the demand for food, feed and industrial uses, Federal experts point out that their immunity to chinch bugs and other pests, the good prices they command compared with other grain crops, their high seed yield and their powers of resistance to drought, all contribute to their popularity.”

Soybeans are used in a wide range of industrial and food products. The latter include flour, breakfast cereals, candies, and “roasted beans with a nutlike flavor.”

• Summary: “Still wider markets for Illinois’ lustiest infant farm industry are expected to follow the establishment of a new government soybean research laboratory at the University of Illinois... Dr. Burlison believes that the staff of 20 researchers who will soon be at work in the 6,000 square feet which the new laboratory will occupy in the Old Agricultural Building at Urbana will find many new outlets for this popular crop.

“Director will be Dr. O.E. May, working under Dr. Henry G. Knight, Chief of the United States Bureau of Chemistry and Soils, and an advisory committee representing the states of Illinois, Indiana, Iowa, Minnesota, Wisconsin, Michigan, Ohio, Missouri, Kansas, Nebraska and the Dakotas... Illinois leads the rapidly-growing soybean industry; produced 55% of the 1935 United States crop of 39,637,000 bushels. This 1935 crop, valued at $34,323,000, was eight times as large as the crop of 1925. Market for commercial beans is furnished by 35 processing plants, 20 food plants, and 50 mills making paints, oils and other soybean products.”

Dr. Knight outlined the three objectives of the new laboratory in a special statement made to Prairie Farmer: “1. To develop industrial uses for soybeans and soybean products. 2. To obtain information on the effects of different processes on the quality and quantity of products obtained from soybeans. 3. To provide facilities for testing the quality and adaptability of types and varieties of soybeans for industrial uses.”

Dr. Knight also discussed five reasons for the rapid growth in soybean production: “1. Increased demand for soybean oil, oilmeal, and food products. 2. Immunity of the soybean to chinch bugs and other pests. 3. Good prices compared to other grain crops. 4. Drouth resistance of the soybean plants. 5. High yield of seed.”

“Funds for operating this laboratory come from the Bankhead-Jones Act which provides for a limited number of laboratories in the major agricultural regions.”

Photos show Dr. Henry G. Knight, Dean H.W. Mumford, and Dr. W.L. Burlison.

• Summary: “Committee on Regional Soybean Research Laboratory, appointed September 9, 1935.

“The committee presented a statement on February 3. Is not the work of this particular committee finished?

“Committee on the Use of Soybeans, appointed February 15, 1934.

“If our files are correct the last communication was a letter which you addressed to the committee on July 25, 1934...”


• Summary: “Doctor Burlison has been appointed as the representative of the Illinois Agricultural Experiment Station to serve with representatives of other States in this region and of the U.S. Department of Agriculture in developing a research program for the Regional Soybean Laboratory. I should like to have you act in an advisory capacity when the chairman feels that there are matters which should be handled as a committee rather than individually. I shall
probably refer to this committee, as occasion arises, matters pertaining to soybean research which are of more or less local concern.

“This committee will supersede the Committee on Regional Soybean Research Laboratory appointed September 9, 1935 and the Committee on the Use of Soybeans appointed February 15, 1934. These committees are hereby discharged.

“cc Professor Rusk, Blair, and Lloyd and Dr. Jordan.”

Note: This is the earliest document seen (Feb. 2017) that contains the term “Regional Soybean Laboratory.”


• Summary: “Research on industrial uses of soybeans will be conducted at a new laboratory opened at Urbana, Illinois, by twelve North Central States and the Department of Agriculture.”

Last year, the increase in U.S. soybean production was the biggest in U.S. history; 40 million bushels were produced in 1935 compared with a little more than 20 million in 1934 and 5 million in 1925.


• Summary: This report (minutes) describes the first meeting of this new organization, held in room 218, New Agriculture Building, University of Illinois, on 22 April 1936.

“O.E. May, Director, Regional Soybean Industrial Products Laboratory, Washington, D.C., called the meeting to order at 10:00 A.M. Each member was called upon to introduce himself. Those present were:

“W.L. Burlison, Head, Dep. of Agronomy, Univ. of Illinois (UI).
“H.R. Kraybill, Prof., Agricultural Chemistry, Purdue Univ. [Indiana].
“R.E. Buchanan, Director, Agric. Experiment Station, Iowa State College.
“H.H. King., Head, Dep. of Chemistry, Kansas State College.
“C.H. Bailey, Prof. Agricultural Biochemistry, Univ. of Minnesota.
“W.C. Etheridge, Head, Dep. of Field Crops, Univ. of Missouri.
“W.W. Burr, College of Agriculture, Univ. of Nebraska.
“R.M. Salter, Head, Dep. of Soils, Ohio State Univ.
“A.N. Hume, Prof., Agricultural Chemistry, Univ. of Wisconsin.
“O.E. May, Director, Regional Soybean Industrial Products Laboratory.
“Doctor Burlison nominated Mr. Herrick for secretary, which nomination was seconded and carried.
“Doctor May gave a brief history of the Soybean Laboratory. The Laboratory was organized to deal primarily with the following projects:

“(1) Industrial utilization of the soybean meal.
“(2) Study of the utilization of soybean oil.
“(3) Chemical engineering.
“(4) Analytical.

“The projects as submitted were then discussed thoroughly by each collaborator in turn. It was moved by Doctor Burlison and seconded by Doctor Link that the outline of proposed project and subproject titles be approved by the committee as a basis for the research program of the Regional Soybean Industrial Products Laboratory.”

Note: This is the earliest document seen (Dec. 2016) that contains the term “Regional Soybean Industrial Products Laboratory.” That name may well have been coined at this meeting.


• Summary: “The purpose of this memorandum is to provide for correlation of the research in the industrial utilization of the soybean and soybean products, to be done at the Regional Laboratory established by the Secretary of Agriculture under the Bankhead-Jones Act and at the various State Agricultural Experiment Stations in the north central region.

“The object of the research to be done under this memorandum is to obtain, through basic research, facts and materials applicable to the industrial utilization of the
soybean and soybean products and to develop methods whereby these facts and materials may be utilized for the benefit of agriculture.

“Agreement: To this end it is mutually agreed:

“(1) That the research of the Regional Laboratory will be confined to certain aspects of the industrial utilization of the soybean and soybean products as covered in the project outline approved by the Secretary of Agriculture of February 20, 1936 (copy attached) and that this research will be integrated with other research in the region as may be agreed upon by the cooperating agencies.

“(2) That, as far as practicable, research in the industrial utilization of the soybean and soybean products conducted by the various State Agricultural Experiment Stations will be integrated with the research of the Regional Laboratory.

“(3) That a supplemental memorandum will be effected between the Department of Agriculture and the State Agricultural Experiment Station at which the Regional Laboratory is located, and that additional supplemental memoranda may be effected with other State Agricultural Experiment Stations in the region, to cover specific cooperation as progress in the research covered by this memorandum may require.

“(4) The State representatives together with representatives from the Bureau of Chemistry and Soils and the Bureau of Plant Industry, provided for in the project outline herewith attached, with the Director of the laboratory shall formulate and recommend annually to the cooperating agencies a program of research to be undertaken by the laboratory in harmony with this memorandum of understanding. These representatives shall recommend plans for coordinating and integrating the research on industrial uses of soybean and soybean products as provided in paragraph (2) above...

“(8) This memorandum of understanding shall become effective March 1, 1936, and shall continue to June 30, 1936, subject to renewal from year to year thereafter by mutual consent of the cooperating parties.”

This agreement was signed between 29 Feb. 1936 (the first signer was H.W. Mumford, Director, Illinois Agricultural Experiment Station) and by 14 April 1936 by the director of the agricultural experiment station in the following states: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin, plus the chiefs of the USDA Bureau of Chemistry and Soils, Bureau of Plant Industry, and Office of Experiment Stations. It was approved on 15 April 1936 by H.A. Wallace, Secretary of Agriculture. Address: Washington, DC.


• Summary: “Of much interest to farmers is the recent announcement that a new regional research laboratory is to be established at the College of Agriculture, University of Illinois, for further investigation concerning the chemical qualities and scientific cultivation of soybeans.

“The laboratory will be directed by Dr. O.E. May, of the United States bureau of chemistry and soils, and its work will be coordinated with that of the experiment station of twelve co-operating mid-Western states. The need of this research is felt because of the rapidly expanding use of soybeans for an ever increasing variety of purposes.

“As a government bulletin points out, last year there were in the market for soybeans no less than 35 oil mills, as well as a number of cottonseed oil mills, 20 mills making food products, 15 making soybean flour, besides 50 factories making the paints, glues, varnishes, linoleum and other
products which were obtaining part of their raw materials from soybeans.

“President I.C. Bradley of the National Soybean Processors’ Association, recently said: ‘The industry is merely in its infancy. To depict the tremendous possibilities sounds like sheer exaggeration or daydreaming. Yet it is extremely important that visions of great possibilities do not veil the hazards and pitfalls to which the new industry is heir. Study, research and development of markets are essential. Our organization is expanding its activities with a view to aiding all other agencies in the drive to help production and open up new outlets.’”


• Summary: With this cover letter, O.E. May is enclosing 2 copies of a signed, condensed transcription of the minutes, 2 copies of the chemical and agronomic project list (which should be considered an integral part of the minutes), and 1 copy of the cover letter “as sufficient evidence of the approval by the Collaborators of the projects submitted to them at that time. The first copy of the minutes is for Burlison’s personal files and the second copy is “for the Agricultural Experiment Station files.”

Note: On May 16, Burlison sent a copy of the minutes to Dean H.W. Mumford. On May 21 Mumford wrote Burlison: “It would seem to me that the Secretary might very well send copies of the minutes, not only to the collaborators, but to the directors of the cooperating experiment stations of the region.


• Summary: An anonymous farmer writes that U.S. newspapers are overlooking the biggest event of the century in agriculture. According to USDA statistics, the U.S. soybean crop has just doubled in size, from 20 million bushels in 1934 to more than 40 million in 1935. And soybean production has increased eight-fold in the past 10 years. This makes it America’s fastest growing crop. The writer contends that the best way for the farmer to help himself is to develop new crops required by both industry and the human stomach [the basic idea of Chemurgy].

Science has played a major role in establishing soybeans as an important U.S. crop and in opening up new markets for soy products. Much of the credit goes to William J. Morse of USDA’s Bureau of Plant Industry. For more than two years he traveled through the Orient, collecting many soybean varieties and sending them back to the USA.

Today soy beans are used in making a wide variety of industrial products, from paint, enamel, varnish, glue and printing ink to rubber substitutes, linoleum, plastics for auto parts and glycerine. They are also used to make various food products such as soy flour, soy sauce, candies, breakfast foods, roasted nut-flavored beans, etc.—as well as livestock feeds.

Twelve North Central States and the USDA recently opened a major soybean industrial research laboratory at the University of Illinois.

Presently 35 mills are crushing soybeans for oil and meal, and a number of cottonseed oil mills are doing the same. Twenty companies are “manufacturing soy foods products, fifteen mills are making soy-bean flour and more than fifty factories are turning out industrial products.”


The Soy bean is the only crop discussed as such. Chapter IX (p. 243-67) contains the six papers presented: 1. Soy beans as a farm crop, by Mr. E.D. Funk; 2. The processing of soy beans, by Mr. Clark Bradley; 3. The rôle of soy bean oil in paint formulation, by Mr. E.E. Ware; 4. Soy bean proteins, by Mr. W.J. O’Brien; 5. Soy bean chemistry, by Dr. H.R. Kraybill; and 6. Mixing soy bean oil and tung oil, by Mr. F. Taggart. A discussion followed, moderated by Dr. C.C. Concannon.

Of the many exhibits, the application of vegetable oils in the manufacture of paints and the manufacture of molded plastics from farm grown materials were given most attention. Both of these projects were demonstrated in 5 different displays. Exhibitors included: Ford Motor Company, I.F. Laucks, Inc. and O’Brien Varnish Company.

Soy bean oil for tractors (p. 360): “If the farmer can extract soy bean oil and run tractors on soy bean oil, he does not have to ship the soy beans to market and pay the freight, and let the industrialist extract the oil... he can run his Diesel
tractor on the oil, and be ahead of the game all around.” Also encourages farmers or groups of farmers to do the initial steps of processing their own soybeans to make industrial products. Note 1. This is the earliest document seen (April 2007) that mentions the use of soybean oil as a specifically “diesel” fuel. Many earlier documents on this general subject referred to its use as “artificial petroleum.”

The casein plastics have increased their consumption during the depression. Their total now reaches 4 million pounds. They are used mostly in buttons and costume jewelry. “Of the soya bean plastics little can yet be definitely said as to prices or possibilities. Their characteristics are naturally similar to the casein materials and like them, they are comparatively expensive.” Noted from the Chemurgic point of view is that the Ford plant output is said to be 300,000 pounds a year; 100,000 pounds of which represent soy bean material.

Financial report. Disbursements for the first year of the Council’s activities ending April 30, 1936 (including organization expense of the First Dearborn Conference): Total Dearborn office—$55,093.39. Total New York office (including printing and distribution of 40,000 copies of Proceedings of First Dearborn Conference)–$44,567.41. Total for the year—$99,660.80. All financial support was supplied by the Chemical Foundation, Inc.

Conference attendance: 1000 attend second conference; 35,000 attend nationwide meetings. Geographically, public meetings have included every section of the country. “The actual number of meetings organized specifically to further the Council’s activities or at which the Council’s program was presented, was in excess of 100, and the combined total attendance is estimated in round numbers at about 35,000.”

The Soy Bean Committee (p. 391, 396-97). The meeting was called to order by Edward J. Dies, Executive Secretary of the National Soy Bean Processing Association [National Soybean Processors Association], Board of Trade Building, Chicago. Members present included E.D. Funk, Burlison, and Kraybill. Those present by invitation included Dr. J.W. Hayward of Archer Daniels Midland Co. (Milwaukee, Wisconsin), E.E. Roquemore of Allied Mills (Chicago, Illinois), E.F. Johnson and Lamar Kishlar of Ralston-Purina Co. (St. Louis, Missouri). Other members listed as being on the committee were Dr. A.A. Horvath, Chemist, Agric. Exp. Station, University of Delaware, Newark, Delaware. And Dr. Henry A. Gardner, Director, National Paint, Varnish & Lacquer Association, 2201 New York Avenue, N.W., Washington, DC. Mr. Adrian Joyce, President. The Glidden Company, 1963 Union Trust Building, Cleveland, Ohio. Note 2. This is the earliest document seen (Oct. 2005) showing that Dr J.W. Hayward is now working for Archer Daniels Midland Co.; an expert on soybean meal, he was formerly at the Univ. of Wisconsin.

“A sub-committee composed of Messrs. I.C. Bradley, president of the National Soy Bean Processors Association, Ware and Burlison, charged with certain work, found that the particular activity would now be carried on by the newly organized Soy Bean Laboratory at Urbana, which under the direction of the Federal government, will coordinate its work with that of the Experiment Stations of twelve cooperating states. Dr. Kraybill then sketched in broad outline aims and purposes of the new Laboratory and indicated potential benefits to all interests from grower to consumer.”

“On motion of Mr. Bradley the resignation of Mr. H.G. Atwood as Chairman of the Committee was accepted and Edward J. Dies, Executive Secretary of the National Soy Bean Processing Association, was elected as Chairman” (p. 396-97).

Photos show: (1) General view of the exhibition hall from the entrance. (2) Mr. Francis P. Garvan, father of the Farm Chemurgic Council and President of The Chemical Foundation. (3) Dr. Charles M.A. Stine, Mr. Williams Haynes, Mr. Howard E. Coffin.

Note 2. This is the earliest document seen (May 2016) that mentions the “National Soy Bean Processors Association” (spelled with “Soy Bean” written as two words).

Note 4. This is the earliest document seen (May 2016) that mentions Edward J. Dies in connection with the National Soybean Processors Association. Note the unusual spelling of the name of the Association of which he is executive secretary. Address: Dearborn, Michigan; New York.


• Summary: Contents: Minutes. Appendixes: A. Memorandum on soybeans: Varieties, introduction, selection, breeding, variety testing and other experimental work—of the Division of Forage Plants, Central Experimental Farm, Ottawa, by L.E. Kirk (A1-5).

B. A report on the present status of the soybean industry, particularly in western Ontario, by F. Dimmock (B1-6).

C. The soybean (The Royal Bank of Canada, Monthly Letter, April 1936) (C1-2).

In addition to the people present at the first conference on April 29, the following were also present: Dr. L.E. Kirk, Mr. C.H. Robinson, and Dr. J.M. Swaine.

The following subjects were discussed: Dr. Kirk talked about the potential for growing soybeans in Manitoba, Saskatchewan (and the central and northern parts of the other prairie provinces), Nova Scotia, Quebec, the Maritimes, Guelph (where O.A.C. had developed and popularized a new variety named Goldsoy), and the area around Medicine Hat (in southeast Alberta). “Southern Ontario was the only suitable place in Canada for the industrial growth of soybeans. There was no future for soybeans in Summerland [BC], which had other feed crops. The British Columbia
Concerning the use of soybean flour to extend wheat flour in foods (such as baked goods): “Dr. Kirk pointed out that a good deal of soybean flour was already being used and that its use was likely to increase...” Dr. Whitby referred to Henry Ford’s plant for making plastics from soybeans and the research on industrial utilization being carried out at Urbana, Illinois [by the U.S. Regional Soybean Laboratory]; “industrial outlets looked as though they would be very important.” “Dr. Kirk mentioned the recent application of soybeans in the manufacture of ice cream, chocolates, sausages and peanut products.” Use of soybeans in feeding animals. Dr. Hopkins was appointed to attend the Second Dearborn Conference of Agriculture, Industry and Science, soon to be held in Michigan; one session was scheduled to be devoted to soybeans. The National Research Council might consider investigations on industrial development of soybeans, being careful not to duplicate the work of Dr. Swaine at the Experimental Farm. The meeting lasted 1 hour and 40 minutes. It was agreed that all discussions and research would be treated as confidential.

See separate entries for each of the 3 Appendixes. Address: Ottawa, Ontario, Canada.


• Summary: “The Advisory Committee on Soybean Research has reviewed the list of projects and subprojects submitted by Doctor H.G. Knight of the Regional Soybean Industrial Products Laboratory. The titles of the projects and subprojects are general and it is difficult to know just exactly what is contemplated under these titles. It is assumed that the leaders, when they have been appointed for the three divisions of the laboratory, will specifically set up the projects in the ordinary fashion.

“Our committee feels, and I am certain that it is also the feeling of the Director of the Laboratory, that each project will be later submitted in definite form to the collaborating groups and to the directors of the respective stations. We are recommending that this be done.

“It should be borne in mind throughout these various proposed studies on industrial utilization of soybean projects that the solution of each problem involves not only the determination of the properties and the adaptability of the soybean product with reference to some particular use, but also the comparison of the soybean product with competitive products already in use of being promoted for use with reference to the desirable and undesirable properties and probably cost of production.

“It would seem to us that the Director of the Regional Soybean Industrial Products Laboratory would need to make a careful survey of what is already being done in order to determine just how far research has progressed on certain proposed projects. Primary Subproject No. 1, ‘Investigations into the Improvement of the Flavor and Keeping Qualities of Edible Soybean Oil,’ is a case in point. Doctor Sybil Woodruff of this Station has done something along this line.

“Your committee approves in general the projects set up under the two headings, namely, the proposed projects for the laboratory itself, and the projects indicated as agronomic and genetic investigations.”


• Summary: The editorial introduction begins: “The sensation of agriculture as far as the industrial and chemical worlds are concerned is the soybean. In 1935 the crop was 39,000,000 bushels, double the crop of 1934...Henry Ford helped make the soybean a fascinating feature of his World’s Fair exhibit of 1934. It was an important unit in his industrialized farm scheme.” The article begins: “A brilliant new star has appeared in the agricultural skies. It is the versatile and resourceful little soybean. Hoary with age in the orient, its recent dizzy rise in America has caused the farm world to blink in wonderment. “Where it is going, what other magic it will perform, is anybody’s guess. But the indisputable fact is that it has already written a new and colorful chapter in agricultural history, and has sent dollars jingling into the pockets of an ever-growing number of farmers.”

Discuss the increasing soybean acreage, establishment of the soybean research laboratory at the University of Illinois, food and industrial uses for the bean, growth of the industry in the United States, “I.C. Bradley, Taylorville, Illinois, president and the National Soybean Processors association,” and the need for tariff protection. “A step of first importance was the recent decision to launch a regional research laboratory at the college of agriculture, University...
of Illinois, to be headed by the able Dr. O.E. May of the United States bureau of chemistry and soils... The work will be coordinated with that of the experiment stations of 12 cooperative states.” Plastics are manufactured from the soybean cake. It is being converted into: steering wheels, gear shift lever balls, horn buttons, light switch handles, distributor bases, distributor covers, window trim strips, dash board panels, timing gears, and electrical insulations. It has been said that “the motor car of the future may be ‘grown on the farm.’”

In 1934 it is reported that the paint industry used 10,451,000 pounds of soybean oil and the linoleum industry used 2,843,000 pounds.

“Tariff protection needed: To protect industry, Congress must take action soon to curb the inflow of competing products. It is claimed that last year we imported 2 billion pounds of foreign fats and oils or oil equivalent, in oil bearing seeds and nuts.” A table (p. 28) shows imports to the USA of nine edible vegetable oils and tallow for the years 1934 and 1935. The vegetable oils are corn, palm kernel, palm, peanut, perilla, soybean, rapeseed, sesame, and cottonseed. In 1935 the top three imported in the largest amounts were palm oil (159.8 million lb), tallow (98.5 million), and cottonseed oil (62.5 million). Soybean oil had the smallest amount imported (5.2 million lb).

The article concludes: “Whatever the outcome, one salient fact remains: The little miracle bean from Manchuria is destined to write its story boldly across the pages of American agricultural history.”

Note 1. This is the earliest publication seen (Sept. 2016) by Edward Jerome Dies concerning soybeans. Never known for understatement, the colorful Mr. Dies was a staff correspondent of the Associated Press and a magazine writer before launching his Chicago public relations bureau. In 1936 his agency was engaged by the National Soybean Processors Association. Soon he became president of the expanding trade group, and continued in office until 1945. A vigorous promoter of soybeans, he was also author of the important book Gold from the Soil (1942, 1943).

Note 2. This is the earliest document seen (May 2016) that mentions the “National Soybean Processors association” (or “Association”).

Note 3. This is the earliest document seen (Aug. 2011) that uses the term “miracle bean” to refer to the soybean. It is also the earliest document seen (Aug. 2011) with the word “miracle” or “miracle bean” in the title in connection with the soybean.

Note 4. This is the earliest document seen (Aug. 2002) that contains the term “Hoary with age” with the respect to the antiquity of the soybean.


• Summary: Introduction: Casein and soy bean glues.
Lecithin from new plants. Use in ice cream and soup tablets (as well as linoleum, printing inks, and lubricating oils).
Industrial forms using soy beans. New laboratory to study uses (regional laboratory in Illinois).

Casein is widely used to make glue. The casein (about 18% by weight) is used with borax water and glycerine in a state of hydrophilic solution to form the highly cohesive jellies called glues.

“The fir and plywood industry of the Pacific coast now uses extensively glue made with soy bean casein. Over half of the box shokk plywood industry-cut boxes made for assembly at the shipper’s plant—in the southern and eastern part of this country recently has adopted soy bean glue in preference to other glues. Tests by chemists of the plywood industry have proven that glue made from soy bean oil will not dissolve in water. The total consumption of soy bean glue for various uses in the wood working industries of this country is nearly 1,500 tons per month.

“Lecithin from new plants: Lecithin is used to give chocolate candy a gloss. Gumdrop manufacturers put in a drop of this substance to prevent hardening in storage. Cotton textile plants produce a soft, supple finish to their goods by the use of lecithin. Tanneries want their chrome leather to take up plenty of grease and lecithin has been found to be the best agent to increase the absorption.

“During the last decade mills for commercial extraction of lecithin from soy beans were successfully operated in Germany and Denmark, and, according to [Bruno] Rewald, over one million pounds are used annually in the German margarine industry. For a number of years soy bean lecithin was imported into the United States in competition with the lecithin extracted from eggs, but recently two mills were constructed in this country to supply the domestic demand. Lecithin is used in margarine to secure a better distribution of the fat.

“A solid made by vulcanization of soy bean oil with sulphur, known as factice, a compounding ingredient for the rubber manufacturer, was introduced last year... This brown compounder is used to increase the aging, curing, strength and wear resisting qualities of automobile tires and other heavy rubber products...”


The Bankhead-Jones Act of 29 June 1935 authorizes the USDA to establish several specialized laboratories in the major agricultural regions of this country. The department last month designated the College of Agriculture of the University of Illinois as the regional government research laboratory to serve the 12 north central states. The 3 objectives of the laboratory are discussed. “It is expected that twenty research men will soon be at work in the 6,000 square feet of space that the new laboratory will occupy.” Address: Staff member, Chicago Journal of Commerce.


* Summary: Prof. J.C. Hackleman, crops extension specialist at the University of Illinois, was elected president of the American Soybean Association at the end of 1936 meeting in Iowa last week. Hackleman said that the emphasis of the Iowa meeting was on soybean utilization. W.L. Burlison, head of the agronomy department of the agricultural college, and O.E. May, director of the regional soybean industrial products laboratory, both spoke at the Iowa meeting.

Next year, the ASA will meet at the University of Illinois. A portrait photo shows Hackleman.


* Summary: The spectacular increases in the acreage planted to soybeans over the period 1926 to 1935 is of course a well known story by now. Equally spectacular and significant have been the increasing amounts of beans harvested as a cash crop for sale as seed and to crushing mills. There was no doubt in the minds of agriculturists by 1934 that the soybean had arrived to stay as an important cash seed crop in the Corn Belt region. While it is of considerable value as a food and feed crop the chief interest in the soybean resides in its remarkable versatility as an industrial raw material by reason of its oil and protein content. In 1926 a little over 2,500,000 pounds of oil were produced, while the crush from the 1935 crop of 39,000,000 bushels of beans will approach 200,000,000 pounds. This represents an 80-fold increase in oil production over a period of nine years. The production of soybean cake and meal naturally has increased to the same degree. It can be realized readily that the enormous jump in oil and meal production, particularly over the past five years, has created actual and potential problems of fundamental importance to the whole industry including the farmer.

“It therefore seemed the part of wisdom to a group of thoughtful agricultural authorities to develop and support a co-ordinated research program which might solve or anticipate these problems, and thus assist in placing the soybean industry in all its phases upon a sound and stable basis. Fortunately a mechanism existed which permitted the setting up of such a program. The Bankhead-Jones Act passed in June, 1935 stated as one of its purposes. ‘The Secretary of Agriculture is authorized and directed to conduct research... relating to the improvement of the quality of, and development of new and improved methods of production of, distribution of, and new and extended uses and market for, agricultural commodities and by-products and manufacturers thereof...’

“In accordance with these and other objectives the United States Department of Agriculture has set up a limited number of specialized laboratories in the large agricultural regions of the country to study some of the basic agricultural problems peculiar to those areas. At a conference of representatives of the Department of Agriculture and the Experimental Station Directors of North Dakota, South Dakota, Nebraska, Kansas, Iowa, Missouri, Wisconsin, Illinois, Indiana, Ohio, and Michigan, held at Chicago early in 1936, it was decided to establish a laboratory at the University of Illinois for a study of the industrial utilization of soybeans and soybean products. The research program was to be set up by a collaborators’ committee comprising the director of the laboratory, representatives of the Bureau of Chemistry and Soils, the Bureau of Plant Industry, and the Experiment Stations of the States named above.

“The immediate objectives of the research program are first, to determine the variation in composition of soybeans resulting from differences in varietal soil and climatic factors; second, to improve the present industrial uses, and develop new industrial outlets for soybeans and soybean products. To gain the first objective, agronomic experiments have been set up under the supervision of the Bureau of Plant Industry of the United States Department of Agriculture, in cooperation with the various State experiment stations. Thus this year five commercial varieties of beans, the Illini, Manchu, Dunfield, Mukden, and Mandarin tire being grown
in various parts of the States of Ohio, Indiana, Illinois, Missouri, and Iowa upon various soil types and under various conditions of fertilizer treatments. These beans will be harvested, brought to the Urbana laboratory, and analyzed carefully for total oil, protein, ash, and phosphatides. In addition the chemical characteristics and composition of the oil will be determined as far as is practicable. The protein present in the beans will be fractionated so as to ascertain if possible just what type of protein is being stored in each variety of bean when it is grown under different conditions. The mineral matter present in the ash will be analyzed in order to establish precisely how much phosphate, potash, and calcium each variety of bean grown under different conditions requires in order to store up a certain quantity of oil and protein. From this combined agronomic and chemical work, it is hoped that data will be obtained which will permit the selection of varieties of beans, and soil and fertilizer conditions which will yield oil, protein, and other materials most economically. The eventual goal being sought in this work, and which may be impossible to realize completely, is that beans and conditions may be selected and established so that it will be feasible to deliberately plant and harvest beans for protein or oil, or the best combined yield of both, or even for a special type of protein or oil as industrial conditions seem to demand. The fact that soybean oil is what is known as a semi-drying oil makes its utilization possible in both the protective coating and edible fields. As recently as 1934 the greatest use for soybean oil was in paint and varnish products, which in that year accounted for approximately 50 percent of the total consumption of soybean oil. In the calendar year 1935, 91,000,000 pounds of soybean oil were consumed; 52,000,000 pounds were utilized for vegetable shortening; over 10,000,000 pounds were for other edible products; 2,500,000 pounds in soap, almost 5,000,000 pounds for linoleum production, 1,700,000 pounds for miscellaneous uses, and 13,000,000 pounds for paint and varnish. During the present year apparently the swing is even more pronounced toward the use of the soybean oil in the edible oil field. As an example, in the first six months of this year over 2,500,000 pounds of soybean oil have gone into uncolored margarine as compared to 500,000 pounds for the same period in 1935. If they were available, figures for other edible oil consumption for the first half of this year would show similar qualitative trends. Because of this fact it has been possible to absorb in the trade the enormously increased oil production of the past year. When we realize that in the first three quarters of the present crushing year beginning October 1, 1935, a total of 164,700,000 pounds of soybean oil has been produced as compared with 59,000,000 pounds for a similar period last year, we can understand what this diversion into the edible oil field has meant to the soybean industry.

“Now the fact that soybean oil can thus be used both in the edible oil and in non-related industrial fields has both its advantages and disadvantages. Its greatest advantage lies in the fact that it can enter practically all fields open to vegetable oils as conditions and prices warrant. The great disadvantage, however, is that because of this very versatility, it must necessarily go into these fields on a price discount basis because its properties are not outstanding in any one of them. In the edible oil field soybean oil suffers from one distinct disadvantage. Freshly refined and deodorized bean oil possesses a smooth bland taste entirely free from objectionable flavor. However, upon standing for certain periods of time a certain amount of undesirable flavor develops, described variously as ‘painty or grassy’ in contradistinction to the beany taste of the unrefined oil. Efforts to treat soybean oil so as to prevent this flavor reversion have been almost entirely unsuccessful, and its cause is unknown at the present time. This has tended to limit the use of soybean oil to the lower grades of salad oil, shortening, and other edible products, or to restrict its use to such products as have a quick turnover in the edible oil fields. With the comparative scarcity of vegetable oils which now exists in this country—as a matter of fact all over the world—there has been a tendency on the part of the trade to overlook this reversion characteristic of soybean oil. But should the output, for instance, of cottonseed, babassu, coconut, and other vegetable oils be increased markedly in the near future, soybean oil might no longer be able to maintain itself in competition with these oils except upon an undisguised out-price [cut-price?] basis.” Continued.

Address: Director, RSIP, Urbana, Illinois.


Summary: The Bankhead-Jones Act of June 29, 1935, states as one of its purposes—“The Secretary of Agriculture is authorized and directed to conduct research... relating to the improvement of the quality of, and the development of new and improved methods of production of, distribution of, and new and extended uses and markets for, agricultural commodities and by-products and manufactures thereof...”

In 1934 “approximately 50% of the total consumption was used in paint and varnish products, while in 1935 this percentage dropped to around 14%, although the consumption for this purpose rose from 10 million pounds in 1934 to 13 million pounds in 1935. In 1935 soybean oil found its greatest outlet in the edible oil field, due to the relative scarcity and consequent high price of cottonseed oil. It finds a more limited use as a binder in casting cores, in the manufacture of linoleum, soap, printing inks, insecticides, and as a source for glycerol and fatty acids.”

The immediate objectives of the new Regional Soybean Industrial Products Laboratory are: 1. The improvement of present industrial uses and the development of new industrial outlets for soybean and soybean products; 2. The
determination of the variation in composition of soybeans resulting from differences in varietal, soil and climatic factors. It is not planned to do work relating to the use of soybeans or soybean meal as a food or feed.

The chemical laboratory has been set up on the basis of 4 sections: 1. Oil; 2. Meal; 3. Development; and 4. Analytical.

Note: This is the earliest document seen (Nov. 2001) that contains the term “Regional Soybean Industrial Products Laboratory.” Address: Director, Regional Soybean Industrial Products Lab., Univ. of Illinois, Urbana, Illinois.


• Summary: (Continued): “The laboratory has therefore set up as its leading oil project a broad investigation into the whole question of flavor and stability of soybean oil, confident that if the problem of reversion of flavor can be solved the oil will retain its place solely on a basis of merit as one of the important factors in the edible oil industry.

“While there is no question but that soybean oil can be used to advantage as a paint oil when mixed with drying oils such as linseed, perilla, and tung, the fact remains that the oil by itself is not a high-quality paint oil and this condition should be squarely recognized.

“One of the projects to be undertaken for study in our laboratory is the improvement of the utility of soybean oil in the field of protective films and coatings. Drying tests will be run on oil derived from different varieties grown under different conditions of culture to ascertain whether such factors influence the value of soybean oil as a paint and varnish vehicle. In addition, it is hoped that other studies will be carried out in cooperation with State, Federal, and industrial laboratories. Investigations dealing with the effect upon the characteristics of the oil of different methods of processing the beans, the use of oil in soaps, and more limited studies of refining processes will also be carried out. It is planned to devote some attention to a study of the anti-oxidants present both in the soybean oil and meal. Experimental studies of the nature of the phosphatides, sterols, and carbohydrates of the soybean, together with some investigation of their possible uses, will be carried out in co-operation, with the Purdue University Agricultural Experiment Station.

“Soybean meal finds its greatest outlet today in the high-protein, stock-feed trade. This laboratory will not undertake any investigations relating to the use of soybeans or soybean meal as a food or a feed as these phases of the soybean problem are being investigated extensively in many other laboratories. There is, however, being set up projects dealing with the preparation and properties of an industrial protein material derived from soybean meal. Soybean meal will be intensively investigated from the standpoint of its utilization in plastic materials. Studies are being planned which have as their object the extension of the use of soybean protein as an adhesive and paper-sizing material. Work will also be undertaken dealing with the use of soybean protein as a raw material for the production of synthetic textile fibers, and it is hoped to ascertain definitely whether the soybean has any future in that field.

“One of the immediate projects to be undertaken this fall will be a survey of the whole soybean industry. Various data will be assembled dealing with the soybean from farm to finished product in order to get a complete and unbiased picture of the soybean industry, particularly those phases relating to production, processing and distribution costs, present and potential uses, and competitive materials.

“The analytical section of the new laboratory is already engaged in active laboratory work. As soon as it is possible the remainder of the staff will be assembled and organized, and it is hoped that laboratory work will be in full swing before winter sets in.

“The laboratory is interested in all phases of the soybean industry from farm to factory, and will welcome any constructive suggestions or ideas which may lead to the further utilization of soybeans in industry. In the name of the United States Department of Agriculture and the cooperating States, I wish to extend a cordial invitation to each of you to visit the Regional Soybean Industrial Products Laboratory, to inspect our apparatus and equipment, to become acquainted with our men, and to bring with you any questions or contributions which you may have.”

Note: This is the earliest English-language document seen (Dec. 2016) that contains the term “synthetic textile fibers” (or “fiber”), or that uses it to refer to spun soy protein fiber used like a textile fiber. Address: Director, RSIP, Urbana, Illinois.

29. Slawson, H.H. 1936. Agriculture’s Jack of all trades: Introducing the versatile soybean with which you may either build automobiles or run them and in which many people see possibilities for farm relief without benefit of subsidy. Nation’s Business 24(9):24-26, 94. Sept.


Five years ago at the Univ. of Illinois soybean researchers searched the USA and Canada for commercial soy products; they collected about 100. “Today that list numbers more than 300 and the ball seems just beginning to roll.”

On 1 July 1936 a systematic research program on soybeans was started at the University of Illinois at Urbana.
Funded by the federal government, with 12 midwestern state agricultural colleges cooperating, an industrial research laboratory as been established in Urbana. Dr. O.E. May of USDA’s Bureau of Chemistry has been placed in charge, with the “help of Dr. W.J. Morse, government scientist, who has made the study of soybeans his life work.” The program will have three objectives: “1. Improvement of present industrial uses and development of new industrial uses for soybeans.” 2. Research on the effects of different processes on the quality and quantity of soybean processes. “3. Facilities for testing different varieties as to adaptability for industrial use.”

In 1930 a research chemist in a private laboratory developed a new method for improving the head of foam on beer—using soy flakes. “Today soybean beer flakes are being made on a commercial scale in Chicago and from there they are pouring into many of the country’s biggest breweries.”

In the Pacific Northwest, five new fir plywood factories (making a total of 23) have been constructed this year—because glue made from soybeans is less expensive than and superior to (incl. more water resistant) traditional plywood glues. Together with several pine plywood factories in California and British Columbia, they are using tons of the new soybean glue each day.

The initial impulse for this new industry came from automobile manufacturers who complained that the plywood they were buying was not sufficiently water resistant. So the Pacific Coast Plywood Manufacturers Association sponsored a contest to find a new glue. A newcomer, I.F. Laucks, Inc., of Seattle [Washington], won with some soupy stuff that did not look like glue at all. And “today this soybean glue—its formula a trade secret—is the standard glue of the plywood industry. Mr. Laucks discusses the reasons for the success of this new glue: (1) Most important is its low cost. (2) Since soybeans are an annual crop, “production can be increased as the demand grows. This is not true of casein or blood, which are by-products of other industries more or less fixed in their production.” (3) It is more uniform. (4) It is more “foolproof” than other water-resistant bases.

At Iowa State College, Dr. O.R. Sweeney is producing gasoline from soybean oil; he cracks it by heating to 350°C using animal charcoal as a catalyst. He then distils one of the fractions. The first person to make petroleum from soybean oil was the Japanese scientist Satow, who made a calcium soap from the oil then subjected it to destructive distillation to get light, middle, and heavy grades of petroleum. Forty gallons of soybean oil yielded about 25 gallons of soybean petroleum, 33 pounds of glycerine (for use in explosives), and 480 cubic feet of combustible gas.

The U.S. paint industry was one of the first to make large use of soybeans—especially in Illinois. Soybean flour helps bread to stay fresh longer. Soybean lecithin is used by confectioners. Tanners use soybeans to increase the grease-absorbing properties of chrome leather. Textile manufacturers use it to make their fabrics soft, supple, and lustrous. It is also used by rubber makers, linoleum makers, soap makers, and sausage and wiener makers. Doctors prescribe soybean ‘milk’ (which is practically free of starch) for some babies and many diabetics. Even the family dog now consumes soybeans, which are less expensive than meat and make his [or her] coat sleek and shiny.

“Not half the story of this amazing development has been told here. U.S. soybean production jumped from around 5 million bushels in 1925, to 18.6 million in 1934 and 39.6 million in 1935. Illinois is the leading state.

“Almost two decades ago, when the first president of the American Farm Bureau Federation, James R. Howard, was beginning that organization’s constructive efforts to aid agriculture by other means than politics, he made a remark which is just beginning to be appreciated at its full significance.

“‘The surest relief for agriculture,’ Mr. Howard said, ‘will come from the production of new agricultural output that will go to industry rather than to the human stomach.’

“The response to that, so far as soybeans are involved, is seen in a recent government statement that at present more than 120 industrial concerns are making soybean products. They include about 35 soybean mills in ten states and a number of cottonseed mills which crush soybeans for oil and meal; 15 soybean flour mills; 20 soybean food products factories and more than 50 plants where various industrial commodities are fabricated from the magic soybean.

“It looks as if industry is beginning to know its beans.”

Photos show: (1) A tractor in a field of piles of soybean hay pushing a device designed to speed the job of getting the hay to the baler. Caption: In Illinois more than 21 million bushels of soybeans were produced last year. (2) A warehouse in Manchukuo filled with piles of round soybean cakes. Two men are carrying 3-4 each on one shoulder up a wooden ramp. (3) A workman standing by a vat filled with a thick white liquid. “The first step in making auto parts is to feed the [soy] bean fibers into the rolls that mix them.” (4) Black auto parts grown on the farm, with a pile of some soybean powder that has not yet gone to the press. (5) “Powdered soybean fibers fed into this press come out in the form of distributor terminal plates for automobiles.”

30. Willard, A.C. 1936. Re: Telephone service at the University of Illinois. Letter to H.W. Mumford, Dean, College of Agriculture, Univ. of Illinois, Urbana, Oct. 23. 1 p. Typed, without signature. • Summary: Gentlemen: Many requests are being received by the Physical Plant Department for additional University telephones and for the replacement of desk-type Bell telephones with cradle-type instruments. Because it is difficult to determine who shall and who shall not be given this service, or to make the necessary adjustments in the annual budget while such functions are centralized in one
administrative department, it seems advisable that the responsibility for such decisions and adjustments be placed in the various departments using and requesting this service.

“We are therefore transferring funds from the 1936-37 Physical Plant Department appropriation to each department now using telephone service on the following basis. All telephone service must be provided for in departmental budgets after the end of the present fiscal year, June 30, 1937.

“The change in policy with reference to Bell telephone rentals will not apply in the case of the Federal Soybean Laboratory...” Attached are two pages of information (dated Oct. 20) on rates for Bell Telephone Service and University Telephone Service.

Note: Arthur Cutts Willard was president of the University of Illinois from 1934 to 1946.


• Summary: The National Soybean Processors Ass’n [Association] met recently at Chicago and heard talks by Dr. O.E. May (director, Regional Soybean Industrial Products Laboratory, at Urbana, Illinois), Dr. W.L. Burlison (head, Dept. of Agronomy, University of Illinois), and J.E. Barr (marketing specialist, Buro [Bureau] of Agricultural Economics, U.S. Dept. of Agriculture).

“President I.C. Bradley declared this had been an epochal year in the history of the soybean industry and praised the cooperation obtained from various government experts in the field of soybeans.

“Other speakers, including J.J. Vollersten of the American Oil Chemists Society, H.W. Irwin and Guy Fox discussed the soybean oil situation, giving particular attention to research work now under way in the edible oil division.

“Mr. Bradley, Taylorville, Illinois, nationally known soybean expert, was reelected pres.; W.L. Shellabarger of Decatur, Illinois, vice pres.; H.R. Schultz, Centerville, Iowa, sec’y [secretary]; John H. Caldwell, St. Louis, Missouri, treasurer. A meeting of the soybean committee of the Farm Chemurgic Council was held after the regular session.”


• Summary: “Wallace B. Van Arsdel and Dr. George B. Brother will head the meal and development sections, respectively, of the Regional Soybean Industrial Products Laboratory established at Urbana, Illinois, by the Bureau of Chemistry and Soils.” Address: USDA.


• Summary: “The Advisory Committee on soybean research appointed some time ago has been of very distinct help to me in discharging my responsibilities as one of the collaborators for the Soybean Laboratory. I hope this committee can be continued for a considerable time.”

Note: Three days later, in a letter dated Nov. 26 and addressed to W.L. Burlison (Chairman), H.H. Mitchell, and Miss Sibyl Woodruff, Dean Mumford wrote: “After reviewing the activities and personnel of the Advisory Committee on Soybean Research, I am of the opinion that there is a need for the future functioning of this committee. I am therefore asking that you continue to act as a member of this committee until further notice.”


• Summary: “A discussion of the work of the agronomic and analytical divisions falls naturally into three parts. At the present time the objectives and purposes of this work will take the major portion of the discussion. The mechanics of operation and means by which these objectives are sought are of interest but may be more clearly seen than described. The results and conclusions so far obtained are few because of the short time in which the laboratory has been working.

“The chemical composition of soybeans determines their value for any use to which they may be put. At present the most valuable soybeans are those possessing high oil and high protein but it is possible to make finer distinctions than this. For use in paints a soybean oil having good drying qualities, that is, a high iodine number, is desired. For hydrogenation purposes, however, an oil with low iodine number would be greatly preferred. The presence of substances such as phosphatides [lecithin] may be desirable for some purposes and undesirable for others. The proportions of the various proteins may vary in soybeans so that one variety may furnish excellent material for plastic manufacture while another will not have such desirable characteristics. It becomes of great importance, therefore, to study the factors influencing this composition. Among other factors variety, soil type and climate may be of considerable importance. The effect of these three factors is being studied this year by the agronomic and analytical divisions of the U.S. Regional Soybean Industrial Products Laboratory. To evaluable properly the influence of these factors on
composition of soybean seed, hundreds of samples must be
grown under carefully observed conditions. Results must be
collected over several years of growth, including good years
and bad. The source of the seed must be carefully checked,
field studies of the soil carried out, and weather observations
taken throughout the growing season. Where it is possible
for so many factors to affect the composition of the beans
great care must be taken so that any variations observed are
attributed to the proper factor.

"In order that variations may be clearly brought out,
analytical methods must be devised to show differences in
composition that actually occur and not introduce errors from
handling or sampling in the laboratory. For a commodity,
such as cottonseed, which has been grown and analyzed for
so many years there are available complete and standardized
analytical guide books which give procedures developed and
checked by hundreds for the complete analysis of cottonseed.
For soybeans no such information exists. Methods are
being studied now with a view toward establishing standard
analytical procedures, but until these are accepted and
confirmed it is necessary to check and recheck all methods
used in the laboratory. These methods are taken where
possible or adapted when necessary from standard manuals
such as those of the Official Agricultural Chemists and the
American Oil Chemists.

"When this work was established in the spring of
1936 one of the objects was that of providing facilities for
testing the quality and adaptability of types and varieties
of soybeans for industrial use, and to obtain through basic
research information that is prerequisite to the efficient and
orderly breeding of improved types and varieties.

Table 1 shows how the chemical composition of
multiple soybean varieties changes at five places where they
are grown. The four columns are: (1) Locality (e.g., Ames,
Iowa). (2) Protein content, ranging from 46.66% to 42.63%.
(3) Oil content, ranging from 20.61% to 19.05%. (4) Iodine
number of the oil, ranging from 117.2 to 130.8. Footnote:
"Each figure is an average of duplicate analyses made on
the following varieties: Manchu, Dunfield, Mandarin, Illini,
Table 2 shows the “Chemical composition of soybeans showing variation with change of variety. The four columns are:

1. Variety (Manchu, Dunfield, Mandarin, Illini, Peking, Mukden).
2. Protein content, ranging from a high of 46.31% for Mukden to a low of 42.07% for Dunfield.
3. Oil content, ranging from a high of 21.49% for Dunfield to a low of 16.40% for Peking.
4. Iodine number of the oil, ranging from a high of 138.4 for Peking to a low of 120.9 for Dunfield.

Footnote: “Each figure is an average of duplicate analyses made on beans grown at the following experiment stations: Urbana, Illinois; Lafayette, Indiana; Ames, Iowa; Columbia, Missouri; and Columbus, Ohio.”

“A soybean variety developed from a pure line usually yields most in the particular environment to which it is best suited. The range of adaptation of these varieties is rather restricted. This means that to secure the best return from the soybean crop a variety most suited to the locality where grown should be developed.

“As the work of the laboratory progresses and different constituents of the soybean are found to be of especial value in certain industrial applications, it may be desirable to develop soybean strains giving increased yields of those constituents.

“This illustrates the necessity for a comprehensive breeding program designed to discover the method of inheritance of the factors responsible for chemical composition as well as those responsible for yield and other agronomic factors. By so doing we can proceed with much more assurance of obtaining the desired soybean strains in a minimum of time.

“The laboratory is maintaining extensive soybean selection nurseries in each of the surrounding soybean States in cooperation with the State experiment stations. There the selections are being studied for desirable agronomic characters and the seed analyzed to discover promising chemical characteristics. The types that prove of outstanding value are distributed more widely for further testing for yield and general economic value. Those new strains that are found to be superior are increased by the State stations, given a name and distributed to farmers in the locality to which the variety is best adapted.

“Much time is being devoted to making controlled crosses between the different soybean types and varieties so that better varieties may be developed and so that a better understanding may be gained as to what superior character each type may be expected to contribute to a new cross.

“Some of this work has been underway in the past, but more rapid progress should be possible through the work of the laboratory. Through its facilities a study of soybean breeding from a chemical approach is now possible in a much larger way than has ever been possible before. It is expected that the laboratory will make a definite contribution to agriculture through its breeding program.

“The accompanying illustration (Figure 1), shows the localities at which beans for the laboratory were grown during the 1936 season. As can be seen, these are sufficient to cover the five States adequately. The plots in each State are under the supervision of a cooperating agent attached to the State Experiment Station. As has been mentioned above, complete data are obtained for all plantings. When the beans are harvested they are sent to Urbana where they are stored in a constant temperature, constant humidity room. Here they can remain for long intervals without fear of alteration in composition until they are analyzed. The samples are brought into the laboratory in sealed jars, ground and analyzed, so far as is possible, on the same day. The analysis includes determination of moisture, nitrogen, ash, phosphorus, calcium, potassium, crude fiber, sugar, oil, and several characteristics of the oil such as iodine number, index of refraction, etc. The determinations are checked by re-running samples of soybeans and by analyzing known solutions. When making as many as 23 determinations on each sample it is possible to complete five samples a week; however, when only a few properties, such as moisture, ash, oil and nitrogen, are determined, then considerably more can be analyzed.

Figure 1 (a map) shows the location of the Laboratory’s experimental plots in 5 cooperating states (Illinois, Indiana, Iowa, Missouri, Ohio) during 1936. Within each state, the name of each location is given. Address: U.S. Regional Soybean Industrial Products Lab., Univ. of Illinois, Urbana, Illinois.


• Summary: Many of you have already visited the Regional Soybean Industrial Products Laboratory here in Urbana. May I urge those who have not already done so to see the Laboratory while here. You will hear from others about the program of this Laboratory, which is now in its second year. Consequently, no specific reference to that particular field of work of the Industrial Farm Products Research Division is necessary at this time.

“The work of the Regional Soybean Laboratory is only a part of the effort being directed by the U.S. Department of Agriculture toward a greater and more diversified industrial utilization of agricultural products and by-products. May I, therefore, take this opportunity to tell you about some of our other work which will be of interest to you? In Washington, D.C., in the laboratories of the Industrial Farm Products Research Division; at Ames, Iowa, in the Agricultural By-Products Laboratory located on the campus of Iowa State College [studying destructive distillation]; and here, at Urbana [Illinois], a concerted attack is being made on the problem of discovering new uses for agricultural products.
in fields apart from the traditional outlets of food, raiment and shelter. I should like to emphasize and illustrate here that research on the industrial utilization of agricultural raw materials serves not only the farmer but also the country as a whole. We hear much in these days of the eventual disappearance of our supplies of oil, coal, and the other natural resources with which we have been so abundantly blessed. In some instances, as in the case of petroleum, exhaustion of the supply is imminent when measured in terms of the probable life of this nation. In other cases, as with soft coal, there is no immediate likelihood of any such catastrophe, but the fact remains that where agricultural products can be made to serve for those raw materials that cannot be replaced, the supply of the latter is thereby prolonged and its more immediate exhaustion need no longer be feared. I should like, therefore, to call to your attention a concept based on the idea that through the products of the farms, fields, and forests we have a renewable supply of raw materials dependent only on the sun, the atmosphere, the soil and the addition of fertilizer to give us a never-ending source of raw materials for our manufacturing industries.

“If we were content merely to point the way to new uses for agricultural products, that problem alone would be a stupendous one; but the work would be only half done if we neglected attempts to improve those industrial processes already in operation. Such processes may be susceptible to improvement through supplies of better raw materials, lower costs of operation, and finished products of better quality. Much has been done in these respects, but this aspect of industry is a never-ending one that offers opportunities for the initiative and resourcefulness of scientists and technologists. There will be presented, consequently, in this summary of the work of the Industrial Farm Products Research Division instances of new work on old products as well as new methods for the production of new products.”

On page 4 is a full-page chart listing the various projects of the Industrial Farm Products Research Division divided into 11 categories. These include: “Fermentation investigations.” “Chemical conversion of oils, fats and waxes.” “Plastics investigations.” “Motor fuels of agricultural origin” (incl. “power alcohol”). “Chemical weed eradication investigations” (incl. use of sodium chlorate). “Research into the industrial utilization of the soybean and soybean products” (6 sub-projects). If you will permit me, I am now going to show a slide listing the various projects of the Industrial Farm Products Research Division. This will give you some idea of the manifold activities with which we concern ourselves. Obviously, the time at my disposal is too short to take up the individual projects you see listed here, and I would therefore prefer to give you a brief outline of the
work along the more important lines.

“It might be of interest to point out at this time that the work of the Department of Agriculture on the industrial utilization of agricultural products is not a new development. It has been going on for many years. Our records show that 30 years ago a study was made of the possibility of utilizing various so-called farm wastes for the manufacture of paper, and there are sporadic instances of work of a similar nature at an even earlier date. The work done on paper is still good in many respects, and the conclusions reached still hold, particularly on the economics of the problem. As long as satisfactory paper can be produced from wood more cheaply than a similar product can be made from such raw materials as straw and cornstalks, wood will continue to be the basic and most important raw material for the manufacture of paper. This does not mean that new methods of collection or production will not reopen this chapter and that we may not yet go to the fields of the Middle West rather than to the forests of the Northwest and Canada for the paper making materials of the future.

“As I said a moment ago, any address dealing with the work of the Industrial Farm Products Research Division in the time at my disposal must be more of an outline than a detailed exposition, so that you will forgive me if I err on the side of brevity.

“The objective of our work on hides and skins is primarily the attainment of better returns to the agricultural producer for these essential leather-making raw materials. The first project listed under hides and skins deals, therefore, with improvements in methods of handling, curing, and storing hides and skins. In general, hides and skins are regarded as by-products of more important operations and, therefore, do not get the attention they would otherwise receive. Whether they realize it or not, farmers, dairymen, and ranchers are producers of hides and skins. Animals cannot be grown without hides or skins and in the aggregate the value of these products attains large proportions. With cattle the hide may represent from 9 to 14 per cent of the value on the hoof. With calves the skin is of even greater worth and often equals 20 per cent of the value of the living bovine baby. Normally we tan each year around two hundred million dollars worth of hides and skins. Of these, domestic agriculture supplies about one-half. Assuming that farmers and cattlemen receive 50 per cent of this valuation, they are producers of hides and skins. Animals cannot be grown without hides or skins and in the aggregate the value of these products attains large proportions. With cattle the hide may represent from 9 to 14 per cent of the value on the hoof. With calves the skin is of even greater worth and often equals 20 per cent of the value of the living bovine baby. Normally we tan each year around two hundred million dollars worth of hides and skins. Of these, domestic agriculture supplies about one-half. Assuming that farmers and cattlemen receive 50 per cent of this valuation, our production of hides and skins is a fifty million dollar agricultural industry. A valuation of this magnitude amply justifies the attention of the Department of Agriculture to the problem of better hides and skins.”

“The next project covers part of the work which is now being done at our Agricultural By-Products Laboratory at Iowa State College in Ames, Iowa. Studies have been made of the possibility of producing useful raw materials from various agricultural by-products by their destructive distillation. This is the process which is commonly used in industry for the production from coal of coke, tar oils and other industrial raw materials which it is hardly necessary to enumerate at this time. As in the case of paper, the cost of collection of the raw material and its relatively great bulk in comparison with coal handicap the average farm waste in its entrance into this field.

“Previous reference has been made to the production of paper from agricultural raw materials. Agricultural products suitable for paper making are composed chiefly of cellulose, lignin and the so-called hemi-celluloses, or wood sugars. Of these, cellulose is at the present time by far the most important, and it is cellulose which is, therefore, receiving our greatest attention. Cellulose of varying purity is the base from which paper is made, and cellulose in a very pure form is used for the manufacture of rayon, cellophane, moving picture film, and other finished products too numerous to mention. Previously I stated that the development of new methods for the production of paper might lead to the utilization of agricultural by-products in this field. Such a method is the nitric acid process which is referred to under one of these projects. By the use of this acid, we obtain a very fine grade of cellulose from certain agricultural wastes, and it is hoped that further investigation of this matter may lead to the entrance of agricultural waste products into the field of cellulose production.” Continued. Address: Chief, Industrial Farm Products Research Div., Bureau of Chemistry and Soils, USDA, Washington, DC.


• Summary: (Continued): “Lignin is the second most important component of agricultural waste products. Due to its peculiar chemical properties, very little is known about the natural constitution of this substance, although a great deal of work has been done on the subject. Inasmuch as lignin is produced annually in the United States to the extent of about fifty million tons, some idea of the importance to agriculture of the solution of this problem can be obtained. Indications at the present time are that some of our work may lead to the use of lignin as an agent in water purification, for which large quantities of this material may be required.

“To complete the picture, a process for the utilization of the hemicelluloses in the production of furfural was worked out in this Division more than ten years ago, and has led to the commercial production of more than 10,000,000 pounds of furfural annually. Furfural is a liquid which finds wide application in the manufacture of plastics, as a solvent, and in the purification of lubricating oils.

“One very interesting phase of the work of the Industrial Farm Products Research Division is that of our fermentation investigations. Some years ago we decided that a study
of the action of microorganisms, and more particularly
molds, might offer possibilities in the further utilization of
agricultural products. At the time this project was started
such important materials as lactic acid, citric acid, alcohol,
and various commercial solvents were being manufactured
as a result of the action of microorganisms. It was decided
that corn sugar, which was then being produced cheaply
and plentifully, offered an ideal raw material for this work.
One of our first accomplishments was the production of
gluconic acid, the calcium salt of which is widely used
in the treatment of many human and animal diseases as a
source of calcium. One example in which you may all be
interested is in the case of milk fever resulting from the
rapid loss of calcium by the cow soon after the birth of the
calf. Intravenous injections of calcium gluconate are used in
the treatment of this disease. When we started work on the
production of calcium gluconate, it was listed in the catalogs
of chemical supply houses at about $150 a pound. It can now
be bought in large quantities for 50 cents a pound, and is
used in the hundreds of thousands of pounds annually.

“This work has continued and has been extremely
productive. The applications of various microorganisms
have led to further improvement in methods of manufacture
for calcium gluconate and the production of a lactic acid
of somewhat different type from that now produced
commercially, as well as the development of a method of
manufacture of sorbose from sorbitol. Sorbose is the basic
raw material for the production of vitamin C, which was
formerly found chiefly in the juices of fruits such as oranges,
lemons, etc. This vitamin is known as the anti-scorbutic
vitamin because it prevents the development of scurvy,
the disease which was the scourge of the deep sea sailor a
century ago.

“Ordinary commercial methods employing molds are
very complicated and necessitate a high degree of chemical
skill, as the mold must be grown as a thin film floating on
the surface of shallow pans of sugar solution. We have
developed a much simplified method of procedure in which
the work is done in a revolving drum. Such a drum has now
been built and is in operation in our laboratory at Ames,
Iowa, as well as in commercial installations.

“I will pass rather lightly over the projects for the
chemical conversion of oils, fats and waxes and that for
the production of plastics. Both are new projects and little can be
expected from them for some time.

“The production of new raw materials from various
waste fats in the agricultural industry offers great
possibilities, and the first of these investigations is aimed at
that end.

“The term ‘plastics’ is known to all of you as the name
of one of the most promising of our modern industries.
Plastics are chemical compounds of a resinous character
which can be rolled, cast, or molded into desired and
permanent forms. In the development of this investigation
we hope to substitute agricultural raw materials for some of
those now used in the industry, as well as the production of
new plastics.

“Finally, we come to the motor fuels investigations. This
again is a new project. The idea of the production of alcohol
to be mixed with gasoline for driving automobile motors is
familiar to all of you. Much has been said on this subject,
and much of what has been said is either exaggerated or
untrue. It is our aim, with the limited funds which we have
had assigned to us for this purpose, to collect statistics on
the raw materials available for the manufacture of alcohol
which will present a true picture of the situation. A bulletin is
now being prepared and will be issued within the next year,
we hope. This statement is not to be taken as any reflection
on much of the work that has been done on the production
of power alcohol or on the possibilities of the development
of this material as an important fuel. It is felt, however, that
in giving any consideration to so important an undertaking,
facts, and not wishful thinking, should be the determining
element. In addition to the production of alcohol as a motor
fuel, it is known that in Europe there is a motor which is
run on solid fuels. Agricultural products such as starch offer
possibilities in this direction, and it is hoped that attention
may be given to work along this line at some future date.

“A word may be given to our work on the manufacture
of sodium chlorate, although this does not properly come
under the subject matter of this paper. This task, though
somewhat out of our regular field, was assigned to the
Industrial Farm Products Research Division, and has been
very successfully carried out. Costs on the production of
sodium chlorate, which is the most efficient known chemical
agent for weed eradication, have been established and new
weed eradication materials have been given consideration.
A report of this work has been made to the Congress of
the United States, and an article has appeared in one of the
current industrial journals. Work is now being carried on in
the hope of cheapening production costs on sodium chlorate
so that it may be more available to the farmer, and further
work on other agents is also in prospect.

“This brings us to the end of a brief exposition of the
work of the Industrial Farm Products Research Division of
the Bureau of Chemistry and Soils. Before closing, there
is one thought that I would like to leave with you. In all
investigations leading to the development of new products
from agricultural materials, we must keep our feet on the
ground and our heads out of the clouds. It is useless to put
some agricultural raw material through a series of chemical
contortions and then say, ‘Look what I’ve got!’ Such a result
means absolutely nothing. When you have applied the proper
amount of research to a project, have developed it on a small
industrial scale, have seen it go into industry and produce
materials which can be sold in a competitive market, then it
is time to lean back and point to a job well done—and not until
then. This is the basic creed of the Industrial Farm Products

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Research Division.”

Note: This is the earliest document seen (Feb. 2017) that contains the term “Regional Soybean Laboratory.” It is used as an abbreviation of the Laboratory’s full formal name—U.S. Regional Soybean Industrial Products Laboratory. Address: Chief, Industrial Farm Products Research Div., Bureau of Chemistry and Soils, USDA, Washington, DC.


**Summary:** “The organization and research program of the U.S. Regional Soybean Industrial Products Laboratory was presented to members of the Association at the meeting held at Ames, Iowa, in September, 1936. Since there have been no changes in these aspects of the laboratory during the past year, it hardly seems necessary to discuss them in detail at this time. Those who may be interested will find a complete account of this subject in the Proceedings of the American Soybean Association for 1936.

“Nevertheless, it should be helpful to those who are not familiar with the organization and who expect to visit the laboratory to outline briefly certain details of its background. The laboratory was organized and is financed under the provisions of the Bankhead-Jones Act, one of the purposes of the enactment of which was to promote research basic to agriculture. The laboratory is regional in its outlook and represents a cooperative effort, participated in by the Bureau of Chemistry and Soils and the Bureau of Plant Industry of the U.S. Department of Agriculture and the Agricultural Experiment Stations of the States of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. The broad objectives of the laboratory are to ascertain the effects of varietal and cultural differences on the chemical composition of the soybean and to develop new industrial outlets and improve present industrial uses for soybeans and soybean products. The research program laid down to achieve these objectives is planned by representatives of the Federal and State agencies named above, and is approved by their chiefs and directors.

“The chemical work of the laboratory is organized under four sections, analytical, oil, meal, and development, and is administratively in charge of the Bureau of Chemistry and Soils. The agronomic work dealing with the cultural and genetic phases of soybean research is administratively in charge of the Bureau of Plant Industry.

“The oil and meal research sections are housed on the second floor of the north end of the Old Agriculture Building. Chemists of the oil research section are investigating various problems connected with the use of soybean oil in paints and varnishes, with the development of new products, with the effects of variations in processing on its physical and chemical characteristics, and with its stability, especially with respect to flavor and odor. Chemists of the meal research section are devoting their attention chiefly to studies of methods for the extraction of protein materials from soybean meal, to improvement of soybean meal and protein as materials for the manufacture of adhesives and paper sizes, and to the investigation of the preparation of plastic materials from soybean protein and meal. Naturally, the chemists of both these sections are carrying out considerable fundamental chemical research in connection with their more practical investigations, and you will have an opportunity tomorrow to hear, from the men who are actually doing the laboratory work, some of the details of the methods and equipment which they are using in their experimental studies.

“The analytical and development sections are located on the first floor of the east side of the Old Agriculture Building. The analytical section is concerned principally with the detailed analysis of the hundreds of samples of soybeans grown under known conditions in various sections of the twelve North Central States under the supervision of the Bureau of Plant Industry and interested Agricultural Experiment Stations. A vast quantity of data is being collected with reference to effect of varietal and cultural differences on chemical composition, and it is hoped that correlations may be established which will prove of considerable value agriculturally and industrially. More will be heard about this particular phase of the work later in this meeting.

“The development section is working broadly on the engineering and economic aspects of soybean utilization, and from its work it is hoped that an unbiased and sound appraisal may be gained of the whole soybean picture, from farm to finished product. At the present time this section is devoting itself largely to various problems connected with the processing of soybeans by solvent extraction and expeller press methods. In addition the chemical engineers of this section will have the responsibility of working out the details of any semi-works scale processes which may be developed on a laboratory scale in the oil and meal research sections.

“It is hoped that each of you will find an opportunity to visit all of the sections of the laboratory during this meeting, and become acquainted with the members of the staff. Questions, suggestions, and comments will be welcomed which will contribute in any way to the further advancement and utilization of the unique and valuable crop in which we are all interested.”

Note: This is the earliest document seen (Feb. 2017) that contains the term “U.S. Regional Soybean Industrial Products Laboratory.” Address: USRSL, Urbana, Illinois.

generations of self-fertilization are put together. Practically we say that after homozygous for several characters, or if several hybrids to make a hybrid population, planted, an F3 generation of heterozygous. Seed of the F2 plants can be put together to make a hybrid population with fair assurance that they will breed true. We prefer controlled crosses to natural crosses in a breeding program, as we are more certain what the parents are and we have greater freedom in our choice of parents. Many soybean crosses give rise to considerable hybrid vigor in F1, but it is impossible to utilize it for increased production as we can in corn, and it is rapidly dissipated as a consequence of self-fertilization. In linkage studies it would be of some advantage if we were able to make crosses easily and in large numbers, so as to get progenies resulting from crossing the double heterozygote with the double recessive. As it is, we have to confine ourselves to the use of F2 data for this purpose. This is no great handicap, however, as many formulae are available by means of which the percentage of crossing over can be readily calculated. Selection and hybridization go together. But selection within a pure strain is ineffective. The method of back-crossing a hybrid to one of the parents has been tried and is believed to have possibilities, but these are limited by the difficulty of making crosses. Also three-way and double-crosses should be tried, but here again the possibilities are limited and for the same reason. By crossing our common varieties we strive to bring together into one type as many desirable characters as possible. Much remains to be done along this line.

"Breeding for chemical composition is a promising but relatively untouched field of work. This character is very complicated in inheritance, and one must work with large numbers to assure progress. In this important field of work, the Regional Soybean Laboratory will be of great help when it is able to analyze for us large numbers of plants individually. We hope, therefore, with their help to be able to report considerable progress on this problem in the near future."

Note: This is the earliest document seen (July 2016) that contains the word “selfing” in connection with soybean breeding. In biology, selfing is a method of seed generation in which pollination is performed manually and the pollen donor and egg donor are from the same plant. Address: Dep. of Agronomy, Univ. of Illinois, Urbana.


**Summary:** Represents an excellent beginning of an intensive study of the carbohydrates in the soybean. In this work these investigators have:

1.Separated sucrose as a chemically pure compound and identified it as such by determinations of refractive index.

2. Developed two workable methods for the isolation of sucrose from soybean oil meal. 3. Employed their developed processes on a larger than “test tube” scale to recover sizable quantities of crystalline pure sucrose. Address: Purdue Univ. Agric. Exp. Station and U.S. Regional Soybean Industrial Products Lab.


**Summary:** “The examples cited above are typical of the results which have been obtained in the paint and varnish research of the U.S. Regional Soybean Industrial Products Laboratory. The work, much of which is still in progress, indicates clearly that properly-treated soybean oil can be substituted up to 100 per cent of the oil vehicle in a considerable number of varnishes, not only without impairment, but in certain cases with actual improvement of the properties of the resulting films.” Phenolic resin-soybean oil varnishes have excellent durability.
Note 1. This is the earliest document seen that mentions phenolic resin in connection with soybeans.

Note 2. This is the earliest document seen (May 2016) that has K.S. Markley as an author.

Note 3. This is the earliest document seen (Dec. 2016) containing the term “U.S. Regional Soybean Industrial Products Laboratory,” Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


• Summary: This “Cross Reference Sheet” states: “A few of the details in connection with this laboratory and extent of cooperation may be helpful to you. A cooperative agreement for the establishment of a Regional Soybean Industrial Products Laboratory to obtain through basic research facts and materials applicable to the industrial utilization of the soybean and soybean products and to develop methods whereby these facts and materials might be utilized for the benefit of agriculture was signed by Secretary [of Agriculture Henry] Wallace February 20, 1936.

“A memorandum was drawn up the purpose of which was to provide for the correlation of the research in the industrial utilization of the soybean and soybean products to be done at the Regional Laboratory established by the Secretary of Agriculture under the Bankhead-Jones Act and at the various agricultural experiment stations in the North Central Region. In addition to being signed by the various officials of the United States Department of Agriculture, it was also signed by the directors of experiment stations in Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Oklahoma, and Wisconsin.

“The laboratory was established on the premises of the University of Illinois. The cooperative agreement was renewed for the fiscal year ending June 30, 1938 and doubtless will continue to be renewed year to year. At the time this agreement was prepared and signed another agreement, attempting to coordinate the research on the agronomic features of soybean production, was also signed by the directors of the agricultural experiment stations of this group of states and the representatives of the United States Department of Agriculture.

“I might add that although a greater degree of coordination is brought about by this arrangement, the agricultural experiment stations are still left free to continue certain aspects of the work on soybeans, particularly in connection with production problems, at this institution the study of the utilization of soybeans for human foods.


• Summary: “Sir: In a letter to the editor of Chemistry and Industry, 56, 937 (1937), entitled, ‘Maleic Anhydride Value or Diene Value,’ R.J. Bruce and P.G. Denley called attention to certain anomalous results which they obtained on determining the M.A.V. of oxidized linseed, perilla, and soybean oils. They state ‘It occurred to us that the M.A.V. might not be solely indicative of conjugated double bonds, but that it might include any maleic anhydride that entered into combination with hydroxyl groups already in the oil or formed during oxidation.’” Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.

43. Morse, W.J.; Cartter, J.L. 1937. Improvement in soybeans. Yearbook of Agriculture (USDA) p. 1154-89. For the year 1937. [67 ref]

• Summary: Contents: History of the soybean. World distribution and production. Utilization of the soybean (with chart). Improvement of soybean varieties. Methods in breeding: Natural and artificial crossing, mutations. Inheritance studies and cytology: Plant characters (flower, stem, pubescence, and foliage; height of plant and maturity; pod-bearing habit and pod characters; sterility, growth habit), seed characters (color of seed coat, hilum, and cotyledon; other seed characters), yield of seed. Disease resistance. Identification of genes and chromosomes. Selected references on genetics of the soybean. Appendix: 1. Workers identified with soybean improvement: United States, foreign countries. 2. List of soybean genes (table). 3. Linkage of soybean characters (table). 4. Soybean varieties: Origin and varietal characteristics (table listing 101 named soybean varieties; for each is given the place and date of introduction or origin, days to mature, flower color, pubescence color, and seed characters {coat color, germ color, hilum color, seeds per pod, seeds per pound}, uses {dry-edible beans, forage, green-vegetable beans, grain}).

The section titled “History of the Soybean” states: “The early history of the soybean is lost in obscurity. Ancient Chinese literature, however, reveals, that it was extensively cultivated and highly valued as a food for centuries before written records were kept. It was one of the grains planted by Hou Tsi, a god of agriculture. The first record of the plant is contained in a materia medica describing the plants of China, written by Emperor Sheng Nung [sic, Shen Nung] in 2838 B.C. The crop is repeatedly mentioned in later records and it was considered the most important cultivated legume and one of the five sacred grains essential to the existence of Chinese civilization. Seed of the plant was sown yearly with great ceremony by the Emperors of China, and poets extolled
its virtues. The records of methods of culture, varieties for different purposes, and numerous uses indicate that the soybean was perhaps one of the oldest crops grown by man.”

Note 1. This is the earliest English-language document seen (Nov. 2013) which states that: (1) The soybean was one of the “five sacred grains.” (2) “The early history of the soybean is lost in obscurity.” (3) The soybean was planted at an early date by “Hou Tsi, a god of agriculture.” (4) The “soybean was perhaps one of the oldest crops grown by man.” It is also the earliest document seen (May 2014) in which William Morse mentions the mythical Chinese emperor “Sheng Nung” in connection with soybeans.

More broadly, this entire story linking Shen Nung with the earliest written record of the soybean, is completely incorrect. Yet because the story was written by Morse (highly regarded as America’s leading authority on the soybean) in a USDA publication, it has unfortunately been repeated, and this source cited, again and again down to the present day (see Hymowitz 1970; Hymowitz and Shurtleff 2005).

Note 2. This is the earliest English-language document seen (May 2014) in which the emperor’s name is spelled “Sheng Nung.”

Note 3. This is the earliest document seen (July 2007) in which William Morse tries to write an early history of the soybean in China. Unfortunately, he does not cite his sources.

The section titled “Improvement of soybean varieties” states: “In the United States, more than 50 percent of the acreage devoted to soybeans is used for forage and pasture; breeding work, therefore, has tended largely toward the development of varieties for hay, silage, and pasture. The development of such varieties as Virginia, Laredo, Ootoota, Wisconsin Black, Manchu, Wilson-Five, Kingwa, Peking, and Ebony by selection from introductions has been the principal factor in the increased use and acreage.

“Beginning with 1929, the use of soybean seed by oil mills has led to a demand for yellow-seeded varieties of high oil content. Agronomists and plant breeders have attempted to meet this demand by making large numbers of selections from foreign introductions and locally grown varieties and by analyzing these for oil content. This has brought about the development of several superior oil varieties and has resulted in a large increase in production of beans for milling purposes. The most popular of these varieties are Illini, Dunfield, Mukden, Mandell, Scioto, Mansoy, Manchu, Mamredo, Delsta, and Mandarin. Results of analyses with more than 1,000 selections and varieties have shown a range of from 12 to 26 percent in oil content. From studies of the oil content of varieties grown in a given locality, it seems possible, from the breeding standpoint, to produce varieties high or low in oil, at least within the known ranges of variation exhibited by common varieties.” (p. 1161-62).

Soybean varieties that have excellent flavor and become soft in less than 2 hours of cooking include Easycook, Bansei, Rokusun, Jogun, Chusei, and Sousei. These are “now in the hands of growers and seedsmen. Experiments by commercial firms have shown that these varieties are superior to commercial varieties for the manufacture of food products, such as bean flour, roasted beans, bean milk, and bean curd [tofu].

“In Japan, certain varieties of soybeans were found that were used solely as green shelled beans. Ranging in maturity from 75 to 170 days, many of these introductions, and selections from them, have been found especially promising for the various sections of the United States. The vegetable soybean offers an excellent food of high nutritional value, especially in the fall when other green beans are lacking and in sections where the Mexican bean beetle prohibits the growing of garden beans. As a result of selection, cooking tests, and adaptation studies; eight green vegetable varieties—Hahto, Kura, Kanro, Hokkaido, Higan, Chusei, Sousei, and Jogun—have been introduced in various sections of the country” (p. 1163).

Photos show: (1) “The late Charles Vancouver Piper, agronomist, United States Department of Agriculture, 1902-26. Pioneer in the introduction and development of soybean varieties for United States conditions.” (2) “Storage yard of a Chinese grain merchant near Kunchuling, Manchuria. More than 80 osier bins, each holding four cartloads of soybeans, were in this yard.” (3) A Manchurian farmer and how he harvests, threshes and cleans soybeans by methods learned from his ancestors; comparison with modern U.S. machine harvesting. (4) “Millions of soybean oil cakes are stored in warehouses in Manchuria awaiting shipment to Japan, Chosen, China, and the East Indies, where they are used for fertilizing purposes and for cattle feed.” A person looks up at the towering stacks. (5) Coolies loading large sacks of soybeans on a freighter for shipment to the oil mills of Europe. One man has hoisted a huge sack onto his back. (6) Five Manchurian farmers who have been awarded certificates and prizes for producing high-quality soybeans. (7) Twenty seeds of a natural soybean hybrid showing peculiar types of coloration. (8) Illustration (line drawing) of a soybean flower and its parts enlarged. Front view, side view, parts of the corolla (standard, wing, one of the keel petals), stamens, pistil. (9) A. Stems and pods of fasciated soybean plants; B. Determinate pod-bearing type; C. Indeterminate pod-bearing type. 10. Chromosome chart showing four groups of linked genes in soybeans.

A table (p. 1157) shows: “Increase in production of soybeans over an 11-year period, 1924-25 to 1935-36, inclusive, in the principal producing countries of the world” (Manchuria, Chosen [Korea], Japan, United States, Netherland India).

Soybean seed size (p. 1177): “The range in size of soybean seed varies according to the variety, each variety having its own typical seed size. Varieties and introductions tested at the Arlington Experiment Farm ranged in average
weight of 100 seeds from about 4 grams for the smallest to about 40 grams for the largest.” Address: 1. Senior Agronomist; 2. Assoc. Agronomist. Both: Div. of Forage Crops and Diseases, Bureau of Plant Industry [USDA, Washington, DC].


• Summary: The regional Soybean Industrial Products Laboratory of the USDA announced today that a new 100% soybean oil varnish is standing up well in weather tests at Urbana, Illinois. The varnish has a rapid drying rate and good water and weather resistance. The soybean laboratory is a Bankhead-Jones research project established on 1 July 1936 in order to study new industrial uses for the soybean and its products.


• Summary: “Soybean protein plastic is understood to be used in the manufacture of the steering wheel, horn button and other such parts of Ford cars.”

“In addition to development undertaken by Ford and other manufacturers, the Federal Government, through the Bureau of Chemistry and Soils of the Department of Agriculture, established early last year a soybean industrial research laboratory at Urbana, Illinois, in cooperation with twelve North Central states. Here some 30 chemists and other staff members are developing and improving industrial uses of soybeans. The Farm Chemurgic Council has been urging the industrial and other use of soybeans for several years as a part of its program to obtain the use of more American-grown agricultural products in industry.

“It is estimated that some 50 factories are turning out various industrial soybean products. Soybeans are used in making such articles as paint, enamel, varnish, glue, printing ink, rubber substitutes, linoleum, insecticides, glycerin, flour, soy sauce, breakfast food, candies, roasted beans with nutlike flavor, livestock feeds, as well as plastics.”


• Summary: “I am enclosing a reprint of an article from Soybean Laboratory here entitled “Soybean Oil Varnishes.” It just looks too good to be true, and I will wait with a good deal of anxiety until the industrial concerns have checked it off. It is really a find and I do believe it is O.K.”


Note 2. On Jan. 29 Burlison sent Mumford a copy of another reprint from the U.S. Soybean Industrial Products Laboratory.


• Summary: The phosphorous compounds present in soybeans have been tentatively divided into four groups: phytins, phosphatides, nucleic compounds, and inorganic phosphorus compounds. The phosphatides contain only a small portion of the phosphorus present in soybeans.

Methods for determining these groups have been studied and applied to the analysis of a sample of soybeans. Address: 1. Junior Chemist; 2. Senior Chemist. Both: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


• Summary: Contents: Introduction. New chlorophyll-deficient types (“The y4 type is a yellowish-green type found in F.P.I. 65388, a small-seeded brown bean…”... The y3 type is a greenish-yellow type first observed as a mutant in the Wilson V variety”). New linkage relationships (tawny vs. gray pubescence color; green seed coat vs. yellow seed coat).

A figure shows a “Provisional soybean chromosome map.” Contains 6 tables.

“Contribution from the Division of Plant Breeding, Department of Agronomy, University of Illinois, Urbana, Illinois, in cooperation with the U.S. Regional Soybean Industrial Products Laboratory, U.S. Dept. of Agriculture. Published with the approval of the Director of the Experiment Station.” Address: 1. Chief in Plant Genetics, Illinois Agric. Exp. Station; 2. Agent, Div. of Foreign Crops and Diseases, Bureau of Plant Industry, USDA.


• Summary: “Resolution was passed at the recent annual meeting that they ‘commend the U.S. Department of Agriculture and the U. of I. [University of Illinois] for establishing a research laboratory for soybeans and favor the extension of further research of farm products to widen the farmers’ market.’”

cc to Executive Committee.


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**Summary:** A new soybean varnish that is standing up well in weather tests has been announced by the Regional Soybean Industrial Products Laboratory of the USDA. The new product, made from 100 per cent soybean oil, has a rapid drying rate and good water and weather resistance.


**Summary:** “Soybean protein has been found to possess properties which permit the production of two different types of plastic material. Addition of water to soybean protein or meal leads to a product similar to casein plastic, whereas reduction of the moisture content below 5 per cent gives a zeinlike plastic. A new method for measuring plastic flow has been developed and applied.” Ed. note.

Casein plastic is the best known and only industrially important protein plastic material up to the present time. They are produced by adding water to the casein up to a total of 25 to 40%, the mixture is plasticized by heat and pressure, formed into the desired shape, and hardened by soaking in dilute formaldehyde solution. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


**Summary:** On the cover: The conference will be held at the “Hotel Fontenele, Omaha, Nebraska. April 25, 26, 27, 1938. Purpose: To advance the industrial use of American farm products through applied science.”


The conference also included four luncheons, an agro session (agricultural alcohol), a chemurgic banquet, a closing general section, an open form near the end, with Wheeler McMillen (President, National Farm Chemurgic Council) presiding. Address: 654 Madison Ave., New York, N.Y.


**Summary:** “There are at present approximately 35 mills crushing soybeans, 15 plants engaged in the manufacture of soybean flour, 20 in the manufacture of soybean food products, and more than 50 in the manufacture of other industrial products.”

“There has been a large increase in the use of soybean seed for industrial and food products such as paints, enamels,
varnish, glue, printing ink, linoleum, plastics, shortenings, margarine, foundry cores, livestock feeds, flour, soy sauce, dietetic foods, infant foods, beverages, and so on.”

Thirty-six different varnishes containing 100% soybean for their oil content have been developed and are now undergoing exposure tests to determine their aging properties.

Photos show: (1) The old agricultural building housing the Regional Soybean Industrial Products Laboratory at Urbana, Illinois. (2) Interior view of the analytical division of the new Soybean Laboratory at Urbana, Illinois. (3) “A modern molecular still at the new Soybean Laboratory at Urbana, Illinois.” (4) Henry G. Knight, Chief, U.S. Bureau of Chemistry and Soils, applying soybean varnish to a cabin cruiser to see how well it will stand up under salt water conditions. Address: U.S. Bureau of Chemistry and Soils, Washington, DC.

   • Summary: Also contains a long section (with 62 of the 86 references) titled “Patents on soybean protein.” All of these patents are U.S. patents. Each of the two sections is arranged alphabetically by author. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.

   • Summary: This is the earliest known study of the unusual solubility behavior of soybean proteins in neutral salt solution. The authors observed that neutral salt solutions disperse less protein from soybean meal than water alone does, and in dilute salt solutions the solubility curve exhibits a sharp minimum at a salt concentration which varies with the kind of salt used. Address: U.S. Regional Soybean Industrial Products Lab., Univ. of Illinois, Urbana.

   • Summary: Based on an article by Dr. Henry G. Knight in Industrial and Engineering Chemistry, News Edition (20 May 1938, p. 291-93). A little more than a year ago active work began on most of the projects at the government’s Soybean Laboratory at the University of Illinois. Thirty-six different varnishes containing 100% soybean oil for their oil content have been developed and are now undergoing exposure tests to determine their aging properties.

   • Summary: “It is the object of this paper to consider some of the factors which might influence the amount of nitrogenous constituents dispersed in water from fat-free soybean meal and to point out analytical precautions that should be taken when the measurement of this dispersion is attempted.”

A study of five physical factors was conducted. The size of the meal particles is a very important factor. Meal passing through a 100-mesh screen was found to be adequate for the purpose of extracting nitrogenous components. “Wet grinding in a ball mill is suggested as an efficient method of dispersing soybean proteins.”

The ratio of water to meal, the temperature, and the length of time of extraction were found to exert small effects. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.

   • Summary: The 96th meeting of the American Chemical Society will be held in Milwaukee, Wisconsin, Sept. 5-8.

The section titled “New synthetic dyes” states: “The utilization of soybean oil in paints and varnishes will be explained by Dr. A.J. Lewis and Klare S. Markley of the United States Regional Soybean Industrial Products Laboratory at Urbana, Illinois. They will outline the results of experimental studies in which soybean oil was the only oil used.” Address: USDA.

   • Summary: A German-language summary of an English-language article with the same authors and title published in 1938 in British Plastics and Moulded Products Trader 10(113):248-251. Address: Illinois.


   • Summary: “During the past year no collaborative work was done on sodium and potassium. The present rapid method for potassium only, Methods of Analysis, A.O.A.C., 1935,
128, gave excellent results on soybean seed.” Address: U.S. Regional Soybean Industrial Products Laboratory, Urbana, Illinois–Associate Referee.


• Summary: The U.S. patent system was discussed at the 96th meeting of the American Chemical Society in Milwaukee, Wisconsin. It is considered basically sound, with only small changes needed.

“George H. Brother of the U.S. Regional Soybean Industrial Products Laboratory at Urbana, Illinois, told the Agricultural Division that millions of dollars worth of farm products are finding new markets in the plastics industry.” This tends to stabilize farm income and reduce prices.

A.J. Lewis and Klare S. Markley, “also chemists in the Soybean Products Laboratory,” foresee the day when U.S. dependence on foreign sources for the bulk of its drying oils used in paints and varnishes will be reduced by the use of soybean oil from domestic crops.

“One of the basic tasks of the laboratory at present, they said, is to find the effect of varietal, climatic, soil and fertilizer differences upon the chemical composition of the soybean; also to develop new industrial outlets.” Address: USDA.


• Summary: Thermoplastic formaldehyde-hardened soybean protein containing 1% formaldehyde and not over 3% moisture, may be mixed with phenolic or urea-formaldehyde molding compounds to produce molding powder with thermosetting properties. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.

64. Brother, George H. 1938. Plastic materials from farm products. RSLM (U.S. Regional Soybean Laboratory Mimeograph, Urbana, Illinois) No. 34. Sept. 9 p. [3 ref]


At the bottom of page 1 we read: (1) Presented before the Division of Agricultural and Food Chemistry of the American Chemical Society at Milwaukee, Wisconsin, September 5-9, 1938. Published in Industrial and Engineering Chemistry Vol. 31, pp. 145-148 (1930).

(2) Defines the U.S. Regional Soybean Industrial Products Laboratory (Urbana, Illinois) as “A cooperative organization participated in by the Bureaus of Chemistry and Soils and of Plant Industry of the United States Department of Agriculture, and the Agricultural Experiment Stations of the North Central States of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.” Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


• Summary: “So much interest has been aroused relative to the U.S. Regional Soybean Industrial Products Laboratory that a few words about the laboratory as a whole may not be out of place. A somewhat detailed description of the organization, facilities, and type of research projects of the laboratory was reported by Dr. Henry G. Knight in the News Edition of Industrial and Engineering Chemistry for May 20, 1938. Consequently, only brief mention will be made of the organizational features of the laboratory while the projects of most interest to those engaged in the technology and production of the products of the drying oil industry will be emphasized.

“The laboratory was organized as a cooperative enterprise by the Bureaus of Chemistry and Soils and Plant Industry of the U.S. Department of Agriculture and the Agricultural Experiment Stations of the States of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. The broad basic objectives of the laboratory are to ascertain the effect on the chemical composition of the soybean of varietal, climatic, soil, and fertilizer differences; and to develop new industrial uses and improve present industrial outlets for soybeans and soybean products.

“That considerable emphasis is being placed on a search for more extended industrial uses of the oil, especially in the drying field, is not surprising in view of the economic position of oil production and consumption in this country. According to the report of the Bureau of the Census, U.S. Department of Commerce, released on March 26, 1938, the total factory consumption in this country of primary animal and vegetable oils and fats amounted to nearly 5 billion pounds for 1937. Of this amount nearly a half billion (457,785,000) pounds was consumed in the production of paints and varnishes. During the same period, according to the Fats and Oils Trade, published by the Federal Bureau of Foreign and Domestic Commerce, this country imported 174,864,803 pounds of tung oil, 43,590,607 pounds of perilla oil, and 534,117,344 pounds of linseed oil in the form of oil and flaxseed, or a total of 752,592,754 pounds. At the same time there was produced from domestically grown flax 130,982,656 pounds of linseed oil. The 1937 domestic production of soybean oil was 194,131,000 pounds of which only 17,157,000 pounds were consumed in the drying oil industry.”

At the bottom of page 1 we read: Presented before the Paint and Varnish Section of the American Chemical Society

**Summary:** "At the last meeting of the American Soybean Association a brief report was made on the work of the agronomic and analytical sections of the U.S. Regional Soybean Industrial Products Laboratory. This report will deal more fully with the investigations of the oil and protein sections. It must be realized that but little time has elapsed since the inauguration of these work projects and the results here discussed are only preliminary. They are to be regarded as indications of what may be expected of future work in these fields, and in no sense as a report on completed research work.

"It may be recalled that when the laboratory was organized as a cooperative venture undertaken by the Bureaus of Chemistry and Soils and Plant Industry of the U.S. Department of Agriculture and the Agricultural Experiment Stations of the twelve North Central States, two broad objectives were laid down by these cooperating agencies to guide the work of the laboratory; (1) to ascertain the effect of varietal, climatic, soil, and fertilizer differences on the chemical composition of the soybean and to develop varieties of soybeans for industrial utilization; and (2) to develop new industrial uses and improve present industrial outlets for soybeans and soybean products. The projected research on the second objective was to deal chiefly with soybean oil and soybean meal or protein, and to conduct engineering and development studies of soybean processing.

"It may not be out of order to mention briefly the progress toward the first objective during the last year. At present over 800 samples have been analyzed chemically for many constituents. These samples represent extremely wide variations in environmental conditions. Briefly, the results so far collected confirm those reported last year. However, differences found during the growing season of 1937 when conditions were more nearly normal as compared with 1936 have been sufficiently great to justify the collection of data for several more years before attempting any sweeping generalizations. The possibilities in breeding soybeans to develop desirable characteristics of oil and protein content, iodine number, etc., look very promising. In addition facilities have been recently set up for physiological studies of the soybean.

"Considerable experimental work has been done during the past year on the use of soybean oil in varnishes and paints. Fatty acids derived from soybean oil have been used for some years in glyptal resin finishes. Likewise soybean oil itself has been used in mixtures with linseed and perilla for paints, and with China-wood oils for varnishes. This laboratory has, therefore, chiefly directed its efforts toward the production of protective films and coatings which contain no oil other than soybean. At the risk of being tedious I shall give a greatly simplified picture of a varnish and how it is made. A varnish is usually composed of a resin or gum, an oil, a drier, and probably some thinning agent. It is desirable to have as finished product a varnish that will dry to a clear hard film quickly, that is easy to apply, and that is resistant to alkali, acids, hot or cold water, and gasoline. Such a varnish should have an average out-door life of about a year, and during that time should remain as a tough elastic film. Variations in the resin, oil, or drier, in the amounts of each used, in the manner of combining, and in the cooking together of these constituents will affect the properties of the varnish. As you all know, soybean oil is correctly classed as a semi-drying oil since normally it requires much longer to dry than linseed oil, for instance, and the resulting film of soybean oil is normally soft and tacky. It is evident that considerable care must be taken to produce a satisfactory varnish from soybean oil alone. A number of very promising varnishes have been made using clarified nonbreak or alkali-refined soybean oil. One crucial test of the durability of varnishes is their resistance to weathering. This is a test for which time is required and there is no satisfactory substitute.

"Some 50 varnishes are now undergoing outdoor exposure tests and among them are some which after the lapse of nearly a year show practically no checking or peeling and still retain their gloss. The resistance of many of these products to acid, alkali, and water is also excellent. At the present time a bakelite resin has proved the most satisfactory and, with such resins, soybean oil varnishes in our experiments will dry free from tack in some 6 to 8 hours and successive coats can be applied on successive days. While ten years ago such a drying rate would have been considered excellent, today varnishes are made which dry tack free in 2 to 4 hours. Although the present achievement of producing a soybean oil varnish which will dry in 6 to 8 hours represents great progress in this field, efforts are being continued to reduce the drying time of these products.

"Work on soybean oil paints has also been carried out with about the same degree of success. Exposure tests still underway show these coatings to be very resistant to weathering although none of them have been exposed sufficiently long to permit an estimate of their ultimate durability.

"Collaborative studies with the National Bureau of Standards, the Norfolk Navy Yard, and the Chicago Paint & Varnish Production Club have been undertaken. It is felt that such work offers the best possibilities for sound and permanent expansion of the use of soybean oil in the field of protective films and coatings."
“Before discussing the work of the laboratory on the utilization of soybean protein in plastic materials it may be well to define the term ‘plastic material’ as used here. In general, a plastic material is a mixture of organic substances which under the influence of heat and pressure may be formed to shape. Plastic materials may be divided into two general classifications, thermoplastic and thermosetting. Plastics of the latter class, of which bakelite is an example, are formed by a non-reversible chemical reaction which produces infusible material. This hardens in the die, after pressing and heating have formed it to the shape desired, and it can be removed from the hot die. The thermoplastic materials such as cellulose acetate soften by the action of heat and pressure without undergoing chemical change. Such material may be repressed again and again. Pieces molded from it must be hardened by chilling the die before the piece is removed.

“Contrary to all published results and opinions this laboratory has discovered that it is possible by hardening soybean protein properly with formaldehyde to produce a thermoplastic material. This discovery makes possible the development of protein molding powders that will come from a die in a finished state. To appreciate properly the importance of this development it must be realized that casein, the only protein plastic used to any extent commercially at present, requires a very long hardening process after being molded or formed to shape. Of course much remains to be done before this soybean plastic which contains no other plastic or filler material is entirely satisfactory. If a satisfactory plasticizer or softener can be found which is also a water repellent, a great improvement in this plastic will result. Some success has been achieved in the intensive search for such an agent.

“It has been found possible to mix thermoplastic, formaldehyde hardened soybean protein or meal with commercial molding materials, such as phenolic or urea compounds, and produce thermosetting material with considerably improved properties. It has also been discovered that soybean protein may be extracted from the fat-free meal in a formaldehyde solution. This hardened protein may possibly be used for the base in the preparation of a great many industrial products, including plastics, laminated material, adhesives, paints, films, etc.

“Limitations of time and space prevent more than a mention of the work in progress on the isolation and identification of minor constituents of soybean oil, the study of the stability of edible oil, methods of following chemical changes in stability, the isolation and study of the proteins of the soybean and their properties in aqueous suspension, the isolation and identification of various sterols and carbohydrates some of which possess considerable interest and potential industrial value, fundamental studies on various phases of soybean processing, and finally refining, bleaching, and deodorization of the oil or its distillation in an extremely high vacuum (molecular), in modern laboratory scale apparatus.

“The list is not complete and the accomplishments which have just been emphasized are merely to point out for your information some trends which the work of the laboratory is following. The prospects are bright for further industrial use of the soybean and its derived products. The chief prerequisites for broadened applications are a more precise knowledge of the physical and chemical properties of the materials for which uses are sought and more definite information concerning the chemistry of the processes through which these materials must pass to produce from them products of industrial importance.”


• Summary: “There have been many disquieting rumors as to the possible future activity of the U.S. Regional Soybean Industrial Products Laboratory at Urbana, Illinois, the work of which has been held in such high regard by soybean growers, processors, and others interested in the growth of the soybean industry.

“At the annual meeting of the National Soybean Processors Association on Oct. 13, this subject was discussed and the following resolution unanimously adopted:

“Whereas, it has been rumored that the Soybean Research Laboratory at Urbana might be discontinued, and

“Whereas, the soybean processing industry feels that the Laboratory serves a very useful and indispensable function in behalf of agriculture, the processing industry, and the consuming industries; therefore, be it

“Resolved, that our Association go on record as being opposed to the abandonment of the Laboratory, and urge not only the continuation of the same, but that serious consideration be given to the expansion of the activities in the interest of the soybean industry as a whole, and to the providing of better and more adequate housing facilities for this project.”

Note: On Oct. 29, W.L. Burlison sent a copy of this letter to J.C. Blair, who was Dean of the College of Agriculture, Univ. of Illinois (1938-1939).


• Summary: Contents: Description of U.S. Regional Soybean


* Summary: “At our Annual Meeting we adopted a resolution urging that the Soybean Laboratory be retained, there being rumors to the contrary. The resolution was sent to Secretary of Agriculture Wallace, and I have just received from J.D. LeCron, Assistant to Sec’y Wallace, the following reply: “We have your letter of October 25, 1938, transmitting a resolution adopted by the National Soybean Processors Association at its annual meeting October 19th, this resolution pertaining to the work and need of continuation of the U.S. Regional Soybean Industrial Products Laboratory at Urbana, Illinois.

“It is very gratifying to have this expression of the high appreciation in which your Association holds this laboratory and we wish to assure you that this Department has never contemplated discontinuing or curtailing the researches now being prosecuted there. Also, the Department recognizes the need for better and enlarged housing facilities for this work and is hopeful that the situation as it now exists relative to these facilities may be rectified.”


* Summary: It was recently observed, during a study of the bodying of soybean oil under oxidative conditions, that an increased hydroxyl number was accompanied by an increased diene value. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


Address: Illinois.


* Summary: Soybean oil from Dunfield soybeans (grown at Columbia, Missouri in 1936) was found to have an iodine number of 101.6. As far as the authors know, this is the lowest iodine number ever recorded for an American cultivated variety of grain-type soybean. This oil appears to contain a higher percentage of oleic acid and a lower percentage of linoleic and linolenic acids than do normal soybean oils.

Note: This is the earliest English-language document seen (June 2009) that contains the term “grain-type” or “grain-type soybean,” which it uses in contrast to “vegetable-type” soybeans. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


“Amount of Protein in Soybeans and Soybean Oil Meal and Factors Affecting Same: Soybeans available in this country and in other countries exhibit a wide variation in protein content, this variation being due to several factors. In the first place, soybeans grown in a single locality show a marked varietal difference in protein content. Piper and Morse (1) state that the principal varieties in the United States may vary from 34.1% to 46.9% in this respect. Carther and Milner (2) of the U.S. Regional Soybean Industrial Products Laboratory at Urbana, whose extensive investigations of the composition of soybeans are still in progress, have reported the following analysis of soybeans to indicate the variation with change of variety [table 1]:

<table>
<thead>
<tr>
<th>Variety</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manchu</td>
<td>45.99%</td>
</tr>
<tr>
<td>Dunfield *</td>
<td>43.95%</td>
</tr>
<tr>
<td>Mandarin</td>
<td>45.54%</td>
</tr>
<tr>
<td>Illini</td>
<td>44.48%</td>
</tr>
<tr>
<td>Peking</td>
<td>43.68%</td>
</tr>
<tr>
<td>Mukden</td>
<td>6.31%</td>
</tr>
<tr>
<td>Dunfield **</td>
<td>42.07%</td>
</tr>
<tr>
<td>Illinois T</td>
<td>43.20%</td>
</tr>
<tr>
<td>F.P.I. 54563-3</td>
<td>44.63%</td>
</tr>
<tr>
<td>Scioto</td>
<td>3.73%</td>
</tr>
</tbody>
</table>

* Seed from Illinois Experiment Station.
** Seed from Purdue Experiment Station [Indiana].

"An individual variety grown in a single location may also vary considerably from year to year. O’Kelly and Gieger (3) found that the Laredo and Mammoth Yellow varieties analyzed for protein as follows over a period of several years (from 1925 to 1932; table 2):

- Laredo ranged from 35.55% to 40.67% protein
- Mammoth Yellow ranged from 39.91% to 44.64 protein

A given variety will also vary considerably in protein content from one locality to another. Webster and Kiltz (4) list the following results for four varieties of soybeans grown in different places in Oklahoma in 1931 [table 3]:

- The variety Chiquita contained 42.50% protein in Craig County but 46.56% in Stillwater Co.
- The variety Dixie contained 43.13% protein in Craig County but 46.82% in Stillwater Co.
- The variety Virginia contained 40.00% protein in Craig County but 44.06% in Stillwater Co.
- The variety Laredo contained 35.00% protein in Craig County but 47.50% in Stillwater Co. This latter variation is probably closely associated with the Iowa locality.

O'Kelly and Gieger (5) found that the Laredo and Mammoth Yellow varieties also vary considerably from year to year. O'Kelly and Gieger (6) who obtained the following results [table 4]:

- Ogemaw, not inoculated had 8.08% moisture and 35.39% protein
- Ogemaw, inoculated had 8.88% moisture and 42.20% protein
- Medium Green, not inoculated had 8.12% moisture and 31.23% protein
- Medium Green, inoculated had 8.80% moisture and 36.45% protein

"There is apparently (7) a relationship between the quantity of rainfall and the protein content of soybeans, the lower rainfall tending to produce a higher protein content. After a certain stage in the maturation process, soybean seeds (3) decline in protein content, but this change is due to decomposition of nitrogen free extract rather than a decrease in the absolute quantity of protein. Likewise, decayed or damaged beans show a higher protein content. There is also some indication (8) of an inverse relationship between the oil content and the protein content of soybeans.

"The amount of protein in soybean oil meal will naturally depend upon the protein content of the soybeans used in processing, but in general the bulk of the soybeans that are processed in this country consist of only a few varieties, grown principally in the Corn Belt States. When these soybeans are all pooled together, the processor finds that the soybeans do not vary a great deal in protein content from one pressing to another. There is, however, a slight difference in protein content between the New Process [solvent] and Old Process soybean oil meals. In fact, the processors employing the solvent method of oil extraction (New Process) have found it possible to safely guarantee 44% of protein in their soybean oil meal; whereas 41% has been the usual guarantee for hydraulic or expeller (Old Process) soybean oil meal (9). Types of Protein in Soybeans and Soybean Oil Meal:

"Osborne and Campbell (10) proposed the name of glycinin for one of the globulin types of protein they obtained from soybeans. They considered it the principal protein, making up about 80 to 90% of the total crude protein contained in soybeans. They also isolated a more soluble globulin which resembled phaseolin in composition and, as far as they could ascertain, it was similar to phaseolin in reaction. They obtained an albumin-like proteid which they termed legumelin, and they estimated it made up about 1.5% of the total protein of the soybean. In addition to these proteins, they isolated a small quantity of proteose. Some of these proteins are listed below with their average composition [table 5]:

Jones and Csonka (11) obtained five protein fractions from soybeans by fractional precipitation at definite concentrations of ammonium sulfate within a range of 33 to 70% of saturation. In order to determine which fraction represented glycinin, a salt extract of soybean meal was dialyzed. From the protein fraction which precipitated, two globulins were separated. One was precipitated from a 10% salt (NaCl) solution by ammonium sulfate at 55% of saturation and did not coagulate even at boiling temperatures. This fraction was called glycinin since its properties agreed with those given by Osborne and Campbell for glycinin.

"Amino Acid Content of the Proteins in Soybeans and Soybean Oil Meal: Osborne and Clapp (12) in their analyses of glycinin, the principal protein of the soybeans, found the content of amino acids was similar to the values reported for casein, the principal protein of milk. Csonka and Jones (13) analyzed the chief protein (glycinin) from seeds of several varieties of soybeans and found them to differ considerably in amino acid content with the greatest variations occurring in cystine content (a low value of .74% for the Illini variety and a high value of 1.45% for the Manchu soybean). Csonka and Jones (14) were the first investigators to report on some of the amino acids contained in the whole (non protein extracted) defatted soybean oil meal. Again cystine was found to be the most variable amino acid for the various varieties tested. Values ranged from .287% for the Illini up to .491% for the Herman variety. However, these investigators did not believe we needed to fear a quantiative deficiency of cystine in any of the common varieties of soybeans or in the meal made from these varieties. Hamilton, et al. (15), Nollau
protein of raw soybeans was due to a de

nutritive value. Mitchell and Smuts (25) and Shrewsbury

of the fact that the raw soybean contains a protein of low

and Parsons (26) reported experimental evidence in support

(24), Mitchell and Smuts (25), and McCollum, Simmonds,

reported similar results with pigs. Mitchell and Villegas

which had been previously cooked. Vestal and Shrewsbury

However, normal growth resulted when they fed soybeans

as the sole or principal source of protein in an otherwise

complete ration did not support appreciable growth.

However, normal growth resulted when they fed soybeans

which had been previously cooked. Vestal and Shrewsbury

(20), Shrewsbury, Vestal, and Hauge (21), and Robison (23)

reported similar results with pigs. Mitchell and Villegas

(24), Mitchell and Smuts (25), and McCollum, Simmonds,

and Parsons (26) reported experimental evidence in support

of the fact that the raw soybean contains a protein of low

nutritive value. Mitchell and Smuts (25) and Shrewsbury

and Bratzler (27) claimed that the low nutritive value of the

protein of raw soybeans was due to a deficiency of the amino

cysteine.” Continued. Address: USA.

74. Dies, Edward J. 1938. Re: Uneasiness about future of

U.S. Regional Soybean Industrial Products Laboratory.

Letter to W.L. Burlison, [Head, Dep. of Agronomy],

University of Illinois, Urbana, Nov. 3. 1 p. Typed, without

signature.

• Summary: “There has been some uneasiness as to the

possible loss of the laboratory, or its absorption. In fact,

concern has been pronounced in some quarters.

“I know no one better informed on this subject than

E.F. Johnson. He has been building obstacles here and

there against efforts to interfere with the laboratory and its

operation. I am not at liberty to reveal any of the information

that has been given to me in confidence, but since you two

are among the strongest advocates, I am asking Mr. Johnson

to give you in confidence what information he is at liberty to

advance:

“Incidentally, yesterday I learned that Urbana has one

in six chances of getting one of the new [USDA Regional

Research] laboratories, which information I also passed

along to Mr. Johnson.”

Note 1. A copy was sent to Mr. E.F. Johnson.

Note 2. On Nov. 4, W.L. Burlison sent a copy of the

letter to Dean Joseph C. Blair [Head of the College of

Agriculture at University of Illinois from 1938 to 1939] and

added: “If I hear from Mr. Johnson, I will send a copy of

the material to you.”

Source: Univ. of Illinois Archives, Agriculture, Dean’s

Office Subject Files 1895-1994. R.S. 8/1/2. Box 28. Folder:

Soybean Regional Research Lab. Address: President,

National Soybean Processors Assoc., 3818 Board of Trade

Building., Chicago [Illinois].


Protein plastics from soybean products: Action of hardening

or tanning agents on protein material. Industrial and


• Summary: “Protein hardened by an aldehyde at or near its

isoelectric point is thermoplastic. The best plastic with the

lowest water absorption is produced by treating the protein

with an aldehyde in its isoelectric range. Water absorption

increases sharply on either side of this range.

“The most effective hardening agents are some of

the aldehydes, and of these, formaldehyde is the best.

Commercial soybean protein is the best protein material of

those studied for the production of plastic material.”

From 1 week to 6 months is required for the hardening.

The seasoning or drying requires about an equal period.

Address: U.S. Regional Soybean Industrial Products Lab.,

Urbana, Illinois.

76. Nagel, R.H.; Becker, H.C.; Milner, R.T. 1938. The

solubility of some constituents of soybean meal in alcohol-


ref]

• Summary: Describes solvent extraction using ethyl alcohol.

Address: U.S. Regional Soybean Industrial Products Lab.,

Urbana, Illinois.

77. Associated Press (AP). 1938. Peoria site for laboratory:

Wallace announces $1,000,000 farm research project. St.


• Summary: This two-part story was filed from two places:


Secretary of Agriculture Wallace said that Peoria was

decided after a study of more than 200 towns and cities.

Last year, some 31 million bushels of corn, most of it grown

in the area, were processed in Peoria, with more in near-by

Pekin. It was used by distilleries, stock feed manufacturers,

and to make industrial alcohol and human foods. The

Corn Products Refining Company, one of the largest corn

processors in the USA, has a huge factory in Pekin. The

blending of commercial grain alcohol with gasoline for use

as a motor fuel began in this vicinity; the project failed for

technical reasons.

Soybean research has been conducted at the University

of Illinois at a government laboratory [U.S. Regional

Soybean Laboratory, Urbana, Illinois]. Human and stock

foods, “plastics and many other trade uses have been found

for this descendant of the Chinese staple.”

Note: This is the earliest document seen (Feb. 2017)
that mentions soybeans in connection with (but not yet at) the new USDA Northern Regional Research Laboratory at Peoria, Illinois.


“Considerable experimental work has been done during the past year on the development of soybean oil protective films and coatings. This has been especially true of 100% soybean oil varnishes.” Some 36 varnishes are undergoing exposure tests at this time. The soybean oil-phenolics dry free from tack in 4 to 6 hours.

Progress has been made in the development of interesting plastic materials from soybean protein. It was discovered that soybean protein could be treated with formaldehyde solution. When dried to a powder, it possessed thermo-plastic properties and could be molded, as long as the moisture content was at least 5%.

“This is entirely contrary to the literature and has not been used heretofore, so far as we are aware, by the casein plastics industry. The soybean protein which is commercially available today may be used in the process. When the protein is treated with formaldehyde solution at a pH near the iso-electric point, a product is formed that when dried, ground to a powder, and molded produces a plastic that is tough, horn-like, transparent, of yellowish brown hue, and has minimum water absorption.

“It does not warp nor crack and readily takes pigments or dyes to give colors ranging from greys through reds, yellows, greens, and blues. When plasticized with glycols it flows readily but not readily enough in its present stage of development for use in injection molds. Since the material is thermoplastic the mold must be chilled before the object can be removed.”

It has been demonstrated in industry that defatted soybean meal can be used successfully as a modifier in the production of phenolic plastics. “Replacement of formaldehyde by furfural led to great improvement in water resistance although the molded products were quite inferior in this respect to those made from soybean protein.”

Page 59: “The accomplishments to which attention has been called in the foregoing are recorded, not from the standpoint of finality, but merely to point out the trends which the work of the laboratory is assuming. It should be emphasized that most of the experimental work here reported has been underway for less than one year, and hence should be construed as indicating only the possibilities which lie ahead, rather than the definite attainment of objectives.

“The prospects are bright for further industrial use of soybean products. The chief prerequisites for such broadened applications are a more precise knowledge of the physical and chemical properties of the materials for which uses are sought and more definite information concerning the chemistry of the processes through which these materials must pass in industrial utilization. The only road over which we may travel safely toward these desired destinations is the highway of research.” Address: Director, U.S. Regional Soybean Industrial Lab., Urbana, Illinois.

• Summary: “The amount of nitrogenous matter extracted from oil-free soybean meal by various acids and sodium and calcium hydroxides was determined over a wide range of pH values. Data are presented to show the influence of hydrogen-ion concentration on the dispersion of the nitrogenous constituents of the meal by sodium chloride and calcium chloride.

Note: This is the 2nd earliest publication seen written by A.K. Smith. It is also the first that contains the famous graph of soy protein solubility. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


• Summary: This photo shows Jackson L. Cartter, W.J. Morse, H.E. Marston, and W.L. Burlison looking at a document. The lower caption reads: “Soybean specialists from 12 North Central states are attending a three-day work planning conference of the U.S. Regional Soybean laboratory at the University of Illinois which ended Friday. Pictured above are, left to right, Jackson L. Cartter, senior agronomist of the laboratory here; W.J. Morse, soybean specialist of the department of agriculture, Washington [DC]; H.E. Marston, representing the agricultural research administration of the department of agriculture, and Dr. W.L. Burlison, head of the U. of I. department of agronomy.”

• Summary: In the USA, the soybean has recently risen to the status of a major crop, with annual acreage approaching 7 million and farm value of close to $40 million. This has led to an intensive study of its possibilities in the industrial field
and to the establishment in 1936 of a cooperative regional soybean laboratory sponsored by 12 states and the USDA. This laboratory is under the direction of USDA’s Bureau of Chemistry and Soils. Research done by the lab in 1938 is summarized.


- **Summary:** Soybean protein, treated with a strong hardening agent such as formaldehyde, forms thermoplastic material. This material requires a softening agent or plasticizer in order to flow properly with heat and pressure. Previously, water was the main plasticizer used. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


- **Summary:** “The application of molecular or short-path distillation to the separation and purification of many organic materials heretofore incapable of distillation or distillable only with extreme difficulty, amply testifies to the value of this relatively new technic in organic research. The extremely low pressures and short path of travel of the evolved vapors employed in this form of distillation permit the separation of many organic species at temperatures well below the point of thermal decomposition.”

The bibliography is divided into two parts: (1) Molecular stills and applications. (2) Accessory apparatus, materials, and technic. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


A widely used molding compound has a phenol-formaldehyde base to which is added both wood flour and soybean meal. The soybean meal serves as more than just a filler; its protein plays a key role in the plastic. The company developing this product [Ford Motor Co.] has increased its use of soybean meal in the product from 4,000 lb in 1934 to 311,750 lb in 1937. This same company has done extensive work on the development of a textile fiber, similar to lanital, from soybean protein. There are “probably few farm materials which are chemically as favorably constituted for plastics development as the soybean.” Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


Feb.

- **Summary:** The author is chairman of a symposium with the same title as this paper, presented at the 96th Meeting of the American Chemical Society, on 5-9 Sept. 1938 in Milwaukee, Wisconsin.

Agricultural scientists have been interested in the possibility of developing industrial uses for agricultural products for many years. A more widespread interest has developed during recent years as exemplified by the Farm Chemurgic movement and the Congressional action to establish 4 regional research laboratories.

This increased interest is apparently the result of: 1. “the belief that the depressed condition of agriculture following the World War was due to the accumulation of surpluses of agricultural products,” and 2. “to a general acceptance of the view that agriculture and industry represent two interdependent groups. Many industrial leaders believe that good industrial conditions are not apt to prevail for any length of time unless agriculture is reasonably prosperous.”

After the war, surpluses became burdensome. “Five important factors are frequently cited as being chiefly responsible for this situation: 1. Cheap sources of the most expensive element of fertilizers (nitrogen) were made possible by the development of synthetic methods of production. 2. Improved agricultural practices have resulted in increased production. 3. Agriculture increased its production as a result of demands arising during the World War. It is estimated that 40 million additional acres were brought into cultivation during that period. 4. The replacement of horse and mule power by mechanical power resulted in a reduction in the consumption of grain. It is estimated that in this way the products from 30 to 35 million acres were replaced by the products of the oil wells. 5. With the development of organic technology there has been an increased replacement of agricultural products in industry by the products of the mine and the oil well...”

“The fields for developing industrial uses for agricultural products may be classified into 3 groups: the utilization of waste and by-products, the introduction of new crops to yield products to take the place of those now imported and used for industrial purposes, and the development of new uses for crops or crop surpluses for purposes other than food.” Address: Purdue Univ. Agric. Exp. Station and U.S. Regional Soybean Industrial Products Lab.


- **Summary:** “Eighty-seven samples of commercial soybean oil were collected at intervals of two or three weeks from thirteen different soybean processing plants during the first six months of 1936. These plants represent three processes—
expeller, hydraulic, and solvent. Analyses of the oils were made as follows: per cent of feet. per cent of break (Gardner method), per cent of phosphatides, acid number, iodine number, refractive index, and drying time before and after removal of the phosphatides and associated compounds. There was a close correlation between the Gardner break and the percentage of phosphatides of the crude oils as calculated from the phosphorus content of the oils. There was a correlation between the average phosphatide contents of the samples of oil from the different plants and the drying rates. No correlation was found between the phosphatide content of the crude oils and the drying rates of the oils from which the phosphatides had been removed. The results show that the presence of phosphatides retards the drying rate of the crude oils but that other factors are also involved.” Address: Purdue Univ. Agric. Exp. Station.


**Summary:** Today, over 7,000,000 acres of soybeans are planted in the United States. But the soybean has not hit the “big-time” by accident or chance. “It is one of the few great American crops coming into its own by research, planned research, patient effort and design. The late C.V. Piper, a scholar, a dreamer and philosopher, who for many years headed the USDA Office of Forage Crops at Washington [DC], was the man who guessed that the soybean might find a large place in our agriculture if we were only equipped with regionally adapted varieties that somewhere in the world must already exist.

“Back in 1907, Piper picked W.J. Morse, a shy, sturdy New York State farm boy who stood up with distinction under the regimen of required studies at Cornell University, and turned over to Morse the task of building a new crop plant for American field agriculture.

Nearly a decade ago [in Feb. 1926] Piper passed away, but Morse, whom he selected for his soybean work, can now look back over the thirty-one years and scan a record of achievement which I do not believe could be matched even by Piper’s hopes and dreams. If there ever was a one-man-made crop in this country, it is the soybean. And W.J. Morse is the man.”

“In 1907 when Morse started work with the crop, there was probably less than 50,000 acres of soys in the whole country.

“Morse realized that if the crop were ever to become national, varieties adapted to the different sections must be developed. And so a dragnet was set for all the soy varieties the Orient had to offer. And through the years Morse has put more than 10,000 different lots of imported beans through his tests. And the Morse test is not just a routine affair. It consists of an intimate personal study of every single bean plant growing in the little plots of these introductions.

“A less exacting man than Morse might have put these lots of beans through a test and got nowhere, for not in a single case has an introduction led immediately and directly to the establishment of a new commercial variety in this country. These introductions, as they come in, are not pure strains. In fact, always a wide variation of plant types are found growing in these little plots of so-called varieties brought in from other lands. Year after year, for more than three decades, Morse has literally lived his summers out in the fields selecting the most promising-looking plants from each of these introductions. And it is from single-plant selections made by Morse that we have developed 90 per cent of the commercial soybean varieties today.

“Back in 1913, the first variety well adapted to the Corn Belt was introduced. This was the well-known Manchu. There followed such sorts as Virginia and Wilson.”

The new trend, north and south, is toward growing soybeans for their seeds, “as higher-yielding varieties have been developed for the different sections and as a new and simple way of harvesting has been devised.

“The big grain yields have been in the Midwest, many of the growers getting around forty-five bushels to the acre. In Wisconsin, yields as high as fifty bushels have been secured... The drift everywhere is toward an earlier type of bean.”

“With soybean oil coming into the picture with prospective large-scale use for paint and varnish, one weakness in the present commercial setup is that the oil mills have not yet offered a premium price for high oil-content varieties. Morse has consistently carried along oil-content studies of all his introductions, and there are now some splendid seed-yielding sorts which carry from 21 to 23 per cent oil, while the ordinary run of beans carries only 18 to 19 per cent. One of Morse’s varieties, the Dunfield, a Midwest adapted bean, very seldom runs under 20 per cent oil.” It has yielded as high as 23.3 per cent. “A sliding price scale based on percentage of oil might prove highly advantageous to both the grower and the oil mill.”

Note: This is the earliest document seen (Aug. 2011) that discusses the many advantages of adopting the practice of buying and selling soybeans on the basis of their composition (oil or protein content).

“And while chemical and heat treatment already show great promise of making over soy oil into a quick-drying paint oil, Morse has started still another attack on this problem.

“Quick-drying oil: In Manchuria there are found little trailing, small-seeded, wild forms of soybeans. These wild soybeans rarely ever carry an excess of 10 per cent of oil, but this oil has a peculiar property. It has what the chemists call an ‘iodine number,’ which runs up to 155. In ordinary soy oil the iodine number is rarely over 130.

“This so-called iodine number is the key to how rapidly an oil will dry, the higher the number the quicker the drying. This wild soybean oil is a quick dryer, and therefore should
be an excellent paint oil without any treatment.”

“When Morse came back from the Orient in 1931, after a two-year stay studying this great Oriental crop, he brought with him a large collection of a radically new type of soy—the green-vegetable type. Previous explorers had missed this type of bean because, in the Orient, they go by an entirely different name. In Manchuria and Japan—the home of this bean sort—ordinary field beans are called Daizu, while the green-vegetable beans are called Eda Mame. Previous explorers, asking for Daizu never in a single instance got Eda Mame. Morse, living close with the bean growers, soon picked up this distinction and brought home the new product in all its variations.

“Today, from this material he brought back there have been developed something like seventy-five distinct green-vegetable varieties, fitting an even wider range of country than do the field-bean kinds. They vary in maturity all the way from seventy-five to one hundred and fifty days. One of these varieties matures seed at Winnipeg, Canada.”

On pages 78-79 are three special sections to the article: (1) “Quick-drying oil:” Wild soybeans are found in Manchuria. They are small seeded and the viny plants have a trailing habit. The seed rarely contains more than 10% oil, but this oil has a very high iodine number (up to 155) which means that the oil dries quickly and is good for paints. The iodine number of regular soybeans is rarely above 130.

(2) “Late soybean news:” At the great soybean iodine number of regular soybeans is rarely above 130. It has a trailing habit. The seed rarely contains more than 10% oil, but this oil has a very high iodine number (up to 155) which means that the oil dries quickly and is good for paints. The iodine number of regular soybeans is rarely above 130.

(3) “A clamor for seed:” An article that the present writer investigated the effect of heat, light, time of reaction, and size of sample on iodine numbers obtained by the Kaufmann method. Address: 1. Junior Chemist; 2. Senior Chemist. Both: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


• Summary: Contents: Introduction. Recent phenomenal acreage increase. Soil relationships. Effect of slope. Climatic influences. Relation to pests and diseases. Use of soybeans for food and feed (coffee substitute, “cooked as a green vegetable,” “soy sprouts of about two inches receive praise as a winter vegetable,” “Duluth confectionary counters display ‘Salted Soys’ alongside other exotic nuts,” “Recipes for preparing soybean ‘milk’ circulate widely”).

Note. This is the 3rd earliest English-language document seen (Jan. 2013) that contains the modern term “soy sprouts.”

Industrial uses of soybean oil and residue: the regional industrial products laboratory in Urbana, Illinois, staffed by 40 men.

Figures show: (1) Bar chart of the world’s principal soybean producing countries in 1924-25, and in 1935-36. In 1936, Manchuria was by far the leader, followed by the USA, Chosen [Korea], Japan (whose production has decreased since 1925), and Netherland India [today’s Indonesia].

(2) A map of the eastern half of the United States, with carefully located 50,000-acre dots showing areas of heaviest soybean production. Between 1934 and 1939, the area increased 5-fold in Mississippi and 21-fold in Minnesota. The area in Oklahoma decreased.

(3) A graph shows that the number of combines used to harvest soybeans in Illinois skyrocketed from 0 in 1924, to about 20 in 1925, to about 75 in 1926, to about 300 in 1927; by 1935 the number had increased to an estimated 3,000. (4) A photo shows a combine harvesting soybeans.

(5) A photo of a “Superior field of Indiana soybeans probably cultivated for the last time as plants shade most of the field’s surface. Two-row corn cultivators or “beet cultivators may till four such soybean rows simultaneously.

(6) A graph shows soybean oil imports into the United states; these imports increased dramatically during World War I, peaking in 1918 [at 335.98 million lb].

(7) A map shows the location of soybean oil mills in the


• Summary: The reaction between formaldehyde and proteins is of paramount importance in the development of protein plastics, coatings, sizes, adhesives, and fibers. It has been used in these industries as a hardening process for many years. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.
United States. There are large numbers in Illinois, Indiana, Ohio, Iowa, and North Carolina.

(8) A bar chart shows “Utilization of soybean oil processed in the United States” in 1934, 1935, and 1936. In 1934 the 30 million lb was used mostly by the drying oil industry. In 1935 the 140 million lb was used mostly for [lard] compounds and vegetable shortenings. In 1936 the 280 million lb was still used mostly for compounds and vegetable shortenings, but a significant amount was used for oleo, other edible, the drying oil industry, and soap.

(9) A photo shows a mill for removal of oil from Corn Belt soybeans; the processing plant serves an area tributary to Champaign, Illinois, and ships the oil to Chicago factory area.

“Soybeans provided some of the none-too-kindly remembered ‘coffee’ rations to Union Civil War soldiers. Sausage makers, at times, put up to 50 per cent soybean flour in part of their product.”

Note: This is the earliest English-language document seen (Dec. 2012) that uses the term “Salted Soys” to refer to soynuts.


• Summary: “Summary: Two quasi-factorial arrangements which are especially well adapted to the testing of differences between large numbers of varieties are described and treated in detail as to their analysis and value.

“The arrangements described are balanced incomplete block and lattice square designs. Soybean variety trials are used to illustrate the analysis and the relative precision on soils of varying homogeneity.” Address: Ames, Iowa.


• Summary: “The situation at Washington [DC] as relates to the future of the soybean laboratory is anything but encouraging. Two or three years ago, when the Bureau of Soils was very solicitous of getting favorable consideration, they were very willing to lead the various officials at the University of Illinois to believe that the arrangement on housing and so forth was only very temporary. At that time the Bureau of Chemistry and Soils placed the new building to house the soybean laboratory as the number one recommendation of the department. Today it occupies tenth position, a point that Senator Lucas’ office made very clear to me in discussing the possibility of some action on a new building.

“There is no doubt that two things have occurred with the establishment of the four federal laboratories. In the first place, I think this increase of money has somewhat gone to the heads of the officers of the Bureau of Soils and they intimate that they might well have the full authorization for handling much more of the money that goes to the Department of Agriculture. Such feelings are substantiated by confidential reports from some of the other departments.

“The second important happening has been that officials of the Bureau of Chemistry and Soils, which very definitely includes Dr. May and Dr. Knight, realize that the appropriations for the four federal laboratories are a part of the AAA program, one of very uncertain future political favor. They are determined, it seems, to make a tie-up so as to use the soybean laboratory as a protection for those other laboratories, even I believe being perfectly willing to force the movement of this laboratory to Peoria, as so doing would help protect the federal laboratories.

“Their present proposal, which they finally agreed to withdraw temporarily, was to have the soybean laboratory report directly to Peoria. They also proposed to make at least the acting head of the soybean laboratory an appointee of the Peoria laboratory and then assign him to the soybean laboratory.

“I had the matter of a new building up with the office of Senator Lucas and of course there is no assurance in the first place that any funds will be available. In the second place, Senator Lucas’ office was very positive that any solicitation on the building must originate from the University. They also reminded me that the Bureau of Soils’ position of placing the new building in tenth position was a serious matter.

“I think temporarily at least my remonstrating with them slowed up any attempt to put in changes. I believe that we have an opportunity to marshal our forces and prevent such a calamity happening. It is my thought that possibly Mr. Atwood should approach Secretary Wallace, that the soybean growers association and the processors association should go directly to Jardine, and the entire situation must be gone over in detail with Dr. Burlison.

“Confidentially, I believe that Milner will resign in the very near future and that probably Hopper will be named head of the laboratory. I am unable to advise as to how much of Milner’s action is due to dissatisfaction with the present maneuvering with the soybean laboratory and how much is due (as he will probably claim) to his preference to stick with strict research and not become administrative.

“The Bureau of Soils conceded that one argument I made had considerable weight. I presented the argument that if the Department placed the soybean laboratory subject to the Peoria laboratory by requiring it to report thusly, the soybean people would have little argument to present to Congress for the soybean laboratory not to be included as an integral part of the Peoria laboratory. This initial step would automatically block any arguments that we might try to put
up to a cut-off of the soybean appropriation and a moving of the laboratory to Peoria.

“Your very truly, Ralston Purina Company, E.F. Johnson, Soybean department.

“P.S. although I question whether sufficient funds could be secured to immediately start work on a new building, my understanding is that it is practically impossible to secure such appropriate unless building plans and specifications are available. With this in mind, it may be best to petition Senator Lucas to ask for $25,000 to be used in the preparation of plans and specifications for such a building at this time.”

Note 1. This is a key document for understanding why much of the Soybean Laboratory was removed from the University of Illinois and merged into the Northern Regional Research Lab.

Note 2. On 3 July 1939 H.P. Rusk returned a copy of this letter sent to him by W.L. Burlison, Head, Agronomy Dep., Univ. of Illinois. Rusk said he read it “with a good deal of interest.”

Source: Univ. of Illinois Archives, Agriculture, Dean’s Office Subject Files 1895-1994. R.S. 8/1/2. Box 28. Folder: Soybean Regional Research Lab. Address: Soybean Department, Ralston Purina Co. (St. Louis, Missouri).

94. Burlison, W.L. 1939. Re: Suggestions for keeping Soybean Laboratory in Urbana. Letter to H.P. Rusk, [Director, Agricultural Experiment Station], Univ. of Illinois, Urbana, July 6. 2 p. Typed, with signature on letterhead.

• Summary: “The other day we were talking about a ‘whispering campaign’ to remove the Soybean Laboratory from Urbana to Peoria. You suggested that I might mention some reasons for keeping it here. Some of these reasons follow.

“Urbana is the center of the soybean region and from that standpoint is the most logical location for the Soybean Laboratory. The Illinois Agricultural Experiment Station has gone to much trouble and inconvenience to provide accommodations for the chemical and agronomic sections of the Laboratory during its early development.

“Excellent library and technical facilities are offered at Urbana. A new power plant of adequate capacity is being erected where steam and power will be available. An excellent building site has been offered the Laboratory and good housing is available to the staff.

“Much space has been provided for the chemical section of the Laboratory. Numerous physiological facilities have been furnished, both greenhouse and laboratory. Facilities for seed storing and conditioning have been furnished.

“The breeding program for development of improved soybean varieties for industrial uses, carried on in close cooperation with the Illinois Agricultural Experiment Station on the fields of the Agronomy Farm is an important part of the soybean program. This program can be carried on more efficiently at Urbana where close cooperation is most advantageous and economical.

“For most rapid progress close cooperation must be maintained between the Laboratory and the Experiment Station and between the agronomic and chemical sections of the Laboratory. Separation of these closely related activities would seriously impair the objectives for which the Laboratory was originally established.

“Moving of the Laboratory from Urbana or association of the Laboratory with any other agency would, without doubt, seriously impair the close and sympathetic interest of the soybean grower and processor in this development.

“It is important to emphasize that the more closely associated different groups are in this project, the better co-ordinated the work is likely to be and I fear that if this work is detached from the Agricultural Experiment Station, even being taken over to Peoria, it will handicap both groups and we will be gradually pulled apart despite all the efforts we may make to avoid this.”

Note: Henry Perly Rusk was Dean of the Illinois College of Agriculture (1939-1952) and Director of the Agricultural Experiment Station (1932-1952).


• Summary: “The other day when I was in your office I agreed to send you one of the soybean protein-phenolic plastic pencils.

“Governor Horner has always been interested in our work, particularly the utilization of farm products by industries. I take it you will want to write a little personal letter to the Governor.

“The pencils are made of 37½ percent oil-free soybean meal, 25 percent wood flour, and 37½ percent phenolic resin. This mixture was developed and made into a molding powder in the soybean laboratory. The soybean meal was first hardened with formaldehyde, dried, and then mixed with the other constituents [Footnote: In our own Soybean Lab]. The mixture was worked on calender rolls, and then powdered. The molding powder made in this way was used in a commercial plant to make the pencils by the same process used on the commercial plastics.”


• **Summary:** “I know you have been interested in our work here dealing with the utilization of farm products by industries, and I take pleasure in sending you, under another cover, one of the soy protein-phenolic plastic pencils which was made in our soybean laboratory.

“The pencils are made of 37½ percent oil-free soybean meal, 25 percent wood flour, and 37½ percent phenolic resin. This mixture was developed and made into a molding powder in the soybean laboratory. The soybean meal was first hardened with formaldehyde, dried, and then mixed with the other constituents. In our own soybean laboratory, the mixture was worked on calender [sic] rolls, and then powdered. The molding powder made in this way was used in a commercial plant to make the pencils by the same process used on the commercial plastics.

“I trust this pencil will be useful to you.

“Very truly yours....”

Source: Univ. of Illinois Archives, Agriculture, Dean’s Office Subject Files 1895-1994. R.S. 8/1/2. Box 28. Folder: Soybean Regional Research Lab. Address: Dean and Director, Univ. of Illinois.


• **Summary:** “I had a long session with Mr. Trullinger and in the course of our conversation I raised the question regarding the soybean laboratory. I think we should have Hannah or someone else make a study of the law establishing the soybean laboratory and the one establishing the million dollar laboratory in Peoria. Apparently there is a little conflict and it appears very probable that those phases of research dealing with direct application to commercial uses, not necessarily discovering new commercial uses, will have to be carried out in Peoria. I was advised by Mr. Trullinger that the only thing which can be done legally is to discontinue certain phases of the work here, or discontinue work here entirely; but the laboratory cannot be transferred to Peoria.”

Note 1. Mr. Trullinger was probably Robert W. Trullinger, head of USDA’s Cooperative State Research Service; later (1946-1955) he was head of USDA’s Office of Experiment Stations.

Note 2. Hannah was H.W. Hannah, Asst. to the Dean, College of Agriculture, Univ. of Illinois.

Source: Univ. of Illinois Archives, Agriculture, Dean’s Office Subject Files 1895-1994. R.S. 8/1/2. Box 28. Folder: Soybean Regional Research Lab. Address: [Director, Agric. Exp. Station, Univ. of Illinois, Urbana].


• **Summary:** “The determination of oil content of soybeans is probably the most important analysis made on this material. The chief factors which may affect this determination are: (1) solvent; (2) apparatus used. (3) grading of sample; and (4) pretreatment of sample.

A graph with 6 curves shows percentage oil extracted vs. time in hours. Address: Millner is chairman.


• **Summary:** “I am handing you herewith the following documents:” Cites four 1939 letters, one confidential, concerning the soybean laboratory (each has a complete record in BIBLIO).

“I am also sending some confidential material which I recently received from Julian Friant.

“I think it may be well for you to refresh your memory regarding the legal authority for the establishment of the soybean laboratory at Urbana. Dr. Burlison and I shall both greatly appreciate any suggestions regarding procedure in the light of the fact that practically everything that Mr. Johnson predicted to Mr. Dies in his letter of June 23 has come to pass and it seems to be a very definite effort on the part of some people we thought were our friends to move all of the soybean work to Peoria.”

Source: Univ. of Illinois Archives, Agriculture, Dean’s Office Subject Files 1895-1994. R.S. 8/1/2. Box 28. Folder: Soybean Regional Research Lab. Address: [Director, Agric. Exp. Station, Univ. of Illinois, Urbana].


• **Summary:** “I have your letter of August 2 in which you advise that indirectly you have learned that Dr. Markley has been ordered to Washington [DC].

“My guess is that unless something drastic is done in the way of building or housing, not only will the best men in the soybean laboratory be moved to Peoria, but the entire laboratory will be moved there in the not too distant future. “However, I have washed my hands of any further activity.”


• **Summary:** An illustration shows the apparatus which was found superior to those of the Bidwell-Sterling type. “Because the removal of droplets of water forming on the walls of the condenser is accomplished automatically and the milky suspension forming in the receiver is eliminated by automatic redistillation.” Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


• **Summary:** A German-language summary of the following English-language article with the same authors and title published in Nov. 1938 in *Industrial and Engineering Chemistry* 30(11):1236-1240. Address: Illinois.


• **Summary:** “At the last meeting of the American Soybean Association, a progress report was made on the status of a number of projects of the U.S. Regional Soybean Industrial Products Laboratory, especially those projects which deal primarily with the utilization of soybean oil in the drying oil industry and soybean protein in the experimental production of plastics. Since that time progress has continued to be made which, in view of the nature and difficulties of the problems, may be considered gratifying even though it may not be said to be spectacular. Mention will be made later of the more important results of these investigations, but I should like to devote a few minutes to a brief discussion of the equipment and facilities of the laboratory as they are constituted at present.

“The greater part of the equipment which was considered most essential for immediate work on the various research projects under investigation has been installed and is currently in operation. The pilot plant solvent extractor (slide), which has not been operated heretofore for lack of personnel, is now in operation, and to date has been used principally for the extraction of wax and oil from soybean hulls and the recovery of oil from the press cake produced during winterization of soybean oil. Studies are under way which are intended to throw light on the nature and composition of both of these products. Investigations are also under way on the factors influencing the rate of extraction of oil from the beans by various solvents and on the effects of variations in these factors on the quality of the oil produced. The forced draft drying chamber (slide) has been equipped for the maintenance and accurate measurement of any predetermined humidity at any temperature up to 340 degrees F. This equipment is being used to determine the equilibrium moisture content of soybeans, and their drying rates at all humidities in the temperature ranges encountered in commercial processing practice.

“An improved type of molecular still (slide) has recently been installed which has, not only a higher total capacity, but also a higher over-all efficiency than the one previously used in the fractional distillation of soybean oil. A laboratory-size paint mill (slide) for use in the preparation of paints and enamels has been installed, and the capacity of the Sanderson drying time meter (slide) has been increased from 6 to 12 units. A pilot plant varnish and synthetic resin kettle (slide) has just been installed and will be placed in operation in the near future. The kettle is electrically heated, and is equipped for operating under atmospheric and up to 60 pounds pressure per square inch, for working under inert gases such as carbon dioxide and nitrogen, and for work in vacuo [sic, vacuo?]. The most recent additions to the equipment of the laboratory have been a Littrow type spectrophotometer and Hilger microphotometer for use in the quantitative determination of trace-elements in the nutrient solutions used for culturing soybeans and in their distribution in various organs of the soybean plant. A small constant temperature room is being remodelled for the installation of this apparatus and the necessary accessory photographic equipment.

“Equipment has been assembled (slide) for the investigation of the fundamental protein-water relationship, which is of extreme importance in any work with soybean meal. A cathaphoresis cell (slide) has been designed and built to enable the study of the effect of electrical charges on the protein particles under different physical and chemical conditions. A slit-ultra microscope (slide) will materially assist in investigations along this line by making possible the direct observation of particles of colloidal dimension. Testing equipment (slide) has been installed to compare the impact and flexing resistance of soybean plastic materials with that of plastic materials already commercially established.

“The engineering section of the laboratory has semi-plant scale equipment for processing soybeans by either the expeller or the solvent extraction method. Expeller crushing is done in a half-size super-duo machine (slide) which is connected to a small rotary drier into which soybeans that have been ground to the proper fineness in a small roller mill
are fed. It has been gratifying to observe that operation of this expeller, in spite of its small size, has been found to be practically identical with that of larger machines and that the products are likewise indistinguishable from commercially-pressed oil and meal.

“Space limitations have prevented the installation of pilot plant continuous solvent extraction apparatus, but a batch extractor (slide) having a capacity of one bushel of beans has been installed...

“On the basis of the exposure records up to the present time, it may be concluded that soybean oil is as durable as tung, perilla, or linseed oils when cooking with rosin ester or Bakelite 254 resin to form varnishes in which the only variable is the type of oil.”

A considerable amount of experimental work has been carried out on the problem of “reversion” of soybean oil.

“The most important development to date in the soybean protein investigations has been the production of a protein solution containing formaldehyde. When this solution dries, the soybean protein which is deposited is formaldehyde-hardened protein, and it is in the most water-resistant state attainable. This protein solution is being used commercially by a paper factory to size glassine paper and by a leather tannery to finish leather; in both cases producing effects superior to those produced by regular sizes or finishes...

“The soybean-phenolic plastic has been further developed, so there is a good possibility that it may find a place in the plastics field. It is about as strong as regular molding Bakelite; almost as water resistant, about 2% absorption in 24 hours; and costs about the same as the cheapest Bakelite.” Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


• Summary: See next page. “The following resolutions were presented to and passed by the American Soybean Association at its twenty-first Annual Convention held at the University of Wisconsin, Madison, Wisconsin, September 11 and 12, 1939.

1. Appreciation is “extended to the Univ. of Wisconsin, Professor G.M. Briggs, and all others who assisted in making this annual meeting such a pleasant and educational affair.

2. Approval and appreciation of the efforts of the legislative committee of the Association in cooperation with the Domestic Fats Conference to protect and further the production of domestic fats and oils until such production reaches our domestic requirements.

3. The development and use of vegetable soybeans has been given real impetus by the excellent research publications of the University of Illinois and by the pioneering work in processing and merchandising the green vegetable soybeans by Wisconsin canning companies.

Similar activity in the field of human food products by many industries constitute a development that is much appreciated.

“4. The continuing interest of the Pennsylvania Railroad, expressed by the activity of its agricultural agent, Mr. Russell G. East, in again circulating its soybean exhibit in cooperation with the American Soybean Association, is deeply appreciated.

“5. Appreciation of the efforts of the United States Regional Soybean Industrial Products Laboratory, extension workers, commercial laboratories, National Chemurgic Council, state experiment stations, and agricultural colleges toward the development of various phases of the American soybean industry.

“6. The financial support of a sympathetic industry which makes possible the annual proceedings of the Association is gratefully acknowledged.

“7. The financing of the activities of the Association on behalf of soybean producers can only be met by an equitably distributed cost to all soybean producers. The directors and officers of the Association are hereby given authority to consider plans for the collection of .1 cent per bushel on all soybeans processed, and to carry out such plans as may be entered into to make such collection possible.


• Summary: Electrodialysis through parchment paper offers no advantages over acid precipitation. Tannic acid may be used to recover protein not precipitated by sulfuric acid. Fig. 1 is a U-shaped graph showing precipitation of soybean protein from water and alkaline dispersions.

Note: This is the earliest document seen (March 2002) concerning use of a membrane technology (electrodialysis) in connection with soy. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


"History: Ancient Chinese literature reveals that the soybean was extensively cultivated and highly valued as a food centuries before written records were kept. The first record of the plant is contained in a materia medica describing the plants of China, written by Emperor Sheng Nung in 2838 B.C. Methods of culture, varieties for different purposes, and numerous uses are repeatedly mentioned in later records, indicating the soybean to be of very ancient cultivation and perhaps one of the oldest crops grown by man. It was considered the most important cultivated legume and one of the five sacred grains essential to the existence of Chinese civilization. Soybean seed was sown yearly with the ages have extolled the virtues of the plant in its services to humanity.

“The soybean was first made known to Europeans by Engelbert Kaempfer, a German botanist, who spent 2 years, 1691-92, in Japan. Seed sent by Chinese missionaries was planted as early as 1740 in botanic gardens in France...”

“Distribution and production: The soybean is grown to a greater extent in Manchuria than in any other country in the world. It occupies about 25 percent of the total cultivated area and is relied upon by the Manchurian farmer as a cash crop. China, Japan, and Chosen [Korea] are large producers and the soybean is cultivated more or less also in the Philippines, Siam, Cochin China, Netherland India [later Indonesia], and India. In other parts of the world, particularly Germany, England, Soviet Union, France, Italy, Czechoslovakia, Rumania, Mexico, Argentina, Cuba, Canada, New South Wales, New Zealand, Algeria, Egypt, British East Africa, South Africa, and Spain, various degrees of success have been obtained.”

The section on diseases discusses the following: Purple spot of seeds, bacterial blight, bacterial pustule, mosaic, wilt, brown spot, sunburn or aphid injury, downy mildew, pod and stem blight, anthracnose, sclerotial stem rot, frog-eye spots, and Pythium root rot.

A table (p. 6-7) shows different varieties of soybeans recommended for four different uses (seed, forage, green vegetable, or dry edible), classified by the length of the growing season. Green vegetable—Very early (100 days or less): Agate, Siou. Early (101 to 110 days): Bansei, Chusei, Goko, Kanro, Waseda. Medium early (111 to 120 days): Fuji, Hakote, Hiro, Hokkaido, Jogun, Kura, Osaya, Sato, Shir, Sousei, Suru, Toku, Willomi. Medium (121 to 130 days): Chame, Funk Delicious, Imperial. Medium late (131 to 140 days): Aoda, Hago, Higan, Rokusun. Late (141 to 160 days): Nanda.

Dry edible—Early (101 to 110 days): Bansei, Chusei, Goko, Kanro, Waseda. Medium early (111 to 120 days): Hokkaido, Jogun, Osaya, Sousei, Suru, Toku, Willomi. Medium (121 to 130 days): Funk Delicious, Imperial. Medium late (131 to 140 days): Easycook*, Haberlandt*, Higan, Rokusun, Tokyo*. Late (141 to 160 days): Nanda.

Note: All dry edible varieties except three (Easycook, Haberlandt, and Tokyo—which are followed by an asterisk (*)) are also included in the green vegetable group. But many in the green vegetable group are not included in the dry edible group.

Detailed descriptions of the following 125 varieties are given (p. 7-17): Agate, A.K., Aksarben, Aoda, Arksoy, Avoyelles, Bansei, Barchet, Biloxi, Black Beauty (same as Ebony), Black Eyebrow, Cayuga, Chame, Charlee, Chernie, Chestnut, Chiquita, Chusei, Clemson, Columbia, Creole, Delnoshat, Delsta, Dixie, Dunfield, Early Green (same as Medium Green), Early Virginia Brown (same as Virginia), Early Wilson (same as Wilson), Early Wisconsin Black (same as Wisconsin Black), Early Yellow (same as Ito San), Easycook, Ebony, Elton, Fuji, Funk Delicious, George Washington, Georgian, Goko, Guelph (same as Medium Green), Habaro, Haberlandt, Hago, Hakote, Harbinsoy, Haysed, Herman, Higan, Hiro, Hokkaido, Hollybrook, Hongkong, Hoosier, Hurtlebrink, Illini, Ilsoy, Imperial, Indiana Hollybrook (same as Midwest), Ito San, Jogun, Kanro, Kingwa, Kura, Laredo, Large Brown (same as Mammoth Brown), Large Yellow (same as Mammoth Yellow), Late Yellow (same as Mammoth Yellow), Lexington, Macoupin, Mamloxi, Mammoth Brown, Mammoth Yellow, Mamredo, Manchu, Mandarin, Mandell, Mansoy, Medium Early Green (same as Medium Green), Medium Early Yellow (same as Ito San), Medium Green, Medium Yellow (same as Midwest), Midwest, Minsoy, Misssoy, Monetta, Morse, Mukden, Nanda, Nanking, Norredo, Northern Hollybrook (same as Midwest), Ogemaw, Old Dominin, Oloxi (formerly Coker’s Black Beauty), Osaya, Oototan, Ozark, Palmetto, Pee Dee (Coker’s 31-15), Peking, Pine Dell Perfetion, Pinup, Richland, Rokusun, Sato, Scito, Shir, Siox, Sooty, Sousei, Southern Green, Southern Prolific, Soysota, Suru, Tarheel Black, Toku, Tokyo, Virginia (selection {19186-D} from the Morse variety at Arlington Experiment Farm in 1907), Waseda, Wea, White Biloxi, Willomi, Wilson, Wilson-Five, Wisconsin Black, Woods’ Yellow, Yelredo (a nonshattering selection, Coker’s 319), Yokoten. Address: 1. Senior Agronomist; 2. Assoc. Agronomist, Div. of Forage Crops and Diseases; Both: USDA Bureau of Plant Industry, Washington, DC.


Summary: A graph of 3 samples of soybean oil, each extracted in a different way, with many samples taken of each, shows that the refractive index and the iodine number of each are in a linear relationship, which can be represented by a formula. Address: U.S. Regional Soybean Industrial
Products Lab., Urbana, Illinois.


   Address: Illinois.

   Chapter 7, “Casein Plastics” (p. 181-232) discusses several applications of soy protein in making plastics. Soybean meal “found industrial application in the form of a mixed phenol-formaldehyde-protein type of plastic. It has to be noted that the recorded work of Satow on the development of plastics form soybean products was by wet-process methods. His extravagant and often contradictory claims become understandable by comparison with analogous early development of casein plastics.” “Recently it has been shown that it is possible to prepare a fully hardened and thermoplastic body from casein or... soybean protein, by treatment with an aldehyde or other hardening agent. With soybean commercial protein, formaldehyde is taken up to about one per cent, forming a perfectly thermoplastic body with moisture reduced to 5 per cent or less.”
   Chapter 8, “Casein Glues” (p. 233-92) notes that “glue made from soybean meal, which chemically is very similar to casein glue, largely displaced casein glue in the manufacture of softwood plywood, especially on the Pacific Coast.” Address: 1. Chief Chemist, S.D. Warren Co., Westbrook, Maine; 2. U.S. Forest Products Lab., Madison, Wisconsin.

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   • Summary: In 1936 Carter helped to organize the U.S. Regional Soybean Industrial Products Laboratory at the University of Illinois (Urbana, Illinois). It was founded April 1936. He became the first director of its agronomic division and was placed in charge of the soybean breeding program for the 12 midwestern states; he studied the soybean’s oil and protein composition, and served as director of the laboratory until his retirement in 1965.
   This digital photo (see next page), with caption, was sent to Soyfoods Center by Joyce Garrison (William Morse’s granddaughter) of West Hartford, Connecticut (July 2004).

   • Summary: “The apparatus described in this paper was developed for the quantitative study of problems involving a gain or loss in weight. Problems of the first type are chiefly associated with the oil obtained from the soybean because it is used in the drying oil industry where the capacity to absorb oxygen is an index of its usefulness for that purpose, and the decrease this capacity is an indication of the deterioration of the oil.”
   Problems of the second type—concerning a loss in weight—appear in the study of drying rates

   • Summary: Casein plastic is the result of a reaction between casein and formaldehyde. Commercial possibilities of the hornlike product of this reaction were first appreciated about 1897 by Adolf Spitteler (21, 25), a German chemist. Throughout this period the industry was entirely controlled by the German-French firm, Internationale Galalith-Gesellschaft Hoff & Compagnie, located at Harburg.
Germany, and the product was called “Galalith,” meaning milkstone. This firm is still in business and is probably the largest casein plastics manufacturer in the world.

The first American casein plastic material was Aladdinite, followed by Karolith, Kyloid, Inda, and finally by American Erinoid. These were not established on a profitable economic basis in this country. Accordingly, Karolith, the Erinoid Company of America, and Pan-Plastics merged in 1931 to form the American Plastics Corporation.


**Summary:** Many representative soybean oils and other vegetable oils were examined by the Cleveland open cup method and their smoke, flash, and fire points were reported. Crude expeller soybean oil had an average flash point of 300°C (573°F) and an average fire point of 351°C (664°F). Crude solvent extracted oil had an average flash point of 316°C (602°F) and an average fire point of 355°C (672°F). Refined soybean oil had an average flash point of 329°C (624°F) and an average fire point of 361°C (681°F).

The higher the flash and fire points, the more thermally stable and less dangerous (as when deep-frying) is the oil. “Soybean oil appears to be superior in smoke, flash, and fire point characteristics to all other oils of corresponding type which were examined, and it may be concluded that good quality soybean oil, free from excessive quantities of free fatty acids and foots, may be safely heated to 600°F (315°C) and above without undue risk of fire.” Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


**Summary:** “Soybean protein dispersions in concentration up to 10% are prepared in the presence of formaldehyde. Mild hydrolytic treatment of the protein is an important factor in preparing such dispersions...

“A protein-formaldehyde dispersion of the type described in this paper has found its first commercial application in the surface sizing of glassine paper for which the usual alkaline type of dispersion made from casein or soybean protein is unsuited.” Making laminated plastics is another application of this dispersion which shows considerable promise. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


**Summary:** “Soybean oil can be considered suitable for the manufacture of varnishes with no loss in durability, either when utilized as the only oil present or when blended with tung, perilla, and linseed oils.” Phenolic resin-soybean oil varnishes have excellent durability. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.

119. ACE (U.S. Bureau of Agricultural Chemistry and
### Table: Factory Production and Consumption of Soybean Oil

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Factory Production</th>
<th>Shortening</th>
<th>Oleomargarine</th>
<th>Other Edible Products</th>
<th>Soap</th>
<th>Drying Oil Industry</th>
<th>Miscellaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>1931</td>
<td>1,000 lb.</td>
<td>1,000 lb.</td>
<td>623</td>
<td>1,000 lb.</td>
<td>3,816</td>
<td>8,901</td>
<td>2,051</td>
</tr>
<tr>
<td>1932</td>
<td>39,445</td>
<td>10,869</td>
<td>3</td>
<td>180</td>
<td>5,571</td>
<td>11,583</td>
<td>1,875</td>
</tr>
<tr>
<td>1933</td>
<td>26,553</td>
<td>4,689</td>
<td>7</td>
<td>460</td>
<td>4,235</td>
<td>14,274</td>
<td>2,626</td>
</tr>
<tr>
<td>1934</td>
<td>35,366</td>
<td>2,755</td>
<td>24</td>
<td>509</td>
<td>1,354</td>
<td>13,353</td>
<td>2,109</td>
</tr>
<tr>
<td>1935</td>
<td>105,066</td>
<td>52,452</td>
<td>1,740</td>
<td>9,421</td>
<td>2,549</td>
<td>17,871</td>
<td>1,665</td>
</tr>
<tr>
<td>1936</td>
<td>225,297</td>
<td>113,897</td>
<td>14,262</td>
<td>21,598</td>
<td>5,023</td>
<td>17,419</td>
<td>3,405</td>
</tr>
<tr>
<td>1937</td>
<td>194,411</td>
<td>90,728</td>
<td>31,793</td>
<td>15,560</td>
<td>10,274</td>
<td>17,157</td>
<td>3,038</td>
</tr>
<tr>
<td>1938</td>
<td>243,613</td>
<td>143,318</td>
<td>39,886</td>
<td>11,280</td>
<td>10,897</td>
<td>18,847</td>
<td>5,340</td>
</tr>
</tbody>
</table>

### Summary:

A table on page 1 shows factory production and consumption of soybean oil in the United States from 1931 to 1938. It is broken down into total factory production, shortening, oleomargarine, other edible products, soap, drying oil industry, and miscellaneous. Note the extensive bibliography. Note also that this is the earliest document seen that specifically mentions the use of soy oil to make detergents.

Concerning sterols: “The unsaponifiable fraction, amounting to 0.5 to 2 percent of the original crude soybean oil, is of little commercial value at the present time. Somewhat less than half of the total unsaponifiable matter of the crude oil consists of a mixture of sterols, principally sitosterols, dihydrositosterol, and stigmasterol... Because of the interest in stigmasterol as a source of material for the preparation of certain sex hormones, the recovery of this substance from the crude mixture of sterols has attracted considerable attention. The stigmasterol content of the crude oil is probably not over 0.1 percent and its recovery entails many operations of a highly technical character.”

Note: This is the earliest document seen (Oct. 2001) concerning industrial (non-food) uses of soy sterols. Address: USDA.


- **Summary:** Contents: Composition and physical properties. Soaps and detergents. Paints, varnishes, and related products. Edible products. Phosphatides [including commercial soybean lecithins]. Sterols. Vitamins.

The section titled “Edible products” states: “In recent years the principal outlet for soybean oil has been in the edible field and, as mentioned above, it is essential that the oil be refined, bleached, winterized, and deodorized to remove part or all of the color and odorous constituents. These operations are highly technical and are carried out on a large scale. The completely refined oil can be used as a salad oil and in the preparation of mayonnaise and salad dressings, in packing fish, and in deep-fat frying of such food products as potato chips, nuts, and doughnuts. For these purposes it is usually blended with cottonseed, corn, or similar oils. Because of the tendency of highly refined soybean oil to undergo flavor reversion, care must be exercised in its use in edible products. Because of the high tinctorial properties of soybean oil it can be used to produce a bright-colored mayonnaise and for coloring oleomargarine.

“In the production of shortening and oleomargarine, soybean oil is hydrogenated after it is refined, and then bleached and deodorized. For use in the manufacture of oleomargarine it is usually blended with some other oil, especially cottonseed or coconut oils, although considerable quantities of oleomargarine made wholly from milk and soybean oil are currently produced. In this case the oil is usually hydrogenated to an iodine number of about 75. Whole milk is inoculated with a mixed culture and incubated or ripened to produce the necessary amount of lactic acid and flavoring constituents required to impart the essential butter flavor to the finished product. After introduction of the salt and other minor ingredients, the milk and hydrogenated oil are properly proportioned and fed to the emulsifying churns or high-speed homogenizers, where they are emulsified to form a creamy liquid which on crystallization forms the finished product known as oleomargarine.

“By far the largest single outlet for soybean oil is in the production of vegetable shortenings and lard compounds. For these uses the oil is hydrogenated to a degree of hardness which depends on the experience of the manufacturer and the type of product desired. The hydrogenated oil is blended with other fats and oils, especially hydrogenated cottonseed oil. In some cases the soybean oil is hardened to a rather high titer and blended with less highly-hydrogenated cottonseed oil.
or other oil in order to improve the flavor stability and retain
the requisite plasticity in the finished product.”

A wide table (p. 1), titled “Factory production and
consumption of soybean oil in the United States” is divided
into 8 columns: (1) Year, 1931-1938. (2) Total factory
production (1,000 lb). (3) Shortening. (4) Oleomargarine. (5)
Other edible products. (6) Soap. (7) Drying oil industry. (8).
Miscellaneous.

In 1938 the three largest uses were (1) Shortening
58.8%. (2) Oleomargarine 16.4%. (3) Drying oil industry
7.74%.

Note: The references are divided into the same groups as
the contents, but they are numbered consecutively. Address:
U.S. Regional Soybean Industrial Products Lab., Urbana,
Illinois.

121. Earle, F.R.; Milner, R.T. 1940. A crystallization method
for the determination of saturated fatty acids in soybean oil.
Oil and Soap 17(5):106-108. May. [7 ref]
• Summary: The American Oil Chemists’ has already
adopted two official methods for the determination of the
amount of saturated acids in vegetable and animal oils and
fats, namely the thiocyanogen and the modified Twitchell
lead salt-alcohol methods. This new method offers some
important improvements. Address: U.S. Regional Soybean
Industrial Products Laboratory, Urbana, Illinois.

122. Nagel, R.H. 1940. Combined support and water supply
• Summary: “The ordinary laboratory assembly of
condensers, using ring stands and long lengths of rubber
tubing, is both insecure and unsightly, especially when
several are used at one time. The accompanying sketch [p.
45] illustrates a plan that has been found very satisfactory
in all respects.” Address: U.S. Regional Soybean Industrial
Products Laboratory, Urbana, Illinois.

123. Detwiler, S.B., Jr.; Markley, K.S. 1940. Laboratory-type
molecular or short-path still: for vegetable and animal fats
and oils. Industrial and Engineering Chemistry, Analytical
• Summary: The design of such a still is described and
illustrated. A photo also shows it. Address: U.S. Regional
Soybean Industrial Products Lab., Urbana, Illinois.

124. Business Week. 1940. New plastic mixture: Soybean
research yields a solution already being used in textiles,
• Summary: “In 1936 the United States Department
of Agriculture established a regional soybean industrial
products laboratory at the University of Illinois, set it the
task of finding some practical uses. Up to then, about the
only applications in industry were paints, especially barn
paint, and the much-discussed Ford products: automobile
paint, and a plastic which contained twice as much phenolic
resin as it contained soybean meal.

“A promising non-food use for soybean meal seemed
to lie in plastics. The key discovery was that protein from
soybean meal could be hardened by a 40% formaldehyde
solution into a thermoplastic material. It was industrially
useless, because it took too long to mold, and absorbed too
much water when submerged. But it was a start.

“Soybean meal from which the oil has been extracted is
much cheaper than the pure protein. Presently the researchers
learned that the meal itself could be treated successfully
with formaldehyde. Adding a phenolic resin or urea resin
to hardened meal made it a quick-setting plastic. Molding
together equal parts of the hardened meal, woodflour, and
resin produced a distinctly new and homogeneous plastic
material.

“This mix is about 15% cheaper than the ordinary resin-
and-woodflour product, and it can be made to brighter dye
shades without weakening the material. Disadvantage: It
still absorbs 3% water in a 48-hour submersion, which is six
times as much as phenolic material absorbs...

“Routine question that arises about every plastic: Has
it a liquid form? The laboratory found that as much as 10%
of soybean protein could be suspended in a formaldehyde
solution. When this solution is applied to a material and
dried, the residue is practically the same plastic. Used to
impregnate paper, cloth, or other fibrous material, it can be
partially dried and then hot-pressed into a strong, lustrous
laminated board, in a broad range of bright or dark shades.

“The same solution is already being used in textiles,
paper, and leather. As a leather finish, it produces a tough,
flexible coating. One large tanner is using it to produce a
premium grade of men’s-shoe weight calf skin. Several paper
mills use it as a water-resistant sizing. In a textile it produces
a semi-permanent stiffening that resists several launderings.

“At least two big soybean processors, The Glidden Co.
of Chicago and the Central Soya Co. of Decatur, Indiana, are
promoting the use of this liquid material commercially, and
are reported to be developing industrial uses along several
related lines.”

125. Dollear, F.G.; Krauczunas, P.; Markley, K.S. 1940. The
chemical composition of some high iodine number soybean
• Summary: In a previous article in this journal (Oct. 1938),
these three researchers reported the results of an examination
of a soybean of abnormally low iodine number, namely
102.9.

The soybeans used in the present investigation were a
wild variety, and three cultivated varieties named Seneca,
Peking, and Illini. The seeds of the wild variety were small,
dark brown or nearly black, and had a very low oil content—
but that oil had a very high iodine number. “This variety has
served as one of the parents in a number of crosses which
have been made in an effort to obtain new strains [varieties] of soybeans yielding oils of higher-than-average iodine numbers.”

Of the 7 soybean oils having iodine numbers ranging from 102.9 to 151.4, the saturated acids were found to comprise 12.7 plus or minus 0.8% and the unsaturated acids, 87.3 plus or minus 0.8% of the total acids present. Thus the ratio of saturated to unsaturated fatty acids in soybean oil was found to be relatively constant, regardless of the iodine number, over the range shown above.

Tables: (1) Analysis of the four soybeans. (2) Yield of soybean oil on extraction (kg and percent).

(3) Physical and chemical characteristics of the oils: Iodine number, thiocyanogen number, saponification number, acid number, diene number, hydroxyl number, unsaponifiable (percent), break (percent), phosphorus (percent), color, refractive index, specific gravity, total acids / iodine number, total acids / thiocyanogen number, saturated acids (percent determined), saturated acids / iodine number, saturated acids / thiocyanogen number, saturated acids, percent corrected.

(4) Comparison of the iodine number and the distribution of fatty acids derived from various soybean oils.

Conclusions: (1) There is a remarkable constancy in the ratio of saturated to unsaturated acids of these soybean oils; it appears to be completely independent of the iodine number of oil from which the acids were derived or the amount of oil present in the seed (whether wild or cultivated).

(2) “The distribution of the unsaturated acids varies in a specific manner with the iodine number of the oil derived from the seed, but is independent of the total amount of acids which are formed during growth and maturation and stored in the seed in the form of various lipids.” Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


• Summary: “In studying the extraction of soybean oil from bean flakes, it has been necessary to know the densities and viscosities of the oil-solvent mixtures as functions of the concentration and temperature in order to correlate data on penetration of the solvent and on the drainage of the solution.” Address: 1-2. Univ. of Illinois, Urbana; 3. U.S. Regional Soybean Industrial Products Lab., Urbana, IL.


• Summary: “A progress report describing several studies on oil determination made during the year covers the subjects listed below:”

“1. Effect of grinding on the determination of oil in soybeans.”

“2. Oil in solvent-extracted soybean meal.”

“3. Oil in soybean meal from continuous presses.”


• Summary: There is no sharp, clear-cut line between proteins and nitrogenous nonproteins, and the more or less arbitrary analytical distinction between them depends largely on the method used. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


84 samples of soybean oils, representing various types of processing and different refining procedures, were examined spectrophotometrically and the spectral-transmissive curves for 35 of them are shown in figures in this article.

“The Lovibond color readings give at best only approximate information concerning the spectral color of an oil.” The carotenoids are removed during the refining operations, with the greatest loss taking place during the deodorizing treatment. “Chlorophyll, which is present in various concentrations in the crude oil, is completely absent from the finished oils so far as spectrophotometric evidence is concerned.” Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


• Summary: “Thermoplastic formaldehyde-hardened soybean meal is converted into a thermosetting, resinous molding plastic with greatly reduced water absorption by mixture with phenolic resin. This is a new type of plastic, definitely superior to any previously suggested modified protein plastic, and it holds good possibilities for future development.” Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.

131. Brother, George H.; Smith, Allan K. Assignors to Henry A. Wallace, as Secretary of Agriculture of the United States of America, and his successors in office. 1940.

**Summary:** “The object of our invention is the dispersion of protein or protein material in the medium of a hardening, tanning, or curing agent.” Another object is the use of a protein dispersion “which will after application dry to hardened protein coats or films without any subsequent treatment.” Address: [U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois].


**Summary:** This article was published in Plastics 4:93-96 (April 1940). Note: This periodical was published in London by Heywood-Temple Industrial Publications Ltd. (also known as Temple Press). It started in 1937.

This article is a summary of three years on soybean plastics at the U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


**Summary:** “A combined adsorption and extraction method for the production of a phosphatide-free sterol concentrate from soybean oil, having 15 to 20 times the sterol content of crude oil, is described.”

Stigmasterol is an excellent material for the synthesis of the hormone progesterone. Stigmasterol occurs as a component of the sterol mixture in many different plants. The only source of commercial importance, however, is the mixed sterols of the soybean in which it occurs to the extent of 20 to 25% of the total sterols.

Note 1. This is the earliest English-language document seen (May 2016) that mentions “progesterone,” or that states progesterone can be synthesized from a compound (stigmasterol) found in soybean oil.

Note 2. Webster’s Dictionary defines progesterone (a term first used in 1935) as “a steroid progestational hormone (C_{21}H_{30}O_{2}).” Progesterone and estrogen are the two main female sex hormones, secreted by a woman’s ovaries. Progesterone is a type of steroid. Address: Indiana (Purdue) Agric. Exp. Station and U.S. Regional Soybean Industrial Products Lab., Lafayette, Indiana.


**Summary:** “In previous years this Association has heard in some detail about the work conducted by the U.S. Regional Soybean Industrial Products Laboratory on the making of paints and varnishes from soybean oil and the making of plastics and other similar products from soybean meal. This year some of the foundation work which will serve as a support for these industrial applications will be described, and mention will be made of a new attack on the problem of increasing the industrial use of soybean oil.

“The agronomic work is carried out in such close collaboration between the agronomists of the Bureau of Plant Industry, the analytical section of the Soybean Laboratory, and the State Agricultural Experiment Stations that credit cannot be given to any one group. The history of other crops has shown the wisdom and necessity of having chemists work with agronomists so that varieties developed for desirable agronomic characteristics may also possess the qualities needed for industrial utilization. In practice it has been found that one agronomist in the field can supply more than enough material for a dozen chemical analysts. As a result, in studying soybean selections, introductions, and crosses the first eliminations are made chiefly on an agronomic basis. This is easily justified, for certainly any varieties which possess such undesirable properties as low yield, lodging, or shattering will never be widely accepted by American growers. Last year over 25,000 plants were grown as second generation selections from the first generation plants grown in 1938. Crosses between pure lines have been made, and sufficient data are now becoming available for some preliminary generalizations. It appears that Dunfield and Mukden varieties contribute more to seed quality than other strains tested. Hundreds of seed from the most promising of these crosses are being analyzed chemically, and on the basis of these analyses further selection and improvements can be made.

“One of the most valuable additions to this general program has been the establishment of uniform nurseries for the study of selections. Eight uniform early nurseries for varieties suitable for the northern part of the soybean belt and 11 uniform late nurseries for selections suitable for southern Indiana, Illinois, and Missouri were established. Because of the splendid cooperation between the laboratory and the State Agricultural Experiment Stations, the results of
these nurseryes have been of material assistance in the early recognition and naming of two very promising varieties. These new varieties are Mount Carmel and Patoka. Results on the uniform late test indicated a remarkable uniformity in behavior of these varieties while the uniform early test showed that for the varieties studied, the areas of adaptation in the northern soybean belt are more irregular and limited. Many hundreds of other selections have been tested for yield in replicated rod rows, and many of these have been analyzed for oil and protein content.

“There are many other phases of agronomic work which can only be touched on briefly. The study of seasonal effect on yield and composition of nine principal soybean varieties has been continued. The results of four seasons are now available and indicate that potassium content shows no large differences between varieties. Results on the four-year period confirm those found for the two-year period and show some varieties consistently are high in oil and low in protein. Significant differences in calcium and phosphorus content have also been observed between varieties. Studies of the effects of fertilizer treatment and fertility level on yield and composition have been continued, and experiments have been started to observe the effect of rate of seeding and date of planting.

“In the greenhouse the effect of root temperatures on the growth of soybeans has been investigated. In this work transpiration and the absorption of anions and cations has also been followed. Soybeans have been grown in culture chambers where the air temperature and humidity have been controlled. A low night temperature was found to delay maturity greatly.

“The nutrition of plants requires what may be classified as major and minor elements. Major elements, such as calcium, phosphorus, and potassium, have been known and studied for a long time. Minor elements, such as zinc, boron, and manganese, are now known to play an important role in the life of plants. The effect of five concentrations of potassium, from 3.16 to 316 p.p.m., on the yield and composition of two varieties has been observed. Both varieties showed a marked response to these extreme concentrations, but did not behave alike. A spectrograph is being used to detect and determine the trace element, boron, which may prove to have a marked effect on composition.

“Increased utilization of soybean oil in protective coatings would probably result from any measures which would increase its drying properties. Soybean oil contains the same constituents which make up linseed oil. Both oils contain glycerides of the unsaturated acids, oleic, linoleic, and linolenic, and the saturated acids, stearic and palmitic. However, in soybean oil the highly unsaturated fatty acid, linolenic, is present in much smaller amounts, and soybean oil also contains larger amounts of the nondrying acids, oleic, stearic, and palmitic. Both of these facts are reflected in the iodine numbers of linseed and soybean oils. The iodine number may be taken as a rough measure of the drying power of the oil; for linseed it ranges from 170 to 190, while for soybean oil the range is 120 to 140.

“Two methods suggest themselves to improve the drying properties of soybean oil. By chemical treatment the unsaturation of the acids might be increased or the unsaturated glycerides present made more reactive. Work of this nature is being carried out, but no results of practical significance have been obtained to date. By a combination of physical and chemical methods it might be possible to separate and remove the larger portion of the nondrying constituents of soybean oil. For example, if all the palmitic, stearic, and oleic acid components could be removed, soybean oil would consist chiefly of the glycerides of linoleic and linolenic acid and would have an iodine number in the neighborhood of 184. All vegetable oils, however, contain mixed glycerides. For example, one molecule of glycerol might have combined with it one molecule of palmitic, one molecule of oleic, and one molecule of linolenic acid. The amounts of pure tri-glycerides, such as triolein or tristearin, are extremely small. As a result the mixed glycerides resemble each other closely and are difficult to separate. Using available data, it may be calculated that there is present in soybean oil a fraction of mixed glycerides amounting to about 30 percent which has an iodine number of 170.

“Work on the separation of this high iodine number fraction of mixed glycerides has been initiated using methods of extraction with liquids. This type of extraction is quite simple and has been extensively used in recent years by the petroleum companies for refining lubricating oils. The method consists in mixing the soybean oil with some immiscible liquid in which the saturated and unsaturated fractions have different solubilities. Two layers separate, one consisting chiefly of solvent with an oil fraction of high iodine number and the other layer, chiefly oil of lower iodine number mixed with a small amount of solvent. In the petroleum industry many methods of accomplishing this liquid-liquid extraction have been studied. It is carried out continuously in a countercurrent apparatus, and is both cheap and efficient. This laboratory has carried out many preliminary experiments and investigated several solvents. It has been possible by this method to produce in the laboratory, from a soybean oil having an iodine number of 130, a very sizeable fraction having an iodine number of 142. When this high iodine number fraction was tested for drying properties, a marked improvement was noted. Further work is needed and is now being carried out with its ultimate objective the development of a cheap process for separating soybean oil into two fractions, one having a high iodine number and furnishing an excellent paint oil, and the remaining fraction having a much lower iodine number and enhanced value for edible purposes. This possibility has attracted much commercial interest, and numerous patents...
have already been issued on the process.

“Time is not available to describe the many other projects studied by the U.S. Soybean Laboratory. These have been presented to you in previous years. In most of the work satisfactory progress has been made. Work is being continued on these lines, and the future should show marked and continued increases in the use of soybeans for industrial purposes.”

A photo shows a farmer, seated on a tractor, pulling a small plow of the 2-wheel type in a field of corn stalks.


• Summary: Sterol glucosides occur to an appreciable extent in commercial expeller soybean oil. They were removed by adsorption methods and were obtained by acetone extraction of the adsorbed material. A sugar obtained from the glucosides was identified as d-glucose. “The sterols obtained by hydrolysis of the glucosides are very similar to the uncombined sterols of the oil and consist of a mixture of sterols in which stigmasterol occurs to the extent of approximately 24%.” Address: Indiana (Purdue) Agric. Exp. Station, Lafayette, Indiana.

• Summary: This is an English-language summary of English-language patent No. 2,210,481.

• Summary: The meeting was called to order by President McIlroy at 8:30 A.M. The secretary’s report, and then the treasurer’s were read and accepted by unanimous vote.

New business: “Jacob Hartz discussed the necessity of the Association broadening its policies in an effort to meet the growing needs of the soybean industry. Two definite suggestions were made to be developed by the Board of Directors, namely: that the Association make plans to employ an executive secretary, and that a soybean periodical be published as an official organ of the Association.

“In order to make way for the development of the above suggestions, amendments to the constitution were presented by the Secretary as follows:” These concerned the board of directors, executive committee, and state executive committee. After some discussion, the amendments were accepted.

There followed a discussion on the use of soybean oil in the manufacture of oleomargarine.

The report of the resolutions committee (K.E. Beeson, chair, George Strayer, George Banks, David Wing) was read by Prof. Beeson and accepted. The resolutions are given: (1) Appreciation to the Ford Motor Company, hosts of this occasion, and especially to Dr. E.A. Ruddiman and Dr. R.A. Boyer of that organization. (2) Gratitude to all agencies interested in soybeans and to the present efficient officers of the Association for their work in planning this meeting. (3) Thanks to all those participating in the 1940 program. (4) Renewed appreciation for the efforts of the U.S. Regional Soybean Industrial Products Laboratory, extension workers, commercial laboratories, National and State chemurgic councils, State Experiment Stations, and agricultural colleges. (5) Gratitude for the financial support of a sympathetic industry which makes possible the printing of the proceedings, and the leaders of the soybean industrial field. (6) Thanks to the Pennsylvania Railroad, through its agricultural representatives Russell G. East and Sydney Friend, for bringing up to date the soybean panel exhibit and making it available as a cooperative exhibit of the Association. (7) Urge the repeal of all federal and state laws imposing unnecessary and unfair restrictions on the sale of oleomargarine made of domestic oils and fats.


• Summary: Pages 1-4 contain a basic description of this subject.

On the bottom half of page 4 is a list of “Manufacturers of soybean processing equipment,” divided into continuous presses, hydraulic pressing equipment, continuous countercurrent solvent extractors, and milling equipment. In each division is the name, city and state of each manufacturer.

**Summary:** The researchers are investigating the nature and cause of the flavor and odor deterioration of refined soybean oil. “A stability apparatus which employs the principle of methylene blue reduction in a fat-dye system to filtered radiation of a tungsten filament lamp is described.” Its advantages are elucidated. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


**Summary:** The writers are investigating the nature and cause of the flavor and odor deterioration of refined soybean oil. Of the various methods examined, the so-called methylene blue test appeared to merit further consideration. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.

142. Detwiler, Samuel B., Jr. 1940. Supplement to bibliography on molecular or short path distillation. Oil and Soap 17(11):241-43. Nov. [100+* ref]

**Summary:** The rapidly increased use of molecular distillation as a tool in organic research and industry requires an update of the bibliography previously published in this journal. At present, perhaps the most important industrial application is in the preparation of vitamin concentrates from fish liver oils. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


**Summary:** The researchers are investigating the nature and cause of the flavor and odor deterioration of refined soybean oil. “In a previous communication a stability apparatus was described which employed the principle of methylene blue reduction in a fat-dye system exposed to filtered radiation of a tungsten filament lamp.” Five conclusions of this further experimentation are given.


**Summary:** “A protein laminated plastic material prepared from unsized kraft paper impregnated with formaldehyde-hardened thermoplastic soybean protein salt compared favorably with similar commercial materials as regards impact and flexural strength and modulus of elasticity, but not as regards water resistance. By placing a single sheet of phenolic- or urea-impregnated paper on each exposed face before pressing, a product resulted with the water resistance and other desirable properties of present commercial products.” Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


**Summary:** Varieties were found to differ significantly in oil and protein content and in the iodine number of the oil.

Table 1, “Mean values of chemical analyses of 10 varieties and strains of soybeans grown in five locations during the 4 years, 1936-1939.” Named varieties are Mandarin, Mukden, Dunfield-, Dunfield-B, Illini, Manchu, Scioto, Peking. Locations are Illinois, Indiana, Iowa, Missouri, Ohio.

Note: This volume contains papers presented at the meeting held in Chicago, Illinois, Dec. 4-6, 1940. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


**Summary:** Editor’s Introduction: “U.S. Regional Soybean Industrial Products Laboratory, a cooperative organization participated in by the Bureau of Agricultural Chemistry and Engineering and Plant Industry of the U.S. Department of Agriculture, and the Agricultural Experiment Stations of the North Central States of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

“The Soybean Laboratory is a research organization. It is attempting to find new uses for soybeans and soybean products and to increase the uses that have already been found for these products. In working in this field of new uses, not all experiments can be successful nor can results be achieved quickly. Since the organization of the laboratory, however, many problems have been successfully attacked, and it is the purpose of the present article to describe a recent
development which shows great promise.

“Huge Quantities Used: The use of paint on roads may not at first seem very important. Consider, however, the many miles of pavement on through highways that have guide stripes down the center. Remember the curves and hills, marked to prohibit one car passing another. Think of the pedestrian lanes, parking flares, and traffic arrows in cities and towns. It is plain that traffic paint is a very important item and that in this day of speedy transportation it is an indispensable aid to traffic control and safety.

“What are the chief requirements of a traffic paint? It must be extremely durable to abrasive wear and to the action of the elements. It must be quick drying so that its application does not interfere with traffic. It must retain its color. Of course, these demands on performance require detailed technical specifications. Many of these specifications have specifically required the use of tung oil (china wood oil).

“Use Organic Chemical: The price of tung oil is double its former value, and, because of disturbances, there is fear that adequate supplies of this oil may not be obtained at any price. These circumstances led to a careful study of the use of soybean oil in traffic paints. From previous work it was known that soybean oil was extremely durable in ordinary wall paints and varnishes. It was known that some treatment would be necessary to hasten the film-forming properties of soybean oil before it could be used successfully, in traffic paints. After many experiments, an organic chemical which acts as an accelerator was discovered. Cooking soybean oil together with this chemical hastens the ‘bodying’ of the oil. Bodying of any oil may be regarded as in some degree the forming of blocks of molecules which will then quickly form a film. The soybean oil after cooking with this accelerator is then combined with a resin or gum to make a varnish type of coating. Pigments, together with thinners, are incorporated in this, and the result is a finished traffic paint.

“Experiments thus far carried out with soybean oil have indicated that it should be possible to make a good traffic paint with this oil. The laboratory has carried out numerous tests on these soybean oil formulations and is now arranging for the highway division of a midwest state to test the most promising formulation under service conditions. If the tests are successful, another extensive use will have been found for soybean oil.”

Note: This is the earliest article seen (Dec. 2016) about the U.S. Regional Soybean Industrial Products Laboratory in Soybean Digest. Address: PhD, Director, U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


149. Brother, George H.; Smith, A.K.; Circle, S.J. 1940. Soybean protein: Resume and bibliography. ACE (U.S. Bureau of Agricultural Chemistry and Engineering) No. 62. 64 p. plus 11-page supplement. 28 cm. [714 ref]

• Summary: Part I is a 20-page review of the literature with the numbers of references in part II cited in text. Part II is a bibliography of 592 references on this subject.


• Summary: “The U.S. Regional Soybean Industrial Products Laboratory was established in July 1936.” During the past 3 years extensive research on soybeans has been conducted.

“The problems of the laboratory may be divided into two broad categories. One includes those projects the solutions of which will yield immediate and practical results in the form of increased use of soybeans and soybean products. The other problems involve long and careful research which now may appear to furnish information of academic importance only by which in the future may serve as the basis for even more important industrial uses.” Address: Director, U.S.
Regional Soybean Industrial Products Lab., Urbana, Illinois.


**Summary:** “The study of moisture in biological materials by oven methods has been attended by several difficulties, among which were the probability of error due to loss or gain in weight during the process of cooling the sample, the considerable work involved in obtaining a series of determinations, and the unknown effect, on a series of determinations, caused by cooling the oven during the removal of samples. Through the development in the U.S. Regional Soybean Industrial Products Laboratory of the apparatus for the continual observation of changes in weight at oven temperatures (1), these difficulties and others were eliminated so that a systematic study of the moisture relations of soybeans could be undertaken.

“It seemed desirable for such a study to compare several types of oven determinations, several varieties of soybeans, a number of samples of the same variety having a range of protein content, a number of samples having a range of oil content, and a number of samples having different moisture contents.” Address: U.S. Regional Industrial Products Lab., Urbana, Illinois.


**Summary:** This is an English-language summary of the following English-language document: Brother, G.H.; McKinney, L.L.; Suttle, W.C. 1940. “Protein plastics from soybean products: Laminated material.” Industrial and Engineering Chemistry 32(12):1648-51. Dec.


**Summary:** An overview of the soybean in America. Discusses industrial uses of soybeans as in glues, paints, varnishes, and plastics, the USDA Regional Soybean Industrial Products Laboratory at Urbana, Illinois, the very important work of William J. Morse, presently senior agronomist at the USDA Bureau of Plant Industry (Morse began work at USDA in 1907 under Charles Vancouver Piper), the use of the flake of soybean meal in brewing to give beer more body and a sturdier, creamier “collar” of white foam, the work of Henry Ford in developing large-scale industrial uses of soybeans, soybean trading on the Chicago Board of Trade, food uses of soybeans (such as green-shelled soybeans, soybean flour, the Soyburger, and soybean bread). Contains 7 photos.


**Summary:** The American soybean processing industry uses hydrocarbons “to solvent-extract about 350,000 tons of beans per year, i.e., over 20% of its operations.”

“Solvent extraction of soybeans, as we know it, did not originate in the U.S. Its reduction to practice occurred in the twenties and early thirties and was the natural result of the requirements of Germany and the Low Countries for supplies of edible oils and of protein feeds for their livestock. In Europe, a soybean extraction industry evolved quite logically as a result of (1) the ability of the German trade program to make available plentiful supplies of Manchurian beans, (2) the necessity for recovering the utmost yield of oil in order to meet domestic deficiencies, and (3) the unique adaptability of soybeans to solvent extraction.”

“As far back as the early twenties, efforts were made to solvent-extract soybeans in this country. A Bollman [Bollmann] type of extractor at Norfolk, Virginia [owned by the Eastern Cotton Oil Co.], ran local soybeans in 1924-1925 and attempted to process imported flaxseed, but the project was unsuccessful. Another Norfolk plant used Scott rotary extractors on a variety of oil-bearing seeds, including soybeans and copra, during the same period. About a year earlier, a batch solvent system at Monticello, Illinois, also failed. The first successful large-scale operations were those of the Archer-Daniels-Midland and the Glidden companies who installed Hildebrandt type extractors in Chicago during 1934 and 1935. The Glidden plant was destroyed by an explosion in 1935 but was immediately rebuilt with a doubled capacity.”

“At present, there are 5 solvent systems used in large-scale soybean extraction in this country, 2 of them being of German and 3 of American origin. These are installed in 8 large (over 50 tons of beans per day) and 2 small plants. At least one other system is operated on a relatively small scale” (see table 2).

An extractor of the Allis-Chalmers type processes soybeans at Cedar Rapids, Iowa. Until recently, another processed soybeans at Evansville, Indiana (probably for American Soya Products Corp.).

“The enthusiasm which ran high in the early 1930’s for the ‘industrialized barn’ type of soybean extractor has become more rationalized, and at least 2 technically satisfactory types of extractors have resulted. The Ford Motor Co. developed one consisting of an inclined tube housing an internal screw which conveys beans upward against a countercurrent solvent flow. It is now being used in one large and 2 small plants, all owned and operated by Ford.

“There has evolved, from work done by Iowa State College and by the R. & H. Chemicals Department of E.I. du Pont de Nemours & Co., an extraction system which, in simple terms, might be described as a Ford extractor running backwards. It is designed for solvents heavier than soybean oil, specifically trichloroethylene; hence it operates with
an upward flow of solvent and downward flow of soybeans in the main extraction tube. There are no commercial installations at present.”

“Apparently there is only one commercial soybean extraction plant in the world using any solvent other than a petroleum cut. The exception is the Manchuria Soybean Industry Co., in Dairen. Here, the so-called hot alcohol process is used with a battery of rotary extractors to process approximately 100 tons of soybeans per day. The solvent is 99.8% ethanol... Considerable research has been directed toward the use of methanol-benzene and ethanol-benzene mixtures for soybean extraction in cases where phosphatide recovery is of importance. In the late 1920’s, the plant of the Hansa-Muehle, A.G., at Hamburg operated for a short time using such mixtures.”

Tables show: (1) Soybeans (tons and percentage of total) processed annually in USA by expeller, solvent, and hydraulic methods (1936-39; in 1939 the percentages were 74.2, 20.2, and 5.4 respectively). (2) Estimated total capacities of installations of the various types of continuous solvent extraction systems worldwide and in the USA (Basis: short tons of oilseeds or oilseed press cakes per 24 hours): Bollman (German): 3,100 / 750. Hildebrandt 2,200 / 430. Fauth (German): 800 / 0. Allis-Chalmers (American): 170 / 170. French (American) 130 / 130. Ford (American): 75 / 75.


• Summary: The melting points of these three mixtures were determined. “In connection with a study of the separation of the fatty acids of soybean oil by crystallization, it appeared desirable to determine whether mixtures of the unsaturated acids, oleic, linoleic, and linolenic, showed compound formation or eutectics, and if so, to locate their compositions and melting points.”

Contains 3 tables, each showing melting point data. Address: U.S. Regional Soybean Industrial Products Laboratory, Urbana, Illinois.


• Summary: A good review of the literature on flavor reversion in soy oil and the theories that have been proposed to explain the phenomenon. Storage in the presence of air under high intensity of light at 50ºC provided the ideal conditions for the most rapid flavor reversion; frequently only a few hours were necessary to produce a detectable level of reversion. The oils proved to be remarkably stable under conditions of darkness at atmospheric pressures and refrigeration (5ºC).

Edible soybean oils stored in a vacuum at 50ºC under high light intensity developed (within a day) a peculiar flavor reminiscent of over-heated rubber, and reversion was difficult to detect because of this odor. At 25ºC the same rubbery odor was detectable after 3-5 days exposure. Address: U.S. Regional Soybean Industrial Products Lab.


“Summary: 1. Preheat curves are given for soybean-phenolic plastics and compared with curves for ordinary phenolic compositions.

“2. The influence of soybean meal on the setting time of a phenolic type plastic is illustrated.

“3. Distance-pressure curves show the effect on flow of modifying a phenolic type molding material with hardened soybean meal.” Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


• Summary: “Henderson’s new $60,000 processing plant of the Ohio Valley Soy Bean Cooperative took its seat on the production roster Wednesday when formal opening of the plant was held at 10 o’clock with a program being conducted by Charles Ball Smith, president of the Co-op, and G.W. Allen, general manager of the plant.

“Several hundred visitors poured through the plant during the morning and the general manager and president explained in detail how machinery on all three floors of the plant will work.

“Many visitors: Visitors were from Indiana, Illinois, Kentucky, Ohio and Virginia, the registration book showed. Due to the illness of Ben E. Niles, president of the state and local Farm Bureau organizations, Mr. Smith opened the meeting and later turned the program over to County Agent Jackson.

Mr. Smith “declared that the soy bean plant is the
realization of a strong Farm Bureau, cooperation of the big and little men and the splendid assistance of the Louisville Bank of Co-operatives.” Dignitaries were then introduced, and short speeches given. “T.R. Bryant, from the College of Agriculture, University of Kentucky, Lexington, explained the soy bean as a defense crop” [in relation to the war in Europe].

“Shortly after 11 o’clock in the morning, President Smith, with Manager Allen and other dignitaries looking on, pressed the button that started conveyors dropping cracked beans into the tempering bins... The two bins have a capacity of 600 bushels of beans daily.”

“Replacing considerable interest also were the reconditioned [used] storage elevators composed of 18 tanks and ten interstices with a total storage capacity of 200,000 bushels.” A “frame and metal building was placed over them. A section of the concrete roof still remains too.”

“Erected in the room on top of the storage elevators is the huge bean cleaner, capable of cleaning 3,000 bushels of beans daily. The processing capacity of the plant is in excess of 1,200 bushels a day–400,000 to 500,000 bushels of beans daily.” A “frame and metal building was placed over them. A section of the concrete roof still remains too.”

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“The cooperatives more than 300 members signed up 15,300 acres of soy beans for 1940 and 1941 at $1 an acre, giving the organization $30,600 of common stock already subscribed of a maximum of 40,000 shares at $1 par value. Beans grown last year are now stored in the bins at the plant.

“Livestock feed: ‘The soy bean serves the greatest number of useful purposes of any product of the soil and holds the greatest promise of agriculture of any plant,’ says Mr. Allen, general manager and secretary of the plant.

“Farmers in this section first began to grow soy beans about 20 years ago. County Agent H.R. Jackson explains principally as feed for livestock and later for the sale of seed and for export to other neighborhoods. The plant is ideal for rotation with corn, of which Henderson county is a heavy producer, Jackson said. It is a legume and its root system stores nitrogen, thereby enriching the soil.”

“Move started in Feb.: Also, several years ago, the farmers sensed the decline in returns from dark tobacco and began to lean more heavily on livestock. This trend created a demand for additional supplemental livestock feed. All these factors have contributed to the steady increase in soy bean acreage.

“Finally the need for a processing plant resulted in concrete action in February 1940 under the sponsorship of the Henderson County Farm Bureau of which Ben E. Niles is president.

“The first step was an educational trip by a group of interested farmers and businessmen to Urbana, Illinois, where a government soybean laboratory [U.S. Regional Soybean Industrial Products Laboratory] is located.

“Interest increased rapidly after the trip and the co-op was formed under the Bingham Cooperative Marketing Act after a mass meeting has been held to determine whether an effort would be made to interest private capital in the plant or whether or whether the project should be set up under a co-operative association.

New building erected: A five acre tract on which stand 18 concrete elevators with a total storage capacity of 200,000 bushels was purchased. This was part of the plant of A. Waller and Company, grain dealers. The mill was destroyed by fire several years ago.

“Reconditioning of the elevators was completed and a metal building 40 x 30 feet has been built to house the two processing mills.”

A brief biography of Mr. Allen is given. For the last 10 years he was “the agricultural agent for the Ohio Valley Trust company, directing operations of the farm properties under its management.” The plant will have two presses and “will serve an area in Kentucky, Indiana and Illinois within a radius of 75 to 100 miles of Henderson.”

Note: The members of this cooperative were farmers; by the 1950s, the members of most soybean processing cooperatives were cooperative grain elevators.


• Summary: “The action of formaldehyde on proteins is of practical as well as theoretical interest. Formaldehyde has long been used industrially to increase the water resistance of proteins, especially casein, in the fields of plastics and coatings. Formaldehyde is also extensively employed as a preservative and fixative for biological specimens and to block off the amino groups in the titration of the acid groups of proteins and amino acids.”

“Summary: A microelectrophoretic technique was used to determine the effect of formaldehyde on the isoelectric points of solvent-extracted soybean meal, of several soybean protein samples prepared in the laboratory by different methods, a commercial soybean protein, casein, gelatin, and egg albumin.”

“The isoelectric points of all the proteins studied were lowered 0.1 to 0.7 pH unit by the action of formaldehyde, except for soybean meal, which was unaffected by 5 or 10 per cent formaldehyde.

“The concentration of formaldehyde and the time of reaction were small but positive factors in the shift of the isoelectric points to lower values for all but two of the proteins studied.”


• Summary: Table 1 gives data on molecular distillation of
Soybean storage has reached a point of perfection far beyond average of roughly 10 mesh. This treatment is followed by drying to a moisture content of 2 to 5 percent in rotary steam driers. The hot, dry material is then conveyed to the presses. Continuous presses used on soybeans in this country are the Anderson Expeller and the French Screw Press. Structural features of the Super-Duo, an expeller which is widely used on soybeans, is shown in the accompanying illustrations. The granular material, hot from the driers, enters the uppermost of three tempering troughs and is slowly conveyed through them, in succession, being held at a high temperature by means of steam jackets. The individual particles are thus permitted to equalize the unsteady state of moisture and heat distribution existing immediately after the drying operation and thus reach the press itself without serious gradients of temperature and moisture content in the single small grains.

“The pressing is done by a worm revolving inside a steel cage, the operation being, to some extent, analogous to that of a household meat grinder. The cylindrical cage, or drainage barrel, is composed of longitudinal, parallel steel bars, closely spaced, between which the oil flows when squeezed out under the influence of pressure developed within the barrel. The pressure may be as high as 10 tons per square inch and is produced partly because of the irregular shape of the worm shaft and partly because of flow restriction by means of an adjustable orifice at the end where the pressed cake is discharged. The flow of oil from the beans under pressure is facilitated by increased temperatures due to friction developed by the action of the screw.

“The cake emerges as irregularly shaped, hard fragments which have been toasted to a brown color by heat developed during the operation. Large masses of cake, if stored hot, will rapidly heat still further to the ignition point, and the cake must therefore be cooled to a safe temperature by adding water and blowing air through it. The final step in preparation of soybean oil meal consists in grinding the cake in a hammer mill.

“Oil from the press is run over a shaking or revolving screen or similar straining device to remove small meal particles, or foots, which are returned to the feed. The strained oil is filtered, generally through a filter press, and marketed as crude soybean oil.

“The French Screw Press is also widely used on soybeans. Its principle of operation is much the same as that of the Super-Duo, but it differs considerably in details of construction. Operating results are approximately the same with either machine, the capacity being about 750 bushels per day. A bushel of beans containing, for instance, 20 percent of oil yields 8 to 10 pounds of crude oil and close to 50 pounds of meal containing about 4.5 percent oil and 40 to 45 percent protein.”

Photos show: (1) Interior of a soybean mill using French Screw Presses. (2) An Allis-Chalmers roller mill for cracking soybeans prior to pressing. (3) An Allis-Chalmers rotary steam drier used on cracked soybeans. (4) Close-up of the
cage of a screw press in action. Oil may be seen oozing between the longitudinal parallel bars. (5) Cracked beans ready to enter the drier, thence the expeller. (6) Oil coming through a filter press before going into tanks for shipment as crude soybean oil. (7) The Super-Duo Expeller (V.D. Anderson Co.; each of 29 major parts is labeled).

Footnote (p. 2): The U.S. Regional Soybean Industrial Products Laboratory is: "A cooperative organization participated in by the Bureaus of Agricultural Chemistry and Engineering and Plant Industry of the U.S. Department of Agriculture, and the Agricultural Experiment Stations of the North Central States of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin." Address: Chemical Engineer, U.S. Regional Soybean Industrial Products Lab.


• Summary: “The Soybean Analysis Committee has conducted no collaborative work during the year, and its report is based on work done at the U.S. Regional Soybean Industrial Products Laboratory.”


• Summary: “In solvent extraction processes, instead of being granulated, the beans are rolled into thin flakes in order to create a high specific surface without introducing excessive fines which would clog filters and other parts of the system. The flaking operation is, in most cases, preceded by cracking and heating and, occasionally, by addition of moisture. Smooth rolls are employed, one pair high, having diameters of 30 to 36 inches, and the flakes produced range in thickness from 6 to 15 thousandths of an inch, depending upon the type of extractor used.

“The Bollman system is shown diagrammatically in Fig. 1. The flakes are introduced into baskets with perforated bottoms which hang between a pair of endless chains comprising two vertical legs, one descending and one ascending. The chain rotates in a clockwise direction making a complete revolution in about 1 hour. Baskets are filled at the top of the right-hand or downcoming leg, and are dumped when they reach the top of the rising leg.

“The extraction is accomplished by means of hexane or similar solvent which is sprayed over the top basket on either side, percolating through lower baskets in succession. Freshly redistilled solvent runs in countercurrent flow down through the ascending chain of baskets; and the resulting solution, known as half-miscella, is collected and pumped to the top of the downcoming side so that it washes the descending baskets in parallel flow.

“The final solution of 20 to 25 percent oil in solvent which accumulates at the bottom of the descending side is known as full-miscella, and, after it has been filtered, the solvent is evaporated, condensed, and returned to the system. The final operation in the preparation of crude oil is the removal of traces of solvent by means of a stripping column.

“The extractor proper is enclosed by a gas-tight steel housing into which fresh flakes are charged and from which extracted meal is discharged by the mechanisms shown in Fig. 2. The extracted solids are fed immediately into steam driers which drive off entrained solvent and discharge finished meal containing well under 1 percent of residual oil.

“The Bollman System: The Bollman or Hansa-Muhle system, as just described, has been built in sizes having capacities of 25 to 400 tons per day, and, with the exception of the extractor proper, is typical of most extraction systems. Each process, however, resorts to a distinctly different method for contacting the bean flakes with solvent.

“Of special importance in this country is the Hildebrandt system which is shown in Fig. 3. Flaked beans are introduced at ‘20’ through the top of the left leg of a U-shaped double column, and are slowly propelled downward, then horizontally toward the right, and then vertically upward through the right-hand leg by means of perforated revolving screw conveyors. Extracted meal is discharged at ‘17’ from the top of the right-hand leg into the driers. Solvent is introduced into the same leg at ‘15,’ somewhat below the
meal exit, and flows through the system countercurrent to the flakes, overflowing through miscella pipes at ‘13,’ somewhat below the top of the left worm flight.

“In this process, the extraction is effected by complete immersion in liquid solvent as contrasted to the percolation action occurring in the Bollman system. Figure 4 shows an installation of two Hildebrandt units. The batteries of horizontal drums shown between the two extractors are meal driers used to drive off all entrained solvent. These extractors are built in two sizes having capacities of 55 and 110 tons per day and are frequently used in multiple installations consisting of two or more units.

“The Ford Motor Company’s extraction system is an attempt to develop a continuous extraction apparatus having the advantages of larger mills but built in a unit small enough to operate as a community plant. The extractor consists of an inclined tube partly filled with solvent through which a modified screw conveyor propels soybean flakes upward while solvent passes downward in countercurrent flow.

“Steam-Jacketed Shell: The upper part of the shell is steam jacketed and serves to remove most of the solvent, the remainder of which is driven off in another inclined tube, or steamer, located immediately below the upper portion of the extractor tube. Solvent is distilled from the miscella and subsequently condensed and returned to the system. Figure 6 shows the interior of one of the Ford experimental plants which consists of two extractors, each having a capacity of 6 tons per day.

“The Allis-Chalmers system is also used on soybeans and is shown in Fig. 5. The extractor consists of a vertical cylinder having circular plates between stationary scraper arms, the plates rotating at slow speed around a central shaft. Flakes are introduced at the top and pass downward, dropping through slots in successive plates so staggered that the material travels in a helical path. Solvent is introduced at the bottom and flows upward in a similar spiral course, overflowing through the miscella outlet connection shown near the top of the column. The extracted flakes settle into the bottom of the column where they are discharged by means of a revolving screw which forces the meal through an adjustable spring-loaded cone valve. This mechanism forms the extracted material into a solid plug, squeezing out most of the solvent and preventing the bulk of the bulk of the solvent in the column from running out along with the flakes. Extractors of this type have been built with a capacity of 50 to 75 tons per day.

“The French Oil Mill Machinery Company has recently entered the field of continuous solvent extraction. In general, their equipment resembles that of the German-manufactured Bollman [Bollmann] system. The Kennedy extractor and the system developed by E.I. du Pont de Nemours and Company, Inc., also deserve mention, although neither is yet in commercial operation on soybeans.”

“... solvent-extracted meal for use in feeds requires a vigorous wet toasting process following the extraction in order to increase its nutrient value and palatability. It is the recent introduction of toasting methods which has largely accounted for the abatement of the long-standing prejudice against the use of solvent-processed meal in feeds.”


- **Summary:** Gives a brief history of the soybean from its origins in China up to the present.

  “In 1804 James Mease, a Pennsylvanian, first mentioned in American literature that the soybean was adapted to Pennsylvania and should be cultivated. In 1829 a brown seeded variety was grown in the Botanic Garden at Cambridge, Massachusetts, as a botanical curiosity. In 1854 the Admiral Perry Expedition brought back two varieties of soybeans from Japan.

  “As early as 1910, imported Manchurian soybeans were first crushed by an oil mill on the Pacific Coast [in Seattle, Washington]. Soybean oil hardened by hydrogenation was used in shortenings as early as 1914... Soybean oil in margarine was first used in large quantities in 1916, although it had been used in a small way as early as 1912.

  “In 1920 an Expeller was first used in processing soybean oil and meal from domestic seed at Chicago Heights, Illinois. In 1922 large scale production of soybean oil and meal was under way at Decatur, Illinois, using Expellers.

  “The following year the first solvent extraction plant for use on soybeans was built at Monticello, Illinois. It was 1929, however, before commercial production was started in the Monticello plant due to the fact that beans were not available at a price which was satisfactory.

  “By 1936 the soybean processing industry had grown to such proportions that the United States Government established the United States Regional Soybean Industrial Products Laboratory at the University of Illinois in cooperation with twelve North Central states.

  “In the Chicago Board of Trade, trading in soybeans is second only to wheat in volume. From small beginnings this industry has grown until the production of soybean oil and meal in the United States is only exceeded by Manchuria, the native home of this little bean.” Address: Member, Soybean Nutritional Research Council.


- **Summary:** “Interest in the improvement of the soybean has given rise to a marked increase in the testing of introductions, selections, and varieties at numerous localities in the major producing areas. Threshing at outlying nurseries is a major problem since soybean plants are bulky and consequently costly to transport. Also, when handled excessively, the plants shatter badly, resulting in loss of considerable seed.

  “In order to overcome some of the inconveniences of this threshing problem, a portable nursery thresher was constructed at Lafayette, Indiana, in 1938 and has been used very successfully through three seasons. This machine was designed after a thresher originally built by the junior author. Some of the features of the threshing and cleaning equipment of the nursery thresher used at the Indiana Agricultural Experiment Station and previously described by Cutler are incorporated.’

  Photos show: (1) Portable nursery thresher viewed from one side; it is mounted on a platform on wheels, pulled behind a truck or car. (3) The portable thresher in operation; three men are at work around it. Address: 1. Junior Agronomist; 2. Agronomist. Both: Div. of Forage Crops and Diseases, Bureau of Plant Industry and Bureau of Agricultural Chemistry and Engineering; U.S. Regional Soybean Industrial Products Lab. [Urbana, Illinois]. USDA.


- **Summary:** “Soybean protein is scheduled to replace milk casein as paper sizing, as an adhesive in making plywood, as an ingredient in water paint, and in many other industrial uses, chemists of the U.S. Department of Agriculture state. Freeing milk casein from industrial demands will aid national defense as well as the aid-to-Britain program, for casein is the raw material from which cheese is made, and more cheese is one of the prime needs of the food-export program...

  “It is estimated that 10,000 tons of soybean protein will be required annually, on the basis of present needs, to make up for casein shortage.”

  Note. This is the earliest English-language document seen (Aug. 2013) that contains the term “replace milk” or the term “replace milk casein.”


- **Summary:** In May and June 1937 the U.S. Regional Soybean Industrial Products Laboratory (in Urbana, Illinois) prepared 36 exterior white paints (3 groups of 12 each) with varying percentages of oils and pigments. These were allowed to weather for 4 years in order to determine their comparative durability. The paints containing 100% of soybean oil as the oil vehicle and 28% of oil by weight showed less film chalking when rubbed than those containing 38% or 48% oil. Such oil-based paints are equal to similar linseed oil and blended perilla-soybean oil paints in resistance to chalking or surface checking. Address: Chemist, U.S. Regional Soybean Industrial Products Lab.


- **Summary:** Growing casein shortages and defense needs for adhesives are driving work on increasing commercial production of soybean protein, started more than 4 years at
the USDA Soybean Research Laboratory in Urbana, Illinois. Soybean protein is considered equivalent to casein and can replace it in most applications. More than 3/4 of industrial casein is used in paper coatings. Large amounts also go to the making of plasmons, plastics, water paints, paper sizing, leather finishes, and insecticide sprays.

One one plant in the USA is now producing refined soybean protein. Working 7 days a week, it turns out about 9 tons of protein daily, less than one-third of the new demand.


• Summary: “An ideal solvent for extracting oil from soybeans should be capable of penetrating the bean flakes and rapidly dissolving and removing the oil and only the oil. Obviously, it must also be easily removable from the oil and the meal, leaving both products in satisfactory form for consumption. Other factors entering into the choice include cost, ease of recovery, fire and explosion hazard, corrosiveness, toxicity and boiling range.

“Apparently, there is only one extraction plant in the world now processing soybeans on a commercial scale with any solvent other than petroleum fractions. The single exception is a Manchurian plant using absolute ethyl alcohol. In this country, most of the solvent consists of hexanes, a typical commercial grade of which has a boiling range of 146º to 158ºF, and a specific gravity of 0.685 at 60ºF. In Europe, it is the usual practice to employ a hydrocarbon boiling between 160º and 195ºF. These petroleum products are excellent fat solvents, and they can be quite readily removed from both the oil and the meal without impairing the qualities of the products. Above all, they are relatively cheap and available in large quantities.

“Solvents flammable: Such solvents are so flammable that their use by any but experienced operators is hazardous, and modern extraction plants are accordingly designed to afford the greatest possible protection from explosions. Buildings should be well ventilated and provided with large areas of windows designed to open or shatter easily in order to relieve pressure in the event of an explosion. The plant should be located at some distance from the power house, and no open lights, flames, etc., should be permitted in the vicinity. Motors and related electrical equipment must be explosion proof, and electric wiring must conform to requirements of the National Electrical Code. Only spark-proof tools should be used in the building, and hobbled shoes, matches, and similar articles should be forbidden. Floors and stairways should be of the grating type.

“Many solvents have been proposed and used experimentally in efforts to reduce the danger of extractor operation. Of these, the chlorinated hydrocarbons have received a great deal of attention. The R. and H. Chemicals Department of the E.I. du Pont de Nemours and Company, Inc. has developed an extraction system particularly suited to trichloroethylene. It consists of an inclined helical conveyor which carries the flakes downward against a rising stream of solvent. Its operation is approximately the reverse of that employed in the Ford extractor since, unlike hexane, trichloroethylene is heavier than soybean oil.

“Hexane cheapest: At present, the principal deterrent to general use of trichloroethylene instead of hexane is its comparatively high cost. It should not be overlooked as a possible solvent for soybean oil, however, because it is entirely nonflammable and nonexplosive. Dry cleaning and metal degreasing industries use it extensively for this reason, and it is likewise used in the extraction of caffeine from coffee.

“A number of patents have been issued on the use of liquid propane and other low-boiling hydrocarbons as oil solvents. These materials are so volatile that the equipment must be designed for operation under pressure. The solvents which are mentioned in the literature, particularly in patents, comprise a very long list. Besides the patents specifying the more conventional solvents such as benzene, carbon tetrachloride, carbon disulphide, etc., other patents have been granted for the use of materials like furfural and sulphur dioxide as solvents for extracting fats and oils from the raw materials.

“The importance of the corrosive properties of any given solvent is difficult to evaluate. Corrosion is a problem in the edible oil industry not primarily from the standpoint of damage to equipment but mainly through the tendency of infinitesimal traces of metallic contaminants to impair the keeping qualities of the finished products. It is well known, for example, that less than one part per million of copper in some edible oils will markedly decrease their stability as regards taste and suitability. It is of utmost importance, then, that solvents used for soybean extraction be entirely noncorrosive toward the metals with which they come into contact.

“It is difficult to predict whether hexane and similar hydrocarbons will continue to be the only solvents used in this country for the extraction of soybean oil. At the present time, the most promising competitors of hexane appear to be ethyl alcohol and trichloroethylene. The properties of these materials are shown in Table I.

“Hot Alcohol Process: When soybean oil is dissolved in absolute ethyl alcohol at temperatures higher than about 150ºF, a homogeneous solution is obtained. Upon cooling, two layers form; the lower one consists chiefly of soybean oil with a small amount of alcohol, and the upper one is mainly alcohol containing a small amount of oil. The relative amounts of the two layers and their compositions depend upon the original solvent-oil ratio, the proof of the alcohol, and the extraction temperature.

“This property has been utilized in the so-called ‘hot alcohol’ process by the Manchuria Soybean Industry
Company which operates a large extraction plant at Dairen. The installation has a daily capacity of approximately 100 tons of beans which are processed in a battery of rotary extractors. The solvent is 99.8 percent ethyl alcohol which is dehydrated at the plant. The beans are selected, cleaned, and if necessary, warmed slightly before flaking. Since absolute ethyl alcohol is a dehydrating agent and loses its solvent power toward soybean oil in the presence of water, the flaked beans are dried prior to the extraction. They are then charged into the extraction battery and leached with the hot alcohol under pressure.

“Oil Separates: The resulting miscella is cooled and pumped into a conical separating tank where oil containing 5 percent alcohol collects in the bottom. It is drawn off, and the solvent is removed in an evaporator. The recovered oil is of semi-refined quality, having a light yellow color and salty taste, and can be used for edible purposes without further refining. The supernatant alcohol in the settling cone is returned to the extraction system; or, when it becomes too contaminated with water or nonoil extractables, it is transferred to a still for recovery of the byproducts and subsequent rectification of the alcohol. The byproducts include sugars, saponins, and phosphatides. The residual meal contains 0.5 to 1 percent oil and requires no refining for use in a variety of foodstuffs. It reportedly commands a price 25 percent higher than that of meal produced by other methods. Furthermore, it is said to possess properties which make it especially suited for the production of industrial proteins.

“The principal advantage of the alcohol extraction method is the ease of byproduct recovery. However, the American market for the above-named byproducts is not highly developed and there has therefore been little incentive toward the introduction of the process into this country. At present, the general use of any solvent which extracts appreciable quantities of nonoil substances along with the oil faces considerable restriction because of the relatively limited markets for such byproducts. The cost of alcohol relative to that of hydrocarbons, the relatively high latent heat of evaporation of ethyl alcohol, and the high initial cost of the equipment have been additional deterrents to the development of the alcohol extraction process in the United States.

“A large amount of experimental work has been done on the use of ethanol-benzene and methanol-benzene mixtures for soybean extraction in cases where phosphatides are to be recovered. During the late 1920’s such mixtures were employed for a while in the huge plant of Hansa-Muhle, A.G., in Hamburg. At about the same time, a small extraction plant in Monticello, Illinois, operated with benzene as a solvent.

“Liquid-Liquid Extraction: Ethyl alcohol is only one of a class of solvents which in certain temperature ranges are only partly miscible with soybean oil. Others include furfural, methyl alcohol, ethyl acetoacetate, acetic acid, etc. The portion of soybean oil which dissolves in these solvents has a slightly higher iodine number than has that portion which remains undissolved. By contacting the oil and solvent in countercurrent flow, it is possible to fractionate the soybean oil into two products, one having a high iodine number and the other having a low iodine number. The former is an excellent drying oil, far superior in this respect to the original oil, and the latter fraction is a good edible oil.

“This new method of solvent extraction has been studied extensively at the U.S. Regional Soybean Industrial Products Laboratory and shows great promise as a means for diverting a substantial part of our soybean oil out of the crowded edible product fields of consumption into industrial channels. It may, too, aid in averting a possibly serious shortage of drying oils resulting from the temporary cessation of imports of these materials from South America and the Orient.

“The process should not be confused with the solvent extraction of oil from the beans. It is an extraction method to which the oil may be subjected as one step in its refining, and the solvents suitable for carrying out the process are generally somewhat different in their properties from the solvents used to extract the oil from the beans. Although liquid-liquid extraction of soybean oil is not yet being carried out commercially, it is reasonable to expect industrial developments along this line in the not too distant future.”

A table shows the properties of normal hexane, ethyl alcohol, and trichloroethylene. For each is given the chemical formula, boiling range (degrees F), and specific gravity [relative density]. Address: Chemical Engineer, U.S. Regional Soybean Industrial Products Lab.

  • Summary: Page 2079: “In a previous publication a method for isolating sterol glucosides from soybean oil by means of an adsorbent was described.” Address: Dep. of Agricultural Chemistry, Purdue Univ. Agric. Exp. Station; U.S. Regional Soybean Industrial Products Lab. [Urbana, Illinois].

  • Summary: Two illustrations show the lathe. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.

  • Summary: This document is entirely typewritten. It was published in Soybean Digest in 1941 in three parts: June, p. 2-3; July, p. 2-3; Aug. p. 4-5—which see for details.
Contents: I. The continuous pressing method. II. The solvent process. III. Solvents for soybean oil extraction: Hot alcohol process, liquid-liquid extraction.


Note: In the upper right corner of page 1 of this document is written: “ACE-119


• Summary: Contents: Introduction. Protein extraction. Saturation tests. Oil varietal, Plastics improved. 535 visitors.

“This year marks the fifth anniversary of the establishment of the U.S. Regional Soybean Industrial Products Laboratory for research into the industrial utilization of soybeans and soybean products. The objectives of the original program were broad and there has been no need of alteration of the plan. Progress on some phases of the work has been described to this Association on previous occasions, but has been presented in more detail in over 80 technical and general papers published in technical and trade journals.

“The soybean is a complex organism and contains all the constituent compounds and elements essential to initiate growth of a soybean plant. In order that increased industrial utilization of the soybean and soybean products may be had and maintained economically in the highly competitive industrial field, it is essential that we learn the fundamental chemical and physical properties of the constituent compounds, particularly of those occurring in the larger amounts. A few illustrations may serve to show the importance of the more fundamental type of studies made by this laboratory.”

“The iodine number of the oil in soybeans is about equally influenced by variety and climatic factors of environment. High temperatures during the oil formation-period depress the iodine number and low temperatures raise it. The exposure tests on paints made with different kinds of oil have now covered a period of 4 years...

“Plastics Improved: Improved plastics of the phenolic-resin type containing as much as one-third soybean meal have been made in the laboratory. These have water absorptions as low as 0.5 per cent and other desirable properties. Soybean meal is now being used commercially in combination with phenolic resins by several plastic molding powder manufacturers. Improved impact strength and low water absorption are claimed for the articles made from these molding compounds.

“Very definite progress is being made in the studies on fractionation of soybean oil so as to obtain a portion having superior drying and film-producing properties. It is hoped through this research and its industrial application that shortages in imported drying oils (tung, linseed, perilla, and oiticica) may be met by these superior fractions of domestically-produced soybean oil.

“535 Visitors: The laboratory serves as a center where the problems of soybean processing and of using soybean oil and meal may be discussed. During the past two years the laboratory has been visited by 535 persons, individually and in groups. A large portion of these have been technical men from the industry interested in discussing technical problems relative to soybeans and soybean products with members of the staff of the laboratory. Recently the technical visitors’ interest has been largely in connection with the production of soybean protein for use in adhesives.

A large portrait photo shows Dr. T.H. Hopper. Address: PhD, Director, U.S. Regional Soybean Industrial Products


Article IX, Committees, lists and describes each.


Standing committees: For each committee, the names of all members (with the chairman designated), with the company and company address of each are given—Traffic and transportation. Research. Finished materials standards. Soybean grades and contracts. Trading rules—oil. Trading rules—meal. Soy flour. Crop improvement. Soybean nutritional research council. Trade development. Edible soybean.


Note 1. This is the earliest document seen (July 2005) that mentions Honeymead in Iowa.

Note 2. This is the earliest document seen (Sept. 2005) that mentions Quincy Soybean Products Co. (Quincy, Illinois) or Irving Rosen. Address: 3818 Board of Trade Building, Chicago, Illinois.


**Summary:** This document begins: “Mills are listed below which process soybeans or are reported to be equipped or will be equipped for soybean crushing. This list is furnished for the information and assistance of the public, but it is to be understood that no guarantee of accuracy or completeness is implied nor is any discrimination intended.”

The listings are alphabetically by state, and alphabetically by city within each state, and alphabetically by company name within each city (for example Chicago and Decatur, Illinois, have four mills each).

The states in which soybean crushing facilities are listed are: Arkansas (4). California (1). Colorado (2). Illinois (19).

Canada: (3, all in Ontario, in Baden, Owen Sound, and Toronto).

Note 1. This list was later expanded twice as: USDA Northern Regional Research Laboratory. 1943. “Soybean processing mills in the United States.” USDA Bureau of Agricultural and Industrial Chemistry. AIC-26. 10 p. Nov. Revised edition, 1948. CA-5, 14 p.

Note 2. We think it is unfortunate that the 1st (1941) list does not distinguish between mills that are confirmed to be crushing soybeans versus those that may do so in the future. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


• Summary: Most crops such as soybeans, with large and heavy seeds, require a relatively simple threshing device. Since seed cleaning devices constructed inside the thresher usually make the thresher more difficult to clean, it was found advantageous to construct this seed cleaner separately.

Two photos show a small, collapsible, portable, and relatively simple but effective seed cleaner in operation in a soybean nursery plot. In one, the cleaner is connected to the thresher by a 4-inch diameter flexible tube. The cleaner consists of a 1/3-inch mesh screen mounted in a metal frame to allow the bean and haulm mixture to be shaken by oscillating the screen assembly. Chaff and dust are blown up and out of the cleaner at one side. The clean seeds roll down into a cloth bag. Address: Div. of Forage Crops and Diseases, Bureau of Plant Industry, USDA, Ames, Iowa.


• Summary: The author first obtained soybean fiber from (1) the Engineering laboratories of the Ford Motor Company, Dearborn, Michigan, (2) The Glidden Company, Cleveland, Ohio, (3) United States Soybean Laboratory, Urbana, Illinois, through the courtesy of the A.E. Staley Manufacturing Company, Decatur, Illinois. He then developed a number of color tests for distinguishing these soybean fibers from Aralac (pigmented or non-pigmented), Lanital, wool, silk, and nylon. These were: Alpha-naphth hypobromite test for arginine, ninhydrine test for beta-alanine, Adamkiewicz test for tryptophane, vanillin test for tryptophane, Morse test for hydroxy-proline, solubility in 18% sodium hydroxide (1 hour hot), and sulphur test for cystine. Address: 1. Research Technologist; 2. Research Asst. Both: Bureau of Industrial Chemistry, Univ. of Texas, Austin, Texas.


• Summary: “Soybean oil treated by a new process just developed by the Regional Soybean Laboratory in Illinois, promises to meet the need for traffic paint on streets and highways and to compete in this respect with imported tung oil if Asiatic conditions interfere with imports. Certain chemical treatments have been developed which are said to give paint made with soybean oil the quick-drying qualities needed in traffic paints.” Address: USDA.


• Summary: Soybean oil meal has a higher moisture absorption capacity before the oil is extracted than after it is extracted. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


• Summary: “Crude lipids extracted from soybeans by petroleum solvents consist roughly of three main fractions, triglycerides, unsaponifiable matter, and phosphatides.” Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


• Summary: “The Soybean Products Laboratory of the Department of Agriculture and the cotton specialists of the Southern Regional Research Laboratory have jointly developed a plastic helmet out of heavy cotton cloth and soybeans. Object: To protect the heads of miners and workers on construction jobs from falling material. The new helmets are lighter than the old metal kind hitherto used. In fact, they are strong enough to deflect blows up to 40 pounds, which is about all that the human neck can stand.”


• Summary: Washington, DC—Because of defense needs for adhesives, USDA is exploring the possibility of increasing commercial production of soybean protein using a process developed by USDA chemists. The goal is to produce enough soybean protein to make up for the growing shortage of casein, a milk protein and an adhesive necessary in defense industries and housing.

Chemists began working on the problem of extracting
the protein from soybeans in a commercially viable way more than 4 years ago in the Soybean Research Laboratory at Urbana, Illinois.

• Summary: The first reference in this bibliography is No. 593 and the last is No. 714. The most recent date seen in any reference is May 1941, so this document must have been completed on or after that date.


• Summary: The references are in many different languages. Most of the English-language patents and articles are annotated (contain a summary), and some of the non-English patents do also.

After the last reference (#181) on page 88, is the following additional back matter: (1) References of high-vacuum sublimation of metals (9 refs, p. 89-94).

• Summary: “Genistein, which is known to occur in soybeans as the aglucone of genistin, was isolated from Dyer’s Broom (Genista tinctoria) in 1899 by Perkin and Newbury. The isoflavone nucleus was established for genistein by Baker and Robinson in 1926, when they found it to be identical to prunetol, and in 1928 they synthesized genistein. The constitution of genistein was thereby established as 5,7,4’-trihydroxyisoflavone. In 1931 Walz isolated genistin from a 90% methanol extract of soybean meal. He found that hydrolysis of genistin with hydrochloric acid gave one mole of genistein and one mole of glucose.”

The author isolated genistin, a crystalline pale-yellow substance, by methanol extraction of hexane-extracted soybean flakes. After recrystallization of the crude product from 80% ethanol, the glycoside was obtained in the form of pale-yellow, thin, rectangular plates that melted at 256°C. Soybean oil meal contains at least 0.1% of genistin.

Crystallographic optical data are presented. Photomicrographs (p. 3275) show genistin (x 75), genistein (x 75), genistin hexaacetate under polarized light (x 540), and genistein triacetate (x 75). A graph (p. 3276) shows absorption spectra of genistin and genistein.

Note: This is the earliest English-language document seen (July 1998) that uses the word “aglucone” (or any related spelling) in connection with soybeans. Webster’s Third New International Dictionary (1963) defines aglucon or aglucone as: “an organic compound (as a phenol or alcohol) combined with the sugar portion of a glycoside and obtainable by hydrolysis.” Webster’s Collegiate Dictionary (1998) defines aglycone (also aglycon) (a term first used in 1925) as: “an organic compound (as a phenol or alcohol) combined with the sugar portion of a glycoside.” Address: Dep. of Agricultural Chemistry, Purdue Univ. Agric. Exp. Station, Lafayette, Indiana—in cooperation with the U.S. Regional Soybean Industrial Products Lab.


• Summary: I. Peptization of soybean protein. II. Precipitation of soybean protein. III. The effect of
formaldehyde on the isoelectric points of soybean and other proteins by microelectrophoresis.

"Acknowledgments: The writer is indebted to Doctor Allan K. Smith, under whose direction this research was accomplished; to the United States Regional Soybean Industrial Products Laboratory, Urbana, Illinois, and its Director, Doctor Reid T. Milner, of the United States Department of Agriculture, Bureau of Agricultural Chemistry and Engineering, who supplied the facilities for the experimental work and permission to use the results; and to Professor Hermann I. Schlesinger and the Department of Chemistry of the University of Chicago for their kind acceptance of this work as dissertation material."

Contains 19 tables and 12 figures.


The classification of proteins proposed in 1908 was based mainly on their physical properties, especially solubility and precipitability, at least for the so-called simple proteins. It has persisted to the present time with but slight modifications. Although this classification undoubtedly has been of great value pending a more precise one, there has been a tendency to overlook its inadequacies.

"The newer physical methods for the study of proteins permit a more precise characterization of them as chemical entities in certain cases. Thus where a protein may be crystallized, maintains a constant composition after repeated crystallizations, and is monodisperse as shown by sedimentation rates in the ultracentrifuge and mobilities in the electrophoresis apparatus, it may be concluded that it exists as a chemical individual, but even here it must be noted that most crystalline proteins contain small amounts of water and salt or other substances from the mother liquor..."

Address: Regional Soybean Lab., Urbana, Illinois.


• Summary: "The excellent durability of 20-gallon phenolic resin-soybean oil varnishes has been noted in 4 previously published papers, but none of these papers has emphasized the excellent gloss retention qualities of phenolic resin-soybean oil varnishes when exposed to service or weathering tests." Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


• Summary: "The present wide industrial production and use of vegetable phosphatides have created considerable interest in methods for the determination of lecithin. Since in nature lecithin is always accompanied by other phosphatides, methods for its determination are based on the fact that it yields choline upon hydrolysis.” Address: Purdue Univ. Agric. Exp. Station; U.S. Regional Soybean Industrial Products Lab.


• Summary: "The vegetable soybean is a new crop for the Iowa farm garden and the Iowa canner. It has been found distinctly superior to the field soybean as a whole-bean food for human consumption. Used as a green vegetable, when harvested in the green-bean stage, or baked as mature dry beans, the high nutritive value of the soybean makes it especially valuable in the human diet.

"Eighty-nine vegetable varieties and four field varieties of soybeans were tested for desirability as a human food. The varieties were judged on the basis of agronomic performance and desirability as a human food when in the green-bean stage. Three vegetable varieties of different maturities were selected as most desirable under Iowa conditions: Sac, a very early variety; Kanro, a mid-season variety; and Jogun, a late variety. When planted at the same time these three varieties provide a succession of green vegetable beans throughout the late summer.

"All vegetable varieties tested had a tendency to shatter more severely when mature than the field varieties now in commercial production. This characteristic necessitates the harvesting of vegetable soybeans immediately upon maturity.

“Seed yield of Kanro and Jogun was approximately 80 percent that of commercially-grown field varieties. Sac, because of its earliness, yielded much less under Iowa conditions.

“Seed size of vegetable varieties was generally considerably greater than that of field varieties now grown in Iowa. The proper green vegetable state was found to extend from the time the pods were approximately two-thirds filled until they attended maximum size, but before they began to turn yellow.

“Parboiling of the pods for 5 minutes greatly facilitated shelling of the green beans.

“Canned green vegetable soybeans proved to be a palatable and desirable food. The addition of sugar in canning improved their palatability.”

Table 1, titled “Summary of agronomic data and palatability scores of soybean varieties tested for suitability as human food at Ames, Iowa, 1935-1939” (p. 394-95) lists all 89 varieties. The following varieties had names: Agate (81037), Bansei, Chusei, Eatum [Erum] (86100), Fuji, Giant Green, Hakote, Hiro, Hokkaido, Illington, Imperial, Jogun, Kanro, Kanum, Kura, Osaya, Sac, Sato, Shiro, Sousei, Suru, Tastee, Toku, Willomi, Wolverine. Probably not vegetable types: Dunfield, Illini (2514 seeds/lb), Manchu, Mukden (2431 seeds/lb). For each variety is given: Date green beans
picked, date mature, height in inches, lodging (0 = perfect, 5 = badly lodged), seed quality (0 = poor, 5 = excellent), seed mottling (0 = none, 5 = much mottling), No. of beans per pound (seed weight), mature seed yield (bu/acre), palatability score (0 = very poor, 10 = excellent). Address: 1. Asst. Geneticist, Div. of Forage Crops and Diseases, Bureau of Plant Industry, USDA, Ames, Iowa.


• Summary: The title page states, from top to bottom: “United States Department of Agriculture. Bureau of Plant Industry, cooperating with Bureau of Agricultural Chemistry and Engineering, and the State Agricultural Experiment Stations of the North Central Region.”


The Introduction states: “One of the purposes of the U.S. Regional Industrial Products Laboratory was to develop improved varieties and strains of soybeans for industrial utilization. To provide a more rapid and accurate method of evaluating new strains developed through the cooperative breeding work, two uniform soybean variety and strain tests were established in the spring of 1939. One of these, now designated the Uniform Test Group II, was made up of varieties and selections of suitable maturity for the northern part of the soybean region and was planted that season at nine locations extending from Ohio to Iowa. The late nursery (Group IV) composed of strains having a maturity later than Illini and Dunfield was planted at 11 locations in southern Indiana, Illinois, and Missouri. The work was continued during 1940 and 1941 with the addition of the uniform midseason nursery (Group III) designed to test selections intermediate in maturity between the first two tests.”

Note from Dr. R.L. Bernard, University of Illinois. 1999. July 15. This may be the first use in print of the word “Group”—meant for test purposes but clearly based solely on maturity. Thus it represents an early step in the evolution of the concept of what was later called a “maturity group.”

Note 2: This is also the earliest document seen (Dec. 2016) that contains the terms “Uniform Test” or “Uniform Test Group.” Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


• Summary: Combining the regional soybean industrial-products laboratories at Urbana and Peoria, Illinois, would not be feasible, according to a USDA official (James T. Jardine, PhD, chief of the Office of Experiment Stations) testifying to the House appropriations committee, which is considering the USDA appropriation bill for fiscal 1943.

Jardine said that the chemical phases of the Urbana laboratory work could be conducted at Peoria, but not the agronomic phases.


• Summary: According to James T. Jardine, it would not be feasible to combine the regional soy bean laboratories at Urbana and Peoria.


• Summary: “Summary: 1. An apparatus is described for conductance and capacitance measurements on conducting solutions from 1 kc. to radio frequencies.” Address: U.S. Regional Soybean Industrial Products Lab. [Urbana, Illinois].


• Summary: About the four regional laboratories, which are under USDA’s Bureau of Agricultural Chemistry and Engineering—With emphasis on the Northern Regional Research Laboratory in Peoria, Illinois; here alcohol motor fuel from farm crops is one of the research subjects. During World War II, there has been a shortage of casein, since much skim milk is taken by Lend-Lease. “As there may be a shortage of casein for coating paper, for plywood, and for paints, the laboratory experts are developing a substitute to be made from corn.

The Northern Laboratory employs 190 people. “Dr. O.E. May, formerly director of the U.S. Soybean Industrial Products laboratory, is in charge of the Northern Laboratory. The research work under his direction is divided into eight main divisions....”

Photos show: (1) Dr. O.E. May, director of the laboratory, seated at his disk. (2) The front entrance to the Northern Regional Research Laboratory. Address: USDA.

198. Cutler, G.H.; Probst, A.H. 1942. Gibson and Patoka soybeans. Indiana (Purdue) Agricultural Experiment Station,
**Summary:** “Black-seeded soybeans have been grown for many years almost to the total exclusion of the yellow-seeded varieties in a large section of southern and southwestern Indiana, for the market outlet was chiefly for seed for soybean hay production. With an increasing demand for soybean oil in recent years a new emphasis has been given to the commercial production and use of yellow-seeded varieties, the present commercial varieties of which yield larger quantities of a superior quality of oil and an oil meal with a more desirable color. Yellow-seeded varieties now sell for 10 to 25 cents more per bushel than the black-seeded kinds.”

Gibson and Pakota are improved yellow-seeded varieties. Gibson is a selection from a cross between Dunfield and Midwest. Patoka is a pure line selection from P.I. 70218-2.


**Summary:** A landmark popular book and a good description of the pioneering period of soybean production and processing in the United States.


Illustrations and diagrams show: (1) Principal centers of U.S. soybean production (p. 19, map). “Almost 90 per cent of all soybeans are harvested in Illinois, Iowa, Indiana, and Ohio. If three other states are included as shown on the map–Missouri, Michigan, and Virginia–the total is 97 per cent. (2) Principal centers of U.S. soybean processing (p. 20, map). Discs of different size show the various centers. Since Illinois produces 52% of the harvested soybeans, central Illinois is the center of soybean processing [crushing] in the USA. “Total processing capacity in late 1942 exceeded 100 million bushels for the regularly established soybean processing plants.” (3) Diagram of uses of the soybean (p. 68).

Chapter 2, “Vignette from antiquity” begins: “Even when the Pyramids were being built, three hundred years before the Tower of Babel, and twelve centuries before Solomon fashioned his temple, the soybean was hoary with age. The earliest writings on the subject go back to the period of the Pyramids.

“But of the science of soybean growing you will find no recorded beginnings in the musty tones [sic, tomes] of oriental history. No book reveals the name of the inquisitive oriental who in the misty long ago began sowing the seeds, harvesting the beans, pounding them into a mash for cooking and eating, and probably boring his friends no end with tales of their merit. There is no record depicting this unsung hero’s foresight in saving the seed of the magic plant against next year’s hunger. Likely as not he was a crude dreamer who fumbled his hunches and accomplished little in a lifetime of wrestling with the problem of proper cultivation.

“Oriental literature of a later date contains much about the plant but of its origin as a food product again there are only legends.

“A choice vignette from antiquity on the initial use of soybeans runs something in this fashion. Long, long ago, far back in the dim past, a caravan pulled out of an eastern China town. It consisted of a number of merchants and their servants... The caravan was bound for a distant inland settlement intent upon disposing of its valuable wares.” After trading in the north, the caravan headed home, “now laden with gold, silver, and choice furs received in payment for the merchandise. Suddenly at dusk on a day when the caravan was still far from home it was surrounded by bandits who had learned of the rich prize at hand. Merchants and servants took quick refuge in a rocky defile easy of defense. Here they were besieged day on day until their scanty provisions ran low and starvation seemed inevitable. At length a servant whispered to his master and pointed to a vinelike plant bearing some sort of legume. No one could recall having seen such a plant before but all were touched with the pinch of hunger. So with grave doubts the men pounded the beans into a thick flour, mixed it with water, and made coarse cakes. Upon these cakes the caravan survived, and with renewed strength fought off the foe until help arrived. And, so the legend goes, from that day forth the miracle bean became the staff of life in China.” Note 1. This story of the caravan besieged by bandits in China is a longer and embellished version of the tale first dreamed up and told by H.W. Galley in Soybean Digest (Dec. 1940).

“True or false, the story has lived through the ages.

“For the first written record of the soybean one must turn to ‘Materia Medica,’ written by Emperor Shen-nung in
2838 B.C. It describes many plants of China including that of the soybean, but even the name is clouded with antiquity. In the early Chinese history the name ‘Shi-yu’ [sic] and the ‘Ta-tou’ were applied to the soybean. These names probably antedate the first authoritative records of the plant.”

Dies then discusses Engelbert Kaempfer, Linnaeus, and Moench.

“Then in 1804 a Yankee Clipper ship in full sail glided down the coast of China searching for ports for a return cargo. Not sure of the length of the return journey, the captain ordered several bags of soybeans tossed into the hold as a reserve food supply. And thus did the first soybeans enter America. Little was done about the soybeans then.

Note 2. This is the earliest document seen (June 2003) that further embellishes the myth of the “clipper ship” with phrases like “glided down the coast of China” or “ordered several bags of soybeans tossed into the hold” – all supposedly in connection with the introduction of the soybean to the United States. This is also the earliest document seen (Aug. 2000) that compares the age of the soybean with that of the pyramids (in Egypt; the oldest and largest was built for Khufu at Giza in the 26th century B.C.), the Tower of Babel (in Babylon [today’s Iraq]), or Solomon’s Temple (in today’s Israel), arguing that the soybean was much older than all of them.

“James Mease of Pennsylvania first mentioned in American literature shortly after this importation that the soybean was adaptable to Pennsylvania and should be cultivated” (p. 9).

In Chapter 3 (p. 14) Dies notes: “The first soybeans processed in this country were imported from Manchuria in 1911 and sold to Herman Meyer who had a small crushing plant in Seattle, later called the Pacific Oil Mills. From the raw material he produced the two chief products – soybean oil meal for livestock feed and soybean oil, selling the latter locally for industrial use. The meal was advertised and sold as ‘Proteina,’ a high-protein feed. The venture did not last for any considerable period; a few years later Meyer passed away.” Note 3. This is the earliest document seen (May 2010) that mentions Herman Meyer.

“Soybeans grown in this country were first processed by the Elizabeth City Oil and Fertilizer Company at Elizabeth City, North Carolina. W.T. Culpepper, now postmaster at Elizabeth City, was manager of the new mill, started in 1912. The first domestic soybeans were crushed for commercial purposes there in the late fall of 1915. It was a small operation.”

Note 4. This is the earliest document seen (May 2010) that mentions W.T. Culpepper.

“At that time, most of the soybeans were grown in North Carolina, and the Winterville Cotton Oil Company at Winterville, North Carolina, purchased expellers for processing purposes, and these operated on soybeans for a limited period. Still another mill, operated by Havens Oil Company at Washington, North Carolina, crushed thirty thousand bushels of beans as an experiment in 1916”

“My uncle, Jonathan Havens,” says J. Havens Moss, “was the first to plant soybeans in this section, devoting considerable acreage to the mammoth yellow [Mammoth Yellow] type which grew and matured splendidly from the very start. Its value to the land was obvious” (p. 14-15).

Note 5. This is the earliest document seen (Aug. 2016) which mentions that Havens Oil Co. crushed soybeans as early as 1916.

Note 6. On the first page of the copy owned by Soyfoods Center is a signed inscription, in dark blue ink, which reads: “With kind regards to Russell East, who has done much on behalf of the soybean – Edward Jerome Dies.”

Note 7. Only minor changes were made on about 13 pages of the revised edition published in March 1943. None of the statistics in the many tables were been updated, and the bibliography was not changed. Address: USA.


• Summary: Page 5: Soybean acreage and production, 1924-1941. United States crop. Soybean harvested for beans. Each crop year extends from Oct. 1 to Sept. 30. Acreage increased from 448,000 acres in 1924 to 5,855,000 acres in 1941. Yield per acre rose from 11.0 bushels in 1924 to a peak of 20.7 bushels in 1939. Production increased from 4,947,000 bushels in 1924 to 106,712,000 bushels in 1941. Sources: (1) Crops and Markets, USDA. (2) Illinois Crop Statistics, Circular 440-441. (3) Latest government reports, 18 Dec. 1941.

millions in 1939. Bulgaria production rose from 77,000 bu in 1934 to 827,000 bu in 1939. Yugoslavia production rose from 26,000 bu in 1934 to 213,000 bu in 1939. 1909-1941. Other European (Poland, Czechoslovakia, Austria) rose from 55,000 bu in 1932 to 60,000 bu in 1935. With many footnotes.

Page 19: Principal centers of soybean production in the USA. “Almost 90 per cent of all soybeans [in the USA] are harvested in Illinois, Iowa, Indiana, and Ohio. If three other states are included as shown on the map-Missouri, Michigan and Virginia—the total is 97 per cent. The size of the baskets is proportional to the volume produced.

Page 20: Principal centers of soybean processing [crushing] in the USA. “As Illinois produces about 52 per cent of the soybeans harvested for seed, Central Illinois is the center of soybean processing as shown on this map. The discs indicate relative importance of the processing centers. Total processing capacity in late 1941 probably exceeded 90 million bushels.

Page 25: Illinois acreage and production of soybeans for beans, 1919-1941. Acreage harvested increased from 3,000 acres in 1919 to 2.285 million acres in 1941. Yield, in bushels per acre, rose from 10.0 in 1919 to 21.5 in 1941. Production increased from 30,000 bu in 1919 to 49.128 million bu in 1941.


Page 53: “United States crop production of soybean oil meal and soybean oil, 1924-1940.” This valuable table is poorly titled. It has 5 columns: (1) Year. (2) Production of soybeans. Increased from 4,947 bu in 1924 to 106.712 million bu in 1941. (3) Crushings [crushed]. Increased from 307,000 bu in 1924 to 64.180 million bu in 1941. (4) Production of meal. Increased from 7,400 tons in 1924 to 1.5369 million tons in 1941. (5) Production of oil. Increased from 2,269 million pounds in 1924 to 565.169 million pounds in 1941.

Page 58: Soybean oil imported and exported, 1912-1940. Imports rose from 24.959 million lb in 1912 to a peak of 335.984 million lb in 1918, decreasing to 4.848 million lb in 1940. Domestic and foreign oil exported decreased from 34.803 million lb in 1919 (For 6 months beginning July 1) to 15.953 million lb in 1940.

Page 61: Soybean oil: factory consumption by classes of products, 1931-1940. Compounds [shortening] and vegetable cooking fats rose from 10,869 lb in 1931 to 212.317 million lb in 1940. Oleomargarine rose from 623,000 lb in 1931 to 87.106 million lb in 1940. Other edible products rose from 180,000 lb in 1932 to 39.980 million lb in 1940. Soap rose from 3.816 million lb in 1931 to 17.612 million lb in 1940. Paint and varnish rose from 6.256 million lb in 1931 to 29.828 million lb in 1940. Linoleum and oilcloth rose from 2.612 million lb in 1931 to 29.828 million lb in 1940. Printing ink rose from 33,000 lb in 1931 to 82,000 lb in 1940. Miscellaneous rose from 2.051 million lb in 1931 to 16.538 million lb in 1940. Foots and loss rose from 1.625 million lb in 1931 to 20.924 million lb in 1940. The total of these uses for soybean oil rose from 27.885 million lb in 1931 to 431.641 million lb in 1940.

Page 68: Diagram of uses of the soybean. The major categories are: Green soybeans, used as fresh vegetables or in canned vegetable salads. Dry soybeans, used for seed or to make bean sprouts, soup, soy sauce, roasted soybeans, boiled soybeans, stock feeds, vegetable milk [soymilk] (used to make liquid milk products, dry soy milk products, bean curds, soy cheese), debittered soybeans (used to make full fat soy flour, soy coffee, soy butter, soy cereal). Soybean oil meal, soybean flour, soy lecithin, crude soybean oil (used to make fatty acids, alkyl resins, glycerine, core oils, soft soaps, hard soaps, insecticides, and many non-food products mentioned above). Refined soybean oil (used to make food products–vegetable shortening, margarine, salad dressing, edible oils, frying oils). Address: USA.
investigations: Progress reports by projects. Agronomic investigations: Progress reports by projects.

The introduction notes that this is the laboratory’s sixth annual report. Emphasis is now “being placed on increased production of soybeans as a part of the program to meet our fats and oils needs during the war emergency period. The high rate of domestic consumption, large purchases for lend-lease shipments, and curtailment of imports of stocks of oilseeds and oils resulting from the war in the Pacific, indicate that the United States will be faced with a possible deficiency of 1 to 1½ billion pounds in the supply of fats and oils from domestic consumption and export in 1942-43.”

The 1942 production goal of 9 million harvested acres and approximately 153 million bushels of soybeans is about 50% higher than the record production of 1941.

Subproject No. 1 (p. 71-72) is titled “The development of varieties of soybeans for various industrial purposes by introduction and selection.” Under “Progress” we read: “The use of the words early, midseason, and late to designate these uniform nurseries is open to objection because a group of strains that are thought of as early for one area may be considered late for another area within the North Central Region. Therefore, the designations of the uniform tests have been changed as follows:

“Uniform Early Test changed to Uniform Test, Group II; Uniform Midseason Test changed to Uniform Test, Group III; Uniform Late Test changed to Uniform Test, Group IV.

“Provision was made for the addition of a test of very early soybean strains, which will be designated as Group I.

“A mimeographed publication has been prepared giving the 1941 yields and chemical composition of all the strains as well as the two-year and three-year summaries for these tests.”

Note 1. This mimeographed publication is RSLM No. 62, dated Feb. 1942.

Note 2. This annual report is interesting in showing (p. 71-72) the evolution of the term “Group.” The term “maturity group” is not yet used, but obviously the “Groups” were based on maturity. The previous annual report (April 1941) uses the terms “Uniform Early Test, Uniform Midseason Test,” etc. Address: Director, Urbana, Illinois.


• Summary: The authors have amassed a considerable amount of data showing the effect of soil, climate, and fertilizer treatment on the degree of saturation in soybean oil.

Contents: Introduction. Effect of variety, location, and season on yield and composition of soybean seed: materials and methods, climatological data, yield, size of seed, protein content, oil content, iodine number, total ash content, phosphorus content, potassium content, calcium content, total sugar content, crude fiber content, unsaponifiable matter in crude soybean oil.

Effect of variety, fertility level, and season on the yield and composition of soybean seed: materials and methods, climatological data, yield, size of seed, protein content, oil content, iodine number. Summary and conclusions.


• Summary: “The purpose of the present investigation is to fractionate and study the materials which make up the crude phosphatides of soybean oil. The phosphatides and associated materials were removed from crude soybean oil by adsorption upon a solid adsorbent and were recovered by successive extractions with organic solvents.” Address: Indiana (Purdue) Agric. Exp. Station and U.S. Regional Soybean Industrial Products Lab., Lafayette, Indiana.


• Summary: “For many years soybeans were regarded as the best legume for hay on land where red clover and alfalfa were not dependable crops. Korean lespedeza, however, is now replacing soybeans as a hay crop on some of the soils that are not adapted to alfalfa and clover. The soybean is still grown for hay on a broad scale, but the current trend seems to be toward an increased acreage for grain and a reduced acreage grown for hay.”


• Summary: “Because of the present emergency in which plastics are being used to replace metals, there is a severe shortage of plastic molding powders. The most common thermosetting molding powder is the phenolic type. One hundred fifty to two hundred million pounds of this type of molding material was produced in 1941. It is usually produced by condensing phenol and formaldehyde to form a fusible resin and subsequently compounding the resin with an equal part of wood flour, along with catalysts, lubricants, and coloring materials.

“It has long been known that phenols and phenolic resins are compatible with soybean protein and soybean meal. Advantage has been taken of this fact to utilize the adhesive properties of soybean meal for supplementing those of phenolic resins in the phenolic resin-wood flour type of plastic. This development enables manufacturers to conserve the more expensive phenolic resin by replacing part of it with

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soybean meal.

“The greatest problem involved in producing a plastic containing soybean meal is attainment of water-resistance. Since soybean meal is highly water absorbent, it tends to impart this property to plastics when used as an ingredient. Treatment with formaldehyde improves the water resistance of soybean meal, but at the same time it decreases the plastic-flow characteristics.

“Another problem is to avoid increase in curing time. Thermosetting materials are discharged from a hot die while, with the thermoplastic materials, the die must be cooled in order to set the plastic. Soybean protein is thermoplastic, provided a plasticizer is used. Phenolic resins in the early stage act as plasticizers for soybean meal. When the resin polymerizes to the insoluble, infusible state it no longer plasticizes the protein material and plastic flow stops. As a result the whole mixture sets up giving a thermosetting plastic which may be removed from the hot die.

“Preparation of meal: Oil-free soybean meal is not suitable for use in plastics without some modification. Soybean meal contains about 10 percent soluble sugars as well as other soluble materials which decrease water resistance. Thus if the untreated meal is used, blistering is likely to result probably due to decomposition of sugars. If meal is used, it must be washed free of soluble materials. This washing must be carried out with water adjusted to the isoelectric point of the protein, ph 4.1-4.3, in order to prevent leaching out some of the protein.

“After washing out the soluble sugars the meal must be given a heat treatment in order to denature or insolubilize the protein. This denaturation is carried out in the laboratory by raising the moisture content of the meal to about 20 percent and heating under pressure at a temperature of 225º to 250º F. for 2 or 3 hours. If the pressure is released suddenly, most of the wafer escapes as vapor and a dry product is obtained which is suitable for use in plastics. Somewhat the same results may be obtained by drying the wet leached meal at moderately high temperatures.

“When protein is extracted from soybean meal a residue is left which is free of water-soluble sugars but may contain from 40 to 60 percent protein. If this material is heat-denatured, it makes an excellent material for use in phenolic plastics.

“Preparation of Molding Powder: The following formula is typical of methods used for preparing molding powders in the laboratory:

“94 parts phenol (1 mole ratio)
“56 parts leached soybean meal, heat-treated
“5 parts hydrated lime
“Mix well and allow phenol to soak into meal.
“Add 122 parts 37-percent formaldehyde solution (1.5 moles).
“Heat in closed, steam-jacketed mixer for 15 minutes with steam pressure of 20 pounds per square inch.
“Heat 1 hour with jacket temperature of 190º to 210ºF.
“Add 112 parts wood flour,
“1 part calcium stearate,
“1 part stearic acid,
“11.66 parts hexamethylenetetramine (equivalent to 0.5 mole of formaldehyde).
“Mix well and dry in air or vacuum at room temperature to a moisture content of less than 5 percent.
“Work on hot calender rolls or in Banbury mixer for 1 to 3 minutes.
“Grind to approximately 16 mesh to obtain molding powder.

“The resin-forming reaction may be carried out in an autoclave or any steam-jacketed mixer which can be closed to prevent the escape of formaldehyde during the reaction. Drying may be accomplished by exhausting the air from the mixer or by spreading the material out for air drying.

“A number of modifications may be made in the formula given above in order to modify properties of the molding powder or of the finished plastic. For example, hydrated lime may be replaced by barium hydroxide, calcium oxide, barium oxide, or ammonia. Hexamethylenetetramine may be replaced by paraformaldehyde, and part of the phenol may be replaced by cresols. Part of the wood flour may be replaced by asbestos fiber in order to give a faster-curing molding powder or a finished plastic with increased heat resistance.
“20 Per Cent Soy: From the proportions of phenol and formaldehyde specified in the formula, approximately 112 parts of phenolic resin will be produced. Half as much soybean meal (56 parts) and 112 parts of wood flour are specified. Therefore, the molding powder will have a composition of approximately 40 percent phenolic resin, 20 percent soybean meal, and 40 percent wood flour. The properties of such a plastic compare favorably with those of a phenolic plastic containing 50 percent phenolic resin and 50 percent wood flour and offers a saving of 10 percent in resin content.

“The amount of soybean meal in the molding powder may be increased to 30 percent with proportionate decrease in phenolic resin. However, an increase in meal content gives a plastic of increased water absorption and lower flexural and impact strengths. The molding powder made with higher meal content usually requires longer curing time and more pressure for molding.

“It should be noted that best results have been obtained by forming the resin in the presence of the soybean meal as described above. Success of this procedure may be accounted for by assuming that the protein reacts with the resin in some manner and forms a perfectly homogeneous mass.

“10 Per Cent Soy: The conventional method for preparing phenolic-type molding powders involves making a fusible resin and grinding it with wood flour, catalysts, pigments, and lubricants in a ball mill. The powdered mixture is then compounded on hot calender rolls to obtain uniformity, and is again pulverized after cooling. The following formula is an example of this method in which 10 percent treated soybean meal is used.

“40 percent two-stage phenolic resin
“5 percent hexamethylenetetramine
“40 percent wood flour
“10 percent treated meal
“2 percent hydrated lime
“1.25 percent stearic acid
“1.75 percent nigrosine dye
“Total: 100 percent
“Ball mill 24 hours.
“Roll for 3 minutes with cold roll at 120°F. and hot roll at 205°F.

“This material gave flow and strength properties comparable with molding powder made with 50 percent resin and 45 percent wood flour used as in the formula given above.

“Replacing Resin: A large number of molding powders have been made in the laboratory in which the resin, wood flour, and meal contents were varied. It was concluded that a leached, denatured soybean meal can be used to replace as much as 5 or 10 percent of the more expensive resin without altering appreciably the curing time and strength properties of the final plastic. Since the meal is only about 50 percent protein, the remaining 50 percent being inert, non-plastic material, 10 percent meal must be used to replace 5 percent resin and 5 percent wood flour.

“When soybean meal is used to replace wood flour, a strikingly large increase is noted in the plastic flow of the molding powder. In other words, a very free-flowing molding powder may be produced by using 50 percent resin, 40 percent wood flour, and 10 percent treated meal or protein residue. Such free-flowing molding powders are usually made by using 60 percent resin and 40 percent wood flour.

“Colored Plastics: Both phenolic resin and wood flour are difficult to dye, and colors are therefore usually obtained by using pigments. Soybean meal offers a protein base for dyeing and tests show that phenolic plastics containing it are more stable to light than are phenolic plastics made without soybean meal when both kinds are colored with organic dye. Color may be obtained as follows:

“Black–2 percent nigrosine dye.
“Brown–2 percent burnt umber and 1 percent brown dye.
“Red–2 percent white clay and 2 percent Phenof orm Red (General Dyestuff Corporation).
“Blue–2 percent white clay and 1 percent Duratint Blue 1001 (Federal Color Laboratories).
“Green–2 percent white clay and 2 percent green dye, A6318 (Kohnstamm).

“Summary: It is possible to use 20 percent of treated soybean meal with 40 percent of phenol-formaldehyde resin and 40 percent of wood flour without decreasing the quality of the plastic or adding undesirable properties to the molding powder, in comparison with a 50:50 mixture of resin and wood flour.

“Dyeing properties are definitely improved by the use of protein material from soybeans. Moreover, the use of the protein material makes it possible to decrease the phenolic resin content because of the increased flow obtained with the soybean protein.

“Research is being continued in the U.S. Regional Soybean Industrial Products Laboratory with the idea of using a larger percentage of soybean meal products in admixture with phenolic resins and obtaining a plastic which is not inferior to those now on the market.”

Photos: (1) “A chemist pours oil-free soybean oilmeal flakes into a mixer, where phenol and formaldehyde are incorporated to form a plastic.” (2) “Representative plastic pieces molded from soybean-phenolic molding powder.” (3) “Beginning at left (clockwise around room): 1. Compounding rolls. 2. Hydraulic press. 3. Mixer. 4. Plastics flow tester.” Address: U.S. Regional Soybean Industrial Products Lab.

Aerobic respiration in seeds is analogous to oxidative combustion; the initial and final products are the same in both cases. Hexose sugars + oxygen lead to carbon dioxide, water, and heat (calories). In addition to the respiration of the seeds themselves, the respiration of bacteria, molds and insects associated with the seeds may account for a large share of the total respiratory activity exhibited in storage. “When respiration occurs at a sufficiently rapid rate to produce more heat more quickly than it can be dissipated, the temperature of the grain rises and heat damage may result.”

“Moisture content has long been recognized as one of the major factors determining the intensity of the respiration of stored grain.” Research has also shown that cracked, shriveled, immature kernels respire more rapidly than sound, plump grain of the same moisture content. The presence of foreign material or of sprouted, frosted, or heat-damaged kernels also increases respiration. Address: Div. of Agricultural Biochemistry, Univ. of Minnesota.


Although it does not say so, we have found that it was published verbatim in two other places: (1) Soybean Digest. 1942. June. p. 4-5, 11. (2) USDA Bureau of Agricultural Chemistry and Engineering. ACE-151. 4 p. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.

208. Smith, Allan K. 1942. Soybean protein. Soybean Digest. July. p. 4-5. • Summary: “The large quantiﬁes of soybean meal left from the solvent extraction of oil from soybeans may be considered as a practically unlimited raw material for the production of soybean protein. If 10 percent of the 1941 crop of soybeans, estimated at 107 million bushels, were processed for protein, we would have approximately a quarter of a billion pounds of this product. It is thus evident that raw material supplies are more than adequate for all visible needs. “Soybean protein is a relatively new commodity on our markets, and in order to ﬁnd a permanent place among other competing industrial proteins, synthetic adhesives, and plastics, it must meet competition in regard to both quality..."
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"Extensive Investigation: The U.S. Regional Soybean Industrial Products Laboratory has made an extensive laboratory investigation of methods for separating the protein from the meal and is continuing these studies along with research on chemical and physical properties of the protein. The results obtained show that the separation of the unmodified protein on a small scale by extraction of the meal with water or dilute alkali and subsequent precipitation with acid is not difficult. Extraction data for acids, bases, and salts are illustrated in Figures 1 and 2. On the other hand, the engineering problems such as clarification, filtration, centrifugation, drying, and grinding which are encountered at various stages of large-scale production are not well understood and might offer considerable difficulty to anyone undertaking commercial production.

"There is also the problem of modifying the properties of soybean protein by chemical treatment to make it suitable for specific uses. This problem deserves a great deal of scientific investigation, and its solution will be the principal means of extending the industrial utilization of soybean protein and probably other proteins as well. Soybean protein is comparatively new in the field of industrial proteins, which include casein, gelatin, blood albumin, egg white, fish glue, and zein. These proteins have various physical and chemical characteristics in common, yet each one possesses an individuality which leads to some specific use. Proteins have the most complicated molecular structures of any substances with which the chemist works, and for this reason truly chemical exploitation will be slow.

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"Industrial Use: While the isolation of soybean protein on a small scale is a relatively simple matter for a chemist, it should be pointed out that its production on a large scale and its utilization by industry require considerable technical skill and will result in disappointment to those attempting commercial processing without a careful study of the problems involved. Furthermore, when soybean protein is recommended for certain uses, one should not expect that it can be substituted in formulas established for other proteins with the same results, but rather that specific or modified formulas will be required. It should be considered as a technical product and sold accordingly.

"As intimated above, soybean protein may be modified during the refining process so as to alter its solubility or dispersing characteristics, its adhesive strength, viscosity, color, and tolerance for formaldehyde. The simplest modifications are effected by a mild hydrolytic treatment with dilute alkali or by the action of proteolytic enzymes. These treatments alter several of the properties of soybean protein; for example, they make it more easily dispersible. Research is in progress on the substitution of organic groups in the protein molecule, because an appreciable change in physical and chemical properties may be expected from this type of chemical alteration.

"In Paper Industry: Indications are that soybean protein will find substantial use in paper coatings, paper sizing, water paints, plastics for buttons and buckles, leather dressings, and adhesives for various purposes, such as making furniture and abrasive paper. Research is in progress toward the production of a wool-like fiber from soybean protein. Such a project, if successful, might consume a considerable tonnage of the protein. The largest use of soybean protein in immediate prospect is for paper coating. Up to the present time soybean protein has not been completely acceptable for all grades of paper coatings, largely because
it is slightly darker in color than casein. Recent work at the Soybean Laboratory indicates that a satisfactory bleach for soybean protein may have been found in sodium dithionite (Na2S2O4) or zinc dithionite (ZnS2O4). It has been shown in the laboratory that 4 or 5 percent of one of these powerful reducing agents on the basis of the protein, added at the time of preparing the coating color results in a paper coating as bright in color as that prepared with a good grade of casein. This bleaching development is still to be proved satisfactory in plant production and printing tests, but the simplicity of operation favors its success. Since the beginning of the war emergency, much of the normal casein supply has been diverted to dry milk production, and we have an increasing shortage of milk casein. Commercial soybean protein which has been developed to the stage where it may satisfactorily take the place of casein in the paper trade can help to fill in this shortage.

Perhaps more important in the present emergency than paper coating, however, is that portion of the plywood industry which depends upon casein as an adhesive and which consumes an estimated 200 tons of casein per month. An increased production of soybean protein would help to relieve the general industrial protein demand and aid in this essential war need.

It is impossible to predict at this early stage of research and development what the future may be for soybean protein as an industrial product, but with all things considered it has many promising possibilities.

Two figures (graphs) show: (1) The solubility of soybean protein in various salts and water. (2) The solubility of soybean protein in alkalies and acids. The pH value of 6.6 is for distilled water.

Note: The U.S. Regional Soybean Industrial Products Laboratory (Urbana, Illinois) is: “A cooperative organization participated in by the Bureaus of Agricultural Chemistry and Engineering and Plant Industry of the U.S. Department of Agriculture, and the Agricultural Experiment Stations of the North Central States of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.”


• Summary: Undenatured soybean protein gives high adhesive values when dispersed with sodium hydroxide but low adhesive values when dispersed in alkaline salts. The dithionite salts are the best agents so far discovered for bleaching soybean protein. Coated paper, prepared in the laboratory, shows that undenatured soybean protein has a higher adhesive strength and a lighter color than a good grade of commercial casein. Address: U.S. Regional Soybean Industrial Products Lab.


• Summary: “The chemical research division, one of two departments of the Regional Soybean Industrial Products Laboratory at Urbana, Illinois, is being moved to the new Northern Research Laboratory at Peoria, Illinois, it has been definitely decided.

“Action for the removal from the University of Illinois has been approved by Congress and funds have been granted to make an immediate change.

“The breeding and culture division, representing the agronomic phase of the U.S.D.A. experiments, is to remain of its present location with its field of work greatly expanded. “Splitting the two divisions of the Laboratory follows the recommendations of Dr. Orville E. May, recently named research coordinator of the staff of the Agricultural Research Administrator and who organized the Laboratory set up on the University campus and served as its director from 1936 to 1938.

“‘The program devoted to breeding and analytical work on soybeans to be done here is going to be much better than in the past,’ says Professor W.L. Burlison, head of the University department of agronomy. ‘We think a fine laboratory will be worked out here. This all will be under the bureau of plant industry.

“‘The work to be moved to Peoria will be devoted to the study of utilization of the oil, with all aspects of the chemical phases considered.’”


• Summary: “The industrial significance of a study of the denaturation of soybean protein lies in the fact that denaturation is a factor to be considered in every commercial process to which the bean is subjected. It is of paramount importance in any process involving the preparation of a water-soluble soybean protein, and this importance is maintained in the possibility of preparing a chemically untreated yet insoluble soybean protein.” Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


• Summary: The President of the United States signed the 1942 agricultural appropriations bill on July 23, transferring a part of the U.S. Regional Soybean Industrial Products Laboratory from Urbana, Illinois, to the Northern Regional Research Laboratory at Peoria.

“This transfer brings the full chemical and engineering research staff of the Soybean Laboratory to the Northern Regional Research Laboratory where it will work in one of
the most modern chemical laboratories and where it will have facilities for pilot-plant experiments, mechanical shops, and glassblower at its disposal. The chemical analytical work connected with the agronomic phases in the development of improved strains and varieties of soybeans remains in Urbana where it will continue its comprehensive program under the Bureau of Plant Industry.

“The chemical research program of the Soybean Laboratory prior to its transfer to Peoria consisted of investigations on methods for purifying and characterizing soybean proteins; development work on the use of soybeans in plastics, adhesives, coatings, and fibers; work on methods for improving the stability of edible soybean oil; and research on refining and chemically modifying soybean oil and its derivatives as a means of increasing its industrial utilization. This chemical research was supplemented by related engineering investigations on expeller and extraction processing the beans and selective-solvent extraction techniques for fractionating the oil as well as on the physical conditions that influence the efficiency of the various processes involved in producing and modifying soybean products.

“To Include Soybeans: The program of the Oil and Protein Division of the Northern Regional Research Laboratory up to the present time has covered research on the isomerization, polymerization, and sulfurization of corn and wheat oils and their derivatives, and industrial application of such investigations to the production of rubber-like materials, drying oils, resins, and plastics from these oils. As the result of the recent Congressional Act, merging part of the Soybean Laboratory with the Northern Regional Research Laboratory, thus making soybeans a research commodity of the latter, the oil and protein program of the Peoria laboratory, previously limited to corn and wheat oils and corn proteins, is now being expanded to include the oil and proteins of soybeans and their derivatives. Since the Northern Regional Research Laboratory already has a group of ten chemists engaged in fundamental research on the chemistry of corn and wheat oils and corn protein, and since the chemistry of these materials is closely related to that of soybean oil and protein, the transfer of the Soybean work to Peoria will lead to greater concentration of research on the soybean research program of the Department of Agriculture.

“Rubber Substitute: The potentialities of chemical
research on such farm commodities as corn and soybeans are well illustrated by the Northern Regional Research Laboratory’s recent development of a rubber-like material which has tentatively been given the name ‘Norepol.’ This material, an elastic vulcanizable polymer originally made from corn oil was described in the July, 1942 issue of ‘The Soybean Digest.’ This work was started as a study of organic chemical functionality in corn oil and its derivatives in relation to the strength and elasticity of the commercial sulfurized corn oil rubber extenders or ‘factices.’ However, as the work progressed, it led further and further away from the factice type of rubber extenders and closer to a product having the properties of rubber. As the work continued, it became evident that the new material might have sufficient strength and elasticity to be used as a rubber substitute for special purposes in our war program. It likewise became evident that some other oil, as well as corn oil, would have to be used as the organic raw material. Fortunately the chemical constitutions of soybean and corn oils are strikingly similar, so cooperative work between the Northern Regional Research Laboratory and the U.S. Regional Soybean Industrial Products Laboratory was begun several months ago. As the result of this work the new elastic, vulcanizable polymer, Norepol, is now being successfully produced on a pilot-plant scale from soybean oil. If the industrial tests now in progress are successful, this bit of ‘theoretical’ research may have a far reaching effect.

“This single example is typical of the results that may come from any well-planned research program. It is illustrative of the kind of dividends which the Soybean Laboratory at Urbana and the Northern Regional Research Laboratory at Peoria have already paid in other fields, and is indicative of the kind of results we may expect from the soybean program in its new home in Peoria.”

“Editor’s note: The Northern Regional Research Laboratory is one of four regional laboratories authorized by Congress in the Agricultural Adjustment Act of 1938 for the purpose of conducting research to develop new uses and outlets for agricultural commodities. These laboratories are administered by the Bureau of Agricultural Chemistry and Engineering of the U.S. Department of Agriculture.

Photos show: (1) Horace T. Herrick, Director. (2) External view of the Northern Regional Research Laboratory at Peoria.

Note: This is the earliest document seen (Dec. 2016) that mentions the word “Norepol.” Address: Director, Northern Regional Research Lab. (NRRL), Peoria, Illinois.

• Summary: Subtitle: Meet a vegetable that’s just learning its own strength. A gold mine for scientists, a boon to health, and a bonanza for homemakers. An overview of the many new ways that soybeans are used in America, with emphasis on industrial uses as for artificial wool, plastics, and enamel. Discusses the work of Henry Ford and the “U.S. Regional Soybean Laboratory.” “Then the young science of farm chemurgy and the new science of nutrition began to focus a searchlight on its [the soybean’s] chemical make-up and the sacred grain of China has turned out to be a powerhouse of energy.” Soybean protein is so much like that of meat that “it is difficult for chemists to distinguish between the two. Our army is using soy flour and some ninety mills are turning out soy flour and grits of fine quality for army use; but as yet it is not widely available in the United States.

“Nutrition is a fighting word today. To those who will profit by it, the new nutrition ‘definitely promises greater vigor, longer life, keener minds and a higher level of cultural attainment.’”

Surprisingly, “soy flour improves candies, such as hard candy, fudge, nut candies and caramels. The lecithin emulsifies the fats and prevents drying out.”

American has developed a “soybean belt” and we grow one-third of the world’s supply.

“The gold rush that’s under way in the laboratories has been led by a canny old prospector named Henry Ford. With the sort of old-fashioned inventiveness that is our special genius he has been thinking for years that we some day would grow automobiles from the soil... Now Ford’s great processing plant at River Rouge takes in soybeans and turn out window frames, steering wheels, gear-shift knobs, distributors and a great variety of automobile parts.”

• Summary: Mainly about soybean seed.

• Summary: This book is a report on agricultural research for the year ending June 30, 1902.

“From less than 5,000 acres to over 2½ million in 20 years; that is the way soybean production has expanded in Iowa. A crop and a record that seem to deserve special mention.”

“Plantings with soybeans at the Iowa Station, however, go farther back than 1910. Charles D. Reed, meteorologist with the United States Weather Bureau at Des Moines, had soybean plantings under observation when he was in charge of the field experiments at the Iowa Station as early as 1898.

“That the work with soybeans at the Iowa Station has been extensive and continuous through a period of years is evidenced by the publications of the Station. In Station Circular 65 ‘Soybeans in Iowa,’ 1920, the opening paragraph states: ‘The Iowa Agricultural Experiment Station has grown a number of different varieties of soybeans each year since 1910.’”

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“The first soybean processing plant to be established in Iowa was the Standard Soybean Mills at Centerville, Iowa, in 1929... Iowa now has 10 such mills. The smallest has an estimated annual capacity of 200,000 bushels and the largest approximately 2½ million.”

Page 386: “The soybean program at the Iowa Station was greatly strengthened and expanded under the leadership of Dr. Martin Weiss, beginning in 1938, at which time 17 variety crosses were made, with a considerable number of very promising lines resulting. “It was not until 1922 that the soybean crop of the state was considered sufficiently important to justify the gathering of statistics on acreage. The acreage of beans grown alone in that year was reported to be 4,686; 3 years later this had jumped to 20,000 and in another 3 years to 44,000.”

A bibliography of publications on soybeans by Iowa State College (from 1920 to 1942) is given.


• Summary: Contents: Processing soybeans: 1. Development of the soybean processing industry. 2. Grading and storage. 3. Methods of processing soybeans. 4. Processing by means of continuous presses: The Anderson expeller, the French screw press, operation of continuous presses. 5. Processing by means of continuous solvent extractors: The Hildebrandt system, the Bollmann system (or Hansa-Muehle extractor), extraction system of the French Oil Mill Machinery Company, the Allis-Chalmers extractor, the Ford extraction system, other solvent systems, solvents, hot alcohol extraction process, extractor design data. 6. Hydraulic pressing (incl. wedge press). 7. Miscellaneous processing methods. 8 Soy flour. 9. Cost of processing soybeans.


Phosphatides (p. 35): “With the development of solvent extraction methods in Germany for the production of soybean oil, the industry was confronted with the problem of disposing of the sludge which separated from the oil when it was clarified by settling or other means. This sludge or foots comprised an emulsion of phosphatides, phytins, bitter principles (glucosides), sterols, mucilaginous substances, finely divided meal, water, and oil. Relatively large volumes of this sludge or foots accumulated at the oil mills. This disagreeable, malodor mass soon underwent decomposition with the formation of even more disagreeable odors, and its disposition became a serious problem to the industry.

“Two groups of patents each covering different processes for the recovery of phosphatides and oil from these sludges or foots were granted about the same time to the firm of J. D. Riedel Akt.-Ges. and to the Hanseatische Mühlhenwerke Akt.-Ges., respectively.” Address: Urbana, Illinois. U.S. Regional Soybean Industrial Products Lab.


• Summary: Contains a superb bibliography.

“Since about 1900 many patents have been granted, especially in Germany, covering the recovery and purification of phosphatides from various plant materials, and particularly from oilseeds and oil bearing materials. The raw materials have comprised wheat, corn, rye, and barley germ (207), and lupins (49), peas (99), soybeans, and other legumes. Ethyl and methyl alcohol were principally employed as solvents, and acetone and salt solutions as purification agents.

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The process covered by the patents of the J.D. Riedel Akt.-Ges. (153, 154, 155, 156), was based primarily on the use of organic solvents for the extraction and purification of the phosphatides contained in the byproduct sludges produced during the refining of soybean oil. It consisted of a series of steps wherein dehydoration of the sludge in
a vacuum at 40° to 50°C. was followed by extraction and separation of the phosphatides and oil by means of methyl alcohol and acetone. A variation of the method comprised the following successive steps: extraction of the sludge with alcohol to remove the water, oil, and phosphatides; separation of the solvent and water by distillation of the extract; and removal of the oil and bitter principles from the phosphatide residue by washing it with acetone. In this method the alcohol-insoluble phosphatides still remained in the residual sludge. In order to recover the alcohol-insoluble phosphatides, the sludge was re-extracted with benzene and the benzene extract treated with alcohol to precipitate the dissolved phosphatides.

"The process never attained permanent industrial importance because of the development at about the same time of another process which was simpler, more efficient, and cheaper of operation. This second process which was known as the 'Bollmann Process' (32) soon assumed dominant importance in the industry and remains so at the present time. It obviates the use of solvents. The principal steps of the operation comprise removal of the solvent by distillation of the miscella, heating the residual oil and treating it, with wet steam at 103°C. After about 15 minutes the phosphatides begin to separate as a flocculent mass containing oil and associated impurities.

"The production and purification of soybean phosphatides has undergone various modifications and improvements since the process was first disclosed in the patent and scientific literature. In the original process the solvent mixture used for extracting the oil consisted of alcohol and benzene (31), although the use of other solvents was claimed. Subsequent steps in the purification of the recovered phosphatides were described in later patents (33, 35, 36, 151).

"Because of the constant improvements which were introduced in the industrial processing of phosphatides, and the consequent flow of patents pertaining thereto, the descriptions of the process which are found in the technical literature vary somewhat in detail, and are not always in accord with the practice actually followed at the time they were written.

"Grün (167), for example, described the process as operated about 1935 at the plant of the Hanseatische Mühlenwerke Akt.-Ges. in Hamburg somewhat as follows:

"Soybeans are extracted in a Bollmann extractor with benzene, petroleum ether, or a mixture of the two, to which a little or as much as 30 percent of alcohol has been added. The solvent is removed from the miscella by distillation and the last traces removed by steaming. Additional water, usually in the form of steam, is admitted to the oil until precipitation of the phosphatides is complete, after which they are separated from the oil by centrifuging. The separated phosphatides are transferred to distillation apparatus, with the possible addition of more water, and the water and odorous impurities removed by distillation under vacuum at about 60°C. The distillation is continued until the residual phosphatides are freed from odor and flavor (34). The product thus obtained contains 60 to 65 percent of phosphatides. It is a brownish yellow product of good odor and flavor. The Hansa-Mühle plant in Hamburg is said to have a daily capacity for the production of phosphatides from 1000 metric tons (35,000 to 40,000 bushels) of soybeans.

"A somewhat similar description of the production of phosphatides is given by Horvath (108).

"Eichberg (63) gives a description of the process for the production of phosphatides which is more nearly in accord with present practices both in the United States and abroad. According to Eichberg and the patents cited by him the process followed at present (1939) is as follows:

"A single petroleum hydrocarbon solvent is used in the extraction of the oil from soybeans which contain 1.5 to 3.0 phosphatides. The use of the single solvent does not remove all of the phosphatides from the beans, since the meal is found to contain about 1.0 percent of residual phosphatides. However, the use of a single solvent yields a product which is relatively free of carbohydrates and entirely free of bitter substances, the presence of which, according to Sorensen and Bean (182), results from the use of alcohol in the extraction process.

"The oil containing the dissolved phosphatides is agitated with water at about 75 to 80°C, in order to flocculate the phosphatide emulsion, which operation requires about three quarters of an hour. The flocculent emulsion is separated from the oil by centrifuging and the separated phosphatides, which actually consist of an emulsion of phosphatides, oil, and water, are subjected to vacuum distillation to remove the water and volatile odor and flavor constituents (35). Simultaneously, they may be bleached with hydrogen peroxide (36), or preferably dibenzoyl peroxide (90), when it is desired to produce a light colored product for certain special uses. The product thus obtained, which consists of a mixture of about 60 to 65 percent phosphatides and 35 to 40 percent soybean oil, is used without further treatment in a variety of products.

"However, for use in certain products, and especially for use in the pharmaceutical and chocolate coating industry, further treatment is necessary. This treatment usually consists simply of removing the soybean oil, or of removing the soybean oil and replacing it with another fat or oil. In order to accomplish this operation, the bleached and dried phosphatide-oil mixture is agitated with acetone, in which the oil is soluble. The supernatant liquid consisting of a solution of oil in the acetone is drawn off from the undissolved phosphatides and the acetone recovered by distillation (89). The acetone-treated phosphatides are again treated under vacuum to remove the last traces of acetone and the oil-free product marketed for use in the pharmaceutical industry, or further treated for use in the
chocolate coating industry. For the latter use the product remaining after the removal of the bulk of the solvent, but prior to its complete removal by heating under vacuum (151), is mixed with another oil, such as refined peanut oil, coconut oil, cocoa butter, or hydrogenated oils. The mixture of phosphatides and added oil is then subjected to vacuum and heat to remove the last traces of solvent. The finished product finds wide use in the preparation of chocolate coatings. The total production and consumption of soybean phosphatides in the United States end abroad is unknown but a conservative estimate would be in the vicinity of ten thousand tons annually.

“Various other processes have been proposed for the production and purification of phosphatides but most of them have not found any appreciable industrial application. Among these other processes may be mentioned the cold solvent extraction proposed by Rewald (150), which has for its object not only the recovery of undenatured phosphatides but also the production of soybean meal with a minimum of denaturation of the proteins. Gensecke (78) proposed the use of acidified saline solutions for removing the phosphatides from the oil. Kelin and Tauboeck (117) proposed the use of silica gels and similar oxidic sols to recover phosphatides from the solvent used to extract the dehydrated crude phosphatides. Gehrke (77) proposed the use of dehydration by means of glycerine instead of vacuum distillation for the separation of water from the crude phosphatides. The process of dehydration with glycine or concentrated aqueous sugar solutions has been patented by the firm of Noblee and Thörl (137, 138, 139). Schwieger (173) proposed a method for purifying crude soybean phosphatides which comprises extracting the sludge with a solvent to remove the oil, treating the residue containing some residual solvent with water, evaporating the water and residual solvent, and incorporating another carrier such as a carbohydrate in an aqueous, solution. Other processes pertaining to the separation of soybean oil phosphatides have been patented by Ginn (82), Kraybill (122), Thurman (187, 188, 189), Beck and Klein (22), and others. None of them are used commercially.” Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


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Two graphs (p. 4) show the extraction of nitrogen from oil-free soybean meal. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


• Summary: “The large quantities of soybean meal left from the solvent extraction of oil from soybeans may be considered as a practically unlimited raw material for the production of soybean protein. If 10 percent of the 1941 crop of soybeans, estimated at 107 million bushels, were processed for protein, we would have approximately a quarter of a billion pounds of this product. It is thus evident that raw material supplies are more than adequate for all visible needs.

“Soybean protein is a relatively new commodity on our markets, and in order to find a permanent place among other competing industrial proteins, synthetic adhesives, and plastics, it must meet competition in regard to both quality and cost. It is not possible at this early stage of development...
to present trustworthy data relative to the cost of refining soybean protein. As regards cost of materials, however, the situation is very promising. If we take the value of solvent-extracted, oil-free meal in normal times at 1½ cents per pound and the protein content as 44 percent, we have an initial cost of unrefined protein of about 3.4 cents per pound, ascribing no value to the nonprotein fraction of the meal. On this basis a liberal allowance can be made for processing costs and still there will remain a satisfactory price range to compete with other proteins which normally sell for 12 to 16 cents per pound.

“The U.S. Regional Soybean Industrial Product Laboratory has made an extensive laboratory investigation of methods for separating the protein from the meal and is continuing these studies along with research on chemical and physical properties of the protein. The results obtained show that the separation of the unmodified protein on a small scale by extraction of the meal with water or dilute alkali and subsequent precipitation with acid is not difficult. Extraction data for acids, bases, and salts are illustrated in Figures 1 and 2. On the other hand, the engineering problems such as clarification, filtration, centrifugation, drying, and grinding which are encountered at various stages of large-scale production, are not well understood and might offer considerable difficulty to anyone undertaking commercial production.

“There is also the problem of modifying the properties of soybean protein by chemical treatment to make it suitable for specific uses. This problem deserves a great deal of scientific investigation, and its solution will be the principal means of extending the industrial utilization of soybean protein and probably other proteins as well.

“Soybean protein is comparatively new in the field of industrial proteins, which include casein, gelatin, blood albumin, egg white, fish glue, and zein. These proteins have various physical and chemical characteristics in common, yet each one possesses an individuality which leads to some specific use. Proteins have the most complicated molecular structures of any substances with which the chemist works, and for this reason truly chemical exploitation will be slow.

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“Soybean protein resembles casein more closely than any other protein, and in the early attempts to introduce it to industry it was called ‘soybean casein’ with the object of trading on the good name of an already established product. In the long run, however, soybean protein must find its place in industry or its own merits, and any attempt to confuse it with casein or other protein cannot be considered a sound policy.

“While the isolation of soybean protein on a small scale is a relatively simple matter for a chemist, it should be pointed out that its production on a large scale and its utilization by industry require considerable technical skill and will result in disappointment to those attempting commercial processing without a careful study of the problems involved. Furthermore, when soybean protein is recommended for certain uses, one should not expect that it can be substituted in formulas established for other proteins with the same results, but rather that specific or modified formulas will be required. It should be considered as a technical product and sold accordingly.

“As intimated above, soybean protein may be modified during the refining process so as to alter its solubility or dispersing characteristics, its adhesive strength, viscosity, color, and tolerance for formaldehyde. The simplest modifications are effected by a mild hydrolytic treatment with dilute alkali or by the action of proteolytic enzymes. These treatments alter several of the properties of soybean protein; for example, they make it more easily dispersible. Research is in progress on the substitution of organic groups in the protein molecule, because, an appreciable change in physical and chemical properties may be expected from this type of chemical alteration.

“Indications are that soybean protein will find substantial use in paper coatings, paper sizing, water paints, plastics for buttons and buckles, leather dressings, and adhesives for various purposes, such as making furniture and abrasive paper. Research is in progress toward the production of a wool-like fiber from soybean protein. Such a project, if successful, might consume a considerable tonnage of the protein.

“The largest use of soybean protein in immediate prospect is for paper coating. Up to the present time soybean protein has not been completely acceptable for all grades of paper coatings, largely because it is slightly darker in color than casein. Recent work at the Soybean Laboratory indicates that a satisfactory bleach for soybean protein may have been found in sodium dithionite (Na2S2O4) or zinc dithionite (ZnS2O4). It has been shown in the laboratory that 4 or 5 percent of one of these powerful reducing agents on the basis of the protein, added at the time of preparing the coating color results in a paper coating as bright in color as that prepared with a good grade of casein. This bleaching development is still to be proved satisfactory in plant production and printing tests, but the simplicity of operation
favors its success. Since the beginning of the war emergency, much of the normal casein supply has been diverted to dry milk production, and we have an increasing shortage of milk casein. Commercial soybean protein which has been developed to the stage where it may satisfactorily take the place of casein in the paper trade can help to fill in this shortage. Perhaps more important in the present emergency than paper coating, however, is that portion of the plywood industry which depends upon casein as an adhesive and which consumes an estimated 200 tons of casein per month. An increased production of soybean protein would help to relieve the general industrial protein demand and aid in this essential war need.

“It is impossible to predict at this early stage of research and development what the future may be for soybean protein as an industrial product, but with all things considered it has many promising possibilities.”


222. Science News Letter. 1943. Soybeans used in production of laminated board. 34:57. Jan. 23. • Summary: Summarizes an article by Dr. George H. Brother of the U.S. Regional Soybean Industrial Products Laboratory, published in Chemical and Engineering News. The new method for making the laminated board is valuable in aircraft and other war industries. “Sheets of unsized kraft paper or other fibrous material are soaked with a solution of soybean protein. After drying, stacks of these plastic sheets are united into laminated board by heat and pressure. This method promises to augment the nation’s limited supply of high-priority phenolic resin now being used.”


“1 Macoupin
“2 Boone
“3 S100
“4 Arksoy 2913
“5 Arksoy
“6 Ralsey
“7 Ogden
“8 Volstate
“9 Tennessee Non-Pop
“10 Tokyo
“11 Arkan
“12 89775-A
“13 86974
“14 97066
“15 84642
“16 Rokusun 25A
“17 Edsoy
“18 Magnolia
“19 Monetta
“20 Auburn #2
“21 Wood’s Yellow
“22 Georgia 731
“23 Georgia 723
“24 Mamredo
“25 Mammoth Yellow
“Row–Series II
“26 Magnolia
“27 Georgia 731
“28 Wood’s Yellow
“29 Mammoth Yellow
“30 Auburn #2
“31 Edsoy
“32 Rokusun 25A
“33 Monetta
“34 Georgia 723
“35 Mamredo
“36 S100
“37 84642
“38 Ogden
Summary: “The reorganization of the Bankhead-Jones Regional Soybean Laboratory has raised a question as to the status of the advisory group of collaborators. Formerly the advisory collaborators from the experiment stations represented their respective institutions in both the chemical and agronomic fields of investigation at the Urbana conferences. The Northern Regional Research Laboratory at Peoria has now arranged for its collaborators to cover chemical investigations.

“In view of the changes in the program of the Urbana laboratory, it seems desirable to suggest that the director of each cooperating experiment station in the North Central Region either reaffirm his present appointee or designate a new advisory collaborator for the Regional Soybean Laboratory at Urbana...”

“The technical personnel held their annual planning conference at Urbana in February and completed arrangements for agronomic studies in 1943. It has been suggested that in view of the ‘emergency’ limitations on personnel and transportation, the advisory collaborators conference be dispensed with this year. The Northern Regional Research Laboratory has scheduled its annual conference at Peoria for April 28 and 29. Representatives from the Regional Soybean Laboratory have been asked to be present. A report on activities of the Regional Soybean Laboratory will be made at that time.”

Address: Instructor in Field Crops, Missouri College of Agriculture, Columbia, Missouri.


Summary: This revised edition is very similar to the first edition published in April 1942. Minor changes have been made on the following pages: 20, 28, 70-73, 84-85, 90-94, 121-22. None of the statistics in the many tables have been updated, and the bibliography is unchanged. Address: USA.


• Summary: “Row Series I
  “1 Boone
  “2 Chief
  “3 Gibson
  “4 Macoupin
  “5 Patoka
  “6 C2

  “7 S32-11
  “8 S49-18
  “9 S100
  “Row Series II
  “10 Chief
  “11 Patoka
  “12 S49-18
  “13 Gibson
  “14 C2
  “15 S100
  “16 Boone
  “17 Macoupin
  “18 S32-11
  “Row Series III
  “19 C2
  “20 S49-18
  “21 Macoupin
  “22 Chief
  “23 S100
  “24 Boone
  “25 S32-11
  “26 Patoka
  “27 Gibson
  “Row Series IV
  “28 Boone
  “29 Gibson
  “30 Macoupin
  “31 Chief
  “32 S32-11
  “33 C2
  “34 S100
  “35 Patoka


• Summary: “The following early hybrid material is available at the U.S. Regional Soybean Laboratory. In the case of F3 material 5 pounds or more of each cross is available. F2 seed is available in much smaller quantities and in most crosses not more than 400 seeds will be available to any one location. However, do not hesitate to ask for more than 400 seeds if you want them since certain crosses are available in much larger quantities.

  “Cross Pedigree
  “LX 715 Richland x Habaro
  “LX 716 Richland x Soysota
  “LX 717 Richland x Ogema
  “LX 718 Richland x Minsoy
  “LX 719 Seneca x Yellow Agate
  “LX 720 Seneca x Minsoy

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“LX 721 Seneca x Mandarin
“LX 722 Habaro x Mandarin
“LX 724 Habaro x Ogema
“LX 725 Habaro x Yellow Agate
“LX 726 Habaro x Minsoy
“LX 727 Mandarin x Yellow Agate
“LX 728 Mandarin x Minsoy
“LX 729 Minsoy x Yellow Agate
“LX 730 Soysota x Minsoy
“LX 732 Soysota x Mandarin
“LX 733 Ogema x Yellow Agate
“LX 734 Ogema x Minsoy
“LX 735 Ogema x Seneca

The following are crosses between early and medium maturing varieties.

“LX 723 Habaro x Mukden
“LX 726 Habaro x Minsoy
“LX 727 Mandarin x Yellow Agate
“LX 728 Mandarin x Minsoy
“LX 729 Minsoy x Yellow Agate
“LX 730 Soysota x Minsoy
“LX 732 Soysota x Mandarin
“LX 733 Ogema x Yellow Agate
“LX 734 Ogema x Minsoy
“LX 735 Ogema x Seneca

In addition the following early and medium early F3 populations from the 1942 list are available.

“LX 605 Illini x Richland
“LX 611 Dunfield x Hudson Manchu
“LX 628 Seneca x Hudson Manchu
“LX 637 Seneca x Richland
“LX 619 Mukden x Richland
“LX 631 Seneca x Dunfield
“LX 651 Richland x Dunfield

“Early F2 hybrids available, 1943

“Cross Pedigree

“LX 873 Sioux x Goldsoy
“LX 874 Yellow Agate x Goldsoy
“LX 875 Yellow Agate x Sioux
“LX 876 Quebec 92 x Yellow Agate

The following F2’s are crosses between medium and medium early or early varieties.

“LX 877 Quebec 92 x Yellow Agate
“LX 878 Quebec 92 x Goldsoy
“LT 879 Quebec 92 x Sioux
“LX 882 Goldsoy x Yellow Agate
“LX 884 Goldsoy x Sioux
“LX 886 Kabott x Yellow Agate
“LX 887 Kabott x Goldsoy
“LX 888 Kabott x Pagoda
“LX 889 Kabott x Quebec 92
“LX 890 Kabott x Sioux
“LX P94 Pagoda x Yellow Agate
“LX 895 Pagoda x Goldsoy
“LX 896 Pagoda x Quebec 92

“LX 899 Ogema x Quebec 91
“LX 900 Minsoy x Yellow Agate
“LX 901 Minsoy x Goldsoy
“LX 902 Minsoy x Quebec 92
“LX 903 Minsoy x Sioux
“LX 883 Goldsoy x Chief

“LX 906 Cayuga x Goldsoy
“LX 907 Cayuga x Kabott
“LX 908 Cayuga x Sioux
“LX 911 Mandarin x Goldsoy
“LX 912 Mandarin x Kabott
“LX 913 Mandarin x Pagoda
“LX 914 Mandarin x Quebec 92
“LX 918 Habaro x Goldsoy
“LX 919 Habaro x Pagoda
“LX 920 Habaro x Quebec 92
“LX 921 Seneca x Goldsoy
“LX 922 Seneca x Kabott
“LX 923 Seneca x Pagoda
“LX 924 Seneca x Quebec 92
“LX 925 Richland x Goldsoy
“LX 891 Richland x Kabott
“LX 927 Richland x Pagoda
“LX 928 Richland x Quebec 92
“LX 929 Richland x Sioux
“LX 915 Mandarin x Sioux

“LX 905 Minsoy x L6-12
“LX 907 Cayuga x L6-12
“LX 908 Cayuga x L6-12
“LX 909 Minsoy x L6-12
“LX 910 Cayuga x L6-12
“LX 917 Mandarin x L6-12
“LX 930 Mukden x Cayuga
“LX 931 Mukden x Goldsoy
“LX 932 Mukden x Kabott
“LX 933 Mukden x pagoda
“LX 934 Mukden x Quebec 92
“LX 935 Lincoln (L6-685) x Pagoda
“LX 936 Lincoln (L6-685) x Quebec 92
“LX 937 Lincoln (L6-685) x Richland
“LX P00 Quebec 92 x Chief

*Summary:* Lists soybean varieties tested in Groups I to VI.

- Group IV: Boone, Chief, Gibson, Macoupin, Patoka, C2, S32-11, S49-18, S100.


*Summary:* “I have your inquiry of March 30... W.L. Burlison has been the official collaborator from the University of Illinois. He is head of the Department of Agronomy and because of his agronomic interests qualifies as an advisory collaborator to the laboratory in its agronomic functions. I am therefore suggesting that he continue to represent the University in this capacity.”


*Summary:* Row Series I

- “1 Chief
- “2 Dunfield
- “3 Illini
- “4 Lincoln
- “5 Patoka
- “6 Scioto
- “7 Viking
- “8 A18-231
- “9 A31-291
- “10 C56
- “11 C60
- “12 C66
- “13 C72
- “14 C64
- “15 C91
- “16 C101
- “17 H6
- “18 H9
- “19 L4-12
- “20 L4-42
- “21 L4-45
- “22 L7-1111
- “23 L7-1280
- “24 S32-3
- “Row Series II “25 S32-6
- “26 H9
- “27 L7-1111
- “28 L4-45
- “29 S32-8
- “30 L4-42
- “31 H6
- “32 C101
- “33 L4-12
- “34 L7-1280
- “35 S32-3
- “36 Illini
- “37 C91
- “38 Viking
- “39 Patoka
- “40 C72
- “41 C66
- “42 A31-291
- “43 C60
- “44 C84
- “45 Scioto
- “46 Lincoln
- “47 Chief
- “48 Dunfield
- “49 C56
- “50 A18-231
- “Row Series III
“51 Chief
“52 A1-291
“53 C101
“54 L7-1111
“55 C72
“56 S32-8
“57 A18-231
“58 C60
“59 Patoka
“60 L4-12
“61 C101
“62 Viking
“63 A31-291
“64 Chief
“65 S32-3
“66 C66
“67 H9
“68 C91
“69 S32-8
“70 A18-231
“71 C72
“72 L4-42
“73 L4-45
“74 C56
“75 Scioto
“Row Series IV
“76 C84
“77 H6
“78 Dunfield
“79 Viking
“80 L4-45
“81 S32-3
“82 Illini
“83 C56
“84 C66
“85 H9
“86 Scioto
“87 Lincoln
“88 C91
“89 L4-42
“90 L7-1260
“91 Dunfield
“92 Illini
“93 L7-1280
“94 L4-12
“95 C84
“96 L7-1111
“97 C60
“98 H6
“99 Patoka


• Summary: “Row Series I

“1 Earlyana
“2 Goldsoy
“3 Habaro
“4 Kabott
“5 Wisconsin Mandarin 3
“6 Wisconsin Mandarin 3 Selection
“7 Wisconsin Mandarin 606
“8 Wisconsin Mandarin 839-14
“9 Mandarin 831
“10 Mandarin
“11 Dimmock Mandarin
“12 McRostie Mandarin
“13 Wisconsin Mandarin 507
“14 Minsoy
“15 O.A.C. 211
“16 Ontario
“17 Pagoda
“18 Richland
“19 H1
“20 H2
“21 H3
“22 H4
“23 H5
“24 P.I. 68666
“25 P.I. 92470
“Row Series II
“26 Richland
“27 H4
“28 H3
“29 P.I. 92470
“30 H2
“31 Pagoda
“32 Ontario
“33 H1
“34 H5
“35 P.I. 68666
“36 Habaro
“37 O.A.C. 211
“38 Wisconsin Mandarin 606
“39 Wisconsin Mandarin 3
“40 Wisconsin Mandarin 507
“41 McRostie Mandarin
“42 Mandarin 831
“43 Dimmock Mandarin
“44 Minsoy
“45 Wisconsin Mandarin 3 Selection
“46 Kabott
“47 Earlyana
“48 Goldsoy
“49 Mandarin

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HISTORY OF U.S. REGIONAL SOYBEAN LABORATORY (1936-2017)


• **Summary:** “Row Series I

  1 Dunfield
  2 Earlyana
  3 Illini
  4 Lincoln
  5 Wisconsin Mandarin 3 Selection
  6 Wisconsin Mandarin 606
  7 Mingo
  8 Mukden
  9 Mukden 4
  10 Richland
  11 A41-251
  12 A45-251
  13 H8
  14 P.I. 91109
  15 P.I. 92592
  16 P.I. 92717
  17 Row Series II
  18 Wisconsin Mandarin 3 Selection
  19 Mingo
  20 P.I. 92592
  21 Dunfield
  22 Wisconsin Mandarin 3 Sel.
  23 Mukden 4
  24 H8
  25 Lincoln
  26 Mukden
  27 A45-251
  28 P.I. 92717
  29 Earlyana
  30 Wisconsin Mandarin 606
  31 Richland
  32 P.I. 91109
  33 Wisconsin Mandarin 606
  34 Richland
  35 H8
  36 Illini
  37 A41-251
  38 P.I. 92592
  39 Earlyana
  40 Mukden
  41 P.I. 92717
  42 Mukden 4
  43 Mingo
  44 Lincoln
  45 Dunfield
  46 Wisconsin Mandarin 3 Selection

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of the U.S. Regional Soybean Industrial Products Laboratory,

[54x77]of the fact that varieties of soybeans have been found to

vary in all of the major chemical constituents studied thus far. It seemed probable that such a study of equilibrium moisture content would also determine whether the routine moisture determination could be eliminated from the analytical program without introducing an appreciable error in calculating results to a uniform moisture basis. Such an elimination would result in a considerable saving in time and expense.” Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.

  • Summary: It is well known that the amount of water present in seeds at the time of extraction has a definite effect on the amount and composition of the extract obtained from oil-seed materials by solvent extraction. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.

  • Summary: Summarizes an article by Dr. George H. Brother of the U.S. Regional Soybean Industrial Products Laboratory, published in Chemical and Engineering News, concerning new developments in the field of soybean plastics which promise to augment the nation’s limited supply of phenolic resins.

  • Summary: “Striking differences in chlorosis typical of iron deficiency were noted in 1938 among a considerable number of soybean varieties when tested on calcareous soils for the first time since their introduction into the United States from Manchuria.” The author determined that susceptibility of soybean PI-54619-5-1 to chlorosis was determined by a single major gene. Address: Div. of Forage Crops and Diseases, Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Research Administration, USDA, and Iowa State College, Ames, Iowa.

  • Summary: “The history of soybeans in the South has been very brief. Soybeans were first grown for hay and forage purposes approximately twenty years ago in a very small way in the Mississippi Valley...”
  “When the small harvester-threshers, commonly called combines, were introduced for the harvesting of soybeans, the acreage increased by leaps and bounds. At that time, (1933) the cotton reduction program was staged by the Triple A. This took out of production 13½ million acres of cotton land in the South and Southwest. Therefore, soybeans really made the first big increase in acreage a decade ago.
  “However, the big impetus to soybean growing in the South was given when all supplies of vegetable oils and high protein meals were shut off from the Orient and Southwest Pacific. Japanese aggression resulted in freighters being put to uses other than bringing these products to the Pacific coast.
  “The writer has been growing and selecting adapted varieties and distributing soybeans as a seedsman in the South for the past eighteen years” [i.e. since 1926].
  “Had Southern farmers and seedsmen insisted on their colleges of agriculture and experiment stations doing half as much work in the propagation of new varieties as has been done in Illinois, Indiana and Ohio, our soybean program for the South would be much further advanced than it is today.”
  “World War II has stopped the flow of vegetable oils and meal from the Orient and South America to our West Coast. The War Production Board, acting last year through the A.A.A., encouraged Southern farmers to triple their soybean acreage by pegging the price at $1.60 per bushel. This resulted in the South’s largest production.”

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Soybean Research Laboratory has directed a program in the twelve northcentral soybean growing states. Unfortunately, their funds were not sufficient to permit work in the South. However, funds have been made available since January 1 through the Bankhead-Jones Act to enable this laboratory, working under the direction of the United States Department of Agriculture Bureau of Plant Industry to carry on the same type program in twelve southern states including Oklahoma and Texas. This work is being done with the cooperation of the colleges of agriculture and experiment stations in those states.”

“Mr. Jacob Hartz is a member of the Chemurgic Council, and is recognized as one of the leading authorities on soybean growing, being Southern Director of the American Soybean Association. He is owner of the Jacob Hartz Seed Company at Stuttgart, Arkansas, and is a member of the Arkansas State Plant Board, representing the Arkansas Seed Growers’ Association. He has been active in various seedsmen’s groups including the Southern Seedsmen’s Association.” Note: This article was adapted from one in Southern Seedsmen. Address: Owner, Jacob Hartz Seed Co., Stuttgart, Arkansas.


• Summary: Introduction: “Molecular distillation has received considerable attention in this laboratory during the past several years and has proved to be a useful tool in studies of the composition of soybean oil (3, 7, 21).

“The extensive literature on molecular distillation (5, 6) reveals that in the field of vegetable fats and oils most workers have used refined oil rather than crude oil as starting material. The desirability of preliminary removal of ‘break’ material is frequently mentioned, while Embree (9) states that molecular distillation cannot be carried out on oils that contain more than traces of phospholipids and mucilaginous matter. For this reason, and to demonstrate the performance of the still used at this laboratory, it appears useful to present the results of a typical molecular distillation of a crude expeller soybean oil.” Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


• Summary: Using liquid extraction with methanol, soybean, corn, cottonseed and linseed oil have been separated into fractions of widely different degrees of saturation. “The more unsaturated fractions of soybean oil are better suited for use as drying oils than the original oils.”

The idea long prevailed that natural fats were mixtures of simple triglycerides. This idea, which has been discarded, has been replaced by the view that “these materials are mixtures of mixed triglycerides and that the fatty acids of seed fats are distributed among the glycerides as widely and evenly as possible.” Address: Purdue Univ. Agric. Exp. Station, Lafayette, Indiana.


• Summary: “The use of crystallization to separate fats, oil, or fatty acids into high-melting saturated fractions and low-melting unsaturated fractions is used” commercially in only a few processes at present.

“Cottonseed oil is often ‘winterized’ by cooling and pressing to remove higher melting glycerides and thus make the oil against freezing at ice-box temperatures.” Since soybean oil solidifies at a lower temperature, it does not require ‘winterization’ although this process is sometimes used to remove traces of waxes it contains. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


• Summary: “Earlyana is a new soybean variety developed by the Purdue University Agricultural Experiment Station. The original plant was selected in 1931 from a row of Dunfield by Claude Greenham, helper in the plant breeding projects.” Four photos show Earlyana. Address: Lafayette, Indiana.


• Summary: For several years soybean meal has been incorporated in phenolic plastics to a limited extent. Research has demonstrated that heat-denatured soybean meal, from which the water-soluble fraction has been removed, can be used to replace part of the resin and wood flour.

Footnote 3. “The Chemical and Engineering Sections of the Soybean Industrial Products Laboratory, Urbana, Illinois, were merged with the Northern Regional Research Laboratory, Peoria, Illinois, July 1, 1942.”

Note 1. These glues were somewhat less stable for outdoor use than the glues made with synthetic resins, so they failed to gain a profitable market. By the early 1970s it appeared that the use of protein glues would be limited to interior grade products. There was no reason to anticipate any substantial expansion of the use of protein (including soy protein) in this market. Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


**Summary:** “One of the most important factors in connection with breeding soybeans is the accurate evaluation of new strains in the yield-testing program. This is especially true when testing strains in which there is not much spread in the yields. Published data on plot technics with this crop are very limited.

“In an effort to evaluate some of the present plot technics used in soybean testing, a study of border effect was undertaken at Lafayette, Indiana, by the U. S. Regional Soybean Industrial Products Laboratory and Purdue University Agricultural Experiment Station cooperating, with four varieties of soybeans. The work was conducted over the 4-year period from 1938 to 1941, inclusive.

“The data of Arny and Hayes show increases in yield resulting from border effect from only the sides of plots which varied from 7.9 to 15.3% with an average of 12.3% in oats, from 14.1 to 23.7% with an average of 18.4% in wheat, and from 21.1 to 45.8% with an average of 26.3% in barley. They observed a rearrangement in yield rank due to border effect and decided to remove the plants from an area at least 1 foot wide within the margins of variety test plots to obliterate border effect.” Address: U.S. Regional Soybean Laboratory Mimeograph, Urbana, Illinois.


**Summary:** This untitled fill-in form has the following blank lines near the top: Station. Month. Year. Truck. Operator. The lower 80% consists of the following vertical columns: Date. Speedometer [sic, Odometer] reading at start of day. Expenses: repairs, operations. Gals. gasoline. Travel and work performed. Address: Urbana, Illinois.


**Summary:** This leaflet gives the program for the “War Conference” held by the ASA from 5-7 Sept. 1943 at the Hotel Montrose in Cedar Rapids, Iowa.

“Sunday, Sept. 5.

• 2:30 p.m. Committee Meetings, Soybean disease—Corn room. Nominations.

• 6:00 p.m. Board of Directors Meeting—Parlor D.

• 8:00 p.m. Annual business meeting—Ballroom.

• 9:00 p.m. ‘Soybeans and the Orient’—Dr. H.W. Miller, International Nutrition Laboratory, Mt. Vernon, Ohio.

“Film strip’—Soybean production, improvement and utilization’—K.E. Beeson, Purdue Univ. [West Lafayette, Indiana].

“Informal discussion and open meeting.

“Monday, Sept. 6.

• 9:00 a.m.—Ballroom. David G. Wing, Pres. American Soybean Association, presiding.

“‘What the soybean means to Iowa’—Harry Linn, State Secretary of Agriculture.

“‘Bureau of Plant Industry’s soybean program’—Dr. W.J. Morse, Senior Agronomist, Bureau of Plant Industry, Washington, DC.

“‘Development and distribution of new soybean varieties’—Dr. J.L. Cartter, Agronomist, U.S. Regional
For soybeans with less than 14 percent moisture, suffer a lowering of grade or a loss of viability. under too rapid drying they will lose in test weight and may moderate temperatures. High temperatures will dry them; but Beans may be dried artificially by using forced air at moderate temperatures. High temperatures will dry them; but under too rapid drying they will lose in test weight and may suffer a lowering of grade or a loss of viability. For soybeans with less than 14 percent moisture, Commodity Credit Corporation is authorizing a premium over base price—and a discount for those over 14 percent. 

“Under official standards all types of damage are considered together. The maximum total damage in the various grades is as follows:

2 percent in No. 1
3 percent in No. 2
5 percent in No. 3
8 percent in No. 4.

Soybeans usually are the driest, keep the best under farm storage conditions, and give the best germination the following spring.

“Seed from fields harvested late in fall is more apt to be high in moisture content, contain more weather-damaged beans, and have a lower viability than seed from early combined fields. The moisture content of soybean seed is the factor that controls their keeping well in storage. One precaution to observe, especially with weather-damaged seed, is to be sure that the moisture content is low enough to prevent molding and heating in the bin.

“What to do about it next year: It is important to plant adapted varieties of soybeans. The kinds that are a little too late for a given section are very apt to be those that give the highest yield during seasons favored by late fall frosts. For this reason some varieties are at times planted farther north than the region to which they are safely adapted under ordinary conditions. These are the beans usually damaged most severely by frost.

“It is strongly recommended that farmers consult State agricultural experiment stations for information on the proper varieties to grow in any specific locality. It is also recommended that seed be tested for germination before planting, to insure adequate stands and prompt emergence. If seed with a moisture content above 12 percent has been stored over winter, a germination report obtained during the winter months may indicate a viability that will be higher than at the time of spring planting. This is due to bin damage that may occur during the warmer temperatures that are usually experienced late in spring. When in doubt, the safest procedure is to obtain a germination test before planting time in spring.

“For further information on the subject of soybean production, write to the Office of Information, Department of Agriculture, for any of the following publications:


“Farmers’ Bulletin 1605, Soybean Hay and Seed Production.


“Farmers’ Bulletin 1937, Soybean Diseases and Their Control.

“The State agricultural experiment station will have information on the best varieties to grow and the best cultural practices for a given locality.
“Facts are Ammunition: Listen to Department of Agriculture radio network broadcasts for facts about wartime farming and homemaking.

The National Farm and Home Hour gives farmers facts from the Department of Agriculture about the changing war needs for their products, information on Government programs to help meet production goals, and policy discussions by agricultural war leaders. It gives homemakers facts about food supplies, ideas on how to save food and clothing, and suggestions on keeping families well fed under rationing.

“Consumer Time presents a dramatized story and discussion combined with the expert advice of a guest authority. These broadcasts present to the consumer the latest facts on conservation, nutrition, rationing, and the wise purchase and use of food, clothing, and household equipment, together with practical tips on wartime living.

“Listen to–National Farm and Home Hour:
“Monday through Friday over stations associated with the Blue Network.
“12:30 p.m. Eastern War Time.
“11:30 a.m. Central War Time.
“10:30 a.m. Mountain War Time.
“6:15 a.m. Pacific War Time. (In California, Oregon, and Washington the early morning broadcasts are the programs presented the previous day in other parts of the country.)
“The National Farm and Home Hour is available to all Blue Network stations.

“Listen to–Consumer Time
“Saturday over stations associated with the National Broadcasting Company.
“12:15 p.m. Eastern War Time.
“11:15 a.m. Central War Time.
“10:15 a.m. Mountain War Time.
“9:15 a.m. Pacific War Time.
“Consumer Time is available to all NBC stations. Consult radio schedule in local newspapers for stations carrying the program.”

Address: Senior Agronomist, Director, U.S. Regional Soybean Lab., Urbana, Illinois.


• Summary: “The original work program of the laboratory involving agronomic, genetical, physiological, and pathological investigations has been somewhat modified for the period of the war emergency. The physiological and purely genetic problems are being postponed, while greater emphasis is being placed on the development and distribution of adapted varieties of superior quality, improved cultural methods, and the study and control of diseases for the maximum production of feed, food, and industrial products under varying conditions of soils, climate and farm practices. Thus the laboratory program for the war emergency period includes the following objectives:

“1. To determine the effects of varietal, soil, and climatic factors, and cultural and production methods on the growth, yield, and composition of soybeans.

“2. To develop by breeding through selection from hybrids and other material, supported by data from chemical analyses, varieties of soybeans of superior quality for industrial purposes.

“3. To study methods of control for the most serious soybean diseases and the possibilities of developing strains highly resistant or immune to these diseases.

“The laboratory, as heretofore, continues its headquarters at Urbana, Illinois, where the University of Illinois has furnished ample greenhouse, storage, office, and laboratory space to meet all special requirements. In view of the fact that soybean diseases are increasing in prevalence and are threatening production in some of the heavy producing areas, a full-time plant disease specialist has been added to the laboratory staff. As it is impossible for one man to give detailed attention to the disease problems in all producing states, the possibility of conducting disease studies with the plant pathologists of the 24 cooperating states is being explored.

“One of the main objectives of the Laboratory and cooperating agencies is to develop improved varieties and strains of soybeans for commercial and industrial utilization. In order that new strains developed through cooperative breeding work can be evaluated more rapidly
and accurately, six varietal groups have been established and designated as Uniform Test Groups I, II, III, IV, V, and VI. Group I includes varieties for the northernmost part of the north central states having approximately the maturity of Mandarin, the groups gradually increasing in length of season to Group VI that contains the late varieties for the southern part of the cotton belt. In the north central states uniform nursery tests are being maintained at 24 different locations and in the southern states at 54 locations in cooperation with state experiment stations and special cooperators.

Note 1. This is the earliest document seen (Dec. 2016) that mentions “Uniform Test Groups” or that gives them any of the following numbers: I, II, III, IV, V, or VI in connection with soybeans.

Note 2: This is the earliest document seen (Dec. 2016) that contains the term “uniform nursery” or the term “uniform nursery tests.”

“At these various places, varieties and strains are being studied for desirable agronomic characters and disease susceptibility and the seed analyzed to discover promising chemical characteristics. Varieties or strains proving of outstanding value are distributed more widely for further testing for yield and general economic value. New strains found to be superior are increased by the state experiment stations, given a name, and distributed to farmers in the area to which the variety is best adapted.

“Some of the agronomic accomplishments of the laboratory to date may be of interest and are summarized briefly as follows:

1. Developed and released through cooperation with state experiment stations the Boone, Chief, Gibson, Patoka, Earlyana, and Lincoln varieties—high-yielding yellow-seeded types of high oil content adapted to a wide range of soil and climatic conditions—for industrial purposes.

2. Developed and distributed to cooperating plant breeders a large amount of hybrid material for further testing and selection.

3. Showed that chemical composition, yield, and general agronomic desirability are characters of the greatest value in developing superior types.

4. Showed by a survey of soybean diseases that certain diseases are increasing in prevalence and are a distinct menace to production in many of our large seed-producing areas.

5. Proved by date-of-planting studies that late varieties at a particular location yield proportionately less than early varieties when planted at a later date.

6. Showed by extensive studies that the chemical constituents of the same variety grown under different climatic conditions differ markedly.

7. Showed that rate of planting has no effect on composition of the seed but does affect yield.

8. Published numerous technical and practical reports and bulletins to assist plant breeders and processors in their respective fields.

9. Showed that fertilizer treatments applied to several soil types in the north central region did not have any marked influence on composition of soybean seed. Treatments applied to soils of low productivity, however, did result in significant increases in yield.

10. Showed by physiological research that varieties grown at warm temperatures produced seed that were higher in protein, ash, and calcium content, but lower in sugar content. The iodine number of oil was lower also under warmer growing conditions.”

Photos show: (1) A portrait photo shows W.J. Morse. (2) The large, modern “solvent extraction bean plant of Honeymead Products Co.” in Cedar Rapids, Iowa. Address: Senior Agronomist, Div. of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, USDA, Washington, DC.


• Summary: Gives a brief history of Morse’s work with soybeans for the USDA. “The name of William J. Morse is destined to be linked permanently with one of the most amazing food plants introduced into the United States, the soybean.

“We are ignoring one of the very best food plants in the world,” he has been saying over and over again, in person and in print, for nearly 30 years, it being a trait of good bureaucrats to ‘prove all things; hold fast to that which is good.’ It required World War II to vindicate Bill’s judgment, but we are now witnessing a rapid acceptance here of the soybean as a first-class human food.”

“Morse came to the Department directly after getting a B.S. degree from Cornell [Univ., Ithaca, New York] in 1907. Ever since, he has been connected with what is now the BPISAE Division of Forage Crops and Diseases. He soon
became enthusiastic over the possibilities of the soybean.

“For more than 30 years he has been testing varieties. He made an extended trip to the Orient to bring back sorts that appeared likely to prove of value to this country. As a result, he has become the outstanding national authority on the soybean. Particular credit is due him for bringing about its use as a human food in the United States, and for providing the varieties of soybeans needed industrially.

“Morse’s reputation in this field, coupled with his known ability to cooperate effectively with fellow workers, led to his supervision over the research activities conducted on soybean improvement and production at the U.S. Regional Soybean Laboratory, Urbana, Illinois. This national recognition came as no surprise to his fellow workers, who have long appreciated his outstanding qualities as a man, as well as his ability as a research worker.”

A photo shows William Morse standing in front of a many floor-to-ceiling shelves filled with soy products (for details see 1936 photo).

This digital photo was sent to Soyfoods Center by Joyce Garrison (William Morse’s granddaughter) of West Hartford, Connecticut (July 2004).


Growers include:

- Associated Seed Growers, Inc., 301 Kentucky Ave., Indianapolis, Indiana or New Haven, Connecticut (handles Bansei {wholesale only}, Emperor, Giant Green, Jogun, Toku, and Willomi).
- Charles Siner, Route 2, Terre Haute, Indiana.
- Charles V. Holdeman, 458 N. Hartmen St., Napanee, Indiana.
- Charlton-Davis Co., Inc., Norfolk, Virginia.
- Corneli Seed Co., 101 Chouteau Ave., St. Louis, Missouri.
- Donald Walker, c/o Ralston Purina Co., Circleville, Ohio.
- E.F. Johnson, 1151 Claytonia Terrace, Richmond Heights, Missouri.
- Farmer Seed & Nursery Co., Faribault, Minnesota.
- Fred H. Scholl, Memphis, Indiana.
- George A. Mitchell, Vineland, New Jersey.
- G.G. McIlroy, Irwin, Ohio (wholesale only).
- Holmes Seed Co., 224 Cleveland Ave., Canton, Ohio.
- International Nutrition Laboratory, Mt. Vernon, Ohio.
- J.B. Lucas, Franklin, Kentucky.

Lee Chambers, Route 1, Kokomo, Indiana.
- Muntz-McLaughlin Co., Holgate, Indiana.
- O.M. Scott & Sons, Marysville, Ohio.
- Ray Monier, Carrollton, Missouri.
- Rufus Gillett, Mazomanie, Wisconsin.
- Russell-Heckle Seed Co., 16 S. Trout Street, Memphis, Tennessee.
- Strayer Seed Farms, Hudson, Iowa.
- The Marsh Foundation, Van Wert, Ohio.
- T.W. Wood and Sons, Richmond, Virginia.
- W. Atlee Burpee Co., Clinton, Iowa.

Footnote: *”This partial list is furnished for your convenience, with no discrimination intended and no guarantee of seed quality, varietal purity, or any other factors involved in the purchase or distribution of seed implied. Additions to this list will be welcomed.”


• Summary: There is usually considerable variation among plant varieties of a given species in reaction to temperature, drought, disease, insects, etc. It is likewise known that plant varieties react differently in the absorption and metabolism of at least some of the chemical elements.


• Summary: An good, readable history of margarine, a “butter substitute,” an “orphan child, disdained by all families of refinement and almost taxed out of existence through the efforts of dairy and butter lobbies.

But because of a butter shortage during World War II, it began to attract attention.

During the War, Oswald H. Brownlee, a research associate at Iowa State College (America’s 2nd largest dairy-products state) wrote a 35-page pamphlet, which was 5th in a “Wartime Farm and Food Policy” series published by the college press. One of his many frank suggestions (p. 29) was “Substitute Margarine for Butter.” This blew the lid off; dairy and butter interests struck back.

The story then starts at the beginning in the 1860s when Napoleon III, faced with a shortage of oils and fats, offered a large cash prize to the man who could invent a cheap butter substitute. The story focus on the history in the United States. After the start of World War II margarine interests discovered that had some strong new friends–farmers who sel them
raw materials. “In 1942, for example, 166.5 million pounds of cottonseed oil and 133.3 million pounds of soybean oil were used to make margarine.” These two oils accounted for 86.5% of the total oils used in margarine. Growers of these two crops were drawn into the struggle, whether they lived in the seep South, where dairying is slight, or in the corn belt, where dairying is a major source of income.

The House Agriculture moved into action, realizing that in 1941 the cotton seed oil used in margarine was produced on 257,478 farms. And there were additional efforts to tear down all barriers to free trade among states—a very complex subject. In the end, margarine will have to rise or stand on its merits.

255. DuBois, J. Harry. 1943. Plastics: a simplified subject. In the end, margarine will have to rise or stand on its down all barriers to free trade among states—a very complex subject. In the end, margarine will have to rise or stand on its merits.

Bartholomew, Stuttgart, C.R. Adair
   “3. Florida Experiment Station, Gainesville. G.E. Ritchey
   “5. Louisiana Experiment Station, Baton Rouge. T.P. Gray
   “6. Mississippi Experiment Station, State College. T.F. O’Kelly
   “8. Oklahoma Experiment Station, Stillwater. H.W. Staten
   “9. South Carolina Experiment Station, Clemson. W.R. Paden
   “10. Tennessee Experiment Station, Knoxville. T.B. Washko
   “11. Texas Experiment Station, College Station. K.F. Menke
   “12. Virginia Experiment Station, Blacksburg. T.B. Hutcheson
   Wednesday Evening, 8 p.m.
   “Interesting War-Time Developments at the Northern Regional Research Laboratory
   “Dr. R.T. Milner, Northern Regional Research Laboratory
   “Fourth Session, March 2
   “Thursday Morning, 8:30 a.m.
   “J.L. Carter, Presiding
   “1. Discussion of soybean diseases.
   “W.B. Allington, U.S. Regional Soybean Laboratory
   “2. Discussion of soybean insect pests.
   “E.W. Dunnam, Bureau of Entomology and Plant Quarantine, U.S.D.A.
   “Fifth Session, March 2
   “Thursday Afternoon, 1:30 p.m.
   “P.R. Henson, Presiding
   “Discussion of Plans for 1944
   “1. Discussion of date-of-planting tests and selections for 1944.
   “H.R. Albrecht, Alabama Experiment Station
   “T.P. Gray, Louisiana Experiment Station
   “T.A. Rigney, North Carolina Experiment Station
   “2. Discussion of breeding methods and maintaining pure seed stocks.
   “L.F. Williams, U.S. Regional Soybean Laboratory
   “3. Discussion of chemical methods of the Laboratory and recommendations for improvement in agronomic end chemical sampling.
   “J.L. Carter, U.S. Regional Soybean Laboratory
   “Thursday Evening, 8 p.m.
   “Illustrated Talk on Soybeans in the Orient
   “W.J. Morse
   “Division of Forage Crops and Diseases
   “Sixth Session, March 3
   “Friday, 6:30 a.m.
   “1. General agronomic problems with soybeans in the Southern States,
   “J.F. O’Kelly, Mississippi Experiment Station
   “J.L. Carter, U.S. Regional Soybean Laboratory
   “3. New cooperative projects
   “J.L. Carter, U.S. Regional Soybean Laboratory
   “4. Individual conferences
   “RSLM 108 1-17-44."

   • **Summary:** “It is well known that the quantity of oil extractable from soybean meal with petroleum ether varies with the moisture content of the meal. Within reasonable limits, the higher the moisture level, the greater the quantity of oil extracted.”
   Yet, in practice, there wide discrepancies which this investigation will address. Address: U.S. Regional Soybean Lab., Urbana, Illinois.

   • **Summary:** Lincoln has outyielded every other soybean variety with which it has been compared in Iowa. Its yields range from 25.0 bu/acre in southern Iowa to 36.4 bu/acre in central Iowa, to 27.0 bu/acre in northern Iowa. A photo shows C.R. Weber in a field at the Agronomy Farm, Ames, Iowa, in 1943, examining soybeans. Address: Iowa State College, Ames, Iowa.

   • **Summary:** “The Illinois Agricultural Experiment Station will soon round out 50 years of experience with soybeans. It was not until after the turn of the century that a few of the more daring farmers tried out this new crop. We have at least one and possibly three or four farmers in Illinois who are just now completing 40 years of experience with the crop on their farms.
   “Frank Hurrelbrink of Taylorville, Christian County,”
secured a few seeds of each of three or four varieties at the Experiment Station in 1904. He has been a true pioneer in his work on this crop. In fact we have, for years, had a variety of soybeans known as Hurrelbrink, which was selected by Mr. Hurrelbrink from the start and which he obtained from the Experiment Station in 1904. This is one of the first varieties, if not the first, selected in Illinois because of its peculiar adaptation and qualities for certain areas.

“Many other pioneers have made definite contributions to the soybean history of Illinois. Without attempting to name all, we might mention Charles Meharry, Tolono; W.E. Riegel, Tolono; C.H. Oathout, Macomb; John T. Smith, Tolono; Russell Davis, Clayton; E.D. Funk, Bloomington; Paschal Allen, Green Valley; and Loren Wilderman, Freeburg.

“As we think back over 25 years of active participation in the soybean program in Illinois, it seems that the progress of the crop has been influenced most by about six events: 1. Introduction or creation of new varieties. 2. Variety demonstrations in more than three-fourths of the counties of the state. 3. Adaptation of the combine to soybean harvesting. 4. Development of a commercial market for the surplus beans. 5. The price guarantee by American Milling Company, Funk Brothers Seed Company, and G.L.F. in 1928. 6. Utilization of soybean oil by the paint industry.

“Despite the efforts of the Experiment Station and of these early producers, the introduction of soybeans to Illinois farmers and the establishment of the crop on Illinois farms was a slow process. Even as late as 1914, the first year for which we have any estimate, the total acreage devoted to soybeans was approximately 1,000 acres, of which 800 acres were grown for hay and 200 acres for seed...

“We can thank our good friend, Mr. A.J. Surratt, for getting these acreage figures some years before we would otherwise have obtained them... Beginning in the winter of 1919-20, a demonstration project was set up for the purpose of acquainting farmers with the new soybean crop and its culture... The first year, 1920, we had three demonstrations. These proved very helpful and a more vigorous effort was made to encourage the use of soybeans. Fifteen counties had soybean demonstrations in 1921, and 16 counties followed the regular extension project outline for this work in 1922. Twenty-seven counties had demonstration plots in 1923, 22 in 1924, and 28 in 1925...

“In 1922 approximately 50 bushels of a pure selection of Manchurian soybeans were introduced into the state and certification of that seed started. A soybean survey made ‘at the end of 1927 indicated that the Manchur occupied between 65 and 70 percent of the commercial soybean producing area in Illinois.’

“The third epoch in Illinois soybean history occurred October 22, 1924, when Garwood Brothers used the first combine ever used in the state to harvest soybeans. The first day from 9 a.m. to 4 p.m. they combined 27 acres of a 65-
34,000 acres below the previous crop. This price guarantee for Illinois soybeans in 1928 and the renewal of a price guarantee for 1929 not only in Illinois but also in Indiana and Ohio surely proved a turning point in soybean history.”

“The sixth epoch in the Illinois soybean story came in 1931, when the Illinois Agricultural Experiment Station began a series of experiments designed to find a method of successfully utilizing soybean oil in paint. This project, under the direction of Dr. W.L. Burlison, led to the utilization of large quantities of soybean oil by several of the large paint manufacturers...

“Another event of far-reaching importance in more recent soybean history was the recognition given Illinois in 1936, when the Regional Soybean Industrial Products Laboratory was located here at the University.” Address: Univ. of Illinois.


• Summary: The title page states, from top to bottom:
  “United States Department of Agriculture. Agricultural Research Administration. Bureau of Plant Industry, Soils, and Agricultural Engineering, cooperating with State Agricultural Experiment Stations of the North Central Region.”


• Summary: “Distilled methyl esters of soybean fat acids were used because they were easy to prepare and could be readily purified by distillation.”

  The summary contains six points; the first of these is:
  “1. A study of reaction time and the effect of oxygen on determination of peroxide by the acetic acid-potassium iodide method shows that a one-hour reaction time in the absence of oxygen is necessary, especially on samples of high peroxide.” Address: U.S. Regional Soybean Industrial Products Laboratory, Urbana, Illinois. Wheeler’s present address: General Mills, Inc., Minneapolis, Minnesota.


• Summary: “A factor of great importance in the continued economical production of soybeans in view of the vast expansion in soybean acreage and the constant decrease in fertility of the soil, is the application of mineral fertilizers to soybeans under those conditions that warrant their use.

  “Since soybeans are frequently impeded in germination and emergence by mineral fertilizers, it is of importance to know what kind and amount of fertilizer may be applied and under what conditions, without injurious effects to the germinating seed and the young seedlings.” Address: Asst. Agronomist, Div. of Forage Crops and Diseases, Bureau of Plant Industry, ARS / USDA; and U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois; and Purdue Univ. Agric. Exp. Station, Lafayette, Indiana.


• Summary: “The First Soybean Processors’ Conference was held in the Illini Union, University of Illinois, Urbana, Illinois, February 24, 1944. The suggestion for the conference originated with the processors and the program was arranged by the Department of Agronomy, University of Illinois, in consultation and cooperation with the processors and the U.S. Regional Soybean Laboratory.”


  On pages 50-51 is list of the name, address, and
organization of the conference attendees. Address: Urbana, Illinois.


**Summary:** “The uniform seed treatment test on oil type soybeans was conducted in 9 North Central States in 1943. These tests were directed by the War Emergency Committee of the Upper Mississippi Valley Plant Pathologists. All the seed was treated and sent out to the cooperators from the U.S. Regional Soybean Laboratory at Urbana, Illinois. Seed of low viability was used and the planting rate was about 1 bushel of seed per acre. In the northern section (South Dakota, Minnesota, and Wisconsin) a Manchu type soybean (72% germination) was used while in the rest of the area the Lincoln variety (47% germination) was used.

“In order to study the effect of seed treatment on the effectiveness of inoculation with nodule bacteria, the plots were split, each whole plot consisting of two 18-foot rows with the same chemical treatment, 1 row inoculated just before planting and 1 row left uninoculated. Each cooperator was furnished with a humus culture of soybean nodule bacteria with instructions to insure uniform inoculation at the different locations. Four randomized blocks were planted at each location. Since the treatment by inoculation interaction this year was not significant the estimates of stand and yield given in the Tables are the average of 8 replications.

“Data were taken on both stand and yield. The seed treatment chemicals and rates of application per bushel were as follows: Untreated check, Semesan Jr. 2 oz., Fermate 1 oz., New Improved Ceresan 1/2 oz., Arasan 1 oz., Arasan 2 oz., Spergon 2 oz., and Spergon 3 oz.

Table 71 gives the names of the cooperators, locations, and general effects of the seed treatments at the various locations in 1943.

“Effect of Soybean Seed Treatment on Stands: Significant increases in stand from seed treatment were obtained in Minnesota, Ohio, Illinois, Iowa, and Nebraska, whereas the increases were not statistically significant in Wisconsin, South Dakota, Kansas, and Missouri. For all the stations together every treatment used was significantly better than the check as shown in Tables 72 and 73. The heavy application of Arasan appeared to be the best treatment this year. The treatment x station and the inoculation x treatment interactions were not statistically significant. Very little is known concerning the causal factors for seed decay, seedling diseases, etc. with soybeans, consequently nothing was learned in regard to control of specific diseases of that nature. Most of the plantings were made later than the normal time due to unfavorable weather conditions. Fairly accurate records were kept of the environmental conditions from the time of planting until the final stand counts were taken. The effectiveness of the seed treatments apparently did not depend upon any one environmental factor.

“Effect of Soybean Seed Treatment on the Yield: Somewhat better yields were obtained from treated seed than from untreated seed in South Dakota, Kansas, Illinois and Ohio, but only in South Dakota were the increases significant as shown in Table 74. No increases were obtained in Missouri, Iowa, and Nebraska. Yields were not obtained at St. Paul, Minnesota, and at Madison, Wisconsin.

“Although in many cases attempts were made to locate the plots where soybeans had never been grown before in order to test adequately the effect of seed treatment upon the effectiveness of inoculation, only one station met with apparent success. At Brookings, South Dakota, the uninoculated rows were entirely free of nodules, While nodulation occurred in the inoculated rows. Careful examination of roots at this station disclosed that all the seed treatments were detrimental but not prohibitive to nodulation. The most interesting result in regard to inoculation, however, is that with the exception of Urbana, Illinois, all the locations reported decreased yields with inoculation. This was true of the checks as well as of the chemical treatments. The reason for this unexpected result is obscure. No effect on stands was found but some of the yields were reduced significantly and the general reduction in yield at all locations was highly significant (Table 75).

“At the locations where the plants from uninoculated seed were well nodulated, treatments with the seed disinfectants used had no noticeable retarding effect on nodulation.

“The common farm practice at present is to plant more soybean seed per acre than is absolutely necessary in order to have added assurance of good stands. The result from seed treatment tests this year indicate that the rate of seeding might possibly be reduced about 10 percent without a reduction in stand if the seed is treated.

“These tests must be conducted for several more years before definite conclusions can be reached. At present seed treatment for soybeans cannot be recommended.”

Note 1. This is the earliest document seen (June 2007) that mentions Spergon.


**Summary:** Considerable variation was reported in the percentage of each of the unsaturated fatty acids in soybean oil from 10 varieties grown in different years. Linolenic acid ranged from 1% to 10% of the total in the oil.
The ratio of saturated to unsaturated fatty acids in soybean oil was found to be relatively constant, regardless of the iodine number (over the range 102.9 to 151.4). Address: U.S. Regional Soybean Industrial Products Lab.


• Summary: Contents: Palatability and nutritive value. Productivity and varietal descriptions. Recommended varieties. Growing the crop: Adaptation, seedbed preparation, time and manner of planting, cultivation, harvesting (green soybeans, mature soybeans), preservation (green-vegetable soybeans, mature soybeans).

“No very sharp distinction need be made between vegetable and field varieties as some of the best standard industrial varieties, such as Dunfield and Illini, are also edible and palatable as food.” Address: Univ. of Nebraska, Lincoln, Nebraska.


• Summary: “The following persons representing eleven of the twelve states in the southern region; the U.S. Regional Soybean Laboratory, Urbana, Illinois; the Division of Forage Crops and Diseases; and the Agricultural Research Administration attended this conference:

“O.S. Aamodt, Beltsville, Maryland
“H.W. Marston, Washington, D.C.
“J.L. Cartter, Urbana, Illinois
“L.F. Williams, Urbana, Illinois
“W.B. Allington, Urbana, Illinois
“J.E. Adams, Stoneville, Mississippi
“P.W. Gull, Stoneville, Mississippi
“P.R. Henson, Stoneville, Mississippi
“R.B. Carr, Stoneville, Mississippi
“Clay Lyle, State College, Mississippi
“J.F. O’Kelly, State College, Mississippi
“T.F. Akers, West Point, Mississippi
“H.A. York, Raymound, Mississippi
“H.R. Albrecht, Auburn, Alabama
“C.K. McClelland, Fayetteville, Arkansas
“C.R. Adair, Stuttgart, Arkansas
“G.E. Ritchey, Gainesville, Florida
“U.R. Gore, Experiment, Georgia
“J.L. Weimer, Experiment, Georgia
“J.L. Stevens, Tifton, Georgia
“J.P. Gray, Baton Rouge, Louisiana
“J.A. Bigney, Raleigh, North Carolina
“E.E. Hartwig, Raleigh, North Carolina
“H.W. Staten, Stillwater, Oklahoma
“W.R. Paden, Clemson, South Carolina
“J.B. Washko, Knoxville, Tennessee
“K.F. Manke, College Station, Texas
“First Session: 2:30 p.m., February 29
“Dr. J.E. Adams conducted a tour of the Delta Experiment Station.
“Second Session: 8:30 a.m., March 1 at Hotel Greenville, Greenville, Mississippi. Dr. J.E. Adams, chairman

“This was a joint meeting with county agents and planters from the Delta section of Mississippi.

“1. Dr. J.E. Adams: Reviewed the history and development of the Delta Experiment Station, Stoneville, Mississippi, and outlined the scope of the experimental work being conducted at that Station.

“2. H.W. Marston: Outlined the work being conducted at the nine U.S. Regional Laboratories and the legislation that made these possible.

“Funds were made available by the Bankhead-Jones act which was passed June 29, 1935.

“The nine regional laboratories are;
“a. U.S. Regional Vegetable Laboratory, Charleston, South Carolina
“b. U.S. Regional Pasture Laboratory, State College, Pennsylvania
“c. U.S. Regional Soybean Laboratory, Urbana, Illinois
“d. U.S. Regional Swine Laboratory, Ames, Iowa
“e. U.S. Regional Sheep Laboratory, Dubois, Idaho
“f. U.S. Regional Animal Disease Laboratory, Auburn, Alabama
“g. U.S. Regional Poultry Laboratory, East Lansing, Michigan
“h. U.S. Regional Salinity Laboratory, Riverside, California
“i. U.S. Regional Plant, Soil, and Nutrition Laboratory, Ithaca, New York

“3. Dr. O.S. Aamodt: Outlined the organization of the U.S. Department of Agriculture.

“a. Extension
“b. Agencies such as AAA and SCS that give advice and financial assistant to farmers.

“c. Research: The research work or the Department is carried on in cooperation with the state experiment stations in order to avoid duplication of efforts. This also makes it possible to carry on fundamental regional investigations that would not be possible for the state experiment stations to do when working as single units.

“4. J.L. Cartter: The work done by the U.S. Regional Soybean Laboratory in the North Central states was reviewed and a summary of the work was presented. It was pointed out that this program had been expanded to include the twelve states in the southern region so that we now have a real cooperative organization for the entire soybean production
area. 5. P.R. Henson: The southern region was defined and
the cooperators from each state were introduced. Virginia
was not represented. Ninety-two variety tests were grown
in 1943. Seventy-seven of these were completed and fifteen
were lost because of dry weather, diseases, insects, livestock
damage, or lack of labor to harvest. Five dates of planting
tests were conducted.

“A short time was given over to a discussion of the
problems in soybean production in the Delta section of
Mississippi. This was entered into by the farmers and county
agents of that section. Most of the farmers seemed to want
a variety that was early in maturity, non-shattering, and
produced good quality beans, with a high oil content.

“Third Session: 1:30 p.m. March 1, Stonenville,
Mississippi. Mr. H.W. Staten, chairman

“Reports on the results of previous investigations and
needs for the future were given by the representatives of the
experiment stations in the southern region.

“1. Alabama Experiment Station, Auburn. H.R. Albrecht
Drought, diseases, and insects were serious at most locations
in Alabama. Sclerotium rolfsii, mildew, pod and stem
blight, Cercospora, and nematodes caused injury at several
locations. The need for breeding work to develop resistant
varieties was pointed out. A breeding program to develop
hay type varieties is underway. In this project selections are
being made from introductions from the U.S. Department of
Agriculture.

“2. Arkansas Experiment Station, Fayetteville, C.K.
McClelland; Stuttgart, C.R. Adair.

“The history of soybean production in Arkansas was
mentioned briefly. The crop was first grown in the State
about 1921. In 1945 it was grown on 267,000 acres.

“In 1943 there was normal to excessive rainfall in the
early summer which was followed by a serious drought in
mid and late summer. Probably because of the drought in
July and August no disease was serious. There was very little
insect damage except caterpillar damage to the late varieties
at Stuttgart.

“Based on needs of growers the breeding program
should seek to produce:

“a. A short season variety that can be used to precede or
follow fall sown small grains

“b. An edible variety that can be produced on a field
scale

“c. A hay variety that will produce high yield of beans
for grain

“d. A high yielding, medium maturing, high oil content
variety

“3. Florida Experiment Station, Gainesville. G.E.
Ritchey

“Most varieties produce good forage yields but produce
very low seed yields although the plants set pods. Plants
that were covered with cheese cloth produced a good crop
of seed but plants shaded in a lath shed did not set any
more seed than plants in the open. The non-setting of seed
did not appear to be caused directly by insects although
it was suggested that it might be caused by a virus or
bacterial disease that was transmitted by insects. It was also
suggested that the soybeans were planted too early although
one introduction from the U.S. Department of Agriculture
produced a good yield when planted April 15 and vegetable
varieties grown in gardens set seed.

“The velvet bean caterpillar caused serious damage;
Tennessee Non-Pop was the most resistant to that insect.

“4. Georgia Experiment Station, Experiment. U.R. Gore
“Low yield caused by late summer drought, poorly
adapted varieties, insects (velvet bean caterpillar), disease
(root rot), and shattering.

“Most of acreage devoted to hay varieties.

“A new hay variety, Gatan, which was selected from
Ootootan is being increased.

“The breeding program includes work on seed, hay, and
edible varieties. At this time the best varieties are: seed–
Ogden; hay–Gatan; and edible–Seminole.

“Tifton–J.L. Stephens

“The uniform groups were grown at five locations. The
variety-station interaction was high which indicates that none
of the varieties now available are widely adapted in south
Georgia. The demand in that section is for a dual purpose–
high seed and hay production-variety.

“One of the serious problems is ‘rust’ which might be a
potash deficiency.

“5. Louisiana Experiment Station, Baton Rouge. J.P.
Gray

“The need in Louisiana is for a forage type variety that
will control the weed growth and produce a high yield of
seed. Varieties that mature in midsummer are not reliable in
yield and the seed produced is of low quality and viability.
Early varieties sown after fall grains usually make high
yields which suggests the need for further date of planting
experiments.

“Mr. Gray suggested that the factors used for
designating lodging were not suitable for viny forage type
varieties.” Continued. Address: U.S. Regional Soybean
Industrial Products Lab., Urbana, Illinois.

270. U.S. Regional Soybean Laboratory. 1944. Southern
States Soybean Planning Conference, U.S. Regional Soybean
Laboratory, Stoneville, Mississippi, February 29 to March 3,
1944 (Continued–Document part II). RSLM (U.S. Regional
Soybean Laboratory Mimeograph, Urbana, Illinois) No. 112.
[March.] 14 p.
• Summary: (Continued): “6. North Carolina Experiment
Station, Raleigh. J.A. Rigney

“Nutritional deficiencies were observed at several
locations. At Rockymont none of the varieties produced a
significant yield of seed although there were differential
varietal responses. Deficiencies were also noted at other
locations. The Soils Department of the North Carolina Experiment Station plans to carry on comprehensive fertilizer studies with soybeans in 1944. Demonstration plots of a few fertilizer treatments will also be grown adjacent to the experimental plots.

“Dry and hot weather prevailed at Raleigh in 1943 so the nurseries were not harvested. Sclerotium rolfsii was severe at one location and a differential varietal response was observed. Fusarium wilt was severe at another location. Nematodes caused damage at one location. Palmetto appeared to be resistant so it will be included in the hybridization program.

“The breeding program was started in 1941. Selections from introductions have been made and also a hybridization program has been started.

“8. South Carolina Experiment Station, Clemson. W.R. Paden

“Excessive rainfall in May (23 inches) followed by a drought in midsummer caused yields to be low in 1943. Group IV grown in the northeastern part of the state and Group V in the east central and central part. No soybeans grown in the western part of the state because of the low rainfall and rodents.

“Soybeans formerly grown for forage but farmers are now interested in growing them for seed production in the eastern part of the state. Most farmers plant soybeans on their poorer soils. An effort is being made to have some of the better soils used for the production of this crop.

“Favorable harvesting conditions usually prevail in September and October so a variety of Arksoy type maturity is about right.

“Blister beetles are usually the most serious insect pest. Bacterial pustule and pod and stem blight were the most serious diseases in 1943.

“Information on date of planting, varieties, and fertilizers are needed.

“Drought and hot dry weather may occur any place in the state although an average rainfall is higher in the eastern than in the western part of the state. It is thought that low humidity at flowering time is detrimental to seed setting.

“9. Oklahoma Experiment Station, Stillwater. H.W. Staten

“Groups V and VI were grown in 1943. The late varieties suffered most from the drought. Volstate is being promoted by the Coker’s Pedigreed Seed Company, Hartsville, South Carolina. Groups V and VI were grown at Monetta and the variety, Monetta, looked good there.

“10. Texas Experiment Station, College Station. K.F. Manke

“Row spacing, Ogden variety, 1943 (rate of planting: 30 lbs/A); yield (bu/A)

<table>
<thead>
<tr>
<th>Rate (lbs/A)</th>
<th>Yield (bu/A)</th>
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<tbody>
<tr>
<td>10</td>
<td>21.3</td>
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<td>20</td>
<td>23.6 3.0 bu/A for sig. diff.</td>
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<td>30</td>
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<td>40</td>
<td>28.0</td>
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“Drilled (7-inch rows) 14.4 10. Texas Experiment Station, College Station. K.F. Manke

“Row spacing, Ogden variety, 1943 (rate of planting: 30 lbs/A)

<table>
<thead>
<tr>
<th>Spacing (ft.)</th>
<th>Yield (bu/A)</th>
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<tr>
<td>2½</td>
<td>14.6</td>
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<tr>
<td>3</td>
<td>18.0 3.1 bu/A for sig. diff.</td>
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<td>3½</td>
<td>16.3</td>
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“Drought and velvet bean caterpillar were serious in the Florence area. The late varieties suffered most from the drought. Volstate is being promoted by the Coker’s Pedigreed Seed Company, Hartsville, South Carolina.

“Groups V and VI were grown at Monetta and the variety, Monetta, looked good there.

“West Tennessee may be the best situated for soybean production because of the proximity of oil mills.

“In 1943 there was a drought in the western part of the state but normal rainfall was obtained at Knoxville.

“Ogden and Volstate best varieties. Tennessee Non-Pop also good but it has been dropped from certification because of lack of uniformity. It was suggested that desirable uniform types might be obtained from that variety by selection.

“Non-shattering Ogden types should be obtained. Rate of planting, Ogden variety, 1943 (2½ ft. spacing)

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<tr>
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“Soybeans are sometimes planted in Rio Grange section about September 15. When planted at that time, all the varieties matured in 85 to 95 days.

“A system of planting nurseries by using a two-row planter and dropping by hand was described.

“Dr. R.T. Milner of the Northern Regional Research Laboratory, Peoria, Illinois, gave an illustrated lecture on ‘Interesting War-Time Developments at the Northern Regional Research Laboratory.’

“Fourth Session: 8:30 a.m., March 2, Stoneville, Mississippi

“J.L. Cartter, chairman

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“Discussion of soybean diseases

“W.B. Allington, U.S. Regional Soybean Laboratory:

“Most important diseases in the South are:

“a. Pod and stem blight (Diaporthe sojae)

“This disease caused by a weak parasite. Any unfavorable environmental condition may predispose the plant to infection. The causal fungus is saprophytic [lives on dead or decaying organic matter] so it cannot readily be controlled by crop rotation. It is most severe on lighter soils. Arksoy strains are susceptible.

“b. Southern root rot (Sclerotium rolfsii)

“This disease is widespread and causes much damage.

“c. Anthracnose (Glomerella glycenes)

“Symptoms may be similar to pod and stem blight but the picnidia are not usually in a definite pattern.

“b. Nematodes (Heterodera marioni)

“Cause serious damage in some locations in the southeast. There seems to be differences in varietal reaction.

“c. Downy mildew (Peronospora manshurica)

“The amount of damage is difficult to determine. Some varieties have only a flecking and the lesions do not develop.

“d. Bacterial leaf spots

“(1) Blight (Pseudomonas glycinea)

“(2) Pustule (Xanthomonas phaseoli var. sojense)

“There are probably two other bacterial leaf spots also which make it extremely difficult to know which of the four diseases are being dealt with in any particular case and so to determine varietal response.

“e. Frog-eye (Cercospora daizu)

“There is differential varietal response to this fungus. Oototan is very susceptible.

“f. Mosaic

“Symptoms appear early but the plant seems to overcome the diseased condition and produces normal seeds.

“g. Purple spot on seeds (Cercospora sp)

“Experiment conducted in Illinois in 19S3 to study effect of this disease on the succeeding crop. It did not reduce the yield but there were more infected seed on plants from diseased seed than there were on plants from healthy seed.

“h. Bud blight (virus) Infection of the plant in early stages kills terminal bud. The axillary buds may then develop and produce a dwarfed, branched plant. When pods are infected early, no seeds are developed and the pods turn brown and drop off. If the pods are infected late, they produce seeds and the seeds are normal in appearance except for size. A 50 percent infection in the field was estimated to cause 25 percent reduction in yield. This disease may not be present in the South.

“There are two strains of the virus. These are indistinguishable in the field but they can be separated in the greenhouse.

“My. Wildfire (bacterial) This disease is new on soybeans but potentially it is the most serious disease.

“General considerations in the disease program

“The increased production of soybeans in recent years are causing these diseases to become more of a factor in soybean production.

“Discussion of soybean insect pests

“Dr. Clay Lyle, Mississippi Agricultural Experiment Station:

“Most of the soybean diseases found in the South now were noted in southeastern and Gulf Coast states in 1925. It is of the greatest importance in the southeastern states. It reaches Stoneville in late August or early September. It can be controlled with cryolite or barium or sodium fluoro silicate.

“b. Bean leaf beetle (Cerotoma trifurcata)

“This insect is variable in color and markings. They feed on young plants and are easily disturbed making them difficult to find. They over-winter as the adult. Control is by dusting with cryolite or derris.

“c. Mexican bean beetle (Epilachna corrupta)

“Found east and south of Mississippi. Not found at Stoneville but usually are in the eastern part of the state.

“d. Southern striped blister beetle (Epilachna lemniscata)

“Sometimes very serious in limited area. They can be controlled with cryolite or by driving off and burning.

“e. Grasshopper (Melanoplus sp.?)

“Control by use of poison bait. Usually of minor importance.

“f. Green stink bug (Aprosternum hilaris)

“Usually of minor importance. No control measure known. Summary of 1943 southern agronomic data Paul
Because of limited time, it was decided to take this phase of the work up at the same time the plans for 1944 were being formulated.

"Summary of 1943 southern chemical data"

"J.L. Carter, U.S. Regional Soybean Laboratory"

"The effect of environment on chemical composition was discussed"

a. At Hartsville, South Carolina, Groups V and VI were planted at two dates. For the most part, varieties in the later planting had the highest oil content.

b. Any condition that increases the vigor of the plant tends to increase the oil content.

c. Iodine number of the oil is governed by the temperature during the time from fertilization to maturity of the seed. The higher the temperature during that period, the lower the iodine number.

d. The variety x location interaction for chemical composition seems to be higher in the southern region than it is in the Cornbelt states in the north central region. An effort will be made to define areas in the South wherein the chemical samples can be composited for analysis.

e. The oil content is more stable between locations than protein.

"Fifth Session: 1:30 p.m., March 2, Stoneville, Mississippi"

"P.R. Henson, chairman"

"Arranging uniform nursery tests or 1944"

"L.F. Williams, U.S. Regional Soybean Laboratory"

"The question of excluding all colored-seeded varieties was raised. Dr. Milner pointed out that there is not much discrimination against the oil from colored varieties and that it should be possible to overcome the slight prejudice against meal from those varieties. It was decided that since some colored-seeded varieties were being used in the breeding program that they should be included in the uniform tests."

"Groups V and VI were reorganized into three groups in order to have a narrower spread in maturity among the varieties within a group."

"The varieties in Uniform Groups V, VI, and VII were decided upon by studying their performance in the uniform tests in 1943 and in tests at the southern stations in former years. The varieties and the source of seed for 1944 and 1945 for Groups V, VI, and VII are given below. The varieties in Group IV are also given although there, was no discussion on the varieties to be included in that test."

"Uniform Group IV"

1. Boone
2. Chief
3. Gibson
4. Macoupin
5. Patoka
6. S32-11
7. S55-10
8. S55-35
9. S100
10. Uniform Group V
11. Source of Seed
12. Variety, 1944, 1945
13. 1. Arksoy 2913, Arkansas, Arkansas
14. 2. Magnolia, Tifton, Stoneville
15. 3. Mamredo, Stoneville, Stoneville
16. 4. N. 41-39, North Carolina, North Carolina
17. 5. Ogden, North Carolina, Tennessee
18. 6. P.I. 97066, Stoneville, North Carolina
19. 7. Ralsoy, Stoneville, Stoneville
20. 8. 2-40-A, General American Life Insurance Co., Arkansas
22. 1. Au #1, Alabama, Alabama
23. 2. Clemson, Clemson, Clemson
24. 3. Clemson Non-Shattering, Henson (N.C. Seed Co.), North Carolina
25. 4. Mamloxi, Stoneville, Stoneville
26. 5. Missoy, Tifton and West Point, West Point
27. 6. Monetta, Monetta and Tifton, Tifton
28. 7. N 41-90, North Carolina, North Carolina
29. 8. Ogden, North Carolina, North Carolina
30. 9. Palmetto, Tifton, Tifton
31. 10. P.I. 85335, Stoneville, Stoneville
32. 11. P.I. 89775A, All 1943 tests, All 1943 tests
33. 12. Rose Non-Pop, North Carolina, North Carolina
34. 13. Tennessee Non-Pop, Tennessee, Tennessee
35. 14. Tokyo, North Carolina, North Carolina
36. 15. Volstate, North Carolina, Tennessee
37. 16. Wood's Yellow Henson (N.C. Seed Co.), North Carolina
38. "Extra variety at some locations."
40. "Source of seed"
41. "Variety, 1944, 1945"
42. "1. Acadian, Louisiana, Louisiana"
43. "2. Avoyelles, Louisiana, Louisiana"
44. "3. Cherokee, Alabama and Arkansas, Arkansas"
45. "4. Delsta, Stoneville, Stoneville"
46. "5. Getan, Experiment, Georgia, Experiment, Georgia"
47. "6. L Z, Louisiana, Louisiana"
48. "7. Mamotan 6640, Stoneville, Stoneville"
49. "8. Nanda, Arkansas, Stoneville"
50. "9. Pelican #1, Louisiana, Louisiana"
51. "10. Seminole, Experiment, Georgia, Experiment, Georgia"
52. "11. Wood's Yellow, Henson (N.C. Seed Co.), North Carolina"
53. "Plan for Uniform Tests in 1944"
54. "1. Number of replications–4"
55. "2. Length of row–plant 20 feet, harvest 16 feet"
56. "3. Rate of planting–200 viable seeds per 20-foot row"
57. "4. Design–it was the opinion of most everybody at the..."
Conference that since the number of varieties was small, complete randomized blocks could be used.

“5. The station that was to grow seed of each variety in the uniform tests for planting in 1945 was agreed upon. These stations are given above in the variety lists.

“6. A scale for recording shattering notes was worked out which is to be included in the instructions for recording notes in 1944 as follows: ‘Shattering shall be recorded on a scale of 1 to 5 according to the following: (1) no shattering; (2) 1 to 5 percent shattered; (3) 6 to 10 percent shattered; (4) 11 to 24 percent shattered; (5) 25 percent and over shattered.’”

“Mr. Henson suggested that a uniform numbering system to be used by the southern states in designating new selections be set up. The following system was agreed upon:

1. Alabama–Au
2. Arkansas R
3. Florida–F
4. Georgia–Ga
5. Louisiana–La
6. Mississippi–D
7. North Carolina–N
8. Oklahoma–Ok
9. South Carolina–SC
10. Tennessee–UT
11. Texas–TS
12. Virginia–V

“Dr. J. E. Adams brought up the question of the name, ‘Edsoy’, which had been assigned to the soybean variety, F.P.I. 85355 and which was introduced by the Delta Experiment Station. Dr. Adams read correspondence between a grower in the South, the A.E. Staley Manufacturing Company, Decatur, Illinois, and Mr. W.J. Morse which brought out the fact that the name, ‘Edsoy’ for that variety conflicted with the Staley Company’s use of the name, ‘Edsoy’ for one of their food products. The Staley Company had used the name, ‘Edsoy’ for 13 years so the use of that word as a varietal name was clearly a case of infringement on the rights of the Company.

“Mr. Rigney made a motion, seconded by Mr. Manke, that the Conference recommend to the Delta Experiment Station that the variety, F.P.I. 85355 he renamed. Motion carried unanimously.

“Mr. Aamodt suggested that the Conference choose several names and let the Delta Experiment Station make the final decision.

“Several names were suggested. Finally the name ‘Delsoy’ was chosen and the representatives of the Delta Experiment Station agreed on that name for F.P.I. 85355.

“It was suggested that Mr. Morse be notified so that the name could be checked to make sure that it did not conflict with the name of any manufactured food product or with the name of any other variety of soybeans. Mr. McClelland suggested that the A.E. Staley Company be notified of the change” (Continued). Address: U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois.


• Summary: (Continued):

“7:30 p.m., March 2, Stoneville, Mississippi
“L.F. Williams, chairman
“Discussion of breeding methods and maintaining pure seed stocks

“1. Maintaining stocks of pure seed
“Mr. O’Kelly explained a system that he had used to develop pure line strains from the Ogden and Volstate varieties.

“Dr. Aamodt suggested that a large number of plant rows be grown. The off type rows could be discarded or at least kept separate, and the typical rows could either be bulked together or they could be planted in larger plots the next year and then bulk the lines that were alike. The advantage of keeping the lines separate through the second year is that there is an opportunity to check the lines again and make sure that no off type lines were included. This system is essentially the one followed by Mr. O’Kelly. Varieties were assigned to most experiment stations represented at the Conference, and it was suggested that as soon as possible (the plants could be collected in 1941) that this system be used to develop pure seed stocks.

“Ogden and Volstate are the only varieties in the South that have been purified by this method. Dr. Williams suggested that if there are different lines of any of the southern varieties, they should all be grown at the same station to determine if they are the same or not and to save the best one.

“2. Methods of handling hybrid material
“At the North Carolina Experiment Station plants are selected from the F2 population and grown in plant rows in F3. F3 lines that seem to be of the desired type are harvested and planted in a yield test in F4.

“Dr. Williams mentioned that at the Iowa Experiment Station a yield test is conducted in F3 by spacing the F2 plants far apart in the row.

“The backcross method is being used by Dr. Williams and also in North Carolina. The crosses listed below were made by Dr. Williams in 1943. Anyone wishing to have the Laboratory use these to make backcrosses should notify Dr. Williams. The crosses are:

“Female Parent, Male Parent, Number of seeds
Lincoln x Biloxi, 22 seeds
Lincoln x Ogden, 5
“Lincoln x Mammoth Yellow, 6
“Lincoln x Herman, 11
“Lincoln x Edsoy, 13
“Lincoln x Ralsoy, 15
“Macoupin x Ogden, 6
“Macoupin x Herman, 6
“Ralsoy x Lincoln, 8
“Ralsoy x Edsoy,
“Ralsoy x 89775A, 1
“Ralsoy x Ogden, 12
“Ralsoy x Herman,
“Ogden x Edsoy, 7
“Ogden x Biloxi, 10
“Mammoth Yellow x Ogden, 7
“Missoy x Ogden, 14
“Biloxi x Ogden, 13
“Nanda x 81044, 9
“Nanda x Edsoy, 12
“Nanda x Seminole, 5
“Nanda x Rokusun, 2
“Seminole x Rokusun, 1

In 1943 a number of F2 populations and F3 lines were grown at the Delta and North Carolina Experiment Stations. These were harvested and grouped according to maturity dates. It was suggested that Mr. Henson send lists of all of this material to the collaborators in the southern states so they could request the material they thought suitable for their area.

Sixth Session: 8:30 a.m., March 3, Stoneville, Mississippi
P.R. Henson, chairman
1. General agronomic problems with soybeans in the southern states
J.F. O’Kelly:
a. Problems to be considered in soybean projects in the South
(1) Cropping and fertilizer studies to raise level of fertility of soils used for soybean production
(2) Weed control should be cooperative project between agronomists and agricultural engineers
(3) Disease studies
(4) Storage
(5) Development of improved seed stocks
(6) Utilization–determine best varieties for sprouting and canning
b. Discussion
The relationship between germination and seed coat color and retention of viability was brought up. Mr. Carter mentioned that there was some data on this that could be obtained from the U.S.D.A. Seed Laboratory in Washington and mimeographed for distribution.
2. Discussion of date of planting tests and suggestions for 1944 The need for data on date of planting seemed to be general, but there was a difference of opinions on the method to use in obtaining those data. It was finally agreed to select several varieties then each station could select four varieties from that list. The varieties selected were: Macoupin, S100, Arksoy, Ogden, Palmetto, Volstate, and Acadian. Each collaborator was to let Mr. Henson know how many tests he would grow and which varieties would be included.
3. Administrative problems: J.L. Carter
4. General discussion.
Motion by Mr. Manko, seconded by Dr. Aamodt, and passed unanimously that the Conference go on record as appreciating the fine cooperation of the Delta Experiment Station throughout the Planning Conference.
Dr. Adams expressed his appreciation in having the Conference at the Delta Experiment Station.
C.R. Adair, Secretary of Conference
February 29 to March 3, 1944

• Summary: “Article and photos are from Farm Science Reporter.” Editor’s introduction: “Account of a new outstanding soybean variety that will be grown on Midwest farms in the near future.
“A new soybean variety that has ‘showed its heels’ in yielding ability to every other bean with which it has been compared in Iowa for the last five years will be grown by a few Iowa farmers in 1944 and it should be in the hands of many who want to give it a try in 1945 and 1946. It promises to be one more vital aid to our farmers in their ‘food battle’ of this war period.
The new variety, Lincoln, has outyielded Richland, Mukden, B.H. (Black Hilum) Manchu, Dunfield and Illini in northern, central and southern Iowa tests that range from three to five years. The Lincoln has been ahead of every other variety in yield in all of these tests every year. But that doesn’t mean that it may be just the variety you want. For instance, it doesn’t stand up nearly as well.
as Richland, not quite as well as Mukden, but it is better than Dunfield and Illini. In none of the Iowa station tests has it ever lodged badly enough to cause excessive loss in harvesting. Then, too, Lincoln is too late, our tests show, to be safely grown in the northern third of Iowa. We are therefore recommending that it be grown only in the counties from Woodbury, Webster, Black Hawk and Dubuque south and not in any counties north of these.

“We do not need to lean entirely on the Iowa station tests to measure the yielding ability of this new soybean variety, for it has had extensive tests in Ohio, Indiana, Illinois, Missouri and Nebraska also. As an average of 61 replicated trials in those five states and Iowa during the five years of 1938 to 1942, Lincoln has outyielded Illini and Dunfield by an average of 6.1 bushels to the acre, or 22 percent. It has averaged a day earlier than Illini, has lodged less than either Dunfield or Illini and has had superior seed quality. It has been superior to Dunfield in percentage of protein, percentage of oil and drying quality of the oil. Dunfield has been considered the best variety in quality of oil.

“And so—for the southern two-thirds of Iowa, as well as many areas of our surrounding states—Lincoln offers to step up yield of beans to the acre and, because of its higher oil content, it should be a real boon in this war period when fats and oils are so badly needed.

“In order to insure the widest distribution and the most rapid increase of high quality seed of this new bean variety, local units of the different farm organizations in the southern two-thirds of Iowa were asked to recommend men in the different counties best qualified from the standpoint of previous experience, equipment and weed free soil, to receive the 1943 seed. The whole effort has been to place the seed in such a way as to insure its most rapid increase and ready availability to the largest number of farmers for planting in 1945. Arrangements have already been made for the distribution of the entire 1943 seed supply. Many should be able to obtain seed locally for planting in 1945 and almost anyone who wants it for the 1946 crop.

“Not a ‘Hybrid’: Lincoln is not a ‘hybrid’ bean—it came from a natural variety cross between a white flowered Mandarin and Manchu. The original hybrid between these two varieties was grown by C.M. Woodworth at the Illinois Agricultural Experiment Station in 1935. From individual plant selections made and tested by L.F. Williams of the United States Regional Soybean Laboratory, in short progeny rows, this new variety of Lincoln originated. It was first tested in yield trials in 1938.

“In search for superior adapted varieties of soybeans approximately 3000 plant introductions from the Orient have been tested cooperatively in Iowa by the United States Regional Soybean Laboratory and the Iowa Agricultural Experiment Station. Varieties now recommended, such as Mukden, Richland, Illini, Dunfield, Black Hilum Manchu and so forth, are the result of single plant selections from plant introductions into the United States. However, not all of these varieties were selected in Iowa. Nor was the Lincoln variety selected in Iowa. The greatest emphasis in soybean breeding work in Iowa is on the production of superior varieties for commercial utilization.

“Soybeans, like oats, are naturally self-pollinated. To artificially make a hybrid, it is therefore necessary to apply pollen by hand from one variety to the newly opened flower of another variety. This cross pollination must be performed at a critical stage, and even with skilled workers only a few crossed seeds can be produced from many hours work.

“The Iowa Station and other experiment stations are doing some hybridization in cooperation with the Regional Soybean Laboratory. For example, we are trying to ‘hook up’ through hybridization the early maturity and ability which Richland has to stand up and not lodge along with the yielding ability and the good oil qualities of Lincoln.

“Hybridization in soybeans is quite different from that in corn. With corn the plant breeder takes plants which normally are cross-pollinated and sees that they are self-
glasses and good light are essential. The tiny shows the technique in hybridizing soybeans. Magnifying (3) “Lincoln plants at the combine stage.” (4) This “picture plants growing in a 51 inches in height. (2) “This picture [of Lincoln soybean Photos: (1) A single plant of Lincoln which measured climate.

It was through a cross of varieties that Lincoln originated, but the cross happened to be one of the few natural crosses—not made by man.

“Lincoln has a yellow seed with a black hilum (scar), white flowers, tawny (brown) pubescence (the hairiness of stems and leaves) and resembles Manchu in general habit and growth.

“Lincoln is not the ‘last word’ in soybeans and we hope that in the future other still better ones will come. In the meantime, until Lincoln seed becomes available for those in the areas to which it is adapted, what should we do to step up production? Iowa stands second in the United States in the number of bushels of soybeans produced, but third (Illinois and Ohio are ahead) in yield per acre. Iowa soybean yields can be expected to rise steadily as farmers gain experience with this crop, which is well adapted to Iowa soil and climate.

Photos: (1) A single plant of Lincoln which measured 51 inches in height. (2) “This picture [of Lincoln soybean plants growing in a field] was taken just before maturity.” (3) “Lincoln plants at the combine stage.” (4) This “picture shows the technique in hybridizing soybeans. Magnifying glasses and good light are essential. The tiny flower must be carefully opened and the pollen of another variety dusted on the seed producing parts. Lincoln is not a hybrid, but a pure line selection from a hybrid population.” Address: Asst. Agronomist of the USDA stationed at Iowa State College [Ames, Iowa].


• Summary: Dr. Klare S. Markley was born in Philadelphia, Pennsylvania, on December 16, 1896, and spent most of his youth in Maryland.

“He was a sophomore in college in 1916 when the shortage of chemists induced him to take a position as analytical chemist with the Bethlehem Steel company. He spent the next four years in metallurgical and chemical work, becoming chief chemist of the Valley Mould and Iron company in 1920.

“In 1921 he resumed his studies, obtaining the B.S. degree in chemical engineering in 1924 and the M.S. degree in chemistry in 1925 from George Washington university. Later he was given the Ph.D. degree in organic chemistry by Johns Hopkins university in 1929.

“At the same time that he re-entered college Dr. Markley became laboratory assistant in the bureau of plant industry of the Department of Agriculture. He was advanced through the various professional grades to his present position as principal chemist at the Southern Regional Research Laboratory in New Orleans [Louisiana].

“From August, 1927, to October, 1939, Dr. Markley served as senior chemist in charge of the Oil Section of the U.S. Regional Soybean laboratory, Urbana, Illinois, leaving for the New Orleans job in the fall of 1939.

“During his 23 years in the Department of Agriculture Dr. Markley has done research in soils, soil micro-organisms, and various plants and plant products including oils, fats, waxes, and proteins. Results of his researches have been published in a series of 54 scientific and technical papers including several monographs and books on the chemistry and technology of fats and oils.

“Dr. Markley spent the summer of 1936 visiting oil and protein laboratories and consulting with staff members of more than a dozen European universities, research institutes, and processing industries. He served as American delegate to the Second International Congress on Microbiology in London that summer and attended the conferences on Analysis of Fats and Oils at the 12th International Union of Chemistry in Lucerne and Zurich, Switzerland.

“In 1942 he addressed the Second Inter-American Conference on Agriculture in Mexico City on the subject of Latin American oil resources.

“Dr. Markley is a member of the American Chemical Society, American Association for the Advancement of Science, Sigma Xi, Alpha Chi Sigma, and Phi Lambda Upsilon. He has been first and second vice president of the American Oil Chemists’ Society and served on several of its technical committees.”

A portrait photo shows Klare S. Markley.
Introduction: The increased demand for vegetable oils because of wartime needs resulted in the expansion of the program of the U.S. Regional Soybean Laboratory at Urbana, Illinois, to include 12 Southern States. The states comprising the southern section are Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia. Headquarters for the southern section are located at the Delta Experiment Station, Stoneville, Mississippi.

“Introduction: The increased demand for vegetable oils because of wartime needs resulted in the expansion of the program of the U.S. Regional Soybean Laboratory at Urbana, Illinois, to include 12 Southern States. The states comprising the southern section are Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia. Headquarters for the southern section are located at the Delta Experiment Station, Stoneville, Mississippi.

“The most important objective of the Regional program is the development of superior varieties of soybeans for industrial purposes for the South. An essential part of this objective is the evaluation of existing southern strains and varieties of soybeans in Uniform Variety Tests. Since 1936, the Regional Soybean Laboratory has been conducting tests composed of groups of varieties and strains of soybeans classified according to maturity in the North Central States. At the time of the inauguration of the southern program, four such uniform variety groups were being tested. The Uniform Variety Test, Group I, contains the short season varieties adapted to the northern tier of states in the North Central Region. The seasonal requirements of Group II, III, and IV, are progressively longer. In keeping with this classification, the southern soybean varieties were tentatively divided into two Uniform Variety Tests, Groups V and VI.
U. S. REGIONAL SOYBEAN LABORATORY
Urbana, Illinois

RESULTS OF THE COOPERATIVE UNIFORM
SOYBEAN TESTS, 1943

PART II. SOUTHERN STATES

Map: Stoneville, Mississippi.

* * *

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH ADMINISTRATION
BUREAU OF PLANT INDUSTRY,
SOILS, AND AGRICULTURAL ENGINEERING,
DIVISION OF FORAGE CROPS AND DISEASES
cooperating with
STATE AGRICULTURAL EXPERIMENT STATIONS

August, 1944.
RAIM 122
The Uniform Variety Test, Group V, includes varieties which normally mature in late September and early October over much of the South. Group VI contains the later maturing strains. The varieties, Arksoy, Ralson, Ogden, and others are typical of the maturity of Group V, while Mammoth Yellow, Mamloxi, and Biloxi are typical strains of Group VI. In addition to these two Uniform Variety Tests, Group IV composed of varieties of the approximate maturity of Macoupin, were grown at a number of locations in the northern and northwestern part of this region.

“In addition to the Uniform Variety Tests, five Dates of Planting Tests were conducted at various points over the South. It is important to know the effect of date of planting not only on yield of soybeans, but also on the chemical composition of the seed. Relatively wide differences in the chemical composition and yield due to variations in rainfall, temperature, and time of planting, have been reported in the North Central States. The long growing season in the South coupled with the wide variations in rainfall and temperature in different sections of the 12 Southern States are factors which must be fully evaluated in order to successfully expand the production of soybeans in the South.

“Average results, both agronomic and chemical, of the Uniform Variety Tests, Groups IV, V, and VI, and the Dates of Planting Tests for the 1943 season are herein reported. The location of the Uniform Variety and Dates of Planting Tests are shown in Figure 1.”

Page 3: Cooperating agencies and personnel for the Southern States, begins:


“Alabama Agricultural Experiment Station Agronomy Department: H.R. Albrecht

“Arkansas Agricultural Experiment Station Agronomy Department: C.K. McClelland

“Florida Agricultural Experiment Station Agronomy Department: George E. Ritchey

“Georgia Agricultural Experiment Station Agronomy Department: U.R. Gore Louisiana Agricultural Experiment Station Agronomy Department: J.P. Gray

Pages 4-5: Location of cooperative nurseries and cooperators.

Page 6: Map of southern states (divided by a curving line into Upper South and Lower South) showing location of cooperative uniform tests, 1943, A small circle indicates Uniform variety tests. A + indicates Uniform dates of planting tests.


• Summary: “In Champaign County 8 fields of soybeans, largely the variety Illini, were examined by Dr. W.B. Allington of the U.S. Regional Soybean Laboratory and the writer on August 28. Traces of Downy Mildew, Pustular Spot, Bacterial Blight, Septoria Brown Spot, and Alternaria atrans were observed. In a 15-acre field Bud Blight (virus resembling Tobacco Ringspot Virus) was found on 66% of the plants and the crop loss estimated at 10%. In another planting of 30 acres the amount of Bud Blight varied in different parts of the field, ranging from 1% to 90% of infected plants, the loss again being estimated at 10%. The buds at the top of the plant were curling or dying and many of the pods with brown blotches and spots were dropping. Brown necrotic areas were also to be found in the stems when cut lengthwise. In the same 30 acres, a trace of Wildfire (bacterial) was also observed as well as an occasional plant dead from Charcoal Rot caused by Sclerotium bataticola.

On another trip south and west of Urbana, the writer and Dr. Allington were accompanied by J.L. Carter [sic, Carter] and Carl Feaster of the U.S. Regional Soybean Laboratory. A number of the soybean fields in Douglas, Coles, Cumberland, Effingham, Fayette, Shelby, and Christian Counties showed traces of the various diseases already mentioned as occurring in Champaign County. However, in none of the 20 fields surveyed on this trip was Wildfire observed and in only 3 fields was Charcoal Rot found, these in Effingham, Fayette and Shelby Counties.” Address: Emergency Plant Disease Prevention Project.


• Summary: About a year and a half ago the U.S. Regional Soybean Laboratory started work on soybean diseases. The primary objective is the control of soybean diseases by use of resistant varieties. The surveys made in 1943 and 1944 have disclosed 6 or 7 diseases of economic importance, or potentially so. Listed in order of importance they are: Bud blight (virus), bacterial pustule, bacterial blight, sclerotial blight (confined to the South), pod and stem blight, downy mildew and wildfire.

“One reason why the soybean has not been plagued by disease epidemics in this country and was relatively free of
disease until recently may be that we have been growing too many different varieties for diseases to get a foothold. The soybean came to this country in the form of literally thousands of collections made in the Orient.” Address: Assoc. Pathologist, U.S. Regional Soybean Lab.


**Summary:** Editor’s introduction: “Report of the work of the last 8 years of this Laboratory, which is a cooperative organization participated in by the Bureau of Plant Industry, Soils and Agricultural Engineering, U.S. Department of Agriculture, and the agricultural experiment stations of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin, Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia. The author is senior agronomist of the Laboratory at Urbana.

“If I were to sum up the work of the Laboratory in one sentence I would say that we are developing improved varieties and strains of soybeans for industrial use. One of the most essential factors in the economical growing of any crop is an adequate supply of adapted productive strains. The soybean crop is no exception to this rule, making a program of varietal improvement of great importance.

“It was not until 1889 that work on this crop was reported by any experiment station. In that year, W.P. Brooks of the Massachusetts Agricultural Experiment Station brought with him several varieties from Japan and the next year C.C. Georgeson of Kansas secured three introductions from the same country. In 1898 the U.S. Department of Agriculture began the introduction of a large number of soybean varieties from all over the Orient. Since that time around 15,000 introductions have been made by the Department and the majority of the present commercial soybean varieties have come from these introductions as a result of improvement through selection.

“Thirty Years: Breeding and selection work to develop improved strains of soybeans with respect to yield and other agronomic characters has been carried on by experiment stations for the last 2 or 3 decades. The high protein and oil content of the seed and the need of these constituents for food and feed has made necessary a large-scale breeding program to meet the demand for improved varieties.

“The U.S. Regional Soybean Laboratory was started in the spring of 1936 as a Bankhead-Jones project, and headquarters were established at the University of Illinois, where adequate laboratory, greenhouse, and office facilities have been provided by the University. With this inauguration of the Laboratory as a cooperative undertaking by the U.S. Department of Agriculture and the 12 states of the North Central Region, a more extensive breeding program became possible, using chemical analysis of strains as a further basis for selection.

“Several thousand soybean plant introductions and selections being grown at the cooperating state experiment stations have been studied for agronomic behavior—such as yield, lodging resistance, shattering resistance, height, seed quality, etc.—and the seed analyzed chemically to determine the best strains for industrial use. Much of our effort during the first few years of the laboratory was devoted to improving the technique of testing strains and in learning the effect of such factors as date and rate of planting, soil type and fertility level of the soil, fertilizer applications, time of trimming the ends of the plots, effect of adjacent varieties of different maturity and many other factors on the accuracy of the soybean yield testing work. All this was a necessary preliminary to any large scale testing of new strains.

In 1938 a system of uniform soybean variety and strain tests was started in the North Central States. In these first tests about 20 or 30 improved strains were grown along with a few of the best commercial varieties. These uniform tests were grown at several locations in each of the cooperating states and seed samples were sent to the analytical section of the Laboratory for chemical analysis. During the first years of this work only three groups of strains were grown and were designated as the early, midseason and late tests. It was soon found that this designation of the tests was inadequate, especially as the area served by the Laboratory increased.

“When speaking of soybean varieties, the terms early, midseason, and late must always be thought of with reference to some small area or zone of latitude under consideration. As an example of this, the variety Macoupin which is considered as a late variety for Illinois is a very early variety for Mississippi conditions. We are now endeavoring to express the maturity rating of a new strain in relation to some standard adapted variety with which we are all familiar. Thus we are using the variety Illini as the reference strain for the group adapted to Central Illinois, and can express maturity of the other selections in the nursery as so many days earlier or later than Illini.

“The number of uniform nursery groups in the North Central States was increased to four in 1942. In July of that year the part of the Laboratory work devoted to the development of new industrial uses for soybeans was transferred to the Northern Regional Research Laboratory at Peoria, Illinois, and at the same time the area served by the U.S. Regional Soybean Laboratory at Urbana was enlarged to include 12 of the southern states as well as the original 12 states of the North Central Region.

“To adequately serve the breeding program of the greatly expanded laboratory region a total of eight uniform nursery groups have been arranged for 1944, including strains early enough for Minnesota and late enough for the Gulf Coast states. Of these nurseries, the Uniform Test, Group 0, is composed of very early strains suitable for the northern part of the North Central Region. Group I is made
up of slightly later material, suited to the latitude of central Wisconsin and southern Minnesota. Group II is composed of strains of a proper maturity for the latitude of northern Illinois and central Iowa. Group III is adapted to central Illinois and Group IV to southern Illinois and Missouri. Groups V, VI, and VII composed of progressively later soybean strains are adapted to the Southern States. These uniform nurseries furnish a means of accurate and rapid determination of the value of any new strains developed through the breeding work.

"Definite progress has been made in the breeding and testing of new soybean strains. Certain strains have been found especially suited to certain specific conditions of environment. One of these strains, Richland, selected by the Indiana Agricultural Experiment Station from a U.S. Department of Agriculture plant introduction is particularly adapted to soils of high productivity due to its short habit of growth and lodging resistance. On the other hand, Earlyana, developed by the Indiana station and widely tested by the Laboratory is 4 or 5 days earlier than Richland and on account of its earliness and tall growth habit is especially adapted to the less fertile soils of the northern part of the soybean belt.

"One of the most important achievements of the cooperative work has been the development of the variety Lincoln. This strain is from a natural cross discovered by the Illinois Agricultural Experiment Station in 1934 and selected by the Laboratory on the basis of outstanding yield and oil content of the seed. In a 4-year comparison in the Uniform Test, Group II, comprising 49 nursery trials in five states, Lincoln has averaged over 5 bushels per acre higher in yield than the average of Illini and Dunfield.

"In the Group III test where it has also been grown for the last 2 years it has shown the same advantage in yield over Illini and Dunfield. In oil content the strain is slightly superior to Dunfield and Scioto, the best in oil of the present commercial varieties, and over 2 percent above Illini. Lincoln has averaged superior in lodging resistance to the common varieties in its maturity class and has excellent seed quality. The variety is adapted in the area where Illini and Dunfield are generally grown and may replace these varieties if its present performance is maintained. This season over 900 cooperators in the soybean belt are growing a total of over 19,000 acres of registered Lincoln seed and there should be sufficient seed to plant nearly 400,000 acres in the spring of 1945." Continued.


• Summary: (Continued): “One of the more important projects of the U.S. Regional Soybean Laboratory is the development and distribution of breeding stocks containing the best of the germ plasm discovered through yield testing and chemical analysis. There is a demand for early varieties, and to supply this need a rather comprehensive group of crosses has been made, including the most important early strains in combination with themselves and with later strains outstanding in yield and composition of seed, resistance to lodging, and other agronomic factors. These stocks have great promise for producing strains for the northern states that are early, high yielding, resistant to lodging, and high in oil content. Lincoln, one of the superior varieties, has been crossed with Richland, a strain maturing about a week earlier and outstanding in lodging resistance. This hybrid was backcrossed to Lincoln in an attempt to secure a strain with the high yield and oil content of Lincoln and the earliness and lodging resistance of Richland. Such a strain would be of great value in northern Ohio, Indiana, Illinois, and Iowa, and in southern Minnesota and Wisconsin.

"Several thousand selections from the back-cross are being grown this year in these states in the search for improved lines. Another backcross involving Lincoln and Pagoda, a very early Canadian variety, was made to secure a strain with the yield and composition of Lincoln and early enough for the northern states of the North Central Region. This segregating material has been distributed widely for testing.

"Disease Not Neglected: Breeding for disease resistance has not been neglected. A pathological section was added to the Laboratory in the spring of 1943 and an intensive search started to locate disease resistant soybean lines to use in the breeding program. In connection with this study it has been necessary to learn more about the fundamental host-pathogen relationships and the conditions for infection so that the soybean strains in a nursery could be given an adequate test for disease resistance.

"A study of the behavior of soybean strains has indicated very clearly that soybean breeding problems cross state lines and that a regional approach to the problem and close cooperation between interested agencies is most desirable, both from the standpoint of economy of operation and of progress in the developing of improved strains. The development of the variety Lincoln is a good example of the value of cooperative testing by several state experiment stations. The establishment of a chemical section in the Soybean Laboratory has made possible for the first time an extensive use of chemical analysis as a very important tool in the breeding work. The cooperation of other bureaus in the U.S. Department of Agriculture and of industrial processors has aided in determining the type of soybeans needed as a raw material for industrial and food use. Thus the increased need for cooperation and the increased dividends resulting from this cooperation are seen in the progress of the work to develop improved strains of soybeans to fill specific needs.

"In the future one of the most useful functions of the U.S. Regional Soybean Laboratory will be the production and distribution of segregating material from promising
soybean crosses and the coordination of the testing program over the region to provide for the more rapid development of improved varieties and strains.”

Note: This is the earliest document seen that clearly describes the history and evolution of the concept of “maturity group”—although it never uses that exact term. Instead it uses terms such as “maturity rating,” “uniform nursery groups,” “Group 0,” “Group I,” “Group II” up to “Group V, VI, and VII.” The clarification of these concepts came out of the cooperative trials of the U.S. Regional Soybean Industrial Products Laboratory.

A small portrait photo shows J.L. Cartter.


- **Summary:** Editor’s introduction:
  “Dr. May, as chief of the Bureau of Agricultural and Industrial Chemistry, administers the four regional research laboratories. He organized and directed the Northern Regional Research Laboratory at Peoria, from the time of its establishment in 1939 to 1942. Prior to that, he organized and directed the Soybean Industrial Products Laboratory at Urbana. Forty-two years old, Dr. May is one of the younger men in responsible research positions.”


About the U.S. Regional Soybean Industrial Products Laboratory at Urbana, Illinois, and the Northern Regional Research Laboratory at Peoria, Illinois.

“To establish a base from which we can estimate the future, it is desirable first to survey the past. A survey of the history of the development of the soybean industry in the United States is both interesting and enlightening. Being a research man, of course, I will talk about the part that research has played in the development of the soybean. For this purpose I wish to return briefly to the early part of 1936, the time at which the U.S. Regional Soybean Industrial Products Laboratory was authorized by the Secretary of Agriculture. At that time it was apparent that much needed to be done and that a centralized laboratory could perform useful services not only by its own research but also by collecting information for all those wishing to advance the industrial utilization of soybeans.”

“Wholehearted Cooperation: One of the most important factors in the Laboratory’s research on soybeans in the past and one of the best omens for progress in the future is the wholehearted cooperation between all parties concerned. The program of the Laboratory was outlined and the location fixed at a conference between the agricultural experiment station directors of North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa, Missouri, Wisconsin, Illinois, Indiana, Ohio, and Michigan, and U.S. Department of Agriculture representatives. Suggestions on, and assistance in, formulating the program were also received from the National Soybean Processors Association, individual soybean companies, and, last but not least, the American Soybean Association.

“In the physical establishment of the Laboratory, great credit is due to Dr. W.L. Burlison for his wise guidance and assistance. Through Dr. Burlison and the late Dean Mumford, every facility of the University was placed at our disposal, and Dr. Burlison’s keen interest and enthusiasm have been a continued support to our program. Laboratory work was also undertaken at the agricultural experiment stations of Indiana and Minnesota under the direction respectively of Doctors H.R. Kraybill and C.H. Bailey. These two men, together with collaborators appointed from the other states mentioned previously, have contributed to the success of the Department’s research on soybean utilization.”

“In July 1942 the chemical and engineering research of the Laboratory was transferred, by an act of Congress, from Urbana to the Northern Regional Research Laboratory at Peoria. The years from 1936 to 1942 had been productive.”

“Removal to Peoria: Removal of part of the Laboratory to Peoria has resulted in an expansion of all phases of soybean research. Increased facilities at the Northern Regional Research Laboratory have permitted faster progress on the chemical and engineering program. In the brief period since the move to Peoria, Norepol and Norelac have been developed. Both of these products are based on certain polymerized fat acids for which soybean oil is by far the largest source. Study of the separation of soybean oil into fractions by liquid-liquid extraction was started at Urbana and is being actively continued at Peoria.”

A small portrait photo shows O.E. May. Address: Chief, Bureau of Agricultural and Industrial Chemistry.


- **Summary:** “Our soybean production is now the largest of any nation. Whether this production will drop back to one hundred million bushels annually, remain about the same, or increase another one hundred million bushels, is the question. It all depends on the price offered the American farmer. As long as he can get a per bushel price as good in comparison to prices of corn, oats and wheat as he is getting today, you can look for no decrease in our soybean acreage. It would be, in my opinion, the height of folly to venture even a guess as to what the price might be a few years after our wars are over.

“The world is overflowing with vegetable oils of low production cost ready to pour into our country just as soon as ships are ready and available for such use. What about the postwar tariffs? Will markets for fats and oils be developed
abroad? Will renewed imports of vegetable oils lessen the demand for soy oil? Will proteins, other than those derived from the soybean, depress the price of the soybean when we have fewer animals to be fed?

“These are some of the factors which will determine our production in the postwar years. Of one thing we can be certain—progress will be made in securing better yielding varieties, in more efficient methods of removing the oil from the bean, and in developing many new uses for various bean products. Of the newer varieties, we should consider the Earlyana and the Lincoln—both discovered and developed by Cornbelt agricultural colleges, and experiment stations.

“The Earlyana is a new variety released by Purdue in 1943. It is one of the earliest varieties of satisfactory oil content recommended for northern Indiana and northwestern Ohio, being 5 to 7 days earlier than the Richland. It is taller than the Richland, does not set beans so close to the ground and will out-yield the Richland on lighter soils.

“The Richland will continue to be a popular early variety on very fertile soils in northern Ohio and Indiana, but it is expected that the Earlyana will largely replace the various other early varieties, on all lighter soils.

“The Earlyana will give growers wanting to follow soybeans with wheat, ample opportunity in the shorter season areas to get wheat in the ground by fly-free date or soon after and will yield within 2 to 4 bushels of the midseason varieties such as Dunfield, Illini, Manchu and Mandell, which mature 10 days to 2 weeks later than the Earlyana and are generally too late for wheat seeding. These early varieties will mature when planted later than the midseason varieties can safely be planted.

“No Earlyana seed was available for general use in 1944, but there will be quite a little for 1945 and probably plenty for 1946.

“Lincoln variety: The Lincoln soybean is the most outstanding of all soybean varieties yet introduced. It is a product and development, primarily of the Illinois Experiment Station and the Illinois College of Agriculture. We Ohioans wish we might claim some credit, yet we are forced to admit that we never saw it until 1939. The Lincoln has been tested for the past 6 years in 82 cooperative tests throughout the soybean belt. Ohio, Indiana, Illinois, Iowa, Missouri and Nebraska cooperated with the U.S. Regional Soybean Laboratory in these tests. The Lincoln has averaged 4 to 6 bushels, or 20 percent higher yield in these tests than such other standard midseason varieties as Dunfield, Illini, Mingo, Mandell and Scioto. Lincoln should now replace all of these varieties including the various strains of Manchu. It also lodged less, had better quality seed, matured at about the same time as the Dunfield and Illini and averaged 8 percent more oil with a higher iodine number. In regional tests in the above states it yielded 5.9 bushels more than Mandell and contained 2.3 percent more oil. With these definite figures of superiority, it is reasonable to state that the grower, who has Lincoln seed for his soybean acreage, can cut his production costs 25 percent. That is, if it costs him $1.00 to grow 1 bushel of Dunfield, he can grow a bushel of Lincoln for 75¢ which is a material saving in anybody’s business.

“There was no Lincoln seed available for 1944 except to growers who have agreed to increase it for seed purposes only. Considerable seed will be available for 1945 and enough for everyone, we hope, by 1946. Along the line of new uses, we may also expect many new chemurgic developments which, in the aggregates will require an increasing percentage of our soybean production.

“Last February in Columbus we had a two-day meeting sponsored by the National Forecast Council of the Ohio Development and Publicity Commission. A number of outstanding men made very wonderful talks relative to what the postwar years had in store for us. One of these talks was of especial interest to me. It was made by Robert A. Boyer, formerly of Ford Motor Co. and now with The Drackett Co.—you all know him. Mr. Boyer, as a research man, tried to pass on to his listeners some of his enthusiasm for the future of the soybean, along with some practical reasons for his enthusiasm. I am going to attempt to give you sort of a brief of a portion of Mr. Boyer’s talk.

“Mr. Boyer said that in spite of the large amount of publicity given the soybean oil and the use of the residue meal, containing the high percent of protein, the most promising and interesting part of the story has not been told.

“In our childhood days we learned to classify objects and materials in the so-called ‘Animal, Mineral or Vegetable Kingdoms.’

“It is with the mineral group that we, as a people, have reached our highest degree of achievement. As we think of this accomplishment, we must acknowledge that the mineral deposits of the earth’s surface have been pretty well discovered and probably are on the way to exhaustion. Sooner or later we are going to have to obtain our mineral supplies from more distant and remote points, or from materials bearing a smaller percentage of the desired elements. Costs will go up. Some nations will not have desirable supplies of necessary minerals.

“Let us consider the vegetable world. Man’s accomplishment in this kingdom is not impressive. There are over 250,000 species of plants already identified by botanists. Of this number we make use of less than 1 percent, and this 1 percent includes our agricultural industry.

“In this vegetable world we find an awful lot of what our scientists call cellulose. The wood from the trees, the stalks and leaves of all plants and crops are mainly cellulose. Today we have vast industries in lumber, cotton, rayon and plastics, all products of a certain type of mechanical manipulation of cellulose. The vegetable world will repeat itself year after year. The science of farming today is, in part, simply a method of controlled production of a very few vegetable plants. Nature really does the job. She gives us an

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inexhaustible supply, a definite advantage over the limited minerals.

“In the plants, the seed is the only part in which we find any quantity of fats and protein. As I said before, the stems and leaves are cellulose.

“Highest form: The animal kingdom represents nature in its highest and most complex form. In the animal kingdom protein plays the same role as cellulose in the vegetable kingdom. Protein is the essential and all important element in every moving thing and living creature on this earth. But when we look for important industries other than food based on protein to compare with the cellulose developments of the vegetable world, we find none.

“Here is where the soybean comes into the picture. This new chemurgic crop makes available to industry for the first time an almost unlimited supply of low cost protein that can be easily stored, handled and extracted in a pure form.

“A few years ago, when it was first realized that such an inexhaustible supply of low cost protein could be secured from the soybean, our research laboratories, which were devoted to this type of experimentation, immediately started a program to convert the protein directly from the soybean into fiber instead of feeding it to the sheep and harvesting the wool from the sheep. These research men, after many years of tireless work, are able today to produce a useful fiber directly from the soybean. Although they feel that their present results are crude in comparison to what they will develop within a few years, their present product indicates, positively, that they are on the right track. It requires the produce from 1 acre of land to support 1 sheep for 1 year to produce 8 pounds of wool. If the acre of land is used for the production of soybeans, the scientist can produce 200 pounds of soybean fiber.

“All other fibers produced from the vegetable world, such as cotton, flax, hemp, are composed of cellulose. All fibers produced by the animal kingdom are composed of protein. In spite of the fact that many of the cellulose fibers are cheaper and sometimes stronger, man is still dependent on the protein fibers, such as wool, for all uses which require warmth, resilience and the ability to retain a desired or given shape. And so we have the protein fiber made directly from the vegetable world. It is but the start of a new industry which can be highly important and far reaching in its effects. A new use for the soybean, which at present is profitably utilizing 14 million of our American farm acres.

“We will all agree that the soybean is a desirable crop from the farmers’ standpoint, if and when the unit price is sufficient to give the farmer some money advantage over other crops. Since laws already passed provide for a floor on farm products, for 2 years after our wars are over, of 90 percent parity, it is certain, in my opinion, that we will have for each of the next 2 years an acreage planted little less than the 14 million we have in 1944.

“From 1946 on I am most optimistic. I have the greatest of confidence in the soybean and in the men behind the soybean industry. I have been intimately associated with both for many years. Difficulties have been met and overcome in the past, and difficulties will be met and overcome in the future. You, my readers, have a similar feeling.”

Address: Director, National Farm Chemurgic Council; President, Farm Management, Inc., Irwin, Ohio. A former president of the American Soybean Assoc.


Article IX, Committees, lists and describes each.


Urea yield committee (14 Sept. 1945).


Note: This is the earliest document seen (March 2008) that uses the name “North Iowa Cooperative Processing
**Summary:** “Prominent among the early soybean growers in the Midwest, who began to study and visualize the possible future of this new crop as early as 1890 in Illinois was J.C. Utter of Wabash County, later followed by Stoddard, Hurrelbrink, Rowe, Allen, Meharry, Smith, Oathout, and Riegel. In Indiana were the Fouts Brothers of Carroll County, J.B. Edmondson of Hendricks County, and Frank Goodwine of Warren County. In Ohio were Glen G. McIlroy of Union County and Leonard Hill of Miami County. In Iowa, Bert Strayer, William McArthur, John Sand, and J.W. Hohlacher were some of the earlier growers. Many other states like Wisconsin, Missouri, and the Carolinas had their earlier growers and champions.”  
“As early as 1915 demonstration projects were set up in different counties in the various states for the purpose of acquainting farmers with the new soybean crop and its culture.” “Early processors: The value of such field demonstrations may be illustrated by referring to some of Illinois’ early progress. First in 1920, Illinois had three demonstrations in the state and in 1925, 28 counties had demonstration plots. This brought the soybean work to the very front door of many farmers.  
“Second in 1922, approximately 50 bushels of a pure selection of Manchu soybeans were introduced into the state from A.A. Evans, West Branch, Michigan, and certification of that seed started. A soybean survey made at the end of 1927 indicated that the Manchu occupied between 65 to 70 percent of the commercial soybean-producing area in Illinois.  
“Third, the rapidity with which farmers have changed to new and better varieties of a crop is illustrated by the swing from Manchu to Illini… Illini was introduced into the (demonstration) plots in 1924 and was released for increase in 1926. A survey made in the fall of 1930 showed the Illini on three-fourths of the commercial acreage.  
“A very definite ‘bottle neck’ began to show up in the soybean production in the early ’20’s, because of the lack of proper harvesting equipment. The small grain harvesting and threshing machinery was not at all adequate and satisfactory. Due to the fact that soybean were not ready to harvest until late fall, the soybean grower encountered many difficulties, such as fall rains, mud, competing with corn harvest, etc.  
“As early as 1920, at a large soybean meeting held on the Fouts Brothers farm at Camden, Indiana, Taylor Fouts showed us a small direct harvesting machine for soybeans. I am sure that the most optimistic persons attending that meeting did not realize that the combine harvester would become prominent in harvesting soybeans so quickly.  
“In the fall of 1924 Garwood Brothers used the first combine in the state of Illinois to harvest soybeans. Fortunately the first combines which came into the soybean fields did a good enough job to prove that they had a future in soybean harvesting, but they were far from being perfect. Consequently for several years, many of the combine builders spent days and weeks with their respective machines in the soybean fields. From 1926 to about 1930 it was no uncommon sight to see a carload of men, including president, vice-president, chief engineer and the best mechanics the company had drive into the soybean field and spend plenty of time, not only studying to improve their own machine but not missing an opportunity to see what improvements the other manufacturers had made. The agricultural engineers of the various college made a very definite contribution in helping improve the combine. As an example, during those early years Mr. Blauser and Mr. Young of our own [Illinois Univ.] Agricultural Engineering Department spent many days in the fields behind the combine gleaning the straw and stubble for wasted soybeans.  
“Another stalemate in the development of the soybean industry seemed unavoidable previous to the establishing of a commercial market for the surplus beans. The earlier popularity and demand for seed kept pace with production for a few years but in the early 20’s many of the producers began to see the day when the demand for seed beans would not be equal to the crop harvested. Efforts to find a commercial processor willing to help pioneer a new industry made relatively slow progress. The processor immediately found it difficult to interest manufacturers of mixed-feeds in soybean products. They were reluctant to attempt to add soybean oil meal to their formulas because there was no assurance of being able to get the needed amount each year. The producer, at the same time, was thinking about reducing his acreage of soybeans because he feared there would not be a market outlet for his beans. This rather uncertain production program came to a climax in 1928.  
“Peoria Plan: As a result of suggestions made in the winter of 1927-28, H.G. Atwood, president, and Arthur G. Heidrick, vice president, of Allied Mills offered to discuss the possibilities of working out a marketing plan for the increased output of soybeans. At a conference attended by Messrs. Atwood, Heidrick, James McConnell of G.L.F. Farms, Farm Adviser Wilfred Shaw and J.C. Hackleman, a plan was formulated for underwriting the production of 50,000 acres of soybeans. Press and radio helped acquaint producers with the program.”  
“This guaranteed price for soybeans did not stop in 1928 but was renewed in 1929 not only with Illinois but was also offered to Indiana and Ohio. This was surely the turning point in soybean history.  
“In the winter of 1928–29 a small group of members of the American Soybean Association, Walter Godchaux of Louisiana, C.L. Meharry of Indiana, John T. Smith and W.E.
Riegel of Illinois went to Washington [DC] in the interest of tariff protection in soybeans, soybean oil and soybean oil meal. Until 1930 soybean producers had very little protection on beans and oil and none on the meal.

“The introduction of adapted varieties makes possible soybeans more economically is to plant better varieties. Because we believe that one of the best ways to produce soybeans. We have put a major emphasis on this project. Soybean Laboratory is the development of improved strains of soybeans. Some of the ways in which soybeans may be improved are as follows:

• **Summary:** “One of the major projects of the U.S. Regional Soybean Laboratory is the development of improved strains of soybeans. We have put a major emphasis on this project because we believe that one of the best ways to produce soybeans more economically is to plant better varieties.

“The introduction of adapted varieties makes possible a wider distribution of profitable production. In established areas improved varieties can raise the yield of beans per acre or the yield of oil per acre without appreciably increasing production costs, thus lowering the cost per unit produced. Although the breeding work has been centered at Urbana during the first 6 or 7 years of the Laboratory, large scale projects have also been under way in Iowa, Indiana, Ohio, and Missouri, and in the past 2 years Wisconsin, Minnesota, Nebraska, Mississippi, and North Carolina have increased the scope of their breeding programs.

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“Some of the ways in which soybeans may be improved are as follows:

1. Increase the ability to produce seed.
2. Increase the resistance to lodging.
3. Increase the resistance to disease.
4. Increase the resistance to insects.
5. Select for more suitable maturity, i.e., earlier or later strains for certain sections.
6. Improve the chemical composition.

“The attempt to increase the yield per acre has received the most attention in the breeding work until recently. There are two reasons for this. First, yield is the most important characteristic and the one most intimately connected with production. If a new variety yields better than the old, farmers are quick to see the advantage of the new strain. Second, an increase in yield of beans per acre has seemed the easiest way to increase the yield of both basic soybean products, meal and oil. So far it has not been difficult to find in almost any segregating population, strains which exceed the yield of the parent varieties. In our present crosses we can hope to secure strains yielding 10 percent more than the parent varieties. Of course, as the level of production is increased in each breeding cycle it probably will become more and more difficult to improve upon the yielding ability of the parent lines.

“Lodging Resistance: Selection for resistance to lodging has also received considerable attention. The Iowa program has especially stressed this characteristic since lodging is quite an important factor in certain sections of that state. Richland has been the most outstanding strain in regard to lodging resistance. This resistance is easily recovered in crosses between Richland and other strains. Due to its relatively early maturity and lodging resistance Richland has entered into a high percentage of the crosses in the northern breeding programs. Patoka and Illinois T117 also contribute considerable lodging resistance to their crosses.

“In the South, Ogden seems to be a promising parent where resistance to lodging is needed, especially on the heavier soils. So many selections from the Richland and T117 crosses look promising that selections from these crosses make up far more than their share of the entries in the preliminary yield trials. It should be pointed out that all of these strains mentioned above are determinate in habit and that a portion of their lodging resistance is due to this characteristic.

“Disease Resistance: To date very little has been done in regard to selection for disease resistance, since the pathological program of the Laboratory has been under way such a short time. However, real progress is being made and it is hoped that in the near future methods can be worked out to test the resistance of selections to a number of important diseases. No clear-cut cases of immunity have been observed in the northern states, but some indications of resistance to Sclerotium rolfsii and root knot [nematode] have been observed in the South and breeding work is under way in North Carolina to transfer this resistance to several of the better commercial strains such as Ogden and Volstate.

“The Laboratory has not initiated any work in regard to selection for insect resistance.

“Date of maturity is an interesting character to work with. In the northern states some varieties are grown with maturities (at Urbana) of 85 days, while the southern states have some which need 185 days to mature. This means that separate breeding programs must be undertaken to supply strains of the proper maturity for each region.

“In general, strains which mature during the hot dry weather of July and August produce poor quality seed, but there is some variability in this respect. For some purposes an early maturing bean is desired and an attempt is being made to secure strains which will mature in early fall and still produce good yields of good quality beans. In much of the South and parts of southern Indiana, Illinois, and
Missouri seed quality is a major factor limiting soybean production. This is closely related to date of maturity. The varieties Patoka and Gibson have helped fill the need for strains of suitable maturity and are able to produce good yields of good quality seed in southern Illinois and Indiana.

“It is a rather common thing to find transgressive segregation for date of maturity in soybean crosses. For instance in a recent cross between Lincoln and Richland, we found some selections which were 10 days earlier than Richland, the earlier parent, and others a week or more later than Lincoln. This fact is of considerable help in breeding work. The cross referred to was made to combine the high yield and chemical composition of Lincoln with the earliness and lodging resistance of Richland. Without the necessity of introducing a third variety, we have gotten strains early enough to go much farther north than either of the parent strains.

“Ever since the foundation of the Soybean Laboratory we have placed considerable importance on the chemical composition of soybean varieties. The fact that most soybeans are processed for oil and meal makes it desirable to have varieties containing the greatest possible quantities of oil and protein. The newly released Lincoln variety contains about 1 percent more oil in the seed than most of the varieties commonly grown in the area to which it is adapted. Breeding work is under way in an attempt to further increase this oil content in Lincoln.

“A new strain from the Iowa program also looks very promising from last year’s uniform tests. This strain has an oil content as high as Lincoln, yields almost as well, stands as well as Richland, and is as early as Richland. In the South the variety Ogden has been found outstanding in oil content, and extensive breeding work is under way to further improve this strain by crossing with other high oil varieties and backcrossing to Ogden in an attempt to retain its high yield, drouth resistance and other desirable characters.

“The hybrid material produced in the breeding programs of the various states cooperating in the Laboratory has been made available to other states. In this way a large number of crosses have been distributed as bulked F2, F3, F4, or F5 populations. A number of selections have also been exchanged between the various states to hasten the testing program. On account of this preliminary testing new strains entered in the uniform testing program have a better chance of exhibiting wide adaptability.

“This uniform testing program is designed to produce the most information in the shortest time from the effort expended. At present there are eight uniform test groups. In these tests are entered the more promising new strains produced by the various breeding programs as well as a number of standard commercial varieties for comparison. Generally these tests contain from 10 to 25 strains and may be planted at from 10 to 40 locations. The agronomic and chemical data from these tests is summarized and made available to all the cooperating agencies.”

Note: This is the earliest published document seen (July 1998; and the second earliest overall) concerning the “release” of a soybean variety, in this case Lincoln. Address: Assoc. Agronomist, U.S. Regional Soybean Lab.


• Summary: Page 2, “Explanatory notes” states: “This is a list of the research projects concerned with soybeans, including edible soybeans and soybean products, currently active at the several State agricultural experiment stations. It was compiled in response to requests from the State experiment stations, the U.S. Department of Agriculture, and other agencies for such information as an aid in their work on various problems connected with the production, handling, and utilization of soybeans.

“This list supersedes a similar publication entitled Soybean Projects of the State Agricultural Experiment Stations, 1937 (May 20, 1937). Most of the projects listed as active in the earlier publication have been completed and replaced by new researches. These deal with numerous problems constantly arising in the soybean industry and reflect the broader scope and greater complexity of the general problem. Enormous expansion in the United States soybean acreage, with recent shift in center of production from the Southeastern States to the Corn Belt, has brought forth problems inherent in the peculiar sensitiveness of soybeans to variations of soil and climate. In addition are those problems concerned with newer production methods, changes in cropping systems, insects and diseases, harvesting, and storage. Other fields of inquiry have come out of wartime demands for soybean oil and meal for use in strategic materials, and the increasing use of soybean meal as a high-protein feed for livestock and poultry. Changes in eating habits in which the soybean plays an important part as a green or dried vegetable and as a protein food to supplement animal products, like meat, eggs, milk, and cheese, have also provided many problems for station research.

“Stations cooperating with the U.S. Regional Soybean Laboratory (Urbana, Illinois) in conducting coordinated adaptation (nursery) tests with groups of varieties and selections include the Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, North Carolina, North Dakota, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Virginia, and Wisconsin Stations. At several stations these tests are carried on as distinct projects, while at other stations the tests proceed as phases of other projects.

“The entries in the list include the project title,
experiment station departments involved, and cooperation with the U.S. Department of Agriculture.”

As an example, here is the first state listed:

Alabama


“Soybean variety test, Agron. & Soils, 3 substations.


“Adaptation of edible soybean varieties, Agron. & Soils.

“Forage tests for hay, temporary grazing, and winter grazing value, Agron. Soils.

“The inorganic nutrition of plants, Agron. & Soils.

“Effect of inoculation on certain legumes, Agron. & Soils,


“Oil crops for Alabama, Agron. & Soils.”

Note 1. Abbreviations:

Agron. = Agronomy
An. Indus = Animal Industry
B.P.I. = Bureau of Plant Industry (USDA)
Coop. = Cooperating with

In addition to “Stations cooperating with the U.S. Regional Soybean Laboratory,” states where soybeans is a very minor crop are also listed with their projects, e.g., Alaska, Arizona, California, Colorado, Delaware, Hawaii, Washington State, West Virginia, and Wyoming. Address: Senior Experiment Station Administrator.


• Summary: Contents: Part I: Foreword, by Edward Jerome Dies, President, Soybean Nutritional Research Council. Introduction. Composition and properties. Mineral constituents. Protein and other nitrogenous constituents. Enzymes. Carbohydrates. Glycosides: Saponins, phytosterolins, isoflavone glycosides. Pigments. Vitamins. Oil and oil-soluble constituents. Physical and chemical characteristics of soybean oils: Acetyl value (see hydroxyl number), acid value (see free fatty acids), break material (mostly phosphatides, pigments, and mucilaginous materials), color, congealing temperature, density, diene numbers, fatty acids, flash, fire and smoke points, fluorescence, free fatty acids, Henner number, hexabromide number, hydroxyl number, iodine number, optical rotation, refining loss, refractive index, Reichert-Meissl number, saponification number (or Koettstorfer number), smoke point (see flash), specific heat, thiocyanogen number, titer, unsaponifiable matter, viscosity, miscellaneous data (Weight of soybean oil per gallon: 7.67 pounds. Weight of soybean oil per standard U.S. tank car: approximately 61,000 to 62,000 pounds. Volume of soybean oil per standard U.S. tank car, approximately 8,000 to 8,060 gallons).


Literature cited.

Part II: Development of the soybean processing industry. Grading and storage. Methods of processing soybeans. Processing by means of continuous presses: The Anderson expeller, the French screw press, operation of continuous presses. Processing by means of continuous solvent extractors: The Hildebrandt system, the Bollmann system [or Hansa-Mühle], extraction system of the French Oil Mill Machinery Company (so closely resembles the Bollmann system in most respects that a detailed description will not be given), the Allis-Chalmers extractor, the Ford extraction system, the Detrex continuous extractor (uses non-inflammable trichloroethylene), other solvent systems, solvents, hot alcohol extraction process, extractor design data. Hydraulic pressing. Miscellaneous processing methods. Soy flour. Cost of processing soybeans: Manufacturers of soybean processing equipment, soybean processing mills in the United States. Production and refining phosphatides. Processing soybean oil for food uses: Neutralizing and washing, bleaching, hydrogenation, deodorization, winterizing, shortening, margarine. Literature cited.

The Allis-Chalmers extractor (p. 180-82): An early edition (Fig. 20) consists of a vertical, cylindrical column containing “a series of horizontal circular plates, equally spaced and fixed to a central shaft which is slowly rotated by a gear-motor. The upper surface of each plate is wiped by a stationary scraper arm fastened to the inner wall of the cylinder. Slots are cut in the plates so that, during rotation, the stationary baffles sweep material, resting upon the disks, through the slots into the plate immediately below.” Footnotes explain that this design is based on U.S. Patents issued to Michelle Bonotto in 1937, 1938, and 1939, and called the Extractol Process.

Figures (photos unless otherwise noted) show: (1) The soybean plant, in foliage and mature. (2) Graph of spectral transmittance and color of crude pressed soybean oils. (3-4) Graph of spectral transmittance and color of crude, solvent-extracted soybean oils. (5) Elevators at a soybean processing mill (Central Soya Co.). (6) Cracking rolls used to prepare soybeans for pressing in expellers or screw presses (Allis-Chalmers). (7) Two steam-heated rotary driers connected in series for drying cracked soybeans (Allis-Chalmers). (8)


Footnote: *"This list is compiled for the convenience of those interested in edible soybeans. We recognize that it is not complete but does include all of those who have replied to our questionnaire. We make no statement as to the varietal purity or seed quality since we did not request producers to send in samples of the seed they had to sell. We will welcome names of any additional growers."

Note: This is the earliest document seen (July 2013) that mentions the soybean variety Sanga. Address: 178 Davenport Hall, Urbana, Illinois.


• **Summary:** "A test to determine the time to plant soybeans was conducted at the Delta Experiment Station at Stoneville, Mississippi, in 1943. The experiment included the four varieties Arksoy, Ogden, Mammoth Yellow, and Magnolia, planted at 3-week intervals beginning April 3 and continuing through July 15. Even though the rainfall was below normal throughout the planting season, there was sufficient moisture to secure good stands with all varieties at every planting except the one on July 15. On this date the soil was so dry that all of the varieties failed to emerge. The growth of the beans planted April 3 through June 3 was normal, averaging approximately 29 inches in height. The growth of those planted June 24 was greatly retarded by the drought of July. The average height for this date of planting was 21 inches. The varieties were harvested as they matured. The yield and other agronomic data and percentage of oil and protein are given in table 1.

"There was little variation in the yield of Ogden for the plantings April 3 through June 3. The highest yield of Arksoy and Mammoth Yellow was obtained when planted May 13. The yield of Magnolia when planted April 3 and June 24 was considerably less than when planted April 24 through June 3. The quality of the seed of Ogden and Arksoy was better on the medium to late plantings than on the earlier plantings. That of Magnolia was best for the May 13 planting which matured October 8. Those harvested October 22 were of slightly inferior quality. The quality of seed of Mammoth Yellow was better on the early plantings than on the late plantings.

"The percentage of oil in Ogden was greater in the early plantings than in the late plantings. In the other varieties there seemed to be no relationship in the date of planting and in the content of either the oil or protein.

"These data are in agreement with previous investigations and indicate that soybeans should be planted..."
from April 15 to May 15 for the best results.”

A large table, “Dates of planting soybeans: Stoneville, Mississippi,” has 8 columns: Variety, date planted, date mature, yield (bu/acre), oil (%), protein (%), plant height (inches), seed quality.

This is a Cooperative investigation between the Bureau of Plant Industry, Soils, and Agricultural Engineering, U.S. Department of Agriculture; the U.S. Regional Soybean Laboratory [Urbana, Illinois]; and the Mississippi Agricultural Experiment Station. Address: Asst. Agronomist, Div. of Forage Crops and Diseases, Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Research Administration, U.S. Dep. of Agriculture.


• **Summary:** This is a 1-page fill-in form. Near the top are two black horizontal lines after: Station. Payroll period. Below that is the word “Month:” followed by a blank space and then two rows of small boxes (one row below the other) with the numbers 1 to 31 in the boxes. After that a vertical column “Total Hours.”

Below that are numerous wide, horizontal blank boxes for each person on the payroll. Inside each box is written. “Title:” “Rate per hour:” and “Name:”

At the bottom left: “* Indicate addresses only when check is to be sent to home address. Personnel affidavit and W-4 forms attached for all new employees.”

“I certify that the personnel listed above have worked as recorded hereon, and that letter of authorization employment reported on this payroll does not exceed 60 days for any unskilled laborer or 30 days for any skilled laborer during the last 12 consecutive months.

Signature”


• **Summary:** Near bottom of title page: “United States Department of Agriculture. Agricultural Research Administration. Bureau of Plant Industry, Soils, and Agricultural Engineering, Division of Forage Crops and Diseases, cooperating with State Agricultural Experiment Stations.”


The map shows that the test sites range from Park River, North Dakota on the far northwest, to Thayer, Kansas on the far southwest, to Sikeston, Missouri on the far south, to Blacksburg, Virginia on the far southeast, to Strongsville, Ohio on the far northeast.

“The Group 0 Test (p. 7) consisted of twelve named varieties: Early White Eyebrow, Goldsoy, Kabott, Kagon, Mandarin (Ottawa), Minsoy, Montreal Manchu, Norsoy, Flambeau, Ontario (from New York), Pagoda, Wisconsin Mandarin. A table gives the source or originating agency, and origin of each.

“The Group I Test (p. 22) consisted of seven named varieties, two U.S.D.A. plant introductions, and seven selections from hybrids.” A table shows the names and origins of these varieties. The named varieties are: Earlyana, Habaro, Manchukota, Mandarin (Ottawa), Ontario, Wis. Manchu 3, Wis. Manchu 606, F.C. 31596 [F.C. = Forage Crops and Diseases, Bureau of Plant Industry].

Group II named varieties (p. 37) are: Dunfield, Earlyana, Harman, Illini, Lincoln, Mingo, Mukden, Richland, Wis. Manchu 3. Group III named varieties (p. 59) are: Chief, Dunfield, Illini, Lincoln, Patoka, Viking.

Group IV named varieties (p. 78) are: Boone, Chief, Gibson, Macoupin, Patoka.

Note: This is the earliest document seen (Sept. 2004) that mentions the soybean variety Harman. Address: 1. Principal Agronomist; 2. Senior Agronomist; 3. Associate Agronomist. All: Div. of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, USDA.

**Summary:** This is a blank form which reads with many long blank lines:

To: __
“Kindly send by __ the following soybean seed as directed below.
From: __
Send to: __
Date: __
Address [3 blank lines]: __
Varieties: __
Date sent: __
Initial: __


**Summary:** This is a 1-page fill-in form. Near the top are written (with a long black after each): “To:” “Date:” “Sir:” Below that are three small rectangular boxes all on the same line. After each is written one of the following: “1034 Voucher” “1012 Expense Account” or Bill of Lading. Below that is a vertical column, 5/16 inch wide and divided by horizontal lines into many small rectangular boxes. After each is written one of the following; the appropriate box is to be checked.

“Not signed by payee.
“Signed invoice not attached.
“Incomplete itemization.
“Insufficient number of copies.
“Travel voucher–name in caption not in agreement with signature.
“Corporation voucher–company name caption should agree with signature.
“Not signed by approving office.
“Approved amount in error.
“Hours worked not listed.
“Rate per hour not given.
“Standard form No. 61, Oath of Office, not attached.
“W-4 forms not attached.
“Surplus statements not attached.
“Amount of charge not listed.
“Weight not given.
“Name of initial transportation company not given.
“Times of departure and times of arrival not given in body of expense account.
“Per diem figured incorrectly.
“Requires statement that no further per diem will be claimed.

Receipts necessary for miscellaneous emergency expenditures, where the amount involved is in excess of $1.00.

“Form AD-102 must be submitted in duplicate for telephone calls.

“1034 vouchers–erasure on total not initialed by payee.”

Note: This is the earliest RSLM document seen (Jan. 2017) on which the laboratory’s address is given as 205 Old Agricultural Building, Urbana. Address: U.S. Regional Soybean Industrial Products Lab., 205 Old Agricultural Building, Urbana, Illinois.


**Summary:** Instructions are given for the construction of a device to eliminate computations of Kjeldahl values. The device consists of concentric circular scales so arranged that when the percentage of moisture in the samples is set opposite the titration of the blank, percentage of N and percentage of protein are read from outer scales opposite the titration of the sample.

295. Probst, A.H.; Cutler, G.H. 1945. Indiana soybean variety tests, 1938-44. *Indiana (Purdue) Agricultural Experiment Station, Mimeo* No. 2. 6 p. June. [7 ref]

**Summary:** On the cover is an outline map of Indiana showing the 9 locations, fairly representative of the soybean growing conditions in Indiana, where the tests were conducted. They are (from north to south): LaGrange, Wanatah, Bluffton, Lafayette, Greenfield, North Vernon, Wheatland, and Mt. Vernon.


At the end of this typewritten document is the following list of references:

Earlyana, An Early Soybean for Northern Indiana. Cir. 286, 1943.
Gibson and Patoka Soybeans–Cir. 270, 1942.
Lincoln–A new Midseason Variety of Soybean well adapted for Central Indiana Agron. Mimeo. 42. 1944.
Soybean Planting Rates and How Widths–Mimeo. 54. 1944.
Late Planting of Corn and Soybeans–Mimeo. 56. Address: Assoc. Agronomist, Div. of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration,

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**Summary:** “Many varieties and strains of soybeans differing in numerous characters frequently are tested together in row-rod nursery yield trials. Although much care may be taken to obtain comparable stands, there may be considerable variation in stand among different strains, or even within strains in different replications. Published data on the influence of plant spacing on different varieties of soybeans in nursery trials are very limited.

“To study the effects of plant spacing on soybeans on yield and several other characters commonly obtained in the evaluation of varieties, an experiment on spacing was carried out with four varieties of soybeans at Lafayette, Indiana, by the U.S. Regional Soybean Laboratory and the Purdue University Agricultural Experiment Station, cooperating. The work was conducted over the 4-year period from 1938 to 1941, inclusive.

“Wiggans found that the soybean plant has the ability to make wide adjustments to space and that optimum rates and spacings for soybeans should be determined not only for the various soybean-producing areas but also for the varieties to be grown.” Address: Associate Agronomist, U.S. Regional Soybean Industrial Products Lab., Urbana, Illinois; and Purdue Univ. Agric. Exp. Station, Lafayette, Indiana.


**Summary:** It was early recognized “that accuracy of sampling is largely determined by sample size and uniformity of material sampled, the more homogeneous the material, the smaller the sample may be.”

The authors sample two varieties of soybeans: Mandarin and Lincoln. They found that 30-gram samples of mixtures of soybeans differ significantly in oil and nitrogen content indicating the need for larger samples. Address: U.S. Regional Soybean Lab., Urbana, Illinois.


**Summary:** This document is typewritten. The title page is missing on the copy archived by USDA-ARS, so we are unable to give the valuable information it contains, especially the RSLM number and date the report was released.

However we can infer the following from the reports before and after it.

At the top of the title page is written:
“U.S. Regional Soybean Laboratory
“Urbana, Illinois.”

Below the title is written:
“United States Department of Agriculture
“Agricultural Research Administration
“Bureau of Plant Industry, Soils, and Agricultural Engineering
“Division of Forage Crops and Diseases
“cooperating with
“State Agricultural Experiment Stations.


“Introduction: The increased demand for vegetable oils because of wartime needs resulted in the expansion of the program of the U.S. Regional Soybean Laboratory at Urbana, Illinois, to include 12 Southern States. The states comprising the southern section are Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia. Headquarters for the southern section are located at the Delta Experiment Station, Stoneville, Mississippi.

“The most important objective of the Regional program is the development of superior varieties of soybeans for industrial purposes for the South. An essential part of this objective is the evaluation of existing southern strains and varieties of soybeans in Uniform Variety Tests. Since 1936, the Regional Soybean Laboratory has been conducting tests composed of groups of varieties and strains of soybeans classified according to maturity in the North Central States. At the time of the inauguration of the southern program, four such uniform variety groups were being tested. The Uniform Variety Test, Group I, contains the short season varieties adapted to the northern tier of states in the North Central Region. The seasonal requirements of Group II, III, and IV, are progressively longer. In keeping with this classification, the southern soybean varieties were tentatively divided into two Uniform Variety Tests, Groups V and VI.

The Uniform Variety Test, Group V, includes varieties which normally mature in late September and early October over much of the South. Group VI contains the later maturing strains. The varieties, Arksoy, Ralsoy, Ogden, and others are typical of the maturity of Group V, while Mammoth Yellow, Mamloxi, and Biloxi are typical strains of Group VI. In addition to these two Uniform Variety Tests, Group IV composed of varieties of the approximate maturity of Macoupin, were grown at a number of locations in the...
northern and northwestern part of this region.

“In addition to the Uniform Variety Tests, five Dates of Planting Tests were conducted at various points over the South. It is important to know the effect of date of planting not only on yield of soybeans, but also on the chemical composition of the seed. Relatively wide differences in the chemical composition and yield due to variations in rainfall, temperature, and time of planting, have been reported in the North Central States. The long growing season in the South coupled with the wide variations in rainfall and temperature in different sections of the 12 Southern States are factors which must be fully evaluated in order to successfully expand the production of soybeans in the South.

“Average results, both agronomic and chemical, of the Uniform Variety Tests, Groups IV, V, and VI, and the Dates of Planting Tests for the 1943 season are herein reported. The location of the Uniform Variety and Dates of Planting Tests are shown in Figure 1.”

Page 3: Cooperating agencies and personnel for the Southern States, begins:


“Alabama Agricultural Experiment Station Agronomy Department: H.R. Albrecht

“Arkansas Agricultural Experiment Station Agronomy Department: C.K. McClelland

“Florida Agricultural Experiment Station Agronomy Department: George E. Ritchey

“Georgia Agricultural Experiment Station Agronomy Department: U.R. Gore Louisiana Agricultural Experiment Station Agronomy Department: J.P. Gray

Pages 4-5: Location of cooperative nurseries and cooperators.

Page 6: Map of southern states (divided by a curving line into Upper South and Lower South) showing location of cooperative uniform tests, 1943, A small circle indicates Uniform variety tests. A + indicates Uniform dates of planting tests.

Page 7: Methods: Tells how the following are measured:


• Summary: This is a typewritten, horizontal, 1-page fill-in form.

“Fertility level should be expressed as previous crop yield per acre, i.e. corn–25 bus. [bushels].

“Height is determined as an estimated average length of plants from the ground to the top extremity at the time of maturity, Height should be reported as the average of at least 2 replications expressed to the nearest inch.

“Lodging notes should be taken at the time of combine maturity on each replication and reported as the average of all replications, expressed to one decimal. Lodging notes should be recorded on a scale of 1 to 5 according to the following criteria: 1. Nearly all plants erect. 2. Either all plants leaning slightly or a few plants down. 3. Either all plants leaning moderately, or 25-50% of the plants down. 4. Either all plants leaning considerably or 50-80% or more of the plants down. 5. 80% or more of the plants down.

“Maturity is the stage when most of the leaves have dropped, most of the pods are ripe and the stems fairly dry, and should recorded as the average maturity date of the four replications. For convenience in harvesting, maturity can generally be estimated a few days before or after the actual date. Maturity index is recorded as the number of days earlier (+) or later (+) than the maturity reference variety. The reference varieties are as follows: Group 0 and I, Mandarin (Ottawa); Group II, Richland; Group III, Illini; Groups IV and IVS, Gibson; Group VI, Ogden; Group VII, Volstate; Group VIII, Wood’s Yellow.

“Yield data is to be reported only from rows with satisfactory stand and should be recorded as bushels per acre expressed to the nearest tenth. Plot weights should be taken only after the seed from all plots in the test has reached a fairly uniform moisture content. Forced air drying is helpful.

“Seed quality should be recorded on a scale of 1 to 5 according to the following: 1. very good; 2. good; 3. fair; 4. poor; 5. very poor. The factors considered in estimating seed quality are: development of seed, wrinkling, damage, and color of the variety.

“Shattering notes, if taken, should be recorded 10 to 14 days after maturity. Shattering should be recorded on a scale of 1 to 5 as follows: 1. No shattering. 2. 1-5% shattered. 3. 6-10% shattered. 4. 11-24% shattered. 5. 25% or over shattered

“For chemical analysis a composite of 50-60 grams of each strain should be prepared by taking equal amounts of seed from each replication. Completed agronomic data sheets should always accompany seed samples in the same box.

“Seed size, if taken, should be expressed as the weight of 100 beans in grams.

“Soil type. This should be the full official state or U.S.D.A. designation (i.e. Norfolk fine sandy loam).”


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**Summary:** “Root temperature as a factor in the growth of soybean plants has not been investigated as far as the writers are able to learn from a review of the literature. However, attention has been directed to this problem by several investigators for other species of plants.” Five studies are reviewed; each showed that warmer temperatures increase plant growth whereas cooler temperatures retard it; each species [and variety] has its optimum temperature or temperature range.

A figure shows a view of the apparatus used in maintaining different temperatures around the roots of the soybean plants in this investigation. Each of the seven box-like units is equipped with heating and cooling coils operated thermostatically. Electrical space heaters provide heat. A common refrigerating compressor supplies the cooling for the units, the refrigerant for each box being controlled by a solenoid valve in the liquid line ahead of the expansion valve for that box. A double pole thermostat with an adjustable differential maintains the temperature.

“A publication by the U.S. Regional Soybean Laboratory, a cooperative organization participated in by the Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Research Administration, and the agricultural experiment stations of Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, North Carolina, North Dakota, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Virginia, and Wisconsin.”


**Summary:** “Southern farmers, until in recent years, have harvested a very low percentage of their total soybean acreage for seed. As late as 1941, only 15.5 percent of the total soybean acreage in 11 southern states was combined.

“While the percentage of total southern acreage of soybeans harvested as an oil crop has more than doubled in recent years, the major portion is still utilized for other purposes. The failure of present varieties to produce satisfactory yields of seed consistently has been in part responsible for the small acreage of oil beans.

“The greatly increased demand for vegetable oils because of wartime needs resulted in the expansion of the research facilities of the U.S. Regional Soybean Laboratory during the winter of 1942-43 to include in the cooperative soybean program the 12 southern states along with the original 12 states of the North Central region.

“Principal Objective: One of the principal objectives of the Southern Program is the development of adapted, higher yielding varieties of soybeans for industrial uses. New strains must be not only higher yielding, but resistant to shattering, lodging and disease, and have a content of oil and protein most desirable for industrial utilization. The average yields of the area of 11.1, 13.4, 9.9, and 12.6 bushels per acre for the 4 years, 1941-44 respectively, are entirely too low for economic production of oil beans. The tendency of most of the present varieties to shatter as the beans mature or immediately thereafter is partly responsible for lower yields over much of the region. During the long growing season such diseases as bacterial pustule, bacterial blight, southern blight, pod and stem blight, and many others are serious factors in reducing yields of soybeans over the region. These are the main factors which must be overcome to produce superior strains for southern conditions.

“Large numbers of new strains resulting from crosses and plant selections are being tested, or are under observation at many of the southern experiment stations. Attempts to combine the high yields and chemical composition of the northern varieties with adapted late maturing southern strains appear promising. Several F4 and F5 strains, from crosses between Arksoy and Dunfield, Chief and Arksoy, and others made by L.F. Williams at the U.S. Regional Soybean Laboratory at Urbana, have many of the desired characteristics. Very promising material is coming out of a large number of crosses by J.A. Rigney and E.E. Hartwig, in the cooperative program at the North Carolina station. In addition to the crossing program, introductions and plant selections in large numbers are being tested for superiority. It is reasonable to expect that from all of this material, some new strains of soybeans will soon be available, fully capable of filling the needs of the South for an oil bean.

“One special project of the breeding program at the Delta Station is the development of a variety that will produce high yields of good quality seed, maturing in late August or early September. The cotton farmers, in particular, desire a variety that will mature before cotton is ready for picking. Varieties such as Macoupin, Patoka, and Gibson will mature at this time, but produce seed of very low quality.

“Many early maturing plants having good to high seed quality have been found in some crosses between northern and southern varieties. To advance this material as rapidly as possible an extra generation is being obtained of these strains by planting them at Weslaco, Texas, in mid-September for late December harvest. Satisfactory yields have been obtained on approximately 600 selections, including strains of early maturity for Texas and Oklahoma.

“The main breeding program, however, is concerned with the development of later maturing varieties, as it is fully expected that the highest yielding soybean varieties
for the South will be those of late maturity. At the present time we have very few late maturing varieties of commercial importance capable of fully utilizing the long growing season for the production of soybeans. Diseases, in particular, may build up to epidemic proportions, causing serious defoliation if not death to the plant at the critical period of seed setting and seed development. Yields of 50 bushels per acre on fertile soil should not be exceptional when fully adapted, late-maturing soybean varieties, resistant to diseases, are developed.

“Pathologists of the region have helped in evaluating varieties and strains of soybeans with respect to disease resistance, and the information thus provided is being used in the breeding program. However, with the increase in number and destructiveness of soybean diseases during the last few years, the disease problem has become urgent. The development of the new soybean disease program of the Bureau of Plant Industry, Soils, and Agricultural Engineering of the United States Department of Agriculture, is expected to greatly facilitate the breeding of disease resistant strains of soybeans.

“Evaluating Varieties: An essential part of the soybean breeding program is the thorough evaluating of existing varieties and strains of soybeans. For this purpose a series of uniform nurseries have been established to evaluate the new and improved soybean strains developed by the Laboratory in comparison with the commercial varieties now being grown. In the regional grouping of these varieties according to maturity, the southern strains are entered in progressively later maturing groups designated Groups V, VI, VII, and VIII. At the present time there are very few strains of proper maturity for Group V, so particular effort is being made to secure superior selections for the northern part of the southern region where strains of this maturity are needed.

“Testing soybean varieties on a regional basis began in 1943. An excellent picture of the good and bad characteristics of the varieties is taking form in that results include yield, lodging, plant height, seed quality, disease resistance, shattering resistance, and chemical composition for each variety at many locations. In planning the tests each year, varieties showing little promise are dropped while new ones are added. New strains are entered in the regional tests as soon as they show promise in local tests. Testing over a wide area will give the plant breeders an evaluation of the new strains in 1 or 2 years, that could hardly be obtained by testing for several years in one section or area. In addition, basic information is secured on the various varieties and strains, pointing the way to the plant breeders for crossing varieties to obtain improvement of a strain in one or more characteristics.

“In general, the varietal response over the region has corresponded to differences expected due to length of day, rainfall, and fertility levels, with the exception of the lower coastal area of southeastern South Carolina, Georgia, Florida, and southern Alabama. In this area the varieties Monetta, C.N.S., Palmetto, and Missoy, all introductions or strains developed from introductions from Nanking, China, appear to be the most promising. Ogden, Volstate, Wood’s Yellow, Tennessee Non-Pop, all of which are high yielding varieties in other sections, are definitely unadapted to this region.

“The varieties in Uniform Tests in the rainfall deficient area of Texas and Oklahoma have shown little promise. Yields have been very low except under irrigation. New strains developed in the cooperative breeding program are under observation at a number of locations in this area.

“Along the northern edge of the region, good yields of fair quality seed were obtained from a number of varieties from Group IV, S100, a strain developed by the Missouri station and C101 developed by Indiana, in particular, having been very productive. Low yields of poor quality seed result, however, from growing these strains farther south.”

Continued. Address: Agronomist, U.S. Regional Soybean Lab., Div. of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, USDA.

• Summary: (Continued): “Promising Varieties: There are a number of promising varieties in the later maturing groups of which Ogden, in Group VI, is the outstanding variety. Developed by the Tennessee Station, this variety has produced high yields all across the upper half of the southern region. The principle objection to Ogden is that under very dry conditions it will shatter as it matures. Volstate, another high yielding variety developed by the Tennessee Station, has performed well in the tests. This variety matures approximately 2 weeks later than Ogden and shatters very little. N41-90, a new strain developed by the North Carolina Experiment Station, is equal, if not superior, to Volstate in yield, and is of particular interest at this time because of its high oil content. The new strains Acadian, Pelican and L.Z., developed by the Louisiana Station, definitely have a place in the lower South. These are late maturing, tall growing, non-shattering strains with a good oil and
protein content.

“Need for Flexibility: The production of soybeans as an oil crop in the South will depend somewhat on the flexibility of this crop with respect to varying crop practices. In this connection, farmers in some sections of the South have found the practice of following early potatoes and winter grain with soybeans to be a profitable one. If productivity can be maintained over a wide range in dates of planting, without adversely affecting the chemical composition of the seed, the acreage of soybeans should be greatly increased. In order to obtain more complete information on this phase of soybean production, cooperative Uniform Dates of Planting Tests are being conducted at a number of locations.

“These consist of three or more varieties representing early, medium, and late maturing strains planted at 3-week intervals beginning in April. Yield data between different dates of planting at any one location have been quite variable.

“General trends in the effect of date of planting on yield and chemical composition are evident from the data, although erratic fluctuations in the data at some locations, apparently due to climatic conditions, tend to obscure such trends. There were no consistent differences in yield between plantings made in April and May. In most of the tests, the yields from late June and July plantings were distinctly lower than those from plantings made earlier in the season. The percentage of oil declined with the very late plantings, while a slight but progressive increase in the iodine number of the oil occurred with lateness of planting. The percentage of protein was not consistently affected by date of planting. Partial and total failures of June and July plantings were reported at some locations both years. These failures due very largely to droughts at planting time, are indicative of the risk involved in late plantings, particularly in the upper South.

“The prompt testing of new strains over a wide area in Uniform Tests, obtaining complete agronomic and chemical data in a short time; the distribution and exchange of new breeding material with other cooperators; the evaluation of cultural requirements of this crop in the widely different areas; and the study of and development of disease resistant strains—all are factors which should result in the development of superior strains of soybeans for industrial utilization for the South.”

A large portrait photo shows Paul R. Henson. Address: Agronomist, U.S. Regional Soybean Lab., Div. of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, USDA.


• Summary: “Although the Lincoln soybean is a relatively new variety, having been in the hands of producers only 2 years, some reports of black and mottled beans have already been coming in. As early as 1942, black beans were noted in the seed from one of the first Lincoln increase plots. This seed was picked over and all black beans removed. Since then, black or black mottled beans have been reported from Ohio, Indiana, and Iowa, as well as Illinois.

“As the occurrence of black beans presents a problem in seed certification, it seemed desirable to find out whether such variation is genetic or environmental. Black and mottled seeds were picked out of several samples of Lincoln in 1942 and 1943 and planted in the nursery at Urbana in 1944.

“The seed was divided into four classes as follows:

1. Normal size, mottled.
2. Normal size, solid black.
3. Approximately half-size, mottled.
4. Approximately half-size, solid black.

“The types of seed planted and the seed produced from them are illustrated above.

“The first class produced plants indistinguishable from normal Lincoln and with typical Lincoln seed. There were very few seeds of the second classification to test, and all of these bred true, producing plants indistinguishable from Lincoln but with solid black seed. The third and fourth classes produced plants and seed typical of Lincoln with the exception that there were a few plants with mosaic-type virus in these two groups. There was no mottling in the seed produced in this experiment in 1944, but in general, there was very little mottling at Urbana that year.

“Black Beans the Result of Mutation: Most of the variation in this experiment arose from environmental causes, but the black seeds in class 2 were evidently the result of a gene mutation from ih to i, since they bred true to the solid color and produced plants typical of the Lincoln variety in other respects. Apparently this mutation occurs
frequently, as it has been observed in a number of other varieties and strains and has occurred at least twice in Lincoln.

“One reason that so many black beans have been noticed in Lincoln may be that the large amount of foundation seed was handled carefully due to the interest attached to this variety. However, it is probable that Lincoln is more susceptible to this mutation than are some other strains. Apparently there is some variation among strains in this respect. Chief, Dunfield, Mukden, Scioto, Earlyana, Richland, Banset, Tokyo, Nandi, and a number of other varieties and selections have mutated to colored seed, but no such mutation from Illini has ever come to the writer’s attention although Illini has been very widely grown. In varieties like Mukden and Dunfield the mutation has a light brown or buff seed, in Earlyana, brown, and in Scioto, black, according to the type of pigment present in the hilum of the original type.

“Possible Causes of Mottling: It is difficult to ascertain the cause of the mottling in the first class. In general, these beans showed less mottling than class 3. It has been found by several workers that wide spacing and rich soil may cause more mottling on normal plants. It is, of course, well known that some varieties mottle more than others. Owen in 1927, in discussing mottling in the soybean, mentioned that in a number of cases diseased plants produced mottled seed. He also noted that frequently this seed was smaller than normal.

“It is probable that the small seed in classes 3 and 4 came from diseased or injured plants. These small seeds were much more heavily mottled than the normal-sized seeds and a higher percentage of them were mottled. Probably whatever factor was responsible for their small size was also responsible for the heavy mottling. The solid black seeds in class 4 were evidently the result of a more extreme extension of the mottling found in class 3.

“What Can Be Done?: Picking out the mottled seed is of no benefit as far as improving the following year’s crop, since the experience of investigators has indicated that such seed will produce plants as free from mottling as will unmottled seed. Picking out the black seeds of the mutant i type will not insure against black seeds in the next year’s crop since the black type is recessive to yellow, and heterozygous types will still be in the population. The only method of eliminating the black seeds is to use pedigreed seed which is known to be free of the mutation. A supply of such seed was produced at the Illinois Station in 1942 and made available to cooperating states.

“To develop this seed, over a hundred individual plants of the Lincoln variety were harvested and the seed from each plant sown in a separate row. At harvest time all rows not typical of the Lincoln variety were discarded. Each of the remaining rows was harvested separately and the seed examined for black beans. All rows showing black beans were discarded and the remaining rows composited to produce the foundation pedigreed seed. If a new mutation occurs in this material, it will be necessary to establish a new pedigreed lot. Such a mutation ordinarily occurs in a pollen or egg cell of a plant and this will then unite with a normal cell to form a plant embryo. Since this mutation is recessive, the resulting plant will have normal-colored seeds and it will not be until the following year that black seeds appear. Thus it is not until 2 years after the mutation occurs that any evidence of it appears.

“Since mottled beans in Lincoln will produce typical Lincoln seed the next year, there seems to be no reason to remove them from the seed before planting. There would also seem to be no particular reason for discriminating against them in certification. Because some of the small mottled seed possibly came from diseased plants, and some diseases may be seed borne, it may be desirable from this standpoint to screen these out, but no great benefit is to be expected from such removal since the percentage of seed-borne disease is likely to be small.

“There is good reason for discriminating against solid-colored black beans, since this experiment has shown that black beans of normal size can be expected to breed true to the black color. In regard to certification, it is suggested that these solid-black beans be considered as varietal mixtures. It is probable that no lot of pure Lincoln seed contains enough of these mutant black beans to bar it from certification.

“There has been a suggestion that it might be desirable to increase the black-seeded Lincoln as a separate variety. This would be quite undesirable since the discount on black soybeans sold for processing would mean a lower return to the grower.”

A large photo shows: “Off-colored beans found in the Lincoln variety and the seed produced by them.”


• Summary: “The uniform soybean seed treatment test in 1944 was expanded to include several Southern and Eastern States as well as most of those in the North Central area which cooperated in 1943. This experiment was conducted at 9 locations in 1943 (PDR Suppl. 145, pp. 76-79), and at 18 locations in 1944 (Table 1).”


• Summary: “An intensive soybean disease survey was made by, the United States Regional Soybean Laboratory in the summer of 1943, covering many of the heavy producing areas. Of particular interest was a disease identified as wildfire, caused by Pseudomonas tabaci (Wolf and Foster) Stapp.

“Three references in the literature report soybeans (Soja max Piper) susceptible to this parasite when artificially inoculated (1, 8, 10)... To the writer’s knowledge, however, the disease has not been previously recognized to cause extensive damage to soybeans in the field. The total damage observed in 1943 and 1944 was not significant. However, in individual fields, damage was severe enough to make evident the potentialities of this disease on soybeans and to emphasize the need for careful study.

“Symptoms: Symptoms are so characteristic that this criterion alone is usually sufficient for identification of wildfire. The necrotic spots on the leaves are variable in size and are nearly always surrounded by a striking wide yellow halo (Fig. 1).”

“Summary: Wildfire, caused by Pseudomonas tabaci, is common on soybeans in most of the commercial soybean growing areas of the United States. The damage in isolated areas is severe. Morphologically, physiologically, serologically, and pathologically the organism isolated from soybeans does not differ from isolates of Ps. tabaci from tobacco, and the two diseases are considered to be caused by the same organism. Watersoaking of soybean leaf tissue greatly enhances penetration of the leaves by Ps. tabaci and spread of the bacteria through the tissue. Physiologic watersoaking was not so effective as storm watersoaking in bringing about penetration. Prolonged watersoaking was not necessary for the growth or dispersion of bacteria within the tissues.”

A footnote at the bottom of the first page states: “A publication by the U.S. Regional Soybean Laboratory, a cooperative organization participated in by the Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration; and the Agricultural Experiment Stations of Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, North Carolina, North Dakota, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Virginia, and Wisconsin.”

Address: Associate pathologist, U.S. Regional Soybean Laboratory, Urbana, Illinois.


• Summary: “Accurate determination of the percentage of oil in soybean seed is of great importance to the plant breeder in the development of high oil producing strains. It is equally important that cooperating laboratories be able to secure comparable analyses.” Address: U.S. Regional Soybean Lab., Urbana, Illinois.


• Summary: “Among the men who have made valuable contributions to the development of the soybean is Dr. O.E. May, chief of the Agricultural Research Administration’s Bureau of Agricultural and Industrial Chemistry.

“Born and reared in a farming section of northeastern Iowa, now one of the leading soybean-producing states, Dr. May has spent most of his life searching for industrial outlets for farm products. It was the industrial fermentation work carried on by Dr. May and associates at Department of Agriculture’s old Arlington Farm, Virginia, that supplied the background experience that enabled the Northern Regional Research Laboratory at Peoria, Illinois, which Dr. May formerly directed, to increase the yield of penicillin so that it could be put into immediate large-scale commercial production.

“It was this same background experience that caused him to be selected to head the Bankhead-Jones Soybean Industrial Products Laboratory at Urbana, Illinois. He was its first director, and served from March 9, 1936, to August 16, 1938. In this short time he assembled a staff of investigators of marked scientific attainments and established for the laboratory a place of high regard with the state agricultural experiment stations as well as the soybean and chemical industries.

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“When the laboratory was established there was urgent need for more information on the chemistry of beans and on the chemical and physical properties of their constituent materials. Information was needed on the protein and oil contents of the different varieties, as well as on the composition and properties of the proteins, phosphatides, oil, minerals, and carbohydrates. Plant breeders needed to know more about the grain varieties being crushed for oil, and more about the effect of rate, date, and method of planting on yield and composition. Farmers needed to know what grain varieties are best adapted for industrial purposes. These are some of the problems that the laboratory tackled while Dr. May was directing its activities. They have not all been solved, to be sure, but considerable and very worthwhile progress is being made. The laboratory’s pilot-plant equipment enabled it to carry promising test-tube research to the semi-commercial production stage where it can be properly evaluated.

“Research on the industrial utilization of soybeans is still carried on under Dr. May’s general supervision at the Bureau’s Peoria Laboratory, where that phase of the work was transferred by an act of Congress in 1942. The agronomic work is conducted at Urbana and at cooperating state agricultural experiment stations.

“Dr. May insists that any accomplishments attributed to him are due even more to the work of the men who have been associated with him. These include such men as R.T. Milner, W.B. VanArsdale, W.H. Goss, K.S. Markley, G.H. Brother, and A.K. Smith, now employed in the Regional Research Laboratories, J.L. Carter and W.J. Morse of the Bureau of Plant Industry, Soils, and Agricultural Engineering, as well as persons connected with the agricultural experiment stations and the soybean industry.

“May feels that the successful results of soybean research in the last 10 years have been due largely to cooperation and teamwork among the various individuals and agencies interested in the constructive development and expansion of the soybean industry.

“Soybeans are used now largely for food products because of the war, but when the war is over it is hoped that new and wider outlets and markets will be developed in both the food and the industrial fields.”

A photo shows Dr. May.


• Summary: This is a typewritten, 1-page fill-in form.

  “Date
  “Name [below line: in full]
  “Address [below line: street, city, state]
  “Date of birth
  “Telephone
  “Person to be notified in case of accident [below 2 lines: Name, Street, City, State, Telephone].
  “List of schools attended [box with 3 blank lines]: Name and location of school, dates attended [From, To].
  “Give name and address of previous employer [two blank lines].” Address: U.S. Regional Soybean Industrial Products Lab., 205 Old Agricultural Building, Urbana, Illinois.


• Summary: Lincoln was the first soybean variety released after the U.S. Regional Soybean Laboratory was established.


• Summary: One of the most important and innovative books on soyfoods ever written. Contents: Preface. 1. Agriculture’s Cinderella: America discovers the soybean, our wonder beans, soy as a food in the United States, soy in rehabilitation food programs, soybeans as an emergency crop, soybean terminology. 2. World-wide use of soybeans: A real antique, monarch of Manchuria, soybeans in mechanized warfare–Germany, soybeans in other countries (USSR, Italy, Spain, Belgium, Holland, Norway, Denmark, Sweden, Great Britain, Canada), soybeans in Lend-Lease and United States Agricultural Marketing Administration, Food for Greece, soybeans and the Mexican Indian, soybeans in Hawaii (Mr. C.G. Lennox). 3. Soybeans and industry: The versatile soy, uses of soybean in industry, soybean paint (from soy oil, incl. Duco finishing), soybean protein (used in making plywood, plastics, water paints, paper sizing, leather finishes, and insecticide sprays), Henry Ford and soybeans, soybean glue (I.F. Laucks and the firms he has licensed turn out some 30,000 tons of soybean glue annually), rubber substitute (Norepol), paper industry (Glidden), plastics, soy-cotton helmets, firefighting compounds, lecithin, fertilizers.

4. Nutritional nuggets: Food value of soybeans and soy products (vegetable or edible types of soybeans, protein, fat & carbohydrate, minerals, vitamins, lecithin, alkaline ash, economy, exaggerated claims), principal uses of soybeans and soy products (meat substitutes, meat enrichers, fortifying
5. From soup to nuts: Green beans, dry beans, frozen beans, roasted soybeans, sprouted soybeans, the cow of China—soy milk, the meat without a bone—tofu or soy cheese, the little giant among protein foods—soy flour, soy grits, puffed grits, soy oil, miscellaneous soy products (soy butter [soy nut butter, p. 99-100], sandwich spreads, malts, coffee substitutes, soy sauce, soy albumen—a new product, greatly improved during the past two years, is now used to “replace egg albumen in candy manufacture” [as in marshmallows]).

Note 1. This is the second earliest document seen (Aug. 2002) in which the soybean is called the “cow of China.”

Note 2. This is the earliest English-language document seen (Dec. 2015) that uses the term “soy albumen” (or “soy albumens”) to refer to isolated soy protein as a product.

6. The blazed trail: Introduction (history and pioneers), our tardy acceptance, food pioneers (health-food stores, Dr. W.D. Sansum of Santa Barbara and soy bread, allergy studies, vegetarians, Seventh-day Adventist food companies, meatlike products, Madison College of Tennessee, Loma Linda Food Co., the International Nutrition Laboratory and Dr. H.W. Miller, special dietary concerns and diabetic diets), establishing soybeans in the kitchen (The Edison Institute and Henry Ford, the USDA and the U.S. Bureau of Home Economics, the Agricultural Marketing Administration, U.S. railroads, the Soy Products Division of the Glidden Co., the Soy Flour Association). 7. The challenge of nutrition: The dangers of hidden hunger, nutrition and health, corrective nutrition, starch-restricted diets, meatless diets, allergy diets, bland diets, building diets, reducing diets, acidophilus culture, lecithin. 8. Our wonder crop: Jack and the beanstalk, early history, new varieties, aids to the industry (Regional Soybean Industrial Products Laboratory, American railroads, American Soybean Association, Fouts Brothers of Indiana, Soybean Digest and George Strayer in Hudson, Iowa, Soy Flour Association with Edward Kahl as first president, Soya Kitchen in Chicago (Illinois) opened in Jan. 1943, National Soybean Processors Assoc., National Farm Chemurgic Council), educational program, restrictive regulations. 9. Soybeans and the farmer: Varieties, sources of information, seeding and inoculating, harvesting, grading, soybean diseases, crop rotation, damaged beans. 10. Tomorrow: Acreage and production, soybeans on the farm, soybeans in nutrition, postwar industrial uses, future improvements. 11. A few suggestions for better living: Kitchen diplomacy, personal opinions, soybeans for everyone. Recipes: Green soybeans, dry soybeans, sprouted soybeans, roasted or toasted soybeans, meat-substitute dishes, soy-enriched meat dishes, soy noodles, macaroni, spaghetti, sauces and gravies, soups, salads, dressings, soy spreads, soy milk, tofu or soy cheese, soy butter, soy cereals, soy desserts, soy candies, soy beverages, soy-flour recipes, bread and muffins, pancakes and waffles, soy gluten recipes, baking-powder biscuits, pastry, cookies and doughnuts, cakes.

Contains recipes for “Soy milk molasses shake (p. 238). Soy puddings. Soy ice cream (p. 250; “Soy milk may be used in place of regular milk in ice-cream recipes... adding whipped cream”). Soy fruit ice cream. Soy chocolate dessert (Eggless) (p. 250-51). Soy shake (p. 254, made in a “liqueurier or mixer”).

The story of Allied aid to Greece [p. 24-26] is one of the great mercy stories of World War II. Starting in March 1942, as many Greeks were starving, the first mercy ship sailed to Greece with food and medicine. Up to Nov. 1943, the United States through Lend-Lease sent 82 million pounds of food to Greece. A number of these foods (including soup powders, stew mixes, and spaghetti) were based on soy flour and grits, and specifically developed to suit Greek tastes.

Concerning Henry Ford (p. 35-38), his “first experiments were made in a laboratory in connection with the Edison Institute in 1930. In these experiments, several tons of wheat were used, also several thousand bushels of carrots; sunflower seeds, which have a high oil content; cabbages; onions; and cornstalks. It was not until December, 1931, after a long series of experiments with the soybean, that Mr. Ford and his chemists felt that they were at last approaching a solution to the problem of finding a basic farm material from which the ordinary farmer could develop a commercially profitable product.”

Note 3. This is the earliest published English-language document seen (Sept. 2013) that uses the term “Soy ice cream” (p. 250).

Note 4. This is the earliest document seen (July 2007, one of two) that uses the word “Cinderella” in connection with the soybean. The author, however, does not elaborate on this idea.

Note 5. This is the earliest English-language document seen (Nov. 2013) that contains the term “soy-flour”—however it is used as an adjective. Address: Southern California.


• **Summary:** “Lincoln soybeans are pleasing the first farmers who tried them. This is shown in a survey made of the 115 growers in the southern two-thirds of the state to whom seed was sent in 1944.

“There were 54 of these men who reported on comparisons in yield between Lincoln and other varieties they had been growing. Of these 54, 47 said the Lincoln out-yielded their home-grown varieties in 1945. The average advantage was about 5½ bushels an acre. This is approximately the same difference as obtained in tests at Iowa station.

“The average yield of these Lincoln soybeans was 31.4 bushels an acre and of the home-grown varieties 25.8.

“In ability to stand up, or lodging resistance, abut half of the 51 who reported said the home-grown variety stood up better than Lincolns.” Address: Iowa State College, Ames,

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**Summary:** “Summary: Uniform soybean variety tests were located at Tunica, Stoneville, Anchorage, Satartia, and Onward in 1945. Yields, other agronomic data, and the chemical composition of the strains and varieties have been summarized according to maturity.

“The strains C101 and S100 have yielded significantly more than Macoupin, a commonly known commercial variety of these strains maturing in early September. The variety, S100, is taller, produces seed of slightly higher quality and matures approximately 10 days later than C101. S100 is low in oil, while C101 is a good oil bean containing approximately 2 percent more oil than S100. One serious objection to these early maturing strains when grown in the Delta is the low quality of seed produced. In the past, Delta farmers have reported low germination of Macoupin due to adverse conditions encountered at harvest and during the storage period. It is expected that similar problems will prevail with these strains.

“Ogden is definitely the highest yielding variety of those normally maturing between October 1 and 15. The 2-year average yield of this variety at Tunica, Stoneville, and Anchorage was 34.5 bushels or 40 percent more than the next highest yielding variety. The chief objection to Ogden is that it shatters on certain soil types and under dry climatic conditions at harvest. It has been observed that shattering is more severe on light or droughty [dry] soils and on heavier soils of low fertility. Even on soils where shattering usually occurs, many farmers prefer Ogden to such non-shattering, lower yielding varieties, as Arksoy 2913 and Ralsoy.

“In the breeding program under way at the Delta Station, plants coming out of crosses between Ogden and other varieties are being studied. It is hoped that strains carrying the high yield of Ogden and the non-shattering habit of Arksoy will be developed.

“Of the varieties normally maturing the last half of October, Volstate and Roanoke, were equally productive. These varieties are similar in many respects and differ in that the oil content of Roanoke is slightly higher than that of Volstate. Both are non-shattering, erect growing, and of sufficient height to combine readily. Wood’s Yellow has been quite productive in a number of locations in the Delta; however, it is low in oil and shatters under dry conditions. To farmers growing a large acreage of soybeans, the practice of planting the acreage to varieties of different maturity to increase the optimum combining period seems advisable, particularly in the production of soybeans for oil.

“The late maturing varieties have not been as productive or as high in content of oil as the better varieties of earlier maturity. The yields of strictly grain types, such as Mamotan, Mamloxi, Delsta, and Nanda have not been greatly different from those of the tall growing Louisiana strains, Academic, L.Z., and Pelican. These late varieties are particularly well suited for inter-planting in corn in that they usually mature after the corn crop is made. Appreciably lower seed yields were obtained from the hay varieties, Avoyelles, Gatan, Red Tanner, and from two vegetable varieties, Cherokee and Seminole.”

Introduction: “Soybean variety and dates of planting tests have been conducted at the Delta Experiment Station, Stoneville, Mississippi, for a number of years. In 1943 the program of the U.S. Regional Soybean Laboratory was enlarged to include 12 southern states with headquarters for the Southern section at Stoneville, Mississippi. As a part of this program, uniform variety tests have been conducted at a number of locations in the Yazoo-Mississippi Delta. The results of these variety tests and a study of the dates of planting at the Delta Station are reported herein.” Address: Mississippi State College, Agric. Exp. Station.


**Summary:** Sampling was for yield, percent protein, percent oil, and iodine number of the oil. Two subsampling units should be taken per field. The optimum size of a subsampling unit is approximately 7 square feet. This sampling helps to meet an increasing demand for pre-harvest information on soybean production and quality. “The rapid increase in soybean production is due to versatile uses of the crop and the ease with which it fits into crop rotations in the Corn Belt. Soybean oil and oilmeal are used in food products, livestock feed and in industrial products such as paints, plastics and rubber substitutes.” Address: Ames, Iowa.


**Summary:** This publication appears to be based on an earlier Iowa State Experiment Station, Mimeograph titled “Progress Report, Soybean hail damage experiments, 1945.”

“Hail damage to the soybean crop has been relatively severe in certain parts of Iowa. The large acreages of soybeans in recent years and the numerous storms have tended to accentuate these losses, of primary concern to farmers, insurance adjustors, and processors in areas where hail damage has been prevalent. In an attempt to answer some of the questions which arise following hail damage, the Iowa Agricultural Experiment Station, in cooperation with the U.S. Regional Soybean Laboratory, initiated a study in 1943 to determine the effects of simulated hail injury on the yield and on other important characters. Only the more
pertinent results will be discussed here.

“The general outline of the experimental work in 1943 and 1944 was as follows: In 1943, one variety, Richland, was used in the investigations. In 1944, Lincoln also was used in addition to Richland. The beans were grown in rows spaced 40 inches apart in order to eliminate as much as possible competition between differentially treated plots. Simulated hail injury was inflicted on replicated rows at five different dates (stages of growth) throughout the growing season in 1943. Ten dates of damage were used in 1944, five of them corresponding to the same stages of growth in 1943. Finally, at each date of damage, three degrees of severity of damage were inflicted. These were called light, medium, and heavy. Check rows, with no damage, were used for comparison.

“The stage of growth and the degree of damage inflicted at each of the five dates used in both years are shown in Table I. As the results with Lincoln and Richland were practically identical in 1944, only the results with the latter will be discussed, in this way making it possible to consider on a uniform basis the two years’ data.

“The removal of leaves and parts of the stems was accomplished by means of upward strokes with an instrument made by mounting several wire hooks on a paddle-like board. A clipping shears and supple switches also were used to advantage. With these implements it was possible to approach the appearances of actual hail injury and to obtain the three degrees of damage.

“The results in 1943 showed that the greatest reductions in yield from all degrees of defoliation and other injury occurred at the fourth date of inflicted damage. At this stage, the soybean plants were beginning to show pods at the top and flowering had ceased. Defoliation during the early stages of growth, when the plants were less than a foot tall, caused only small reductions in yield. Plants cut off immediately above the cotyledons (seed leaves) at the first date, when they were 4-5 inches tall, produced new branches in the axils of the cotyledons and made good recovery. Simulated hail injury at the last date, when the pods were full and the bottom leaves were turning yellow, appeared to be primarily mechanical. In other words, losses in yield at this date were due almost entirely to pod removal.”

Continues with a “Comparison of Two Years.” There are two tables. Address: 1. Agent, Div. of Forage Crops and Diseases; 2. Research Assoc. Prof. of Farm Crops. Both: Iowa Agric. Exp. Station. Ames, Iowa.

318. Soybean Digest. 1946. USDA men who have contributed to soybean development: J.L. Cartter. Jan. p. 26. • Summary: Jackson L. Cartter, director of the Regional Soybean Laboratory of the U.S. Department of Agriculture at Urbana, Illinois, started on his career in soybean research back in 1928 when a soybean laboratory was at Holgate, Ohio. A native of Brookfield, Missouri, he got his B.S. degree at Montana State College in 1925, his M.S. at Iowa State College in 1927, and did further work in agronomy at the University of Wisconsin.

“Cartter’s investigations and his research direction cover a period of increasingly rapid expansion of the growing and utilization of this remarkable addition to American agriculture. In the beginning at Holgate he worked on the oil factor in the crop, its production and the development of high-oil varieties for the Cornbelt.

“When the Department moved the laboratory from Ohio to Arlington Farm, Virginia, just across the Potomac from Washington, Cartter continued chemical studies of the soybean for the benefit of growers and the industry, throughout the country.

“In 1936 he was made head of the agronomic section of the U.S. Regional Soybean Industrial Products Laboratory, Urbana, Illinois, where he supervised agronomic, physiologic, and genetic studies of the soybean in 12 North Central states. When the industrial sections of the laboratory were transferred to the Northern Regional Research Laboratory at Peoria, Illinois, in 1942, the rest of the work remained at Urbana under the name U.S. Regional Soybean Laboratory, and Cartter was made director. At that time the research work on the crop was extended to the 12 Southern states and expanded to take in the problems of disease control.

“The Laboratory and the cooperating states, under Cartter’s leadership, have provided the industry with superior high-oil varieties including Chief, Patoka, Gibson, Earlyana, Boone, Richland, and the very recent Lincoln, a variety that ‘stands head and shoulders above other varieties,’ out-yielding them and producing an oil of better quality in higher percentage. At the same time the soybean-producing areas have been expanded and many new facts have been found on how to handle the growing crop.”

A small portrait photo shows Jackson L. Cartter.

• Summary: This is a typewritten, horizontal, 1-page fill-in form with lines for vertical columns.

("Please indicate how many tests you desire at each location.")
A box with 10 blank rows has the following vertical columns: “Location. Number of tests (0, I, II, III, IV). Send to.

“Please indicate whether or not tests are to be randomized. Yes. No.” Address: U.S. Regional Soybean Industrial Products Lab., 205 Old Agricultural Building, Urbana, Illinois.

320. U.S. Regional Soybean Laboratory. comp. 1946. Results of the Cooperative Uniform Soybean Tests, 1945:

**Summary:** Near bottom of title page: “United States Department of Agriculture. Agricultural Research Administration. Bureau of Plant Industry, Soils, and Agricultural Engineering, Division of Forage Crops and Diseases, cooperating with State Agricultural Experiment Stations.”


The Introduction begins: “One of the main purposes of the U.S. Regional Soybean Laboratory is to develop through breeding and selection improved strains of soybeans for industrial utilization. All promising material developed through the selection program is classified into maturity groups and is grown along with check varieties at a sufficient number of locations to enable agronomists to determine the value of these strains under a wide range of environmental conditions. None of these uniform groups have been established. The four earliest include soybean strains of suitable maturity for the North Central States and the other five groups contain strains adapted to the southern part of the United States.

Note: This is the earliest document seen (Dec. 2016) that uses the term “maturity groups” (or “maturity group”). Prior to this time they were called simply “groups” (as in Group III) or “Uniform Test Groups” or “nursery groups.”

The named varieties in the new Group 0 are: Early White Eyebrow, Flambeau, Goldsoy, Kabott, Kagon, Mandarin (Ottawa), Minsoy, Montreal Manchu, Nosoy, Ontario, Pagoda, Pridesoy, and Wis. Mandarin 507 [Wis. = Wisconsin]. Address: Urbana, Illinois.


**Summary:** From a talk by R.R. Kalton before a Farm and Home Week audience at Iowa State College. Recommendations are for Iowa.

“There are a number of important points that must be considered in order to obtain maximum yields of soybeans. Of course, the first essential is the selection of a good, recommended variety. Other significant factors affecting yields are date and rate of planting, inoculation, row width, cultivation, soil fertility, harvesting methods, and seedbed preparation. Each of these will be discussed briefly in the following sections in the light of the most recent information available.

“Date of planting studies just completed indicate that the best yields are obtained when planting is done early, May 15-25, if planting in rows. If beans are to be drilled solid, planting should be delayed until the last week in May to allow more time to kill weeds.

“The correct rate of planting soybeans should give a thick enough stand in the row and still conserve on the seed supply. The best rate of planting for medium width rows (rows averaging 28-32 inches apart) is about one bushel per acre. Forty-five to 50 pounds of seed per acre are sufficient for wide rows (rows 40-42 inches apart). If drilling the beans solid, 2 bushels per acre are satisfactory. All of these rates are based on good seed with high germination and few cracked beans. Increased allowances must be made for poor germination and more than a few cracked seeds. As for inoculation, the best answer is to inoculate all seed planted with a good soybean inoculant. It is the cheapest insurance available for high yields.

“Yield tests with different row widths have been carried out in several states in this area. The results show that medium width rows gave higher yields of grain than either wide-spaced or solid-planted rows. The spacing of rows should be as narrow as the tractor tread and cultivating equipment will permit. If narrowing the planter and cultivating equipment is not practical, the gauge marker on the planter may be shortened, giving alternate wide rows of about 24-28 inches and 36-42 inches. This practice increases the number of rows in the field and helps increase yields. Removing the outside sweeps on the cultivator enables cultivation to go ahead as usual.

“Weeds are by far the greatest menace to high soybean yields. Weed control should start even before planting with thorough surface tillage. Cultivation to kill weeds should be started as soon as the beans come through the ground. The rotary hoe, weeder, or harrow, all serve satisfactorily for early cultivation. They also can be used for breaking a soil crust before the beans come up. These implements should be used several times, if necessary, until the beans are 6-8 inches high. After the beans are 6-8 inches high, one to three row-cultivations generally give sufficient weed control. Sweep shovels do a good job and leave the field smoother for combining.

“Soybeans, like corn, do respond to higher levels of soil
fertility. However, little, if any, increase in yield has been obtained by direct applications of fertilizer to the soybean crop. Therefore, it is best to use fertilizers on other crops in the rotation, and keep up soybean yields by trying to keep all the good land on the farm in a high state of fertility.

“A well prepared seedbed is essential for a good soybean crop. When beans follow corn, either fall or early spring plowing is satisfactory. Several workings with the disk and harrow help to free the land of weeds before planting. In a dry spring, firming the soil with a cultipacker may prove beneficial for germination.

“Practically all soybeans grown for seed are now harvested with a combine. Even though this method undoubtedly is the cheapest and easiest method of harvesting, it too may play a vital role in bringing about maximum yields. Improper adjustments, or combining at the wrong time, may cause considerable loss of beans through shattering, cracking, and poor threshing. Therefore, proper adjustments and combining at the right time are necessary to harvest the greatest possible yield of beans.

“Although the factors in the preceding paragraphs may not all seem of consequence in the attainment of maximum soybean yields, it is an established fact that the farmers in Iowa who have been getting yields of 25-35 bushels per acre the last few years have been following most of these recommended practices. Average soybean yields in Iowa during this same period have been between 18-20 bushels per acre. Good cultural practices do assist the farmer in realizing a greater return for his efforts.”

A photo shows Robert R. Kalton standing behind a table as he addresses his audience at Iowa State College. Address: Agent of the Div. of Forage Crops and Diseases, Iowa Agric. Exp. Station.


• Summary: “The southern soybean program conducted in cooperation with the U.S. Regional Soybean Laboratory and the 12 Southern States began with the 1943 growing season. The completion of the 1945 tests concludes three years of testing soybean varieties on a uniform basis in the Southern States. A very good picture of the adaptation and relative industrial value of the many varieties and strains is evident from these tests. During this period breeding programs have been underway in the various states. A number of new strains are coming out of these programs and are available for entry in Uniform Tests in 1946. Many varieties tested two or more years over wide areas will be dropped to make room for new strains. We may well consider that the preliminary phases of the soybean program in the South are over and that the breeding, testing and development of new strains of soybeans for industrial utilization is definitely under way.

“Wednesday, February 13–P.R. Henson, Chairman

“The conference was called to order at 9 a.m. by Mr. P.R. Henson, who introduced Dr. J.E. Adams, Director of the Delta Experiment Station. Dr. Adams welcomed the collaborators to the Station and invited them to visit the various projects at the Station in which they might be interested.

“Dr. Dorman, Director of the Mississippi Experiment Station at State College, gave a brief review of the experimental work at the state and Delta experiment stations. He also discussed the various possibilities of the Pace Bill.

“The following state and federal personnel were in attendance:

“Aamodt, O.S., Head Agronomist, Forage Crops & Diseases, U.S.D.A., Beltsville, Maryland.


“Adams, J.E., Director, Delta Branch Station, Stoneville, Mississippi.


“Allington, W.B., Pathologist, Forage Crops & Diseases, Urbana, Illinois.


“Chilton, S.J.P., Pathologist, Louisiana Experiment Station, University, Louisiana.

“Cralley, E.M., Pathologist, Arkansas Experiment Station, Fayetteville, Arkansas.

“Dorman, C., Director, Mississippi Experiment Station, State College, Miss.

“Gore, U.R., Agronomist, Georgia Experiment Station, Experiment, Georgia.

“Gray, J.P., Agronomist, Louisiana Experiment Station, University, Louisiana.

Page 2: “State and Federal Personnel in Attendance (continued):


“Henson, P.R., Agronomist, U.S. Regional Soybean Laboratory, Stoneville, Mississippi.

“Lehman, S.G., Pathologist, N.C. Experiment Station, Raleigh, North Carolina.


“McVickar, M.H., Agronomist, Virginia Experiment Station, Blacksburg, Va.

“Milner, R.T., Chemist, Northern Regional Research Laboratory, Peoria, Illinois.

“Morse, W.J., Agronomist, Forage Crops & Diseases,
U.S.D.A., Beltsville, Maryland.
    “O’Kelly, J.F., Agronomist, Mississippi Experiment Station, State College, Mississippi.
    “Paden, W.R., Agronomist, S.C. Experiment Station, Clemson, South Carolina.
    “Pitner, John, Agronomist, Delta Experiment Station, Stoneville, Mississippi.
    “Presley, J.T., Pathologist, Mississippi Experiment Station, State College, Mississippi.
    “Reynolds, E.B., Agronomist, Texas Experiment Station, College Station, Texas.
    “Staten, H.W., Agronomist, Oklahoma Experiment Station, Stillwater, Oklahoma.
    “Stephens, J.L., Agronomist (U.S.D.A.) Coastal Plain Experiment Station, Tifton, Georgia.
    “Washko, J.B., Agronomist, Tennessee Experiment Station, Knoxville, Tennessee.
    “Weimer, J.L., Pathologist, U.S.D.A., Georgia Experiment Station, Experiment Georgia.
    “York, H.A., Agronomist, Mississippi Branch Station, Raymond, Mississippi.
    “Reports of Collaborators
    “Each collaborator was asked for a report of the general soybean situation in his state and a resumé of the soybean research work that was being conducted. These reports follow:
    “Alabama–Mr. E.F. Schultz was unable to be present due to an experiment station conference.
    “Arkansas report by C. Roy Adair–In 1945, Uniform Test Groups VI and VII were grown at six locations and Uniform Test Group VIII was grown at three locations. Additional variety tests were also grown at four locations. Approximately 425 hybrid lines were grown at Stuttgart. Plant selections were made from 96 of those lines.
    “The objectives in the breeding work are for:
    “(1) A satisfactory variety that is a couple of weeks earlier than Arksoy.
    “(2) A variety that matures at the same time, and is equal to or better than Ogden in yield and oil content, and which does not shatter as badly as Ogden.
    “More work should be done on dates of planting as the results obtained indicate that most soybeans in this state are planted too late.
    “Arkansas report by C. Roy Adair (continued)–The principle soybean growing sections of the state are in the cotton growing areas of the Delta in eastern Arkansas and the Arkansas and Red River Valleys and in the rice section in east-central Arkansas. Soybeans must compete with cotton and corn in the cotton growing sections of the State. In the rice section it is a good practice to follow a three-year rotation with the land in rice one year in three. Under that system of management, soybeans do not compete with rice for the land, but the crop does compete with lespedeza and in some cases with winter oats.
    “Florida–Mr. G.E. Ritchey was unable to be present, due to an experiment station conference.
    “Georgia, Coastal Plain, report by J.L. Stephens–This report covers tests made at Blackville, South Carolina; Millen, Georgia; Richmond Hill, Georgia; and Tifton, Georgia. Plantings were made around May 1st. Seasonal conditions were generally favorable. Good stands were secured at all locations and vegetative growth was normal.
    “Blackville, South Carolina–Planting was made on Orangeburg sandy loam soil of medium fertility. Soybean yields were fair. Some leaf diseases were noted but none of serious proportions. Nematode damage was very light.
    “Millen, Georgia–Planting was made on extra good Ruston sandy loam. Vegetative growth of soybeans was exceptionally large with many varieties attaining five to six feet. Vegetative growth continued throughout the summer so that fruiting was retarded. Many bean pods ‘blasted’ and only a few varieties matured seed before frost of either Group VII or VIII. Those groups were not harvested this year, because of the serious blasting and incomplete maturity. It is believe that earlier maturity and better seed production would have been secured if plot location had been on poorer soil.
    “Richmond Hill, Georgia–This location is near the coast and on a Norfolk sand of Hammock type or a sandy soil of relatively high organic content. Soybean growth is always good on this type of soil early in the season. Later in the season, however, nematodes become a serious factor and in many instances entire plots are destroyed by them. This year nematodes did more damage at this location than any other here being reported on. Groups VII and VIII were grown.
    “Tifton, Georgia–Groups VII and VIII were grown and in addition dates of seeding tests. Selections from North Carolina were also grown. The soil where all plots were located was Tifton sandy loam in a fair to good state of cultivation. Nematode damage was slight this year. Growth of beans was good and on the average, the highest yield of beans was secured at this location.
    “Georgia, Experiment, report by U.R. Gore–Soybeans are grown in Georgia for hay, 96,000 acres with a yield of 0.9 ton per acre, and beans 13,000 acres with a seed yield of 6.5 tons per acre. Seed yields of beans are generally too low to prove profitable to farmers.
    “The new soybean variety, Gatan, is a result of the soybean breeding program of the Georgia Experiment Station. It originated from a natural cross with Otootan, which has been selected until practically uniform. Gatan produces...” Continued. Address: U.S. Regional Soybean Industrial Products Lab., 205 Old Agricultural Building, Urbana, Illinois.

• Summary: (Continued): Page 9: “Special Topics.

“Discussion of General Soybean Fertility Problems by E.E. Hartwig–The experiments on soybean fertilization being conducted in North Carolina by W.L. Nelson were discussed by E.E. Hartwig.

“In some areas of North Carolina very low soybean yields have been obtained. Experiments are being conducted in which a program of soil testing together with fertilizer and varietal experiments are integrated in an effort to find the best method to increase the yield of soybeans to an economical level.

“Experiments have shown that in many soils applications of lime are necessary. In experiments on five soil types where the pH ranged from 5.0 to 4.1, broad-cast applications of 2000 to 9600 pounds per acre of dolomitic limestone increased the yield in each case. The average increase was 10.9 bushels per acre. It has been found that manganese deficiency will result on some of the dark poorly drained soils in the lower coastal plains if brought above pH 5.8 to 6.0.

“Potash experiments were conducted on seven soil types in which the available K20 ranged from 28 to 535 pounds per acre. Substantial increases were obtained in all cases where the available K20 was 103 pounds per acre or less when 60 to 120 pounds per acre of K20 was side-dressed at first cultivation.

“Phosphate experiments were conducted at seven locations on six soil types. Treble superphosphate was applied in the row at planting at the rate of 40 to 60 pounds per acre of P2O5. In one case where the soluble P2O5 was 32 pounds per acre, an application of phosphate increased, the yield from 6.4 to 33.6 bushels. In five cases where the soluble P2O5 ranged from 50 to 228 pounds per acre an application of phosphate increased the yield, on the average, from 27.5 to 29.4 bushels.

“As a result of these fertilizer trials, it is planned to conduct fertilizer-varietal experiments on farm fields where the yield of soybeans has been less than 20 bushels per acre. In these experiments, lime and phosphate will be applied where needed, before or at planting time, and 150 pounds of muriate of potash will be applied soon after emergence. Ogden, Roanoke and a local variety will be used.

“Studies on Soil Losses with Soybean and Cotton Rotations at the Southern Piedmont Conservation Experiment Station, Watkinsville, Georgia by W.E. Adams–The following report gives the soil losses in soil erosion studies for soybean and cotton rotations for the year 1942.

The 57-year average annual rainfall for Watkinsville, Georgia, is 49.48 inches. The 1942 total rainfall was 50.09 inches; or 0.51 inch excess. Rainfall is generally fairly well distributed except for a drop in the spring and fall. The periodic soil losses based on continuous cotton are as follows:

“September-February 13% of year’s total soil loss
“March-May 20%
“June-August 67%

“The heavy soil losses during the March-August period are due to the excessive rains which occur during this period. Generally, about 6 rains cause approximately 90 percent of the annual soil losses.

Page 10: “Following is the runoff and soil loss summary for 1945 from a 3-year Kudzu-corn rotation on 11 percent slope, Class IV land;

“Crop; Runoff, percent; Soil loss, T/ac.
“1. Kudzu (no hay) 6.2 24
“2. Kudzu (no hay) 5.1 .29
“3. Corn–Kudzu 6.4 1.04

“The following 3-year corn-Kobe lespedeza rotation also on Class IV land; when compared with the corn-kudzu rotation, illustrates the effectiveness of kudzu in controlling soil and water losses.

“1945 data (average of 2 plots). Crop; Runoff (%); Soil loss (T/ac.)
“1. Oats (seed)–Kobe lesped. for seed 15.5 4.69
“2. Volunteer Kobe lesped. for seed 16.9 2.51
“3. Corn–Oats 14.1 5.48

“Soybean Production in the United States, Past and Future by E.G. Strand–The soybean is a relatively new crop in American agriculture. Fifty years ago the soybean in the United States amounted to little more than a garden curiosity. However, the merits and possibilities of the plant were recognized by some workers in the United States Department of Agriculture and at some of the State Agricultural Experiment Stations. Consequently, in 1898, there was begun a program of introducing large number of soybean varieties into this country, primarily from eastern Asia, and this was accompanied by a program of improvement through selection and breeding. Thousands of soybean selections were brought in for study and experiment. During the last 40 years the rise of the soybean as an American crop has been dramatic. The acreage grown for all purposes expanded from 50,000 acres in 1907 to 460,000 acres in 1917. By 1924 the planted acreage was approaching 2 million, in 1934 it was over 6 million, and in 1943 it was almost 16 million acres. Since 1942 soybeans have ranked seventh among American crops, exclusive of hay and pasture, in acreage of land occupied. In some counties in the Corn Belt soybeans have occupied more than one-third of the cropland during the war. A substantial industry based on soybeans has been developed, during the last decade.

“From the early part of the century until less than 20
years ago most of the soybeans in this country were grown in the eastern states and in the South. A rapid expansion began in the North Central States in the 1920’s, and by 1934 the two leading states were Illinois and Indiana. In 1944 the five leading states were Illinois, Iowa, Indiana, Ohio, and Missouri, and these five states accounted for 84 percent of the acreage harvested for beans in the United States that year. The five leading states in the South in soybeans harvested for beans are now Arkansas, North Carolina, Virginia, Mississippi, and Tennessee.

“At first and for several years, soybeans in the United States were grown primarily as a forage crop. With the adoption of improved varieties for bean production a gradual increase in the proportion harvested for beans began to get underway. The proportion grown for this purpose increased rapidly during World War II. In 1944, 72 percent of the total planted acreage was harvested for beans.

“There has been a strong upward trend in yields of soybeans in the United States as a whole since 1924. The yields obtained in the Corn Belt have been the major factor in the national average. Average yields in the Delta fluctuated moderately from 1924 to 1937, and since then have moved upward to a level higher than average yields in the Atlantic Coast region. In the Atlantic Coast region yields have shown little trend since 1931 although the direction was downward before that time. Yields in the five Corn Belt States averaged 60 percent higher than yields in the other two regions during the four years 1941-44.

“The principal uses of soybeans (i.e., the beans) are for processing, for seed, and for feed. Processing for oil and meal constituted a minor use of soybeans until about 1930, and it was not until 1936 that as much as one-half of the domestic production was so used. The volume of processing increased rapidly during the last 10 years. In 1943-44 it was equal to 74 percent of the production.

“From 90 to 98 percent of the soybean oil meal produced in the United States is used for livestock feed. The total quantities used in making soya flour and in the manufacture of industrial products has never been but a minor proportion. As for soybean oil, by far the greatest proportion is used for food purposes (principally in shortening and margarine) but substantial quantities were also used in paints and other industrial products before the war. In 1939 soybean oil comprised 5.6 percent of the total production of fats and oils (including butter, lard, tallow, and all vegetable oils) from domestic materials in the United States. In 1943, the proportion accounted for by soybean oil was 11.4 percent.

“The important elements in the price of soybeans are the prices of soybean oil and of soybean oil meal. Prices of soybeans in the years ahead will therefore be intimately affected by the general market situation for high-protein feeds and for all fats and oils, for these are highly competitive fields. The factor that will affect the market situation most will be the level of economic activity and employment in the nation. A conservative estimate for the postwar period might be an annual domestic disappearance in the United States of 11 billion pounds of all fats and oils and an annual domestic production of 10 billion pounds. If we assume that soybean oil will account for 8.5 percent of the total domestic production of fats and oils it would mean the harvesting of about 6,850,000 acres of soybeans for beans annually in the postwar period. (This estimate also involves the following assumptions: that yields will average 20.5 bushels per acre, that 70 percent of the soybeans produced will be processed for oil and meal, and, that the average yield of oil per bushel of soybeans processed will be 9.5 pounds. The acreage of cotton assumed in connection with this estimate was about 24 million acres). In addition to the soybeans harvested for beans about 3 million acres of soybeans would perhaps be grown for hay and other uses.”


• Summary: (Continued): Page 13: “The Bureau of Agricultural Economics is continuing the study of factors affecting the competitive position of soybeans in the United States in the years ahead. As a part of this study meetings were held last fall with several groups of soybean growers in Illinois and Iowa. In most of the areas represented at these meetings the majority of farmers expressed the desire to reduce their acreages of intertilled crops below the wartime level in order to increase their acreages of oats and clover, and they indicated that this would generally mean proportionately larger reductions in acreages of soybeans than of corn. They made estimates of the acreages of soybeans that would be grown on typical farms under various assumed price situations. They also gave information relative to their experiences and practices in soybean production and on how soybeans fit into their farming operations. This information, together with that obtained from other sources, is being analyzed, at the present time. A report on this study is to be completed in the next few months and should be published within the year.

“Wednesday evening, February 13

“Dr. Milner gave an illustrated lecture on the work being done with soybeans at the Northern Regional Research Laboratory, Peoria, Illinois. Dr. Milner stressed the value of soybean oil in food products and mentioned the request from oil users that emphasis be placed on the development of low iodine number soybean strains. He pointed out that
there is some dispute as to what causes reversion in soybean oil after refining. Some investigators hold to the idea that the phosphatide [lecithin] portion of soybean oil is responsible for reversion. However, other refiners express the opinion that the linolenic acid content of the oil is responsible and base their request for varieties with a low iodine number on this basis.

“Thursday. February 14–P.R. Henson, Chairman

“Resumé of Comments on the Origin, Objectives and Present Status of the U.S. Regional Soybean Laboratory, Stoneville, Mississippi by O.S. Aamodt.

“The nine Bankhead-Jones Regional Research Laboratories were established ten years ago to carry on fundamental research on regional problems not provided for at the time, or contemplated in the future, on regular funds or state funds provided by the Federal Government. Sixty percent of the funds provided by Congress was allotted to the States and 40 percent to the Secretary of Agriculture for the establishment of Regional Research Laboratories and for special studies. The Experiment Station directors in each region in consultation with the U.S. Department of Agriculture selected the most urgent problems in their region. A Regional Soybean Laboratory was suggested by the North Central Directors. The laboratory was developed cooperatively by the Bureaus of Chemistry and Plant Industry with an Advisory Committee of the North Central Experiment Station Directors. When the Northern Regional Research Laboratory was developed at Peoria, the research on industrial utilization and processing was transferred to the new laboratory there. The production and improvement program and the analytic laboratory remained at Urbana as the U.S. Regional Soybean Laboratory.

“Early in the war, it was evident that acreage requirements for soybeans would need to be met in part outside of the North Central Region. Considerable progress had already been made in the production of soybeans in limited areas in the South. It was believed that the acreage of soybeans could be expanded in the South if the region had the assistance of the Regional Soybean Laboratory. The Directors of the North Central Region agreed to make the facilities of the Laboratory available to the Southern States, provided additional funds were made available to take care of the increased costs of the expanded program. Arrangements were made accordingly with the understanding that if reductions became necessary at a later date, they would be in the expanded program. The question has also been raised as to whether the southern program was developed as a temporary war-time measure or a permanent part of the Regional Laboratory. This matter should be clarified by the Directors of the Region.

“You as technical collaborators representing the 12 cooperating Southern States, together with the Laboratory staff and representatives of the Division of Forage Crops and Diseases of the Bureau of Plant Industry, Soils, and Agricultural Engineering, are responsible for the planning and conducting of the work in the South. This is a ‘work planning conference.’ We have associated with us this year a group of plant pathologists operating on regular and state funds. We expect to integrate completely the activities of the two groups as mutually supporting phases of work toward a common objective.

“Several informal regional conference groups are also operating in different sections of the country, such as the alfalfa improvement conference, the corn breeders’ conference, the spring wheat improvement conference, etc. These groups, having a common interest and purpose, gather around the table as their activities require to consider objectives and methods for attaining them. Their procedure is somewhat as follows: Collect and review the available information concerning the past, current, and proposed research work relating to the problem under consideration; study and correlate the information by means of individual and group conferences or special committees; prepare reports and make recommendations to the cooperating agencies; plan a coordinated program of research; arrange for essential materials, equipment, and personnel; avoid undesirable and unnecessary duplication of effort; and secure greater economy and efficiency in the expenditure of funds.

“It is important to recognize that no one plan for organization can be final in all details. The nine U.S. Department of Agriculture Bankhead-Jones Laboratories are not organized and operated on the same lines. Neither are the many informal conference groups operating in all sections of the country. Each one has adapted its organization and activities to its dominating requirements, facilities, and personnel at hand.

“It is also important to recognize that no one research plan can or will be final. To be useful a regional research program must be dynamic, changing with every new need or advance. It must permit the investigator to make adjustments from old or less promising fields to newer and more fertile opportunities or possibilities. The important thing is to arrange all activities so that they may be quickly responsive to the needs of the future. It is unlikely that the research and educational patterns of today are likely to fit the needs of tomorrow.

“One of the most serious problems in meeting the needs of tomorrow is financial limitations. The funds allotted to the Federal Government are limited by the Congressional appropriations which, together with budget reductions and increased operating costs, make it impossible for research work to expand to meet natural growth requirements. All of the funds for Bankhead-Jones Laboratories are obligated to be spent in the field. The administrative subject matter Division is not permitted to spend any of the funds in Washington. To help keep our finances straight, all payrolls, vouchers, etc., on Bankhead-Jones funds are first cleared through the Urbana Laboratory.
The new disease expenditures clear directly through the Division of Forage Crops at Beltsville, Maryland. The entire program is a function of the cooperative regional organization. It is desirable that each of you keep your own director fully informed of developments not only in subject matter, but organization and finances as well. We are delighted to have Director Dorman with us this year as the official representative of the Southern Experiment Station Directors."


• Summary: Page 17: “Dates of Planting Studies

“All agreed that additional information was needed on dates of planting. There was, however, a wide divergence of opinion on the method to use. One method suggested was to plant all uniform groups at two or three dates. This method would give valuable information on the intervarietal response to date of planting but it did not meet with the general approval of the group because of the lack of labor to handle the added work involved. It was also felt by some of the men that this method would not give all the information needed.

“In some areas it is a customary practice to plant soybeans after early crops, such as potatoes and small grains. It was the opinion of the men from those areas that an experiment should be conducted in which the late date of plantings should actually follow the early crop. The general opinion seemed to be that in a case of this kind, that at least one entire uniform group should be used.

“There were others in the group who thought that this test should be continued about the same as it has been in the past. The method would be to use three or four varieties adapted to that area and plant at several dates. Sufficient dates would be used to find the extremes in planting dates.

“Since there were so many suggestions on methods of conducting the date of planting experiment, it was decided not to try to conduct a uniform plan. In each state where it is thought necessary to work on this problem, an experiment will be conducted that best suits that area.

“Thursday evening, February 14

“W.J. Morse gave an illustrated talk on soybean culture, marketing, and utilisation in the Orient. Dr. J.S. Adams showed a colored motion picture on the flame cultivator used in killing weeds in cotton and to a small extent in soybeans. In the use of the flame cultivator on soybeans two years ago it was found that with slow speed the soybean plants were injured more or less, cracking open the stems. With high speed, there was much less injury. During the past summer tests with the flame cultivator on soybeans showed no injury.

“Friday, February 15–H.Y. Marston, Chairman


“The following members participated in the pathological conference:

“S. Chilton
“E.M. Cralley
“S.G. Lehman
“J.L. Weimer
“W.B. Allington

“Soybean seed treatments in 1945 increased stands in most instances but increases in seed yield were not significant. Arasan proved to be consistently better than the other chemicals used. Dr. Cralley reported one case in Arkansas where N.I. Ceresan was outstanding in increasing the stand as contrasted to the other chemicals. It was agreed that the seed treatment test should be revised in 1946 and that 5 seed lots be used, each lot being affected by a specific disease or condition. Only one chemical, Arasan, is to be used at the 2 oz/bu. rate. Three dates of planting are to be recommended but the number of dates at each location was left to the judgment of the cooperator. Notes are to be taken on stand and disease control but the harvesting for yield is optional. The question was discussed relative to the possibility of recommending a lower rate of seeding of soybeans in combination with seed treatment but no specific conclusion was reached. Dr. Lehman reported that his data indicated a differential response of varieties to seed treatment, the variety Herman responding better than most others.

“The testing of varieties for resistance to Sclerotium rolfsii by Dr. Weimer at Experiment, Georgia, has disclosed no resistance. Most of the varieties in all the uniform yield nurseries have been tested. The method used consists of growing the inoculum on sterile oats in giant cultures and placing the inoculum in contact with the base of the plants, covering it later with a small amount of soil. In 1944, a few plants in several varieties survived. Seed was saved from these plants and planted in 1945 in plant rows which were inoculated. All of these plants were readily killed by the fungus, indicating that the plants had merely escaped and
had no resistance of importance. In another test, plants were
grown at various spacings in the row which was inoculated
at one end by the same method. The plants at the point of
inoculation were killed but the infection failed to spread
along the row, even in cases where the plants were so thick
that they were almost in contact with each other. This
indicates that the soil environment was not too favorable
for the disease, since in nature the fungus is commonly
observed to spread from plant to plant on the surface. There
is a question, however, as to whether the method used for
inoculation is not too drastic, covering up some useful
resistance. It was agreed that the present method was rapidly
eliminating all the varieties as a source of resistance, and that
if none are found to be resistant, the method might then be
revised if possible and the tests made over again.

“The nematode resistance tests at Experiment, Georgia,
were not productive in 1945 due to lack of infection. It was
agreed that the test should be abandoned at that location
and that Dr. Weimer and Mr. Stephens make tests at or
near Tifton, Georgia, where nematode infection is more
dependable. The possibility of biologic races of nematodes
affecting varieties differently was recognized and discussed.
It is the plan that a test will be made also in 1946 at Raleigh,
North Carolina, under the direction of Dr. Lehman.

“The work on bacterial leaf spots (i.e. bacterial pustule
and bacterial blight) was discussed by Drs. Lehman and
Allington. The use of a power sprayer in and bacterial blight) was discussed by Drs. Lehman and
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each row. The row numbers are on the packet, and field plans
accompany these instructions. Dates of planting are optional.
In the case of three dates of planting, it is recommended
that the first date be two weeks before normal, the second
about normal, and the third two weeks after the normal
date. In the case of two dates, the two earlier times would
perhaps be best. Where only one date of planting is made,
the second should be about two weeks before the normal date. These
recommendations are based upon the assumption that the
beneficial effect of seed treatment will be most pronounced
on earlier plantings. The untreated seeds should be planted
first or by different persons in order to avoid carryover of
chemical to the untreated seeds. To avoid loss of chemical
from the seed, drop the treated seed directly from the
envelope. The identity of the seed is as follows:

1. Lincoln x Richland hybrid encrusted with mildew
from Wisconsin.
2. Volstate with low germination from North Carolina.
3. Ottawa Mandarin with weather damage from
Minnesota.
4. Rose Non-Pop with low germination from North Carolina.
5. Giant Green, weather damage and low germination.
This lot is from Illinois and produces mostly *Alternaria* and
*Aspergillus* in culture.
6. Records. The final stand records obtained should be
sent in as soon as possible. Other information desired is as follows:
1. Type of soil.
2. General soil fertility.
3. Previous crop.
4. Date of last soybean crop.
5. Method and date of soil preparation.
6. Moisture conditions at planting time.
7. Moisture conditions between planting and final stand
counts.
8. Daily soil and air temperatures if possible
(Maximum and minimum).
9. Accurate notes on apparent disease control,
perticularly bacterial leaf spots, mildew, and seedling blights
such as *Rhizoctonia* and *Pythium*.

On pages 2 and 3 are diagrams concerning the 1st,
2nd, and 3rd planting dates. For each of the three, Blocks A
through D are shown. For each block is given the Row, the
Treatment, and the Variation.

Note: Even though this document is undated, we can
estimate the date by looking at the dates of No. 133 (8
April 1946) and No. 135 (29 April 1946) - the documents
in this series numbered just before and after this No. 134,
which was probably published in mid-April 1946. Address:
U.S. Regional Soybean Industrial Products Lab., 205 Old
Agricultural Building, Urbana, Illinois.

327. Probst, A.H. 1946. Third work planning conference
of the North Central States Collaborators of the U.S.
Regional Soybean Laboratory, Urbana, Illinois, February
20, 21, 22, 1946. RSLM (U.S. Regional Soybean Laboratory

**Summary:** Note: This is a typewritten report.

A conference of the North Central States technical
collaborators of the U.S. Regional Soybean Laboratory was
held, at Urbana, Illinois, on February 20-22, 1946, to review
the accomplishments of the cooperative work and to plan
future soybean investigations. This conference marked the
tenth year of the cooperative work of the Laboratory. In
addition to the planning of agronomic and plant breeding
research, the presence of cooperating plant pathologists made
possible an integration of disease studies with the other work
for the benefit of the entire program.

Wednesday, February 20– J.L. Carter, Chairman
The conference was called to order at 9:00 a.m.
in Room 314 Illini Union Building at the University of
Illinois. The following State and Federal personnel were in
attendance:

- Aamodt, O.S., Head Agronomist, Forage Crops &
  Diseases, U.S.D.A., Beltsville, Maryland.
- Albrecht, H.R., Agronomist, Indiana Experiment
  Station, Lafayette, Indiana.
- Allington, W.B., Pathologist, U.S.D.A., Forage Crops
  and Diseases, Urbana, Illinois.
- Burlison, W.L., Agronomist, Illinois Experiment
  Station, Urbana. Illinois.
- Caldwell, R.M. Pathologist, Indiana Experiment
  Station, Lafayette, Indiana.
- Carter, J.L., Agronomist, U.S. Regional Soybean
  Laboratory, Urbana.
- Chamberlain, D.W., Pathologist, U.S. Regional
  Soybean Laboratory, Urbana, Illinois.
- Collins, F.I., Chemist, U.S. Regional Soybean
  Laboratory, Urbana, Illinois. Crall, J.H., Pathologist,
  Missouri Agricultural Experiment Station, Columbia,
  Missouri.
- DeTurk, E.E., Agronomist, Illinois Experiment Station,
  Urbana, Illinois.
- Englehorn, A.J., Agronomist, Iowa Experiment Station,
  Ames, Iowa.
- Erickson, E.L., Agronomist, South Dakota Experiment
  Station, Brookings, S.D.
- Feaster, C.V., Agronomist, U.S. Regional Soybean
  Laboratory, Columbia, Missouri.
- Frank, F.A., Agronomist, Indiana Agricultural
  Experiment Station, Lafayette, Indiana.
- Fuelleman, R.F., Agronomist, Illinois Experiment
  Station, Lafayette, Indiana.
- Hackleman, J.C., Crops Extension, Illinois Experiment
  Station, Urbana, Illinois.
- Henson, P.R., Agronomist, U.S. Regional Soybean
  Laboratory, Stoneville, Mississippi.

“Jones, F.W., Pathologist, U.S.D.A., Wisconsin Experiment Station, Madison, Wisconsin.


“Koehler, B., Pathologist, Illinois Experiment Station, Urbana, Illinois.


“Lambert, J.W., Agronomist, Minnesota Experiment Station, St. Paul, Minn.


“Milner, R.T., Chemist, Northern Regional Research Laboratory, Peoria, Illinois.

“Morse, W.J., Agronomist, U.S.D.A., Forage Crops & Diseases, Beltsville, Maryland.


“Rusk, H.P., Director, Illinois Experiment Station, Urbana, Illinois.

“Saboe, L.C., Agronomist, U.S. Regional Soybean Laboratory, Columbus, Ohio.

“Sears, O.H., Agronomist, Illinois Experiment Station, Urbana, Illinois.


“Stoa, T.E., Agronomist, North Dakota Experiment Station, Fargo, N.D.

“Tervet, I.W., Pathologist, Minnesota Experiment Station, St. Paul, Minn.

“Torrie, J.H., Agronomist, Wisconsin Experiment Station, Madison, Wisconsin.

“Tucker, C.M., Pathologist, Missouri Experiment Station, Columbia, Missouri.


“Weiss, M.G., Agronomist, Iowa Experiment Station, Ames, Iowa.

“Welch, A., Pathologist, Iowa Experiment Station, Ames, Iowa.


“Zahnley, J.W., Agronomist, Kansas Experiment Station, Manhattan, Kansas.

“The first speaker was Director H.P. Rusk who welcomed the collaborators on behalf of the North Central States Experiment Station Directors. Director Rusk expressed his enthusiastic endorsement of this type of cooperative attack on a problem of vital importance to the region. He pointed out that the Experiment Station Directors of the North Central region were endeavoring to approach all their common problems in the spirit of helpful cooperation. Director Rusk spoke briefly on the Morrow plots started at the Illinois Agricultural Experiment Station in 1867 and mentioned that very little work had been done to measure the effect of soil fertility programs and cropping practices on the quality of the crop produced. He emphasized the necessity for research to study the effect of crop quality on animal and human nutrition.

“A Word of Welcome to the Regional Soybean Conference by W.L. Burlison–It affords me real pleasure to add my word of welcome to what Dean Rusk has already said. If there is anything we here at the University can do to make your stay pleasant and profitable, I am sure you will give us this opportunity to serve you.

“The Regional Soybean Laboratory was established at the University of Illinois 10 years ago. Much has been accomplished in soybean research during this past decade. Herbert Hoover once said,

“‘Discovery and invention do not spring full grown from the brains of men. The labor of a host of men, great laboratories, long, patient, scientific experiment build up the structure of knowledge, not stone by stone, but particle by particle. This adding of fact to fact some day brings forth a revolutionary discovery, an illuminating hypothesis, a great generalization, or a practical invention.’

“The establishment of the Regional Soybean Laboratory was one of the first of the nine Bankhead-Jones laboratories to be launched. It was a new adventure in cooperation. I think we all agree that we have learned much about what the word ‘cooperation’ means between Federal and state workers. In speaking to the Fifty-Fourth Annual Convention of the Association of Land-Grant Colleges and Universities at Chicago on November 11, 1940, President Farrell of Kansas sounded a warning that is always worth remembering whenever Federal and state scientists are working cooperatively on research problems such as is represented by the U.S. Regional Soybean Laboratory. President Farrell said in referring to our dual system of government:

“‘The Federal-State system is clumsy, slow, sometimes inefficient, irritating but supremely desirable. The welfare of the whole nation requires that both the Union and the individual states be strong and vigorous; the Union to perform those functions that unity implies and requires; the individual states and the people to perform all other
functions. If either the Union or its component parts should become impotent, the whole national structure would collapse...

"In our dual system of government, each side sooner or later must work harmoniously with the other. Each must recognize that the other has an indispensable function to perform if the whole nation is to benefit. Each must be actuated by a spirit of generosity, fairness and good will and by an honest desire to serve the common weal. Each must recognize that the parts must be strong and responsible if the whole is to endure.'

"If we keep in mind these admonitions, our cooperative efforts will continue to grow and our endeavors, of course, will be ever more productive.

"General Discussion of Soybean Fertility Problems

"Dr. E.E. DeTurk of the Illinois Agricultural Experiment Station led a discussion on the soil fertility problem as it relates to soybean production. In the course of the discussion he called on several agronomists and soils men from neighboring state experiment stations. The discussion by Dr. DeTurk was divided into two phases: I. Chemical Changes During Growth, and II. Comments on Plant Feeding.

"I. Chemical Changes During Growth. Soybeans were grown on untreated soil and also with superphosphate (0-20-0) and with a phosphate-potash (0-20-20) fertilizer. Samples were taken at weekly intervals from emergence to maturity and cotyledons, leaves, stems, seeds and pods were analyzed for nitrogen, phosphorus, potassium, and calcium. Some noteworthy observations were:

"1. At the age of six weeks growth (gain in dry weight) ceased for a week. This stage marked the peak of synopsis. A sharp drop in leaf weight and a slight drop in stem weight began at the end of the 9th week, at the initiation of seed enlargement. Seed weight per plant increased at a steep gradient until the 13th week and then more slowly until the 15th (maturity).

"2. Nitrogen uptake proceeded at a rapid and uniform rate from the end of the 6th to the end of the 12th week from emergence except during the 7th..." Continued. Address: U.S. Regional Soybean Lab., Lafayette, Indiana.


• Summary: (Continued): Page 6: "... application during dry seasons. In general, soybeans respond to an increase in fertility level caused by application of lime, fertilizers, and manure.

"In Iowa the soybean will compete with other intertilled crops, and acreage will depend upon the price and yield relationship with corn. In southern Iowa the yield, ratio is about 2.5 bushels of corn to one of soybean, in central Iowa 2.5 or 3 to one, and in northern Iowa 3 or 4 to one. In rotations, corn following soybeans for beans usually gives a larger yield than corn following corn. On sloping land, an advantage of 2 or 3 bushels is obtained from seeding soybeans on the contour. Studies on nitrogen nutrition of the soybean plant have shown that the nodule mechanism does not supply sufficient nitrogen and that as the general fertility level increases the yield and nitrogen in the beans increases, in both inoculated and uninoculated plots. Management practices that supply abundant nitrogen to the soil in mid-season should contribute to higher yields.

"Reports of Collaborators

"The principle work for the first day of the conference was the presentation of reports by each of the collaborators present, giving the highlights of the soybean situation in his state and reporting on experimental work that is underway.

"Illinois report by L.F. Williams–Cooperative soybean testing is being conducted at several locations in Illinois. There is one in northern Illinois at Compton where Group II is grown, and there is one at Dwight in North Central Illinois where Groups II and III are grown. In the Central section we have a plot in western Illinois at Clayton where Groups III and IV are grown. At Urbana, in east central Illinois, we grow Groups II, III, and IV. Groups III and IV are also grown at Stonington, which is about sixty miles south of Urbana and farther west. These locations are all on relatively good soils. In South Central Illinois we have a plot at Edgewood where we grow Groups III and IV. This location has a light soil on tight clay and is representative of many of the poorer soils in southern Illinois. At Freeburg, in the southwestern part of the state, we also grow Groups III and IV. This location is representative of some of the better soil in southern Illinois, and has given very satisfactory yields of soybeans.

"Since Lincoln has proven so satisfactory, we have used it extensively in crosses. The cross Lincoln x Richland combined the high yield and high oil content of Lincoln with the earliness and lodging resistance of Richland. In the first yield tests of selections from this cross in 1945, out of about 600 strains we have 10 which combine these four desirable characteristics. Some of these strains even exceed the better parent in one or more respects. Several of these strains are a week or more earlier than Richland. We also have 10 other selections which have high yield, high oil content, and high lodging resistance. Six of these are of Lincoln maturity, and four are later than Lincoln.

"Lincoln has also been crossed with such late types as Patoka, Chief, Gibson, and, Macoupin to produce good breeding material for the southern sections of Indiana, Illinois, Missouri, and other states requiring strains of comparable maturity.

Page 9: “Excessive late spring precipitation delayed planting in much of the state. Planting was very late in
A total of 29,431 acres of soybeans were certified for seed in Indiana in 1945 with a production of 27,924,000 bushels of beans. This was a record crop and was 18 percent higher production than in 1944. The average acre yield was 19.5 bushels. About 41 percent of the acreage harvested for beans was planted in rows.

There were 1,432,000 acres of soybeans harvested for grain in Indiana in 1945 with a production of 27,924,000 bushels of beans. This was a record crop and was 18 percent higher production than in 1944. The average acre yield was 19.5 bushels. About 41 percent of the acreage harvested for beans was planted in rows.

A total of 29,431 acres of soybeans were certified for seed. Lincoln comprised 85 percent of this acreage. The acreage certified by varieties was as follows: Lincoln, 25,048; Earlyana, 2,797; Richland, 682; Gibson, 264; Dunfield, 210; Chief, 148; Kingwa, 124; Patoka, 101; and Mandell, 57.

Yield tests are being conducted on Group II, III, and IV strains at 8 locations. The development of a suitable very early yellow-seeded variety for muck soils for northern Indiana has been undertaken.

The interaction of varieties to different levels of soil productivity is being studied.

Iowa report by R.R. Kalton–The objectives of the experimental soybean work in Iowa are several. The primary goal is the development of new strains of soybeans which are superior in agronomic and chemical characteristics to the commercially grown varieties now available. In addition to this, there are several other lines of research on soybeans which are under investigation. Some of these are the evaluation of the best cultural practices for growing soybeans, studies on the effect of simulated hail injury to soybeans, and an investigation into some of the fundamental genetic aspects pertinent to the soybean breeding program. A few highlights of the Iowa soybean experimental work are discussed below.

Three different Uniform Group Tests (I, II, and III) of the U.S. Regional Soybean Laboratory are grown in Iowa. As these tests contain most of the important varieties of interest in the areas where the tests are grown, they serve as a basis for varietal recommendations to farmers. They also contain the most promising experimental strains developed in the soybean breeding programs of the North Central States. Therefore, these tests assist in the widespread evaluation of breeding material. In these tests in Iowa, Lincoln consistently has outyielded all other varieties in the central and southern areas of the state. In the northern Iowa tests, Earlyana, Richland, and Habaro generally have yielded about the same. Richland has done best on rich soils in this area when planted early. On soils of medium fertility, the added height of Earlyana has favored it. Habaro has performed, satisfactorily when planted late on rich soils. The possibilities of obtaining new improved varieties appear very promising, judging from the relative performance of some of the experimental strains in the same tests.

Page 18: A table shows which varieties in Group II are resistant to a certain unknown disease. These varieties are A3-108, Harman, A3-9, Mukden, Pennsoy, Manchu 3, and Dunfield.

Since the above is based on one year’s results at one location, further tests are necessary.

Fifty-two border plants of Lincoln were classified according to size of leaf pustule for downy mildew. Thirty-six plants had large pustules of which 20.5 percent of the seeds were encrusted with oospores and 26 plants had small pustules with 8.4 percent infested seeds.

Approximately 100 L x R and (L x R) x L lines were tested for yield at Madison [Wisconsin]. The selections ranged in maturity from Mandarin to Lincoln. Only one out-yielded Manchu 3, however. About 1/3 were better than either Lincoln or Richland. Many of these selections were excellent for strength of straw, maturity, height, and oil percent. Mildew infection ranged from 9 to a high of 38 percent of the seeds encrusted with mildew. It is hoped that the relative low yield of these strains is a reflection of the 1945 Lincoln response. A negative non-significant correlation of -.157 was found between yield and percent of seeds encrusted with mildew for 63 (L x R) x L selections.

For the three-year period, 1943 to 1945, the average increase in precision obtained for the lattice design compared to the randomized complete block was 130 percent for 7 tests at Madison, 114 percent for 4 tests at Eau Claire, and 111 percent for 3 tests at Spooner.

Seed from 110 acres of registered Flambeau is available for 1946 planting.” (Continued): Address: U.S. Regional Soybean Lab., Lafayette, Indiana.


Summary: (Continued): Page 18:

Comments on the Origin, Objectives and Present Status of the U.S. Regional Soybean Laboratory by O.S. Aamodt–The nine Bankhead-Jones Regional Research Laboratories were established ten years ago to carry on fundamental research on regional problems not provided for at the time, or contemplated in the future, on regular funds or state funds provided by the Federal Government. Sixty percent of the funds provided by Congress was allotted to the States and 40 percent to the Secretary of Agriculture.
for the establishment of Regional Research Laboratories and for special studies. The Experiment Station directors in each region on consultation with the U.S. Department of Agriculture selected the most urgent problems in their region. A Regional Soybean Laboratory was suggested by the North Central Directors. The Laboratory was developed cooperatively by the Bureaus of Chemistry and Plant Industry with an Advisory Committee of the North Central Experiment Station Directors. When the Northern Regional Research Laboratory was developed at Peoria, the research on industrial utilization and processing was transferred to the new laboratory there. The production and improvement program and the analytic laboratory remained at Urbana as the U.S. Regional Soybean Laboratory. You as technical collaborators representing the 12 cooperating North Central States, together with the laboratory staff and representatives of the Division of Forage Crops and Diseases of the Bureau of Plant Industry, Soils, and. Agricultural Engineering, are responsible for the planning and conducting of the work. This is a ‘work planning conference.’ We have associated with us this year a group of plant pathologists operating on regular and state funds. We expect to integrate completely the activities of the two groups as mutually supporting phases of work toward a common objective. Several informal regional conference groups are also operating in different sections of the country, such as the alfalfa improvement conference, the corn breeders’ conference, the spring wheat improvement conference, etc. These groups, having a common interest and purpose, gather around the table as their activities require to consider objectives and methods for attaining them. Their procedure is somewhat as follows: Collect and review the available information concerning the past, current, and proposed research work relating to the problem under consideration; study and correlate the information by means of individual and group conferences or special committees; prepare reports and make recommendations to the cooperating agencies; plan a coordinated program or research; arrange for essential materials, equipment and personnel; avoid undesirable and unnecessary duplication of effort; and secure greater economy and efficiency in the expenditure of funds.

“It is important to recognize that no one plan for organization can be final in all details. The nine U.S. Department of Agriculture Bankhead-Jones Laboratories are not organized and operated on the same lines. Neither are the many informal conference groups operating in all sections of the country. Each one has adapted its organization and activities to its dominating requirements. facilities, and personnel at hand.

“It is also important to recognize that no one research plan can or will be final. To be useful a regional research program must be dynamic, changing with every new need or advance. It must permit the investigator to make adjustments from old or less promising fields to newer and more fertile opportunities or possibilities. The important thing is to arrange all activities so that they may be quickly responsive to the needs of the future. It is unlikely that the research and educational patterns of today are likely to fit the needs of tomorrow.

“One of the most serious problems in meeting the needs of tomorrow is financial limitations. The funds allotted to the Federal Government are limited by the Congressional appropriations which, together with budget reductions and increased operating costs, make it impossible for research work to expand to meet natural growth requirements. All of the funds for Bankhead-Jones Laboratories are obligated to be spent in the field. The administrative subject matter Division is not permitted to expend any of the funds in Washington. To help keep our finances straight all payrolls, vouchers, etc., on Bankhead-Jones funds are first cleared through the Urbana Laboratory. The new disease expenditures clear directly through the Division of Forage Crops at Beltsville, Maryland. The entire program is a function of the cooperative regional organization. It is desirable that each of you keep your own director fully informed of developments not only in subject matter but organization and finances as well. We are delighted to have Dean Rusk with us this year as the official representative of the North Central Experiment Station Directors.

Page 20: “Wednesday evening, February 20

“The evening session convened, at 730 p.m. in the Mini Union Building, and the families of the Laboratory personnel and the agronomy Department were invited.

“The first part of the evening program was an illustrated talk by Dr. R.T. Milner of the Northern Regional Research Laboratory, Peoria, Illinois, describing the work of that laboratory with special emphasis on the research problems on the utilization of soybeans in industry. Dr. Milner pointed out the importance of soybean oil in foods and indicated that industrial oil users were looking for an oil with low iodine number.

“Mr. Morse of the Division of Forage Crops gave an illustrated talk on the culture and utilization of the soybean and its products in China and Japan.

“Thursday, February 21–L.F. Williams, Chairman

“Arranging of the Uniform Nursery Test. 1946

“Mr. Carter prefaced the discussion on the Uniform Tests for 1946 by presenting a graph showing the relation between iodine number of soybean oil and the percentage of the principal fatty acids. Percentage of linolenic acid decreases from approximately 6 percent in oil with an iodine number of 150 to 3 percent in an oil with an iodine number of 100, indicating the difficulty of reducing the linolenic acid content to a negligible amount as has been requested by some manufacturers who are using the oil for edible purposes. The reason for the interest is that linolenic acid is said by some investigators to be the cause of ‘flavor reversion’ in the oil.
Any improvement in flavor and keeping quality that can be obtained through plant breeding will result in wider use of soybean oil in the edible field. The Laboratory will continue to determine iodine number of oil on all breeding samples and attention will continue to be directed toward selecting for oil quality as well as quantity in the breeding program.

Further work will be undertaken, in cooperation with the Northern Regional Research Laboratory at Peoria, and one or two of the commercial users of soybean oil to study the effect of iodine number on keeping quality. All new strains will be evaluated for industrial use as well as for agronomic superiority before release.

Cooperative work in the Southern States by P.R. Henson—Southern farmers, until in recent years, have harvested a very low percentage of their total soybean acreage for seed. As late as 1941, only 15.5 percent of the total soybean acreage in 11 southern states was combined. While the percentage of total southern acreage of soybeans harvested as an oil crop has more than doubled in recent years, the major portion is still utilized for other purposes. The failure of present varieties to produce satisfactory yields of seed consistently has been in part responsible for the small acreage of oil beans. The average yields of the area 11.1, 13.4, 9.9, and 12.6 bushels per acre for the 4 years, 1941-44 respectively, are entirely too low for economic production of oil beans” (Continued). Address: U.S. Regional Soybean Lab., Lafayette, Indiana.


• Summary: (Continued): Page 15:
  - Selecting of Entries for Uniform Test Group IV
  - The group agreed to drop Boone, Macoupin, and S55-10 from the Uniform Test. Illinois will continue to grow Macoupin and Missouri will continue to grow Boone.
  - C508 was the only new entry in the test.
  - Mr. Probst objected to growing S100 on the basis that it is too late for southern Indiana conditions and other northern Areas of Group IV territory where it is being grown, and because of its low oil content. He said the average yield has been good but it has been badly frosted in some cases with resulting low yields.
  - “The varieties and strains chosen for this test, along with the name of the state that is to furnish 10 pounds of cleaned seed to the Laboratory by March 15, are as follows:
    1. Chief, Mini x Manchu, Illinois
    2. C101, Dunfield x Manchu, Indiana
    3. C425, T117 x Mansoy, Indiana
    4. C439, Dunfield x Mansoy, Indiana
    5. C447, Dunfield x Mansoy, Indiana
    6. C453, Dunfield x Mansoy, Indiana
    7. C458, Dunfield x Mansoy, Indiana
    8. C461, Dunfield x Mansoy, Indiana
    9. C463, Dunfield x Mansoy, Indiana
    10. C464, Dunfield x Mansoy, Indiana
    11. C470, Rogue from P.I. 54592, Indiana
    12. C508 (LX590-13), Patoka x L7-1355, Indiana
    13. Gibson, Midwest x Dunfield, Indiana
    14. Patoka, P.I. 70218-2, Indiana
    15. S55-19, Virginia x P.I. 37062, Missouri
    16. S100, Rogue from Illini, Missouri
  - “Increase and Distribution of New Varieties
    - Suggestions for recommendations of new and superior strains to be released were requested, and Mr. Kalton suggested the strain designated A4-107-12 from the cross Mukden x Richland, which had been developed cooperatively by the Iowa Agricultural Experiment Station and the U.S. Regional Soybean Laboratory. Mr. Kalton submitted his recommendations in the form of a report by the Committee on the Distribution of Seed and Plant Material of the Iowa Agricultural Experiment Station.
    - Page 26:
      - “This recommendation reads as follows:
      - “Committee on the Distribution of Seed and Plant Material
      - “Iowa Agricultural Experiment Station
      - “Approval is hereby requested for distribution of the following under the rules of the Committee:
      - “Identification (Name and/or number):
        - “Hawkeye soybean
        - “Pedigree No. A4-107-12
        - “Pedigree:
          - “1938–Hybrid No. 1415. (Mukden x Richland) Final pedigree No. A4-107-12.
          - “Origin: Hawkeye (A4-107-12) originated as a single plant selection in a F5 row of the cross Mukden x Richland, made in 1938 by Dr. M.G. Weiss. Plant selections from the progeny of this cross were made each year from the F2 to the F5 generation. Yield tests were conducted from the F3 to the F5 generation on a plant-progeny basis, in this way obtaining a good preliminary evaluation of the progenitors of this strain. The final plant selection was made in a F5 row of A3-107, by C.R. Weber in 1943. The plants in the F6 progeny row were bulked in 1944, to constitute the original foundation seed of Hawkeye (A4-107-12) for increase.
        - “Description (Taxonomic):
          - “Plant–Flower color–purple
          - “Pubescence color–gray
          - “Type of growth–determinate
        - “Plant height–medium–averages 3-4” taller than Richland
        - “Erect growth with few short branches at basal portion
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of stem.
“Seed–Size–about 2600 seeds per pound; slightly larger than Richland.
“Shape–ellipsoidal
“Color–light yellow
“Hilum color–light brown margin, grayish black center
“Pods–turn light brown at harvest, like Mukden parent predominantly 3 seeded.

“The characteristic hilum color is such as to distinguish this variety from other commercial varieties now available.
Page 31: “Messrs. Torrie, Lambert, Williams, and Probst were to organize strains for a HLT II with A3K-884, Earlyana, Wisconsin Manchu 3, Richland and A4-107-12 as check varieties.

“The possibility of having a HLT III was mentioned but no plans were made. Dr. Williams, after previous consultation with Dr. Milner, Mr. Collins, and Mr. Krober, suggested the elimination of protein and iodine number analyses and not regrinding for oil analyses on all early generation strains, that is, those not entered in the uniform tests, in order to run more samples for oil analyses. Those present were agreeable to this suggestion.

“Friday, February 22–H.W. Marston, Chairman
“The Place of Soybeans in the Soil Conservation Program by C.A. Van Doren, Soil Conservation Research–The belief is prevalent among farmers that the production of soybeans contributes directly to an increased loss of soil from cultivated land. Actual measurements of soil loss from soybeans, as compared with losses from other cultivated crops, do not consistently show greater losses from soybeans than from many other cultivated crops. Under some conditions, the type of physical structure developed on soybean ground may increase infiltration, thus reducing soil losses. Table I shows the relative losses from corn and soybeans from plots located on a four percent slope at Urbana, Illinois.

“Table I. Relative Soil Losses from Soybeans and Corn as Affected by Surface Mulches (1)–Artificial Rain–1.75 inches in one hour.

A table has 7 columns: (1) Date and loss of soil in lb/acre. (2-3) Bare (2) soybeans or corn. (4-5) Straw mulched (3) soybeans or corn. (6-7) Residue (4) soybeans or corn. Oct. 1941. Bare: 1800 vs. 3100. Straw mulch: 97 vs. 94. Residue: 605 vs. 251. Oct. 1942. Bare: 3400 vs. 4100. Straw mulch: 26 vs. 36. Residue: 722 vs. 159.

“(1) All tests were made on plots in quadruplicate on a four percent slope.
“(2) Bare plots were clean-tilled during growing season and all crop residues removed at harvest time: corn as fodder, soybeans as hay.
“(3) Straw-mulched plots were plowed in the spring and mulched after planting with 2 tons per acre of wheat straw.
“(4) Residue plots were clean-tilled during growing season with soybean straw and corn stover returned after harvest to the respective corn and soybean plots.

“Farmers want to produce soybeans. We should therefore attempt to tell them how they may be produced with a minimum loss of soil by erosion. Four considerations should be kept in mind in producing soybeans. We should first consider the land use phases of production. Continued use of any field for cultivated crops such as corn and soybeans will eventually bring about a depletion of plant food nutrients, poor physical condition of the soil, low organic matter content, and reduced yields. Instead of substituting soybeans for a grain or clover crop in our Corn Belt rotations, soybeans should be placed in a rotation instead of a cultivated crop.” Address: U.S. Regional Soybean Lab., Lafayette, Indiana.

• Summary: (Continued): Page 35:

“The disease work conducted by Dr. A. Welch located at Ames, Iowa, will be principally on root rots, especially the Pythium, Rhizoctonia, and Fusarium types. Pod and Stem Blight will also be studied at this location. Dr. Tucker at Columbia, Missouri, will be interested in a study of Charcoal Root Rot and related root troubles, Dr. Caldwell, Purdue University, will study root rots as they occur in general in Indiana, paying particular attention to the effect of soil types as an influence on their occurrence.

“It was agreed that in late August, a conference of the pathologists would be necessary at some Central location to further coordinate the disease work on this crop and to acquaint everyone concerned, with field symptoms of soybean diseases.

“Administrative Problems–Mr. Carter discussed special administrative problems, stating that at the time of the expansion of the cooperative research work to include the 12 states of the Southern region, a definite allocation of funds was made between the headquarters of the Laboratory at Urbana, the allocation of other work in the North Central States, and the work in the Southern States. At that time Federal support to the cooperative work in each of the states was increased substantially, but since that time there have been no increases in the total funds. Since that time, statutory increases in salaries have severely limited the funds that remain for general operations and supplies. During the last two years the Budget Bureau has been calling for a further breakdown of funds and a definite allocation for each quarter, making it necessary that a quarterly apportionment of expenditures be requested of each field agency.

“Mr. Marston was called, on for remarks along this line, and he stated that we are being called upon more and more
to spend our budget within quarters. He emphasized that we are permitted to estimate probable expenditures during each quarter of the year, but after submitting this estimate, we must live very closely within that figure or run the risk of losing the unspent balance at the end of each quarter.

“The collaborators were called upon to estimate the quarterly expenditures that would more nearly reflect the best distribution of funds and the following typical suggestions were made:”

A table shows the estimates of the percentage of the total to be spent in the 1st, 2nd, 3rd, and 4th quarters by four men from 4 areas:
- General (Carter) 10, 40, 20, 30
- Illinois (Williams) 15, 35, 20, 30
- Indiana (Probst) 20, 40, 15, 25
- Nebraska (Slatensek) 15, 50, 5, 30

“The suggestions will be used in estimating the approximate distribution of funds to be requested for the 1947 fiscal year. The higher rate of expenditure during the second quarter of the fiscal year is easy to justify, as threshing operations are conducted during that period. Relatively heavy expenditures...”

Page 37: “... regular line projects of the Division of Forage Crops and Diseases so that specific items of work could be more promptly located in the annual reports. These projects are sufficiently broad to cover all of the line projects that are being undertaken at the present time.

“Work project a-4-3: Soybean Production, Breeding, Disease, and Quality Investigations.
- a-4-3-1: Development of Improved Varieties of Soybeans for Industrial Use.
- a-4-3-2: Plant Breeding Research.
- a-4-3-3: Securing and Maintaining Breeding Stocks—maintaining superior germ plasm for breeding and for genetical research.
- a-4-3-4: Cultural Practices—effect on yield and chemical composition of soybean seed.
- a-4-3-5: Environmental Conditions—effect on the yield and composition of soybean seed.
- a-4-3-6: Storage Studies—effect on viability, longevity, and, composition of soybean seed.
- a-4-3-7: Virus Diseases of the Soybean—studies of etiology and control.
- a-4-3-8: Root Diseases and Seedling Blights—life history and control.
- a-4-3-9: Leaf and Stem Diseases Other than Virus Diseases—life history and control.
- a-4-3-10: Survey of Soybean Diseases—to determine the need for research work and study the effect of control measures.

“The conference unanimously approved the suggestion that the Laboratory staff, the Agronomy Department staff, and the Illini Union be thanked for the fine conditions under which the meeting was held and the excellent accommodations that were made available.

“The meeting was adjourned at 12:30 p.m., February 22.
- A.H. Probst
- Secretary of Conference


The article begins: “A disease of soybean caused by the tobacco ring-spot virus has been responsible for substantial losses in yield in the midwestern producing areas in recent years. It is not definitely known how long significant damage has been occurring but the losses in 1943 and 1944 exceeded all previous records and ranks this disease among the most destructive of the soybean.

“Pierce (1934) noted the destructive nature of this virus on soybean and certain other legumes, but did not observe its occurrence in nature. Samson (1942) reported finding the disease in experimental plantings of vegetable soybeans in Indiana in 1941, Melhus (1942) observed it in Iowa in 1942, and later Johnson (1943) reported the disease on soybean in Ohio. It is likely that at that time, it was distributed extensively throughout the midwest in small amounts but had escaped detection.”

Photos show: (1A) A soybean plant infected with the bud blight showing the characteristic curving of the terminal pod. (1B) Pod symptoms resulting from infection near blossoming time. Note distorted and shrunken pods.

(Photograph 1B courtesy of Dr. B. Koehler of the Illinois Agricultural Experiment Station.)

A footnote at the bottom of the first page states: “A publication by the U.S. Regional Soybean Laboratory, a cooperative organization participated in by the Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration; and the Agricultural Experiment Stations of Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, North Carolina, North Dakota, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Virginia, and Wisconsin.”

Address: Associate pathologist, U.S. Regional Soybean Laboratory, Urbana, Illinois.

- Summary: This English-language article was first published in Soybean Digest in Sept. 1944 (p. 39-40).
Begin with history of the U.S. Regional Soybean Industrial Products Laboratory (Univ. of Illinois) and its successor the Northern Regional Research Laboratory (Peoria, Illinois). Discusses current projects and predictions for the future.


- **Summary:** This soybean disease was first discovered in central Illinois in the fall of 1944. The symptoms are briefly described. The causal fungus was not fruiting and appeared to be soil-borne.


- **Summary:** “The Delta Experiment Station, a branch of the Mississippi Agricultural Experiment Station, located at Stoneville, Mississippi, began its soybean research program in 1920, and by 1942 this program became one of the station’s major projects. Since that period there has been a gradually increasing interest in soybeans in the Delta. The initiation of the southern regional program in 1943, with headquarters for the Southern states at the Delta Station, resulted in an expanded breeding and testing program under Mississippi conditions. In 1944 and 1945, introductions, progenies, selections and varieties under test numbered approximately 3,000.”

“These investigations, concerned primarily with the production of better varieties of soybeans for industrial utilization and adapted to Delta conditions, may be divided rather broadly into: (1) The development of superior material by hybridization and through selections within introductions and established varieties; and (2) subsequent evaluation through field tests of these selections and varieties as to their date of maturity, yield, seed quality, and oil and protein content.

“Grouped According to Maturity: The 2,000 to 2,500 hybrid lines of approximately 75 crosses now under observation, represent the best blood lines of varieties adapted to northern, southeastern and southern conditions. These crosses were made by Dr. Leonard F. Williams of the U.S. Regional Soybean Laboratory, Urbana, Illinois, and Dr. E.E. Hartwig and Mr. J.A. Rigney of the U.S. Regional Laboratory and the North Carolina Agricultural Experiment Station, Raleigh, North Carolina, respectively. The maturity range of this material extends from early August to late November. In 1944 approximately 30 of the most promising commercial varieties were in the uniform variety yield tests and approximately 200 other varieties and selections were in preliminary yield tests. In 1945 the number of varieties in the uniform tests was increased to approximately 40, and the number in the preliminary test, including hybrid lines, to approximately 600. During 1944 and 1945 a number of these tests were conducted at several locations to determine the adaptation of these varieties and strains to conditions in the Yazoo-Mississippi Delta.

“Since the normal maturity of existing varieties, adapted to southern conditions, ranges from early September to early November, the varieties tested were grouped according to maturity in order to obtain more accurate information on the performance of each variety. They were grouped as follows: (1) early strains maturing prior to September 15; (2) medium strains, October 1 to October 15; (3) medium-late strains, October 15 to November 1; and (4) late strains, those maturing after November 1. At present there are no promising varieties which normally mature between September 15 and October 1.

“Plantings were made on four major soil types in the Delta, extending from the northern to the southern part of the area. The soils for the several locations are: Dubbs silt loam at Tunica; Robinsonville very fine sandy loam at Stoneville; Yazoo silt loam at Anchorage; and Sharkey clay soil (commonly known as ‘bucksot’) at Onward.

“Plant height and lodging notes were taken on the varieties as they matured. Yields were determined from the weight of seed harvested from a 16-foot section from each of the four one-row plots of each variety. All yields were analyzed statistically to determine whether the differences were significant. At some locations the two seasons varied to such an extent, primarily in the amount and distribution of rainfall, that the yield and rank of some varieties was quite different.

“The quality and size of seed of each variety was recorded, and a composite sample taken for chemical analysis. All analyses were made by the U.S. Regional Soybean Laboratory at Urbana, Illinois. Two-year average yields for 1944-45, other agronomic and morphologic data, percentage of protein, oil, and the iodine numbers of the oil are summarized by maturity groups in tables 1, 2, 3, and 4.

“Early Varieties: Many planters have expressed an interest in a soybean that can be combined before the peak of the cotton picking season. This has assumed increasing importance as the labor supply dwindled during the war years. Consequently, one of the aims of the soybean breeding program at the Delta Experiment Station is to develop an early maturing variety of soybeans.

“The early maturing strains being tested at the present time by the Delta Station are better adapted to northern than to southern conditions, ‘being among the best for Kentucky, Missouri, southern Illinois and southern Indiana, where they mature during the cool fall months, producing excellent yields of high quality seed. Under Delta conditions, however, the same strains mature from late August to early September.

“The highest yielding early varieties in the Delta in 1944-45 were: C101, a new strain developed by the Indiana Agricultural Experiment Station; and S100 developed by the Missouri Agricultural Experiment Station...”
Continues to discuss: More early varieties. Medium varieties (Ogden). Medium-late varieties (Roanoke, Volstate). Late varieties (Delsta, Mamloxi, Mamotan, Nanda).

Tables give a “Summary of agronomic and chemical data for the soybean varieties and strains, 1944-45.” (1) Early maturing strains. (2) Medium maturing strains. (3) Medium-late maturing strains. (4) Late maturing strains.

A map shows the Mississippi Delta, located between the Mississippi River and the Yazoo River (which meet at Vicksburg), and the various locations where the soybean tests are conducted. Address: Asst. Agronomist, Delta Branch Exp. Station, Stoneville, Mississippi.


• Summary: On June 20 some 200 guests observed the opening of the new Swift & Co. soybean mill at Frankfort, Indiana. Among the prominent guests who were introduced were: Hobart Creighton, speaker of the Indiana House of Representatives; Dr. J.L. Cartter, Regional Soybean Laboratory, Urbana, Illinois; Keller E. Beeson, Purdue University; George Strayer. The new solvent extraction plant includes a battery of 26 concrete storage bins with a million bushel capacity.

“Swift & Co. operates five other soybean mills, located at Champaign and Cairo, Illinois; Fostoria, Ohio; Des Moines, Iowa; and Blytheville, Arkansas.

“Most of Frankfort’s mill production of soybean oil will be shipped to company refineries. The soybean oil meal will be sold as livestock fed to farmers, feed dealers and mixed feed manufacturers.” A ground-level photo shows the new plant.


• Summary: This entire document, including the cover, is typewritten.

At the top of the title page is written:
“U.S. Regional Soybean Laboratory
“Urbana, Illinois.”

Below the title is written:
“United States Department of Agriculture
“Agricultural Research Administration
“Bureau of Plant Industry, Soils, and Agricultural Engineering
“Division of Forage Crops and Diseases
“cooperating with
“State Agricultural Experiment Stations.

“(Not for Publication)
“July 1946
“RSLM 136.”


Pages 4-5: Location of cooperative nurseries and cooperators.

Page 6 (Fig. 1): Map of southern states showing location of most of the cooperative uniform tests; 1945. Page 6a: Subdivisions of the Southern Region (from left to right): West (Texas and Oklahoma), Delta (Louisiana, Mississippi, Arkansas, Missouri), Upper and Central South (Tennessee, Kentucky, West Virginia), Southeast (including all of Alabama, Georgia, Florida, and South Carolina), and East Coast (North Carolina, Virginia).

Page 7: Methods: Tell show the following are measured:
Height (of plants). Maturity. Seed quality (rated from 1 to 5). Statistical analysis (by analysis of variance).


• Summary: This article is about the 3-day meeting of the American Soybean Association in St. Louis, Missouri. The soybean industry thrived during the depression, more than doubled in size during World War II, and is now continuing to grow. The A.E. Staley Manufacturing Co., America’s largest soybean processor, has just started construction of a new $1 million plant that will turn soybeans into monosodium glutamate (MSG), making one million pounds a year. MSG has been previously made on a small scale in the USA from wheat, but Staley’s plant will be the first to make it on a large scale from soybeans.

The Drackett Co. in Cincinnati is putting the finishing touches on a commercial plant that will make a wool-like fibre from soybeans. Robert A. Boyer, the firm’s research director, said the new fibre will be used mostly for blending with rayon. He thinks it may sell for less than wool.

ADM, one of America’s four largest soybean processors, earlier this year completed a plant to make a “whipping agent” from the versatile soybean; it can replace egg albumin, which is much more expensive.

Dr. Harry W. Miller, president of the International Nutrition Laboratory (Mt. Vernon, Ohio), “started making

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soybean products in Shanghai, China, in 1935. Bombed out in 1937 by the Nips [Nippone = Japanese], he came to this country and began making similar products here in 1939. Now his firm does a $500,000 a year business and could do a lot more if sugar and other ingredients used with soybeans were available.” His most popular items are [soy] milk, cutlets, and canned green soybeans. He says the milk tastes “rather like malted milk and is especially good for infants and others allergic to animal milk. His company has also developed a cheese made from soymilk [tofu], a prepared mix for ice cream from the soymilk, and “albumen sheets” [yuba], which are very popular in China.

These sheets aren’t much thicker than a piece of paper and are used in China to make the layers of a loaf filled with mushrooms. The Chinese also use soybeans [yuba] to make products that taste like both fish and chicken. In American kitchens, an excellent substitute for butter can be made “by combining soya oil, soya milk,” carotene oil for color, and salt.

One big American breakfast cereal maker is said to be planning to introduce a “soya flake cereal soon, similar in appearance to cornflakes. Another may soon market a puffed soyabean cereal, a third may introduce a cooked cereal made from soybeans, oats and wheat.”

General Mills is building a factory for producing a synthetic resin from soybeans—a product developed at the Northern Regional Research Laboratory in Peoria, Illinois. Dr. G.E. Hilbert, NRRL’s director, says this new resin shows “considerable promise as a protective coating and as a heat-sealing and moisture-proofing agent.

During the past few years, soybean processors have been switching to the solvent extraction systems, from the expeller system, for obtaining oil from soybeans. Most newer plants use hexane solvent. The advantage of the solvent system is that it removes all but about half of one percent of the oil, compared with 3½% to 5% left in the meal when expellers are used. The meal currently sells for 3 cents/lb compared with 11.75 cents/lb for the oil.

NRRL has recently developed a process that uses alcohol instead of hexane. This yields superior “soyflour.” Before the war, production of soyflour was 25 million lb/year; this year it is expected to top 400 million lb. Roth Products Corp. of Chicago has already used 6 million pounds of soyflour this year in its dehydrated soups, baked goods, pancake flour mixes, and sausage filler.

The soybean industry (especially the NRRL) is also working to make soybean oil more stable. It “has a tendency to develop a grassy or painty flavor on standing.” A process obtained from Germany “goes a long way toward preventing the development of these objectionable flavors.”

The Lincoln soybean variety, developed at the U.S. [Regional] Soybean Laboratory at Urbana, Illinois, and first made available to farmers during the war, is playing a major role in increasing yields. Today farmers in the corn belt are getting 25-30 bushels/acre with Lincoln, compared with only 15-16 bushels/acre in the early 1920s with varieties then available. Moreover, today’s soybeans contain 20-21% oil compared with only 15-17% about 20-25 years ago.

339. Left to right—“Soybean” Johnson, W.J. Morse, W.L. Burlison, unknown man, at the American Soybean Association’s annual meeting, St. Louis, Missouri, in the Hotel Jefferson (Photograph). 1946. Aug.

• Summary: See next page. This digital photo, with caption and date, was sent to Soyfoods Center by Joyce Garrison (William Morse’s granddaughter) of West Hartford, Connecticut (July 2004).

340. Soybean Digest. 1946. USDA men who have contributed to soybean development: Reid Thompson Milner. Aug. p. 27.

• Summary: Dr. Reid Thompson Milner is a native of Illinois. He graduated in chemical engineering at the University of Illinois, and continued his studies there in physical chemistry for the M.S. degree. Subsequently, he attended the University of California where he received his Ph.D. in chemistry. His research career began at the Bureau of Mines in Pittsburgh. Later he transferred to the Fixed Nitrogen Laboratory of the U.S. Department of Agriculture’s Bureau of Chemistry and Soils at Washington, D.C.

“Dr. Milner became interested in soybeans in 1936 when he joined the staff of the U.S. Regional Soybean Industrial Products Laboratory, Urbana, Illinois, at the request of Dr. O.E. May who invited him to take charge of the analytical section of that Laboratory.

“In addition to his duties in directing the analytical work of the Laboratory, he carried on many physical chemical researches on soybean oil and soybean protein. Outstanding among his published investigations were reports of studies of the physical chemical factors affecting the dispersion of soybean protein in water, the effect of alcohol on soybean protein dispersions, the determination of non-protein nitrogen in soybean oil meal, and a method for the determination of saturated fatty acids in oil.

“When Dr. May was called to Washington to assist in the organization of the four Regional Research Laboratories, Dr. Milner was appointed to succeed him as director of the U.S. Regional Soybean Industrial Products Laboratory. He assumed this responsible position of leadership on August 1, 1939, and directed the Laboratory with distinction and with the hearty approval of his associates in the Laboratory and in industry.

“When the Northern Regional Research Laboratory was organized, Dr. Milner was selected to head the analytical and physical chemical division, a position which gave him an even broader field in the program for industrial utilization of agricultural commodities.

“Dr. Milner’s diversity of interests and his spirit of
cooperation are well illustrated by his activity on the Soybean Nutritional Research Council and his committee work in the American Oil Chemists’ Society. In the latter organization, he is chairman of the soybean analysis committee, and is serving on committees for bleaching methods, oil color, refining loss, fat analysis, and seed and meal analysis. Dr. Milner is at present the first vice president of the Oil Chemists’ Society.

“In connection with the wartime soybean marketing program, the Commodity Credit Corporation requested the aid of Dr. Milner in establishing proper methods of analyses, in training personnel in these methods, and in checking the accuracy of the analyses so performed.

“His present program in the application of physical chemical methods to analytical chemistry includes X-ray analysis, spectroscopic investigations, and high-vacuum distillation methods. Penicillin and Norepol are specific examples of products whose development was materially aided by these physical methods.

“Determination of chemical and physical properties and characteristics of commodities and their products and derivatives, and provision of specialized chemical and physical services and investigations and general service analyses for all laboratory research projects have comprised an important and effective approach to the greater industrial utilization of agricultural commodities.”

A photo shows Dr. Reid T. Milner.


• Summary: “Losses from soybean diseases were considerable in the Cornbelt in 1945. The new disease which was first observed in a few fields in central Illinois in 1944 was very severe in some sections of the Cornbelt in 1945. It has been named ‘Brown Stem Rot’ and is caused by a fungus which has not yet been named. Total losses were sustained in a few fields in central Illinois, and the damage in several counties in that area was conservatively estimated at 10 percent.

“The fungus apparently exists in the soils of the Midwest and infects the soybean plants either through the roots or at the base of the stem near the soil surface. Soybean plants growing in the greenhouse in naturally infested soil obtained from diseased fields usually become infected if grown under proper conditions of temperature. The disease has been produced repeatedly in greenhouse experiments by inoculation with the specific pathogenic organism responsible.

“Temperature conditions have a marked effect upon the symptoms produced and the time at which they appear. Artificially inoculated plants growing in culture chambers with air temperatures between 55 and 65 degrees F. usually die before blossoming time. If the temperature is maintained above 70 degrees F. the plants will appear relatively free of disease and mature more normally. The development of the disease is therefore considered to be dependent upon low air temperatures such as are generally found in the field each fall. The rate of development of symptoms is remarkably rapid under conditions favorable for the disease.

“The interior of the stems of infected plants has a brown coloration (Figure 1), starting at the base of the plant and speeding upward, sometimes nearly to the tops. The plant stems may be weakened before maturity in the fall and severe lodging of the plants is not uncommon. Complete lodging is characteristic of infected plants before they have reached the stage when they may be combined. The top leaves of the plants may be blighted suddenly, making the field assume a scorched appearance almost overnight (Figure 2).

“Control measures for brown stem rot are not yet known. Observations indicate the possibility that fertility of the soil may affect the damage but accurate data on this point are still lacking. Tests are now under way to determine the effect of nitrogen, phosphorus, and potash fertilization on the incidence and severity of brown stem rot.

“Bacterial blight was a serious disease of soybeans in 1945. This disease causes serious damage to the leaves often leaving them in a torn and tattered state similar to damage caused by hail. Apparently the cool season in 1945 was conducive to rapid development of bacterial blight since its ravages extended over the entire area in this country where soybeans are grown. In the variety tests in 1945, where a search for resistance was made, only slight differences were found between varieties.

“The bacterial pustule disease was less severe in general during 1945 than in previous years. This is usually the most damaging of the leaf diseases. Effective resistance has been found in a southern variety and a breeding program is under way to incorporate this resistance into varieties suitable for each of the soybean growing areas.

“The bud blight virus disease was less severe in 1945 than in previous years. Apparently the cool season was less conducive to the spread of the virus which possibly is carried by a specific insect. No resistance is known for this disease although a large number of varieties have been tested. An intensive study is being carried on at the present time in an effort to find an insect vector responsible for the transmission of this virus.

“The work of the U. S. Department of Agriculture on soybean diseases is proceeding along rather fundamental lines at present, since this is a necessary prerequisite to a sound basis for attempts at control. The field of soybean pathology, as a whole, has been greatly neglected in the past and the lack of fundamental knowledge regarding the nature and behavior of these diseases is plain. It is hoped that these efforts will soon lay a foundation on which specific practical recommendations for disease control can be based.

Photos show: (1) Internal tissue symptoms produced
by the brown stem rot disease. The diseased stems show extensive internal browning. (2) Leaf symptoms produced by the brown stem rot disease. Note the dead areas which may appear very rapidly. Address: Pathologist, Division of Forage Crops and Diseases, Bureau of Plant Industry. Soils, and Agricultural Engineering, Agricultural Research Administration, U.S. Dept. of Agric. (On staff of U. S. Regional Soybean Laboratory until Oct. 8, 1944).


Summary: “The regional soybean program in the South covers 12 southern states beginning with Oklahoma and Texas on the western end of the region, extending eastward to the coast, including the states of Tennessee and Virginia. The work is being carried on as a cooperative project with the U.S. Regional Soybean Laboratory and the agricultural experiment stations of these 12 southern states. Headquarters for the southern section are located at the Delta Experiment Station, Stoneville, Mississippi.

Footnote: The U.S. Regional Soybean Laboratory is: “An organization participated in by the Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Research Administration, U.S. Dept. of Agriculture, and the Agricultural Experiment Stations of Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, North Carolina, North Dakota. Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Virginia, and Wisconsin. The culture of soybeans as an oil crop is not new to the South. In 1920, the four leading states in the production of soybeans for seed were: North Carolina, Virginia, Alabama and Missouri. In 1931, of the Southern states, only North Carolina remained in this top group. Since that time the production in the southern states in percent of the total U.S. crop has steadily declined. The lack of adapted varieties suitable for bean production, the conflict with cotton for labor, the absence of adequate farm machinery on the cotton and tobacco farms, and the adverse climatic conditions over much of the South during the late fall and early winter when soybeans are ready for harvest, are factors which have discouraged the production of soybeans as an oil crop.

“The regional soybean program in the South has as its objective the development of better adapted, higher yielding strains of soybeans for industrial utilization. Varieties must be developed that are high yielding, resistant to lodging, diseases, and have a content of oil and protein most desirable for industrial utilization.

“The varied rotations and cropping practices characteristic of different sections of the South necessitate the development of adapted varieties covering a wide range in maturity. Cotton farmers of the Mississippi Delta section of Tennessee, Arkansas, Mississippi and northern Louisiana, desire a variety which will mature in August or early September, in order to utilize their labor supply more efficiently. There is a definite need over much of the South for a variety that will mature in September or early October, in order that winter grains or alfalfa may be planted after the soybeans are harvested. In the Southeast, where it is a common practice to plant soybeans after small grains, and in south Alabama after early potatoes, a somewhat different variety may be needed. The farmers of certain sections of Oklahoma and Texas want a high yielding drought resistant variety that will set and develop seed during the hot dry summer months. These factors are being considered in the development of better varieties for the different sections of the South.

“Breeding and selection work to develop better varieties is under way at a number of the southern agricultural experiment stations in the cooperative improvement program. New strains as rapidly as they are developed, are entered in uniform variety tests and are grown across the southern region. The varieties of similar maturity are grouped in uniform tests according to a system established by the U.S. Regional Soybean Laboratory in 1938.

“The southern varieties and strains are entered in the progressively later maturing groups of VI, VII, and VIII. Through the middle South, the strains of group VI normally mature from October 1 through 15, those of group VII, October 16-31, and Group VIII, in early November. The maturity of these groups is a few days later across the upper South and earlier in the lower South. Because of the interest early maturing soybeans, the uniform test, Group IV, is being grown at a number of locations across the upper South. Yields with other agronomic data are taken by the cooperators in the region. Seed samples from the tests are sent to the U.S. Regional Soybean Laboratory for chemical analyses.”

The rest of the article discusses particular varieties developed for the U.S. South. Contains 4 tables.

A photo shows 13 men, all dressed in coats and ties, seated or standing. The caption: “When Regional Laboratory and university agriculturists get together, at ASA convention in St. Louis. From left to right, back row: Robert B. Carr, Stoneville, Mississippi; L.F. Williams, Urbana, Illinois; Dr. Howard W. Johnson, Beltsville, Maryland; Paul R. Henson, Stoneville; Dr. W.B. Allington, Urbana; Dr. Donald W. Chamberlain, Urbana. Front row: J.L. Carter, Urbana; C.R. Weber, Ames, Iowa; Dr. D.F. Beard, Ohio State University, Columbus. Ohio; Dr. W.J. Morse, Beltsville, Maryland; Dean F. McAlister, Urbana; Dr. Lewis C. Saboe, Columbus; and Carl V. Feaster, Columbia, Missouri.” Address: Agronomist, U.S. Regional Soybean Lab., Div. of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Delta Branch Experiment Station, Stoneville, Mississippi.

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“In 1936 the U.S. Regional Soybean Industrial Products Laboratory was established at Urbana, Illinois. The chemical and engineering research of that laboratory was transferred by an act of Congress from Urbana to the Northern Regional Research Laboratory at Peoria in July 1942.

“Removal of part of the laboratory to Peoria has resulted in an expansion of all phases of soybean research.” Dr. Reid T. Milner, formerly director of the U.S. Regional Soybean Laboratory, is now head of the analytical and physical chemical division of the NRRL “Technological and fundamental research on soybeans is being carried out by the oil and protein division of which J.C. Cowan is in charge. This group is concentrating practically all its activities on soybean oil and meal. Most of our new developments originate in this division.” The engineering and development division, headed by C.T. Langford, is translating laboratory developments to a pilot-plant scale. This division obtains cost data and evaluates the economic feasibility of the developments. “The fermentation division, headed by A.F. Langlykke, has examined the conversion of soybeans to soybean cheese [fermented tofu] and soya sauce.”

“Flavor stability of soybean oil: One factor which limited the use of soybean oil for edible purposes prior to World War II, and which will limit its consumption after the war is the flavor instability of the oil as well as various products made from it, such as salad oils, margarine, and shortening. As compared to competitive food oils, soybean oil suffers from the disadvantage of rapidly developing a grassy or pungent flavor on standing. This change in flavor has usually been called ‘reversion.’

“The solution of this flavor problem is perhaps the most important one facing the soybean industry. It must be overcome if the gain in the amount of soybeans utilized during the war is to be maintained or if the demand for soybeans in the future is to increase. A solution to the problem will not only enable soybean production to continue on a greatly expanded scale but should also increase substantially the market value of the crop.

“A systematic research program with the aim of increasing the flavor stability of soybean oil has been undertaken, and the work has been under way for 2 years. One of the difficult problems which faced us in organizing this program was that of measuring the change in flavor of oils during storage. It is well known that no single chemical test or even a series of such tests, can measure satisfactorily the kind or degree of flavor in aged soybean oils.

“The most precise method, and this leaves much to be desired, is that of tasting. In organizing our tasting panel, advantage was taken of the experience of industry in this field. Sixty members of the Laboratory were screened from the standpoint of sensitivity and reliability in detecting types and degree of flavor. The panel now consists of 12 scientists, with 10 alternates. The flavors of the oils under investigation are scored by the tasters and the results analyzed by a statistician. In this manner the error due to the variability of the human element has been reduced to a minimum. The judicious use of these tasters as analytical tools has enabled us to measure with confidence improvements effected in flavor stability of the oil.

Progress made on this problem of flavor reversion was accelerated through information gleaned in Germany. In the summer of 1945, W.H. Goss, one of the soybean experts of the Northern Regional Research Laboratory, and who later in this program will describe for you his experiences in Germany, was loaned to the technical industrial intelligence committee of the Foreign Economic Administration to investigate the German vegetable oil processing industry. His thorough and methodical investigation of practically all the companies processing vegetable oils in Germany disclosed that the Germans had apparently developed a number of methods which were claimed to produce a practically stable soybean oil. In view of the circumstances under which some of this information was obtained, Mr. Goss believed these processes had merit and were not merely manufactured in the minds of the German oil experts during the stress of the interviews. Shortly after this technical information became available, J.C. Cowan and H.J. Dutton, who are, in charge of the soybean oil flavor program, subjected one of these German methods to careful examination. They first studied the application of the German technique for improving the flavor stability of refined, unhardened soybean oil. Their work is now being extended to investigate the effectiveness of the method when used in the production of shortenings.

“The results thus far obtained indicate that the one German method which we have under investigation yields a soybean oil in which the development of objectionable flavors is retarded to a very considerable extent. When the refined oils used in these tests were stored at room temperature, for example, those which received the German treatment required more than four times as long to develop disagreeable flavors as did those which were similarly refined without use of the special technique.

“This improved soybean oil can be prepared cheaply and easily by appropriate processing of solvent-extracted oil,
but apparently not from the expeller type of oil. A number of other features of German oilseed technology, which appear to have merit, are also under investigation. In order that industry could take advantage of these findings, the results of our work were disseminated to the soybean industry at a meeting of the Soybean Research Council last April and at the annual meeting of the American Oil Chemists Society in New Orleans [Louisiana] in May. These results have aroused the interest of industry and stimulated research activities and processing investigations along similar lines. A cooperative program for translating our results to a pilot-plant scale is being developed between the Laboratory and one of the large soybean oil refiners.

“The ultimate significance of this work to the American farmer and the soybean industry is difficult to gauge at this early stage in the development. There can be little doubt, however, that it will place soybean oil in a more favorable competitive position with respect to other food oils and tend to reduce the price differential that has existed between them; and any such change will be reflected in enhanced returns to the growers.”

A large portrait photo shows G.E. Hilbert. Address: Director, NRRL, Peoria, Illinois.


• Summary: “Since July 1, 1945, when additional funds were made available by Congress to the Division of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, U.S. Department of Agriculture, for soybean disease investigations, plant disease specialists have been employed at a number of strategic locations in the United States to carry on a coordinated program of pathological research. The organization that has been set up is outlined briefly in the following paragraphs.

“Since the Cornbelt is the major soybean producing area of the United States, first consideration has been given to organizing the work in that region. Dr. William B. Allington, plant pathologist of the U.S. Regional Soybean Laboratory, was assigned to the new project on October 8, 1945 as coordinator of the soybean disease work in the Cornbelt. He retained his headquarters at Urbana, Illinois, where he works in close cooperation with the Illinois Agricultural Experiment Station and the staff of the U.S. Regional Soybean Laboratory. On January 14, 1946, Dr. Donald W. Chamberlain was appointed at Urbana, Illinois, to work with Dr. Allington on the numerous soybean disease problems being investigated there, thus continuing and broadening the research program at this location.

“Other centers of investigation have been established in cooperation with the state agricultural experiment stations and agricultural colleges of the South at the following locations: Raleigh, North Carolina; Experiment, Georgia, and Baton Rouge, Louisiana. Root-knot [nematode], southern blight, and other diseases of the soybean are being investigated in this region.

“Here, as in the North, the plant disease studies are being closely integrated with the work of the plant breeders with the objective of producing improved, disease-resistant soybean varieties.

“Overall coordination for the entire program is supplied from the national headquarters of the Division of Forage Crops and Diseases at Beltsville, Maryland, by Dr. J. Lewis Allison, head of our project on forage crops diseases. Research on soybean diseases is conducted at this location by Dr. C. L. Lefebvre, who has been assigned part time to the soybean disease project.

“In summary, we feel that during the past 14 months an adequate organization has been set up and qualified personnel have been employed to make possible a vigorous attack on soybean disease problems in the major soybean producing areas of the United States. This organization has been integrated closely with existing state and federal organizations devoted to soybean breeding and disease work. It is believed that through this enlarged, coordinated program faster progress will be possible in developing control measures for soybean diseases, particularly through the development and release to the growers of improved, disease resistant soybean varieties.”

A photo shows some the USDA men working on soybean diseases who attended the ASA convention. From left to right: Dr. Donald W. Chamberlain, U.S. Regional
HISTORY OF U.S. REGIONAL SOYBEAN LABORATORY (1936-2017) 179

Soybean Laboratory, Urbana, Illinois; J.M. Crall, pathologist for the University of Missouri and USDA; Dr. Howard W. Johnson, Bureau of Plant Industry, Beltsville, Maryland; Dr. W.B. Allington, U.S. Regional Soybean Laboratory, Urbana. Address: 1. Principal Agronomist; 2. Senior Pathologist. Both: Div. of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U.S. Dep. of Agriculture.

• Summary: A vertical typewritten 1-page fill-in form.

Top blank line: “(Department or Establishment) (Bureau or Division) (Place of Employment)”

“I (blank line) Do solemnly swear (or affirm) that I do not advocate, nor am I a member of any political party or organization that advocates the overthrow of the Government of the United States by force or violence; and that during such time as I am an employee of the Federal Government, I will not advocate nor become a member of any political party or organization that advocates the overthrow of the Government of the United States by force or violence.

“I do further swear (or affirm) that I am not a member of an organization of Government employees that asserts the right to strike against the Government of the United States; and that during such time as I am an employee of the U.S. Department of Agriculture I will not become a member of an organization of Government employees that asserts the right to strike against the Government of the United States, nor will I engage in a strike against the Government of the United States, (Blank line): “(Signature of Appointee)”

“Subscribed and sworn before me this (blank line) “day of” (blank line) “A.D., 19_.”

“at (City) (State)

“Blank line (Signature of Officer)

“Date worked (blank line). Hours: (blank line). Rate of pay.

“I received of (blank line) “the amount of $: (blank line) “for the above labor performed.”

(Blank line) “(Signature of Appointee)”

(Blank line) “(Date)” Address: Urbana, Illinois.

• Summary: “William Joseph Morse was born in New York in 1884. He was granted the B.S. degree by Cornell University [Ithaca, New York] in 1907 and the same year began his studies with the U.S. Dept. of Agriculture where he is, at present, principle agronomist in charge of soybean investigations for the Division of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering. The U.S. Regional Soybean Laboratory, conducting research in twenty-four states is also under his direction.

“Although Mr. Morse has published many papers on his investigations on cowpeas, velvet beans and other miscellaneous legumes, his chief interest and work has been with soybeans. It may be appropriately stated that he is the father of soybean production in American agriculture. His many authoritative publications on varieties, culture and uses of the soybean attest to his outstanding work. From 1929 to 1931, he traveled through China, Japan, Korea and Manchuria collecting new varieties of soybeans and compiling data on cultural methods and uses for them.

“Mr. Morse was three-times president of the American Soybean Association, and has served the American Society of Agronomy for many years on the important committee of Varietal Standardization and Registration.” A photo shows William Morse.

Note: This is the earliest document seen (June 2003) that uses the word “father” in connection with William Morse and soybean production in the USA.

• Summary: “Paul R. Henson has been southern coordinator of the U.S. Department of Agriculture’s Regional Soybean Laboratory since July 1942. He works at the Delta Experiment Station, Stoneville, Mississippi, supervising cooperative work on soybean improvement in the 12 states that make up the southern wing of the Laboratory and carrying on the soybean experiments at his home station.

“He has been with the Division of Forage Crops and Disease of the Agricultural research Administration for 13 years and is familiar with the region and the soybean work going on in the various states. He plans and conducts agronomic and breeding experiments and as a result of the work already done superior grain types of soybeans for the region will be available in the near future. Previously the forage types were the main southern goal, but the war emergency demand for fats and oils speeded up the development of the grain types of soybeans with high oil content.

“Henson and the research men of the various states were enabled to do rapid development work because of the vast amount of available hybrid material, selections and introductions; interchange of promising strains among the stations; and extensive variety nursery plantings. In addition to the grain varieties, they have also been building up better vegetable varieties for the region.

“Mr. Henson, who was born at McLoud, Oklahoma, 41 years ago, got his B.S. degree at Iowa State College and his M.S. at the University of Maryland. He was in charge of the department of alfalfa investigations at the Delta Experiment Station from his appointment in 1930 to 1938 when he was transferred to the Plant Industry Station at
Beltsville, Maryland. Expansion of the soybean cultural and improvement work took him back to Stoneville in 1942.”

A portrait photo shows Paul R. Henson. A 2nd photo shows Mr. Henson. Address: Delta Experiment Station, Stoneville, Mississippi.

348. Allington, William B.; Feaster, C.V. 1946. The relation of stomatal behavior at the time of inoculation to the severity of infection of soybeans by Xanthomonas phaseoli var. sojense (Hedges) (Starr) Burk. Phytopathology 36:385-86. *

349. Kalton, R.R. 1946. Iowa soybean variety tests, 1939-45. Iowa Agricultural Experiment Station, Leaflet Agronomy No. 41. 6 p. Assisted by Iowa Agric. Exp. Station. *

350. Crall, J.M. 1947. Brown stem rot of soybean in Missouri. Plant Disease Reporter (USDA) 31(1):14. Jan. 15. • Summary: “Soybean plants forwarded to this station from Taylor, Missouri (across the Mississippi River from Quincy, Illinois) showed symptoms of the brown stem rot disease (1). Isolations from these plants yielded the as yet unclassified causal fungus. Verification of the identity of the fungus was made by Dr. W.B. Allington of the U.S. Regional Soybean Laboratory, Urbana, Illinois.

“From a talk with the farmer in whose fields the disease was occurring it was learned that the first affected plants were noted during the first week in September. At the time the field was seen by the writer on September 24, the plants were maturing and accurate estimates of the severity of the infection were difficult to make. However, at least 40 acres of a 145-acre field of [the soybean variety] Illini were showing general infection, with scattered infection throughout the rest of this field and an adjacent large field planted to Illini. Both of these fields had been in soybeans for the past several seasons. A nearby 10-acre field of Lincoln [variety soybeans] planted on ‘new’ ground showed no brown stem rot.

“Although a complete survey of the district was not made, brown stem rot was found in several other fields in the vicinity. In addition, unverified reports have been received of the occurrence of this disease in the river bottom lands east of Palmyra, Missouri (10 miles south of Taylor). No other occurrences of the disease in Missouri are known.

“The most striking symptom of the disease was a marked interveinal chlorosis, followed by necrosis, of the leaflets. Such plants always showed the characteristic brown rot when the stems were split.

“An unusually cool late summer is believed to have been a factor contributing to the outbreak of the disease this season.

“Brown stem rot has been reported as appearing in a few fields in Illinois in the fall of 1944 and occurring in severe epidemic form in Central Indiana, Illinois, and Iowa in 1945 (1). This is the first re- ported occurrence of the disease in Missouri.”


Below that is a wide table with 8 columns and 9 rows:

“Location of test. Number of tests needed: 0, I, II, III, IV, IVS. Ship seed to (Name and Address).

“If you desire planting plans for the above tests, please indicate by check mark” [in following box]. Note: No date of publication is on the document--Date received stamp on the back of the document says: July 16, 1947. However since RSLM 142 is dated February 5-7, 1947, this form must be before that date. Address: Urbana, Illinois.

352. Adair, C. Roy. 1947. Third work planning conference of the U.S. Regional Soybean Laboratory for the Southern States region, Memphis, Tennessee, February 5-7, 1947. RSLM (U.S. Regional Soybean Laboratory Mimeograph, Urbana, Illinois) No. 142. Undated. 29 p. • Summary: “The third work planning conference of the collaborators conducting the soybean improvement program in cooperation with the U.S. Regional Soybean Laboratory was held at Hotel Peabody, Memphis, Tennessee, on February 5-7, 1947. The conference was called for the purpose of reviewing accomplishments during the past season and planning the research program for the coming year. The two previous conferences were held at the Mississippi Agricultural Experiment Station, Delta Branch Station, Stoneville, Mississippi, the headquarters of the southern section of the Laboratory. However, it was decided to hold this third meeting in Memphis to effect a saving in time and travel expense for the conference members.

“Wednesday, February 5—P.R. Henson, Chairman

“The conference was called to order at 9:00 a.m. with the following State and Federal men in attendance:

“Aamodt, O.S., Head Agronomist, Forage Crops & Diseases, USDA, Beltsville, Maryland

“Adair, C.R., Agronomist, U.S.D.A., Rice Branch Station, Stuttgart, Arkansas

“Allington, W.B., Pathologist, Forage Crops & Diseases, Urbana, Illinois

“Carr, R.B., Agronomist, U.S. Regional Soybean Laboratory, Stoneville, Mississippi

“Carter, J.L., Agronomist, U.S. Regional Soybean Laboratory, Stoneville, Mississippi
Laboratory, Urbana, Illinois
“Collins, F.I., Chemist, U.S. Regional Soybean Laboratory, Urbana, Illinois
“Dameron, J., Agronomist, Cotton Branch Station, Marianna, Arkansas
“Erdman, L.W., Bacteriologist, U.S. Department of Agriculture, Beltsville, Maryland
“Gray, J.P., Agronomist, Louisiana Experiment Station, Baton Rouge, La.
“Hartwig, E.E., Agronomist, U. S. Regional Soybean Laboratory, Raleigh, North Carolina
“Henson, P.R., Agronomist, U.S. Regional Soybean Laboratory, Stoneville, Mississippi
“McVickar, M.H., Agronomist, Virginia Agr. Exp. Station, Blacksburg, Virginia
“Marston. H.W., Agricultural Research Administration, USDA, Washington, D.C.
“Milner, R.T., Chemist, Northern Regional Research Laboratory, Peoria, Illinois
“Morse, W.J., Agronomist, Forage Crops & Diseases, U.S.D.A., Beltsville, Maryland
“O’Kelly, J.F., Agronomist, Mississippi Exp. Station, State College, Mississippi
“Sayre, C.R., Agronomist, Delta Experiment Station, Stoneville, Mississippi
“Schember, V.E., Agronomist, Texas Agr. Exp. Sta., College Station, Texas
“Sprague, H.B., Agronomist, Texas State Research Foundation, Dallas, Texas
“Staten, H.W., Agronomist, Oklahoma Agr. Exp. Station, Stillwater, Oklahoma
“Williams, L.F., Agronomist, U.S. Regional Soybean Laboratory, Urbana, Illinois

Page 2: “A Coordinated Approach to Regional Research Problems in the Southern States by F.S. Chance–The first speaker on the morning program was Director F.S. Chance of the Tennessee Agricultural Experiment Station who welcomed the collaborators to the State. Dr. Chasse discussed the aim of the Southern Station Directors to coordinate their programs on mutual problems to the extent that work at the stations will be replication and not duplication.

“Several proposed Flannagan-Hope projects were discussed. Marketing projects on the problems of cotton and tobacco have been more difficult to outline than projects on poultry and dairy products, or on marketing of perishable products. Among the present projects under Flannagan-Hope, those on marketing will get first consideration. The southern stations are joining in the printing of research bulletins covering certain phases of activity, among these being the work at the Vegetable Breeding Laboratory. The Southern Directors are looking forward to continued cooperation of this kind.

“The Place of Soybeans in an Efficient Agriculture in the South by C.R. Sayre–In general farm incomes for 1946 averaged three times those received in 1935-39. This reflects a strong purchaser demand for farm products which is likely to continue for most commodities through much of 1947. Fats and oil prices are apt to be maintained at favorable levels relative to other products. When a world market perspective is used, there is a shortage of fats and oils of startling proportions. Assuming pre-war levels of consumption, the requirements in 1946 were 5 to 6 million tons. Supplies of fats and oils available for export from all sources were about 3 million tons. The extent to which this world-wide demand is satiated depends upon the accumulation of purchasing power through favorable trade balance, loans, or relief allocations for many war-torn countries. It is of interest in passing that the United States became a net exporter of fats and oils for the first time during World War II. Our expanded production–particularly of soybeans–and restricted consumption resulted in the shift.

“It is estimated that this country could have used an additional million tons of fats and oils in 1946 had supply conditions permitted. Unless extremely chaotic conditions develop from industrial descriptions, demand for farm products in general should remain at a high level, and, a large crop of soybeans in 1947 could probably be moved at favorable prices.

“So far soybeans have been ‘on the third team’ when you consider the prevailing farming systems in most parts of the South. This, of course, does not detract from their importance as an enterprise for research and improvement, but it is reflected in the attitude toward the crop in many sections. This exists in the minds of many agricultural workers as well as farmers. Some of it has grown out of early disappointments when soybeans did not attain the spectacular yield levels nor have quite all the soil-building qualities which were included in their ‘advanced billing.’ Then, too, many people appraise a crop by looking at historical acreages, yields, and volume of production. These in no way reflect the future potentialities of soybeans, if they are improved in the future, in balanced and efficient farming systems in many parts of the South.

“We should appraise the enterprise in terms of their place in the best adapted farming systems in each major
production situation in each production area of the South. Space limitations permit mentioning only three. In the Mississippi Delta it is estimated that 75 percent of the farming systems would be cotton, cash grain (including soybeans), and roughage systems in an efficient agriculture. Soybeans would be one prospect for some of the land which is not of top-notch quality for cotton. On farms where soybeans, small grains, and possibly combinerable sorghums were grown, machinery costs for these crops could be kept at a minimum.

“In the Tidewater area of Virginia and North Carolina, commercial soybeans have been fitted in to good advantage. There is little cotton grown on farms in the area, and soybeans help to balance out the utilization of both labor and equipment.”

Note: The Tidewater area or region of these two states is the low-lying Atlantic coastal plain in southeast Virginia and northeast North Carolina. In these areas, the water level rises when the tides come in.

“The Piedmont [foothills, between the Tidewater area and the Blue Ridge Mountains] presents a different situation. It is difficult to expect economic success with a cash crop alternative that is not a high-valued labor-intensive enterprise in most parts of this area. Grain crops for feed for livestock appear to present a more favorable opportunity, and in most instances they would contribute less to erosion than do soybeans.

“Work of the Northern Regional Research Laboratory, by R.T. Milner–The work of the Northern Regional Research Laboratory on other commodities, such as agricultural residues and cereal crops, was first summarized. From agricultural residues, there have been produced (1) Noreseal, a cork substitute, now being tried on a commercial scale with 70,000 bottles; (2) a soft gilt blasting process for cleaning machinery, now in commercial use; (3) Noreplast, a plastic molding powder containing up to 50 percent of residues; (4) furfural products of interest to synthetic chemical producers; (5) a new process of pulping straw, now being given commercial trial in Holland and of much interest here; and (6) synthetic liquid fuels, with a semi-works plant using one ton of corncobs per day, now in experimental operation at this Laboratory.

“Cereal crops work is in progress on (1) study of starch granules at different stages of maturity; (2) alcohol as a motor fuel; (3) improved feed and food products from fermentation processes; (4) fibers both from zein, a corn protein, and from amylose or acetylated amylose; (5) better steeping agents; (6) glucose sirup from wheat flour; and (7) a survey for better antibiotics.

“The most important soybean research project of the Northern Laboratory has been a study of the flavor stability of the oil. For this purpose, a great deal of work has been required to establish a means of testing reversion. No chemical method could be found so a taste panel of ten experienced tasters was established. This group meets twice daily and their results are evaluated statistically. The results to date are inadequate to solve the problem, but are more hopeful than at any time during the eleven years the laboratory has been working on the stability problem. It is clear that soybean oils produced commercially differ markedly in stability, that part of these differences are caused by bad practices in processing the beans, that many oils are greatly benefited by use of 0.01 percent citric acid during deodorization, and that this treatment improves both expeller and extracted oils” Continued. Address: Secretary of the Conference, Memphis, Tennessee; U.S. Regional Soybean Laboratory, Urbana, Illinois.


• Summary: (Continued): “Work on soybean oil for protective coatings continues. Norelac, a rubber substitute, and Norepol, a polyamide useful for heat-sealing and paper coating, are two products of the Northern Laboratory that have received commercial trials. New catalysts have been found to have increased conjugation to soybean oil, and can [page 4] produce a product which dries to a wrinkled film in one hour without metallic drier. Lime (5 percent) in soybean oil paints has been found to be very beneficial. Applications of soybean protein to paper coating and shotgun shell casings have been made.

“Report of Collaborators

“Each of the collaborators presented a report on the accomplishments of the soybean research program during the past season and described the position of soybeans in the general farming system of his state. Mr. E.F. Schultz, the collaborator from Alabama, was unable to be present but submitted a statement of progress to be included in the report. A report covering research in southeast Missouri is also included.

“Alabama report by E.F. Schultz–Uniform nursery groups VI, VII, and VIII were planted at Fairhope, Crossville, Belle Mina, and Tallasse. All tests were harvested except Group VIII at Tallasse.

“The Alabama nursery was reduced from about 300 strains to 45. Of these 45 strains, 3 that had showed promise were planted adjacent to the regional nurseries at all four locations in Alabama so that their yields could be compared with those of the varieties in the regional tests. The yields of the three strains were no better than those of the varieties in the regional tests but still as good as the rest of the Alabama nursery.

“It is entirely probable that, since our best strains do not seem better than commercially available varieties, soybean
breeding work in Alabama may be set aside for a while.

“Other work with soybeans has already been discontinued in Alabama, the regional nurseries and the Alabama nursery being the only soybean work in progress during the past year.

“Arkansas report by C.R. Adair–The estimated acreage, yield per acre and total production in Arkansas in 1946 increased 256, 143, and 368 percent, respectively, compared with the averages for 1935-1944. The acreage harvested for seed during the period 1935-44 was 115,000 acres; for 1945 it was 209,000 acres; and for 1946 it was 295,000 acres. The average yields per acre were: for 1935-44, 12.9; for 1945, 16.0; and for 1946, 18.5 bushels. The total production for those periods was: 1935-44, 1,484,000; 1945, 3,344,000; and 1946, 5,458,000 bushels.

“The increase in acreage, yield per acre, and, total production has been brought about by the demand for oil seed crops and the resulting increase in price per bushel, the introduction of higher yielding varieties, growing soybeans on the better land instead of other cash crops, and the use of better cultural practices.

“The 1946 season was one of contrasts in Arkansas. At most places where the tests were conducted there was excessive rainfall during May. Near drought conditions prevailed in late summer at Stuttgart, Marianna, and Desha county; and there was insufficient rainfall at Fayetteville in August. The mean daily temperatures were below normal throughout most of the season.”

Page 14: South Carolina report by W. R. Paden–Soybeans have been grown in South Carolina for many years. Most of the crop has been grown for forage but during the past few years the proportion grown for seed has been increasing. An average of 28,000 acres was grown for forage in the ten-year period, 1935-44; 20,000 acres in 1945; and 24,000 acres in 1946. The acreage grown for seed during these same periods was 10,000; 8,000; and 16,000 acres, respectively. The yields per acre were 6.9, 7.0, and 6.0 bushels for the same period, respectively. This increase in acreage planted for beans and increase in yield per acre is undoubtedly a result in the use of improved bean varieties.

“The uniform nursery tests have been conducted each year at Clemson and at two of the branch stations, Pee Dee and Edisto, since the tests were first started. Both early and late plantings on Cecil sandy loam (upland) soil last year at Clemson and one medium early planting on Congaree silt loam (bottomland) soil were made. The average yield of ten varieties (Group VII) on the Cecil soil was 17.3 bushels for the early planting in comparison with 13.0 bushels for the late planting. The protein and oil contents were also slightly higher from the earlier planting. The highest yield from the early planting was made by the N44-72 variety with 20.6 bushels and from the late planting by Volstate with 23.0 bushels. Wood’s Yellow produced the highest yield, 40.2 bushels on the Congaree silt loam. Field tests with the Ogden variety showed that this variety was a high producer of seed; but due to its heavy shattering, it is necessary to harvest immediately after maturity especially on the light soils. Two dates of planting were made at the Edisto Station with an average yield of 24.8 bushels for the early and 22.2 bushels for the late planting. The highest yield from the early planting was made by the N44-774 variety with 32.1 bushels and from the late planting was N44-92 with 27.6 bushels per acre.

“No breeding or selection work is being done by the experiment station other than the testing of selected strains by Dr. Hartwig at the Pee Dee Station. Coker’s Pedigreed Seed Company at Hartsville, South Carolina, has some soybean breeding underway and appears to have one or two promising varieties which should soon be ready for release.

“Tennessee report by O.H. Long–According to Release No. 696 of the Department of Agriculture Statistical Service, Nashville, soybeans for seed were harvested from 45,000 acres in Tennessee in 1946 with an average acre yield of 18.0 bushels. The average yield compares with 14.5 bushels obtained in 1945 and 8.2 bushels for the 10-year period, 1933-1942. It is believed that this increase in acre yield was due to favorable growing conditions generally throughout the State in 1946, as well as the increased use of improved varieties, particularly the varieties Ogden and Volstate which were developed by the Tennessee Agricultural Experiment Station.

“A release from the U.S. Department of Agriculture, Production and Marketing Administration, Nashville, has suggested a goal of 80,000 harvested acres of seed soybean in 1947 with a total production of 1,120,000 bushels.

“Uniform Soybean Nurseries, Groups IVS and VI, were grown at three locations in Tennessee in 1946. These were located at Knoxville, Crossville in East Tennessee, and Jackson in West Tennessee. The highest yields were obtained at Jackson, the mean yield being slightly over 30 bushels as an average of the two groups. The next highest yields were obtained at Knoxville where the mean yield was slightly...”

(Continued). Address: Secretary of the Conference, Memphis, Tennessee; U.S. Regional Soybean Laboratory, Urbana, Illinois.


• Summary: (Continued): Page 20: “Thursday afternoon, February 6–R.W. Marston, Chairman Special Topic–Factors Affecting Soybean Production

“Legume Inoculation in the South with Special Reference to Soybeans by Lewis W. Erdman–Data taken from New Jersey Station Bulletin 607 were given to picture

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May in problems of breeding for increased quality, oil content, etc., in a given locality may be an important factor. Also, the adaptation of strains of bacteria for different varieties some do better on certain varieties, and there is evidence of the nitrogen balance in the soils of the United States. The annual additions of 5,464,566 tons of nitrogen fixed by symbiotic bacteria in legumes (including 1,698,794 tons for harvested crops; 2,320,772 tons for pastures in farms; and 1,445,000 tons for pastures not in farms) plus 4,366,170 tons fixed by non-symbiotic microorganisms represented roughly 9/16 of the total nitrogen income from all sources amounting to 16,450,000 tons. Total annual losses amounted to 23,660,000 tons, making a net annual loss of 7,210,000 tons.

“Since 1930 these losses have been reduced considerably, due to the efforts of the Soil Conservation Service. Likewise, additions of nitrogen have been materially increased due to the huge increase in acreages of inoculated legumes, especially during the war years.

“In 1929 estimated total production of legume bacteria cultures for all cross inoculation groups was around 1,500,000 bushel units. Now the estimated annual production of legume inoculants is around 22,500,000 bushel units. It was further estimated that of this total, about 15,000,000 bushels have been prepared for the inoculation of soybeans. Soybean bacteria (Rhizobium japonicum) are specialists—some do better on certain varieties, and there is evidence that adaptation of strains of bacteria for different varieties in a given locality may be an important factor. Also, the problems of breeding for increased quality, oil content, etc., may influence the genetic factors within the plant that carry the ability to be nodulated and to enter into an efficient symbiosis with the Rhizobium. Laredo and Peking soybeans have always presented an inoculation problem to the soil bacteriologist, in that they are more difficult to successfully inoculate than other varieties. Soybeans are grown in corn belt soils at a time when there is a maximum production of NO3 nitrogen by soil organisms. When NO3 is present, soybeans utilize it; and the need for fixation is lessened. This may account for the relatively small amount of nitrogen fixed by soybeans. A 25-bushel soybean crop, requires about 125 pounds nitrogen. It is doubtful if more than 50 pounds per acre are fixed under corn belt conditions, consequently high yields are produced at the expense of soil nitrogen.

“In the south, soils are notably deficient in nitrogen as well as certain other nutrients. Low State averages mentioned in the State reports seem to offer a challenge for better cultural and fertilizer practices and perhaps inoculation research on soybeans.

“There is a need for more accurate data showing the amounts of nitrogen fixed by different legumes growing under different soil and climatic conditions. With the new technique using the stable isotope N15, it will be possible to calculate the effect of various levels of fertility on the amount of nitrogen fixed by various legumes.

Page 24: “Soybean meal for poultry has certain advantages:

“(1) Low price and abundance compared to animal protein supplements.

“(2) Soybean meal has a good proportion of most of the essential amino acids though low in one or two.

“(3) Soybean meal has certain disadvantages; “(1) lower mineral content than some protein supplements.

“(2) Lower vitamin content (riboflavin especially)

“(3) Heat treatment is desirable to improve biological value, but too much heating is harmful.

“A laying ration containing 30 percent soybean meal was satisfactory for egg production but caused low hatchability and low viability of chicks. This was not true of some strains of poultry. The laying rations and growing rations were improved by addition of fish meal, dried skimmed milk, or fresh cow manure. Green pasture also improved the gains.

“Cottonseed meal cannot be used in laying ration but can be used in growing rations. All this work is being done on expeller and (hexane) solvent meal. The experiments will have to be repeated if alcohol-solvent meal becomes plentiful enough to become generally available.

“Discussion of Cooperative Soybean Projects for the Southern States—Mr. Marston discussed the Flannagan-Hope bill and tentatively defined marketing as anything that happens to a commodity after harvest.

“A request from one of the Experiment Stations for additional research on soybean production problems and on soybean storage and marketing problems in the South was brought to the attention of the conference group. Following a discussion of the need for such work, it was moved by Professor J.F. O’Kelly, Mississippi Agricultural Experiment Station, that two projects, (1) breeding, cultural, and production, and (2) seed storage and marketing for soybeans, be submitted to the Directors of the Agricultural Experiment Stations of the southern states for their consideration as a project under the Flannagan-Hope Research and Marketing Act. This was seconded by Professor H.W. Staten of the Oklahoma Agricultural Experiment Station and carried unanimously.

“The following committees were appointed: (1) Committee to consider seed storage and marketing project—W.R. Paden, C.R. Sayre, H.W. Marston, W.J. Morse, L.E. Holman, P.R. Henson, and J.L. Carter; and (2) Committee to check the production research project—H.W. Staten, C.R. Adair, John Gray, and W.B. Allington.

“The committees were instructed, to draw up an outline of the proposed project consideration at the afternoon session.

“New Soybean Introductions and Recent Developments Abroad, by W.J. Morse—The introduction of soybeans since 1932 has been at a rather low ebb. From 1932 to 1946, inclusive, 316 samples have been received from foreign countries, of which 100 were from oriental countries—China, Japan, Manchuria, India, and Java. Although these
introductions have been tested at several locations, as yet very few have shown any special promise. P.I. 4104,881–Nanksoy, from Nanking, China–has shown some promise as a grain type in Louisiana. In 1946, 105 introductions–very early [page 25] early, and medium early types–were received from the Belgium Department of Agriculture. This collection represented varieties and strains obtained originally from Austria, Canada, Denmark, Netherlands, Portugal, Rumania, Sweden, United States, and U.S.S.R. Some rather interesting strains were noted in the introductions grown at Urbana, Illinois, and Beltsville, Maryland, in 1946. The following table shows the countries from which introductions were received and the number from each country by years:–

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of Lots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>14 in 1942</td>
</tr>
<tr>
<td>Australia</td>
<td>7 in 1939</td>
</tr>
<tr>
<td>Belgium</td>
<td>106 in 1946</td>
</tr>
<tr>
<td>Brazil</td>
<td>1 in 1936</td>
</tr>
<tr>
<td>Canada</td>
<td>3 in 1938</td>
</tr>
<tr>
<td>China</td>
<td>57 in 1933-1937</td>
</tr>
<tr>
<td>El Salvador</td>
<td>2 in 1946</td>
</tr>
<tr>
<td>England</td>
<td>1 in 1945</td>
</tr>
<tr>
<td>France</td>
<td>3 in 1937 and 13 in 1946</td>
</tr>
<tr>
<td>Guatemala</td>
<td>1 in 1941</td>
</tr>
<tr>
<td>Hawaii</td>
<td>2 in 1944</td>
</tr>
<tr>
<td>India</td>
<td>21 in 1936 and 7 in 1937</td>
</tr>
<tr>
<td>Japan</td>
<td>5 in 1932-1937</td>
</tr>
<tr>
<td>Java</td>
<td>8 in 1939</td>
</tr>
<tr>
<td>Manchuria</td>
<td>12 in 1932-1941</td>
</tr>
<tr>
<td>Netherlands</td>
<td>18 in 1939 and 12 in 1946</td>
</tr>
<tr>
<td>Poland</td>
<td>8 in 1934 and 1 in 1940</td>
</tr>
<tr>
<td>Spain</td>
<td>1 in 1934</td>
</tr>
<tr>
<td>Sweden</td>
<td>1 in 1936</td>
</tr>
<tr>
<td>Tibet</td>
<td>2 in 1932</td>
</tr>
<tr>
<td>Uruguay</td>
<td>1 in 1935</td>
</tr>
<tr>
<td>U.S.S.R.</td>
<td>4 in 1933 and 1 in 1934</td>
</tr>
<tr>
<td>Venezuela</td>
<td>3 in 1940</td>
</tr>
</tbody>
</table>

In reviewing the introductions received during the past several years, it was noted that very few varieties have been obtained south of Nanking, China. Although the number of introductions has been few, several have given good results in the Southern States, such as Biloxi, Laredo, Seminole, Cherokee, Palmetto, Nanksoy, Clemson, Missoy, and others from the Nanking region. It would seem that South China offers an excellent region for exploration of new varieties. Chinese have informed us that the south region does not have an abundance of varieties. However, whenever we do get an introduction from that region, it seems to fit in somewhere in our Southern States and it is believed that there are many varieties and strains in the South China region that would be of value to our southern soybean program.

“As to recent developments abroad with soybeans, it would seem from the numerous foreign visitors to the office and our foreign correspondence that interest in soybean production is world wide. From July 1, 1945, to July 1, 1946, we had at the Division 50 visitors from 20 foreign countries. Some of these spent from one or two months to a year studying all phases of the industry. The foreign requests for experimental lots of seed were numerous. The following table indicates the widespread interest in the crop:” (Continued). Address: Secretary of the Conference, Memphis, Tennessee; U.S. Regional Soybean Laboratory, Urbana, Illinois.


**Summary:** (Continued): Page 26: A large table titled “Foreign Countries Sent Experimental Lots of Soybeans During 1944, 1945, and 1946” gives the name of many foreign countries and the number of lots sent to each, as follows:

- Argentina 4
- Australia 11
- Austria 1
- Barbados, B.W.I. [British West Indies], 1
- Belgian Congo 1
- Belgium 4
- Bolivia 1
- Brazil 8
- Canada 2
- Chile 2
- China 1
- Colombia 9
- Costa Rica 6
- Cuba 5
- Czechoslovakia 1
- Dominican Republic 1
- Ecuador 4
- Egypt 2
- El Salvador 4
- England 4
- Ethiopia 3
- France 6
- French Equatorial Africa 1
- Germany 1
- Gold Coast, Africa 2
- Guatemala 3
- Haiti 4
- Hawaii 1
- Honduras 4
- India 6
- Iraq 1
- Italy 1
- Jamaica, B.W.I. 1
- Madagascar 1
“Malta 1
“Mexico 12
“Montserrat [sic, Montserrat], B.W.I. 1
“Morocco 2
“Nassau, B.W.I. 1
“Netherlands 2
“Nicaragua 3
“Palestine 3
“Paraguay 1
“Peru 6
“Puerto Rico 1
“Scotland 1
“South Africa 1
“Spain 1
“Sweden 1
“Trinidad 1
“U.S.S.R. 3
“Venezuela 7

Note: The meaning of “a lot” of soybeans is unclear. How many soybeans and how many varieties are in a lot?

Following the talk by Mr. Morse the conference recommended that a project be submitted for exploration in south China to secure introductions for use in the breeding program of the southern states.

New Research Projects to be Considered—(a) Uniform fertilizer experiments. The outlining of a uniform project on the effect of fertilizers on yield and composition of soybeans is complicated by differences in soils, and levels of fertility among the interested states. The conference decided the problem was worth further study and Dr. W.R. Paden has agreed to serve as chairman of the Uniform Fertilizer Committee to draw up a project outline for consideration by the soybean conference group at the next meeting.

(b) Collection, storage, and maintenance of foundation stocks of soybeans. No action was taken on this project other than to urge that each collaborator send Mr. Henson samples of any soybean introductions or selections regardless of character. Any size sample between one ounce and one pound will be satisfactory. These may be of value in the search for disease resistant strains.

(c) Size of samples for chemical analysis was discussed and two recommendations made;

(1) Sample size should be between 60 and 100 grams.
(2) All foreign material should be removed from the samples.

(d) Crosses to be made. Mr. Henson suggested that collaborators write him or Dr. Williams suggesting any crosses that would be of value to the breeding program.

Friday afternoon, February 7

Consideration of Proposed Flannagan-Hope Research Projects—The two committees appointed at the morning session submitted for consideration of the collaborators the following two projects entitled: (1) ‘Harvesting, storing, and marketing of soybeans, lupines, and other legume seeds in the southern region.’ (2) ‘Develop improved strains and methods of culture of soybeans for food, forage, and industrial purposes in the Southern States.’ It was moved by Professor H.W. Staten of the Oklahoma Agricultural Experiment Station that the reports be adopted and that copies of the proposed new projects be sent to the Directors of the Southern Agricultural Experiment Stations. The motion was seconded by M.H. McVickar of the Virginia Agricultural Experiment Station and carried unanimously. Copies of the proposed project outlines as approved by the Southern States collaborators on the soybean improvement work are attached at the end of this report.

Industrial Evaluation of Soybean Varieties—A commercial soybean oil refinery has agreed to evaluate a few of the better strains of soybeans that have been developed through the breeding program in order to determine if the high-yielding, high oil strains being developed are suitable for industrial use. It is suggested that seed of the following strains be submitted:

Group IVS (2 strains): S5100 and Gibson
Group VI (2 strains): Ogden and Arksoy 2913
Group VII (4 strains): N44-92, N44-774, Roanoke, Palmetto or C.N.S.
Group VIII (2 strains): Acadian and Mamloxi

Mr. Henson will notify the collaborators as to the amount of seed each will be requested to submit to him for preparing the composites for industrial evaluation.

Page 28: “Time and Frequency or Meetings—Time for the next meeting of the group was discussed and it was decided that perhaps a meeting every two years would be sufficient, with a small group meeting during the alternate year to plan experiments for consideration by the group. It was suggested that some travel funds might be held in reserve to meet with other groups of agronomists to plan new projects.

C. Roy Adair
“Secretary of the Conference
“Memphis, Tennessee
“February 5-7, 1947.” Continued (two attachments).
Address: Secretary of the Conference, Memphis, Tennessee; U.S. Regional Soybean Laboratory, Urbana, Illinois.


• Summary: (Continued): Attachment #1.

Bureau of Plant Industry. Soils and Agricultural Engineering.

Preliminary Project Estimate
“Fiscal Year 1947, under H.R. 6932 (Flannagan-Hope Marketing-Research Bill)
“Act Title: Title I, Sec. 10 (b) Amount: $75,000
“Short Title: Develop improved strains and methods of culture of soybeans for food, forage, and industrial purposes in the Southern States.

“Objective: Research with soybeans in the Southern States at present is in cooperation with the U.S. Regional Soybean Laboratory of the North Central States. Due to the original regional setup (twelve North Central States) of the Laboratory, only limited and temporary financial support could be made available for cooperative work outside of the specified region. In view of this status and the continued need for an increasing acreage of soybeans for industrial and forage purposes, southern collaborators feel that the soybean program should be on a more permanent basis. The development of superior varieties, especially for high oil content and high yield, adapted to the wide range of soil and climatic conditions in the Southern States and improved methods of culture are essential for increased acreage and a more economical production of the crop. The improved strains should be tested over a wide area to determine their resistance to diseases, insects, drought, and factors affecting quality and storage of seed. Studies are also needed to determine the effect of various soil types, fertilizer practices, stage of growth of the plants, diseases, and other factors on growth and yield of plants and composition and quality of seed.

“Plan: These investigations are to be conducted in cooperation with the state agricultural experiment stations in twelve southern states and will be integrated with existing State and Federal programs in those states, and with the U.S. Regional Soybean Laboratory at Urbana, Illinois. Selected progenies will be studied for chemical composition, disease and insect resistance, superior seed and forage qualities under different environmental conditions, and factors affecting production and quality of seed in the humid areas of the South. The investigations will be conducted in the field, laboratory, and greenhouse. Relative-producing ability and, quality will be determined and superior strains recommended for commercial use.

“Financial Requirements: It is estimated that the annual cost will be $75,000 distributed in the first year as follows:
“Personal Services—$57,900
“Travel—$4,000
“Equipment—$4,000
“Land and Structures—$60,000
“All Other—9,100 Total: $75,000
“After the first year, it is estimated that approximately $60,000 will be required for personal services and $15,000 for other expenses. Duration of the project is indefinite.

“Amount Available, 1947, for same objective: None.


“Preliminary Project Estimate

“Fiscal Year 1947, under H.R. 6932
“(Flannagan-Hope Marketing-Research Bill)

“Act Title: Title I, Sec. 10 (b) Amount __
“(Supplemented from Sec. 9b, (1), (2), and (3))

“Short Title: Harvesting, storing, and marketing of soybeans, lupines, and other legume seeds in the southern region.

“Objective: To determine the factors affecting quality and viability of soybeans, lupines, and other legume seeds during harvesting, storage, and marketing in the southern region. To develop improved marketing methods with the purpose of increasing returns to the grower.

“Plan; These investigations will involve the cooperation of the following State and Federal agencies:

“(1) State Agricultural Experiment Stations in the region.

“(2) Bureau of Plant Industry, Soils, and Agricultural Engineering.

“(3) U.S. Regional Soybean Laboratory.

“(4) Bureau of Agricultural Economics.

“(5) Bureau of Entomology and Plant Quarantine.

“(6) Bureau of Agricultural and Industrial Chemistry.

“(7) Such other State, Federal, and private agencies as may be able to contribute to the project.

“The contemplated research which will be integrated, with the project on improved strains and methods of culture, involves the following phases: (1) a study of harvesting and storage methods needed to maintain good seed quality and viability; (2) a study of methods and, procedures of selling on basis of oil quantity and quality, and any other factors that should reflect increased return to the grower; (3) a study of methods of improving market news service; (4) a study of trade channels.

“Financial Requirements: It is estimated that the annual cost will be distributed in the first year as follows:

“(To be determined by the various cooperating agencies)

“After the first year, it is estimated that approximately $__ will be required for personal services and $__ for other expenses. Delay in filling positions during the first year is reflected in the increased amount for other expenses to be used to provide storage houses and other equipment needed to initiate the project. The duration is estimated to be five years.

“Amount Available, 1947, for same objective; None for work in southern region.” Address: Secretary of the Conference, Memphis, Tennessee; U.S. Regional Soybean Laboratory, Urbana, Illinois.

Summary: Near bottom of title page: “United States Department of Agriculture. Agricultural Research Administration. Bureau of Plant Industry, Soils, and Agricultural Engineering, Division of Forage Crops and Diseases, cooperating with State Agricultural Experiment Stations.”


Summary: Work on the use of isolated soybean protein as a plastic was abandoned in favor of the use of specially treated soybean meals as modifiers and extenders in phenol formaldehyde plastics. The greatest problem involved in producing a plastic containing soybean meal is the attainment of water resistance. Address: NRRL, Peoria, Illinois.


Summary: State agricultural experiment stations: Listed alphabetically by state. For each state gives the city and main researchers. U.S. Regional Soybean Laboratory, Urbana, Illinois: Directors, staff members, field [collaborators]. Soybean disease project: Project leader, coordinators, field. Northern Regional Research Laboratory, Peoria, Illinois: Director, Assistant to the director, oil and protein division, analytical and physical chemical div., fermentation div., engineering and development div., commodity development division.

360. Soybean Digest. 1947. USDA men who have contributed to soybean development: Probst is federal soybean breeder in his home state. March. p. 29.

Summary: “Albert H. Probst, a member of the scientific staff of the U.S. Regional Soybean Laboratory for Indiana, has been doing agronomic work for this organization since May 1, 1936, all of the time in Indiana. In cooperation with Purdue University he has done work of great importance in developing the crop in that state.

“Probst and Dr. G.H. Cutler of the Indiana Agricultural Experiment Station, working cooperatively, have developed three new superior varieties–Gibson, Patoka, and Earlyana. Gibson and Patoka are good oil varieties. In the southern and south central parts of Indiana, where only forage types were grown until recently, they are providing a new cash crop.

Probst and Cutler developed the Earlyana, a quick-maturing industrial type, for northern sections of the Cornbelt which is now doing well there.

“By developing these new heavy yielders with a high percentage of good quality oil, Probst and the other agronomists with whom he has worked have not only helped greatly in stabilizing Indiana agriculture but have given the entire soybean industry a better foundation.

“Mr. Probst was born in Indiana, at Lawrenceburg in 1912. He has the degrees of B.S. and M.S., both from Purdue University. He lives at Lafayette.”

A portrait photo shows Albert H. “Al” Probst.


Summary: Footnotes on page 27: 1. Cooperative investigations of the Division of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U.S. Department of Agriculture, and the Georgia Agricultural Experiment Station, Paper No. 165. Journal Series, Georgia Agricultural Experiment Station.

“3. Cooperators to whom credit is due for assistance in obtaining the data presented herein are Mr. P.R. Henson, Dr. H.W. Johnson, and Mr. R.B. Carr, Stoneville, Mississippi. Dr. S.J.P. Chilton and Dr. J.P. Gray, Baton Rouge, Louisiana. Dr. Coyt Wilson and Mr. E.F. Schultz, Auburn, Alabama. Mr. J.L. Stephens, Tifton, Georgia, and Mr. I.E. Adams, Watkinsville, Georgia, and Dr. U.R. Gore, Experiment, Georgia.”

“Introduction: During the past three summers (1944-1946), a survey has been made of the diseases occurring on the varieties and strains of soybeans in the regional nurseries grown as a cooperative project between the U.S. Regional Soybean Laboratory, Urbana, Illinois, and the State
Agricultural Experiment Stations in the South.

“All regional uniform nurseries consist of 20-foot randomized rows of each variety tested replicated four times. They are in charge of a Station or a cooperating Federal Agronomist and are located at the Experiment Station and at one or more field stations in some States. At many stations the cooperator in charge of the nursery assisted in taking the notes. The States covered by this survey include Alabama, Georgia, Louisiana, Mississippi, and one station in South Carolina.

“For their convenience, the cooperating agencies have arranged the soybean varieties used in the uniform nurseries in groups numbered from O to VIII according to maturity. Groups 0 to IV-S are grown largely in the north and central sections of the United States and Groups VI to VIII are grown in the Southern States. This survey was concerned largely with Groups VI to VIII; but, because of the interest in parts of the South in soybeans that mature early in September, the varieties and strains of Group IV-S were grown at a number of locations.

“Through the mid-South, the soybeans of Group VI normally mature from October 1 to 15; those of Group VII, October 16 to 30; and those of Group VIII after November 1. Usually two or more groups were grown at a location.

“It is, of course, understood that the data presented in this paper are of such a nature that, at least for the most part, only tentative conclusions can be drawn. Some of the data presented, however, are highly suggestive and indicate quite clearly in what varieties resistance may be found. The proper rating of the varieties intermediate in resistance can only be determined by careful experimental testing. This is true largely because of the scarcity of disease in some nurseries and a lack of uniformity of infection in others.

“Methods: Readings were made on one or two dates each year. Since time would not have permitted making counts, even if that had been considered worth while, the relative resistance of the varieties was determined by inspection only. There was so much variation in the stage of development of the diseases present at the different locations as a result of differences in date of seeding, soil type, geographical location, and other factors that it did not seem practical to make too close readings. For this reason ratings on a scale in which 0 = no disease, 1 = Very slight, 2 = medium, 3 = considerable, 4 = severe, and 5 = very severe were adopted. Occasionally an intermediate reading seemed justified and then a rating of ½ was used (e. g., 2 ½, 3 ½, etc.). Such ratings are, of course, arbitrary and their value naturally varies with the observer. The ratings presented in this paper were checked on numerous occasions by other pathologists and agronomists and, for the most part, there was close agreement among the different ratings. When practical the readings were made by two persons; and, if these were at variance, an agreement was reached. All the readings at each location were made the same day, but those at different locations covered a period of a little over a month. This fact must be taken into consideration in appraising the data, since the diseases usually became progressively more severe as the season advanced.

“Results: So many figures have been obtained during the past three years that it is not feasible to present all of them. For this reason only the readings for pustule-blight, frogeye, wildfire, and mosaic made in 1946 are given in detail (Tables 1-12) and the data for the three years are summarized (Tables 13-16). The data in Tables 1-12 are typical of those obtained for all three years. No readings are recorded for certain varieties at some locations because such varieties were missing, usually as a result of a shortage of seed. The data are presented under the heading of the different diseases.

“Bacterial Pustule-Blight Complex: The most widespread and prevalent of the diseases encountered were the bacterial leaf spots, bacterial pustule (Xanthomonas phaseoli var. sojense (Hedges) Starr & Burkholder), and bacterial blight (Pseudomonas glycinea (Coerper) Stapp). The symptoms of these two diseases are so similar, especially in late stages of development, that they were rated as one disease. For the most part, pustule appeared to be far more prevalent than blight although some varieties are very susceptible to the latter. The data in Tables 1-3 and those dealing with pustule-blight in Tables 13-16, therefore, represent a mixture of pustule and blight. Since these two diseases are considered as one, the name pustule-blight seems appropriate.

“A study of the data for Group VI (Table 1) shows that there is a variation of two or three points in the ratings of replications at a location, but more commonly the variation is not greater than one point. In 26 percent of the nurseries the readings were the same for all four replications. The two readings given for Stoneville, Mississippi, were made on plots planted on two different dates, namely, on April 18 and May 29, respectively. The earliest readings for the season were made at Tallassee, Alabama, on July 22 and the latest at Watkinsville, Georgia, on August 30. The planting at Tallassee had little disease at the time the readings were made. At Fairhope, Alabama, the readings ranged from 1 for Ogden and Dortchsoy #2 to 5 for Burdette #19. As might be expected, there was a slightly higher average reading in the earlier planting at Stoneville. The ratings at Watkinsville were influenced by two factors, namely, drought and insect damage, which, at least in part, account for the lower readings. As was usually the case, the readings at Baton Rouge, Louisiana, were higher than elsewhere, being influenced largely by high rainfall at that location. It should be pointed out that Ogden, a variety usually freer of disease than most of the others, rated fairly high at Baton Rouge, although it still had less disease than all of the others except Dortchsoy #2. These two varieties gave what appeared to be significantly lower average readings and may be considered as possessing some resistance to pustule-blight.
Louisiana Green, however, and, even though it looked
• Reporter, Supplement
in the South (Continued–Document part II).
Research Administration, USDA.
Industry, Soils, and Agricultural Engineering, Agricultural
succeeding years” (Continued). Address: Senior Pathologist,
relatively resistant one year does not necessarily appear so in
period of years have shown that a variety that appears to be
must be withheld for the present. Observations over a
This is the
Ogden and C-N-S sometimes showed considerable disease.
Group VIII Cherokee and Louisiana Green showed the most
resistance. Louisiana Green appeared to be outstanding in
its resistance to these diseases even at Baton Rouge where
Ogden, which was the only variety repeated in
Group VII, again rated lower than most of the others and
must be considered in a class with Palmetto and C-N-S. In
Group VIII Cherokee and Louisiana Green showed the most
resistance. Louisiana Green appeared to be outstanding in
its resistance to these diseases even at Baton Rouge where
Ogden and C-N-S sometimes showed considerable disease.
This is the first year (1946) observations were made on
Louisiana Green, however, and, even though it looked
exceedingly promising, final judgment as to its resistance
must be withheld for the present. Observations over a
period of years have shown that a variety that appears to be
relatively resistant one year does not necessarily appear so in
succeeding years” (Continued). Address: Senior Pathologist,
Division of Forage Crops and Diseases, Bureau of Plant
Industry, Soils, and Agricultural Engineering, Agricultural
Research Administration, USDA.

in the South (Continued–Document part II). Plant Disease
• Summary: (Continued): “Wildfire: Wildfire (Pseudomonas
  tabaci (Wolf & Foster) (Stapp)) seems to be increasing in
  importance from year to year. At least that has been true in
  some plots observed by the writer during the past three years.
  This disease is erratic in its appearance, often being severe
  at one end or at the center of a row and absent from the other
  parts. This has made it difficult to rate the severity of
  the disease accurately. In general, however, those with whom
  the matter was discussed agreed that the part of the row most
  severely affected represented the resistance of the variety, the
  absence of the disease from the remainder of the row being
  attributed to lack of inoculation. The ratings, therefore, were
  based on the part of the row most severely affected.
  “The data in the Tables 4-6 show that there was no
wildfire at Fairhope, Alabama, in the 1946 nursery except
for a trace in one row each of Mamotan and Gatan in Group
VIII (Table 6). In Group VI the disease was most severe at
Stoneville, Mississippi, with the exception of a few rows at
Watkinsville, Georgia. The same is true in Group VII (Table
5). In Group VIII wildfire was most severe at Stoneville, and
at Tifton, Georgia. Even at locations where wildfire was not
severe it varied greatly on different varieties. For example,
in Group VII Roanoke, Volstate, Wood’s Yellow, and P.I.
54618-4-1-2 were the only varieties severely affected, and
in these varieties the degree of infection sometimes varied
from O to 3 in different replications at the same location,
suggesting a lack of uniformity in the distribution of the
inoculum. In Group VIII Mamloxi, Acadian, Mamotan,
Nanda, and Coker’s Selection #433 were most severely
affected. If any varieties are to be selected as resistant on
the basis of the data presented in Tables 4-6 they are Ogden,
Dortchsoy #2, F.C. 30261-1, Palmetto, C-N-S, Cherokee, and
Louisiana Green.

“Frogyee: In general, frogyee (Cercospora sojina Hara)
was not severe in 1946, except in some varieties at Baton
Rouge, Louisiana, and at Stoneville, Mississippi. Three
varieties in Group VI, Ogden, Rose Non-pop, and Burdette
#20, and three of Group VIII, Acadian, Gatan, and Cherokee,
were medium to very severely affected at Baton Rouge. In
Group VII six varieties, N44-774, Palmetto, C-N-S, N42-
26, N44-92, and Red Tanner, were medium to very severely
affected at Baton Rouge. The last three of these varieties
were moderately diseased at Stoneville, but the other three
had no frogyee or only a trace of the disease. This, together
with the fact that in Group VI Ogden was listed among the
susceptible varieties at Baton Rouge and in Group VII it
was not, indicates that caution is necessary in drawing final
conclusions regarding resistance to frogyee.

“Mosaic: Each year observations were made on the
presence of mosaic, but there was so little of the disease in
most places that the data for 1946 only are given (Tables
10-12). The disease was most evident at Tallassee, Alabama,
where there was a trace in all varieties and where a few were
moderately affected. The most seriously affected varieties
observed in 1946 (having an average rating of 1.0 or over),
were Rose Non-pop, Burdette #13, Palmetto, Nanda,
Mamotan, Gatan, Seminole, C-N-S, Acadian, N44-
92, Cherokee, Red Tanner, Mamloxi, and Louisiana Green.
If any variety is to be classed as resistant on the basis of
these data, especially the ratings at Tallassee, it is Ogden, and
possibly Dortchsoy #2, although neither is immune.

“Summary of Data for 1944-1946: Having observed
the nature of the data secured and the variations obtained in
the different replications and locations, the summary tables
following should be largely self-explanatory. These tables
give the averages of the readings for all locations for pustule-
blight, wildfire, frogyee, and downy mildew. Table 13
gives the data for Group IV-S. In this Group in 1944 Chief
appeared to show some resistance to pustule blight, but this
was not confirmed in 1945. The figures fail to indicate that
any variety in this Group is appreciably resistant to pustule-
blight. The data for wildfire indicate that S100 and Gibson
are more susceptible to wildfire than some of the others;
but, as in the case of pustule-blight, there is no satisfactory
evidence of resistance. The data for the three years seem
to support the statement made previously that wildfire is
increasing in severity.
Note: Discussion of Groups, varieties, diseases, and which varieties are most likely to have resistance to which diseases continues from page 32 to page 35. A summary starts at the bottom of page 35 and ends at the bottom of page 36. There are full-page detailed tables on pages 37 to 53.

The first table can serve as a good typical example:
(1) “Bacterial pustule-blight ratings in soybean nurseries at several locations in 1946. Group VI.”

This table has 10 columns. First is location and date (e.g., Tallassee, Ala. 7-22-46). The next 8 columns are names of soybean varieties grown at those locations. Below each variety is its rating for this disease at the different locations on the different dates. At the bottom of each column in the average rating; the lower that number, the greater the likelihood that that variety has resistance to that disease.

The goal of this entire project is to try to locate soybean varieties with resistance to certain diseases. Address: Senior Pathologist, Division of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, USDA.


• Summary: Presented by R.T. Milner at the Soybean Conference held at the Northern Regional Research Laboratory, Peoria, Illinois, on February 27-28, 1947.

“Ten years have passed since organized research on the industrial possibilities of soybeans was started in 1936. This, as many will remember, began with the establishment of the U.S. Regional Soybean Industrial Products Laboratory at Urbana, Illinois. It was an outgrowth both of the increasing popularity of soybeans as a farm crop and of the farsightedness of many individuals who recognized the industrial potentialities of a crop rich both in protein and oil. We have only to recall the prominent part the soybean played in recent years to recognize the country’s good fortune in having men not only with vision but also with the enthusiasm to start soybean research on a sound and practical basis.

“Prior to the establishment of the Urbana Laboratory, Dr. O.E. May and Mr. H.T. Herrick had spent much time in laying the groundwork of the research program. In their survey, the objective was to learn from industry what problems should be studied by the U.S. Department of Agriculture and what questions were receiving industrial attention.

“Work on the most important problems shown by this survey demanded the attention of both chemists and agronomists, and, with such changes as situations have dictated, has been continued. However, after the establishment of the Northern Regional Research Laboratory, chemical and engineering research was transferred from Urbana to Peoria, but the work has continued without halt.

“There have always been more problems, either suggested by others or developed in the course of our work, than there have been hands or money to investigate. But, much has been accomplished and marked progress has been made. This may well be considered, from the standpoint of our chemical and engineering research at this Laboratory, by distinguishing four main fields. Let us call them composition, protein, oil, and processing.

“Research on the composition of soybeans, soybean oil, and soybean oil meal is fundamental and is necessary for other work or contemplated uses. We worked on the analytical determination of oil in soybeans and, during the war, when beans were bought and sold on an oil-content basis, our information and results were made available to the Commodity Credit Corporation as a basis from which was evolved, after many difficulties, a system of measuring oil content that satisfied both buyers and sellers.

“At this Laboratory we have made contributions to many other problems. Among these are the determination of moisture, measurement of the amounts of the individual fatty acids in soybean oil, the isolation and composition of phosphatides from this oil, and the determination of refining loss. Much of this work was carried out in close collaboration with the American Oil Chemist’s Society and with technical and research committees of the National Soybean Processors Association. Some of these problems are still being actively investigated; work along these and similar lines will always be needed as a basis and guide for other research on soybeans.

“In studying soybean protein we have tried to find new uses and improve present ones, not only for isolated protein but also for soybean oil meal. By proper formulation we have used soybean oil meal as an extender for phenolic resins for plywood glues of both heat- and cold-setting types, and these have found some degree of commercial acceptance. We have also published extensively on the use of soybean meal in phenolic-type plastics, where lower-cost materials with improved color result from its use.

“Although a large part of the present production of soybean protein is now used for paper coatings, this use would be much expanded if the color of the protein could be enhanced further. Improvement in the color of soybean protein, therefore, has been one of our major objectives. Better flavor of the protein is also desirable to encourage its use in such edible products as whips or meringues. Fortunately, we have found a change in the processing of soybeans that improves both color and flavor. I shall discuss it later.

“Protective Coatings: In accordance with suggestions received from industry when the Soybean Laboratory was started, much of our work on soybean oil has been directed toward improving its drying properties for ultimate use in protective coatings. Along with this we have made various modifications and derivatives of linoleic acid, the major constituent of soybean oil. In the course of our work we have
developed and reported on the following: a rubber substitute, “Norepol”; a poly-amide useful for heat sealing and protective coatings, “Norelac”; and a catalytic method for isomerizing vegetable oils. The problem of flavor stability in soybean oil is receiving more emphasis now than any of our other soybean projects at the Northern Regional Research Laboratory. Work on it was started when the U.S. Regional Soybean Industrial Products Laboratory was established at Urbana, but not until the last 2 years have we obtained really encouraging results.

“Because of the lack of a satisfactory analytical procedure for evaluating flavor stability, we have devoted a great deal of time and effort to the development of a reliable taste panel which could determine the degree to which flavors have deteriorated in edible fats subjected to various treatments and conditions of storage. This flavor instability, or ‘going bad,’ is often referred to as reversion. Our panel is composed of selected individuals who have good taste sensitivities and who have been trained to judge the organoleptic properties of oils. Their results are analyzed statistically and have been found to be quite reliable and reproducible.

“The most significant progress we have made toward solution of the so-called reversion problem resulted from an investigation of the methods used in Germany for processing soybeans and soybean oil. The Germans had at least one remedy for flavor instability in soybean oil. Their practices appear to have some merit, although not completely applicable to conditions in this country. Nevertheless, they have provided us with a new insight into the causes of flavor reversion and of some precautions that must be taken to avoid it.

“German refiners use practically all their soybean oil without hydrogenating it, mixing it with other types of hard fats to produce blended products, chiefly margarine. The reason for this is that they discovered how to prevent the reversion of unhardened oil, or at least to inhibit its occurrence during the normal shelf life of the products, but their procedure is not applicable to hydrogenated soybean oil. The German method consists of the addition of a small amount of citric acid in the deodorization step, but it is highly effective only if the oil has been produced with a minimum of abuse and harsh treatment during production and in the earlier stages of refining.

“Cause of Reversion: The elimination of these deleterious practices, in our opinion, affords one of the promising approaches to solution of the flavor problem in this country, for we have obtained considerable evidence that such abuses are occurring in many, perhaps most, of the processing mills and refineries in this country. We intend to pursue the study of these apparently harmful conditions, with a view toward suggesting corrections.

“We are also attempting to discover the exact cause of flavor reversion, hoping that success will enable us to devise means for preventing the chemical reactions responsible for undesirable flavors and odors. In our studies of reversion, we have received excellent cooperation from the processors and refiners and have maintained close contact with the Soybean Research Council.

“Other research carried out at this Laboratory may be grouped under the broad heading of ‘processing.’ As I mentioned before, in attempting to improve the color of soybean protein for paper coatings and its flavor for edible purposes, we found it necessary to modify the method of removing the oil from the beans. If alcohol is used as solvent instead of the usual hydrocarbon solvent for oil extraction, the resulting oil meal may be used to produce a protein of much improved color and blander flavor. A favorable feature of this alcoholic extraction is the method of separating oil from the miscella, which avoids distillation of the solvent. We expect this new type of soybean processing will result in products of increased value and utility.

“Study of Fractionation: The separation of soybean oil by purely physical means into two fractions, one more suitable for edible use and one more suitable for protective coatings, has been intensively studied. The principles of this continuous process of liquid-liquid extraction are well established but our engineering studies on this process are not yet complete.

“Largely as a part of these so-called processing studies, but based also on our other work on soybeans, we have accumulated a large amount of background information. The availability of this information, and of the research workers who have read and thought about their respective problems, has made it possible to furnish much help to inquirers such as farmers, processors, industrialists, agents of the government, experiment stations, and others. This information has been of immediate and tangible value, although in a sense it is a byproduct of our research program. Thus, specific formulas that call for soybean products have been furnished to makers of plywood, paint manufacturers, paper coaters, tanners, and many others who have requested assistance. Groups of farmers, county agents, and business men have received advice on the advisability of establishing processing plants or the operation of such plants.

“This review of past and present research of the Northern Regional Research Laboratory indicates, I trust, a program with some very definite accomplishments to its credit. Its flexibility is not the least of its important features, yet this in no way hinders adherence to a definite objective for wider industrial application of soybean products. It is, we feel, a program that is and will continue to be exceptionally valuable to growers and to those in industry.” Address: NRRL, Peoria, Illinois.

364. Staff of the U.S. Regional Soybean Laboratory, Southern Section. comps. 1947. Results of the Cooperative Uniform Soybean Tests, 1946: Part II. Southern

**Summary:** Except for the cover, this document is typewritten.


“Introduction: Breeding to develop adapted high-yielding varieties of soybeans, having a composition most suited to industrial utilization, is the chief objective of the cooperative program between the U.S. Regional Soybean Laboratory and the State Agricultural Experiment Stations of the Southern States. Active breeding programs are under way at a number of locations, representative of a wide range in environmental conditions. The free exchange of material for preliminary study between cooperative breeders is providing an excellent basis for the evaluation of new strains over the region. Many new strains from this program have been selected from hybrid populations for further study. All promising material is classified into maturity groups and is grown along with check varieties at a sufficient number of locations to enable agronomists to determine the value of these strains over a wide range of environmental conditions.

“Strains adapted to the Southern States are entered in the progressively later-maturing tests, Groups IV-S, VI, VII, and VIII. At normal planting dates, the varieties and strains of Group IV-S mature from late August to early September. The varieties and strains of Group VI mature in early October, those of Group VII in late October, and those of Group VIII in early November. The maturity of the varieties within these groups are progressively later across the Upper South and earlier in the Lower South.

“At the time the southern program was initiated in 1943, strains had not been developed of a maturity between Macoupin or S100 of Group IV, and Ogden-Arksoy varieties of Group VI. Varieties of this maturity would be particularly desirable as the early maturity and harvest would allow more time for seed-bed preparation and fall seeding of winter grains, an excellent cropping sequence in the South. The acreage per combine could also be materially increased by
growing varieties of different maturities. In this connection, a group of new strains of Group V maturity, developed in the cooperative breeding program, were grown in preliminary tests at a number of locations in 1946. The better strains of this group were selected by the collaborators and entered as Uniform Test Group V in 1947 regional tests.”

Pages 4-5: Location of cooperative nurseries and cooperators.

Page 6 (Fig. 1): Map of southern states showing location of most of the cooperative uniform tests, 1945. Page 6a: Subdivisions of the Southern Region (from left to right): West (Texas and Oklahoma), Delta (Louisiana, Mississippi, Arkansas, Missouri), Upper and Central South (Tennessee, Kentucky, West Virginia), Southeast (including all of Alabama, Georgia, Florida, and South Carolina), and East Coast (North Carolina, Virginia).


• Summary: A talk given on Feb. 28, 1947 at the Soybean Conference, Northern Regional Research Laboratory, Peoria, Illinois, discusses some of the accomplishments of the Regional Soybean Laboratory at Urbana.

Editor’s introduction: “A comprehensive breeding and disease control program, tailor-made to fit the changing needs of the times, has been developed by the U.S. Regional Soybean Laboratory. Mr. Cartter has been agronomist in charge of the Laboratory at Urbana since 1942.”

“We plan to tell you this morning about the organization of the U.S. Regional Soybean Laboratory and some of the accomplishments. We will also discuss the soybean disease investigations of the Division of Forage Crops and Diseases and mention some of the accomplishments of that work. The U.S. Regional Soybean Laboratory was organized in 1936, being the third of a series of laboratories initiated under the Bankhead-Jones Act. The Soybean Laboratory as originally set up was a cooperation between the Bureau of Plant Industry, Soils, and Agricultural Engineering; the Bureau of Agricultural and Industrial Chemistry; and the 12 states of the North Central region.

“In 1942 the work on industrial utilization of the soybean was transferred to the Northern Regional Research Laboratory. At that same time, there was an urgent need developing for additional vegetable oils and high-protein feeds to meet the demands of the war period. At the request of the experiment station directors of the Southeastern states and with the permission of the directors of the North Central states, the work of the Laboratory was expanded to include the two regions. The purpose of the Laboratory as set forth in a cooperative agreement approved by the North Central directors in October 1942 reads as follows:

‘‘The object of the research to be done under this memorandum is to develop, through breeding, adapted superior strains or varieties of soybeans for industrial purposes and to obtain facts relating to the effect of variety, soil, climate, fertilizers, minor elements, and disease on the growth methods of production, and composition of soybean seed for industrial uses.’

“Work during the first few years was devoted to fundamental studies on the methods of breeding soybeans and on exploring the factors affecting accuracy of nursery trials. Along with this work we also began the collection of soybean introductions and selections to serve as a foundation stock of germ plasm for the breeding work. Along with these fundamental studies and the collection of foundation material, an extensive program of breeding was initiated.

“The development of improved varieties of soybeans, in early years, came through selections from introductions obtained from the Orient. This first work, which occupied the period up to the last few years, resulted in the development of such varieties as Dunfield, Illini, Manchu, Richland, and many of the other varieties with which we have been familiar in the past and which have played an important part in the establishment of soybeans as a major crop.

“New, improved soybean varieties are now produced largely by hybridization. Most of the crosses that are being developed through the cooperative program are made at four or five breeding centers and the better of the segregating plant populations are distributed in an early stage to all the interested experiment stations so that further selection can be done in the area for which the strains are being developed.

“In connection with the evaluation of new strains, the establishment of an analytical section in the Laboratory has permitted the use of chemical analysis as a tool in the breeding work. In the past it has been customary to make selection only for yield, lodging resistance, seed quality, maturity, and such other agronomic factors that could be observed. The use of chemical analysis has increased tremendously the opportunities for developing varieties that are superior for industrial use, as well as superior in yield.

“After strains produced through the breeding work have become sufficiently fixed as to type, the better of them are placed in preliminary nurseries. The best of these are entered in what we have designated as the ‘Uniform Soybean Tests’ which have been set up to give a critical evaluation of the top strains that are being developed through the breeding program. The varieties and strains we are studying in the Uniform Soybean Tests are divided into maturity groups, and starting with the very earliest, adapted to North Dakota and Minnesota, we have designated these as the Uniform Test,
Groups 0, I, II, III, etc., extending down to Group VIII which is composed of very late strains adapted to the southern part of the Gulf Coast Region of the United States; During the past season nurseries were planted at 44 locations in the North Central states and at 52 locations in the South.

“Accomplishments of the Breeding Program: In regard to accomplishments we will mention first some of the progress in the Southeastern states. In 1943 and for the next 2 years, the Uniform Tests which we established in cooperation with the state experiment stations of the region were composed mostly of the named varieties that were available and were being recommended by the state stations. These studies indicated that Ogden, which was then grown to a limited extent, was outstanding in the upper half of the Southern region, being the highest in yield and oil content of the strains under test, and being very lodging resistant. It is now the principal variety in this area. Ogden, however, is rather short especially on poor soils, and has a tendency to shatter. It is now being used extensively in crosses to carry its desirable qualities into new strains that are taller and hold their seed better.

“Roanoke, a selection from a mixed seed lot, has been developed at the North Carolina Experiment Station by Jack Rigney of the agronomy department and Edgar Hartwig of the Laboratory. Roanoke is some 10 days later than Ogden, being of about the same maturity as Volstate. It has been outstanding in the central South, slightly out-yielding Volstate, and having an oil content about 0.7 percent higher.

“A selection out of a cross Haberlandt x Ogden is showing much promise in recent yield tests. This strain has the yield of Ogden combined with the taller and better seed-holding habit of the Haberlandt variety. In general it is adapted to less fertile soils than Ogden and embodies the high oil content characteristic of the Haberlandt. Many of these new strains will rapidly replace the older varieties, as their value is realized and seed stocks become available.

“Up to this year there have been no particularly outstanding strains of the maturity of Group V, that is, for material to be grown through Tennessee, northern Arkansas, and Oklahoma. We are starting in 1947 a Group V nursery which will contain strains from crosses between Dunfield x Arksoy, Haberlandt x Dunfield, and a number of other crosses between the better northern and southern strains. We feel confident that through this breeding program strains will be developed that will be superior and well adapted to this area.

“Southeastern States: In the southeastern part of the United States some difficulty has been encountered in obtaining strains with good seed quality. It has been found that varieties coming from the Nanking region of China are able to develop good seed under these conditions. Many of these types, such as Monetta, Nanking, Palmetto, and Missoy, have been crossed with such high-yielding, high-oil-content strains as Ogden and Volstate, and selections from these crosses have been obtained that give indication of being superior to any of the strains now available for the southeastern Coastal Plains region. One of these new strains from a cross Ogden x Missoy entered in Uniform Test, Group VII, in 1946 led these strains in yield in the Southeast this first year.

“Turning to the North Central States, the first few years of the Laboratory work, so far as the development of varieties and strains was concerned, was devoted mainly to the agronomic and chemical evaluation of the varieties that were available. Among the strains released on the basis of the evaluation were Patoka, Gibson, and Earlyana developed by the Indiana Experiment Station; Chief, developed by the Illinois Station; and Boone, developed by the Missouri Station. By growing strains in the Uniform Nurseries at many locations in a region, it has been possible to evaluate them in a relatively short period of time. This is due to the fact that within a single year the seasonal conditions will vary considerably from place to place giving the equivalent of several crop years of information within a single season.”

Address: Agronomist in Charge, Regional Soybean Lab., Urbana, Illinois.


• Summary: Continued: “A Canadian variety, Capital, developed at Ottawa, Ontario, has been tested widely from Oregon to New York for the first time in the Uniform Tests in 1946, and has proved to be high in yield and high in oil content. This strain being earlier, taller, higher in yield and in oil content than Mandarin (Ottawa) should be valuable in the northern tier of states.

“Another promising strain for the Northern states, a selection from Mukden x Richland developed in cooperation...
with the Iowa station is somewhat earlier than Earlyana, stands up much better, yields more and has a higher oil content. It should be very useful in southern Minnesota, Wisconsin, Michigan and northern Indiana.

"Another selection from the same cross has been yielding only slightly under Lincoln, has averaged from 4 to 7 days earlier, and has ranked better in lodging resistance and equal in oil content. This strain will probably be released this year and should replace Richland in its area of adaptation as well as some of the Lincoln acreage where earlier maturity is desired. Lincoln is probably the most outstanding variety developed to date. This strain, originating from a natural cross between Mandarin and Manchu, was developed cooperatively by the Illinois Station and the Laboratory and was released for increase simultaneously by several of the stations in the Cornbelt. Lincoln has proved outstanding in yield and oil content in its area of adaptation and is rapidly replacing such varieties as Illini, Dunfield, Mukden, Manchu, and others of similar maturity. The variety Lincoln at present is grown on over half of the soybean acreage in Illinois and Indiana and is partly responsible for the high yield per acre obtained last season.

"Drawback of Lincoln: This variety, while being outstanding in yield and oil content, does not have all the lodging resistance that producers would like, nor is it early enough for growing in the northern parts of Indiana, Illinois, and Iowa. A backcross, Lincoln x (Lincoln x Richland), has been made for the purpose of combining the high yield and high oil content of Lincoln with the lodging resistance and earliness of Richland. The earliest segregates from this backcross have been sent to Minnesota, the slightly later material sent to Wisconsin, Iowa, Indiana, and Ohio, and the late material from the cross held at Urbana and points of similar latitude. Transgressive segregation for earliness has been obtained and some of the progeny from this backcross show promise of being early and lodging resistant, as well as having high yield and high oil content.

"A selection from a cross Dunfield x developed cooperatively with Iowa, has averaged higher in oil content than either of the parents, being outstanding at many of the nursery locations, occasionally exceeding Lincoln in yield and oil content. This strain has good lodging resistance, but its yield performance has been somewhat erratic. It is of entirely different parentage than Lincoln and for this reason the pathologists are recommending on the basis of their experience with other crops that the variety be released for increase in areas where its performance has been as good as that of Lincoln. The basis for this recommendation is that in case of a serious outbreak from some new and quite virulent disease, one variety of a crop might chance to be resistant.
to the particular disease while another variety embodying different germ plasm might be susceptible.

“Some New Strains: A number of improved strains of Group IV maturity have been developed in cooperation with the Indiana Station. One of them from a cross between Dunfield and Mansoy is being considered for release. This strain has a high yield and high oil content and is well adapted in the Group IV area. This strain is taller than Patoka and equal in lodging resistance. It has better yield and higher oil content than Chief, Patoka and Gibson, and may well replace these varieties.

“Thus as we look at the new varieties that have been developed through the cooperative efforts of the state experiment stations and the Laboratory, we see that in general these varieties have a wide area of adaptation, illustrating the value of a coordinated regional approach in this work.

“Organization of the Disease Work: We would like to tell you about the organization of the soybean disease project in the Division of Forage Crops and Diseases and of some of the accomplishments of this work.

“For several years after soybeans were introduced into this country we frequently heard the expression that the crop was free from diseases. This is the usual experience with a crop that is introduced into a new locality, and it is not until the crop has been grown for a number of years and the acreage becomes concentrated that serious diseases begin to make their appearance. This is the case with soybeans. In 1944 through the efforts of soybean producers and processors funds were made available by Congress to the Bureau of Plant Industry for conducting research on soybean diseases.

“At the time the soybean disease work was initiated in the Department of Agriculture, the fundamental knowledge in this field was remarkably low. We are, therefore, still very much concerned in our disease work with the fundamental nature of the diseases.

“The research work under the new soybean disease project in the Division is being devoted to the study of the life histories and control of diseases and the development of methods of testing soybean strains for resistance. The work is closely integrated with the work of the Soybean Laboratory and the state experiment stations. The leader of this new project is located at Urbana with a coordinator for the southern work located at the southern headquarters for the Laboratory project at Stoneville, Mississippi. In this way close coordination can be maintained. Cooperative disease work is being conducted in 11 states at the present time.

“There are 25 or 30 diseases that affect the soybean, some of them being more serious than others. The work on two of these diseases, bacterial pustule and downy mildew, exemplify the manner in which we are integrating this work with that of the breeding project. It has been found that a Southern variety, C.N.S., while not being a superior one agronomically does carry resistance to bacterial pustule. Crosses have been made between C.N.S. and superior varieties from other areas in order to introduce this factor of resistance into these new strains. Progeny from several of these crosses have shown sharp segregation for pustule resistance, giving us definite promise that this phase of the program will be successful.

“With downy mildew we have also found that breeding for resistance is possible and several crosses have been made for the purpose of developing improved mildew resistant strains.

“Two other diseases, bud blight and brown stem rot, are relatively new and give evidence of being among our most severe ones in this area. Bud blight caused by the tobacco ring spot virus has been quite destructive in rather localized areas and if given ideal conditions might prove serious. This disease is manifest in several ways, depending upon the stage of growth of the soybean plant at time of infection. The disease is not carried in the seed so far as we have been able to determine by extensive investigations. So far no insect vector or over-wintering plant has been found to carry the virus from season to season. The present work on this disease, therefore, embodies a search for possible insect vectors, alternate hosts and resistant varieties.

“Brown Stem Rot Threatens: Brown stem rot is possibly the most threatening of any of the diseases that are now known to attack the soybean. It is caused by a fungus recently identified as of the genus Cephalosporium, being a new species published on recently by Presley and Allington. The fungus exists in the soil and attacks the soybean plants, possibly through the roots. The first leaf symptoms usually appear in the fall as the plants approach maturity, generally appearing as a withering of the leaf tissue between the veins. These leaf symptoms often occur quite suddenly and may be mistaken for a light frost. Stem symptoms consist of a browning of the pith, usually starting from the base of the plant and working upwards. It may be distinguished from bud blight by the fact that bud blight also causes a browning of the pith but this browning generally starts at the upper nodes of the plant and works downward.

“In several locations this past season Dr. Allington and his co-workers have observed areas of severe infection of brown stem rot sharply delineated from healthy areas in the field by straight lines. In all of these instances a history of the field showed that in the infected portion soybeans had followed soybeans, either directly or with only one or two other crops intervening in the rotation. The healthy area of the field was that portion where soybeans had not followed soybeans directly but where the soybean crops had been separated at least 3 years in the cropping sequence. These observations give us a lead on a possible control, and we are now advocating that in areas where this disease has appeared soybeans should not follow soybeans in the cropping sequence oftener than once in 4 years.
“A search is being made among all the introductions and selections that are available in an effort to find types that are resistant to the various soybean diseases that are of economic importance. As these resistant strains are found they will be crossed with the better agronomic types for the purpose of producing improved, disease resistant strains for industrial use.”

Photos show: (1) An aerial view of the Delta Experiment Station at Stoneville, Mississippi, where the breeding work of the Southeastern states is centered. (2) J.L. Carter standing as he speaks. (3) The Ohio State University football stadium. Address: Agronomist in Charge, Regional Soybean Lab., Urbana, Illinois.


- Summary: Page 1: “Prepared in the Office of the Administrator of the Agricultural Research Administration in collaboration with those responsible for the research described.”

Contents: Introduction. Background of soybean problems. Organization of the Laboratory. The cooperative research program. Accomplishments of the research work: Soybeans and their industrial uses, protein content of soybeans, oil content of soybeans, improvement of soybean varieties (the new Lincoln variety, extending the range of soybean production, basic information on varieties and strains, physiological studies), disease-control studies, extension of the cooperative program to the South, storage of soybeans, establishment of standards and studies of composition and use, research services to growers and processors, improving industrial products from soybean meal, improving industrial products from soybean oil. Publications of the soybean laboratory and cooperators.

The lengthy bibliography is titled “Publications of the Soybean Laboratory and Cooperators.” It includes the research of the Laboratory prior to its transfer to Peoria in 1942. This publication is one of a series of nine covering the regional laboratories established under the Bankhead-Jones Act of 1935.

This publication begins: “Establishment of a new laboratory to study ‘America’s fastest expanding crop’ was announced by the Secretary of Agriculture on March 16, 1936. ‘Twelve North Central States and the U.S. Department of Agriculture have opened a cooperative soybean industrial research laboratory at Urbana, Illinois,’ the announcement reported. The 12 participating States were Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Nebraska, Kansas, Missouri, North Dakota, and South Dakota (fig. 1).

“Representatives of the Department and of the experiment stations of these States had met in Chicago February 7, 1936, to give joint consideration to the establishment and planning of a regional laboratory under the provisions of the Bankhead-Jones Act. Suggestions for research received from the States were used in outlining a proposed program for the consideration of the joint conference, which recommended approval of a soybean laboratory for the region and agreed to the general objectives.

“Background of Soybean Problems: During the period 1926-35 the acreage of soybeans harvested for beans increased from 466,000 to 2,915,000 acres, and the production of beans rose from 5,239,000 to 48,901,000 bushels. Much of this expansion took place in States of the north-central region. The research and educational programs of State agencies and the Department contributed to this growth. The availability of new varieties of soybeans suited to differences in soil fertility and length of growing season was an important factor in the expansion of production into new areas. The study and distribution by the Department of thousands of new introductions of soybeans from the Far East provided material for this expansion.

“The demand for food and feed crops in the years 1915-25 had given considerable impetus to the growing of soybeans for hay and grazing, which created a demand for seed beans. As better adapted varieties were established, seed production expanded into new areas, and attractive prices for the seed stimulated seed growing in areas that had previously depended on outside sources.

“The use of soybeans for hay and grazing familiarized many farmers with the crop. Soybeans proved resistant to drought and provided a legume for use on lands unsuited to the production of red clover. On other lands where red clover frequently failed, the soybean was used as a catch crop. It also fitted into the primary cropping system of certain areas of the region, replacing grain, particularly oats. The period 1925-35 was marked by diminishing export outlets for grain, and growers were looking for new crops.

“According to the annual report of the Illinois Agricultural Experiment Station for 1935-36, on 102 farms in the heavy soybean-producing area in Illinois, soybeans in 1935 occupied 36 percent of the total farm area and 42 percent of the area in harvested crops, as compared with about 16 percent and 20 percent, respectively, in 1928 and 1929. This rapid increase came about largely because farmers substituted soybeans for a part of their grain crops. In 1928 and 1929 the acreage of soybeans on these farms was second to that in corn; in 1935 there was more land in soybeans than in corn.

“Reduced domestic production of other oil-bearing seeds and increase of duty on imported vegetable oils were favorable to the expanding commercial production of soybeans for oil. Cottonseed production was down because of diminishing export outlets for cotton and increasing hazards from boll weevil in the cotton States, resulting in
reductions in cotton acreage.

“Prices in 1915 and 1925 were favorable to expansion in soybean seed production. The adaptation of the combine to harvesting and improvements in varieties and in cultural methods stimulated production of seed. By 1928 growing of soybeans for processing was accelerated in Illinois by an offer by processors of contracts for commercial seed production up to 50,000 acres with a guaranteed price of $1.35 per bushel for No. 2 beans delivered at two points in the State. These market contracts and the later development of a growers’ marketing organization gave a measure of stability to commercial production.

“When a soybean laboratory was under consideration in 1935, considerable industrial technology on the utilization of soybean products had already been developed. Industries had gained some experience through the use of limited domestic supplies and large importations of soybeans during World War I. A measure of the previous developments in the technology of the crop is the fact that 206 patents were issued on soybean products and processes in the United States between 1905 and 1936. The patents included 107 pertaining to food uses, 52 to general processes, and 47 to nonfood industrial processes. Various industries in the north-central region were ready to use the soybean and its products. The soap industry with its expanding markets, paint and varnish manufacturers, vegetable-shortening and oleomargarine processors, casein and glue producers, and plastics manufacturers were established in the region. There was no lack of an industrial market for soybean oil, and the demands for meal in industrial products and food were growing.

“The background conditions which have been described were largely favorable to the expansion of the soybean crop. The crop and its associated industries, however, had made progress in the face of many difficulties, and the outlook in 1935 was far from favorable in all respects.

“Returns to growers had been unsatisfactory. The Illinois Agricultural Experiment Station reported that during the decade 1921-30 soybeans were less profitable on the better land of the Corn Belt than corn, wheat, alfalfa, or red clover, though they were more profitable than oats or timothy. It was further reported that ‘during this period the returns from soybeans, including seed and mill beans, and straw lacked 17 cents an acre of being sufficient to pay growing and harvesting costs and taxes and interest on the land.’ Varieties of beans better suited to industrial utilization and further economies in the cost of production were considered necessary. Those most familiar with the agronomic phases of the crop saw opportunities to improve its position through breeding and introducing varieties better adapted to the region and to industrial uses.

“At the time of the establishment of the Soybean Laboratory, the expansion in processing facilities had kept pace with the increased production of beans, and the products were finding ready market outlets. The equipment and processes used had been developed for handling other oilseeds, however, and they needed adjustment to be effective in processing soybeans. Soybean products were supplying a market made available by the shortage of lard, cottonseed, flaxseed, and casein and were looked upon as inferior substitutes. If the primary products should regain their normal rate of production, it was feared that soybeans would lose this market. Those most familiar with the industry and its problems felt that the future competitive position of soybeans could be strengthened through improvement of the industrial processes and modification of the products. There was a need for adequate market grades as a basis for dealing with growers. Shortening made from soybean oil had poor keeping quality and unpalatable flavors. Soybean oil for paints and varnishes needed improvement in drying properties and uniformity of quality. Soybean protein was being used to some extent, but basic information on its recovery, natural properties, and opportunities for modification was largely lacking” (Continued). Address: Administrator of Agricultural Research.

Summary: Continued. Page 4: “Organization of the Laboratory: In selecting the location for the Soybean Laboratory, the advantages offered by the University of Illinois at Urbana were considered outstanding. The University, through its research and extension programs, had successfully established a place for the crop in the agriculture of the State. Illinois, in the heart of the north-central soybean-producing area, grows more soybeans than any other State. The offer of laboratory space, storage facilities, plot land, and associated services by the University made possible the immediate establishment of the laboratory at Urbana.

“Since the problems of soybean production and utilization required both biological and technological studies, two bureaus of the Department cooperated with the States in planning the research program of the laboratory. The Bureau of Plant Industry cooperated in the development of plans for the study of factors influencing the production and quality of the crop, and the Bureau of Chemistry and Soils contributed to the planning of research on the qualities of soybeans desired by industry and the development of industrial processes to extend the uses for soybean products.

“The initial organization of the laboratory called for a director as administrative head and a staff of specialists in agronomy and chemistry. The agronomic work was integrated with the Department’s soybean program in the Bureau of Plant Industry, and with work in the States by the establishment of cooperative agents in five States in the major soil and climatic areas where soybeans were produced.

“The chemical personnel included as project leaders a chemical engineer to serve the processing requirements of the laboratory and to conduct research in this field, a chemist familiar with industrial plastics and other uses for plant proteins, an oil chemist, and an analytical chemist; and in addition, three associate chemists and a number of assistants. Under cooperative arrangements with the Indiana Agricultural Experiment Station, two cooperative agents were appointed for chemical research on soybean products in that institution.

“The understanding between the 12 States and the Department provided for continued joint planning and coordination of the laboratory’s research program for the broad regional attack on soybean production and utilization problems. State representatives designated by their respective experiment station directors were appointed collaborators by the Secretary of Agriculture. The collaborators and Department representatives functioned as a planning and integrating group. Representatives of the States agreed to assemble short abstracts descriptive of any work being carried on at their stations which pertained to soybeans.

“On July 1, 1942, the research on utilization of soybeans and their byproducts, which up to that time had been carried on in the laboratory at Urbana, was transferred to the Northern Regional Research Laboratory at Peoria, Illinois.

The agronomic studies, including genetics, breeding, and physiology, were continued at the Soybean Laboratory and in the cooperating States. Chemical facilities to serve the breeding and physiological programs also remained in the Urbana laboratory. The soybean was designated as one of the farm commodities for study at the Northern Regional Research Laboratory, and the research program on industrial utilization has been further developed there. As a result of this change the U.S. Regional Soybean Laboratory at Urbana was able to extend the cooperative breeding and research studies to the agricultural experiment stations of 12 Southern States.

“The Cooperative Research Program: At the first meeting of the collaborators in Urbana on April 22, 1936, consideration was given to the further development of research plans. In fields of chemistry and chemical engineering four groups of projects were outlined. These included studies of (1) soybean oil in food and nonfood uses, (2) soybean meal as a source of industrial products, (3) chemical properties of soybeans and their products, and (4) engineering aspects of processing. Joint agronomic and chemical research was outlined to study the influence of differences in variety, soil type, soil treatment, and climate on the composition of the beans. Agronomic studies were directed to the further selection and improvement of varieties by breeding with special reference to regional adaptation and industrial uses. The soybean production studies were later supplemented with controlled physiological investigations to learn more about the influence of environment on the composition of soybeans, and with studies of soybean diseases and their control by breeding resistant varieties and by other methods.

“The cooperative research planned with the Indiana Agricultural Experiment Station included studies of the chemistry of the phosphatides, sterols, and associated compounds of soybeans and of the isolation, identification, and characterization of the carbohydrates of soybeans.

“Accomplishments of the Research Work: In reviewing the work and accomplishments of the U.S. Regional Soybean Laboratory, it should be remembered that its purpose was specific and that its progress was the result of the splendid cooperation of growers, processors, manufacturers, and educational and research forces in the region. Its founders planned ‘to obtain, through basic research, facts and materials applicable to the industrial utilization of the soybean and soybean products and to develop methods whereby these facts and materials may be utilized for the benefit of agriculture.’ The plans were unique at the time in that they proposed to integrate research on the production of a farm crop with research for its industrial utilization. It was expected that the closer association of these purposes would result in a clearer understanding of the factors which influence the industrial qualities of the crop. In the present summary of progress toward this end, consideration is
given to improvements in and standardization of the crop as a source of industrial raw material, the advancement of basic knowledge of its components and properties, and the application of this knowledge to the manufacture of useful products.”

“Soybeans and Their Industrial Uses: The long and varied use of the soybean in the Orient has developed and preserved varieties suited to a broad range of climate and use. Some of those varieties had been introduced into the United States by representatives of the State experiment stations and were grown on limited areas prior to 1900. The Department introduced a large number of varieties in 1898 and has continued to seek superior strains since that time. The careful study by W.J. Morse, of the Bureau of Plant Industry, of soybeans and their associated industries in the Orient in 1929-31 was fruitful in the selection of soybean varieties suited to special purposes and in the collection of accurate information on the processing and manufacture of soybean products. The results of this study proved valuable to the development of the Soybean Laboratory program and to the solution of emergency problems during World War II.

“Previous studies of available varieties had given some measure of the differences in plant and seed characters of soybeans due to variety. Varietal differences in oil content, oil properties, and protein content had been observed, but the available information on varieties of soybeans adapted to the north-central region did not permit accurate predictions as to their quantitative or qualitative industrial properties. The cooperative research program, therefore, included plans for a systematic study of representative varieties to be grown under the various soil and climatic conditions in the region. These uniform variety tests have been conducted by the State agricultural experiment stations in Ohio, Indiana, Illinois, Iowa, and Missouri since the beginning of the cooperative program in 1936, and all of the North Central States have cooperated in this work since 1942. It was expected that agronomic records of the variety and environment correlated with chemical analysis of the seed would indicate differences due to variety and shed some light on the influence of environment, soil type, soil fertility, and seasonal climatic conditions on the industrial constituents and their properties.

“The initial variety studies of 1936 included the following 8 named varieties and one strain designated by number, arranged according to length of time required to mature, from 100 to 130 days: Mandarin, Mukden, Illini, Dunfield, Manchu, Scioto, T-117, Peking, and Boone. Plantings were made in uniform tests at 43 points representative of soybean-producing areas in Illinois, Indiana, Iowa, Missouri, and Ohio. Additional varieties and strains were included in these tests as promising selections were developed in the breeding program. The variety studies conducted each year since 1936 have provided helpful information on the adaptation of varieties in the region to industrial processing.”

Each of the accomplishments outlined in the Contents (above) is discussed here in detail.

Photos and figures show: Cover: The laboratory buildings at the University of Illinois, Urbana. (1) A map of the United States. The States originally cooperating in the work of the Soybean Laboratory are those shown in black. Since 1942 the shaded States also have been cooperating with the laboratory in its research program.

(2) Culture chamber at the Soybean Laboratory where soybeans are grown under controlled environmental conditions. (3) Laboratory equipment for determining the oil content of soybeans of different varieties and strains.

(4) Two men in a field studying the growth of different varieties of soybeans in a nursery at Lafayette, Indiana. (5) A field of Lincoln soybeans in southern Iowa.

(6) Examining a soybean plant that has been inoculated with a known disease and grown under controlled conditions so that the symptoms of the disease can be studied. (7) Making a chemical analysis of some of the constituents of soybeans. The chemical composition of soybeans is an important index to their potential uses.

(8) Soybean flakes freed from oil and ready to make into a plastic material by the use of chemicals, pressure, and heat. (9) Inspecting test panels treated with soybean-oil varnish and exposed to the weather on a 45º rack. Address: Administrator of Agricultural Research.


• Summary: “In 1882 a soybean later designated as Mammoth Yellow was introduced into the northeastern section of North Carolina. This variety proved to be well adapted to the Tidewater area of North Carolina and Virginia and the soybean gained a foothold in America. Soybean production in that area was for the purpose of forage production or for seed to be sold in other areas.

“Many of these seeds were planted in more northern states where the variety would not mature. Consequently, it could be used for forage purposes only and growers had to come back to North Carolina for seed stocks each year. This market was lost when earlier maturing varieties were introduced into the Cornbelt. However, in 1915, 200,000 bushels of North Carolina grown beans were crushed by local cottonseed mills.

“The first statistics for the soybean crop were in 1909 when it was reported that 12,000 acres were grown in North Carolina with an average yield of 12 bushels per acre. A survey made in 1916 of 50 farms in the Tidewater area on which soybeans were grown found yields ranging from 4 to 39 bushels per acre with an average yield of about 19 bushels per acre.

“In the early years of soybean production, harvesting for seed presented a difficulty. The mule drawn one-row beater was developed for row planted beans, and under favorable
conditions saved from 50 to 75 percent of the crop. With the development of the combine harvester most of the one-row beaters have been replaced.

“Soybean production in the Carolinas is confined largely to the Coastal Plain area. Here a large part of the crop is planted in rows and is harvested for seed. The Coastal Plain can be divided into the Tidewater area immediately along the coast in which the soils are rather low lying and high in organic matter, and the upper part of the Coastal Plain which has lighter soils. The Tidewater area is not as well suited to the culture of tobacco, cotton, or peanuts as the upper part of the Coastal Plain so soybeans have occupied a much larger percentage of the cultivated acreage. In some of the Tidewater counties of North Carolina, 35 to 45 percent of the cultivated acreage is planted to soybeans. Although soybeans are usually considered better adapted to the Tidewater area, equally good yields have been obtained on the sandy soils of the Upper Coastal Plain. In the Piedmont area a large portion of the beans grown are seeded solid after small grain and cut for hay.

“In the Tidewater area soybeans are planted to occupy the land for the full season or after mid-June following Irish potatoes. When grown as a full season crop they are usually grown in rotation with corn. Farmers in this area consider that soybeans have a definite beneficial effect on the physical condition of their soils. In the more southern sections of the state and in South Carolina, soybeans are often planted after small grain is harvested. Excellent seed yields can be obtained with the late plantings but yields will decrease sharply in most years if the crop is planted after June 20.

“Relatively few varieties have gained prominence in North Carolina. The Mammoth Yellow variety which grew so well in the region produced seed relatively low in oil content, and shattered its seed quite readily upon maturity. Mammoth Yellow matured in late October. About 1907 the Tokyo and Haberlandt varieties were introduced. Neither of these varieties offered any improvement in seed holding but Haberlandt did have a higher oil content. Tokyo matures in late October and Haberlandt matures in early October. About 1936 the T.W. Wood Seed Co. of Richmond, Virginia, introduced a variety named Woods Yellow which was reported to be a selection from Mammoth Yellow. Woods Yellow holds its seed fairly well, has a rather low oil content, and produces a rank, coarse plant somewhat difficult to combine. In recent years Woods Yellow has been the most popular variety, although Tokyo and Haberlandt have been quite popular in some areas.

“CNS Popular: Another of the old varieties is Biloxi, a late, rank-growing, brown-seeded type. Biloxi has been largely interplanted with corn for soil improvement or for grazing. Several varieties, Palmetto, Missoy, Clemson, Nanking, and CNS, derived from introductions from Nanking, China, make excellent growth in the Upper Coastal Plain of South Carolina and Georgia. All of these varieties have low oil content and with the exception of CNS shatter quite badly. CNS is now grown to greater extent than any other variety in this group.

“Varieties now recommended for North Carolina are Ogden and Roanoke. Ogden, developed by the Tennessee Agricultural Experiment Station, was first grown on a field scale in North Carolina in 1944, and has been well received by soybean growers. Ogden has a medium growth type, stands very well, has a good oil content, and shatters less than Tokyo and Haberlandt. Ogden will usually hold its seed at least 2 weeks after it has reached combine maturity. It matures about October 10 to 15. During the 1946 season Ogden demonstrated that it could tolerate an excess of moisture better than some other varieties on the low lying poorly drained soils.

“In the spring of 1946, the variety Roanoke was released from the North Carolina Agricultural Experiment Station as a result of cooperative research with the U.S. Regional Soybean Laboratory. Roanoke is a late-October-maturing bean, medium tall in growth habit, holds, its seed extremely well, and has the highest oil content of any soybean adapted to the southern states. Its average oil content for the past 3 years at the Experiment Station farm near Raleigh is 21.9 percent as compared with 19 percent for Woods Yellow. Roanoke can be expected to give higher seed yields than Woods Yellow if plant nutrient requirements are adequately supplied. Since Roanoke is a taller growing variety than Ogden it has a greater tendency to lodge, especially on heavier soils. However, the added height is usually an advantage in the Upper Coastal Plain. Roanoke is also well adapted to the Coastal Plain of South Carolina.

“A rather extensive breeding program was initiated in 1942 to develop better adapted varieties. This program was expanded in 1943 in cooperation with the U.S. Regional Soybean Laboratory. In addition to high yielding ability, improvement in seed holding, lodging resistance, chemical composition, seed quality, and disease resistance are considered highly important. During the past season (1946) approximately 25,000 F2 plants and over 4,000 single plant progeny rows were grown for selection purposes. Approximately 500 new strains, mostly selections from crosses, were grown in replicated yield trials at several different locations. Some of these strains give promise of improvement over existing varieties.

“There is little hope for raising the low average yield for North Carolina to any appreciable extent by breeding alone. The production of a profitable yield of soybeans demands an adequate supply of plant nutrients and the success of soybeans in the Southeast will depend upon satisfying the nutrient demands. Unfortunately the soybean early gained the reputation of getting along without any fertilizer. In addition to being grown without the addition of any fertilizer, soybeans are also quite often grown in rotation with crops receiving only light applications of fertilizer.
“When one drives through the Coastal Plain area in mid-summer potash deficiency as shown by foliar symptoms is readily apparent and widespread. However, numerous experiments during the past few years have demonstrated that yield responses can be expected from potash applications even when plants appear to be making normal growth and show no foliar symptoms. Not so conspicuous but equally widespread is the need for limestone. Many of the soils of the Tidewater area have a pH value of 5 or below. These soils give excellent responses to applications of dolomitic limestone. However, liming in excess of pH 6.0 will cause manganese deficiency on some soils. Most of the Coastal Plain soils are better supplied with phosphate than with limestone or potash, but phosphate is equally necessary in producing satisfactory seed yields.

“The present fertilizer recommendations for soybeans in North Carolina are as follows:

“(1) Lime in accordance with needs as determined by soil analysis and
“(2) Apply 400 pounds of 0-10-20 fertilizer per acre, unless beans are grown in rotation with a heavily fertilized truck crop.

“A 40-bushel crop of beans removes approximately 30 pounds of P 05 [phosphoric anhydride / phosphoric acid] and 60 pounds of K 0 [potassium oxide] from the soil. Results during the past few years indicate that 30 to 40 bushels of beans per acre can be safely expected with the use of an adapted variety and a complete fertilization program.”


• Summary: (Continued): “On Coastal Plain Area: During 1946 nine variety-fertility experiments were carried to completion in the Coastal Plain area of North Carolina. These tests included the varieties Ogden, Roanoke, and the local variety; each variety was grown on limed and unlimed soil, with and without 400 pounds of 0-10-20 fertilizer. The average yield for the Ogden variety in these nine experiments was as follows: no treatment 22 bushels; lime alone, 24.8 bushels; 400 pounds 0-10-20, 27.2 bushels; lime plus 400 pounds 0-10-20 fertilizer, 34.4 bushels.

“A good illustration of the need of a balanced fertility program are the results obtained in one of these experiments on the O.P. Wells farm in Duplin County on a Dunbar fine sandy loam. The Ogden variety produced 22.5 bushels with no treatment, 22.4 bushels with fertilizer, 32.8 bushels with lime alone and 37.7 bushels with lime and fertilizer. If this farmer had used only fertilizer with no lime he could easily have supported the long standing idea that fertilization of soybeans did not pay. His soil had a pH of 5.2 and 1 ton of dolomitic limestone was applied.

“In another experiment on a Norfolk loamy fine sand very low in potash and having a pH of 5.8 the following yields were produced: no treatment, 5.0 bushels; lime alone, 2.6 bushels; 400 pounds 0-10-20, 22.1 bushels; lime plus 400 pounds 0-10-20, 31.9 bushels (see Fig. 1).

“Returns from Fertilizers: Some will concede that fertilization might pay where yields are extremely low. However, in an experiment on an Elkton silt loam in Pasquotank County a yield of 42 bushels was obtained with no treatment and 48 bushels with application of 400 pounds 0-10-20—a return of $16.50 for a $7.00 investment. In several instances yields of approximately 30 bushels have been obtained with no treatment and increases of at least 10 bushels obtained following treatment. While excellent yield responses have been obtained following applications of lime and an 0-10-20 fertilizer, there still may be other factors limiting yield in some instances such as the physical condition of the soil or minor elements. Either excesses or deficiencies of rainfall may seriously curtail yields but fluctuations due to weather are minimized with good fertilizer practices.

“Along with an adapted variety and sound fertilizer practices a good stand is essential to high yields. In an experiment conducted in the Tidewater area in 1944 using the Ogden and Volstate varieties with 12, 6, 4 and 2 plants per foot, the average yields of the two varieties were 42, 37, 32 and 25 bushels respectively. At another location the same year under extremely dry conditions no yield response was obtained.

“Last year a farmer cooperator combined approximately 25 bushels per acre from his Haberlandt beans with an average stand of two plants per foot. His same seed planted in the variety-fertility experiment with an average stand of eight plants per foot at maturity produced 35 bushels per acre. In addition to usually giving an increase in yield, the more thickly planted beans get off to a faster start and materially aid in weed control. This in itself is considered sufficient justification for thicker planting. Also from the standpoint of weed control, a 36-inch row is favored over a 42-inch row as the middles are more quickly and completely shaded and weed growth is retarded. Present rate of planting recommendations are to plant 10 to 12 seed per foot. When planting in 36-inch rows approximately 1 bushel per acre will be required with either Ogden or Roanoke varieties.

“While research in varietal improvement, fertilization, diseases, and cultural practices will be continued, an active extension program under the supervision of Dr. E.R. Collins, in charge of Agronomy Extension is under way to make the 12-14 bushel state average yield a thing of the past. In 1947 each county agricultural agent in the Coastal Plain area of North Carolina had at least one demonstration putting the best production practices known into use. This demonstration
consisted of 1 acre limed in accordance with need at least 2 months before planting and fertilized with 400 pounds 0-10-20 fertilizer. Care was taken that the fertilizer was not in direct contact with seed. Good quality Ogden or Roanoke seed were planted at the rate of 10 to 12 beans per foot in 36-inch or 42-inch rows. Beans were planted in a well prepared seed bed between May 1 and 20th and cultivated to control weeds. One-half acre of beans were planted on either side of the demonstration acre and handled according to the farmer’s usual practices. Harvesting of these beans will help many farmers to realize that they too can produce a good yield of soybeans.

“With the gradual decline in cotton acreage and improvement in corn fertilization practices, additional acres will probably be released for the production of other crops. Soybeans can readily fit onto this land and will produce profitable yields when adequately fertilized. Numerous cotton seed mills (hydraulic press type) each year process the present soybean crop and are interested in increased production. The expanding livestock industry gives promise of an expanding local market for protein feeds.”

Photos show: (1) Response to potash fertilizer in a field of Ogden soybeans having a Norfolk loamy fine sand very low in potash. (2) A field showing soybeans planted in beds for drainage purposes on a low lying soil in the Tidewater area. Roanoke variety, seed yield 41 bu per acre. (3) Woods Yellow variety left, Roanoke right, showing rapid early growth characteristic for Roanoke. Soybean variety-fertility experiment in Duplin Co. Seed yield of Woods Yellow 29.7 bu per acre, Roanoke 36.4 bu per acre. Address: 1. Associate Agronomist, U.S. Regional Soybean Lab., Bureau of Plant Industry, Soils & Agricultural Engineering, Agricultural Research Administration, USDA; 2. North Carolina Agric. Exp. Station.

• Summary: “Dr. Leonard F. Williams, now associate agronomist at the U.S. Regional Soybean Laboratory, Urbana, Illinois, has been with this 24-statewide organization of the U.S. Department of Agriculture for 11 years. The states cooperating with the U.S. Department of Agriculture on this research know him as the scientific contact man on genetics studies of this crop. He supervises breeding work and distributes promising material to the cooperators.

“The breeding program he developed in the North Central States has resulted in several new varieties of soybeans superior in yield, in oil content, and in quality of oil or ‘iodine number’ to the varieties that had been commonly grown.

“Outstanding varieties bred by Dr. Williams, in cooperation with Dr. C.W. Woodworth of the Illinois Agricultural Experiment Station, are Chief and Lincoln. The Lincoln, named only 4 years ago, stands head and shoulders above the other varieties in the North Central States, with possible exception of the new Hawkeye. It not only outyielded the former best varieties of the region by 5 or 6 bushels to the acre, but was ahead of them in percentage and quality of oil.

“Of the crosses made in recent years by Dr. Williams thousands of selections are now under test throughout the 24 states cooperating with the Urbana Laboratory. Many of these strains are promising as industrial types for various sections.

“Men like Williams and other research men will keep on producing still newer strains better adapted to various localities and yielding more and better oil for, perhaps, more and more purposes.”

A portrait photo shows Dr. Leonard F. Williams.

Address: Iowa.

• Summary: “Several new varieties of soybeans have been developed that strengthened the position of soybeans, as an oil crop for industrial use in the South. The new kinds are of wide adaptation, and the southern farmer now has a much better opportunity to select a high-yielding variety suited in his own cropping practices.

“And, looking to the future, breeding programs are
going forward all over the South. Large numbers of new strains and hybrid lines are being tested, or are under observation at many of the southern experiment stations. Crosses have been made and promising early strains having a high oil content are being selected from crosses between high-yielding, high-oil northern varieties and adapted southern varieties. Several non-shattering hybrid lines that appear to have good yielding ability are under test. Lines resistant to bacterial pustule have been selected from crosses with CNS and other southern varieties. Crosses between high-yielding grain types are expected to bring us productive strains better adapted to the lower Coastal Plain section of the Southeast.

“It is not unreasonable to expect that from all this material many new strains will soon be developed, fully capable of meeting the needs of the southern farmer for an oil bean and of overcoming several circumstances that have been handicaps to growing soybeans there: The lack of adapted varieties, the conflict with cotton for labor during the harvest season, and adverse climatic conditions during the late fall and winter.

“Two areas produce more than 90 percent of the soybeans grown in the South for industrial use: The Coastal Plain soils of North Carolina and Virginia and the Mississippi Delta sections of Arkansas, Tennessee, Mississippi, and Louisiana. Only 17.5 percent of the total soybean acreage in the South was harvested for beans during the 10-year period, 1934 to 1943. The average yield then was 11.1 bushels an acre. In 1945, after several better kinds became available, 27.6 percent of the total acreage was harvested for beans, and the average yield, 13.8 bushels an acre, was 24 percent above that from 1934 to 1943.

“To meet the demand for more oil during the war and to encourage an expansion of soybean plantings in the South by developing varieties adapted to the section so it, too, could help fill the need, the facilities of the United States Regional Soybean Laboratory at Urbana, Illinois, were expanded in 1942 to include 12 Southern States in a cooperative soybean improvement program. Southern headquarters for the region were located at the Delta Branch Experiment Station at Stoneville, Mississippi.

“To achieve the chief aim of the program—the development of adapted higher-yielding sorts for industrial uses—varieties must be developed that not only yield more, but resist shattering, lodging, and diseases, and have a content of oil and protein most desirable for industrial uses. Such new varieties, besides, must fit into the varied rotations and cropping practices characteristic of the different sections of the South. Cotton farmers of the Delta section of Arkansas, Mississippi, and northern Louisiana want a high-yielding variety that will mature in August or early September so they can better use their labor supply. Others want a kind that will mature in September or early October, so that winter grains or alfalfa may be planted after the soybeans are combined. Possibly a somewhat different type is needed in the East and Southeast, where soybeans are often planted after oats or, as in southern Alabama, after early potatoes. The farmers of Oklahoma and Texas want a productive, drought-resistant variety that will develop and mature seed during dry summers. All these factors had to be considered.

“The principal varieties that were being grown for beans when the southern soybean program was initiated were Arksoy, Arksoy 2913, Ralsoy, Mamredo, and Macoupin in the central and upper South; Wood’s Yellow, Herman, and Tokyo, in the East; and Palmetto, Mamloxi, Clemson, and Nanking in the South and Southeast. Two new strains, Ogden and Volstate, had been developed and released by the Tennessee Agricultural Experiment Station, but had not been grown to any extent over the South at that time.

“Breeding and selection work to develop better adapted varieties are under way at most of the southern experiment stations in the cooperative program. New strains are entered in the uniform tests across the region as rapidly as they are developed. The varieties are grouped by maturity, in conformity with the system established by the Regional Soybean Laboratory in 1938. The varieties and strains of the Uniform Tests, groups 0 to IV, are adapted to the Northern States. The southern varieties are entered in the progressively later maturing groups of VI, VII, and VIII. Through the mid-South, the strains of group VI normally mature from October 1 through October 15, those of group VII, October 16 to 30, and group VIII, November 1 and later. The maturity of these groups is a few days later across the upper South and earlier in the lower South. Varieties of late September maturity, group V, have not yet been developed. Because of the interest in very early maturing beans, the varieties and strains of group IV are being grown at a number of locations across the upper South. Cooperators in the region carefully note yields, with other agronomic and morphologic data. Seed samples from the tests are sent to the Urbana laboratory for chemical analyses. All data on new varieties are taken from the regional variety tests. Because the varieties in the tests were regrouped in 1944, only 2-year averages are given.

“The new, early-maturing strain, S100, has consistently yielded above the commercial varieties of this maturity. It is a rogue out of Illini, and was developed under the direction of B.M. King, agronomist of the Missouri Agricultural Experiment Station. The seeds are yellow and medium in size. S100 is tall-growing, with gray pubescence and white flowers. The principal objection to it is its low content of oil. It yields well and is well adapted along the northern rim of the southern region, but excellent yields of good quality beans have been obtained from it as far south as Stoneville.

“Ogden is the most productive soybean of midseason maturity for the South. It was developed from a selection from the cross, Tokyo x P.I. 54610, by the late H.P. Ogden, associate agronomist of the Tennessee Agricultural
Roanoke were increased in 1945. Approximately 500 bushels of Roanoke were available for increase in 1946. Their excellent showing the first year in the tests and in other tests in North Carolina left little doubt as to its superior yield and high quality of yellow seed. Continued. Address: Agronomist, U.S. Regional Soybean Lab., Stoneville, Mississippi, in the Bureau of Plant Industry, Soils and Agricultural Engineering.


• Summary: (Continued): “Roanoke was selected as a single plant from a mixed seed lot in the fall of 1941. The strain was developed under the direction of J.A. Rigney, associate agronomist of the North Carolina Agricultural Experiment Station, in cooperation with E.E. Hartwig of the Department. It was entered in the Regional Variety Test, group VII, in 1944. Its excellent showing the first year in the tests and in other tests in North Carolina left little doubt as to its superiority. It resembles Volstate in appearance, with gray pubescence, and yellow seed of medium size. Roanoke is higher in oil and has yielded slightly more than Volstate. Both varieties are superior to Wood’s Yellow in yield, resistance to shattering, and content of oil. Seed stocks of Roanoke were increased in 1945. Approximately 500 bushels of certified seed were available for further increase in 1946.

“Volstate and Roanoke are adapted to an area that includes the lower half of Arkansas and the upper third of Louisiana, extending eastward through the mid-South, the Piedmont, and Coastal Plain areas of North Carolina; neither is adapted to the lower South and Southeast.

“A third promising variety, CNS, is like Roanoke and Volstate in maturity. CNS was selected out of the Clemson variety by J.E. Wannamaker of St. Matthews, South Carolina. Plants of CNS are of medium height, with tawny pubescence and purple flowers. The yellow, medium-size seeds number approximately 3,400 to the pound, compared to Palmetto’s 3,700 seeds to a pound. The oil content of CNS is low, but it is higher than that of Palmetto. CNS is well adapted to the Coastal Plain soils of South Carolina, Georgia, and Alabama and is resistant to bacterial pustule, a serious leaf disease. Breeders have used CNS in crosses to get resistant varieties adapted to other regions.

“The new late-maturing varieties, Pelican, Acadian, and L.Z., appear to be promising for the lower South. All three were selected from crosses made by John P. Gray, associate agronomist of the Louisiana Agricultural Experiment Station. Their seed is yellow, with dark-brown or black hilums, and medium small to small in size. Acadian has 3,520 seeds to the pound, L.Z. 3,890, and Pelican 3,950. The oil content of each is much higher than Wood’s Yellow and Mamloxi. All 3 are tall-growing types, but, unlike very little in the lower Coastal Plain area. They hold their seed well and shatter much less than established varieties. Pelican, Acadian, and L.Z. have been tested for 3 years in the Uniform Variety Test, group VIII. They have yielded equally well through the southern half of the region, but are particularly well adapted in southern Louisiana and to the Coastal Plain soils in southern Alabama and Georgia.”


Tables: (1) Comparison of the agronomic properties of S100, Gibson, Patoka, Macoupin, Boone, two-year average, 1944-45.

(2) Comparison of the agronomic properties of Ogden, Arksoy 2913, Mamredo, Ralsoy, two-year average, 1944-45.


• Summary: “In fifteen crosses between the domestic...
soybean (Glycine hispida (Moench) Maxim) and the wild soybean (Glycine ussuriensis Regel and Maack), seed size was found to be geometric in inheritance. Neither the large size of the domestic parent nor the small size of the wild parent was recovered in over 4000 F2 plants nor in the first backcross generation...” Address: U.S. Regional Soybean Lab., Urbana, Illinois.


“Introduction: “... Nine uniform test groups have been established, the first five of which include strains of proper maturity for the North Central States. The other four groups contain strains adapted to the southern part of the United States, and a summary of performance of these will be found in Part II of this report, which is published separately.

“Uniform Test, Group 0, contains the strains that will bloom and mature under the longer days encountered during summer in the Dakotas, Minnesota, and northern Wisconsin. Group I contains strains generally adapted to South Dakota, the southern parts of Minnesota, Wisconsin, and Michigan, and northern Ohio. Groups II, III, and IV, respectively, include strains adapted to locations farther south in the North Central States and to other areas of similar latitude. In general, each group is arranged to include strains differing in maturity by not over 10 to 15 days. Maturity of the strains is expressed as so many days earlier or later than some well-known check or reference variety in the group.”

“Cooperating Agencies and Personnel from the North Central Region:


“Illinois Agricultural Experiment Station, Agronomy Department: W.L. Burlison and C.M. Woodworth.

“Iowa Agricultural Experiment Station, Farm Crops Department: I.J. Johnson, M.G. Weiss.

“Kansas Agricultural Experiment Station, Agronomy Department: J.W. Zahley.

“Michigan Agricultural Experiment Station, Agronomy Department: L.V. Nelson.

“Minnesota Agricultural Experiment Station, Agronomy Department: J.W. Lamberti.

“Missouri Agricultural Experiment Station, Field Crops Department: W.C. Etheridge.

“Nebraska Agricultural Experiment Station, Agronomy Department: F.D. Keim.

“North Dakota Agricultural Experiment Station, Agronomy Department: T.E. Stoa.

“Ohio Agricultural Experiment Station, Agronomy Department: J.L. Haynes, L.E. Thatcher.

“Purdue Agricultural Experiment Station, Agronomy Department: G.H. Cutler, H.H. Kramer.

“South Dakota Agricultural Experiment Station, Agronomy Department: M.W. Adams.


• Summary: “The Fourth Work Planning Conference of the North Central States technical collaborators of the U.S. Regional Soybean Laboratory was held in Urbana, Illinois, on March 1-3, 1948, to review the accomplishments of the cooperative research conducted during the past season and to plan future investigations. Four new soybean strains were considered for release, and a permanent soybean crop committee was appointed by the conference to draw up recommendations for handling the increase and release of new strains.

“Monday, March 1–J.L. Cartter, Chairman

“The planning conference was called to order at 1215 p.m. in the Faculty Lounge, Illini Union Building, at the University of Illinois. The following were in attendance:

“Aamodt, O.S., Head Agronomist, Forage Crops & Diseases, U.S.D.A., Beltsville, Maryland

“Bray, R.H., Agronomist, Illinois Agricultural Experiment Station, Urbana, Illinois

“Burlison, W.L., Agronomist, Illinois Agricultural Experiment Station, Urbana, Illinois


“Cartter, J.L., Agronomist, U.S. Regional Soybean
Laboratory, Urbana, Illinois


“Collins, F.I., Chemist, U.S. Regional Soybean Laboratory, Urbana, Illinois

“Cutler, G.H.; Agronomist, Purdue Agr. Experiment Station, Lafayette, Indiana

“DeTurk, E.E., Agronomist, Illinois Agricultural Experiment Station, Urbana, Illinois

“Feaster, C.V., Agronomist, U.S. Regional Soybean Laboratory, Columbia, Missouri

“Frank, F.A., Agronomist, Purdue Agricultural Experiment Station, Lafayette, Indiana

“Fuelleman, R.F., Agronomist, Illinois Agr. Experiment Station, Urbana; Illinois

“Hackleman, J.C., Agronomist, Illinois Agr. Experiment Station, Urbana; Illinois

“Hartwig, E.E., Agronomist, U.S. Regional Soybean Laboratory, Raleigh, North Carolina

“Henson, P.R., Agronomist, U.S. Regional Soybean Laboratory, Stoneville, Mississippi

“Heusinkveld, D., Agronomist, U.S. Regional Soybean Laboratory, Urbana, Illinois

Holman, L.E., Agricultural Engineer, U.S.D.A., Urbana, Illinois

“Hoover, M.M., Director, Plant Introduction Station, Ames, Iowa

“Johnson, I.J., Agronomist, Iowa Agricultural Experiment Station, Ames, Iowa

“Keim, F.D., Agronomist, Nebraska Agricultural Experiment Station, Lincoln; Nebraska

“Koehler, B., Pathologist, Illinois Agricultural Experiment Station, Urbana, Illinois

“Kramer, H.H., Agronomist, Purdue Agr. Experiment Station, Lafayette, Ind.

“Krober, O.A., Chemist, U.S. Regional Soybean Laboratory, Urbana, Illinois

“Lang, A.L., Agronomist, Illinois Agricultural Experiment Station; Urbana, Illinois

“McAlister, D.F., Physiologist, U.S. Regional Soybean Laboratory, Urbana, Illinois


“Milner, R.T., Chemist, Northern Regional Research Laboratory, Peoria, Illinois Morse, W.J., Agronomist, Forage Crops & Diseases, U.S.D.A., Beltsville, Maryland

“Pitner, J.B.; Agronomist; Rockefeller Research Institution, Mexico City, Mexico

“Probst, A.H., Agronomist, U.S. Regional Soybean Laboratory, Lafayette, Indiana

“Saboe, L.C., Agronomist, U.S. Regional Soybean Laboratory, Columbus, Ohio

“Stoa, T.E., Agronomist, North Dakota Agr. Experiment Station, Fargo, North Dakota

“Torrie, J.H., Agronomist, Wisconsin Agricultural Experiment Station, Madison, Wisconsin


“Volk, N.J., Associate Director, Purdue Agr. Experiment Station, Lafayette, Indiana

“Weber, C.R.; Agronomist; U.S. Regional Soybean Laboratory, Ames, Iowa

“Weiss, M.G., Agronomist, Iowa Agricultural Experiment Station; Ames, Iowa

“Williams, L.F., Agronomist, U.S. Regional Soybean Laboratory, Urbana, Illinois


“Zahnley, J.W., Agronomist, Kansas Agr. Experiment Station, Manhattan, Kansas

“The first speaker of the afternoon was Dr. W.E. Carroll, Associate Director of the Illinois Agricultural Experiment Station, who welcomed the collaborators on behalf of the Experiment Station. Dr. Carroll was asked by the Chairman of the North Central Directors’ Conference to attend the Soybean Laboratory meetings and to bring a report of accomplishments to the next Directors’ meeting. Dr. Carroll in his talk emphasized the importance of both informal and formal cooperation among agricultural workers. He stressed the increase in the cooperative approach to many problems within the North Central States, especially since the Production and Marketing Administration has been organized. The Directors have had much informal cooperation under way before this time, particularly in the field of livestock marketing and studies on land tenure.

“Reports of Research

“The first afternoon of the conference was devoted to the presentation of reports on soybean research at each station by collaborators.

“Illinois report by W.L. Burlison–The Illinois Agricultural Experiment Station has many soybean research projects, among them one on price studies and one on the cost of growing and combine harvesting the crop. The Animal Science Department has projects on protein supplements for growing and fattening pigs, the nutritive value of protein feeds and animal products, changes in nutritive value of feeds due to storage, effect of soybean meal in poultry rations, and methionine supplementation in swine rations. The Home Economics Department has projects on soybeans as human food and on the value of the protein of soybeans in the dietaries of adult human subjects. The Agricultural Engineering Department is studying methods of harvesting, storing, and artificially drying soybeans. The Entomology Department is studying the biology and control of grape colsalis on soybeans and the control of insects affecting soybeans in storage.

“The Agronomy Department has a number of projects on soybeans, one being on genetics. In the season of 1947,
studies on soybean hybrids, originally made by Gordon E. Geeseman in 1945, were continued. Ten varieties were crossed in all possible ways, making 45 different crosses in all. The varieties were Chief, Dunfield, Illini, Mukden, Earlyana, Richland, T117, Hawkeye, Lincoln, and Patoka. F1 plants were grown and compared with the parents in 1946. Analysis of the data has not been completed. Summary tables have been made for number of branches per plant, yield of seed per plant, and weight of 100 seeds. In number of branches per plant, the hybrids were very nearly the same as the parents, but in yield of seed, considerable...”

Page 12: In 1946 and 1947 a little more than 900,000 acres in Ohio were devoted to soybean production for seed. A large percentage of this acreage is in the northwestern one-fourth of the state.

“South Dakota report by W.W. Adams–During the last season, the Group 0, Group I, and Group II Uniform nurseries were grown, spanning the state’s soybean growing area from extreme north to south. Several standard varieties were also included with these uniform tests.

“At the main station, a rate of seed experiment and a row width trial were established but were not harvested because of the extensive hail damage occurring the last of June.

“The work in 1947 indicated the superiority of the varieties Capital and Hawkeye for certain areas of the state and reaffirmed the position of Ottawa Mandarin as a good variety for the east-central section. Interest has been directed toward a few other entries in the variety tests having possible value for one or more areas of eastern South Dakota.

“In 1948 a variety test for hay will be conducted in addition to the uniform nurseries and other agronomic trials for seed.

“Wisconsin report by J.H. Torrie–The soybean research program of the Department of Agronomy, University of Wisconsin, is conducted in cooperation with the U.S. Regional Soybean Laboratory, Urbana, Illinois. The program is primarily concerned with the breeding of new varieties adapted for Wisconsin conditions and the evaluation of new strains developed in Wisconsin and by other stations. The program for the southern and central portions of Wisconsin is centered at Madison, whereas that for the northern portion is under the supervision of Messrs. A.M. Strommen and C. Rydberg at the Branch Experiment Station, Spooner, Wisconsin.

“At Madison experiments are under way to determine the effect of different dates of planting and methods of planting (broadcast and different row widths) on the yield and other agronomic characters of several soybean varieties. Studies are also under way to determine any change that may occur in yield and other characters of successive generations of several bulked soybean crosses. The inheritance of downy mildew reaction is under investigation.

“Soybean genetic work at the Laboratory headquarters by L.F. Williams–Several experiments in breeding are under way at Urbana. In one experiment the backcross method of breeding is being compared with the straight cross. In one test the cross Lincoln x Richland and the backcross Lincoln x Lincoln x Richland are being compared, and in another the cross Lincoln x Ogden and the backcross Lincoln x Lincoln x Ogden.

“An attempt to combine the high iodine number of the wild soybean with the desirable agronomic characteristics of the commercial type has failed. The cross Patoka x Wild has been crossed and backcrossed to Lincoln, selecting only for erect habit and freedom from shattering. An analysis of 270 lines from this material indicates no lines much higher than Lincoln in iodine number and many lines similar to Lincoln in oil content. Many resemble Lincoln in appearance and yield. However, some of these lines do have a higher protein content than the common commercial varieties” (Continued).


• Summary: (Continued): Page 13: “Breeding work has been initiated to transfer the resistance to pustule of the C.N.S. variety to the Lincoln variety. The C.N.S. variety is low in oil, very susceptible to bacterial blight and lodging, and very late for this latitude. Selections in the BC1S2 generation, grown in 1947, had resistance to pustule, together with satisfactory lodging and maturity. Their oil content and yield performance will be tested later.

“A study of the effects of natural selection on a mixed population has been under way for five years. A mixture of seven varieties has been grown at each of six locations, the seed from each location being returned to the same location each year. Preliminary results indicate that Scioto has almost disappeared from the mixture at most locations, while Patoka and Dunfield have increased at certain locations and decreased at others.

“An experiment has just been concluded studying the effects of gaps in the row on the yield of the affected row and the adjacent row. This experiment has been conducted for three years, using the Lincoln and Hawkeye varieties in 36- and 24-inch row widths, with gaps of 12, 18, 24, 30, and 40 inches in a rod row. There were no significant effects of gaps on the adjacent rows in any combination of varieties and row spacings. There were no significant differences at the 36-inch spacing between the check and the rows with 12-, 18-, 24-, and 30-inch gaps. Rows having 40-inch gaps averaged about 1.5 bushels per acre less than the check. In the 24-inch spacings, On the other hand, a gap of 24 inches lowered the yield 2.1 bushels; a 30-inch gap, 3.2 bushels; and a 40-inch..."
from the standpoint of the efficiency of soybean varieties in the use and/or absorption of potassium and phosphorus. Preliminary cultures under controlled conditions have indicated that soybean varieties differ in their capacity to make vegetative growth when these two elements are held at a very low concentration. To furnish basic information for use in the mineral nutrition study, a series was made of the mobility of food reserves in Lincoln and Earlyana cotyledons and the influence of these reserves on the development of the plant. At emergence, one-third of the phosphorus, two-thirds of the potassium, nearly all of the available magnesium, one-third of the protein, one-half of the fats and oils, and nearly all of the total sugars had been transferred from the cotyledons to the seedlings. Removal of the cotyledons at emergence or two days later resulted in a decreased plant size throughout the plant growing season with both varieties. Subsequent dates of cotyledon removal (up to 38 days after planting) gave at most only a temporary setback to the plants. No significant differences in seed yield were apparent between any of the treatments.

“Satisfactory control of red spiders on soybeans grown under greenhouse conditions has been obtained by using as a spray 70 percent hexaethyltetraphosphate (trade name “Blot”) at a dilution of 1 part of the insecticide to 1200 parts of distilled water. A miscible concentrate of DDT (trade name “Cert-O-Kill”) used as a spray in a concentration of 1 part of the insecticide to 400 parts of distilled water has proved effective in the control of white fly on soybeans. A soil composed of 1 part of field soil, 1 part pit sand, and 1 part granulated peat moss (by volume) [page 14] plus 100 cc. of a 4-8-4, powdered, commercial fertilizer to each 5 gallons of this mixture has produced satisfactory growth of soybeans in the greenhouse. Number 10 cans with drain holes punched in the bottom and filled with the above mixture have been large enough to grow single soybean plants to maturity. Fluorescent lamps, mounted vertically, have proved to be suitable as a source of supplementary light for soybeans. The chief advantages of these lamps are the uniform illumination of the whole plant and the relatively small amount of heat given off.

“Tests have been conducted on storage and germination in vitro of Lincoln, Ogden, and Patoka pollen. Germination values of as high as 75 percent have been obtained using a medium composed of 2 percent agar and 20 percent sucrose. Pollen of Ogden was germinated on this medium after storage for 22 days at 0°C and about 50 percent relative humidity.

“Analytical-Chemical work at the Laboratory headquarters by F.I. Collins and O.A. Krober–A means of readily separating high and low oil lines in a bulk population from a soybean cross would open up a new field in the breeding for improvement in oil content. The density of soybean oil is 0.90 to 0.93 grams per cc. and the density of soybean seed is 1.14 to 1.28. Recent work by the Laboratory on the density and chemical composition of single seed has indicated that seed separation on the basis of specific gravity may offer promise. In general, seeds with the lower densities have the higher percentage of oil. A method has been developed for separating a sample into high and low oil portions by specific gravity without damage to viability. The method has shown promise on the basis of one year’s trial and will be tested more extensively during the coming season.

“Cooperative research on the effect of storage on the chemical composition of soybean seed has been conducted over a period of three seasons. The conclusion from this study is that oil and protein content of soybean seed does not change appreciably during the first year under ordinary commercial storage.

“Other problems receiving attention are: (1) Effect of moisture content of soybeans and rate of predrying on chemical analyses of soybeans. (2) Varietal and environmental conditions that may cause differences in the amount of gums and mucilagenous material that is extracted from soybean meal by Skelly F. [hydrocarbon solvent].

“The Laboratory has started research on developing suitable methods for the determination of essential amino acids in soybean protein. This preliminary work is on the hydrolysis or breaking down of the protein into its amino acids, an essential step in amino acid analysis. A study is also being made of the digestion process in the protein determination with a view to increasing speed of reaction and preventing loss by voltilization.

“In addition, cooperative work is being carried on with the plant physiology section in greenhouse studies of plant metabolism, and between 5000 and 5500 samples have been analyzed in connection with the plant breeding work” (Continued). Address: Secretary of Conference, Agronomist, Forage Crops & Diseases, U.S.D.A., Beltsville, Maryland.


• Summary: (Continued): Page 15: “Soybean Disease Research by D.W. Chamberlain–The ever-changing aspect of the disease picture in economic plants has interested and plagued pathologists for many years. New diseases
have appeared without previous warning, minor ones have attained major importance, and major diseases of long standing have varied in relative prevalence and intensity from year to year. Although the soybean is a comparative newcomer in the field of important crop plants, a review of the last decade gives ample evidence that the disease situation of this species parallels that of other crops.

“For example, bud blight (virus) and brown stem rot (Cephalosporium sp.), two of our most serious soybean diseases in the Midwest, were unknown ten years ago. Both attained widespread distribution in the Midwest within two years after they were first reported in the field. In 1943 Septoria brown spot was found in only trace amounts in Illinois; in 1947 it was one of our two most common leaf spots. The two bacterial leaf spots illustrate the variation in prevalence of long-established diseases. In 1943 and 1944 bacterial pustule (Xanthomonas phaseoli var. sojensis) was the most common disease of soybean in Illinois and throughout the Midwest, while bacterial blight (Pseudomonas glycinea) was of minor importance; in 1947 pustule was rare and bacterial blight was the most prevalent disease. A few years ago wildfire was distributed throughout the northern and southern soybean-producing regions. In 1947 it was confined almost entirely to the southern states. The cool, wet spring weather of the past few seasons in the Midwest may explain the advance of bacterial blight, but there is no satisfactory explanation for the recession of bacterial pustule and wildfire.

“Two diseases that appeared in unusual amounts in Illinois in 1947 were Rhizoctonia root and basal stem rot and Alternaria leaf spot. The former occurred early in the season when cool, wet weather prevailed, killing young plants in scattered spots one to several feet in diameter. Stands in certain fields were reduced an estimated 2 to 3 percent, but in most cases the loss was negligible. Alternaria leaf spot appeared in July and increased steadily through August. This is not considered a serious disease as it usually appears in seasons of considerable drought. Alternaria does not seem to be an aggressive parasite on vigorously growing soybeans.

“Since breeding for disease resistance is usually the most practical and effective method of controlling disease losses, a search for resistant material was begun in 1947. All available soybean introductions and varieties were grown at Urbana, Illinois, and inoculated with the bacterial blight organism (Pseudomonas glycinea). About 50 introductions showed marked resistance, and from this group three of the best were selected and retested in the greenhouse. They have shown a high type of resistance that makes them a promising source of germ plasm for the plant breeders. Two additional nurseries, including about 1200 introductions and varieties, were grown in a test for resistance to bud blight and brown stem rot. Since there is no known method of creating epiphytotics of these two diseases artificially, the nurseries were located at Weldon, Illinois, on a field that has consistently produced uniform brown stem rot infection, and at Oblong, Illinois, where severe bud blight has developed naturally for several years. About 200 introductions at Oblong showed no trace of bud blight. However, bud blight infection in 1947 was not uniformly heavy and those introductions must be retested repeatedly until true resistance can be differentiated from escapes. At Weldon all of the material was...”

Page 25: “Wednesday morning, March 3
“The report of the committees on uniform nursery tests and preliminary tests for 1948 by L.F. Williams–The uniform nursery tests and preliminary tests for the 1948 season were outlined as follows:

“Strain–Origin

Group 0

1. Capital–Selection from Strain 171 x A.K. (Harrow)

2. Flambeau–Sel. from Manchu

3. Goldsoy–Sel. from O.A.C. 211

4. Kabott–Sel. from Intr. from Ninguta, Manchuria

5. Mandarin (Ottawa)–Sel. from Mandarin

6. Montreal Manchu–Sel. from Manchu

7. 0-255–Sel. from Strain 171 x A.R. (Harrow)

8. W4-610–Sel. from Richland x Kabott

9. W4-631–Sel. from Richland x Kabott

10. W55-4142–Sel. from Kabott x Goldsoy

11. W55-4143–Sel. from Mukden x Pagoda

12. W6S-339–Sel. from Cayuga x Kabott

Preliminary Group 0 [from here on we will omit the Origin]

1. Capital

2. Flambeau

3. Mandarin (Ottawa)

4. M8

5. M9

6. M11

7. M305-2

8. 0-10

9. W5-2070

10. W5-2260

11. W6S-326

12. MS-338

13. A6S-341

14. W6S-441

15. W6S-457

Group I

1. Earlyana

2. Habaro

3. Mandarin (Ottawa)

4. Wisconsin Manchu 3

5. A3K-884

6. A6K-937

7. H5S

8. H2804

9. H6403

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“10. M1
“11. M4
“12. W5-2175
“13. W5-2307
“14. W5-3638
“Preliminary Group I
“1. Mandarin (Ottawa)
“2. Mandarin Rogue
“3. A6K-937
“4. A6K-649
“5. A6K-0649
“6. A6K-1428
“7. A6K-1521
“8. A6K-1810
“9. Cornell 1069-4-1-1-4-2
“10. Cornell 1136-5-3-1
“11. Cornell 1175
“12. Cornell 1196
“13. L6-8091
“14. L6-8144
“15. L6-8148
“16. L6-8174
“17. L6-8179
“18. L6-8275
“19. M6
“20. M7
“21. M10
“22. W4-3190
“23. W4-4018
“24. W5-3346
“25. W5-3372
“26. W5-3633
“Group II
“1. Bavender Special
“2. Earlyana
“3. Hawkeye
“4. Korean
“5. Lincoln
“6. Richland
“7. A5-2683
“8. A6K-937
“9. C789
“10. C790
“11. C791
“12. H6150
“13. L4-8066
“14. L4-8090
“15. L6-8144
“16. L6-8182
“17. L6-8474
“18. L6-8622
“Preliminary Group III
“1. Mandarin (Ottawa)
“2. Mandarin Rogue
“3. A6K-937
“4. A6K-649
“5. A6K-1428
“6. A6K-1521
“7. A6K-1810
“8. A6K-1910
“9. Cornell 1069-4-1-1-4-2
“10. Cornell 1136-5-3-1
“11. Cornell 1175
“12. Cornell 1196
“13. L6-8091
“14. L6-8144
“15. L6-8148
“16. L6-8174
“17. L6-8179
“18. L6-8275
“19. M6
“20. M7
“21. M10
“22. W4-3190
“23. W4-4018
“24. W5-3346
“25. W5-3372
“26. W5-3633
“Group II
“1. Bavender Special
“2. Earlyana
“3. Hawkeye
“4. Korean
“5. Lincoln
“6. Richland
“7. A5-2683
“8. A6K-937
“9. C789
“10. C790
“11. C791
“12. H6150
“13. L4-8066
“14. L4-8090
“15. L6-8144
“16. L6-8182
“17. L6-8474
“18. L6-8622
“Preliminary Group III
“1. Mandarin (Ottawa)
“2. Mandarin Rogue
“3. A6K-937
“4. A6K-649
“5. A6K-1428
“6. A6K-1521
“7. A6K-1810
“8. A6K-1910
“9. Cornell 1069-4-1-1-4-2
“10. Cornell 1136-5-3-1
“11. Cornell 1175
“12. Cornell 1196
“13. L6-8091
“14. L6-8144
“15. L6-8148
“16. L6-8174
“17. L6-8179
“18. L6-8275
“19. M6
“20. M7
“21. M10
“22. W4-3190
“23. W4-4018
“24. W5-3346
“25. W5-3372
“26. W5-3633
“Group IV
“1. Chief
“2. Gibson
“3. Patoka
“4. C463
“5. C490
“6. C499
“7. C500
“8. C501
“9. C502
“10. C508
“11. C612
“12. L3-2010


• Summary: (Continued): Page 28: “Preliminary Group IV
“1. Chief
“2. Gibson
“3. C463
“4. C508
“5. S100
“6. CX6742-11

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“7. CX6742-16
“8. CX6742-20
“9. CX6742-22
“10. CX6742-34
“11. CX6842-17
“12. CX7342-27
“13. CX7342-39
“14. CX7342-42
“15. CX7342-53
“16. D56-8
“17. D523-30
“18. D523-55
“19. DSS6-4
“20. L4-6238
“21. L4-6259
“22. L4-6290
“23. L6-5002
“24. L6-5658
“25. L6-5679
“26. L6-5680
“27. L6-5683
“28. S4-241
“29. S4-307
“30. S4-374
“31. SS-41
“32. 35-234

Fundamental genetic studies of value to the breeding program–C.M. Woodworth, Chairman–The conference discussed what fundamental genetic research might be undertaken that would be of value to the next phase in the breeding program.

“The first topic discussed was breeding for increased oil content. In studying segregation for oil content in the F2, a minimum of 200 and better 500 selections should be analyzed. This would entail a tremendous number of analyses. Starting with a cross between a high x a high, a high x a low, and a low x a low oil strain, using two crosses for each, would require around 3000 determinations. The possibility of a quick method for oil determination was discussed, but it was pointed out that with the personnel available there is no method of sufficient promise at present to permit the handling of so many determinations. A preliminary picture of the use of specific gravity in separating segregating populations into high and low oil fractions was discussed by Mr. Collins, but it was pointed out that the method had not been sufficiently tested to predict its value. It is known that a number of environmental factors affect the specific gravity of the seed, and the influence of each of these factors must be carefully studied before the method can be reliably utilized in breeding work. Additional information on the subject will be gained during the coming season.

“Another question discussed was the magnitude of environmental effects. Spaced plants have been found to have less variation due to environment than plants that are crowded in the row, pointing to the desirability of making selections from spaced plantings. The desirability of further experimental work on the effect of environment in a selection nursery was pointed out.

“Breeding for disease resistance looks encouraging. Germ plasm resistant to bacterial pustule has been found, and crosses have been made to transfer this resistance in desirable high yielding types. Resistance in most cases is rather clear-cut, and a measure of success has been achieved in selecting pustule resistant lines. C.N.S., a southern variety, is quite resistant, and in crosses with Ralsoy it has given segregation in the F3 in a ratio of 1 resistant–2 moderately resistant–1 susceptible. Ogden is moderately resistant, and in a cross Ogden x C.N.S. very few susceptible plants were found. In no crosses involving two susceptible lines has there been resistance, and in one case a very susceptible line was found. It looks like resistance to bacterial pustule could be added very easily by means of a backcross.

“Among 1400 introductions studied in 1947, about 50 were found to be fairly resistant to bacterial blight. Further testing in the greenhouse proved three of these lines to be highly resistant to the disease, and crosses are being made to transfer this to improved agronomic types.

“All of the introductions and varieties available at the Laboratory have been tested for resistance to brown stem rot and bud blight, but in no case have any resistant lines been uncovered. In the case of these two diseases we may have to be satisfied with comparative or partial resistance.

“Soybeans strains resistant to downy mildew have been found and preliminary studies indicate a 3:1 segregation with resistance dominant, but with a modifying factor affecting the ratios. Using the moist chambers, it is easy to get infection in the first true leaf stage.

“The meeting adjourned at 12:30 p.m., March 3.
“W.J. Morse
“Secretary of Conference.”

Continues with a 9-page separately-paged list at the end titled “Soybean varietal names used to date,” compiled by W.J. Morse. Address: Secretary of Conference, Agronomist, Forage Crops & Diseases, U.S.D.A., Beltsville, Maryland.

381. Morse, W.J. comp. 1948. Soybean varietal names used to date.

• Summary: This is a 9-page separately-paged list:
  “Variety Name–Source [Unfortunately will omit the Source for all but a few]
  “Acadian–Louisiana Experiment Station 40-293
  “Acme–P.I. 14954
  “Adams–A5-2683 (A3-176)
  “Agate–P.I. 81037
  “A.K.–Manchuria 1912
  “A.K. (Harrow)–Dominion Experiment Station, Canada
  “Akasoya–Japanese variety (Indiana)
“Aksarben
“Allison Black
“American Oil King—Same as Midwest
“Amherst
“Anwei—La Choy Company (Ohio)
“Aoda
“Arikara
“Arisoy
“Arkan
“Arksoy
“Arksoy 2913
“Arlington
“Armredo
“Auburn
“Austin
“Austrian Green
“Avoyelles
“Baird
“Bakaziro
“Banner
“Bansei
“Barchet
“Bavender Special
“Bell
“Best Green
“Best White
“Biloxi
“Biltan
“Black
“Black Beauty
“Black Champion
“Black Sable
“Boone
“Bopp
“Brindle
“Brooks
“Brown
“Brown Otootan
“Brownie
“Buckeye Cross (BX)—Same as Mt. Carmel
“Buckshot
“Burnette
“Buster Brown—Same as Trenton
“Butterball
“Capital
“Cayuga
“Chame
“Chang
“Charlee
“Chernie
“Cherokee
“Chestnut

“Chief
“Chinaton Echo
“Chiquita
“Chuku
“Chusei
“Cibao
“Clay—Same as Midwest
“Claybank—Same as Midwest
“Clemson—P.I. 71659
“Cloud—P.I. 16790
“Cluster Bean—Same as Midwest
“C.N.S.—J.E. Wannamaker (South Carolina)
“Coker’s Black Beauty—Same as Oloxi
“Coker’s 31-15—Same as Pee Dee
“Columbia
“Columbian
“Creole
“Delmoshat—Delta Station selection 6679
“Delredo—Mississippi selection
“Delsoy—P.I. 85355
“Delsta—Delta Station #6677
“DeSoto—Reported by Ohio grower
“Dixie
“Dortchsoy #2—Dortch Company (Arkansas)
“Dortchsoy #6
“Dortchsoy #7
“Doxie—Georgia Experiment Station
“Duggar—P.I. 17268C
“Dunfield—P.I. 36846
“Dunland
“Dwarf Brown
“Dwarf Early Yellow
“Dwarf Green
“Earlyana
“Early—Same as Ito San
“Early Black—Same as Buckshot
“Early Brown
“Early Green—Same as Medium Green
“Early Indiana Laredo
“Early Japan
“Early Korean
“Early Laredo—Same as Norredo
“Early Mammoth Black—Same as Buckshot
“Early Mandarin—Same as Mandarin
“Early Virginia Brown—Same as Virginia
“Early White—Same as Ito San
“Early White Eyebrow—Source unknown
“Early Wilson—Same as Wilson
“Early Wilson Black—Same as Wilson
“Early Wisconsin Black—Same as Wisconsin Black
“Early Woods Yellow—[Blank]
“Early Yellow—Same as Ito San
“Easycook—P.I. 34702
“Ebony—P.I. 17254
“Eda–P.I. 17257
“Eda Mame–Ito San and Eda
“Edgecombe–R.P. Cooke, Williamsburg, Virginia
“Edna–P.I. 17252C
“Edsoy–Changed to Delsoy
“Edward–P.I. 14953
“Elton–P.I. 20406
“Emperor–P.I. 97155
“Essex–Same as Peking
“Etampes–Same as Ito San
“Etum–P.I. 86100
“Extra Early Black–Same as Buckshot
“Fairchild–P.I. 19184
“Farnham
“Feed All–A.M. Johnson (North Carolina)
“Feese’s Prolific–Same as Midwest
“Flambeau–Wisconsin selection 839-14
“Flat Black–Same as Flat King
“Flat King–P.I. 17252
“Flava–P.I. 16789A
“Foster’s Prolific
“Fungi
“Funk Delicious
“Funman
“Gala
“Galaway
“Gatan
“Gem
“George Washington
“Georgian
“German Coffee Berry
“Giant Brown
“Giant Green
“Giant Yellow
“Gibson
“Goku
“Golden
“Goldsoy–Ontario Station, Canada
“Gosha–Same as Manhattan
“Granger
“Green
“Green and Black
“Greenfield
“Green Samarow
“Guelph
“Habaro
“Haberlandt
“Hafto
“Hakote
“Hamilton
“Hankow
“Hansen
“Harbinsoy

“Harman
“Hawkeye
“Hay Boy
“Hayseed
“Herman
“Hidatsa
“Higan
“Hiro
“Hokkaido
“Hollybrook
“Hollybrook Early
“Hongkong
“Hoosier
“Hope
“Hudson Manchu
“Hurrelbrink
“Ignotum
“Illington
“Illini
“Illinois 13-19
“Illinois Champion
“Ilsoy
“Imperial
“Indiana Hollybrook
“Indiana Meadow
“Italian
“Ito Mame
“Ito San–P.I. 17268
“Jackson
“Japanese #15
“Japan Pea–Same as Ito San
“Jefferson
“Jet
“Jogun
“Johnsoy
“Kabott
“Kagon
“Kanro
“Kanum
“Kentucky A
“Kia
“Kingston
“Kingwa
“Kirin
“Kungchuling
“Kura
“Laredo
“Large Black
“Large Brown
“Large Yellow
“Late
“Late Ito Mame
“Late Yellow
“Lexington
Lincoln
“Little Wonder
“Looney #2
“Lowrie
“Loxitan
“Ludeke
“LZ
“Macoupin
“Magnolia
“Mamiloxi
“Mammoth
“Mammoth Black
“Mammoth Brown
“Mammoth Yellow
“Mamotan
“Mamredo
“Manchu
“Manchu #3
“Manchu #606
“Manchukota
“Manchuria
“Manchuria 13-177
“Mandarin
“Mandarin #507
“Mandarin (Ottawa)
“Mandell
“Mandriff
“Manhattan
“Manitoba Brown
“Mansfield
“Mansoy
“Marlow
“Matthews
“McClave
“Medium Black
“Medium Early Black
“Medium Early Brown
“Medium Early Yellow–Same as Ito San
“Medium Green–Same as Guelph
“Medium Yellow–Same as Midwest
“Mendota–Wisconsin Expt. Station selection
“Meridian
“Merid
“Merk
“Meyer
“Miami
“Michigan Green
“Midland
“Midunk
“Midwest
“Midwest Free
“Mikado
“Mingo
“Minsoya
“Minsona
“Minsoy
“Missoy
“Misstucky
“Monetta
“Mongol
“Monroe
“Montreal Manchu–T.B. Macauley (Canada)
“Morgan
“Morse–P.I. 19186
“Mount Carmel
“Mukden
“Mukden #4
“Nanda
“Nanking
“Nanksoy
“Nansemond
“Nansemond Early
“Natsu
“Nela
“Nemo
“New Bush Bean
“New London
“Nielsen
“Nigra
“Norredo–Unknown
“Norsoy (Pridesoy)
“Northern Hollybrook
“Nuttall–P.I. 17253
“O.A.C. 211–Canada Experiment Station
“Ogden
“Ogumaw
“Ohio 9035–Same as Hamilton
“Ohio Champion–Same as Midwest
“Ohio Medium Green–Same as Guelph
“Okute
“Old Dominion
“Oloxi
“Ontario
“Osaya
“Ootoman–Formosa
“Otoxi–South Africa
“Ottawa Mandarin–See Mandarin (Ottawa)
“Ozark
“Pagoda
“Palmetto
“Patoka–P.I. 70218-2-19-3
“Pee Dee–Coker’s 31-15
“Peking
“Pekwa–Combined with Kingwa
“Pelican
“Pennsoy
“Perley’s Mongol
“Pine Dell Perfection
“Pingsu
“Pinpu”
“Pluto”
“Pocahontas”
“Premier”
“Preston”
“Pridesoy”
“Prolific”
“Purredo”
“Quillian”
“Ralsoy”
“Rattlesnake”
“Red Otootan”
“Red Sable”
“Red Tanner”
“Reiching”
“Riceland”
“Richfield”
“Richland”
“Rila”
“Roanoke”
“Rokusun”
“Roosevelt”
“Rose Non Pop”
“Round Black”
“Royal”
“S100”
“Sable”
“Sac”
“Sainte Anne”
“Samarow”
“Sangra”
“Saskatoon”
“Sato”
“Scioto”
“Sedo–P.I. 23229”
“Seminole–P.I. 93058”
“Seneca–F.C. 03654A”
“Shanghai–Same as Tarheel Black”
“Sherwood–P.I. 17862”
“Shinto–P.I. 89128”
“Siberia”
“Sijo”
“Siolet”
“Soyo Good–Same as Etum”
“Soy Good–Same as Etum”
“Soysota–P.I. 28019”
“Stuart–P.I. 22644”
“Summerland–Canada Station selection”
“Super Quick–Same as Sousei”
“Suru–P.I. 89128”
“Swan–P.I. 22379”
“Taha–P.I. 21999”
“Tanloxi–Delta Station selection 483”
“Tanner–Farmer selection (Alabama)”
“Tarheel–Same as Tarheel Black”
“Tarheel Black–P.I. 14952”
“Tarheel Brown–Same as Mammoth Brown”
“Tashing–P.I. 20854”
“Tastee–P.I. 86019”
“Tennessee Non Pop–Tennessee Expt. Station selection”
“Tenses–P.I. 104881”
“Texoil–Farmer selection (Texas)”
“Tinzan–Australia selection”
“Toku–P.I. 86129”
“Tokyo–P.I. 17264”
“Trenton–P.I. 24610”
“Trinitaria–Salvador selection”
“U.S.-2–P.I. 70218-2”
“U.S.-5–P.I. 54563-5”
“Viking–Illinois Experiment Station selection”
“Vilnensis–Poland variety”
“Vireo–P.I. 22874”
“Virginia–P.I. 19186D”
“Virginia Brown–Same as Virginia”
“Volstate–Tennessee Expt. Station selection”
“Wabash–C463”
“Waseda–P.I. 80461-1”
“Wee–P.I. 30600”
“White–Same as Haberlandt”
“White Biloxi–Delta Experiment Station selection”
“White Eyebrow–P.I. 30745”
“Willomi–P.I. 81044-1”
“Wilson”
“Wilson Black”
“Wilson Early Black”
“Wilson-Five”
“Wing’s Royal–Same as Peking”
“Wisconsin”
“Wisconsin Black”
“Wisconsin Early Black”
“Wisconsin Early Green”
“Wisconsin Manchu #3”
“Wisconsin Manchu #606”
“Wisconsin Mandarin #507”
“Wolverine”
“Wonder”
“Woods Yellow”
“Wyokatenn”
“Yellow–Same as Mammoth Yellow”
“Yellow Biloxi”
“Yellow Marvel”
“Yelnando–Coker’s 433”
“Yelredo–Coker’s 319”
<table>
<thead>
<tr>
<th>Variety Name</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown Otootan–Same as Tanner.</td>
<td></td>
</tr>
<tr>
<td>Black–Same as Buckshot.</td>
<td>Black Champion–Same as Peking.</td>
</tr>
<tr>
<td>Black Beauty–Same as Ebony.</td>
<td>Black Champion–Same as Peking.</td>
</tr>
<tr>
<td>Best Green–Same as Hope.</td>
<td>Best White–Same as Amherst.</td>
</tr>
<tr>
<td>Best White–Same as Amherst.</td>
<td>Best White–Same as Amherst.</td>
</tr>
<tr>
<td>American Oil King–Same as Midwest.</td>
<td>Aksarben–P.I. 36576.</td>
</tr>
<tr>
<td>Acadian–Louisiana</td>
<td>Acadian–Louisiana</td>
</tr>
<tr>
<td>Special–Bavender selection (Iowa).</td>
<td>Special–Bavender selection (Iowa).</td>
</tr>
<tr>
<td>Bell–Same as Midwest.</td>
<td>Bell–Same as Midwest.</td>
</tr>
<tr>
<td>Canada Exp. Station, Harrow.</td>
<td>Canada Exp. Station, Harrow.</td>
</tr>
<tr>
<td>Coker–Same as Midwest.</td>
<td>Coker–Same as Midwest.</td>
</tr>
<tr>
<td>Pioneer–B.P.</td>
<td>Pioneer–B.P.</td>
</tr>
<tr>
<td>American Oil King–Same as Japanese variety (Indiana).</td>
<td>American Oil King–Same as Japanese variety (Indiana).</td>
</tr>
<tr>
<td>American Oil King–Same as Japanese variety (Indiana).</td>
<td>American Oil King–Same as Japanese variety (Indiana).</td>
</tr>
<tr>
<td>American Oil King–Same as Japanese variety (Indiana).</td>
<td>American Oil King–Same as Japanese variety (Indiana).</td>
</tr>
</tbody>
</table>


Note 2. This is the earliest document seen (Oct. 2013) that mentions the soybean varieties Brown Otootan, Early Mammoth Black, or Hidatsa.

Note 3. This is the earliest document seen (July 2013) which states that Black Champion is the same as Peking, or that Best Green is the same as Hope, or that Brown Otootan is the same as Tanner, or that Early Mammoth Black is the same as Buckshot, or that Hollybrook Early is the same as Midwest. Continued. Address: USDA, Bureau of Plant Industry, Soils & Agricultural Engineering, Div. of Forage Crops & Diseases [Beltsville, Maryland].


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RESULTS OF
THE COOPERATIVE UNIFORM
SOYBEAN TESTS, 1947
PART II. SOUTHERN STATES
by adverse weather conditions usually prevailing in late fall and early winter over much of the South.

“Varieties and new strains of soybeans are grouped according to maturity to form nine uniform soybean variety tests or groups. Groups 0 through IV include varieties adapted to the North Central States. A summary of the performance of these groups will be found in Part I of this report, which is published separately. Varieties and new strains adapted to the Southern States are included in Groups V, VI, VII, and VIII. The late-maturing Corn Belt varieties of Group IV, regrouped in part to form Group IV-S, appear promising and are being tested in the upper part of the southern region. Where adapted and at normal planting dates, the varieties of Group IV-S mature in late August and early September; Group V in late September; Group VI in early October; Group VII in late October; and Group VIII in early November. The maturity of the varieties within these groups are progressively later across the Upper South and earlier in the Lower South.”

Pages 4-5: Location of cooperative nurseries [and cooperators].

Page 6 (Fig. 1): Map of southern states showing location of most of the cooperative uniform tests, 1947.

Page 7: Methods: Tells how the following are measured: Yields, Chemical composition. Lodging. Shattering. Height (of plants). Maturity. Seed quality (rated from 1 to 5). Statistical analysis (by analysis of variance).


• Summary: A large photo shows: “Soybean Lab–These soybean oil extractors in the Regional Soybean laboratory, Urbana, Illinois, aid in the finding of superior varieties and strains for industrial use. Floyd Collins, staff member, operates them.”

William Morse, the soft-spoken scientist, almost single-handed, introduced and ‘sold’ the soybean to America.

Morse’s big break came in 1929. The reputation of the soybean had grown and the Agriculture department sent him to the Orient to seek more varieties. “It was a cherished dream realized at last.”

A large portrait photo shows William Morse. Address: Central Press Correspondent.


• Summary: Presented at Cooperative Soybean Oil Mills Conference, Northern Regional Research Laboratory, Peoria, Illinois, 25-27 May 1948.

“The object of our commodity project on soybeans and other oilseeds is to develop new scientific, chemical, and technical uses, and new extended markets and outlets for oilseeds and their constituents. Naturally, during the past several years our work on this project has been limited primarily, but by no means exclusively, to the most important oilseed crop of this region. Because soybeans are a comparatively new crop, the need for and the possibilities of achievement in research on the utilization of the soybean and its constituents is greater than for any other oilseed commodity.

“Our research at this Laboratory is divided among seven divisions, all but two of these divisions having direct interest in soybeans. The five divisions that have been or are actively engaged in research on some phase of soybean technology are Fermentation Division, Engineering and Development Division, Commodity Development Division, Analytical and Physical Chemical Division, and Oil and Protein Division. For instance, the Analytical and Physical Chemical Division, as the name suggests, is concerned with analysis for oil content, fatty acid composition, and other problems related to analytical and physical characteristics. The Engineering and Development Division is concerned with pilot-plant studies on unit operations involving soybean processing. The Oil and Protein Division is primarily and almost exclusively concerned with soybeans. Since oilseeds are composed mainly of oil and protein, it is easy to understand why this last named Division has its greatest interest in oilseed commodities. With soybeans the most important oilseed crop of this region, the direction of most of our attention to soybeans is understandable.

“Here at the Northern Laboratory we are equipped primarily to deal with the fundamental aspects of problems associated with the industrial utilization of soybeans, as contrasted with their utilization in foods or feeds. However, we have been doing considerable work on edible oil and on foods for humans from soybeans and soybean meal. This work will be expanded during the next several years under the Research and Marketing Act with the aim of solving many of the problems facing these outlets for soybeans and soybean products. With both the food and industrial nonfood uses we are prepared on occasion to work on specific practical problems, such as the development of new formulas for adhesives or paints. Usually these formulating problems are limited in scope and duration. But some of them continue for long periods as, for example, paints from soybean oil. By the study of the fundamental aspects of practical problems and by studies in formulation, we have succeeded in making a number of worth while contributions to soybean technology.

“When this Bureau first started its research on soybeans, at the U.S. Regional Soybean Industrial Products Laboratory, Urbana, Illinois, a policy of publicizing its information was
established. Since then more than 170 papers or scientific reports have been published to increase the knowledge of soybean chemistry and technology. It is impossible because of the shortage of time to attempt a review of all these papers that deal with our developments. However, I do wish to list some of the more important of our specific contributions.

“Our important contributions are:

1. Studies on the utilization of nonbreak and alkali-refined soybean oil for paints and varnishes.
2. Precise determination of oil content and lack of change in oil content under conditions of commercial storage.
3. Liquid-liquid fractionation of soybean oil with furfural to give paint and edible oil fractions.
4. A process for alcoholic extraction of soybeans.
5. Utilization of soybeans for food use.
7. Protein adhesive for shotgun shell casings.
8. Plywood adhesives for hard and soft woods.
9. Polyamide resins from soybean oil.
10. Studies on the composition of soybean lecithin.

Other developments worth mentioning are a standardized factory-scale process for Chinese soya sauce, use of soybean meal in plastics, the analysis of oil for fatty acids, studies on conjugated oils, and so on. However, I want to tell you about four of our developments.

“Protein Adhesive for Shotgun Shell Casings
In the search for an adhesive derived from agricultural products, an ammunition manufacturer sought the help of the Northern Laboratory on the possibility of using soybean protein as an adhesive in shotgun shell casings. Because of their background of experience on the behavior of soybean protein, Dr. Smith, Mr. Babcock, and Mr. McKinney of this Laboratory were able to develop readily on a laboratory scale several formulations of soybean protein adhesives which showed definite promise.

“In cooperation with these chemists, the industrial company first conducted pilot-plant runs and then full-scale plant trials to evaluate these formulations, and a large number of experimental shells were made for testing. The casings are made by rolling a special sheet of paper on a mandrel. While this operation proceeds, a thin solution of the soybean adhesive is spread over the surface of the paper. The cylindrical, laminated casings are discharged from the machine at the rate of 50 to 60 per minute. Shooting trials and aging tests were conducted to determine if the casings made with soybean protein deteriorated during storage. The shells were found to be equal or superior to those that the company had manufactured previously. In particular, the shell casings were ‘tougher’ or more ‘leathery’ and had better ‘water resistance,’ both characteristics being improvements in the right direction. Actual commercial use by this company of soybean protein for shotgun shell casings was started 1 year ago.

“This research was strictly a study of formulations. It was not fundamental. It was, however, an opportunity to make a direct contribution to utilization on a specific problem and we made it. The entire work required no more than the time of one man for a 3-month period.

“Plywood Adhesives This country annually produces large quantities of soybean oil meal which are marketed almost entirely as feed for livestock and poultry. For example, 3 million tons or more of soybean oil meal was produced in 1947. Only a very small amount of this was used industrially.

“One of the industrial uses for soybean oil meal is the preparation of adhesives which are widely used in soft and hard plywood industries. Plywood bonded with soybean adhesives is considered to be water-resistant but not waterproof.

“During World War II, the plywood industry was required to produce large quantities of waterproof plywood for the aircraft industry. For this purpose the phenolic resins rather than soybean adhesives were used. In 1942-44, this use of phenolic resins increased from 21 to 29 million pounds, while the use of soybean adhesives was decreasing from 45 to 37 million pounds.

“A method was sought to reduce the unfavorable trend of soybean adhesives and to economize on the use of phenolic resins, which were critical materials. A.K. Smith and G.E. Babcock of this Laboratory discovered that substantial amounts of the soybean meal which is a byproduct in the manufacture of soybean protein could be used as an adhesive with the phenolic resins” (Continued). Address: NRRL, Peoria, Illinois.


• Summary: “In discussing composition and its relation to the price of soybeans and soybean oil, I must refer briefly to the start of analytical work at the U.S. Regional Soybean Industrial Products Laboratory at Urbana, Illinois, in 1936. When that Laboratory was started, one of the four sections was an Analytical Section. The section had two main purposes in view.

“The first was to determine in detail the composition of soybeans in the hope of finding ‘hidden values’ in the constituents. At that time a complete analysis of soybeans had never been made and, in fact, a fairly large part of the mature soybean was of unknown composition. It seemed possible that in this unknown portion valuable constituents might be found that would enhance the value of the crop.
The Laboratory at Urbana found that there was a surprising amount of sugar or sucrose in soybeans, averaging around 10 percent. Also work was undertaken and actively pursued on the sterols and phosphatides found in the soybean fraction. As you know, the soybean phosphatides have been extensively used, and sterols from soybeans now serve as a starting point for the synthesis of hormones.

“The second purpose of the Analytical Section was to assist the agronomist and geneticist in their plant-breeding program. For this purpose it was necessary to find how composition was affected by variety, environment, and fertility level of the soil. With this information as background, continued analysis was needed to discover new varieties which had high oil and protein contents and to make sure that these varieties exceeded in these respects those in current production. The first 5 years’ work on this second problem are summarized in Technical Bulletin 787 of the U.S. Department of Agriculture. On inspecting the reports in this bulletin on varieties studied for a 5-year period, you will be struck by the fact that most of them are no longer grown. This in itself is a tribute to the success of the agronomist and the geneticist, since the new varieties—Lincoln, Chief, Hawkeye, and the others now appearing—are a direct outgrowth of this breeding and testing program. The high oil content of the new varieties is not an accident. It was aimed for by the geneticist and confirmed by chemical analysis before these varieties were released for general use.”

Address: NRRL, Peoria, Illinois.


**Summary:** “Certain qualities are desired in a soybean variety regardless of where it is grown. These qualities are high seed yield, good seed quality, high percentage of oil and protein, adaptability to combine harvesting, and freedom from disease injury. However, one quality which does differ markedly both in requirements and behavior is maturity. Maturity and adaptation to specific environments are characteristics which make southern varieties different from Cornbelt varieties.

“Nearly 30 years ago plant physiologists learned that soybeans were very sensitive to length of day. That is, some types will begin to flower and develop seed with 16 hours of daylight while other varieties will not begin to reproduce until day length is 14 hours or less. Under the day length conditions occurring at Memphis during the growing season all strains adapted to the central Cornbelt area will begin flowering in about 30 days after emergence. Consequently they make only limited growth and mature too early to give maximum seed yields. On the other hand a variety like Ogden which makes good growth and matures about October 10 at Memphis will not mature before frost in central Illinois.

“During the past several years we have been evaluating soybean varieties with regard to their specific qualities and
characteristics. We are not only interested in learning which are the best strains available but also what characteristics each strain possesses so that we might use these good qualities in our improvement program.

“Soybeans are a self pollinated crop. Once a variety is established as a uniform type, we have practically no chance of making any improvement by selection within that variety. To make improvement we must have variability. To get this variability it is necessary to make crosses between types possessing the different characteristics and selecting in later generations. Some of the more advanced work has dealt with getting improved seed holding, adaptation to specific areas, and disease resistance.

“One of the varieties well adapted for seed production in much of the South is Ogden. The Ogden variety gives excellent seed yield, stands up well, is moderately resistant to the bacterial leaf diseases, and has a quite satisfactory oil content. However, Ogden will shatter under some conditions and also sometimes produces seed of poor quality. One of the types chosen to combine with Ogden to correct these weaknesses was the Ralsoy variety. This variety has excellent seed holding qualities, but gives much lower seed yields, especially when the fertility level is such that Ogden will yield 35 to 40 bushels per acre. Ralsoy also is quite susceptible to bacterial pustule and wildfire.

“The problem then is to maintain as many Ogden qualities as possible but still add seed holding. Since the genes conditioning the various characteristics segregate and recombine more or less at random in the F2 and later generations it is necessary to observe rather large numbers in order to obtain the desired combination. Disease susceptible and shattering plants or lines can be eliminated in the second or third generation by observation, but we have no method of predicting by observation which strains are going to be the best seed producers. To pick out the best yielding strains it is necessary to grow them at several locations to evaluate their adaptation to different environments. After testing numerous strains from the cross Ralsoy x Ogden, one of the most promising strains is N45-2994. While this strain has not been tested thoroughly enough to know its adaptability, it appears to possess many of the good qualities of each parent. Other strains with good seed holding qualities have also been crossed with Ogden to bring about improvement in seed holding. We believe that some of these crosses will give non-shattering strains equal in other respects to Ogden.

“Chinese Strains: Several types introduced from the vicinity of Nanking, China, such as Palmetto, Missoy, Nanking, and CNS make excellent growth on the Coastal Plain soils of the lower Southeast. However, each of these strains has a low oil content. Crosses have been made using these types with Ogden, Volstate, and Roanoke. Selections from these crosses are now in advanced stages of testing. Some of the better strains such as N45-3563, N45-3728, and N46-2652 possess many of the growth qualities of Palmetto and Missoy plus approaching Roanoke in seed holding and oil content. It is anticipated that some of these strains will provide good seed varieties in an area where the varieties like Ogden and Roanoke have not been too well adapted.

“Another phase of the breeding program has been directed toward transferring resistance to bacterial pustule and wildfire [a bacterial foliage disease of soybeans, caused by *Pseudomonas* varieties] to the better seed producing types. Both of these diseases are frequently present in soybean fields. One of the first strains to be identified as carrying a high degree of resistance to both bacterial pustule and wildfire was the variety CNS. CNS as a variety is not well adapted for production in the two major production centers of the South—the coastal plain area of North Carolina and Virginia or the Delta area of Arkansas and Mississippi. In these areas it lodges badly, produces low seed yields, and has a low oil content.

“The first crosses using CNS as a parent were made in 1943. Its resistance to bacterial pustule appears to be rather simply inherited. However, from the first cycle crosses strains which carried the desired degree of disease resistance have not equalled Ogden or Roanoke in seed production or oil content in their areas of best adaptation. These strains do equal CNS in disease resistance and surpass it in agronomic qualities. The better strains from the crosses with CNS carrying resistance to bacterial pustule and wildfire have been crossed with the best agronomic types for the different production areas of the South. It should not be long before types carrying a high degree of resistance to these two bacterial leaf diseases along with good seed production and high oil content will be available.

“Several insects frequently cause severe defoliation in the region. One of the worst offenders is the velvetbean caterpillar. On several occasions differential feeding has been observed when velvetbean caterpillars have moved in on a nursery containing different strains. However, each of these least desired strains has been observed to be severely defoliated by the same insect when grown alone. Consequently we do not have sufficient differences upon which to base a program for resistance to velvetbean caterpillar attack at the present time. The insect can be controlled by dusting. Very few varieties have been available to fill a maturity gap between such varieties as Patoka and Gibson which are grown in southern Indiana and Ogden which is about 3 weeks later. This season a considerable acreage has been planted of the variety S-100 which fits in very well between these other varieties in maturity. S-100 is recognized as carrying somewhat lower oil content than other popular varieties, and a somewhat greater degree of susceptibility to the wildfire disease. These qualities will probably restrict the use of S-100 as a variety. Other strains derived from crosses between productive Cornbelt varieties and medium early Southern types are now in test. In preliminary trials some of these strains which are similar

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to S-100 in maturity have surpassed it in other qualities, especially oil content.

“Good Soil Needed: While it is possible to breed superior varieties of soybeans which will give higher seed yields because of better adaptation to specific environments and a better complement of genetic factors for yield, it must also be recognized that the seed yield of any variety is closely associated with the productive capacity of the soil. A 40-bushel soybean seed crop removes in the seed the equivalent of 300 pounds 0-10-20 [NPK] fertilizer. If the phosphate and potash supply in the soil limits production to 20 bushels per acre, little is to be gained by planting a variety having a higher yield potentiality. Very often improvement in fertilization practices is the first step necessary toward improving seed yields. Likewise other cultural practices such as stand and weed control cannot be neglected if high yields are expected.

“At the present time varieties like S-100, Ogden, Roanoke, and Acadian offer maturity range for production in almost any area of the South. Each of these strains has the capacity to produce high seed yields in areas where adapted, providing of course that the nutrient requirements are fulfilled. It is recognized that these and other varieties have limitations and breeding work is in progress to correct some of these defects. Furthermore, it is recognized that progress in any breeding program is dependent on knowledge of the inheritance of the various qualities and characteristics. We, therefore, are interested in problems directed toward gaining further genetic information as well as practical improvement.” Address: Agronomist, U.S. Regional Soybean Lab., Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Research Administration, USDA.


- **Summary:** “The soybean is moving south. Statistics prove it. Soybean acres and yield jumped 5-fold during war and postwar years in the six Midswest states, Arkansas, Kentucky, Missouri, Mississippi, Louisiana and Tennessee. At the same time acreage and yield tripled in the 12 Southern states served by the U.S. Regional Soybean Laboratory.

“But the South is only once again claiming her own. An old sea captain, we are told [by A.E. Staley, Sr.], first brought soybeans direct from the Orient to North Carolina. Planters grew them there as ‘Japan peas.’ Under the prodding of such enthusiasts as the late C.B. Williams at the North Carolina Experiment Station, the growing of soybeans spread rapidly in the South.

“The first American-grown soybeans were processed in North Carolina; and they were first processed by solvent-extraction in Virginia.

“In 1920 the five leading soybean states were all in the South. But in following years Southern farmers lost interest, due to lack of suitable varieties, the lack of harvesting machinery, and mainly perhaps, to the pull of past habits that tied them to a single crop. The Nation’s soybean center shifted to the Cornbelt. By 1935 Missouri was the only Southern state included in the first five in soybean production.

“During the war and postwar the South turned again to soybeans. She is now growing far more of them than ever. The combine has come in to make them more profitable. The call for diversified farming is at last beginning to be heeded in the South as elsewhere. New and better varieties such as S-100 and Roanoke are coming from the experiment stations.

“The soybean at no time lacked for true friends in the South. There were men who believed in its ultimate triumph there—breeders working for private firms and the Regional Soybean Laboratory and the state experiment stations, growers who kept on planting the crop, and agricultural leaders like J.B. Crain who built processing and refining plants, grew large acreages themselves and induced others to follow suit.

“These men were quietly at work preparing for the day of the soybean’s return. Their work is now rewarded. No one now can doubt that the soybean along with cotton and other typical Southern crops will remain to share in the South’s destiny.”

Note: This is the earliest document seen (Nov. 2016) that contains the word “Midsouth.”


- **Summary:** “Paul R. Henson, coordinator for the work of the U.S. Regional Soybean Laboratory in 12 Southern states since June 1942, has become leader of the miscellaneous legume project of USDA’s Division of Forage Crops and Diseases.

“Henson was transferred from the Delta Branch Experiment Station at Stoneville, Mississippi, to Beltsville, Maryland, in June.

“Henson has been succeeded at Stoneville by Dr. E.E. Hartwig, located at the North Carolina Experiment Station, Raleigh, North Carolina, at the time of his new assignment. Dr. Hartwig has been a member of the Regional Laboratory staff since February 1943, and has been in charge of USDA’s soybean investigations in North and South Carolina. He assumed his duties at Stoneville Sept. 1.

“Herbert W. Johnson, a graduate of the University of Tennessee, has taken Dr. Hartwig’s place at Raleigh.” A portrait photo shows Paul Henson.

• **Summary:** In the section titled USDA “Agricultural Research Administration,” under “Special research fund” (p. 17) we read that this fund was authorized by section 4, title I, of the Bankhead-Jones Act (approved June 29, 1935). Nine regional laboratories have been established under the Act. One of these is the Soybean Regional Laboratory, Urbana, Illinois.

A table (p. 26), in the section on Agricultural Research Administration, under “Special research fund” shows that appropriation of: “(b) $5,000 for construction of seed and equipment storage building at the Soybean Laboratory.” A summary (p. 579) repeats the information from p. 26.

Note 1. These funds were used to start what is today called the USDA Soybean Germplasm Collection.

Note 2. This is the earliest document seen (Dec. 2016) concerning any soybean germplasm collection, worldwide. In fact, the USDA germplasm collection at Urbana was started in 1948. Address: Washington, DC.


• **Summary:** (1) 1948 Aug.–Dr. Lew Allison (left, in a white shirt and necktie) and W.J. Morse (right, in a coat) at the Soybean Experimental Plots in Beltsville, Maryland.

   (2) 1948 Aug.–Dr. Lew Allison (left), William Stuart (center) and W.J. Morse (right, in a hat) in Beltsville.


   These digital photos, with captions and dates, were sent to Soyfoods Center by Joyce Garrison (William Morse’s granddaughter) of West Hartford, Connecticut (July 2004).


• **Summary:** In southeast Missouri the growing season is long, and consequently, soybeans are frequently planted from mid-April to mid-July. The varieties grown range in maturity from those commonly grown in the central Corn Belt to those commonly grown in the northern Cotton Belt, the greater portion of the acreage being planted to full-season varieties such as Ralson, Arksoy, and Ogden. Under these conditions, it seems necessary to determine the favorable planting time and the effect that planting date has upon maturity, seed yields, and seed quality of different varieties.

   “A study to gain information on the effect of date of planting was conducted cooperatively by the U.S. Regional Soybean Laboratory and the Missouri Agricultural Experiment Station on the Southeast Missouri Experiment Field at Sikeston in the four-year period 1942 through 1945.” Five varieties were tested: Ralson (137), S-100 (124), Boone (117), Chief (109), and Dunfield (100). In parentheses after each is the rated maturity in days if planted on June 1 at Sikeston, Missouri. These soybean varieties were selected to represent maturity groups commonly grown from the central Corn Belt to the northern Cotton Belt. Address: U.S. Regional Soybean Lab., Div. of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agric. Engineering, Agricultural Research Administration, USDA; Missouri Agric. Exp. Station, Columbia.


• **Summary:** Except for the cover, this document is typewritten.


   Page 1: “Introduction: The program of the U.S. Regional Soybean Laboratory includes developing and evaluating soybean varieties for industrial utilization. As a means of evaluating present varieties and new strains developed through breeding, replicated plantings are made under a wide variety of environmental conditions. Because soybean strains are very sensitive to photoperiod, it has been necessary to classify types into maturity groups. For convenience these maturity groups are designated Group 0, I, II, to VII, VIII, extending from north to south. This report includes a summary of agronomic and chemical characteristics of varieties and new strains for the Southern States. Maturity groups included are IV, V, VI, VII, and VIII.

   “The cooperative program between the Soybean Laboratory and the states in the southern region was initiated in 1943. At that time there was only limited information available showing the regions of adaptation of the existing varieties of soybeans. During the first few years most of the strains included in the uniform nurseries were established varieties. As agronomic and chemical data were accumulated on these strains, the poorer producers were eliminated from the tests. At the present time, the material grown in the regional nurseries comprises top-producing varieties and new selections from the breeding programs. This testing program gives agronomic and chemical data from a wide variety of conditions. Because of these tests, the breeder can get new strains into production in a minimum amount of time.

   “A wide range of soil and climatic conditions exist in the region. It is too much to expect that any one variety
should give top performance in all areas where a particular maturity group is to be grown. As an aid in recognizing regional adaptation, the region has been subdivided into five rather broad areas, which still represent a wide range of soil types. These are: (1) the East Coast, consisting of the Coastal Plain of Virginia, North Carolina, and the upper half of South Carolina; (2) the Southeast, consisting of the Coastal Plain soils of the lower half of South Carolina, Georgia, Florida, Alabama, and Mississippi; (3) the Upper and Central South, including the Piedmont soils between the Coastal Plain and Mississippi Delta; (4) the Delta area, composed of the alluvial soils from the Mississippi River in Missouri, Arkansas, Tennessee, Mississippi, and Louisiana; and (5) the West, or Southwest, comprising the western half of Arkansas and Louisiana, Oklahoma and Texas. A map is included to illustrate those areas.

“As further aid in interpreting yield responses, rainfall data is reported for many of the locations where nurseries were grown. Since much of the summer rainfall is from local showers, rainfall is reported only for those locations where records were taken close to the nurseries. Daily minimum and maximum temperatures are reported from representative locations for the production areas.

“Rates of fertilization [sic, are] is reported for those locations where the plots wore fertilized. Soil type is reported for all locations.”

Pages 3-4: Location of cooperative nurseries [and cooperators].

Unnumbered page: Map of southern states showing location of most of the cooperative uniform tests, 1948.


• Summary: “The Fourth. Work Planning Conference of the Southern States technical collaborators of the U.S. Regional Soybean Laboratory was held in Birmingham, Alabama, on March 2-4, 1949, to review the accomplishments of the cooperative soybean research conducted during the past season and to plan future investigations. Birmingham was chosen for the meeting this year on a trial basis, as it appeared to be centrally located for all collaborators.

“Wednesday, March 2–Edgar E. Hartwig, Chairman

“The conference was called to order at 9:00 a.m. in a conference room of the Hotel Bankhead. The following were in attendance:

“Adair, C.R., Agronomist, U.S.D.A., Rice Branch Station, Stuttgart, Arkansas

“Allison, J.L., Sr. Pathologist, Forage Crops and Diseases, U.S.D.A., Beltsville, Maryland

“Canode, G.L. Agronomist, Oklahoma Experiment Station, Stillwater, Oklahoma

“Carr, R.B., Agronomist, U.S. Regional Soybean Laboratory, Stoneville, Mississippi

“Carter, J.L., Agronomist, U.S. Regional Soybean Laboratory, Urbana, Illinois

“Collins, F.I., Chemist, U.S. Regional Soybean Laboratory, Urbana, Illinois

“Cowan, J.C., Head, Oil & Protein Div., Northern Regional Research Laboratory, Peoria, Illinois

“Craigmiles, J.P., Agronomist, Georgia Experiment Station, Experiment, Georgia

“Feaster, C.V., Agronomist, U.S. Regional Soybean Laboratory, Columbia, Missouri

“Gray, J.P. Agronomist, Louisiana Experiment Station, Baton Rouge, Louisiana

“Hartwig, E.E., Agronomist, Delta Experiment Station, Stoneville, Mississippi

“Johnson, H.W., Agronomist, North Carolina Experiment Station, Raleigh, North Carolina

“Johnson, H.W., Pathologist, Forage Crops & Diseases, U.S.D.A. Stoneville, Mississippi

“McAlister, D.F., Physiologist, U.S. Regional Soybean Laboratory, Urbana, Illinois

“Miley, D.G., Superintendent, Delta Branch, Mississippi Experiment Station, Stoneville

“Morse, W.J., Agronomist, Forage Crops & Diseases, U.S.D.A., Beltsville, Maryland

“Myers, W.M. Agronomist, Forage Crops & Diseases, U.S.D.A., Beltsville, Maryland

“Nelson, W.L., Agronomist, North Carolina Experiment Station, Raleigh, North Carolina

“O’Kelly, J.F., Agronomist, Mississippi Experiment Station, State College, Mississippi

“Paden, W.R., Agronomist, South Carolina Experiment Station, Clemson, South Carolina

“Pitner, J.B., Agronomist, Rockefeller Research Institution, Mexico City, Mexico

“Potts, R.C., Agronomist, Texas Experiment Station, College Station, Texas

“Simmons, C.F., Agronomist, Alabama Experiment Station, Auburn, Alabama

“Skold, L.N., Agronomist, Tennessee Experiment Station, Knoxville, Tennessee

“Smith, R.L., Agronomist, North Florida Experiment Station, Quincy, Florida

“Smith, T.J., Agronomist, Virginia Experiment Station, Blacksburg, Virginia

“Williams, L.F., Agronomist, U.S. Regional Soybean Laboratory, Urbana, Illinois

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“Reports of Research Dr. Edgar E. Hartwig opened the conference with an outline of the subjects to be covered during the meeting. The morning was to be devoted to brief reports by the collaborators on high-lights of the work in their state and factors of importance in determining the types of research that should be outlined for the coming season.

“Arkansas report by C.R. Adair–The estimated acreage of soybeans harvested for seed in Arkansas in 1948 was 264,000 acres, which was 19,000 acres less than in 1947 but 106,000 acres more than the 1937-46 average. The average yield per acre in 1948 was 19.5 bushels which was 7.5 bushels more than 1947 and 5.5 bushels more than the 1937-46 average. The total production in 1948 was 5,148,000 bushels compared with 3,396,000 bushels in 1947 and an average of 2,296,000 bushels for the 1937-46 period.

“Conditions at planting time were unfavorable because of excessive rainfall. However, conditions improved as the season advanced. There was ample summer rainfall in most sections of the state for development of a good crop. Yields were reduced by a lack of rainfall on light sandy soils in the southwestern part of the state.

“The principal areas of soybean production in Arkansas are the Mississippi Delta in the eastern part of the state, Grand Prairie and in the Arkansas, lower White, Red and St. Francis river valleys.

“In the northeastern part of the state Ogden is the principal variety although there seems to be an increasing interest in earlier varieties such as S100. Later varieties such as Roanoke and Volstate have not produced as well as Ogden and the growers do not like the later varieties because of danger of rain before harvest.

“In the southeastern part of the state Ogden is the leading variety although Volstate and Roanoke are grown on a limited acreage. There is some interest in S100 to be grown and followed by fall sown oats.

“In the Grand Prairie area Ogden, Arksoy, Tanner and Volstate are the leading varieties. S100 is grown on a limited acreage in rotation with fall sown oats. The later (Group VII) varieties are more popular in this section because S100 and to some extent Ogden conflict with rice harvest.

“Groups V, VI and VII are made up of varieties most widely adapted in Arkansas. Varieties in Group IV can be grown in the northern part of the state but those varieties produce less than Group V varieties on the average. The varieties in Group VIII can be grown in the southern part of the state but those varieties produced less than the better varieties in Groups VI and VII. It is planned to devote most time testing Groups V, VI and VII. Any breeding work that is done will be to develop strains within the maturity range of those three groups. Groups IV and VIII will probably be grown at one place in the state so there will be some information on new strains in those groups.

“Pod and stem blight and wildfire caused damage in local areas. Bacterial pustule was quite serious probably because of the frequent showers during the summer. Varieties resistant to these diseases would be very beneficial.

Page 12: “November rainfall was above normal in most sections of the State and seriously hampered harvesting of soybeans. Fields were so wet that the harvest in December was also delayed resulting in poor quality beans for many farmers. An estimated 20% of the crop remained unharvested on January 1.

“The Experiment Station has received more requests than in previous years and farmers have shown more interest in a high yielding early bean in middle and eastern Virginia. This allows early hoggging down where desired and also permits beans to be harvested for grain in time for seeding winter cover crops. The best early bean to date is S100 although it is not early enough in some sections.

“The S100 bean is ten days to two weeks earlier than Ogden in Eastern Virginia. One of its best characteristics is the excellent quality of the beans. The beans do not mold or deteriorate to any degree oven though they may be left in the field six weeks or two months after maturity.

“Several of the newer strains which have been tested in the past 2-3 years look very promising.

“Report of Soybean Work in Mexico Being Conducted by John B. Pittner–Dr. Pittner, working on soybean breeding and production problems for the Rockefeller Institute at Mexico City, reports that they are enthusiastic about the prospects of developing the crop. One of the reasons for their interest is that Mexico imports much vegetable oil, mainly cotton seed, and would like to develop local oil production that would give badly needed protein for the people of Mexico. One of the problems in this area is that they have a rainy season and a dry season with the rains coming in late June and ending in October. The soybean appears to fit in well with wheat in a rotation and applications of nitrogen are important in securing good yields. A wide range of soybean selections have been studied under conditions at the high altitudes near Mexico City and also at one of their experiment stations at 1500 feet elevation. Selections in Group V, VI, and VII maturity look best under these conditions and strain S-100 has given good results. Plantings at 5000 feet elevation have given the best yields so far. Introducing a new crop is always a problem, but they are hoping to build up an acreage and expect yields of around 25 bushels per acre without too much difficulty. Increase plots of 3-100 and Ogden are now being grown to get a start toward commercial production.

“Wednesday afternoon, March 2–W.R. Paden, Chairman

“Fertilizer Treatment and Placement Responses by W.L. Nelson–Soybeans are heavy feeders on the soil, soybeans and peanuts removing about the same amount of mineral nutrients. They remove about 60 pounds per acre K2O [potassium oxide] with tobacco and cotton removing 35 pounds. Soybeans remove about 33 pounds per acre P2O5 [phosphoric anhydride] with tobacco removing only 5
pounds. In North Carolina soybeans give a marked response to dolomitic limestone and soil at pH 4.5 may need 3½ tons limestone per acre. Some Manganese deficiency is now showing up, the symptoms being green veins with the interveinal area yellow. Much of this manganese deficiency is due to over enthusiastic liming” (Continued). Address: Secretary to the Conference, Agronomist, Forage Crops & Diseases, U.S.D.A., Beltsville, Maryland.


• Summary: (Continued): Page 15: “b. Committee to consider desirability of outlining general rules for guidance of the soybean conference group in the increase and release of new soybean varieties.
  “J.P. Gray, W.M. Myers
  “D.G. Miley, J.F. O’Kelly
  “W.J. Morse, W.R. Pad
  “J.L. Catter, Chairman
  “c. Committee to consider needed research on fertilizer applications and the effect of competition on the accuracy of yield testing in soybean nurseries.
  “C.R. Adair, J.D. Pitner
  “E.E. Hartwig, L.N. Skold
  “W.L. Nelson
  “W.R. Pad, Chairman
  “Thursday morning, March 3--C.R. Adair Chairman
  “The Breeding Program of the Regional Laboratory in the Southern States–Past, Present, and Future–Round Table Discussion–Several ideas were brought out in the round table discussion on breeding. There was general agreement that more fundamental genetic work was necessary. Dr. Miley of the Delta Branch Station, Mississippi Experiment Station stated that he supported wholeheartedly the idea of more fundamental studios by the U.S.D.A. staff with more of the practical breeding work if necessary being carried on by state men in order that the fundamental research could progress rapidly.

  “Date of flowering or length of period from flowering to maturity may have an important bearing on oil content. Among crosses from low oil parents the high [oil] progeny may be due to date of blooming—an environmental rather than genetic effect.

  “A desire was expressed for segregating material from a wider range of crosses for local selection work. More F2 seed can be obtained by spaced F1 plants. If any selection has been exercised in the F2 generation, this fact is important to know when studying the F3 and such notes should accompany the distribution of any of this material. In the F2, selection can be made for some characters such as maturity and disease resistance. Dr. Myers expressed the opinion that if we know more about inheritance of quantitative characters and what factors could be selected for in the F2 and what could not be, we would be in a position to make more rapid progress. It was his opinion that we would make more progress in the next 10 years by concentrating on fundamental studies coordinated in a balanced program with practical breeding than we would through practical breeding alone in a similar length of time.

  “Soybean Disease Investigations in the Southern States by Howard W. Johnson–The attention of those present was called to pages 102 to 107 of the “Results of the Cooperative Uniform Soybean Tests, 1948. Part II. Southern States” where the results of the soybean disease research in the South has been summarized. Particular attention was called to page 103 where are listed the varieties and strains in the uniform groups that appear to be resistant to the bacterial foliage diseases. In addition to the disease readings made on the uniform nurseries by the cooperating pathologists, strains appearing to possess resistance are planted in a special disease nursery at Stoneville, Mississippi, and an attempt is made to obtain a uniform infestation of the bacterial foliage diseases by inoculating spreader [sic] rows of the highly susceptible Ralsoy variety.

  “The work of Graham on the bacterial foliage diseases, of Lehman on purple seed stain, of Weimer on southern blight and of Holdeman on anthracnose was reviewed. Tables of data were presented showing that treating soybean seed with chemical disinfectants in the fall of harvest or in the spring before planting resulted in better stands at Stoneville, Mississippi, but failed to give increased yields with the relatively high seeding rates used.

  “Slides were shown illustrating the injury caused in soybean nurseries by the velvet bean caterpillar, the bean leaf beetle and the green clover worm. Practical control of these pests can be obtained by timely applications of D.D.T. dust. The copper dusting experiments in North Carolina and at Stoneville were reviewed and the possibility of using a D.D.T.-copper dust mixture for control of insect pests and bacterial foliage diseases was suggested.

  “Preliminary results of tests set up at Stoneville, Mississippi in cooperation with the Southern Regional Research Laboratory to determine whether a mixture of propylene glycol dipropionate and 4,6-bis-chloromethyl xylene applied to soybean seed in the fall would prevent loss of viability during storage were presented.

  “While no significant differences were evident in the data for the first four months of storage, attention was called to the fact that the test had been set up with S-100 seed, having an original moisture content of 10.4 percent. Could the test have been set up earlier while the moisture content was above 14 percent, it is felt that benefits from treatment might have been demonstrated.

  “Thursday afternoon, March 3--J.P. O’Kelly, Chairman
“The Place of the New Varieties Released in the North Central States by L.F. Williams—Several new varieties have been named in the Northern States in recent months and the origin and place of these may be of some interest to this group. The Wabash variety is derived from a cross between Dunfield and Mansoy. This variety is similar to Chief in maturity and is an improvement over Chief in yielding ability, resistance to lodging and in oil content of the seed. It has been a much more dependable yielder in Group IV than Chief and Gibson. It is being released by Indiana, Illinois, Missouri and Kansas and is recommended for the Southern portion of Indiana and Illinois, and the Central portion of Missouri.

“The Hawkeye variety is descended from a cross between Mukden and Richland. This variety is of Richland maturity and is similar to Richland in appearance, but yields much better, is somewhat taller, and has a higher oil content. It has been released by Ohio, Indiana, Illinois, Wisconsin, Iowa, Minnesota, Nebraska and South Dakota. This variety should replace Richland in commercial production.

“The Monroe variety is from a cross between Mukden and Mandarin and has been released particularly as an early variety to precede winter wheat in Northern Ohio. It is between the two parents in maturity” (Continued). Address: Secretary to the Conference, Agronomist, Forage Crops & Diseases, U.S.D.A., Beltsville, Maryland.


• Summary: (Continued): Page 20: “Based partly on procedures previously found helpful in other sections the committee recommended the following six points that might be useful to the soybean plant breeders.

  “1. Regional testing. All soybean selections contemplated for release should be widely tested in the region through the facilities of the uniform soybean tests.
  “2. Seed increase. New varieties intended for release should be simultaneously increased by the interested experiment stations in the area where the new variety would be adapted.
  “3. Naming varieties. General names should be selected and announced after seed is available for distribution.
  “4. Preventing escapes. Effort should be made to prevent the escape of small quantities of seed of new soybean varieties before the time of the official experiment station release.
  “5. Preparation and release of information. The sponsoring agencies should prepare general information regarding a new variety and distribute it to other states so that they could modify and add to it to meet their local conditions. Only general information should be given to national farm magazines.
  “6. The soybean crop conference should have general supervision over the release of a new variety.

“The committee suggested that the recommendations developed by the directors of the North Central States be given careful consideration by each collaborator in order that he could come to the next soybean conference prepared to discuss rules that should be set up in the Southern States.

“It was moved by Dr. Gray of Louisiana that the report of the North Central Directors regarding “Recommendations of the Seed Practices Committee of the North Central Region” be incorporated in the minutes of this conference so that they could be studied in detail between now and the next meeting of the Southern Soybean Conference group. This motion was carried unanimously and the secretary directed to incorporate these recommendations, if approval could be secured from Dr. N.J. Volk, Administrative Adviser of the Regional Technical Committee on Seed Practices of the North Central Directors. These recommendations are as follows:

“RECOMMENDATION NO. 1: REGIONAL TESTING

THE COMMITTEE RECOMMENDS THAT THE DIRECTORS ASK THE FARM CROPS RESEARCH WORKERS TO INITIATE OR CONTINUE COOPERATIVE REGIONAL TRIALS OF ALL IMPORTANT FARM CROPS, WHERE FEASIBLE, SO THAT NEW AND PROMISING STRAINS MAY RECEIVE ADEQUATE REGIONAL TESTING DURING THE TWO OR THREE YEARS PRIOR TO THE POSSIBLE DISTRIBUTION OF THE NEW STRAIN OR VARIETY TO SEED PRODUCERS.”

Page 21: “There have been instances in the past, and there are several right now, of new varieties ready to be released that may have regional adaptation but which neighboring states have not had an opportunity to test thoroughly. Breeders should be given the opportunity by the Directors to meet periodically to discuss test results, to select strains for regional tests, and to inform each other of new strains approaching release.

“RECOMMENDATION NO. 2: SIMULTANEOUS MULTIPLICATION

THE COMMITTEE RECOMMENDS THAT AT THE TIME IT IS DETERMINED THAT A STRAIN WILL BE NAMED AND RELEASED THE FOSTERING AGENCY OR AGENCIES SHALL SUPPLY THE INTERESTED STATES WITH A REASONABLE AMOUNT OF SEED FOR SIMULTANEOUS MULTIPLICATION.

There are a number of good examples of shortages of seed in one state or another and of existing policies that prevented an interested state from securing seed. Approval of the above recommendation would tend to eliminate such situations.

“RECOMMENDATION NO. 3: NAMING VARIETIES
“THE COMMITTEE RECOMMENDS THAT ALL NEW VARIETIES HAVING REGIONAL ADAPTATION BE GIVEN NAMES OF A GENERAL NATURE WHENEVER POSSIBLE. THE NAMES SHOULD NOT BE ANNOUNCED UNTIL AFTER SEED HAS BEEN PRODUCED FOR GENERAL DISTRIBUTION.

“Possible names should be discussed by the breeders from the states concerned but final choice should be the privilege of the originating agency or agencies. Good examples of satisfactory general names are: Vicland [sic], Lincoln and Midland.

“RECOMMENDATION NO. 4: PREVENTION OF ESCAPES

“The committee recommends that the directors insist that precautions be taken by research and extension workers to prevent escapes.

“Escapes occur in a number of ways, such as: (1) Seed given to friends by state and federal employees; (2) Farmers harvest test strips planted on their farms for demonstration or testing purposes; (3) Seed deliberately taken by individuals having no right to the seed. Multiplication of seed via the escape route makes orderly distribution of seed very difficult.

“RECOMMENDATION NO. 5: PREPARATION AND RELEASE OF INFORMATION

“The committee recommends that pertinent information as to the basic facts of origin and characteristics, and data justifying the increase and release of a new variety shall be prepared by the fostering agency or agencies. Participating states shall use this material supported or modified by them information in state publicity. Publicity intended for national or regional periodicals should include information on the regional adaptation of the variety. A uniform date for the release of initial publicity shall be agreed upon by the interested states.

“The fostering agency or agencies are best qualified to prepare the initial publicity. They have the background information and facts from which to describe the development and the characteristics of the variety. Advanced publicity has often complicated the distribution problem. In some cases, the publicity has been put out too soon, and in others, it was not complete. Recommendation No. 5, if followed, should ensure agreement ahead of time on the nature and time of release of publicity.


“The committee recommends: (a) that specific crop conferences functioning currently or to be organized also handle the seed distribution problems for their respective crops in accordance with recommendations set forth in this report. When multiplication and distribution of a new variety are to be considered, representatives of the seed practices committee from the states interested in the variety shall automatically become members of the crop conference; (b) that new crop conferences be created whenever the need demands it to handle crops not already covered by a conference; (c) that the United States Department of Agriculture be invited to send representatives to each meeting; (d) that the seed practices committee of the North Central Region be called together only when matters of policy or some problem affecting the whole region has arisen that require the action of the entire committee.

“A number of conferences are currently functioning such as the soybean conference, alfalfa conference, barley institute, flax institute, wheat conferences and others. Some of these conferences have been making recommendations with respect to seed multiplication and distribution and should continue to do so in accordance with the recommendations set forth in this report. It is suggested that closed meetings be held when desirable to discuss problems pertaining to the recommendations presented herein.

“RECOMMENDATION NO. 7: MASS MULTIPLICATION AND SEED DISTRIBUTION PLANS

“The committee recommends that in addition to carrying out recommendations 1, 2, 3, 4, and 5, these crop conferences shall develop regional plans for the mass multiplication and distribution of new crop varieties.

“RECOMMENDATION NO. 8: APPROVAL FOR MEETINGS AND REPORT OF PROCEEDINGS

“It is recommended that all crop conferences clear all meetings through, and report proceedings to the administrative adviser of the seed practices committee.

“Such a procedure would make these meetings official with respect to the North Central Directors’ Association.

“APPROVED by the North Central Directors April 13, 1948.

“c. Committee to consider needed research on fertilizer applications and the effect of competition on the accuracy of yield testing in soybean nurseries—W.R. Paden

“The committee did not recommend any uniform large scale fertilizer test but drew up the following general suggestions which the collaborators could adapt to their local
needs:
  “Fertilization
  “The policy recommended by the committee is that each cooperator obtain a soil sample from his proposed nursery area prior to planting and have a test made at his state soil testing laboratory. This test will serve as an aid for any soil...” (Continued). Address: Secretary to the Conference, Agronomist, Forage Crops & Diseases, U.S.D.A., Beltsville, Maryland.

  • Summary: (Continued): Page 24: “List of Names Used for Soybean Varieties
    The conference directed the secretary to append to this report a complete list of all names that have been used for soybean varieties in the United States.
    “This list, which is attached, was prepared by Mr. Morse as a guide to avoid duplication in naming of new varieties.
    Note: This list is identical to the 9-page attachment to RSLM No. 148 (March 1948).
    “Friday morning, March 4–John Gray, Chairman
    “Work of the Northern Regional Research Laboratory by John R. Cowan, Northern Regional Research Laboratory, Peoria, Illinois. Dr. Cowan reported to the group that Dr. Milner is now Director of the Northern Regional Research Laboratory, having been promoted from Head of the Analytical and Physical Chemical Division. The position as Head of the Analytical Division will be filled by Dr. Fritz Scente. A new division has been added to the Laboratory during the past year, a Motor Fuels Evaluation Division. The principle accomplishment of the Motor Fuels Division has been the development of a fuel injector operating off the manifold pressure of a gasoline engine to inject an alcohol and water mixture automatically as the manifold pressure increases. By this device trucks and automobiles with relatively high compression engines will be able to use 3-grade low octane gasolines while running under average light loads and will ordinarily use the alcohol-water mixture to increase octane rating of the fuel mixture as the power demand increases either for acceleration or for hill climbing. The principle has considerable promise and is being actively tested under practical road conditions.
    “The Laboratory has five RMA projects under way in addition to the regular fund projects: utilization of grain, flavor stability of soybean oil, development of anti-biotics, utilization of soybean flour and utilization of lecithin.
    “Spectrophotometric methods are being developed for determining the percentage of the different fatty acids in soybean oil. Studies are also being made of the refining losses in soybean oil and the best methods for determining refining losses. The Laboratory has established an organoleptic test panel for measuring soybean oil reversions as a part of flavor stability studies. This method so far has been the most promising and the only reliable method of studying flavor revision. The method has been refined to the point where small differences can be measured fairly reliably.
    “Soybean oil is a major food oil in this country at the present time, though it may not remain so unless the problem of flavor reversion can be solved. The Laboratory and others working on the problem are beginning to see definite progress though much remains to be done. Among the causes of flavor reversion are trace amounts of metals. Iron is the most important and 0.3 parts per million will have a measurable influence on stability. One part per million in often present in samples of soybean oil. Citric acid measurably improves the stability of samples. There are also a number of other agents including carboxylic acid and some of the phosphates, which, when added to oil, will make the iron no longer available as a pro-oxidant. These compounds are added in trace amounts of water at the start of the refining process.
    “It has been suggested that phosphatides may be the cause of flavor reversion. Every fraction of phosphatide material that has been removed from soybean oil and later re-added has improved flavor stability, thus it is no longer thought of as a cause of reversion.
    “The Laboratory has been working on corn protein and has developed excellent zein fibers. Dr. Cowan exhibited a hat made of 15 percent zein and 85 percent rabbit fur that had excellent durability as a hat material. One advantage of this zein fiber is that it can be dyed in an acid bath the same as wool. The fiber has good wet strength, which also is an advantage over some other vegetable fibers.
    “The Engineering Division of the Laboratory has improved the liquid-liquid extraction process to the point where a fraction can be produced that is a superior paint oil, and another fraction produced that is a satisfactory vegetable oil equal to untreated oil for food use.
    “Alcoholic extraction has been developed to where 95 percent alcohol can be used economically without distillation in a low pressure extractor and a better oil for food use can be obtained than from hexane extraction. Those oils are more free of gums. A lighter meal can also be obtained from the alcohol extraction. The process is in pilot plant scale and appears promising from the standpoint of economical operation.
    “Another product of the Laboratory has shown considerable promise. This has been named Gelsoy and is obtained from water extraction of meal that has been previously extracted with alcohol to remove a gel inhibitor. The Gelsoy can be used industrially in crown seals and has a vegetable glue. As an edible product it can be used in stable
ice cream and as icings and candy.

“Another development of the Laboratory has been the modification of soybean oil to a product with a configuration similar to that of tung oil. The process involves addition and splitting off of chlorine and one of the early difficulties was that of chlorine removal. Now the process has been refined to the point where all but one percent of the chlorine can be removed, making the oil very suitable for industrial use.

“The Paint Section of the Laboratory, using 100 percent soybean oil in the vehicle, has been able to develop a very suitable 8-hour drying paint that stands up well and has no after-tack. Chemists have learned that the addition of 4 percent CaO [calcium oxide / lime], will materially speed drying, improve durability, prevent dirt collection and prevent after-tack. The drying time of this paint is around 8 hours compared to 4 hours for linseed oil.

“A discussion of iodine number in relation to soybean breeding followed Dr. Cowan’s talk and in response to a question, he stated that flavor reversion, if caused by linolenic acid, would be a proportional effect and on this assumption he felt that the lower the iodine number the more stable an oil should be. Dr. Cowan stated that the rate of oxidation of oleic, linoleic, and linolenic acids were in the ratio of 1 to 12 to 24. Thus a small shift in linolenic acid might be important in oil stability.

“The Conference adjourned after expressing gratitude to the Bankhead Hotel and to others who had made the arrangements for the meeting.

“W.J. Morse, Secretary to the Conference. Birmingham, Alabama, March 4, 1949.” Address: Secretary to the Conference, Agronomist, Forage Crops & Diseases, U.S.D.A., Beltsville, Maryland.


Note: This work was done in the pilot plant and laboratory of The Buckeye Cotton Oil Company (subsidiary of The Procter and Gamble Company). Address: Soybean Research Council, Technical Div., The Buckeye Cotton Oil Co., M.A.&R. Building, Ivorydale 17, Ohio. Subsidiary of Procter & Gamble Co.


• Summary: Near bottom of title page: “United States Department of Agriculture. Agricultural Research Administration. Bureau of Plant Industry, Soils, and Agricultural Engineering, Division of Forage Crops and Diseases, cooperating with State Agricultural Experiment Stations.”


• Summary: “Dear Mr. Cartter:

“In 1946 Dr. Burlison, head of the Agronomy department, discussed with you the matter of a temporary steel building at South Farm to be used as a utility and storage building in connection with the cooperative soybean breeding research program. At that time, the plans of the Experiment Station were not developed very far with respect to the building program at South Farm. In the last two years we have given consideration to the development of a series of small buildings grouped around the main seedhouse and it appears that several cooperating agencies will be wanting to build structures of this nature.

“We have had occasion to develop plans for other branch stations of the Illinois Experiment Station during this period and have gone over almost entirely to the utilization of concrete blocks as a building material. We would prefer, if possible, to have you utilise this same type of construction in your proposed storage and utility building at South Farm.

“We find in the development of plans for buildings at the Farm that if we permit a large number of small structures of different types to be erected, the development is apt to look haphazard. We would, therefore, prefer to have two or three agencies go together in the development of these storage buildings so that a common wall could be used between them, making the buildings appear larger and more orderly. It would, therefore, be helpful in the development of our Agronomy Farm campus if your building could be of
concrete blocks and built together with the building which
the Natural History Survey is now preparing to erect.
“Yours very truly,...”
Source: Univ. of Illinois Archives, Agriculture, Dean’s
Office Subject Files 1895-1994. R.S. 8/1/2. Box 28. Folder:
Soybean Regional Research Lab. Address: Associate
Director, Agric. Exp. Station, Univ. of Illinois, Urbana,
Illinois.

the soybean laboratory. Letter to Mr. J.L. Carter, Director,
U.S. Regional Soybean Laboratory, 205 Davenport Hall,
Urbana, Illinois, May 26. 2 p. Typed, without signature
(carbon copy).
• Summary: “... When you have gotten approval for your
building, we can determine its location in consultation with
Dr. Burlison and others.
“We were fortunate indeed to obtain a high quality,
semi-prefabricated, ‘demountable’ building of the modern
design for the Natural History Survey. The quoted price
for the erection, including high quality baked-enamel
aluminum siding, is $4,457. This is nearly $1,000 less than
for a comparable concrete block structure and apparently
considerably less than for a steel-framed building with
galvanized iron covering.
“If your specification could have been modified to
permit this type structure, we could get it for $4,357 (so far
as I can determine, you could still obtain the building for this
cost).
“Actually the only difference in the general character
of the ‘Best farm’ building and a steel-framed, steel-covered
structure is in the walls and trusses (steel vs. wood) and the
covering (steel vs. aluminum).
“I understand fully the problem of conforming to the
budget bill which prescribed the particular structural details.
In my judgment, important advancement has occurred in the
period since plans were first made. Now we can obtain high
quality aluminum covering material, wood truss designs
are prefabricated from No. 1 lumber and metal timbers
connectors, and specialized crews are available for erection.
“We shall give every possible co-operation in meeting
your needs. Although members of the experiment station
staff agreed to the placement of a plain galvanized steel
structure on the farm, recent progress does raise the question
of its desirability. I feel certain that the administrative
officials will wish to review the plans and specifications for
the new building before final decisions are made...”
Source: Univ. of Illinois Archives, Agriculture, Dean’s
Office Subject Files 1895-1994. R.S. 8/1/2. Box 28. Folder:
Soybean Regional Research Lab. Address: [Prof. of Farm
Structures, Dep. of Agricultural Engineering, Univ. of
Illinois, Urbana].

404. Soybean Digest. 1949. Beckel, worker with soy protein,
“Most edible fatty products develop flavors and odors which may be described as rancid. Soybean oil, on aging or when used for frying or cooking, develops rancid odors and flavors just as do other oils. But in addition it also develops more dominant flavors and odors, which are best described as painty, grassy, or fishy. This is sometimes called ‘reversion.’ These flavors are held to a minimum in hydrogenated products and are most predominant in liquid or salad soybean oil. Refiners of oil consider this ‘reversion’ problem to be of first importance.

“The American Soybean Association and the National Soybean Processors Association have placed it at the top of research problems dealing with the utilization of soybeans. Reports of refiners indicate consumers show a preference for vegetable oil products which contain 50 percent or less of hydrogenated products and are most predominant in liquid or salad soybean oil. Refiners of oil consider this ‘reversion’ problem to be of first importance.

“Simultaneously, it has been necessary to set up laboratory procedures which permit evaluation of proposed cures and give us a basis for attempting to determine the effect of various refining procedures on the oil. Since the paired-sample technique was adopted for taste panel work, it was decided to build our program around procedures which would permit refining, bleaching, and deodorizing four samples at once. There was nothing magic in four samples; four appeared to be the largest number of samples which could be deodorized (steamed under vacuum at 210º C.) under identical conditions. Four samples permitted us to have a control and three variables in every deodorizing four samples at once. There was nothing magic in four samples; four appeared to be the largest number of samples which could be deodorized (steamed under vacuum at 210º C.) under identical conditions. Four samples permitted us to have a control and three variables in every deodorization if we so desired. Figure 3 shows the laboratory deodorizer used for our work.

“Table II shows how successful we have been in obtaining reproducible results. Note that all four samples vary in flavor score at zero time from 7.9 to 8.3 with no significant difference between samples. After aging to develop flavor and testing one against the other, the biggest difference between any two samples tasted as pairs was 0.6 and no significant differences are found. The extent of oxidation in the oxidizing tests at 100º C. varies between 52.7 and 54.5 peroxide value; this difference is not significant. The samples, you will note, are not identical although supposedly identical treatments were given. However, the differences between samples are not significant, i.e., they were probably caused by chance circumstances.

“In addition to the taste panel evaluation we also have determined oxidative stability as measured by the peroxides in samples stored at 60º C., in samples after 8 hours at 100º C. with a stream of air passed through the sample (A.O.M. [active oxygen method]), and in samples stored at room temperature.

“In 1945, Warren Goss, formerly a chemical engineer at the Laboratory, investigated the German vegetable oil industry and came home with a number of suggestions regarding soybean oil. Two of these suggestions were that
lecithin is responsible for ‘reversion,’ and should be removed by repeated water washing, and that citric acid added during deodorization retards appearance of ‘reversion.’ Using the procedures mentioned above, we examined these two conditions and concluded that citric acid does improve flavor stability but it does not do so by inactivating the lecithin.

“Table III shows how the flavor score of the oil changed on storage at room temperature. Note how the peroxide level increases immediately in the control sample but does not appreciably increase in the citrated sample for 18 weeks. Citric acid reacts with very small amounts of metals in the oils and prevents the action of these metals as catalysts for oxidation. One of the major offenders is iron and Table IV shows how citric acid reduces the oxidation in soybean oil as determined by the active oxygen method (A.O.M.)

“Note that the use of citric acid improved both the control sample and the sample containing added iron. Citric acid added after deodorization also appears to be helpful and it appears to serve both as a metallic fixative and synergist for antioxidants in the oil.” Continued. Address: Head, Oil and Protein Div., NRRL, Peoria, Illinois.


Handwritten: *Soybean Farming* is now available; prices are given for non-members and members, for 100 to 1,000 copies. Assessments: Regular $0.0004 per bushel, 40 cents per 1,000, $400 per million. Max. $3,200 per year. Min. $100 per year. July 6 meeting decreases the regular assessment to $0.0003 per bushel.


Standing committees: For each committee, the names of all members (with the chairman designated), with the company and company address of each are given–Traffic and transportation. Technical. Soybean grades and contracts. Oil trading rules. Meal trading rules. Crop improvement. Soybean research council. Uniform rules and standards for soybean oil meal. Safety and insurance. Lecithin. Regional: Ohio, Michigan, and East; Illinois, Indiana, Kentucky, Wisconsin; Iowa, Minnesota, Nebraska, South Dakota; Missouri, Kansas, and Mississippi River Delta Sections. Handwritten on blank facing pages: Nominating committee. Reception committee. Official weights committee. Crop improvement steering committee. Two new members (people; Francis E. Calvert, The Drackett Co., Oct. 1949).


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• Summary: “Geo. M. Strayer, secretary-treasurer of the American Soybean Association, Hudson, Iowa, and J.L. Carter, director of the U.S. Regional Soybean Laboratory, Urbana, Illinois, left New York City September 16 by air for Frankfurt, Germany on a 6-week technical mission for ECA.

While abroad Strayer and Carter will analyze the soybean production program in various European countries under the Marshall plan. They will check varieties and the breeding work on the soybeans that are being raised for food in these countries.

“The two men will also appraise the use of U.S.-grown soybean in European food products. They will visit manufacturing plants making these products to seek possible recommendations for ECA and U.S. soybean growers on how best to meet European needs. Manchuria supplied the European market for soybeans before the war, but European countries are now depending on U.S. soybeans.

“The trip is being financed entirely by ECA funds.

“Countries to be visited include Germany, Denmark, Sweden, Holland, Belgium and possibly France. Headquarters will be at Frankfurt.”


• Summary: Keller E. Beeson, extension agronomist at Purdue University and former president of ASA, was born on March 18, 1894 at Columbia City, Indiana. Now deceased, he had been an extension agronomist at Purdue beginning in 1924. He cooperated with the railroads in running the educational “Soybean Special” trains through Indiana. Before the days of the Soybean Digest, Mr. Beeson pioneered the preparation of the printed report of the annual meeting, which was ready for distribution at the meeting. He also started the mimeographed circular letters that went out at intervals to the membership. These were forerunners of the Digest.

“Jacob Hartz, Jr., Arkansas farm and seed leader, and onetime president of ASA, was born at Racine, Wisconsin, on April 4, 1888 the son of German immigrants. He was one of eight children. Because of his father’s poor health he was forced to leave school after completing the eighth grade. At the age of 20 he went to work as a traveling salesman for the P & O Plow Co. and spent several years in Arkansas.

“In 1917 Mr. Hartz moved to Wheatley, Arkansas, and went into the hardware business. In 1924, he moved to Stuttgart, Arkansas, his present home. There he joined his father and A.R. Thorell in the Hartz-Thorell Supply Co. which grew and prospered and became the leading farm machinery business in the state.

“It was early in this business that Mr. Hartz became interested in soybeans and started on the journey that was to make him one of the soybean pioneers and leaders of the South. Hartz was looking for a soil building crop to save the rice farmers of the Grand Prairie section of Arkansas who were driving themselves to ruin with a one-crop program of rice. Rice takes a tremendous amount of nitrogen from the soil and nothing was being done to replace this needed element.

“In conjunction with the Peoples National Bank of Stuttgart [in about 1925] the Hartz-Thorell Co. bought 25 bushels of Laredo soybeans. These beans were put out with key farmers over the Grand Prairie in small quantities and were planted on land that had been in rice the previous year. When the beneficial results that followed were noted [the rice farmers used the soybeans as a hay crop], a never ending search for the most suitable varieties was begun. Mr. Hartz and his partner soon found themselves in the seed business [starting about 1926] where the former has remained ever since.

“Mr. Hartz had a manifold job, the chief of which his boys have always referred to as ‘Pop’s Preaching the Soybean Gospel’ to farmers and agricultural leaders in Arkansas and the South. In their contacts and travels many years later they are continually running into men who say that Mr. Hartz started them in the soybean business.
He found a market for the farmer’s bean crop and was instrumental in having favorable freight rates established for soybeans and other Arkansas farm products. “In 1936 the Hartz-Thorell Supply Co. designed and constructed what remains the most modern and efficient seed cleaning processing plant in the South. ‘The Hartz-Thorell partnership was dissolved in June, 1942. Mr. Hartz and his two older sons, B.J. and Jake, Jr., acquired the seed end of the business which they operate under the title Jacob Hartz Seed Co.

“Mr. Hartz worked diligently in several seed organizations such as the Arkansas Seed Growers Association, the Arkansas Seed Dealers’ Association, and the Southern Seedsmen Association. He was elected president of the first two and first vice-president of the third, a South-wide seed dealers association. In all of the organizations he has fostered the soybean and guided its progress. He served many years on the Arkansas State Plant Board. In this capacity he helped in the first certification of soybean seed in the state.

“There is one other organization that he has helped to build, one that is dear to his heart, the American Soybean Association. He was elected the first Southern director and has served in that capacity until the present. He is a former vice president of the Association.

“The above are some of the things that long ago earned for Mr. Hartz the deserved title of ‘Soybean King of Arkansas.’”

“E.F. Johnson, affectionately known as ‘Soybean’ by an entire industry, has been a real pioneer and has made a contribution both as a grower and processor. He was born at Stryker, Ohio, 59 years ago [ca. Oct. 1889]. He received his education at the University of Indiana, Purdue University, and Ohio State University. He started his soybean plots in the spring of 1912 and has been a grower ever since. At present, he is a producer of edible varieties. He was a teacher of extension work for 7 years and an assistant professor for 2 years. For a time he was agricultural director for the Soo Line. He is now affiliated with the Delphos Grain & Soya Products Co., Inc., at Delphos, Ohio. He served as president of both the American Soybean Association and the National Soybean Processors Association, and as treasurer of the latter organization. He has been actively interested in the National Farm Chemurgic Council since its inception. Mr. Johnson has always been very active in the work of the American Soybean Association, serving on programs and committees. One of the early annual meetings of the Association was held on his farm. He was one of those whose efforts and encouragement brought about the founding of the Soybean Digest.”

Photos show: (1-3) Individual portraits of Keller Beeson, Jacob Hartz, Sr., and E.F. Johnson. (4) Three U.S. Regional Soybean Laboratory agronomists at the ASA convention: Dr. Lewis Saboe, Columbus, Ohio; Leonard F. Williams, Urbana, Illinois; Albert H. Probst, Lafayette, Indiana.

Note 1. Concerning E.F. “Soybean” Johnson: There are many published lists of the presidents, officers, and directors of the American Soybean Association (ASA). E.F. Johnson is never listed as a president, or as an officer, or as a director of the ASA. In 1937-38 he was elected president, chairman of the executive committee, and chairman of the statistical committee of the National Soybean Processors Association (NSPA). Strangely enough, one E.C. Johnson of Stryker, Ohio (the same small town in which E.F. Johnson was born and raised and lived until the 1930s) was vice-president of the ASA in 1924 and 1925, yet several extensive searches by experts in Stryker, Ohio, can find no evidence that a person named E.C. Johnson ever lived in Stryker (See 1999 letter from Jane Anderson of Stryker). Her theory is that E.F. and E.C. were one and the same person.

Note 2. This is the earliest article seen that mentions the Delphos Grain & Soya Products Co.


• Summary: A horizontal typewritten 2-page fill-in form.

Below that, flush left: “Budget statement for 1948 fiscal year.

Below that is a wide blank table with 7 rows and 6 columns: (1) Date of Entry. (2) Description. (3) Amount Paid. (4) Unencumbered Balance. (5) Remarks.

Below that: “Letter of Authorization No. ___ Assigned to ___

Below that is a continuation of the same table as above, also with 7 rows and 6 columns.

Page 2 is filled with the same 6-column form and its heading as page 1.

Since RSLM 145 is dated Oct. 21, 1949, this form (RSLM 144) must have been created before that date, and probably shortly before that date. Address: Urbana, Illinois.


• Summary: A vertical typewritten 1-page fill-in form.

The top blank line is for writing the destination of the trip.

“Name (blank line)

“Date (short blank line) Left Urbana, Illinois

“Date (short blank line) Arrived

“Date (short blank line) Left

“Date (short blank line) Arrived

“Date (short blank line) Left

“Date (short blank line) Arrived Urbana, Illinois.

“Method of travel (long blank line)

**Summary:** A comprehensive review of the literature on soybean breeding and management. The first such treatment since Piper and Morse’s classic book, *The Soybean* (1923). Contents: 1. Introduction. 2. Production and distribution: In the world, in the United States. 3. Disposition and utilization. 4. Physiology of the soybean plant: Floral initiation (varietal differences, duration of dark and photoperiods, light intensity and photosynthesis, age and position of induced tissue, temperature effects), nutrition (nitrogen, phosphorus, major cations, micronutrients), root temperatures. 5. Effect of climate and location: Location and season effects, simulated hail damage. 6. Effect of cultural practices: Rotations, fertilizers and soil management (response, placement), seed inoculation, seed germinability (viability, disinfectants and protectants, hormones), time of planting, method and rate of planting, weed control, harvesting. 7. Genetics and cytology. 8. Variety improvement. 9. Effect on soils. 10. Disease and insect pests. 11. Regional approach to soybean research (U.S. Regional Soybean Laboratory). Address: Iowa State College, Ames, Iowa.


**Summary:** The Introduction states that this project was instituted at the request of officials of the German Government and financed entirely from Marshall Plan funds. The two-man “technical assistance team” traveled in Germany for about five weeks in Sept/Oct. 1949 “contacting soybean breeders, research institutes, growers, food manufacturers, oilseed crushers, and a wide variety of other persons working in the over-all field. Short trips into Sweden [to visit Sven Holmberg] and Holland were taken for the purpose of studying breeding work being done there on early-maturing soybean varieties which might be adapted to Germany or German breeding programs. Transportation throughout Germany was by Army automobile, making possible many visits to points not readily accessible by common carrier.

“Assistance in making contacts and arrangements was offered by Dr. William Bening of the German Soya Association, to whom thanks are also due for his time and energy in acting as interpreter in the German travels. Acknowledgements are also due Dr. Wilhelm Rudorf and the members of the staff of the Food and Agricultural Division of the Food and Agricultural Division of HICOG [High Commissioner for Germany] for their time, assistance and suggestions toward the betterment of this study. ECA is the European Co-operation Administration.” The last section, titled “Recommendations,” contains 11 recommendations, including: “3. We recommend the immediate inclusion of not less than 3% nor more than 5% soy flour in bakery goods and bread to improve the protein level and handling qualities and that the German Food Ministry make provision for the blending of soy flour with wheat and rye flour at that distribution level which will insure best utilization.

“4. We recommend the adoption of governmental measures necessary to facilitate the marketing and usage of sausage and meat products containing soy protein in reasonable amounts in order to increase food values and decrease food costs. Inclusion of 10% soy flour (dry weight) in a produce sold on the basis of its own merits at a price proportionally lower than pure meat products would appear to offer a promising means of protein fortification in the diet of the average German.

“5. We recommend that food manufacturers be encouraged to continue their work on specialty products utilizing soy for human consumption, especially candies, cookies, doughnuts and other products where soy protein is used in a desirable form to raise nutritional levels.”

“7. We suggest the necessity of an educational campaign by government and industry which will distribute factual information on the true food value of soy and soy products. Extreme care should be exercised in keeping all material factual.”

Note: This was George Strayer’s first trip overseas or to Europe to study the market potential for American soybeans. Address: 1. Director, U.S. Regional Soybean Lab., Urbana, Illinois; 2. Secretary-Treasurer, American Soybean Assoc., Hudson, Iowa.


**Summary:** “The first team of agricultural experts sent to West Germany under the program of technical assistance provided in the Marshall Plan completed its work and returned to the United States early in November according to an announcement made by the German Foods Ministry.

“Composed of Jackson L. Cartter, director of the Regional Soybean Laboratory of the U.S. Department of Agriculture at Urbana, Illinois, and Geo. M. Strayer, Hudson, Iowa, secretary of the American Soybean Association and editor of the *Soybean Digest*, this technical assistance team was financed by Marshall Plan funds, went to Germany at the request of Foods Ministry officials to make a survey of soybean production and utilization possibilities in West Germany. They spent 5 weeks traveling over Germany, Holland and south Sweden studying the soybean breeding
and testing work being done on European and American varieties, as it would apply to German conditions together with the processing of the crop and its incorporation into food products.

“Recommendations of the team of experts to German government officials included:

“A strong recommendation for continuation and expansion of soybean breeding work in an endeavor to produce varieties combining sufficiently early maturity with high yields;

“A suggestion that in today’s West German national economy commercial production of soybeans cannot be economical in view of present relatively low soybean yields as compared with high yields of carbohydrate crops; and a

“Strong recommendation that in a German food economy which falls far short of correct protein levels for growth and maintenance of the human body soybean protein should be incorporated in small amounts into staple items of the average diet.

“Contrary to current opinion in Germany,” commented Strayer, ‘soybean protein is not an ersatz product. In reality it is the most nearly balanced and complete of all vegetable proteins available in commercial quantities today. The quality of the protein compares very favorably with that of the best meats, and can be supplied at only a fraction of the cost. Proof of its nutritional qualities and commercial adaptation lies in its use in a high proportion of the candy, confectionery, bakery, and ground meat products made in the United States today.

“Properly prepared soy flour contains about 50 percent pure protein,’ Strayer continued,’ and when used in small quantities to enrich meat and bakery goods, two of the staples of the German diet, will naturally increase food values. Five percent soy flour added to wheat flour will increase by 50 percent the protein content of the loaf, as well as supplying a much more complete balance of essential amino acids.

“Germany,” Strayer continued, ‘has been a leader in soybean processing since the 1920’s, having developed the first solvent processing plants for oilseeds. The German foods industry has developed a number of very desirable food products, utilizing the value of soy protein in acceptable food products. Importations of raw soybeans are again possible, thus enabling Germany to produce the style and types of protein-fortified foods most desirable.’

“In discussing the possibilities of soybean production on a commercial basis in West Germany Cartter, who is in charge of the soybean breeding laboratory, which has developed varieties comprising 95 percent of the 13 million acres of soybeans now grown each year in the U.S., pointed out that European plant breeders have made a distinct advance through the production of soybean varieties sufficiently early for the German climate. American varieties do not lend themselves to commercial production here because of the difference in climatic conditions, however, they should be included in the breeding program.”

“However, we are convinced that at the present stage of development, and in view of the need for high tonnages of carbohydrate foods for human consumption, soybeans can be produced more economically for the time being in other parts of the world than Germany. For the time being it is only good logic to produce potatoes, wheat, rye and root crops here, supplementing them with proteins from outside sources.”

A photo shows J.L. Cartter (head to waist).


• Summary: “If just by waving a magic wand you could add a pound of oil to the yield of each bushel of soybeans processed in the soybean mills of this country, you would be adding from 15 to 40 million dollars worth of new wealth to the soybean crop each year. Then, if you could make soybeans yield 4 more bushels per acre your magic would be worth a hundred, million dollars a year.

“On March 16, 1936, the Secretary of Agriculture announced: Twelve North Central States and the U.S. Department of Agriculture have opened a cooperative soybean industrial research laboratory at Urbana, Illinois. With that announcement the research workers in these 12 states and those in the U.S.D.A. started working their magic in unison, and within the past dozen years they have waved approximately 1 pound more oil into each bushel of soybeans grown in the U.S., and they have also increased yields fully 4 bushels on each acre planted to soybeans.

“Of course, this was not all done by magic alone. A tremendous amount of painstaking work was involved. A lot of ground work had been done before 1936. Then, too, putting more oil in the beans and stepping up yields were only two of the things they were doing. They were coordinating the research program for a broad regional attack on soybean production and utilization problems. This regional approach to hybridization studies and tests and to the evaluation of varieties through the Uniform Variety Tests, study of diseases, etc. has had much to do with the improved composition of soybeans and with the development, testing, and distribution of better varieties.

“On July 1, 1942, research on utilization of soybeans and their by-products, which up to that time had been carried on at Urbana, was transferred to the Northern Regional Research Laboratory at Peoria, Illinois, where the research program on industrial utilization has been further developed. This change enabled the soybean laboratory at Urbana to extend the agronomic studies, including genetics, breeding, physiology, and diseases, to the agricultural experiment stations of 12 southern states.

“The magic of the agronomists, who are participating in the cooperative program of the Soybean Laboratory,
HISTORY OF U.S. REGIONAL SOYBEAN LABORATORY (1936-2017) 245

has been directed mainly to the improvement of varieties. Through introductions, selections, and hybridization, they have conjured up strains that are resistant to lodging and shattering, and which turn out better yields of high quality seed with high oil and protein content. Much progress has been made in the development of strains better suited to conditions of the various producing areas. They have pushed the limits of successful soybean production northward in Michigan, Wisconsin, Minnesota, and the Dakotas.

“A number of new varieties have been developed through introductions from the Orient and from selections, but the greatest number of improved strains have come from the hundreds of crosses that have been made between varieties. Individual varieties have superior qualities, such as, habit of growth, early maturity, high yield, high oil, high protein, and in the quality of these properties. No one variety combines all of the desirable features, so these scientists have made crosses of 2 or more varieties in order to bring together in the new strain the particular qualities wanted in its makeup. From the segregates of these crosses new and improved lines are selected. From their wand-waving have come such superior soybeans as Lincoln; Hawkeye, Earlyana, Adams, Monroe, and many others.

“That is why soybeans today are so much better than they ever were before–better plants, better seed, more oil, better protein, better adapted varieties, and yields per acre about twice as high as they were 20 years ago.”

On an outline map of the United States: “The States originally cooperating in the work of the Soybean Laboratory are those shown in black. Since 1942 the shaded States [in the south] also have been cooperating with the laboratory in its research program.”

Note: This is the earliest document seen (Nov. 2003) concerning the breeding or selection of soybeans for use as soy oil or meal.


* Summary: This is a combination obituary and memorial resolution: “Alfred Theodore Wiancko was born in Ontario, Canada and reared on a farm in that Province. He was graduated from the Ontario Agricultural College in 1895 following which he served there three years as Assistant Librarian and Instructor in German. From 1901 through 1902 he served as Instructor in Agriculture and Assistant Agriculturist at the Nebraska College and Station.

“In January, 1903, Wiancko was appointed Associate Professor and Associate Agriculturist at Purdue University and headed up both teaching and research in agronomic subjects. The School of Agriculture was reorganized into 4 major departments in 1908 and Prof. Wiancko became Head of the Agronomy Department. In the A.E.S. [Agricultural Experiment Station] the Department of Agriculture was changed to the Department of Agronomy in 1909 and in 1911 the soil fertility work of the Chemical Department was combined with the crops work of the Agronomy Department and called the Soils and Crops Department under A.T. Wiancko, Chief. In the fall of 1903, Prof. Wiancko and M.L. Fisher organized and taught two courses in crops and two courses in soils. Other courses in agronomy were added from time to time as well as additional staff members.”

“Prof. Wiancko’s primary interest was in research. In addition to the 10 acres of the University Farm set aside for research in agriculture (agronomy) he conducted a large number of cooperative tests with farmers in the early years. It was through these tests that soybeans were introduced into the Cornbelt in 1904. These cooperative tests were later replaced by outlying experiment fields on the major soil types of the state. At one time there were 11 such fields. In 1913, Prof. Wiancko was instrumental in having the University acquire the Wilson Farm–later the Soils and Crops Farm–consisting of 120 acres immediately east of Lafayette...”

“A full time soybean specialist was attached to the Agronomy Department in 1935 in cooperation with the Central Soybean Laboratory of the U.S.D.A.”

“Prof. Wiancko was a prolific writer on agronomic subjects and was either author or co-author of 23 bulletins, 27 circulars and 27 soil survey reports. He was active in the American Society of Agronomy in which he was elected a Fellow. He served with the Soil Survey Association in this country and as its President in 1922.”

“Prof. Wiancko retired as Chief of the Agronomy Department July 1, 1943 with the title of Professor Emeritus until his death December 10, 1949.”

Source: Purdue University, West Lafayette, Indiana, in the Department of Agronomy, Biographical File–Department Heads. A copy is on the back of Prof. Wiancko’s portrait hanging in the Department Heads Conference Room. Address: Dep. of Agronomy, Purdue Univ., West Lafayette, Indiana.


* Summary: “Relatively homozygous experimental strains and named varieties were tested. The U.S. Regional Soybean Laboratory Uniform Group Tests, I, II, and III, the Early Elite Test, the Early Pedigree Selection Test and the Late Elite Test were conducted in various parts of the state.”

Adams, a selection from Dunfield x Illini crosses, gave slightly higher seed yields, has a higher seed oil content and is somewhat earlier than Lincoln. It was released to growers in southern Iowa in 1949. Adams has consistently outperformed the standard soybean varieties grown in these areas: Earlyana, Early Minnesota Manchu, Habaro, and
Ottawa Mandarin, in seed yield and seed oil content.

“Regional testing has made it possible to evaluate more rapidly the performance of superior strains than would have been possible otherwise. For example, Hawkeye was selected, tested, increased and released for distribution in 1948 from a cross made in 1938.” Address: Ames, Iowa.


• **Summary:** Jackson L. Cartter and George M. Strayer, both U.S. experts on soybeans, discuss the goals and implementation of this technical project, which they have developed with Dr. William Benning.

Yet, despite the wording of this technical project, the U.S. soybean industry was mainly interested in selling soybeans and soybean products to West Germany. The U.S. had little interest in teaching German soybean breeders anything. Address: 1. Director, U.S. Regional Soybean Lab., Urbana, Illinois; 2. Head [Hauptgeschaeftsfiuehrer], American Soybean Assoc., Hudson, Iowa.


• **Summary:** “Most varieties of soybeans drop their leaves readily upon reaching maturity. Leaf separation is due, in all probability, to the formation of an abscission layer at the base of the petiole as explained for plants in general by Eames and McDaniels (1925). Several varieties of soybeans are known in which leaf abscission is considerably delayed and under some conditions at least a portion of the leaves may remain attached to the main stem for an extended period after maturity of the plant. Kingwa, a selection from a commercial lot of Peking made and described by Garber and Hoover (1932), was released as a variety primarily because of its marked ability to retain its leaves at maturity and, mainly for this reason, became popular in several soybean growing areas as a hay variety. This variety has been used exclusively as the delayed abscission type in crosses for the inheritance studies reported herein.” Address: Assoc. Agronomist, U.S. Regional Soybean Lab., Div. of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, ARS, USDA; and Purdue Univ. Agric. Exp. Station, Lafayette, Indiana.


• **Summary:** “A number of well known soybean authorities in industry and government will appear on the program of the 2-day soybean conference at the Northern Regional Research Laboratory at Peoria, Illinois, Jan. 16 and 17, Director R. T. Milner has announced.

“The meeting is slanted for soybean processors. R.G. Houghtlin, president of the National Soybean Processors Association, Chicago, Illinois, will be chairman of the first day’s program, Milner of the second.

“The complete program:

“January 16

“9:30 a.m.—Announcements and introductory remarks, Milner.

“9:45 a.m.—‘Development of New Varieties of Soybeans.’ J.L. Cartter, director U.S. Regional Soybean Laboratory.


“2:15 p.m.—‘Factors Affecting the Choice of a Method for Processing Soybeans,’ W.H. Goss, associate director, department of scientific research and technical development, Pillsbury Mills, Inc.

“3:00 p.m.—‘Importance of the Quality of Soybean Oil Meal in Present-Day Feed Formulation,’ by R.C. Holder, director nutritional department, Central Soya Co., Inc.

“4:00 p.m.—‘Problems in the Production and Use of Soy Flour,’ R.G. Brierley, vice chairman, Soya Food Research Council.

“January 17

“9:30 a.m.—‘Lime as a Hardening Agent in Soybean Oil Paints,’ A.J. Lewis, chemist, industrial oil section, oil and protein division, Northern Regional Research Laboratory.

“9:50 a.m.—‘Conducting a Taste Panel for the Evaluation of Edible Oils,’ Helen Mosher, food technologist, oil and protein division, NRRL.

“10:15 a.m.—‘Effect of Metals on the Quality of Edible Oil,’ C.D. Evans, in charge, edible oil section, oil and protein division, NRRL.

“11:00 a.m.—‘Cotton Acreage Allotment and Marketing Quota Program and Its Effect on the Production of Cottonseed,’ J. H. Dean, assistant director, cotton branch, Production and Marketing Administration.

“11:30 a.m.—‘Acreage Allotments for Soybeans and Other Oil Crops,’ Martin Sorkin, peanut and oilseeds programs division, fats and oils branch, Production and Marketing Administration.

“12:00 noon—General discussion and summary of meeting, Milner.”


• **Summary:** “Dr. Martin G. Weiss, research professor
of agronomy [at Iowa Agric. Exp. Station], has resigned, effective Jan. 15 to accept a position with the Division of Forage Crops and Diseases, United States Department of Agriculture, Beltsville, Maryland. He will be leader in charge of soybean investigation for the Bureau of Plant Industry, Soils and Agricultural Engineering, succeeding W.J. Morse who retired Dec. 1. Under his jurisdiction will be the U.S. Regional Soybean Laboratory at the University of Illinois and soybean work in 12 north central and 12 southern states. In addition he will supervise pathological work in a number of states.”

Weiss became a USDA collaborator at the Iowa Agric. Exp. Station in 1936. In 1938 he made a cross of Mukden and Richland soybeans from which the present Hawkeye variety originated. Photos show the author and Robert R. Kalton, who will replace him at Iowa.


• Summary: “About 135 soybean processors and others heard industry problems and new developments discussed by qualified experts at the 2-day soybean conference at the Northern Regional Research Laboratory in Peoria Jan. 16-17. The morning session of the second day was devoted to recent research at the laboratory and covered the soybean oil taste panel, lime as a hardening agent in soybean oil paints and the effect of metals on edible oil quality.

“Other papers covered such widely divergent subjects as new varieties, the soybean industry in Europe, hedging problems, methods of processing, quality of soybean oil meal in feed formulation and promotion of soy flour.

“Speakers on the program included: J.L. Carter, director, U.S. Regional Soybean Laboratory; Geo. M. Strayer, secretary-treasurer, American Soybean Association; C.E. Robinson, futures trading analyst, Commodity Exchange Authority.

“W.H. Goss, associate director, department of scientific research and technical development, Pillsbury Mills, Inc.; R.C. Holder, director, nutritional department, Central Soya Co., Indiana; R.G. Brierley, vice chairman, executive board, Soya Food Research Council.

“A.J. Lewis, chemist industrial oil section, oil and protein division, Northern Regional Research Laboratory; Helen Moser, food technologist, oil and protein division, NRRL; C.D. Evans, in charge, edible oil section, oil and protein division, NRRL; and J.H. Dean, assistant director, cotton branch, Production and Marketing Administration.

“A speech by Martin Sorkin, grain branch, Production and Marketing Administration, on ‘Acreage Allotments for Soybeans and Other Oil Crops,’ was cancelled. It was announced from the floor that the talk would not be given since no acreage allotment program for soybeans had been set up.

“Presiding at the sessions were R.G. Houghtlin, president of the National Soybean Producers Association [sic, National Soybean Processors Association], Chicago, Illinois; and R.T. Milner, director of the Laboratory [NRRL].

“States represented at the conference included: Illinois, Ohio, Indiana, Minnesota, Pennsylvania, Iowa, Missouri, Mississippi, Wisconsin, Massachusetts, Kansas, Kentucky, Alabama, New York, Georgia, Tennessee, Delaware, Nebraska, Michigan and Washington, D.C.

“Three of the papers given at the conference are carried in this issue of the Soybean Digest. Others will be published in future issues.

“Photos of informal groups at the conference shown on this page were taken by Kent Pellett, managing editor of the Soybean Digest.”

Five photos show groups of people at the conference talking and listening. The captions read: (1) “At left, two agronomists talk shop: C.R. Weber, U.S. Regional Soybean Laboratory, Ames, Iowa; and C.V. Feaster, Missouri Agricultural Experiment Station, Columbia, Missouri.

(2) “In center, part of the group at the soybean conference in Peoria Jan. 16-17. At far left you see Director R. T. Milner of the Northern Regional Research Laboratory, host to the conference.

(3) “At right, visiting between sessions are O.H. Alderks, manager technical division, Buckeye Cotton Oil Co., Ivorydale, Ohio; and H.A. Abbott, manager soybean division, Funk Bros. Seed Co., Bloomington, Illinois.


• Summary: Near bottom of title page: “United States Department of Agriculture. Agricultural Research Administration. Bureau of Plant Industry, Soils, and Agricultural Engineering, Division of Forage Crops and Diseases, cooperating with State Agricultural Experiment Stations.”


• Summary: Except for the cover, this document is typewritten.

Contents: Introduction. Cooperation (gives cooperating


**Summary:**
1. Capital–Selection from Strain 171 x A.K. (Harrow)
   - 2. Flambeau–Sel. from Introduction from Russia
   - 3. Hokien**–Sel. from Capital, Imperial Seed Co.
   - 4. Mandarin (Ottawa)–Sel. from Mandarin
   - 5. Pridesoy 57–Sel. from Pridesoy
   - 6. M8–Sel. from Lincoln x (Lincoln x Richland)
   - 7. M9–Sel. from Lincoln x (Lincoln x Richland)
   - 8. 0-17*–Sel. from Pagoda
   - 9. 0-200*–Sel. from Manchu
   - 10. 0-255–Sel. from Strain 171 x A.K. (Harrow)
   - 11. W4-2115*–Sel. from Lincoln x (Lincoln x Richland)

12. W5-2260–Sel. from Ontario x Richland
13. W6S-246**–Sel. from Lincoln x Pagoda
14. W6S-292*–Sel. from Lincoln x Seneca
15. W6S-341–Sel. from Cayuga x Kabott
16. W8S-1019**–Sel. from Kabott x Chief
17. W8S-1200**–Sel. from Richland x Flambeau
18. W8S-1460**–Sel. from Hawkeye x Flambeau

*** Entries from Preliminary Test, Group 0, 1949.

*** New entries.

Uniform Test, Group I, 1950
1. Blackhawk
2. Earlyana
3. Habaro
4. Harly
5. Mandarin (Ottawa)
6. Monroe
7. A6X-549
8. A6K-1329**
9. A6K-1801*
10. L6-8179
11. L6-8275
12. M2***
13. M10
14. W4-3190
15. W5-3346*
16. W5-3633
17. W8S-1025**
18. W8S-1035**

** Entry from Prelim. Test, Group I, 1947.

Uniform Test, Group II, 1950
1. Adams–Selection from Illini x Dunfield
2. Blackhawk–Sel. from Mukden x Richland
3. Earlyana–Sel. from a natural hybrid
4. Hawkeye–Sel. from Mukden x Richland
5. Lincoln–Sel. from Mandarin x Manchu
6. Richland–Sel. from P.I. 70502-2
7. A7-6102–Sel. from Lincoln x (Lincoln x Richland)
8. A7-6103**–Sel. from Lincoln x (Lincoln x Richland)
9. A7-6520–Sel. from Lincoln x (Lincoln x Richland)
10. A7-6619**–Sel. from Lincoln x (Lincoln x Richland)

11. C683**–Sel. from Mukden x Richland
12. C739–Sel. from Lincoln 7 (Lincoln x Richland)
13. C776–Sel. from Lincoln x (Lincoln x Richland)
14. H3665–Sel. from Richland x Wisconsin Manchu 3
15. H6150–Sel. from Lincoln x (Lincoln x Richland)
16. H6217**–Sel. from Lincoln x (Lincoln x Richland)
17. H6403–Sel. from Lincoln x (Lincoln x Richland)
18. L8-7289**–Sel. from Seneca. x Richland
19. W5-3372*–Sel. from Lincoln x (Lincoln x Richland)
20. W8-1028**–Sel. from Lincoln x Manchu 606

** Entry from Prelim. Test, Group I, 1949.

** New entries. 1. H6217** Sel. from Lincoln x (Lincoln x Richland) 2. H6403 Sel. from Lincoln x (Lincoln x Richland) 3. L8-7289** Sel. from Seneca. x Richland 4. W5-3372* Sc?. from Lincoln x (Lincoln x Richland) 5. W8-1028** Sel. from Lincoln x Manchu 606

Uniform Test, Group III, 1950

1. Adams–Selection from Illini x Dunfield
2. Chief–Sel. from Illini x Manchu
3. Dunfield–P.I. 36846
4. Illini–Sel. from A.K.
5. Lincoln–Sel. from Mandarin x Manchu
6. A7-1953–Sel. from Lincoln x (Lincoln x Richland)
7. C764*–Sel. from Lincoln x (Lincoln x Richland)
8. L6-1152–Sel. from Lincoln x (Lincoln x Richland)
9. L6-1503–Sel. from Lincoln x (Lincoln x Richland)
10. L6-2132–Sel. from Lincoln x (Lincoln x Richland)

* New entry.

Preliminary Test, Group III, 1950 [Note: Origin varieties are mainly Lincoln, Richland, Earlyana, Macoupin, Illini, and Manchu].

1. Chief
2. Lincoln
3. A7-2002*
4. 0974
5. 0976
6. 0977
“4. Wabash–Sel. from Dun
“2. Chief–Sel. from Illini x Manchu
“1. Anderson*–Rogue in Lincoln

Strain–Origin
Uniform Test, Group IV, 1950
Group III, because of insufficient seed.

“Uniform Test, Group IV, 1950

“Strain–Origin
“1. Anderson*–Rogue in Lincoln
“2. Chief–Selection from Illini x Manchu
“4. Wabash–Sel. from Dunfield x Mansoy
“5. C612–Sel. from C508 (Patoka x L7-1355)
“6. L6-1656–Sel. from Lincoln x (Lincoln x Richland)
“7. L6-5679–Sel. from Lincoln x Richland
“8. S7-270**–Sel. from Chief x (Macoupin x Chief)

** Due to its late maturity, Anderson has been transferred from Group III. L8-6797 and L8-6857, which were on the Tentative List of Entries for Group IV, will be grown in Group IV (South) instead, of Group IV (North).

*** Entry from Prelim. Test, Group IV, 1949

“Preliminary Test, Group IV, 1950;

“1. Chief–Selection from Illini x Manchu
“2. Cypress #1–Sel. from Korean, Valley Farms Co.
“3. Wabash–Sel. from Dunfield x Mansoy
“4. C612–Sel. from C508 (Patoka x L7-1355)
“5. C794–Sel. from Lincoln x Patoka
“6. C799–Sel. from C143 x Lincoln
“7. C801–Sel. from C143 x Lincoln
“8. C805*–Sel. from 0143 x Lincoln
“9. C975–Sel. from Lincoln x (Richland x Earlyana)
“10. C979–Sel. from Lincoln x (Richland x Earlyana)
“11. C982–Sel. from Lincoln x (Richland x Earlyana)
“12. C984–Sel. from Lincoln x Ogden
“13. C985–Sel. from Lincoln x Ogden
“14. C986–Sel. from Lincoln x Ogden
“15. L8-10755–Sel. from Lincoln x (Lincoln x C171)
“16. L8-1077R–Sel. from Lincoln x (Lincoln x C171)
“17. L8-10780–Sel. from Lincoln x (Lincoln x C171)
“18. L8-10789–Sel. from Lincoln x (Lincoln x Chief)
“19. L8-10952–Sel. from Lincoln x (Lincoln x Macoupin)

** Those strains were originally entered in the Uniform Test, Group IV, 1950; but because of insufficient seed, have been transferred to the Preliminary Test, Group IV.”

Address: Urbana, Illinois.


• Summary: Contents: Introduction. Variety tests prior to 1940. U.S.D.A. Regional Soybean Laboratory and soybean variety testing in 1942. Variety testing 1943 to 1950: Early maturing varieties (Group IV and V), late maturing varieties (Group VI and VII). Comparison of S-100 to Ogden.

“Soybean variety tests were conducted by the Oklahoma Agricultural Experiment Station as early as 1918. It was not until 1926, however, that a large number of varieties were available for testing. During the period 1926 to 1934, experiment station workers conducted tests at many different locations in the State to determine the reaction of soybean varieties to different climatic and soil conditions. These tests were located at Granite, Goodwell, Lone Grove, Pauls Valley, Purcell, Carrier, Eufaula, Durant, Okmulgee, Sapupa, Nowata, McAlester, Heavener and Stillwater.


“During the early years of World War II it became apparent that there would be a serious shortage of vegetable oils, fats, and high protein feed due to reduction in imports and the increased demands of war time needs. To meet this need the work of the U.S. Regional Soybean Laboratory of Urbana, Illinois, was expanded in 1942 to include cooperation with Oklahoma and eleven other southern states.” Address: Asst. Agronomist.


• Summary: “An important milepost in the development of the soybean industry in the United States has been attained during the past decade, 1940-1950. During this period the first soybean varieties developed through carefully planned controlled hybridization and selection programs were made available to growers. The development of these superior varieties and the extensive testing necessary to determine
their value was made possible by a closely coordinated research program between the U.S. Department of Agriculture and the cooperating state agricultural experiment stations.”

The costs to the federal and state governments of operating the U.S. Regional Soybean Laboratory are about $300,000 a year. In 1950 about 50% of the total soybean acreage in America was planted to the improved varieties developed by the Lab; they yielded an additional 3 bushels per acre on 6 million acres. At $2/bushel the extra soybeans are worth $36 million to soybean farmers and the increased oil content adds another $15 million, for a total increase in value of about $50 million a year. Address: Principal Agronomist, Div. of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, USDA, Beltsville, Maryland.


• Summary: “The first mention of the soybean in the United States is by Mease in 1804, who stated that ‘the soybean bears the climate of Pennsylvania very well and should be cultivated.’ In 1829, Thomas Nuttall grew a variety in the botanic gardens at Cambridge, Massachusetts. From observations he wrote, ‘Its principal recommendation at present is only a luxury, affording the well-known sauce, soy, which at this time is only prepared in China and Japan.’ The Perry expedition to Japan in 1854 brought back two varieties of soybeans which were distributed by the United States Commissioner of Patents. Frequent references to the soybean occurred thereafter in agricultural literature under such names as Japan pea, Japan bean, and Japanese fodder plant. [Note: The last two names do not appear in the SoyaScan database as of Nov. 1991.]

“Previous to the numerous introductions by the United States Department of Agriculture beginning in 1898, there were not more than eight varieties of soybeans grown in the United States and these with quite limited adaptation to soil and climatic conditions. With the introduction and development of new and improved varieties adapted to a greater range of soil and climatic conditions and uses, acreage and production gradually increased. Until about 20 years ago, most of the soybeans in this country were grown in the southern and eastern states. In 1919, the five leading states in soybean acreage were North Carolina, Virginia, Mississippi, Kentucky, and Alabama. By 1924, the relatively more rapid expansion of the crop in the north central region of the country brought Illinois into the leading position, followed by Indiana, Tennessee, North Carolina, and Missouri. Illinois has held the lead in acreage and production ever since, and the north central region has grown in importance as a region of soybean production and processing.

“Soybeans at first, and for several years, were grown primarily as a forage and pasture crop. Previous to 1930 the acreage harvested for seed was less than one-fourth the total acreage grown for all purposes. With the adaption [adoption] of improved methods of culture, improvement of machinery for planting, cultivating, and harvesting, adapted improved varieties for processing for oil, and with the development of markets for soybeans for crushing purposes, a gradual increase in the proportion of acreage harvested for soybeans took place. In 1939, 40% of the total soybean acreage was harvested for seed. The proportion for this purpose increased rapidly during the war years. In 1944, 72% of the total planted acreage was harvested for seed and in 1947, 84.5%. An important factor in the marked increase in acreage of soybeans in 1934 was the severe drought, which ruined large acreages of corn, small grains, and tame hay in the early season of the year—as a result of which soybeans were planted as an emergency crop. The program of the Agricultural Adjustment Administration, United States Department of Agriculture was a stimulus to the expansion in acreage of soybeans in the last half of the 1930’s. Corn acreage limitations and allotments restricted the acreage of corn and so increased the acreage of cropland available to other crops. Soybeans for seed, although classified as a soil-depleting crop in the principal producing regions, competed effectively for part of this acreage. The greatest annual increase in acreage of soybeans harvested for seed occurred in 1942, in response to the urgent appeal by the Government early that year for a large increase in soybean production to meet wartime demands for oil and fats. Programs of production goals and guaranteed support prices have contributed to maintaining production at a high level since 1942. The Government program for soybean processors, which greatly reduced their risks, was also of importance.

“Standards for use in grading and marketing soybeans
were set up by the United States Department of Agriculture as early as 1925 and in 1936 a future [futures] market for soybeans was established in Chicago. In 1929, a soybean laboratory was established in Ohio by the United States Department of Agriculture to conduct research toward the development of high-oil and high-protein varieties. In 1936, the United States Regional Soybean Industrial Products Laboratory was located at Urbana, Illinois, and in cooperation with the experiment stations of the 12 north central states began agronomic investigations in the development of new improved varieties for industrial purposes and chemical research on the development of new industrial uses for soybeans. In 1942, the laboratory work devoted to industrial uses was transferred from Urbana to the Northern Regional Research Laboratory at Peoria, Illinois. At this time the agronomic research remaining at Urbana was designated the United States Regional Soybean Laboratory and was expanded to include 12 southern states in addition to the 12 north central states originally served. The Regional Research Laboratory at Peoria conducts research on soybean processing and on processing and utilization of the oil and oil meal for food and industrial purposes.

“Numerous commercial concerns as well as many public research institutions, are conducting research designed to develop more efficient techniques in processing soybeans for food and industrial uses. Much research is also being conducted on methods for improving the quality of oil and flour, and for adapting these products to specific uses.” Address: 6809 Fifth St. N.W., Washington, DC; formerly Principal Agronomist, Div. of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, USDA, Beltsville, Maryland.


**Summary:** A comprehensive review of the subject.


**Summary:** “The National Soybean Crop Improvement Council, with the help and advice of Agricultural and Experiment Stations of the leading soybean states, has produced a new colored, sound, 16-mm. soybean movie entitled ‘Soybeans–The Feature Story.’

“Synopsis: This absorbing informative film, in full color, tells the interesting story of the origin and growth of the soybean from ancient China to its present important place in our National economy.

“A reporter’s assignment to write the story of soybeans takes him into many interesting phases of soybean production. At a local soybean processing plant the history of the soybean from its earliest beginning to the remarkable place it occupies in our agriculture today is vividly and interestingly portrayed. Processing methods, products, uses, markets, and research are presented in colorful sequences.

“Scientists at the Universities and the U.S. Regional Laboratory show how soybeans are crossed to produce new and improved varieties.

“The real heart of the film is the sequence of scenes emphasizing good cultural practices. The proper steps in planting, cultivating, weed control and harvesting are carefully stressed. Both live action and animation are used to show that soybeans, a legume crop, removes less plant food from the soil than most farm crops. The relationship of soybeans to runoff and erosion is explained and the right planting methods for sloping fields recommended. Out on the farms of soybean growers combining and marketing practices are portrayed. Here, with the help of the men actually producing the crop, the final appraisal of the soybean is made and the ‘Feature Story’ completed.

“Distribution: Copies of this film have been placed with the Extension Film Libraries of eight of the principal soybean states for the convenience of County Agents, Vo-Ag Teachers, G.I. Instructors, Schools, Farm Organizations, and others wishing to use the film. It may be secured from the Soybean Digest of Hudson, Iowa and most of the soybean processing companies have copies of the film for use in meetings in their local areas.

“In addition to the above distributing agencies, films will be available from Modern Talking Picture Service, 142 East Ontario Street, Chicago 11, Illinois. Film requests to Modern Talking Picture Service should be addressed to Chicago but the films will be supplied from the nearest one of their 10 midwest city branches.”

“Additional Soybean Literature Available with Film: For limited distribution to audiences seeing ‘Soybeans–The Feature Story’ (one copy per family of actually interested members) the National Soybean Crop Improvement Council, Box 108, Decatur, Indiana, will supply free upon request:

“A. Copies of a 4-page colored brochure giving the story of the film and some pertinent facts about the soybean crop.

“B. Copies of a 44-page booklet entitled ‘Soybean Farming’ which answers many of the questions about soybeans and the place this crop should occupy in our...
agricultural economy.”


• **Summary:** Near bottom of title page: “United States Department of Agriculture. Agricultural Research Administration. Bureau of Plant Industry, Soils, and Agricultural Engineering, Division of Forage Crops and Diseases, cooperating with State Agricultural Experiment Stations.”


• **Summary:** Except for the cover, this document is typewritten.

Near bottom of title page: “United States Department of Agriculture. Agricultural Research Administration. Bureau of Plant Industry, Soils, and Agricultural Engineering, Division of Forage Crops and Diseases, cooperating with State Agricultural Experiment Stations.”


• **Summary:** “This study was initiated to determine the quantitative relationships between the various reserve constituents in soybean seeds as they are used by the developing seedling, and the effect of removal of the food supply contained in the cotyledons on subsequent growth of the plants. Many investigations have dealt with the transformations which occur in the reserve food materials in seeds of crop plants as germination proceeds. Few studies, however, have been concerned with the rate of transfer of these foods to the seedling.

“No reports have been found in the literature on how long the seedling is dependent on the reserves in the cotyledons for successful establishment and later development. This information was desired for use in mineral nutrition studies on soybeans particularly where the effects of limiting levels of some of the major nutrients are being investigated. At starvation levels of nutrition, it was felt that the amount of a particular element supplied by the cotyledons may be sufficient to influence experimental procedure.”


• **Summary:** “Dr. Leonard F. Williams, plant breeder for the U.S. Regional Soybean Laboratory at Urbana, Illinois, has been transferred to Columbia, Missouri, where he will carry on an enlarged breeding program in cooperation with the Missouri State Experiment Station, according to J.L. Cartter, director of the Laboratory.

“The vacancy in Illinois was filled Aug. 1 by Dr. Robert D. Osler who recently obtained his doctorate degree in plant breeding from the University of Minnesota.”


• **Summary:** “Perry is a new high yielding, high oil content, lodging resistant soybean variety similar in maturity to Gibson but about 5 days later than Wabash. This new variety is well adapted as a full-season variety in southwestern Texas.”


• **Summary:** Near bottom of title page: “United States
Department of Agriculture. Agricultural Research Administration. Bureau of Plant Industry, Soils, and Agricultural Engineering, Division of Forage Crops and Diseases, cooperating with State Agricultural Experiment Stations.”


“Introduction: The U.S. Regional Soybean Laboratory was organized in 1936 under the Bankhead-Jones Act, as a cooperative project by the U.S. Department of Agriculture and the twelve Agricultural Experiment Stations of the North Central Region. In 1942, the work of the Soybean Laboratory was expanded to include cooperation with twelve Agricultural Experiment Stations of the Southeastern Region.

“The research program of the Laboratory has been directed toward the development of improved varieties and strains of soybeans for industrial use, and the obtaining of fundamental information necessary to the efficient breeding of strains to meet specific needs. Many high yielding, high oil content strains have been developed and released through the cooperative breeding program. Blackhawk, which was released last year, has been increased to over 276,000 bushels of seed for 1952 planting. Within the next two years, Blackhawk should produce a noticeable effect on the oil yield of beans coming from the northern Iowa and southern Minnesota area. Perry (C612), a new strain of Group IV maturity, is being simultaneously released this spring by the four states of Indiana, Illinois, Missouri, and Kansas. Perry is four days later than Wabash, similar in oil content, and three bushels higher in yield. Seed stocks of Perry, estimated at 9,000 bushels, for planting in 1952 should produce enough to meet much of the 1953 seed requirements.

“Nine uniform test groups have been established to measure the yield and range of adaptation of the better strains that are being developed through the breeding program, the first five of which include strains of proper maturity for the North Central States. The other four groups contain strains adapted to the southern part of the United States, and a summary of performance of these will be found in Part II of this report, which is published separately.

“Uniform Test, Group 0, contains the strains that will bloom and mature under the longer days encountered during summer in the Dakotas, Minnesota, and northern Wisconsin. Group I contains strains generally adapted to South Dakota, the southern parts of Minnesota, Wisconsin, and Michigan, and the northern part of Ohio. Groups II, III, and IV, respectively, include strains adapted to locations farther south in the North Central States and to other areas of similar latitude. In general, each group is arranged to include strains differing in maturity by not over ten to fifteen days. Maturity of the strains is expressed as so many days earlier or later than some well-known check or reference variety in the group.

“Weather information is presented as an aid in interpreting the performance of strains under local climatic conditions. Row spacing at each nursery has been added to the yield tables this season. This information may be helpful when comparing strains at different locations. The 1951 season was cooler than 1950 or 1949 in the northern part of the North Central States. This cooler temperature is reflected in the higher mean iodine number of oil in Groups 0 and I. The mean iodine number values for Group 0 were 130, 134 and 137 for 1949, 1950, and 1951, respectively. Corresponding values for Group I were 130, 134, and 136. These differences were not apparent at the locations where Group II and later strains were grown. Another effect of the cool summer in the North was the very heavy bacterial blight infection late in the season. Leaf damage in 1951 was the most severe on record.” Address: U.S. Regional Soybean Lab., Urbana, Illinois.


• Summary: “Perry is a new high-yielding pure line selection of soybeans from a cross Patoka x L-7-31355. The original cross was made in 1939 by Dr. L. F. Williams, U.S. Regional Soybean Laboratory at Urbana, Illinois. Selections from this cross were made by Drs. A.H. Probst and G.H. Cutler of Purdue University, West Lafayette, Indiana.

“The Perry soybean is adapted to the southern part of the Corn Belt and the northern edge of the Cotton Belt, including the southern portions of Indiana, Illinois, Missouri, and Kansas.” Address: Dep. of Agronomy.


• Summary: Except for the cover, this document is typewritten.

Near bottom of title page: “United States Department of Agriculture. Agricultural Research Administration. Bureau of Plant Industry, Soils, and Agricultural Engineering, Division of Forage Crops and Diseases, cooperating with State Agricultural Experiment Stations.”


**Summary:** The authors observed positive genotypic correlations of yield with plant height and maturity in the soybean. Address: Agronomy Dep., Iowa Agric. Exp. Station; U.S. Regional Soybean Lab., Div. of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, ARA, USDA.


**Summary:** The Dorman soybean variety was named for Clarence Dorman, the late director of the Mississippi Agricultural Experiment Station. It is well adapted to the alluvial soils of the Mississippi Valley and the region between southeastern Missouri and northeastern Louisiana, where it will replace S100 and constitute a variety adapted to the areas between those to which Perry and Ogden are adapted.

“Dorman is the result of hybridization or crossing of promising parent varieties or strains and the selection of superior plants from such crosses.” In 1941 the ground work for the Dorman variety was laid when Dr. L.F. Williams made a cross between the variety Dunfield and Arksoy 2913 at the U.S. Regional Soybean Laboratory, Urbana, Illinois.


**Summary:** Contents: 1. Introduction: Purpose and scope, source of data, procedure. 2. Production: World production, national production, acreage changes in the Corn Belt, Minnesota production, areas of production, suitable varieties, acreage changes in Minnesota, summary.


4. The processing industry: Marketing channels of the crop, historical evolution, the national processing industry, the Minnesota processing industry, technical development, processing costs, Minnesota processing costs, summary.

5. Factors affecting the competitive position of the Minnesota soybean processor: Transportation, Minnesota transportation, Buffalo–New York, Fargo–North Dakota, St. Cloud–Minnesota, Chicago soybean prices, qualifications, foreign market, summary, storage, commodity markets, price formulation, government action, the Minnesota processor, crushing margins, specific example, crushing-margin relationships over time.


Bibliography.

Although Minnesota was one of the last states to develop a soybean crop, the state now ranks 6th in total soybean production in America. In the decade from 1940 to 1950 the dollar value of the Minnesota soybean crop rose from $76,000 to $37,000,000.

The U.S. Regional Soybean Laboratory is discussed on pages 24 and 56.

A summary of soybean-processing facilities and operation status, excluding mills crushing soybeans temporarily or less than half their operating time, United States, May 1945 and January 1951. (31) Soybean processing margin by size and type of plant, 1943-1944.

The processing costs of six Minnesota soybean plants, percentage breakdown and actual cents-per-bushel range, 1951. (34) The capacity of soybean mills in specified areas, excluding mills crushing soybeans temporarily or less than half their operating time, May 1945 and 1950. (35) The overall freight advantages per ton of meal shipped, as used by commercial men for territories rather than specific locations.


Address: Minnesota.

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“The Field Husbandry Department of the Ontario Agricultural College has attempted to keep pace with the rapid development of the soybean crop. At present the emphasis is on a breeding program, the chief aim of which is the production of varieties suitable for growing in zones 2, 3 and 4. Through the cooperation of the United States Regional Soybean Laboratory and the Canadian Stations of Harrow and Ottawa, a good deal of hybrid material has been obtained on which to base our selection. As well, this Department has also initiated a hybridization program of its own.

“The 1952 season will see plant lines established in the following crosses:” Address: Guelph, Ontario, Canada.


• Summary: Dr. Burlison, who had retired in June 1951, prepared this undated, handwritten manuscript for a talk on soybeans he gave or intended to give in about 1954.

Contents: Introduction. 1. The challenge of the past: Publications, research, extension work, early soybean farmers (Stoddard of Carlinville), American Soybean Association, soybean processors in the USA and Illinois, Illinois Farm Advisers Assoc., H.G. Atwood and the Peoria Association, farmers (Stoddard of Carlinville), American Soybean Association. 2. The facts of the present: Strong interest by the university, researchers, farmers, and processors, average yield has more than doubled.


As early as 1897 in Illinois, “the soybean showed great future promise. To date our College of Agriculture has published 32 bulletins and 42 circulars and many hundreds of journal articles and pamphlets of various kinds. This is truly a fine record.” Today in the United States there are 260 plants which process soybeans; 37 of these are in Illinois.

“It should be noted that the first recorded effort to find an outlet for surplus [soybeans] was in 1921 when the president of the Illinois Farm Advisers Association contacted the industry for the purpose of finding a possible outlet in Illinois to handle our soybeans. Our soybean production was just getting under way which meant some uncertainty in soybean supplies.

“This uncertainty continued until 1928 when, because of heavy abandonment of winter wheat in Illinois, it seemed necessary to turn to soybeans for a part of the acreage if some assurance could be given that a sudden increase in production would not result in ruinous prices. After some negotiations with the late H.G. Atwood a price was set for soybeans as far as his company was concerned. So far as we know, this is the first instance of a case where the price was fixed before that crop was produced. This was a very important move in giving soybeans considerable stability.

“The most significant recent event in soybean history was the establishment in 1936 of the Regional Soybean Laboratory a part of which is now located in Peoria, Illinois, and a section devoted to soybean breeding with headquarters at this university.”

“Illinois is still by long odds the leading soybean-producing state. Of the state’s 102 counties, 41 produced from 1- to almost 4 million bushels in 1951. Outside of Illinois there are only 21 counties in the nation that produced 1 million bushels of soybeans last year. Four Illinois counties grew between 3 and 4 million bushels in 1951.” Champaign County leads the nation with almost 4 million bushels. Address: Univ. of Illinois.


• Summary: Soybean production has grown dramatically in Arkansas. In 1924, approximately 1,400 acres were harvested for seed, while in 1952, this had increased to more than 850,000 acres. This report discusses the performance (agronomic and chemical composition data) of 23 soybean varieties at four locations for the years 1949-52.

Page 3 notes: “Since 1943 the soybean varietal testing program has been conducted as a cooperative project between the Arkansas Agricultural Experiment Station and the U.S. Regional Soybean Laboratory, Division of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U.S. Department of Agriculture.” Address: Dep. of Agronomy, Univ. of Arkansas, Fayetteville, Arkansas.


• Summary: Near bottom of title page: “United States Department of Agriculture. Agricultural Research Administration. Bureau of Plant Industry, Soils, and Agricultural Engineering, Division of Forage Crops and
Diseases, cooperating with State Agricultural Experiment Stations.”


• Summary: Except for the cover, this document is typewritten.

Near bottom of title page: “United States Department of Agriculture. Agricultural Research Administration. Bureau of Plant Industry, Soils, and Agricultural Engineering, Division of Forage Crops and Diseases, cooperating with State Agricultural Experiment Stations.”


“Introduction: The program of the U.S. Regional Soybean Laboratory has been directed toward the development of improved strains of soybeans and the obtaining of fundamental information necessary to the efficient breeding of strains to meet specific needs. In the Southern Region, fundamental studies and breeding programs are conducted at the two centers, Stoneville, Mississippi, and Raleigh, North Carolina. After promising new strains are developed at these breeding centers, they are advanced to the uniform regional tests, conducted in cooperation with the 12 southeastern states. This testing program enables the breeder to evaluate new strains under a wide variety of conditions, and permits new strains to be put into production in a minimum amount of time.

“Nine uniform test groups have been established to evaluate the better strains developed in the breeding programs, The Groups 0 through IV are adapted in the northern part of the United States, and the Groups IV through VIII are grown in the southern part. Within their area of adaptation, there is a maturity range of 12 to 18 days within each maturity group. The best standard variety available of each maturity class is used as a check variety with which to compare new strains as to seed yield, chemical composition, maturity, height, lodging, and seed quality. For the groups grown in the southern area, the check varieties are Perry, Dorman, Ogden, Roanoke, and Improved Pelican. At Stoneville, Mississippi, where all maturity classes will mature, the approximate maturity dates of these varieties when planted during the first half of May are: Perry, September 6; Dorman, September 20; Ogden, October 10; Roanoke, October 25; and Improved Pelican, November 8.

“The 1952 cooperative nurseries complete 10 years of regional strain evaluation in the Southern States. Of the 43 strains included in Groups V through VIII, only three, S-100, Ogden, and Acadian, were included in 1943. The results of these tests have shown the advantages of the improved varieties, and as a result, varieties such as Ogden and Roanoke have replaced largely the older varieties such as Arksoy, Ralsoy, Tokyo, Woods Yellow, and Palmetto. However, the good characteristics of some of these strains have been utilized in the breeding program. For example, N47-3479, which has shown promise in Group VII, has Palmetto as one of its parents. Although the variety CNS was shown to have an oil content too low for satisfactory commercial production, its resistance to bacterial pustule has been incorporated into many of the new strains now in test.

“A wide range of soil and climatic conditions exist in the region. As an aid in recognizing regional adaptation, the region has been subdivided into five rather broad areas, which still represent a wide range of soil types. These are: (1) the East Coast, consisting of the Coastal Plain and Tidewater areas of southern Delaware, the Eastern Shore of Maryland, Virginia, North Carolina, and the upper half of South Carolina; (2) the Southeast, consisting primarily of the Coastal Plain soils of the Gulf Coast area, but also including similar soils from South Carolina southward; (3) the Upper and Central South, including the Piedmont and loessal hill soils east of the Mississippi River; (4) the Delta area, composed of the alluvial soils along the Mississippi River from southern Missouri, southward, and (5) the Southwest, comprising Arkansas and Louisiana, outside of the Delta, and Oklahoma and Texas. In the Southwest area, most of the potential soybean-growing areas are on the alluvial river valley soils. A map is included to illustrate the five production areas.

“On nearly all of the Coastal Plain, Piedmont, and loessal soils fertilization is essential for satisfactory soybean production. A table showing soil types and rate of fertilization is included.

“As a further aid in interpreting varietal responses, rainfall data is reported for many of the locations where nurseries were grown. Since much of the summer rainfall is from local showers, rainfall data is included only from locations where records were taken reasonably close to the nurseries. Daily minimum and maximum temperatures are reported for the representative locations for the various production areas.

“The 1952 season was characterized by an extreme summer drought [drought], especially in the Delta section, and by an early killing frost. The effects of the frost were felt in the Southwest, Delta, and upper East Coast plantings.
In calculating variety means for seed yield, data from tests with extremely low yields or where the coefficient of variability exceed 25 per cent, are not included in the area means.” Address: 1. Agronomist; 2. Clerk-Stenographer [Stoneville, Mississippi].


**Summary:** The introduction states: “In order to make the present introductions more useful and available to soybean breeders, it was considered worthwhile to evaluate the present stock of introductions by maturity groups and circulate the information to soybean workers. The data presented here are the first to be obtained under the new plan. As other maturity groups are evaluated, additional summaries will be prepared and made available to those desiring them.

“Nine maturity groups have been established for convenience in classifying the Plant Introductions, as well as the soybean varieties and strains being evaluated by plant breeders in the United States. Maturity Group 0 includes strains that will bloom and mature normally under the longer days encountered during the summer in the Dakotas, Minnesota, and northern Wisconsin. Group I contains strains generally adapted to South Dakota, the southern parts of Minnesota, Wisconsin, and Michigan, and the northern part of Ohio. Groups II, III, and IV include strains adapted to locations further south in the Northern Central States, and to other areas of similar latitude. Maturity Groups V, VI, VII, and VIII contain lines adapted further south, with the Group VIII material being of full season maturity in the Gulf Coast area.

“The characters and information which are or will be included in future reports were decided upon at a conference held at Urbana in March of 1953. These characters are as follows:"

- Line number. Variety name or Plant Introduction number. Source (such as Harbin, Kirin, Manchuria). Year introduced (1922-1929). Flower color (purple, white, or purple throat). Flowering date. Maturity date (95-100% of pods ripe). Lodging (1 = erect; 5 = prostrate). Height. Uniformity score (1 = good; 5 = poor). Growth type (vegetable, hay, grain, procumbent, bushy, slender). Pubescence color. Pubescence type (normal, appressed, pseudo glabrous, glabrous). Degree of podding. Yield (bushels/acre). Percentage of protein. Percentage of oil. Color of seed coat. Color of hilum. Weight per 100 seeds. Seed quality (1 = good; 5 = poor). Disease notes (0 = immune; 5 = extremely susceptible). Remarks (deviations from normal pod color, deviations from normal leaf shape, deviations from 2-3 seeds per pod, deviations from normal leaf surface, shattering, bloom on seed coat, stems green after pods ripe).

Named varieties: Mandarin (Ottawa), Blackhawk. These variety trials were conducted at Urbana, Illinois, in 1952.

Note: This is the earliest document seen (Dec. 2016) with the term “germ plasm” (or “germplasm”) in the title.
Address: 501 Davenport Hall, Urbana, Illinois.


**Summary:** Jackson “is the twelfth in a series of superior varieties for the different producing areas that have been released in the last dozen years. Clark is another new variety announced only June 15 for the northern Corn Belt.”

“The seed of Jackson is straw yellow in color, but easily distinguished from seed of Roanoke and Volstate because of its distinctive brown eye or seed scar.”

“The Jackson variety traces its parentage to the varieties Volstate and Palmetto. The original cross was made in 1943 by Dr. E.E. Hartwig of the U.S. Regional Soybean Laboratory, working in cooperation with the North Carolina Agricultural Experiment Station. A backcross of the F1 was made to Volstate in 1944. The objective was to produce a variety for the lower southeastern part of the United States that would grow tall like Palmetto and have the good seed holding and chemical qualities of Volstate.” Address: Washington, DC.


**Summary:** This bulletin is divided into two major parts: Soybeans (p. 469-89), and corn (p. 489-504). Two widely different types of injury were inflicted on soybeans: defoliation and breakage. “Defoliation reduced yields more than did breakage. Yield consistently was reduced most when injury was inflicted at about the time seed began to develop in the lower pods.” Address: Agronomy Dep., Ames, Iowa; United States Regional Soybean Lab., Div. of Forage Crops and Diseases, Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Research Administration USDA, cooperating.

450. Chemurgic Digest. 1954. The soybean story. Over the years, researchers literally have taken the soybean apart, and as a result, soybean oil today ranks first among all domestic vegetable oils in supply and consumption. Jan. p. 8.

**Summary:** Soybean utilization research was transferred to the new Northern Regional Research Laboratory at Peoria, Illinois in 1942. The agronomic research remained at Urbana and was expanded to include 12 Southern States, with 2 new
research centers in the South to serve that region. “Research emphasis was shifted from simply making selections from introduced varieties to breeding hybrids of the superior selections. In the last 10 years this hybrid breeding program has produced an improved variety—12 in all—for every major soybean producing area in the country.”


**Summary:** Near bottom of title page: “United States Department of Agriculture. Agricultural Research Service. Field Crops Research Branch, cooperating with State Agricultural Experiment Stations.”


**Summary:** Near bottom of title page: “United States Department of Agriculture. Agricultural Research Service. Field Crops Research Branch, cooperating with State Agricultural Experiment Stations.”

Contents: Cooperating personnel (gives person’s name, city, and state). Introduction. Location of cooperative nurseries [on outline map of south-eastern USA]. Methods. Uniform test, Group IV. Uniform test, Group V. Uniform test, Group VI. Preliminary test, Group VI. Uniform test, Group VII. Preliminary test, Group VII. Uniform test, Group VIII.

“Introduction: The program of the U.S. Regional Soybean Laboratory has been directed toward the development of improved strains of soybeans and the obtaining of fundamental information necessary to the efficient breeding of strains to meet specific needs. In the Southern Region, fundamental studies and breeding programs are conducted at the two centers, Stoneville, Mississippi, and Raleigh, North Carolina. After promising new strains are developed at these breeding centers, they are advanced to the uniform regional tests, conducted in cooperation with the 12 southeastern states. This testing program enables the breeder to evaluate new strains under a wide variety of conditions, and permits new strains to be put into production in a minimum amount of time.

“Nine uniform tests groups have been established to evaluate the better strains developed in the breeding programs. The Groups 0 through IV are adapted in the northern part of the United States, and the Groups IV through VIII are grown in the southern part. Within their area of adaptation, there is a maturity range of 12 to 16 days within each maturity class. The best standard variety available of each maturity class is used as a check variety with which to compare new strains as to seed yield, chemical composition, maturity, height, lodging, and seed quality. For the groups grown in the southern area, the check varieties are Perry, Dorman, Ogden, Jackson, and Improved Pelican. At Stoneville, Mississippi, where all maturity classes will mature, the approximate maturity dates of these varieties when planted during the first half of May are: Perry, September 6; Dorman, September 20; Ogden, October 10; Jackson, October 25; and Improved Pelican, November 8.

“A wide range of soil and climatic conditions exist in the region. As an aid in recognizing regional adaptation, the region has been subdivided into five rather broad areas which still represent a wide range of soil types. These are: (1) the East Coast, consisting of the Coastal Plain and Tidewater areas of the Eastern Shore of Maryland, Virginia; North Carolina; and the upper half of South Carolina; (2) the Southeast, consisting primarily of the Coastal Plain soils of the Gulf Coast area, but also including similar soils from South Carolina southward; (3) the Upper and Central South, including the Piedmont and loessal hill soils east of the Mississippi River; (14) the Delta area, composed of the alluvial soils along the Mississippi River from southern Missouri, southward, and (5) the Southwest, comprising Arkansas and Louisiana, outside of the Delta, and Oklahoma and Texas. In the Southwest area, most of the potential soybean-growing areas are on the alluvial river valley soils. A map is included to illustrate the five production areas.

“On nearly all of the Coastal Plain, Piedmont, and loessal soils, fertilization is essential for satisfactory soybean production. A table showing soil types and rate of fertilization is included.

“As a further aid in interpreting varietal responses, rainfall data is reported for many of the locations where nurseries were grown. Since much of the summer rainfall is from local showers, rainfall data is included only from locations where records were taken reasonably close to the nurseries. Daily minimum and maximum temperatures are reported for the representative locations for the various production areas.

“The 1953 season was characterized by extremes in moisture. Through much of the central south, May was extremely wet and planting was delayed until late May and early June. The wet period followed by a long drouth
[drought] period contributed to poor seed bed preparation which resulted in poor stands. For this reason, accuracy of several of the yield comparisons were [sic, was] seriously reduced. Late summer drought reduced yield in much of the area. However, on the heavy clay soil at Stoneville, soybeans again demonstrated their ability to get a high percentage of their moisture requirements from the soil water.” Address: 1. Agronomist; 2. Clerk-Stenographer. Both: Stoneville, Mississippi.

**Summary:** Dr. Reid T. Milner, who has been director of the USDA Northern Regional Research Laboratory at Peoria, has become the new head of the food technology department at the University of Illinois. “Milner served on the University faculty from 1936 until 1941 during which time he helped set up the Regional Soybean Laboratory at Urbana. In 1941 he went to the Peoria laboratory to take charge of the analytical and physical chemical work. He has been president of the American Oil Chemists Society and is recognized as one of the nation’s leading soybean oil chemists.” A photo shows Milner.

**Summary:** Contents: Studies at Stoneville, Mississippi: Factors to be considered in determining planting date: soil temperature, day length, rainfall in the spring. Plan of studies. Results: growth rate, time of blooming, plant height, length of fruiting period, date of maturity, seed yield, seed quality, chemical composition of seed. West Florida results. Summary.  
Studies were conducted at Stoneville, Mississippi, during 1949-51, and in West Florida in 1952. They were designed to provide basic information on the rate of emergence and growth, total growth, seed yield, and seed composition of soybeans planted over a range of dates in the southern USA. Varieties used were Wabash, S-100, Ogden, and Roanoke, the top-yielding varieties of maturity groups IV, V, VI, and VII and classified as very early, early, medium, and medium late, respectively, at Stoneville.  
Summary (p. 12-13): “A time-of-planting study conducted at Stoneville, Mississippi, with four varieties of soybeans gave very similar results each year for the 3-year period 1949-51, even though moisture conditions differed by seasons.  
“Optimum planting date for the Southern States appears to be the date when the minimum soil temperature attains 65°F. and after the day length reaches or exceeds 14½ hours.  
“Planting under such conditions will give more rapid emergence, more rapid growth, higher seed yields, and better seed quality than earlier planting. Rapid emergence and rapid growth should contribute to greater ease in weed control.  
“Medium- and medium-late maturing varieties show less reduction in bean yield from late plantings than do short-season varieties. A delay of 72 days in planting delayed maturity of Wabash 33 days; S-100, 33 days; Ogden, 24 days; and Roanoke, 5 days. Therefore, in a double-cropping system, where soybeans are planted late following white potatoes or small grain, a medium-late maturing variety will usually give higher seed yields than earlier maturing varieties, and its maturity will closely approximate its normal maturity date for earlier plantings. Since height is reduced in late plantings and pods are formed closer to the ground, less harvesting loss will usually be encountered in very late plantings by utilizing tall varieties of medium, medium-late, or late maturity.  
“Seed yield data from a date-of-planting study made at Walnut Hill, Florida, are in agreement with the conclusions drawn at Stoneville, Mississippi.  
Page 3: “For convenience, soybean researchers classify soybean varieties in nine maturity groups, 0 to VIII. Groups 0 and I are adapted in the northern part of the United States. Succeeding groups are adapted farther south. Group VIII is adapted only in the extreme southern area of the country. Wabash, of group IV maturity, is a full-season variety in south-central Indiana.” Address: Agronomist, Field Crops Research Branch, Agricultural Research Service, Stoneville, Mississippi.

**Summary:** “New strains of crop species in variety development programs are continuously being evaluated with respect to one another and to established varieties. In such a program it is very desirable to know the effect of nutritional factors on the expression of characters utilized for selection. Because of the unique role of phosphorus compounds in metabolic processes and the extensive use of this element in fertilizers, studies of how plants respond to varying levels of phosphorus are particularly interesting. The objective of the present study is to determine the response of several soybean varieties to different phosphorus levels.” Address: U.S. Regional Soybean Lab., Urbana, Illinois.

**Summary:** Varieties discussed include Ogden (introduced in about 1943 in Tennessee, it soon became the most popular soybean in the South), Roanoke (1946, from North Carolina), Dorman (1952, the first of 3 varieties released from the hybridization and selection program of the U.S. Regional Soybean Laboratory), Dortchsoy, Jackson (1953, RSL), Lee (1954, RSL), and Improved Pelican. “Better varieties and improved cultural practices will strengthen the competitive position of soybeans in the South.”

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The underlying objective of agricultural research has been to increase production efficiency. The success of this tax-supported and private research is demonstrated by the fact that in 1940 each individual employed on the farm produced enough food and fiber for himself and 11 others; whereas today each farming individual produces enough for himself and 17 others.

Although research workers have found the ways and means of increasing the returns from each unit of land, labor, and capital invested, they cannot claim full credit for the increased production efficiency. Vigorous extension workers have carried the results of research to the farmers and demonstrated how they could be put into practice. Farmers have learned to rely on the recommendations of their experiment stations, and today the findings of research are put into practice quicker than they have ever been before.

The net result is that the backlog of research information that has been accepted by farmers is diminishing steadily. In many cases this situation has resulted in a critical evaluation of our approach to research, which in turn has resulted in greater emphasis on fundamental or basic research in an attempt to insure that we will continue to add to this backlog of research information.

The present intensified program of soybean research began in the U.S. Department of Agriculture in 1936, when the acreage of soybeans harvested for beans in the United States was 2,359,000. Production has increased steadily since that date and in recent years the acreage harvested for beans has been about six times what it was in 1936. This rapid expansion in soybean production created new problems with diseases and insects, cultural and fertilization practices, and varieties, and our research effort has not kept pace with the increase in production problems. However, increased funds appropriated this year will enable us to expand the research program.

From the beginning of the soybean research program in the Department of Agriculture, the work has been cooperative with state experiment stations and this cooperation has been excellent from the start. Federal funds for extensive cooperative work in all states where soybeans are important have not been available and the major portion of what has been available has been concentrated in a few research centers. Currently these research centers are located in Iowa, Illinois, Indiana, Missouri, Maryland, North Carolina, Mississippi, and California, and at most of these centers an agronomist and pathologist are working as a team on the development of improved varieties and cultural practices.

State Contributions: The state stations where research centers are located contribute heavily to the cost of the program, but the information and new varieties from the program are made available to all states in the region. In addition to the research centers, small cooperative programs are under way in 18 other states. Work on major lines of research in the northern states is coordinated by Mr. J.L. Carter, and Dr. E.E. Hartwig is the coordinator for the southern states.

Although research initiative and originality is encouraged in each individual program, coordination of the work in all the programs insures against excessive duplication of effort and permits an almost immediate exchange of important information and material.

The research team at the U.S. Regional Soybean Laboratory headquarters at Urbana, Illinois, is composed of a physiologist and two chemists, as well as an agronomist and pathologist. In addition to doing research on oil and protein, the two chemists operate the analytical section of the laboratory, which provides analyses for the compositional characters oil, protein, and iodine number for all the cooperative soybean research in the United States.

These compositional characters are important in soybean breeding programs, and the lack of facilities sufficient for analyzing large numbers of varieties and strains has been a bottleneck in breeding progress. The results of breeding experiments indicate that the accurate evaluation of a group of selections or varieties with respect to yield must involve much more extensive testing than the evaluation for compositional characters. Thus, in early generations following a cross, when the small amount of seed precludes extensive testing, it is possible to identify and eliminate inferior selections with respect to compositional characters.

Such elimination would mean that in later generations more intensive selection for yield could be practiced without the difficulties involved in selecting rigorously for yield and compositional characters at the same time. This would enable breeders to evaluate a larger number of selections for yield, thereby increasing the chances of obtaining a selection superior to present varieties. In the past, many high-yielding
selections have been carried into advanced stages of testing only to be discarded because they were deficient in some compositional character.

“The increased funds will enable us to expand research in three general areas, and the first of these is an expansion of the facilities and capacity of the analytical section. This enlarged capacity will enable the agronomists to follow a more efficient breeding system and increase the productiveness of the entire research program.

“The second area of expansion is in fundamental genetics and breeding. Increased emphasis on this type of research is necessary if breeders are to continue to be as productive in the future as they have been in the past. The general level of performance of present day varieties is considerably higher than it was only a decade ago, and the development of new varieties that are superior to existing ones is becoming increasingly difficult. Therefore, it behooves us to accumulate basic information that will enable us to do a better job of breeding in the future.

“In this research we expect to accumulate information on such problems as: What are the characteristics that indicate two varieties will yield superior progeny if crossed? What easily-measured characters tend to be associated with important characters which are difficult and expensive to measure? What procedure of crossing, selection, and recrossing is most efficient? How is resistance to important diseases inherited and what economic losses result from a given level of infection of each disease alone and in various combinations? What are the difficulties involved and what breeding materials and procedures should be used should economic conditions indicate an important shift in the relative emphasis placed on oil and protein in our breeding programs? And many other similar problems.

“The third area of expanded research is in the evaluation of genotypes in our germ plasm collection for disease resistance and other important characters. The need for this expanded work is clearly demonstrated by the fact that we have no good source of resistance to two of the most important diseases, stem canker and brown stem rot. Also, preliminary evaluations of this collection indicate that it contains an extremely wide range of types with respect to compositional characters, seed size and quality, height, lodging, shattering, etc. Detailed and accurate information on the selections in this collection may prove to be of immeasurable value to the breeding programs of the future.

“In this expanded program, a research center will be established in the northern fringe of the soybean-producing states and one in the southern fringe; the existing centers will be strengthened, chiefly through the addition of subprofessional assistants to work with the agronomists and pathologists; and the work in two of the eighteen cooperating states will be increased.

“Although the expanded program will enable us to do a thorough job of evaluating selections in the germ plasm collection with respect to compositional characters considered in our breeding programs, it will not be possible to evaluate them for special properties with respect to oil or protein quality or other chemical characteristics. However, if soybeans that have unusual or specialized chemical characteristics are sought in any of the research laboratories of industry, we will be happy to furnish laboratory samples from selections in the germ plasm collection for evaluation in these laboratories.”


• Summary: This volume of the 6-volume history, covers the period 1930-1939. Chapter 3, “The Depression-Proof Industry,” discusses Dr. William J. Hale and the origins of chemurgy. He dramatized his idea at the 1931 meeting of the Manufacturing Chemists’ Association, then in 1934 he coined the word “chemurgy,” analogous to metallurgy, meaning working with chemicals, and published his provocative volume, The Farm Chemurgic. In 1935, with the active support of Francis P. Garvan and Henry Ford, the Farm Chemurgic Council met at Dearborn, Michigan, and formally organized, with Garvan as president, Wheeler McMillen as vice-president for science, etc. In 1938 Wheeler McMillen succeeded Garvan as president. The chemurgic movement spread far and fast, particularly in the South. At the second Chemurgic Conference in 1936 there was an active discussion of alcohol-gasoline blends. Garvan said that if the 33½% alcohol fuel marketed in England were adopted in the USA, it would put 90 million acres and 6 million unemployed back to work. Henry Ford became interested in growing crops for alcohol to use in lacquers and fuels (power alcohol).

Chapter 16, titled “New Raw Materials” (p. 226-42), notes that “Depression conditions put a premium upon low-cost supplies and emphasized, especially in the chemical industry, every possible salvage of any waste... Henry Ford not only underwrote the early meetings of the National Farm Chemurgic Council, but he set up at Dearborn a farm products research group... where soybeans became the chief project.

“In the South, where the great staple crops cotton and tobacco had been true chemurgic enterprises generations before Dr. Hale had coined the word, the interest was particularly keen, and in 1937 Senator Bilbo of Mississippi introduced a bill (S. 2140) appropriating $1,000,000 to be administered by the Department of Agriculture in establishing a research center to solve Southern agricultural problems by finding suitable new crops and profitable new uses for farm products. This idea was altogether too

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promising to be confined to a single section. Accordingly, the Farm Relief Act of 1938 carried a rider appropriating $4,000,000 for the establishment of four regional laboratories devoted primarily to chemurgic research...

“Eventually the laboratories were well located at New Orleans, Louisiana; Peoria, Illinois; Albany, California, across the bay from San Francisco; and Wyndmoor, a suburb of Philadelphia [Pennsylvania].”

Pages 277-78 note that the isolation of progesterone, a female sex hormone, was announced almost simultaneously by 4 groups of workers in 1934. It “can be extracted from animal ovaries or synthesized from sterols such as stigmasterol, obtained from soybeans, or obtained from brain or spinal cord of animals...”

In the chapter “New Constituents for Coatings,” pages 355-57 note: “Henry Ford helped the soybean mightily. In 1932 the Ford Motor Company planted 8,000 experimental acres, increased two years later to 12,000, on which 300 varieties were tested, and the harvested crop was processed in an experimental six-ton plant in Greenfield Village. Over 1,000,000 gallons of [soy] oil were used in the ‘paint job’ on Ford cars, 540,000 gallons more made into glycerin to charge the shock absorbers, while 200,000 gallons were used as sand-core binder in the foundry, requirements that demanded beans from 64,000 additional acres. These chemurgic feats were not hidden under a basket, and Ford publicity induced many Middle West farmers to grow this crop.

“The soybean has had an interesting part in crushing techniques. In 1927, when the crop passed 2,000,000 bushels, only a small part of it went to the crushers, the largest at the time, A.E. Staley Manufacturing Company of Decatur, Illinois, handling that year only 165,000 bushels. Staley, which first crushed soybeans in 1922, had been followed by Funk Brothers and a little later by Allied Mills, and with the exception of the pioneer, all the early crushers used plate-type hydraulic presses, standard equipment for linseed crushing. Staley was a trail blazer, demonstrating the expeller press as more efficient for use with soybeans. In 1934 the first large-scale solvent-recovery plant was put in operation by Archer-Daniels-Midland, followed shortly by a similar installation by the Glidden Company, which was demolished by an explosion soon after its completion. This disaster retarded the development of this process, and during the thirty expeller-type equipment was almost universally adopted. Spencer Kellogg & Sons first crushed soybeans at its Des Moines [Iowa] plant in 1934 and each year following installed equipment at another of its plants, employing both the expeller and solvent methods. In establishing this new industry, the individual leaders were Augustus Staley, late president of A.E. Staley Manufacturing Company and Whitney Eastman, formerly with Archer-Daniels-Midland and more lately with General Mills...

“The earliest extraction operations, installed in 1934-35 by Archer-Daniels-Midland and Glidden, employed Hildebrandt extractors, and a variety of solvents were tried out: acetone, benzene, gasoline, carbon bisulfide, and some of the chlorinated solvents. Glidden embarked on chemical exploitations of soybeans, extracting lecithin, marketed by the American Lecithin Company (Joseph Eichberg, president), and developing a paper-coating product known as Alpha-Protein. In 1934 Archer-Daniels-Midland reopened the plant of its subsidiary, Wm. O. Goodrich Company at Milwaukee, Wisconsin, as a soya operation, and in 1938 Spencer Kellogg purchased the Shellabarger Grain Products Company’s oil mill at Decatur. Other well-known firms interested in soybean products during the 1930s were the Buckeye Cotton Oil Company, subsidiary of Procter & Gamble, soaps, and Larrowe Milling Company, feedstuffs.”

Pages 471 and 472 give the high and low price per pound for crude domestic soybean oil in tanks from 1930 to 1939.

Appendix X (p. 486-490), titled “The Farm Chemurgic Movement” by William J. Hale, gives an excellent, concise history of the subject.

Appendix XXVII gives a detailed table showing factory consumption of primary fats and oils in 1939. The leading vegetable oils (in million lb) were: cottonseed oil 1,321, coconut oil 529, soybean oil 370, linseed oil 344, and palm oil 271. The soybean oil was used mostly in shortening (201.6), followed by oleomargarine (70.8), and other edible products (32.3). The main non-food industrial uses were paint and varnish (21.7), soap (11.2), and linoleum & oilcloth (6.4). Address: Stonington, Connecticut.


• Summary: Near bottom of title page: “United States Department of Agriculture. Agricultural Research Service. Field Crops Research Branch, cooperating with State Agricultural Experiment Stations.”


Introduction: “Three new strains were released in 1954, Norchief and Chippewa adapted to the northern part of the North Central Region, and Lee for the Central part of the Southern Region. Norchief is the product of a cross involving Hawkeye” [an improved strain released in 1948] and Flambeau. “Chippewa is a backcross with Lincoln as the recurrent parent.” “Lee, a high yielding, high oil variety
resistant to pustule, wildfire, frog-eye and target spot, is the first strain from a cross designed purposely to breed for disease resistance” (p. 2). Address: U.S. Regional Soybean Lab., Urbana, Illinois.


• Summary: Near bottom of title page: “United States Department of Agriculture. Agricultural Research Service. Field Crops Research Branch, cooperating with State Agricultural Experiment Stations.”


• Summary: A comprehensive review of the literature on soybean breeding and management. The first such treatment since Piper and Morse’s classic book, The Soybean (1923). Contents: 1. Introduction. 2. Production and distribution: In the world, in the United States. 3. Disposition and utilization. 4. Physiology of the soybean plant: Floral initiation (varietal differences, duration of dark and photoperiods, light intensity and photosynthesis, age and position of induced tissue, temperature effects), nutrition (nitrogen, phosphorus, major cations, micronutrients), root temperatures. 5. Effect of climate and location: Location and season effects, simulated hail damage.


Considerable impetus was given to agronomic research on soybeans by the organization of the regional laboratory. Of great immediate importance were the regional variety tests, organized and carried out by the agronomy section of the laboratory. Regional evaluation soon revealed the merits of certain varieties such as Chief, Earlyana, Gibson, Patoka, Boone and Viking; these were distributed to farmers by the states to which the varieties were best adapted.

Regional cooperative testing turned out to be a powerful new tool which clarified the results and shortened the total testing time by up to one-third. The program led to the development and distribution of several superior varieties such as Lincoln, Hawkeye, Adams, Monroe, Wabash and Ogden. Part of the program was to increase the oil content of new varieties.

Soon research on soybean diseases was closely integrated with the breeding program to facilitate the development of improved, disease-resistant varieties. “Although the pathological investigations are relatively new, much progress has been made in the identification of pathogens, the determination of the relative damage attributable to the various diseases, the search for resistant host germ plasm, transmission of the parasites, and control measures.” These cooperative pathological investigations will, no doubt, contribute greatly toward sustaining high production of soybeans in the United States. Address: USDA, Beltsville, Maryland.


• Summary: “In the various European countries more or less serious efforts have been made to introduce the soybean as a crop. The northern extremes where soybeans are grown as a major crop in Asia are the plains of the Amur, the Nonni and the Sungari rivers on the mainland and the Japanese island of Hokkaido...”

“Hokkaido is the only country in the world where soybeans are grown as a major crop in a relatively cool and partly marine climate. There is no doubt that soybean breeding material from Hokkaido holds more promise for Sweden, and generally for northern Europe, than material from Manchuria and other regions with a continental climate. “In accordance with this surmise the author brought home to Sweden in 1940 a collection of soybean strains from Hokkaido and southern Sachalin (Sakhalin, Karafuto).”

“This Japanese material was used in some 2,700 hybridizations followed by selection for adaptation. The choice of this breeding material has reduced the adaptation problem for Sweden to practical dimensions...”

“Although the Kalmar-Oland region of Sweden, latitude 56º-57º, where the Fiskeby varieties of soybeans are grown commercially, enjoys a longer frost-free season than many soybean growing districts in Hokkaido, northern Manchuria...”
and the northern United States, this relatively long growing season is required to ripen extra early varieties in a cool autumn. Only the breeding of Swedish soybean varieties combining earliness with adaptation to the day length of the latitude has made it possible to grow soybeans regularly in Sweden.

“In 1941 seed of three early foreign soybean varieties was distributed by the Swedish government Food Commission to farmers for practical growing trials. These failed and the experiment of growing foreign soybean varieties was soon abandoned.

“But the breeding of soybeans with a view to adaptation was pursued with the support of the government both by the Swedish Seed Association at Svalof and Algot Holmberg Seeds Ltd. at Fiskeby.

“In 1950 a brown-seeded soybean, Sv. Ugra, was announced at Svalof. It was from a cross of Wisconsin Black with a Polish variety. The yellow-seeded Fiskeby III originating from a cross between a German strain and a Sachalin variety was released by Holmberg in 1949.

“Since Fiskeby III was of the edible type it has been approved for use in army rations, school lunches, etc. It is grown commercially on a small scale in the Kalmar-Oland region. Its mean yield over a 10-year period has been 23.2 bushels per acre...

“In Holland a private breeder, Dr. Louis Koch, has also used northern Japanese material with good results. His successful work has been discontinued but his strains are kept alive.”

A photo taken at Fiskeby in 1949 shows (left to right): Pierre Holmberg, George M. Strayer, M.E. Paddock (agricultural representative on an E.C.A. mission), J.L. Carter (U.S. Regional Soybean Laboratory), and Sven A. Holmberg.

E.C.A. stands for European Cooperation Administration, which was a United States government agency set up in 1948 to administer the Marshall Plan. It reported to both the State Department and the Department of Commerce. Address: Fiskeby, Norrkoping, Sweden.


• Summary: Near bottom of title page: “United States Department of Agriculture. Agricultural Research Service. Field Crops Research Branch, cooperating with State Agricultural Experiment Stations.”


Grant, a new soybean variety, was released in the fall of 1955. Address: U.S. Regional Soybean Lab., Urbana, Illinois.


• Summary: Near bottom of title page: “United States Department of Agriculture. Agricultural Research Service. Field Crops Research Branch, cooperating with State Agricultural Experiment Stations.”

“Soybeans have long been recognized as good competitors with weeds. Their ability to shade out small weeds quickly has made soybeans an excellent smother crop for various perennial and annual weeds. Under average to good conditions of production, cultural operations permit soybeans to become established at the expense of weeds, and surviving infestations are generally dominated by the beans over most of the growing season. When this happens, losses in bean yield may be appreciable but not in the nature of a crop failure. The major concern of soybean producers is not the large weed infestation resulting from gross neglect, but moderate to light infestations. These very often survive a good program of cultural control and frequently interfere with harvesting operations as well as producing seeds which further infest the soil.

Modern soybean production methods utilize many cultural practices which result in good control of annual weeds. Among these are good crop rotations and fertilization, good seedbed preparation, proper choice of varieties and planting rates, and timely and effective cultivation. When maximum results are obtained with these operations, infestations which survive may be so small that they present no serious hazard to bean production. Whenever these practices are not fully effective, serious infestations may survive. The yield reducing potential of surviving infestations must be considered in relation to the further cost of their elimination, either by extra cultivation operations, by the use of herbicides or by a combination of both.

Experiments conducted recently in Iowa measured yield losses resulting when annual weeds grew in competition with soybeans. Beans and weeds were grown together in drilled rows, 40 inches apart. Infestations of green and yellow fox-tail, smartweed, velvetweed, and various pigweed species were maintained at levels closely approximating conditions observed in many soybean fields. Yield comparisons were made between weed-free and weed-infested experimental plots grown over a range of moisture, soil and temperature conditions encountered in the different seasons at several locations in central and north central Iowa.

Moderate weed infestations reduced soybean yields an average of 3 to 4 bushels per acre. In any particular season the extent of bean yield loss was roughly proportional to the growth of weeds; greatest yield losses were associated with heaviest weed growth. Broadleaf species such as smartweed, velvet-weed, and pigweed reduced bean yields a little more than comparable infestations of yellow and green fox-tail.

“Poor Stands: When stands of beans fell below 10 plants per foot of row, bean losses from weeds increased markedly. Bean losses from these annual weeds were slightly less in a dry season than in a relatively wet one. Under dry conditions beans competed very well with weeds, and tended to crowd out the weeds early in the season. In wet seasons the growth of beans and weeds was good during the early part of the season, and when a dry period occurred in midsummer sizable bean yield reductions resulted.

Herbicide Limitations: Such experiments not only demonstrate the importance of weeds in soybean production, but emphasize the need for effective cultivation programs, and indicate some possible limitations in the potential role of herbicides for soybeans. Economical and practical control of annual weeds in soybeans demands a thorough job of cultural control. In many instances this may be sufficient from a practical point of view. Inherent in such a program is the timely and effective use of the rotary hoe to destroy very small weed seedlings in either rowed or solid drilled beans, followed by effective shovel cultivations in rowed beans.

Weed control practices prior to seeding must include a seedbed preparation program designed to destroy one or more crops of germinating weeds before the beans are planted. Sometimes the failure of cultivation to control annual weeds results from the occurrence of rainfall and wet soil conditions which interfere with the timeliness of early cultivations.

To date, attempts to use herbicides as a means of controlling weeds during periods of wet weather, have met with only limited success. Several rather promising herbicides have been tested for annual weed control in soybeans, and further progress may be expected in this connection. Successful utilization of herbicides for annual weed control in soybeans requires more than the development of a suitably selective herbicide. The herbicide should be adapted to current methods of soybean production, the cost should not be out of line with expected economic return, crop injury must be at a minimum and the herbicide should be utilized as a supplement to cultivation and not as a complete substitute. There is little point in substituting a rather expensive herbicide treatment for a relatively cheap cultivation. There is much to be said, however, for supplementing a good cultivation program with an effective and relatively cheap herbicide.

In recent years numerous herbicides have been evaluated as pre-emergence sprays for soybeans under a range of weather conditions common to Iowa. Among the herbicides tested have been various formulations of 2,4-D, amine salt formulations of dinitro-o-sec-butyl phenol, several CIPC materials, naphthyl phthalamic acid, and more recently a few chlorinated acetamide formulations. Each of these herbicides has shown considerable promise under certain
crop and weather conditions. However, when wet weather hampered early cultivation the rates of herbicide application required for adequate weed control produced varying degrees of bean injury.

“Thus, it appears that the use of herbicides for the control of annual weeds in soybeans is limited by a number of practical considerations. Under many conditions of soybean production with moderate infestations of annual weeds, the use of a perfect herbicide as a supplement to cultivation might be expected to return an average yield increase of 3 or 4 bushels. Many of the effective herbicides currently available usually cause some bean injury when used under wet conditions.

“The margin of use for herbicides is further narrowed by the fact that many weeds which survive the present average job of cultivation might be further reduced by more thorough, timely cultivation early in the season, using the rotary hoe or other shallow cultivation implements. The actual cost to a producer of a single rotary hoe operation is probably very close to 75¢ per acre. Substitution of herbicides for one or two such operations does not appear to be economically practical with the present prices of herbicides.

“The cost of the herbicide treatment may be reduced by band applications over the bean rows. Such methods of application, however, require considerable care in execution, and do not materially reduce the need for cultivation, since the area between the rows must be cultivated early if later shovel cultivations are to be fully effective. Future developments in herbicide technology may well result in a herbicide which is completely selective and well within the economic limits outlined above. For the present, however, control of annual weeds in soybeans can be most effectively and economically achieved by timely, repeated and effective cultivation operations. Such a program should include the practices shown in the box.”

The box (sidebar)—“An Effective and Economical Program of Weed Control:

“1—Maintenance of soil fertility and long term control of weeds by the use of adequate crop rotations.

“2—Proper sequence of timing of land preparation and seeding, which will permit the destruction of one or more crops of annual weeds prior to seeding.

“3—Seeding of beans at a rate and at a time when soil temperatures are warm enough to insure rapid emergence of beans ahead of weeds.

“4—Timely and repeated use of the rotary hoe or other shallow cultivation implements on rowed or solid-drilled soybeans to kill germinating weeds while they are still ‘in the white.’ Proper speed and weighting of shallow tillage implements are essential.

“5—A careful followup program of shovel cultivations in row planted beans, to complete the job of weed control.”

Address: 1. Associate Prof. of Botany and Plant Pathology and Agronomy (Farm Crops), Iowa State College.


In short: Twenty-one varieties of soybeans were tested in Illinois. Information is given on seed yields, seed quality, protein content, oil content, plant heights, lodging tendencies, and relative rates of maturity.

Tables: (1) Soybean yield trials: seven locations in Illinois, 1951-1955; averages of four replications (varieties listed in order of maturity, early to late).


(3) Yields, some plant characteristics, and seed content: varieties tested in North-Central Region (Averages of 5 years, 1951-1955, at 12 to 25 locations).

(4) Origin and identifying characteristics of some soybean varieties (the 8 recommended varieties plus 15 “other varieties”). For each variety is given: Variety name. Parentage or origin. Year released. Flower color. Pubescence color (Footnote: short hairs on leaf, stem, and pod. Color best observed on mature plants). Seed scar [hilum] color. Footnote: Seed coats of all varieties listed are light yellow, except Ogden which is light green.


• Summary: The oil content of soybeans was found to vary with the position of the pod on the plant, the position of the pod on the raceme, and the position of the seed in the pod. Seeds from the lower half of plants were 0.5% higher in oil and 1% lower in protein than those from the upper half. Beans near the tip of long terminal racemes contained less oil than those farther down. Seed nearest the tip of the pod had the highest oil and lowest protein content. Address: U.S. Regional Soybean Lab., Urbana, Illinois.
• Summary: “For the first time in 4 years, the American Soybean Association again returns to a university campus for its annual convention.

“The place is the University of Illinois, at Urbana. The dates are Aug. 13-16.

“And for the third successive year grower and processor groups will hold joint meetings. The National Soybean Processors Association and the advisory board of the National Soybean Crop Improvement Council will meet at the same time as ASA.”

“The meetings will help the U.S. Regional Soybean Laboratory, also at Urbana, celebrate its 20th anniversary.”

An aerial photo shows the Morrow Plots at the University of Illinois. “They are the oldest soil experimental plots in America and the oldest corn test plots in the world, in continuous use since 1876.”


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• Summary: “The American Soybean Association and the National Soybean Processors Association this year will hold their joint annual meeting in the top soybean producing county of the country—Champaign County, home of the University of Illinois.”

“Few soybeans were grown in Illinois earlier than 1890 when J.C. Utter, Mt. Carmel, began growing the crop. In 1914, the total acreage had jumped to 16,000; by 1925, 290,000; 1930, 720,000; 1935, 2,431,000, and by 1955, the last harvest, to 4,370,000 acres.”

“The University began its experimental work in 1897 with plantings obtained from the U.S. Department of Agriculture. USDA had brought to this country pods of beans from China, where they had been known for 5,000 years.

“These original plantings were successfully grown in the laboratory, then on a small experimental plot on the Agronomy South Farm. The results looked promising.

“When these results were laid before 25 progressive farmers by Burlison and Hackleman, they all agreed to plant “a few acres.” They, too, were successful. These farmers and the University then began to preach soybeans in earnest, and by 1914 they had succeeded in boosting soybean acreage to 1,000 acres.”

A photo shows the Soybean convention committee left to right: J.L. Cartter, director, U.S. Regional Soybean Laboratory, chairman; W.L. Burlison, retired chairman of the dep. of agronomy, Univ. of Illinois; M.B. Russell, chairman, Univ. of Illinois department of agronomy; and R.T. Milner, chairman, Univ. Illinois department of food technology. Absent when the picture was taken was Frank B. Lanham, chairman, Univ. of Illinois department of agricultural engineering. Building in the background is Davenport Hall, original home of the College of Agriculture and present site of the agronomy department and the U.S. Regional Soybean Laboratory.


• Summary: Contents: Introduction: Tribute to colleagues Prof. Hackleman, Woodworth, and Sears. The soybean beginning: Bulletin No. 43 of 1896, Circular No. 5 of 1897, Bulletin 198 of 1917 (note gap since 1897), Bulletin 310 of 1928 (“a most comprehensive publication dealing with nearly all phases of soybean management... This bulletin, after almost a third of a century, enjoys a wide interest”), Bulletin 384 of 1932 (“considered a classic today”), soybean varieties (Illini released in 1927, followed by Chief, Viking, and Lincoln), the Regional Soybean Laboratory, Bulletin 386 of 1932, Bulletin 456 of 1939, and Bulletin 462 of 1940. Other departments cooperate fully with agronomy: Agricultural Economics (starting in 1925; nine masters degrees and 7 PhD degrees), Agricultural Engineering (studies on operation of the combine since 1923, and storage since 1943), Animal Science (from 1923), Dairy Science, Food Technology, Horticulture (studies on edible soybeans), Home Economics (“Work on soybeans and soybean products as human food was launched in 1930 and has continued to date. The present program is under the direction of Dr. Frances O. Van Duyne”). Extension effective. American Soybean Association and Soybean Digest. National Soybean Processors Association. Pioneers early & modern. Brief summary.

Concerning work on food technology: “Before 1937 formulas were developed by including both soy protein and soybean oil in frozen desserts [with dairy products]. At a meeting of the American Soybean Association held here in 1937 a sherbet containing soybean protein was served to the Association.” “In a study made by Dr. Tracy during the war emergency, he showed the possibilities of producing a desirable processed cheese by combining ripened cheddar cheese and low fat soybean flour. As much as 30% of the cheese solids could be replaced in this manner without serious change of either the flavor or body of the finished product.”

Concerning extension work: “Our soybean extension program has been both vigorous and determined under Professor J.C. Hackleman’s direction since 1920, a period of 36 years. He held three demonstrations the first year. By 1925, 28 counties had put out demonstration plots; from here on—year in and year out—seeing soybeans in a field was a crusade for soybean improvement. In 1922, 50 bushels of a pure selection of Manchu were distributed and at the end of 1927, about 65% of our commercial soybean areas were in this variety.”
Pioneer farmers and others, early and modern: “The University of Illinois has always recognized the value of our pioneers on the farm and in industry. Our farm pioneers have contributed much to our progress and always will. We would like to mention the names of early and modern farm pioneers who have done so much for soybeans in this state: J.C. Utter, Frank Hurrelbrink, C.A. Rowe, Ralph and Paschal Allen, C.L. Meharry, John T. Smith, C.H. Outhout, E.D. Funk, Russell Davis, Loren Wilderman, and W. E. Riegel. Here in my hands is a pamphlet with the title, “Soy or Soya Beans—What They Are, How to Grow Them, and What They Are Good For,” presented on Dec. 21, 1898, before the Macoupin County Institute by W.H. Stoddard, Collinsville, Illinois. Many things in the booklet are just as good now as then. This was written by a farmer pioneer.

“What of Garwood Brothers? In the fall of 1924 Garwood Bros., modern pioneers, used the first combine in Illinois to harvest soybeans. They gambled and won. Faith, hope and patience won. It is interesting that Garwood’s had faith, greater than some of our machinery engineers. These are the types of early and modern pioneers who helped answer the question, ‘How did it happen?’”

Photos show: (1) Dr. Burlison at the podium, flanked by C.M. Woodworth (plant breeder) and J.C. Hackleman (extension agronomist). A tribute was paid to all three men at the 1956 ASA Convention. “Burlison said he had a part in persuading both men to come to Illinois. Both retired Sept. 1.” (2) O.H. Sears, the third member of the group that Burlison helped persuade to come to Illinois. Address: Prof. of Agronomy, Emeritus, Univ. of Illinois.


• Summary: The rapid, steady increase in soybean production in the USA has been made possible, in part, by a coordinated research program. “The Bankhead-Jones Act, passed in June 1935 [in the depths of the Great Depression, with Franklin D. Roosevelt as president and Henry A. Wallace and Secretary of Agriculture], stated as one of its purposes, ‘The Secretary of Agriculture is authorized and directed to conduct research... relating to the improvement of the quality of and development of new and improved methods of production of, distribution of, and new and extended uses and markets for agricultural commodities and byproducts...’

“The U.S. Regional Soybean Laboratory was the third of a number of laboratories established under this act for the purpose of fostering cooperation between the U.S. Department of Agriculture [USDA] and the state agricultural experiment stations in conducting research on specific crops. At that time we were pioneering in the cooperative development of new soybean varieties for industrial use and also pioneering in a new type of federal-state cooperation itself. Over the years we have learned to take this type of cooperation for granted.”

“The Laboratory was established as a cooperative undertaking between the Bureaus of Chemistry and Soils and Plant Industry of the USDA, and the 12 state agricultural experiment stations of the North-Central region. As a matter of historical interest, the meeting at which the formal cooperative agreement was formulated was held in Chicago, Feb. 7, 1936.

“When the Laboratory was inaugurated in the spring of 1936, the headquarters was established here at the University of Illinois, where adequate laboratory, greenhouse, and office facilities were provided by the University through the active leadership of Dr. W.L. Burlison. In 1942, the work on processing and industrial utilization was transferred to the Northern Regional Research Laboratory at Peoria, Illinois. This utilization research was reported in over 130 publications and so will not be reviewed here.

“In the same year, at the request of the directors of the agricultural experiment stations of the Southern states, the work of the U.S. Regional Soybean Laboratory was expanded to include this region also.

“Following the reorganization of the USDA in 1953, the Soybean Project, which includes the Soybean Laboratory, is a part of the forage and range section, field crops research branch, Agricultural Research Service, USDA.”

In 1938 the Uniform Soybean Tests, as they have come to be known, were initiated on a limited basis with only 3 maturity groups. “The work was rapidly expanded until 9 maturity groups have now been established”–5 for the North Central states and 4 for the Southern states. There are presently “over 100 cooperative nursery locations where new varieties are given a thorough evaluation before being recommended for release to producers.

“Prior to 1936, farmers were growing many of the older soybean varieties such as Manchu, Dunfield, Illini, Mammoth Yellow, Biliox, and many other strains produced mainly by selection from plant introductions.”


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Agricultural Research Service, USDA.

• Summary: Gray is from Baton Rouge, Louisiana. He was an agronomist with the Louisiana State University, and a former president of the ASA. He hosted the annual meeting of the ASA in Louisiana in 1933.

Cartter is with the U.S. Regional Soybean Laboratory in Illinois. “Mr. Cartter was born in Brookfield, Missouri, in 1902, and moved to Montana in 1906. He graduated from Montana State College in 1925, received his masters degree from Iowa State College in 1927, and later did graduate work at the University of Wisconsin. From 1928 to 1933 he was an agronomist for the USDA at Holgate, Ohio. From 1933 to 1936 he was an agronomist at the USDA Agricultural Experiment Station, Arlington Farm, Virginia.” He helped to organize the U.S. Regional Soybean Laboratory at Urbana, Illinois, and has been associated with it since the beginning.

“First, he was director of the agronomic section of the Laboratory. When the chemical section of the laboratory was moved to Peoria, he became director, which position he now holds. As a result of the program of the U.S. Regional Soybean Laboratory, 16 improved varieties of soybeans have been released jointly by the Laboratory and the various states.

“Prior to his association with the Laboratory, Mr. Cartter as U.S. Department of Agriculture agent, tested, multiplied and classified many thousands of foreign introductions, a number of which were later released as new varieties.

“Mr. Cartter has been called ‘One of the outstanding workers and leaders in breeding research on soybeans.’” Mr. Cartter was born in Brookfield, Missouri, 1902. He received his masters degree at Iowa State College in 1927, and later did graduate work at the Univ. of Wisconsin. From 1928 to 1933 he was an agronomist for the U.S. Dep. of Agriculture at Holgate, Ohio. From 1933 to 1936 he was an agronomist at the USDA experiment station, Arlington Farm, Virginia. A photo shows each man.

• Summary: Note from Dr. Richard Bernard, Univ. of Illinois. 1999. July 28. These disease summaries were issued anonymously. D.W. Chamberlain, USDA soybean pathologist at the University of Illinois, compiled them. Address: Urbana, Illinois.

• Summary: “Due to the delay incident to obtaining bids and other details for the proposed utility building for the Soybean Laboratory, it has been necessary to go ahead with the building authorized for the Natural History Survey. It would seem most desirable that this building be located just east of the steel-framed screen house now on the farm, with the south edges of the two in line.

“When you have gotten approval for your building, we can determine its location in consultation with Dr. Burlison and others.

“We were fortunate indeed to obtain a high quality, semi-prefabricated, ‘demountable’ building of the modern design for the Natural History Survey. The quoted price for the erection, including high quality baked-enamel aluminum siding, is $4,457. This is nearly $1,000 less than for a comparable concrete block structure and apparently considerably less than for a steel-framed building with galvanized iron covering.

“If your specification could have been modified to permit this type structure, we could get it for $4,357 (so far as I can determine, you could still obtain the building for this cost).

“Actually the only difference in the general character of the ‘Best farm’ building and a steel-framed, steel-covered structure is in the walls and trusses (steel vs. wood) and the covering (steel vs. aluminum).

“I understand fully the problem of conforming to the budget bill which prescribed the particular structural details. In my judgment, important advancement has occurred in the
period since plans were first made. Now we can obtain high quality aluminum covering material, wood truss designs are prefabricated from No. 1 lumber and metal timbers connectors, and specialized crews are available for erection.

“We shall give every possible co-operation in meeting your needs. Although members of the experiment station staff agreed to the placement of a plain galvanized steel structure on the farm, recent progress does raise the question of its desirability. I feel certain that the administrative officials will wish to review the plans and specifications for the new building before final decisions are made.

“One suggestion was that the authority might be allowed to lapse for 1948-49, and that a different type structure be requested in the next budget—it may not be feasible to do this, however.”

Address: Urbana, Illinois.


• Summary: On the front page of this 123-page typescript these words appear prominently in the middle of the page:

“NOT FOR PUBLICATION—This is a Progress Report of Cooperative Investigations Containing Data the Interpretation of Which May Be Modified With Additional Experimentation. Publication, Display or Distribution of Any Data or Any Statements Herein is Prohibited Without Prior Written Approval of the Field Crops Research Branch, ARS, USDA, and the Cooperating Agency or Agencies Concerned.” Address: Urbana, Illinois.


• Summary: On the front page of this 90-page typescript these words appear prominently in the middle of the page:

“NOT FOR PUBLICATION—This is a Progress Report of Cooperative Investigations Containing Data the Interpretation of Which May Be Modified With Additional Experimentation. Publication, Display or Distribution of Any Data or Any Statements Herein is Prohibited Without Prior Written Approval of the Field Crops Research Branch, ARS, USDA, and the Cooperating Agency or Agencies Concerned.” Address: Urbana, Illinois.


Named varieties: Mandarin (Ottawa), Flambeau.
Address: Urbana, Illinois.

Address: Urbana, Illinois.


• Summary: This year Illinois farmers harvested about 28% of the soybeans grown in the USA—about 136 million bushels, worth over $300 million. This is more than double that of the next highest state, Minnesota, with 56 million bushels. Soybeans are the fourth largest source of cash in Illinois after hogs, cattle and calves, and corn.

This huge lead enjoyed by Illinois in soybean production is due to various reasons: (1) Favorable climate and soils. (2) An active research program at the University of Illinois dating back to 1896. (3) Development of improved varieties for the state. (4) Feeding tests showing the value of soybean meal in livestock feeding. (5) Establishment in 1936 of the U.S. Regional Soybean Laboratory at the University of Illinois. (6) The growth of many soybean processing plants, which provide a close and dependable market. Illinois is now the leading U.S. state in soybean processing.

Illinois counties leading in soybean production are Champaign, Vermilion, Iroquois, Sangamon, and Christian.

Nationwide in 1955, soybeans accounted for 2.6% of all cash farm income. But for Illinois farmers, soybeans made up 11.6% of all cash farm income.


“Introduction: The U.S. Regional Soybean Laboratory was organized in 1936 under the Bankhead Jones Act, as a cooperative project by the U.S. Department of Agriculture and the 12 Agricultural Experiment Stations of the North Central Region. In 1942 the work of Soybean Laboratory was expanded to include cooperation with 12 Agricultural Experiment Stations of the Southern Region also. The research program of the laboratory has been directed toward the development of improved varieties and strains of soybeans for industrial use, and the obtaining of fundamental information necessary to the efficient breeding of strains to meet specific needs.

“The Uniform Soybean Tests were initiated in 1938 on a limited basis but the work was rapidly expanded until nine tests groups were established to measure the yield and range of adaptation of the better strains developed by the laboratory’s breeding program. The first five groups include strains of proper maturity for the Central States. The other four groups contain strains adapted to the Southern States. The summary of performance of the first five groups is included in Part I of this report. Information on the last four groups adapted to the southern part of the United States is contained in Part II, which is issued separately.

“The first Uniform Preliminary Test was grown in 1944 to gain regional information on a larger number of strains that could be entered in the Uniform Tests. These tests at a limited number of locations have been useful in the early screening of experimental strains, thus improving the quality of entries in the Uniform Tests. Four such Preliminary Tests were grown in 1956, covering Maturity Groups I through IV.

“Uniform Test, Group 0, contains the strains that will bloom and mature under the longer days encountered during the summer in the Dakotas, Minnesota, and northern Wisconsin. Group I contains strains generally adapted to South Dakota, the southern parts of Minnesota, Wisconsin, and Michigan, and the northern parts of Iowa and Ohio. Groups II, III, and IV, respectively, include strains adapted to locations farther south in the North Central States and to other areas of similar latitude. In general, each group is

**Summary:** “Rate of planting and row width studies have been conducted in all of the major soybean producing areas of the South. Results of most of these studies are in fairly close agreement and indicate that the optimum rate within the row is 10-12 viable seed per foot and that there is no yield advantage for planting in rows narrower than 36 to 40 inches.

“Plantings of less than 10-12 seeds per foot of row will frequently yield as well as thicker planting, but the seedling growth is at a slower rate and more difficulty is encountered in weed control. Planting at rates heavier than 10 to 12 seeds per foot of row gives better early season weed control, but a greater amount of lodging usually results.

“Thirty-six or 38-inch rows have an advantage over 40-inch rows in that four rows can be handled with greater ease with a 12-foot combine.

“In 1944, the three varieties Ogden, Volstate, and Woods Yellow were grown at four rates in the row—2, 3, 6, and 12 plants per foot of row at two locations in eastern North Carolina. For the varieties Ogden and Volstate, this would mean planting rates of approximately 10, 15, 30, and 60 pounds per acre, and for Woods Yellow the planting rates would have been approximately 13, 20, 40, and 80 pounds. Row width was 40 inches. Plantings were made in early May. All plantings were made at a heavy rate and thinned to the desired spacing after emergence. Yields in these plantings are reported in Table 1.

“In these plantings, harvest loss from combining the two and three plants per foot rate would have been greater than from the two thicker rates, because pods were borne much closer to the ground.

“In 1947, 1948, and 1949, a rate of planting study was conducted on a Norfolk Sandy Loam soil at Rocky Mount, North Carolina. The Roanoke variety was planted in early May at the rates of 4, 6, 9, and 12 seeds per foot in 42-inch rows. Seeds having a laboratory germination of 90 to 95% were used. Seedling emergence ranged from 80 to 85% each year. Planting rate had no influence on percentage emergence in any year. A higher percentage of the plants survived to maturity in the thinner plantings. Seed yields were low in each of the first 2 years, and very good the third year. Yield was not influenced by planting rate. The results for the 3 years are reported in Table 2.

“There was a greater amount of lodging in the planting of 12 seeds per foot than where 9 seeds per foot were planted. On the basis of these studies and observations at other locations, a planting rate of 9 seeds per foot was recommended for Roanoke in North Carolina.

“In order to study the interrelations of row width and planting within the row, studies were made at Plymouth, N.C., using four row widths, 24, 30, 36, and 42 inches, and three rates within the row, 4, 6, and 12 plants per foot. All plantings were made at a thicker rate and thinned to the required spacing. Plantings were made in early May. Results for the Ogden variety are reported in Table 3.

“These studies showed no advantage for planting in rows closer than the conventional 36- to 42-inch rows. Thicker plantings in the row had an advantage from the standpoint of early weed control, regardless of row width. Lodging increased appreciably as row width was reduced.

“The plant population of 12 plants per foot appeared to be slightly excessive. A planting rate of 10-12 viable seeds per foot in 36- to 42-inch rows was concluded to be near the optimum for seed yield, early weed control, and a minimum amount of lodging.

“H.M. Camper and Dr. T.J. Smith conducted studies at Warsaw, Virginia, for the years 1952, 1953 and 1954 in which they used 12, 24, and 36-inch rows and planted at the rates of 3, 5, and 7 pecks per acre. Average planting dates were May 10, May 24, June 8, June 23, and July 9. Narrow rows had no yield advantage over the 36-inch row for the Ogden variety in any of the first four planting dates. Narrow rows gave higher yields than the 36-inch row in the July 9 plantings, but Ogden yielded appreciably less when planted in narrow rows on July 9 than when planted in 36-inch rows on June 26 or earlier. Seven pecks per acre reduced yield of Ogden in the May and June plantings.

“In 1949, Ogden soybeans were planted in late May at Stoneville, Mississippi, in four row widths—24, 30, 36, and 42 inches—at the rate of 10 viable seeds per foot of row. The mean yield for all plantings was 39.5 bushels per acre with no difference for row width.

“In 1950, Dorman, Ogden, and Roanoke varieties were planted in early May in 28, 32, 36, and 40-inch rows on a
sandy loam soil at Stoneville. All plantings were made at the rate of 10 seeds per foot of row. In these plantings the row middles in the 28-inch rows were shaded in 37 days as compared with 44 days for the 36-inch row. This difference might mean one less cultivation for the narrow rows. A greater amount of lodging resulted from planting in the narrow rows. Seed yields are reported in Table 4.

“Planting rates in 36-inch rows were tested at Stoneville on a sandy loam soil for the years 1952, 1953, and 1954. The three varieties Dorman, Ogden, and Lee were planted at the rates of 6, 9, 12, 18, and 21 seeds per foot. Percentage emergence was not influenced by planting rate in any of these plantings. Seed yield was influenced very little by planting rate. The mean yields for the three varieties in 1954 for the 6, 9, 12, 18, and 21 seeds per foot planting rates were 36.9, 35.4, 37.5, 36.8, 38.5, and 35.8 bushels per acre. The six-seed-per-foot planting required a longer time to give complete ground shading. Lodging was considerably greater in the 18 and 21 seeds per foot planting rates. For the Dorman and Lee varieties, the approximate planting rates would be 27, 40, 54, 80, and 94 pounds per acre, while for Ogden the rates would be approximately 30, 45, 60, 90, and 105 pounds per acre. The 9-to-12-seeds-per-foot rates gave excellent early growth with a minimum amount of lodging.

“In 1955, Dorman and Lee were planted at three planting dates on a heavy clay soil at Stoneville, Miss. Three planting rates–6, 12, and 18 seeds per foot–were used in 36-inch rows. Percentage emergence was slightly higher for the thinner planting rates. Seed yields for the May 10 and May 31 plantings are reported in Table 5.

“These plantings were made with an old style double disk opener which did not place the seed uniformly at the bottom of the furrow opening. As a result the percentage emergence was somewhat lower than has been obtained from the use of newer style double disk openers on the heavy clay soils. Therefore, the apparent advantage for thicker planting in late May or early June is not typical.

“During the years 1950, 1951, 1952, and 1953 plantings of Ogden beans were made by Ralph Smith in west Florida at the rates of 30 to 120 pounds per acre. These plantings were made in 36-inch rows in early June. Results are reported in Table 6.

“In 1952, Ogden soybeans were grown in six row widths in West Florida. When each row received a comparable amount of fertilizer and approximately one seed per inch in the row, the yields for the different row widths were as follows: 12-inch, 35.2 bushels; 18-inch, 31.9 bushels; 24-inch, 32.3 bushels; 30-inch, 32.9 bushels; 36-inch, 34.2 bushels; and 42-inch, 30.6 bushels.

“Studies conducted by the Arkansas Agricultural Experiment Station at Stuttgart in 1950 and 1951, at Clarkedale in 1950, and at Marianna in 1951 showed a distinct yield advantage for planting in narrow rows. Results obtained for the Ogden variety are reported in Table 7. In these studies the 10-inch and 20-inch rows were hand hoed to control weeds and the 40-inch rows were cultivated.

“Plant growth in the Arkansas tests was less than was produced in the other studies reported from other states. The reduced plant growth probably explains the greater differences in seed yield among the different row widths.

“Perhaps growers in the North Central area will wonder why experimental plantings in their area show a yield advantage for narrow rows while most results in the South show no advantage for narrow rows. Much of the difference can be explained by the fact that adapted Southern varieties have much heavier foliage and will normally completely fill the row middles in 36- to 40-inch rows (fig. 1). Crowding these heavy foliage types into narrow rows results in increased lodging.

“In this discussion, increased lodging from thick plantings or narrow rows has been emphasized. Readers may feel that the data presented does not show too much yield reduction from the heavy planting rates. However, severe lodging increases problems in maintaining proper combine adjustment, particularly height of cutter bar and reel, and will frequently result in greater harvesting losses.

“Growers frequently say that they like to plant extra seed because they believe it will improve their chances of obtaining a stand. Excess seed is no substitute for a good seedbed. Two bushels per acre in a dry cloddy seedbed will fail just as surely as 10 viable seeds per foot in 36- to 40-inch rows. Rate of planting studies with different varieties and strains of soybeans have shown little difference in the optimum planting rate in the row. Soybean varieties do differ, however, in the number of seeds in a bushel. A large seeded variety having only 2,000 seeds per pound will require 87 pounds of seed per acre to give the same planting rate as will be obtained by planting 50 pounds of a variety having 3,500 seeds per pound. The most positive method of checking planting rate is to put seed in one hopper, drive at regular planting speed on firm ground, and count seed dropped in several 36-inch sections of row. With seed having a germination of 90% or better, one seed per inch will usually be an adequate amount of seed. Seed of any variety will differ slightly in size from year to year. Therefore, it is desirable to check planting rate every year ahead of planting time.”

Address: Research Agronomist, Mississippi Agric. Exp. Station, Stoneville, MS, and coordinator of the U.S. Regional Soybean Lab. research program.


• Summary: Except for the cover, this document is
was shown to have an oil content too low for satisfactory commercial production, its resistance to bacterial pustule has been incorporated into many of the new strains now in test.

“A wide range of soil and climatic conditions exist in the region. As an aid in recognizing regional adaptation, the region has been subdivided into five rather broad areas, which still represent a wide range of soil types. These are: (1) the East Coast, consisting of the Coastal Plain and Tidewater areas of southern Delaware, the Eastern Shore of Maryland, Virginia, North Carolina, and the upper half of South Carolina; (2) the Southeast, consisting primarily of the Coastal Plain soils of the Gulf Coast area, but also including similar soils from South Carolina southward; (3) the Upper and Central South, including the Piedmont and loessal hill soils east of the Mississippi River; (4) the Delta area, composed of the alluvial soils along the Mississippi River from southern Missouri, southward, and (5) the Southwest, comprising Arkansas and Louisiana, outside of the Delta, and Oklahoma and Texas. In the Southwest area, most of the potential soybean-growing areas are on the alluvial river valley soils. A map is included to illustrate the five production areas,

“On nearly all of the Coastal Plain, Piedmont, and loessal soils fertilization is essential for satisfactory soybean production. A table showing soil types and rate of fertilization is included.

“As a further aid in interpreting varietal responses, rainfall data is reported for the representative locations for the various production areas.

“The 1952 season was characterized by an extreme summer drouth [drought], especially in the Delta section, and by an early killing frost. The effects of the frost were felt in the Southwest, Delta, and upper East Coast plantings.

“In calculating variety means for seed yield, data from tests with extremely low yields or where the coefficient of variability exceed 25 per cent, are not included in the area means.” Address: 1. Agronomist; 2. Clerk-Stenographer; 3. Agricultural Aid [Stoneville, Mississippi].


• Summary: Nine species of tropical plants closely related to soybeans are being studied at the University of Illinois by research workers at the U.S. Regional Soybean Laboratory. Most of the plants are perennial vines. A photo shows Richard Bernard examining one of the plants. The plants, which have come from the Belgian Congo, South Africa, Southern Rhodesia, Kenya, Nigeria, Australia, Formosa [Taiwan], and Malaya, may have disease resistance that
might be bred into regular soybeans. The leaves and flowers of these plants are similar to those of regular soybeans. The seeds form in pods but are much smaller than regular soybeans.

Note: These are probably wild perennial Glycine species.

*Summary:* “Dr. Allan K. Smith, a member of the Northern Regional Research Laboratory, Peoria, Illinois, and an international authority on soybean protein and its uses, received a superior service award from Secretary Ezra T. Benson at the Department of Agriculture’s 11th annual awards ceremonies in Washington, D.C.

“Dr. Smith received his award ‘for meritorious creative contributions advancing basic knowledge of soybean proteins leading to their isolation and characterization, pilot-plant production, and increased industrial and food uses.’”

“Dr. Smith started his research on the chemistry and uses of soybean protein at USDA’s Regional Soybean Industrial Products Laboratory at Urbana, Illinois. When that laboratory became an integral part of the Northern Regional Laboratory at Peoria in 1942, he continued his research on protein properties and food uses of oilseeds.

“The basic research results on soybean protein conducted under his direction have made a major contribution to the estimated annual production of 50 million pounds of isolated soybean protein. Based on information developed in his studies, this protein is used in paper coating, in plywood adhesives, and in shotgun shell casings, as well as in such food products as bread, spaghetti, breakfast foods and cheese.”

Note: This is the earliest document seen (Dec. 2015) that contains industry and market statistics for soy protein isolates (or concentrates, or textured soy protein products) by geographical region.

A portrait photo shows Dr. Smith.

*Summary:* Soybean oil from all locations and varieties have been analyzed for linolenic and linoleic acid by an improved spectrometric method. Address: Field Crops Research Branch, USDA Regional Soybean Lab., Urbana, Illinois.

*Summary:* “Linolenic acid content of soybean oil from location and variety composites varied from about 5% to about 8.5% and linoleic acid varied from about 46% to about 54%. The levels of both fatty acids were closely, but inversely correlated with temperature.” Address: 1. Plant physiologist; 2. Chemist, Crops Research Div., ARS, USDA, U.S. Regional Soybean Lab., Urbana, Illinois.

Address: Research Agronomists, USDA, Urbana, Illinois.

*Summary:* Except for the cover, this entire document is typewritten.

Near bottom of title page: “United States Department of Agriculture.
“Agricultural Research Service.
“Crops Research Division.
“Cooperating with State Agricultural Experiment Stations.”


*Summary:* Except for the cover, this document is typewritten.


test, Group VII. Preliminary Group VII. Uniform test, Group VIII.

Introduction: The program of the U.S. Regional Soybean Laboratory has been directed toward the development of improved strains of soybeans and the obtaining of fundamental information necessary to the efficient breeding of strains to meet specific needs. In the Southern Region, fundamental studies and breeding programs are conducted at the two centers, Stoneville, Mississippi, and Raleigh, North Carolina. After promising new strains are developed at these breeding centers, they are advanced to the uniform regional tests, conducted in cooperation with the 12 southeastern states. This testing program enables the breeder to evaluate new strains under a wide variety of conditions, and permits new strains to be put into production in a minimum amount of time.

Nine uniform test groups have been established to evaluate the better strains developed in the breeding programs. The Groups 0 through IV are adapted in the northern part of the United States, and the Groups IV through VIII are grown in the southern part. Within their area of adaptation, there is a maturity range of 12 to 18 days within each maturity group. The best standard variety available of each maturity class is used as a check variety with which to compare new strains as to seed yield, chemical composition, maturity, height, lodging, and seed quality. For the groups grown in the southern area, the check varieties are Perry, Dorman, Ogden, Roanoke, and Improved Pelican. At Stoneville, Mississippi, where all maturity classes will mature, the approximate maturity dates of these varieties when planted during the first half of May are: Perry, September 6; Dorman, September 20; Ogden, October 10; Roanoke, October 25; and Improved Pelican, November 8.

The 1952 cooperative nurseries complete 10 years of regional strain evaluation in the Southern States. Of the 43 strains included in Groups V through VIII, only three, S-100, Ogden, and Acadian, were included in 1943. The results of these tests have shown the advantages of the improved varieties, and as a result, varieties such as Ogden and Roanoke have replaced largely the older varieties such as Arksoy, Ralsoy, Tokyo, Woods Yellow, and Palmetto. However, the good characteristics of some of these strains have been utilized in the breeding program. For example, N47-3479, which has shown promise in Group VII, has Palmetto as one of its parents. Although the variety CNS was shown to have an oil content too low for satisfactory commercial production, its resistance to bacterial pustule has been incorporated into many of the new strains now in test.

“A wide range of soil and climatic conditions exist in the region. As an aid in recognizing regional adaptation, the region has been subdivided into five rather broad areas, which still represent a wide range of soil types. These are: (1) the East Coast, consisting of the Coastal Plain and Tidewater areas of southern Delaware, the Eastern Shore of Maryland, Virginia, North Carolina, and the upper half of South Carolina; (2) the Southeast, consisting primarily of the Coastal Plain soils of the Gulf Coast area, but also including similar soils from South Carolina southward; (3) the Upper and Central South, including the Piedmont and loessial hill soils east of the Mississippi River; (4) the Delta area, composed of the alluvial soils along the Mississippi River from southern Missouri, southward, and (5) the Southwest, comprising Arkansas and Louisiana, outside of the Delta, and Oklahoma and Texas. In the Southwest area, most of the potential soybean-growing areas are on the alluvial river valley soils. A map is included to illustrate the five production areas.

“On nearly all of the Coastal Plain, Piedmont, and loessial soils fertilization is essential for satisfactory soybean production. A table showing soil types and rate of fertilization is included.

“As a further aid in interpreting varietal responses, rainfall data is reported for many of the locations where nurseries were grown. Since much of the summer rainfall is from local showers, rainfall data is included only from locations where records were taken reasonably close to the nurseries. Daily minimum and maximum temperatures are reported for the representative locations for the various production areas.

“The 1952 season was characterized by an extreme summer drought [drought], especially in the Delta section, and by an early killing frost. The effects of the frost were felt in the Southwest, Delta, and upper East Coast plantings.

“In calculating variety means for seed yield, data from tests with extremely low yields or where the coefficient of variability exceed 25 per cent, are not included in the area means.” Address: 1. Agronomist; 2. Clerk-Stenographer; 3. Agricultural Aid [Stoneville, Mississippi].


• Summary: Contents: Introduction. Method of testing: Yield, maturity, lodging, height, seed quality, chemical composition. Soybean varieties: Choosing an adapted variety, varieties recommended for Illinois (Chippewa, Harosoy, Hawkeye, Adams, Lincoln, and Clark; a map shows where each yields best). Other varieties: Blackhawk, Monroe, Earlyana, Korean (or Early Korean), Richland, Bavender Special, Dunfield, Illini, Chief, Wabash, Perry, Roe, Dorman, S100, Smith Super, Ogden, Lee.

Tables show: (1) Soybean yield trials at nine locations, 1951-1957. (2) Agronomic traits and seed composition of varieties. For each variety is shown: Average yield, maturity, lodging, height, seed quality, seeds per pounds, seed composition (percentage of protein and oil). (3) Origin and identifying characteristics of some soybean varieties. For each variety is shown: Parentage or origin, year released,
flower color (purple, white, or [rarely] purple and white), pubescence color (brown or gray), hilum color (black, black and brown, buff, dilute black, gray, light yellow).

A note below the table explains: “The hilum is the eye or seed scar where the seed is attached to the pod. Seed coats of all varieties listed are light yellow except those of Ogden and Smith Super which are light green.” A hilum color given as “dilute black” means that center of hilum is black, margin is buff.


“Probably no single cultural factor is more important to soybean production than the date of planting.” Four soybean varieties planted in Urbana, Illinois, on May 1 yield higher than when planted at any later date. Address: U.S. Regional Soybean Lab., Urbana, Illinois; Plant Physiologist and Agronomist, respectively, Crops Research Div., ARS, USDA.

Address: Urbana, Illinois.

• Summary: Data supplied by James C. Sentz, University of Minnesota, St. Paul. Address: Urbana, Illinois.

• Summary: A new high-yielding soybean variety, Shelby has been developed by the U.S. Regional Soybean Laboratory and cooperating state agricultural experiment stations. A map shows that it is best suited for central Illinois and Indiana, and northern Missouri. A photo shows Dr. A.H. Probst, USDA plant breeder at Purdue University, with the new Shelby variety. Address: Illinois Agric. Exp. Station.

• Summary: The oil content of soybean seeds averaged 23.2%, 20.8%, and 19.5% when day temperatures of 85ºF, 77ºF, and 70ºF, respectively, were used during the pod-filling stage. A day temperature of 85ºF for one week during this period increased oil content from 19.6% to 22%. Temperature changes affected mostly the triglyceride portion of the oil. Address: U.S. Regional Soybean Lab., Urbana, Illinois; Plant Physiologist and Agronomist, respectively, Crops Research Div., ARS, USDA.

• Summary: Pod removal: When up to 22% of the pods of Lincoln soybeans, or up to 17% of the pods of Hawkeye soybeans were removed, compensating increases in seed weight occurred and yields were close to the maximum. Sugars, starch, and proteins accumulated in the leaves and stems of the plants which had 80% of the pods removed. Pod removal increased the seed protein content and decreased the oil content and its iodine number.

Defoliation: Seed yields of plants with 80% artificial defoliation were reduced by nearly 50% and yields of plants with 40% defoliation by 21%. Severe defoliation (80%) decreased the protein content and raised the oil iodine number of the seed. Address: U.S. Regional Soybean Lab., Urbana, Illinois.

• Summary: This new soybean variety, which was developed by the Iowa Experiment Station, will first be available to Nebraska farmers in 1959. It is expected to be higher yielding than Hawkeye, Adams, or Lincoln–and is expected to replace all of the Lincoln acreage and part of Adams and Hawkeye in Nebraska. In yield, it consistently exceeds Adams and Lincoln by 1-3 bushels/acre. In maturity, it is 7 days earlier than Clark, one day earlier than Lincoln, and about 5 days later than Hawkeye. In lodging, it stands somewhat better than Adams and Lincoln. In oil and protein content, it is comparable to Lincoln. A table shows the results of yield tests at four locations in Nebraska (northeast, east-central, central, and southeast) from 1953 to 1957. A large photo shows LaMoine Brownlee, Assistant Manager of the Foundation Seed Division, holding several Ford soybean plants and standing in front of a field of Fords.

Development of the Ford variety: In 1941, to improve the standability of the Lincoln, it was crossed with the Richland (which is resistant to lodging) at the Iowa Experiment Station. his hybrid was then crossed back to Lincoln at the Illinois Experiment Station. Hundreds of selections from this backcross were made at Iowa State College over a period of 13 years. The best of these was tested in Iowa, Nebraska, and other North-Central states. The U.S. Regional Soybean Laboratory also cooperated. Ford
was the one that proved most outstanding.

Appearance: Ford looks very much like Lincoln with white flowers. Its seeds are yellow with a black hilum, and nearly round.

“Availability of seed: Ford is being increased in Iowa, Nebraska and South Dakota in 1958. Seed available from the Foundation Seed Division of the Nebraska College of Agriculture for 1959 planting will go to certified seed growers in the areas where the variety is best adapted. Seed should be generally available to soybean growers in 1960.”

Note: This is the earliest document seen (Dec. 1998) that mentions the Ford soybean variety.

499. Soybean Digest. 1959. W.L. Burlison is gone. Jan. p. 35. • Summary: “Dr. W.L. Burlison, professor of agronomy, emeritus, at the University of Illinois and one of the key figures in the development of the soybean crop and industry in the United States, died peacefully in his sleep at his home at Urbana, Illinois, Dec. 25. He was 76.

“Dr. Burlison was head of the department of agronomy at the University of Illinois from 1920 until his retirement in 1951. He saw the crop develop from a few bushels to half a billion bushels annually. It was in no small part due to Burlison’s leadership that Illinois has paced the nation in soybean production for over 30 years and at times has produced over half the crop.

“A vigorous research and extension program covering more than 35 years is one of the major reasons why Illinois today is the top soybean state.’ Mr. Guither noted Dr. Burlison’s leadership in this work.

“Dr. Burlison was one of the founders of both the American Soybean Association [ASA] and the National Soybean Processors Association. He served both as president and secretary of ASA. He was a longtime counselor to both Associations and helped to promote friendly relationships between the two groups.

“He was an honorary life member of both Associations. He was one of the first two men to be so honored by ASA in 1946, the other being W.J. Morse, who pioneered the soybean work in the U.S. Department of Agriculture.

“When the American Soybean Association celebrated its 25th anniversary with its annual convention at the University of Illinois in 1945, Dr. Burlison was the key man in planning that program and made it a high point in ASA history.

“His vision and foresight resulted in the establishment of the U.S. Soybean Laboratory at Urbana. This later became the U.S. Regional Soybean Laboratory at Urbana, where the soybean breeding work for 12 Midwest states is directed and the Northern Regional Research Laboratory at Peoria, where soybean industrial and foods work is centered.

“Dr. Burlison was born in 1882 in Harrison, Arkansas. He attended country school in Oklahoma. He received his bachelor of science degree at Oklahoma A&M College in 1905, and his Master of Science and Ph.D. at the University of Illinois in 1908 and 1915. He was the author of a book entitled, Farm Crop Projects, and author or co-author of 30 bulletins, 25 circulars and at least 65 scientific and popular articles. He was a member of and active in many agricultural, scientific, civic and religious organizations for many years.

“Dr. Burlison is survived by Mrs. Burlison, who attended many soybean meetings with her husband, two daughters and two sons.”

A large portrait photo shows W.L. Burlison.


• Summary: Near bottom of title page: “United States Department of Agriculture. Agricultural Research Service. Crops Research Division, cooperating with State Agricultural Experiment Stations.”

HISTORY OF U.S. REGIONAL SOYBEAN LABORATORY (1936-2017) 281


• Summary: Except for the cover, this document is typewritten.


• Summary: “Soybeans are a naturally self-pollinated crop, and therefore breeding methods are essentially the same as those used for wheat and oats. The first step in developing an improved variety is choosing the parents to be used in crossing. The U.S. Regional Soybean Laboratory has a ‘Germ Plasm Bank’ of about 3,000 strains collected mainly from Manchuria, China, and Japan. Many of these strains have some outstanding traits, such as disease resistance or high oil content, that breeders can use in crosses to improve soybean strains for particular areas of adaptation. The plants in this collection are evaluated and made available to soybean breeders throughout the country.

“The next step is making the actual cross-pollination. Before natural pollination occurs, the small flower bud must be opened and the pollen-bearing structures called stamens are removed with a small pointed pair of forceps. Pollen is then applied from an open flower of another variety with which the cross is to be made. Many such pollinations are not successful, but under good conditions about one seed is obtained for every hand pollination.

“Sometimes ‘backcrossing’ is done in cases where it is desired to transfer such traits as disease resistance or seed coat color, which are inherited in a simple manner and easily evaluated, to an otherwise excellent variety. To do this the variety is crossed to any strain with the desired trait and the plant that is produced is then ‘backcrossed’ back to the variety we wish to improve. This process is repeated for several generations.

“The final step in producing a new variety is testing, selecting, and retesting the many different strains obtained from each cross. Field and laboratory testing are both used extensively, so that high-yielding lines will have also been evaluated for protein and oil content and other characteristics that make the variety valuable to industry. After a year or two of testing, the best strains are used in the regional Uniform Tests, which are grown at 20 to 30 locations throughout the Soybean Belt.

“These tests show the reaction of the strains to diverse soil, fertility, and cultural conditions, and their resistance to lodging and shattering under widely different rainfall and drought conditions. Detailed information is also obtained on resistance to diseases occurring in the various sections of the country. Testing over a wide geographical range makes it possible to select strains with wide areas of adaptation, and reduces the time necessary to evaluate the possible performance of strains in any one area.

“Strains that perform best under the varied conditions imposed by the Uniform Tests are considered for rapid increase of seed and eventual release by interested state experiment stations. Strains are frequently in as many as 100 tests over three to six years before being recommended to farmers. Recommended soybean varieties have undergone this method of evaluation prior to their recommendation. A report of the performance of these recommended varieties for your area may be obtained from your Agricultural Experiment Station.” Address: Research Agronomist, U.S. Regional Soybean Lab. (Univ. of Illinois).


• Summary: “Each worthwhile American industry exists because of the vision, faith, and ability of one or more great men who saw the possibilities and steadfastly carried the torch for its development and growth.

“Such a man was Dr. W.L. Burlison, for 30 years head of the agronomy department of the University of Illinois, and who passed away on last Christmas Day at age 76. He is generally acclaimed as one of the men most responsible for

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the growth of the soybean industry in the United States.

“Burlison could see the usefulness of the soybean 50 years ago and started tests to prove its value. All of his active lifetime as an agronomist he encouraged farmers to grow soybeans and his staff to experiment on the improvement of soybean varieties and the development of better cultural practices. He saw the soybean grow from an oriental emigrant to a crop second only to corn in his own state of Illinois and to a billion dollar crop for American farmers.

It was largely his vision and foresight that led to the establishment of the U.S. Soybean Laboratory at Urbana, from which came the U.S. Regional Soybean Laboratory at Urbana where the soybean breeding work of the 24 northern and southern cooperating states is directed, and the Northern Regional Research Laboratory at Peoria where industrial and food uses of the Soybean are studied.

“He was one of the founders and an honorary life member of the American Soybean Association, the National Soybean Processors Association, and a Charter member of the Advisory Board of the National Soybean Crop Improvement Council.

“He was author or co-author of a great number of bulletins, circulars, and scientific papers. He continually worked for closer cooperation and understanding between the Land Grant Colleges and Experiment Stations and the handlers, buyers, and processors of farm products.

“Dr. Burlison wanted to improve farm crops, but he wanted more than that. He wanted to improve mankind. He always found time for the Boy Scouts, for his church, and for the many students and farmers who sought his friendly counsel. A fitting tribute to Dr. Burlison was the brochure prepared by his host of friends at the time of his retirement as head of the Agronomy Department. It was titled ‘Leader, Agricultural Statesman–Friend.’ Such a man as Burlison cannot be replaced, but great indeed is the heritage he has left to Illinois, to soybeans, and to farming.”

A portrait photo shows W.L. Burlison.


• Summary: “Soybeans are native to eastern Asia, where they have been cultivated for over 5,000 years. They were first introduced into the United States on a large scale about 60 years ago.

“Most early varieties were produced as selections from these introduced strains. Such varieties as Illini, Dunfield, Richland, Manchu, Patoka, and the hay types, Wilson and Virginia, originated in this way.

“The first soybean variety for Illinois developed by selection following crossing was Chief, selected from the cross Illini x Manchu and released by the Illinois Agricultural Experiment Station in 1940. All presently recommended varieties in Illinois have been selected from crosses.

“First Step: Soybeans are a naturally self-pollinated crop (less than 1% of the flowers are fertilized with pollen carried by insects from other plants), and therefore breeding methods are essentially the same as those used for wheat and oats.

“The first step in developing an improved variety is choosing the parents to be used in crossing. The U.S. Regional Soybean Laboratory, with headquarters located at the University of Illinois, has a ‘Germ Plasm Bank’ of about 3,000 strains collected mainly from Manchuria, China, and Japan. Most of these strains are poor in general agronomic desirability, but many have some outstanding trait, such as disease resistance or high oil content, that breeders can use in crosses to improve soybean strains for commercial growing. These plant introductions are evaluated and made available to soybean breeders throughout the country.

“Second Step: The next step is making the actual cross-pollination. Before natural pollination occurs, the small flower bud must be opened and the pollen-bearing stamens removed with a small pointed pair of forceps. Pollen is then applied from an open flower of another variety with which the cross is to be made. Many such pollinations are not successful, but under good conditions about one seed is obtained for every two or three hand pollinations.

“Sometimes backcrossing is done in cases where it is desired to transfer such traits as disease resistance or seed coat color, which are simply inherited and easily evaluated, to an otherwise excellent variety. The variety is crossed to any strain with the desired trait, the plant that is produced is ‘back-crossed’ to the variety, and this process is repeated for several generations.

“Final Step: The final step in producing a new variety is testing, selecting, and retesting the many different strains obtained from each cross. In the second generation (F2) following crossing, individual plants of the segregating population are selected for such traits as disease resistance, seed color, and resistance to lodging and shattering. These plants are classified into maturity groups, and the progeny of each plant is planted in a row at a location suitable for its maturity.

“In the F3 generation and again in the F4, the best appearing plants from the best appearing rows are selected. Strains from F3 or F4 plants are usually sufficiently uniform for preliminary yield testing in replicated plots at several locations in the state.

“In addition to agronomic evaluation, chemical evaluation is carried on concurrently so that high-yielding lines have also been evaluated from protein and oil content and other characteristics that make the variety valuable to industry.

“After a year or two of testing and possible reselection, the best strains are entered in regional preliminary tests and grown at one or two locations in several states to more thoroughly evaluate their potential performance.

“The best strains from the preliminary tests are entered
in the regional uniform tests, which are grown at 15 to 25 locations throughout the soybean belt.

“These tests show the reaction of the strains to diverse soil, fertility, and cultural conditions, and their resistance to lodging and shattering under widely different rainfall and drought conditions. Detailed information is also obtained on resistance to diseases occurring in the various sections of the country. Testing over a wide geographical range makes it possible to select strains with wide areas of adaptation, and the relative potential performance of strains in any one area can be estimated in a shorter time.

“Recommended Varieties: Strains that perform best under the varied conditions imposed by the uniform tests are considered for simultaneous increase and release by interested state experiment stations. Strains are frequently in as many as 100 tests over 3 to 6 years before being recommended to farmers. All presently recommended soybean varieties in Illinois have undergone this method of evaluation prior to their recommendation. A report of the performance of these recommended varieties appears in Illinois Agricultural Experiment Station Circular 760.

“The table [in the circular], based on data from the Cooperative Crop Reporting Service, shows the percentage of the total soybean acreage in Illinois that each soybean variety occupies. Lincoln was released in 1944 and, partly because of its higher yield and superior lodging resistance, rapidly replaced other varieties of comparable maturity. Now Lincoln has been largely replaced by superior varieties more recently released.

“No new variety is released for commercial production unless it has been proved, through extensive testing, to be superior in one or more characters to existing varieties it is designed to replace. It takes about 10 years to produce a soybean variety from the initial cross to the time it is made available to farmers.

“Variety development has made possible the establishment and rapid expansion of the soybean as a grain crop in the Midwest. Present breeding work will aid in further expanding the crop by increasing production efficiency and reducing the threat of new diseases.”

A photo shows “U.S. Regional Soybean Laboratory test plots.” Address: Research Agronomists, ARS, USDA.


• Summary: “In recognition of achievements in research a Superior Service Award has been conferred by the U.S. Department of Agriculture on Leonard L. McKinney of the Northern Regional Research Laboratory, one of the utilization and development divisions of USDA’s Agricultural Research Service.

“Citation for the Peoria scientist was presented May 25 by Secretary of Agriculture Ezra Taft Benson during special ceremonies in Washington, D.C.

“Mr. McKinney, assistant director at the Northern Laboratory and until recently leader of its protein research group, received the Department’s Superior Service Award for developing new commercial derivatives from vegetable proteins and for discovering what causes toxicity to arise in proteins during certain types of processing. By identifying, isolating, and synthesizing the toxic factor, Mr. McKinney provided new chemical agents for medical research and information important for processing agricultural products.

“The toxicity of trichloroethylene-extracted soybean oil meal (TESOM) has plagued soybean processors and livestock farmers around the world since it was first observed in Scotland in 1912. Many research workers studied the problem and decided that modern technology could avoid whatever altered the blood-forming power of the bone marrow and caused hemorrhagic aplastic anemia in cattle. Soybean meal extracted by other means does not have the toxicity of TESOM.

“Between 1943 and 1950, 11 plants were built in the United States, one in Italy, and another in Japan to use trichloroethylene, a non-explosive solvent. High death rates began to occur again in herds of cattle where TESOM was fed.

“In 1951, Mr. McKinney postulated the cause of TESOM toxicity—a theory that he and his associates finally proved by chemical synthesis of a cysteine derivative (DCVC) in 1957. Calves fed extremely small doses of DCVC developed symptoms identical to those associated with TESOM poisoning. After 1952 trichloroethylene was no longer used in the United States as a solvent to extract oil from soybeans.

“In September 1958 Mr. McKinney was invited by the Cancer Chemotherapy Center, National Institutes of Health, to discuss his work with those who had recognized DCVC as an important lead for health studies and as a chemical compound that might aid in developing new anticancer drugs. Various medical schools reported experimental results with DCVC, particularly when it was used clinically in certain forms of leukemia. One physician commented, ‘For the first time, we have an agent for producing controlled aplastic anemia in animals at will.’

“While solving the TESOM problem, Mr. McKinney conducted research leading to a new product from corn. Water-soluble zein was in commercial production within a year after he described how to process this corn protein the 1957 meeting of the Illinois Academy of Science. Mr. McKinney started research on the chemistry and uses of proteins in 1937 at the Department’s Regional Soybean Industrial Products Laboratory in Urbana.”

A photo shows Leonard L. McKinney seated in a laboratory and wearing a white lab coat.

506. Orr, Richard. 1959. Day by day on the farm: Plan attack
soy for human consumption: 1. Full-fat soy were produced in 1956. There are 3 principle types available human consumption in the United States. About 114,000 tons Substantial quantities of soy total."

"Although the industrial nonfood uses of soybean oil make up only a small portion of the total consumption, they must not be considered unimportant... Soybean oil-modified alkyd resins are now of great importance in the coatings industry, and a research breakthrough could easily double the current industrial use of 300-plus million pounds."

"Many other soybean products have important and sizable uses. For example, some 25 to 35 million pounds of soybean lecithin is produced annually and finds its way into foods, cosmetics, and even paint."

Photos show: Spencer Kellogg’s soybean storage plant (elevator with 19 concrete silos on one side) at Bellevue. A continuous solvent extraction plant. Address: Vice President, Spencer Kellogg and Sons, Inc., Buffalo, New York.

• Summary: This is publication No. 325 of the U.S. Regional Soybean Laboratory, Urbana, Illinois. Address: 1. Plant Physiologist; 2. Chemist; 3. Physical Science Aid. All: Crops Research Div., ARS, USDA.

• Summary: Soybeans are fourth in terms of production among American grain crops, surpassed by only corn, oats, and wheat. Major varieties include—in the Midwest: Adams, Chippewa, Clark, Harosoy, and Hawkeye; in the South: Dorman, Jackson, Lee, and Ogden. “Many state experiment stations as well as the U.S. Soybean Laboratory at Urbana, Illinois, have participated in the extensive and extremely effective agronomic program which has widely extended growing areas and increased yields.”  

SOM is soybean oil meal. “Various types of mechanical pressing were once important, but comparatively few soybeans are so processed today except in the South, where they are sometimes crushed at local cottonseed expeller plants... Some plants are equipped to manufacture soy flour, to isolate protein, and even to manufacture adhesives.”  

“Total consumption of protein meal has increased to nearly 3 times the prewar average and now stands at over 10 million tons; soybean oil meal comprises about 70% of this total.”

Substantial quantities of soyflour are used in foods for human consumption in the United States. About 114,000 tons were produced in 1956. There are 3 principle types available for human consumption: 1. Full-fat soyflour. 2. Low-fat soyflour. 3. Defatted soyflour. Protein content rages from 42 to 52%. The flour is used in a variety of foods—pet foods, doughnut and waffle mixes, sausages, bread, etc. Soybean flour and isolated protein has important industrial uses, principally as adhesives, paper coatings, etc.

“Although the industrial nonfood uses of soybean oil make up only a small portion of the total consumption, they must not be considered unimportant... Soybean oil-modified alkyd resins are now of great importance in the coatings industry, and a research breakthrough could easily double the current industrial use of 300-plus million pounds."

"Many other soybean products have important and sizable uses. For example, some 25 to 35 million pounds of soybean lecithin is produced annually and finds its way into foods, cosmetics, and even paint.”

Photos show: Spencer Kellogg’s soybean storage plant (elevator with 19 concrete silos on one side) at Bellevue. A continuous solvent extraction plant. Address: Vice President, Spencer Kellogg and Sons, Inc., Buffalo, New York.

• Summary: Near bottom of title page: “United States Department of Agriculture. Agricultural Research Service. Crops Research Division, cooperating with State Agricultural Experiment Stations.”  


• Summary: Except for the cover, this document is typewritten.  


• Summary: The first comprehensive review on soybean physiology by the leading authority on the subject.  


- **Summary:** Near bottom of title page: “United States Department of Agriculture. Agricultural Research Service. Crops Research Division, cooperating with State Agricultural Experiment Stations.”


- **Summary:** Except for the cover, this document is typewritten.


- **Summary:** The linolenic acid content of 251 soybean varieties ranged from 4.89 to 9.28% and the linoleic content ranged from 35.8 to 53.4%. It was found that inheritance of both fatty acids was quantitative rather than qualitative.

The content of polyunsaturated fatty acids in soybeans has not generally been used as a criterion for selection in soybean breeding. However, since there is solid evidence that linolenic acid is at least partly responsible for the undesirable off flavors from flavor reversion in refined soybean oil, studies of fatty acid inheritance should provide useful information.

Note: This is the earliest document seen (Nov. 2003) concerning the breeding of soybeans for improved seed quality (reduced linolenic acid). Address: Purdue Univ., Lafayette, Indiana.


- **Summary:** “A marked difference in the response of Chief and Lincoln varieties of soybeans to high concentrations of phosphorus in nutrient solution was observed several years ago. These varieties respond similarly to moderate phosphorus concentrations, but if phosphorus is increased five- to ten-fold Chief responds by increased vegetative growth and seed production whereas Lincoln develops a reddish-brown leaf discoloration, has a reduced growth rate, and produces very few seeds.

  “Under suitable conditions, the difference between the two varieties is very striking, with leaf symptoms appearing on Lincoln plants within 2 to 5 days after establishment of the high-phosphorus regime. Such symptoms may also appear on Chief plants, but either much higher concentrations of phosphorus or longer exposure is required.

  “The varietal difference in response to phosphorus provides an unusual tool for genetic and biochemical studies of phosphorus nutrition in soybeans. Its potential usefulness for such studies would be enhanced by information on the response of additional soybean varieties to phosphorus. This report presents a classification of a large number of soybean varieties according to their phosphorus responses. Nearly all varieties currently recommended in the United States and Canada plus others of interest for historical or other reasons are included.”

Note: This is: “Publication No. 351 of the U.S. Regional Soybean Laboratory, Urbana, Illinois.” Address: U.S. Regional Soybean Lab., Urbana, Illinois.


- **Summary:** “Why don’t soybeans yield as much as corn or cotton? This question has probably occurred to every farmer who has grown soybeans after experience with other crops, and it has probably been asked of every agronomist working with soybeans.

  “There are some basic biological facts which are pertinent to such a question. In this paper some of these facts as they relate to soybeans and corn will be considered.
Similar comparisons of soybeans with other crops would be possible.

“Basic to any inter-crop comparison is a consideration of the chemical composition of the product. Soybeans are relatively high in oil and protein and relatively low in carbohydrates. Corn, on the other hand, is high in carbohydrates and low in oil and protein. The average energy contents or caloric values of these three classes of food materials are as follows: carbohydrates, 1,860 Kcals/ lb.; fats and oils, 4,300; proteins, 2,560. Fats and oils contain two and one-third times as much energy per pound as do carbohydrates. Proteins contain one and a third times as much. It is therefore apparent that a bushel of soybeans will contain substantially more energy than a bushel of corn.

“Both corn and soybeans (as well as any other crop) depend on sunlight for the energy which is ultimately stored in the seeds. During the season a field of corn and a field of soybeans will absorb about the same total amount of light. Therefore they have available about the same amount of energy. If one crop concentrates this fixed amount of energy into units which contain more energy per pound it will obviously be able to make fewer pounds. This is exactly the situation in the case of soybeans as compared with corn. Soybeans concentrate more of the total available energy in oil and protein than does corn and therefore can make fewer total pounds of material from the given amount of light energy which is absorbed.

“In addition to the storage of some of the energy in the seed another important concept to recognize concerns the ‘work’ which the plant must do to make high-energy materials such as oil and protein. The first major product of photosynthesis is carbohydrate which the leaves of most plants store in the form of starch. This carbohydrate can be considered a raw material or starting material for the synthesis or formation of other materials. To make products such as oil and protein the plant must not only concentrate the energy into tighter units but also must consume a certain amount of energy to do the work of synthesis.

“To illustrate, in making 1 pound of oil a plant uses up nearly 5 pounds of carbohydrates. About 55% of the energy in 5 pounds of carbohydrates is represented by the energy in 1 pound of oil. The remaining 45% is used up or ‘burned’ in the process of building the higher energy oil molecules and is thus lost from the plant.

“Cost of Protein: There is a similar cost in the synthesis of protein but it is somewhat smaller than that required for synthesis of oil.

“The magnitude and importance of the chemical composition and the work factor are illustrated in table 1. When the caloric values of the stored materials and the work factors are considered, a bushel of soybeans represents more than twice the caloric value of a bushel of corn.

“The item in table 1. for work energy in nitrogen fixation should be noted. There is considerable uncertainty about the precision of the estimate of this item. There is also uncertainty about the amount of energy required by any plant to absorb nutrient elements from the soil. It is the general opinion, however, that energy requirements for absorption of nutrients is quite low. The information available on the metabolism of the nodule systems in which nitrogen is fixed suggests that for a crop of about 40 bushels of soybeans the work factor estimated in table 1 is probably reasonable. Corn and other non-legumes have no such energy requirement. At the bottom of table 1 is a summary indicating that a yield of about 45 bushels of soybeans is equivalent to 100 bushels of corn. It is interesting that the Illinois average yields for the 10-year period 1948-57 and for the years 1958 and 1959 show a ratio of soybean to corn yields of .40 to .45 in each case.

“Response Surprising: The information and concepts concerning energy are important in placing inter-crop comparisons in proper perspective. The often alleged poor response of soybeans is in fact not real. On a pound or bushel basis soybeans are simply more valuable than corn, not only in the market place and in animal feeding value but in terms of energy content or work the plant has to do. A field of soybeans which is producing in the 45-bushel range is doing the same job as a field of corn producing in the 100-bushel range.

“These considerations in no way detract from the desire to improve soybean crop performance. In a way it is surprising that soybeans have done so well with techniques designed for other crops. This pertains not only to machinery but to fertilizer and cultural practices.

“It is quite possible that soybeans have nutrient requirements at different stages of growth which are unlike those of other crops. This is illustrated for potassium in figure 1. Whereas corn contains its maximum amount of potassium when seed development begins and actually appears to lose about 10% during the latter part of the growth cycle, soybeans have a high requirement for potassium during the period of seed development. Yet there is reason for serious doubt as to whether a good soybean crop can get all the potassium it needs during this late period. Acquisition of potassium is probably limited both by the immobility of the element in the soil and by the reduction or cessation of root growth during this late period. This fertility-plant relationship seems to be quite different in corn and soybeans and illustrates the fact that practices appropriate for one crop are not necessarily best for another crop.

“There is need for a new approach in the study of fertility problems as related to soybeans which takes into account special requirements during the latter part of the growth cycle.

“The soybean has similar high requirements for other elements, particularly phosphorus and nitrogen, during the period of seed development. The problems for phosphorus are very similar to those for potassium. Since phosphorus
is relatively immobile in the soil the possibility exists that
deficiencies of this element and of potassium may exist in
the immediate zone of the root even though a soil test might
indicate adequate supplies of the element. For nitrogen the
problems are somewhat different because the element is
mobile and the operation of the nitrogen fixing system is
intimately involved in the general nitrogen picture.

“In summary it can be stated that any comparison of two
crops such as soybeans and corn should take into account
their chemical compositions and the energy factors involved,
ot only in the stored materials such as carbohydrates,
fats and proteins, but also the energy requirements for the
formation of high-energy materials. There is evidence that
soybeans have somewhat different requirements for nutrients
as related to stage of growth and these differences should
also be considered in inter-crop comparisons.”

Tables (1) “Work” in soybean and corn production.
Figures: (1) Graph of potassium accumulation in
soybean and corn plants during growth. Address: Plant
Physiologist, U.S. Regional Soybean Lab.

Lawrence, Ruth E.; Younger, Carolyn J. comps. 1962.
Results of the Cooperative Uniform Soybean Tests, 1961:
Part I. North Central States. RSLM (U.S. Regional Soybean
Laboratory Mimeograph, Urbana, Illinois) No. 211. March.
arsuserfiles/50200500/nust/1961%20nust.PDF
• Summary: Near bottom of title page: “United States
Department of Agriculture. Agricultural Research Service.
Crops Research Division, cooperating with State Agricultural
Experiment Stations.”

Contents: Cooperating personnel. Introduction. Location
of nurseries. Methods. Uniform test, Group IV. Uniform
test, Group V. Preliminary Group V. Uniform test, Group VI.
Preliminary Group VI. Uniform test, Group VII. Preliminary
Group VII. Uniform test, Group VIII. Preliminary Group
VIII. Address: 1. Agronomist; 2. Statistical Clerk [Stoneville,
Mississippi].

Quantitative interrelations of protein and nonprotein
April. [8 ref]  • Summary: High-protein soybeans averaged 48.3% protein;
low-protein samples averaged 32.4% and 31.3% protein.
Cellulose, crude fiber, and ash account for 25-30% of the dry
weight in mature soybean seeds.

Note: This is publication No. 362 of the U.S. Regional
Soybean Laboratory, Urbana, Illinois. Received June 19,
1961. Address: Crops Research Div., ARS, USDA.

520. USDA Northern Regional Research Laboratory. ed.
1962. Proceedings of Conference on Soybean Products for
Protein in Human Foods. Peoria, Illinois. iii + 242 p. Held
13-15 Sept. 1961 at Northern Regional Research Laboratory,
Peoria, Illinois. No index. 26 cm.
• Summary: The earliest conference on this subject in the
USA. A very important document, with many excellent
articles by experts in their fields worldwide.

Contents: Introductory remarks. Session I: Nutritional
deficiency problems in developing areas of the world. II:
World marketing of soybeans and soybean products. III:
Research and development on soybean foods. IV: Nutritional
and biological studies. V: Processing and feeding value of
fluid and dry soy milks. VI: Problems involved in increasing
world-wide use of soybean products as foods–panel
discussion. VII: Committee on quality and processing guide
for edible soy flour and grits. VIII: Summary of conference.
List of attendance. Most of the 106 attendees are PhDs or
leaders in agriculture, business, government, or scientific
research. The complete list follows:
Altschul, A. M. Southern Utilization Research and
Development Division, ARS, USDA, New Orleans,
Louisiana
Anderson, D. W., Jr. The Borden Company, 350
Madison Avenue, New York 17, New York
Andrews, J. S. General Mills, Inc., 9200 Wayzata
Boulevard, Minneapolis 26, Minnesota
Anson, M. L. Consultant, 100 Eaton Square, London,
S.W. 1, England
Bailey, E. M. A. E. Staley Manufacturing Company,
Decatur, Illinois
Barnes, R. H. Cornell University, Ithaca, New York
Bean, L. H. Food for Peace, The White House,
Washington, D. C.

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Proceedings of Conference on

SOYBEAN PRODUCTS
FOR PROTEIN IN
HUMAN FOODS

September 13-15, 1961

United States Department of Agriculture
Agricultural Research Service
Biddle, C. B. Biddle Farms, Remington, Indiana
Booth, A. N. Western Utilization Research and Development Division, ARS, USDA, Albany, California
Bowen, H. B. Spencer Kellogg and Sons, Inc., Decatur, Illinois
Brubaker, E. J. The Borden Company, 350 Madison Avenue, New York 17, New York
Buelens, Emil Central Soya Company, Inc., 1825 North Laramie, Chicago, Illinois
Cartter, J. L. Regional Soybean Laboratory, USDA, Urbana, Illinois
Clayton, R. A. General Mills, Inc., 9200 Wayzata Boulevard, Minneapolis 26, Minnesota
Cowan, J. C. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois
Cox, W. B. Honeymead Products Co., Box 50, Mankato, Minnesota
Darby, W. J. Vanderbilt University, Nashville 5, Tennessee
Dimler, R. J. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois
Diser, G. M. Archer-Daniels-Midland Company, 3100 38th Avenue South, Minneapolis 40, Minnesota
Eldridge, A. C. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois
Eversole, Russell Cargill, Inc., 200 Grain Exchange, Minneapolis, Minnesota
Fischer, R. W. Soybean Council of America, Inc., Waterloo, Iowa
Fomon, S. J. University of Iowa Medical School, Iowa City, Iowa
Frampton, V. L. Southern Utilization Research and Development Division, ARS, USDA, New Orleans, Louisiana
Griffin, E. L., Jr. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois
Groves, M. L. Eastern Utilization Research and Development Division, ARS, USDA, Philadelphia, Pennsylvania
Gyorgy, Paul Philadelphia General Hospital, Pediatrics Department, Philadelphia 4, Pennsylvania
Hackler, L. R. New York State AES, Cornell University, Geneva, New York
Hafner, F. H. General Mills, Inc., 9200 Wayzata Boulevard, Minneapolis 26, Minnesota
Hand, D. B. New York State AES, Cornell University, Geneva, New York
Hayashi, Shizuka Japanese American Soybean Institute, Nikkatsu International Building, Room 410, No. 1, 1-Chomo Yurakucho, Chiyoda-Ku, Tokyo, Japan
Hayward, J. W. Soybean Council of America, 304 Baker Building, Minneapolis 4, Minnesota
Heidinger, H. C. Archer-Daniels-Midland Co., Minneapolis 40, Minnesota
Hesseltine, C. W. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois
Hilbert, G. E. Foreign Research and Technical Programs, ARS, USDA, Washington 25, D.C.
Hildebrand, F. C. General Mills, Inc., 9200 Wayzata Boulevard, Minneapolis 26, Minnesota
Horan, F. E. Archer-Daniels-Midland Company, Minneapolis 40, Minnesota
Hougen, V. H. Foreign Marketing Branch, FAS [Foreign Agricultural Service], USDA, Washington 25, D. C.
Houghtlin, R. G. National Soybean Processors Association, 3818 Board of Trade Building, Chicago 4, Illinois
Hoover, S. R. Utilization Research and Development, ARS, USDA, Washington 25, D. C.
Hubbard, J. E. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois
Huge, W. E. Central Soya Company, Inc., 300 Fort Wayne Bank Building, Fort Wayne 2, Indiana
Jackson, R. W. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois
Judd, R. W. National Soybean Crop Improvement Council, 3818 Board of Trade Building, Chicago 4, Illinois
Kemmerer, K. S. Mead Johnson Research Center, Evansville 21, Indiana
Kirk, Dorsey Oilseeds and Peanut RMA Committee, Oblong, Illinois
Kirk, L. D. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois
Krober, O. A. Regional Soybean Laboratory, ARS, USDA, Urbana, Illinois
Maclay, W. D. Utilization Research and Development, ARS, USDA, Washington 25, D. C.
Maddy, K. H. Monsanto Chemical Co., St. Louis, Missouri
Matchett, J. R. Utilization Research and Development, ARS, USDA, Washington 25, D. C.
Mattil, K. F. Swift and Company, Union Stock Yards, Chicago 9, Illinois
McGinnis, James Washington State University, Pullman,
WASHINGTON

McKinney, L. L. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois

McVay, M. D. Cargill, Inc., 200 Grain Exchange, Minneapolis, Minnesota

Melnichyn, Paul Fruit and Vegetable Laboratory, ARS, USDA, Pasadena, California


Miller, D. L. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois

Miller, W. H. International Nutrition Research Foundation, 11503 Pierce Boulevard, Arlington, California


Mustakas, G. C. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois

Ogilvy, W. S. Mead Johnson Research Center, Evansville 21, Indiana

Oldham, Helen G. Human Nutrition Research Division, ARS, USDA, Washington 25, D. C.

Pellett, Kent The Soybean Digest, Hudson, Iowa

Pence, J. W. Western Utilization Research and Development Division, ARS, USDA, Albany, California

Post, N. J. Food for Peace, 224 Executive Office Building, Washington 25, D. C.

Rackis, J. J. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois


Rist, C. E. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois

Roach, H. L. Soybean Council of America, Inc., 408 Marsh Place Building, Waterloo, Iowa

Rolvaag, K. F. Lieutenant Governor, State of Minnesota, St. Paul, Minnesota


Salisbury, G. W. University of Illinois, Urbana, Illinois

Saret, H. P. Mead Johnson Research Center, Evansville 21, Indiana

Schaefer, W. C. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois


Seltzer, J. J. Archer-Daniels-Midland Company, 700 Investors Building, Minneapolis, Minnesota

Senti, F. R. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois

Sherman, Norman State of Minnesota, St. Paul, Minnesota

Sikes, W. W. Fats and Oils Division, FAS, USDA, Washington 25, D. C.

Smith, A. K. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois

Steinkraus, K. H. New York State AES, Cornell University, Geneva, New York

Stewart, George F. University of California, College of Agriculture, Davis, California

Strayer, G. M. American Soybean Association, Hudson, Iowa

Tawa, Andre

Soybean Council of America, U.A.R., 8 Dr Abdel Hamid Said Street, Cairo, Egypt

Teeter, H. M. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois

Tjessem, W. E. Ralston Purina Company, St. Louis 2, Missouri

Trotter, W. K. Northern Utilization Research and Development Division, ERS [USDA’s Economic Research Service], USDA, Peoria, Illinois

Van Buren, J. P. New York State AES, Cornell University, Geneva, New York

Van Veen, A. G. Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, Rome, Italy

Walker, Alan D. Spillers Limited, Station Road, Cambridge, England

Wall, J. S. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois

Wilcke, H. L. Ralston Purina Company, St. Louis 2, Missouri

Witham, W. C. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois

Wolf, W. J. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois

Wolff, I. A. Northern Utilization Research and Development Division, ARS, USDA, Peoria, Illinois


• Summary: “The University of Minnesota is carrying on an active and growing soybean research program on four fronts—varietal improvement, genetic, diseases and weed control.

“Minnesota is in the favorable position of having large areas of fertile farm land well adapted to soybean production, coupled with low cost water transportation to the world’s markets. Although much progress has been made in the last 20 years in breeding varieties suitable for Minnesota
conditions, a great deal more can be done.

"Participating in the expanding Minnesota soybean improvement program are J.W. Lambert, professor of agronomy and plant genetics; R.L. Cooper, research associate in agronomy and plant genetics; and Bill W. Kennedy, research associate in plant pathology and botany.

Objectives of this project are the development of varieties of soybeans with the best yield, height, standing ability, disease resistance and seed quality compatible with the maturity required by the various growing areas in Minnesota.

"Special emphasis is being given to strains having early maturity for the western and northwestern parts of the state; seeds having yellow hila or seed scars, tough and durable seed coats and high protein content; and strains having resistance to bacterial blight and chlorosis.

"Increased emphasis on high protein content and on light colored hila is a reflection of the growing importance to American producers of the foreign market—which is largely a market for soybeans to be used as human food.

"Cooperating at the University in the soybean breeding and testing work are the department of agronomy and plant genetics, the department of plant pathology and botany and the Southern, Southwestern, West Central and Northeast Experiment Stations. Also cooperating is the crops research division of the USDA's Agricultural Research Service, particularly the U.S. Regional Soybean Laboratory at Urbana, Illinois.

"In view of Minnesota's range of latitude, selection for several maturities is necessary. Hence, in the expanded program, greater use of the facilities of the University's outlying stations is contemplated. Greater use of greenhouse and climate control chambers for increasing generations per year is also contemplated. These facilities are expected to prove useful for crossing and for producing very early generations. In addition, the possibilities of going to Mexico or the southern hemisphere with overwinter nurseries are being vigorously explored. These southern nurseries would be particularly useful for later segregating of generations and early increases.

"Minnesota researchers feel that a strong program in soybean genetics, coupled with a strong breeding program, offers the greatest possibility for success in providing the various sections of the state with varieties that will perform well on farms and at the same time will be highly acceptable in the market place.

"Objectives of the soybean genetics research project at the University of Minnesota include: the study of the inheritance of the various qualitative traits such as hilum color, seedcoat mottling, and disease reactions—which affect the economic value of the crop. Diseases to receive first attention will be bacterial blight, iron chlorosis, and seed deterioration in storage.

"Another objective of the genetics project is to study the inheritance of certain 'physiologic' traits which may affect the efficiency of the plant in the fabrication and differentiation of stored organic materials.

"A third objective is to study the inheritance of various quantitative traits, such as quantity and quality of protein and components of yield, which have profound effects on the productivity and value of the crop.

"The information gained in working toward these objectives is being related to varietal improvement of soybeans.

"The same departments as those taking part in the breeding and testing work are cooperating in the genetics project. Also cooperating are the University's Rosemount Agricultural Experiment Station and the same branch stations as those cooperating in the breeding and testing project. Leaders in the genetics project are also Lambert and Cooper.

"The control of weeds has long been recognized as a major problem of soybean production in Minnesota. Recent research has involved mainly the use of chemicals to supplement or replace cultivation. Amiben and CDAA (Randox [made by Monsanto]) are two chemicals that research trials have shown are useful for this purpose.

CDAA is available as a liquid or granule and will control annual grass weeds. Amiben, available as a liquid, controls most annual grass and broad-leaved weeds. However, neither compound is very effective on cocklebur, a serious weed in soybean fields. Present research involves midseason treatments with phenoxy herbicides to control cocklebur and other broadleaved weeds.

"Basic studies are under way at the University of Minnesota to determine the mode of action of Amiben and other herbicides used on soybeans. What temperature and humidity do to the effectiveness of herbicides is being studied in controlled environment systems at the University of Minnesota. Radioisotope labeled herbicides are being used to follow the uptake, movement and deactivation of herbicides in soybeans and various weed species.

"Richard Behrens, associate professor of agronomy and plant genetics, is in charge of soybean weed control research at the University of Minnesota."

A photo shows J.W. Lambert, University of Minnesota professor of agronomy and plant genetics, in a field of soybeans at branch experiment station, Waseca.

Howell (1975) states: "In 1961 the Minnesota legislature authorized several soybean research positions. This was the first State action specifically directed toward building a soybean research program."


• Summary: "It is evident from the discussions of the last 2 days that American soybeans are an increasingly important commodity in the world market. This international status of the crop has come about in a relatively short period of time
and is the result of the interaction of many factors.

“Of primary importance, without doubt, is the intrinsic value of soybean seed itself. Few other seeds have the fortunate combination of a high content of high quality protein and a moderately high content of high quality edible oil. This unique combination is of course the real basis for the current importance of the soybean in world nutrition and the reason why our very capable business organizations have been able to develop the new markets that are absorbing so large a part of our national production.

“There are other factors, however, that have been and will continue to be of importance in expanding the position of U.S. soybeans and soybean products in the world market. In no other country, for example, is there a comparable land area so well suited to soybean production; nor is there anywhere else a comparable group of such well-equipped and efficient producers, handlers, and processors. The far-flung acres of fertile farm land are a gift of nature but the corps of producers, handlers, and processors are a product of the American economic and educational system.

“Stated another way, this group has developed as a result of hard work, faith, and vision operating in a climate of free enterprise. Giving direction and vitality to this development have been research programs of both government and industry. And it is with such research that the present discussion is concerned, since by no other means can the position of American soybeans in the world market be expanded or even maintained.

“Research on soybeans is proceeding along many fronts. At this convention you have heard research reports on utilization by Drs. Senti and Cowan, on weather relations by Dr. Thompson, and on marketing by Dr. West. My remarks will be confined to one phase of production research, the breeding of new varieties.

“The importance of varietal research in the dramatic rise of the soybean crop in the United States is easily demonstrated. Before the turn of the century and for some years after, USDA exploration and plant introduction teams in the Far East performed the indispensable service of bringing a large number of soybean types and varieties to the United States. These were in turn tested in many of the state agricultural experiment stations. Information was obtained on varietal adaptation, on cultural methods, and on possible uses in the farm rotations.

“For 20 or 30 years the principal uses of the crop seemed to be for forage and soil improvement. The small amount of selection done by plant breeders during this period was slanted toward these uses. However, with the coming of the small combine harvester and the discovery by oilseed crushers of the value of the threshed seed, a new day dawned for the soybean in the United States. It was quickly recognized as a potentially great cash crop. The need for well-adapted varieties that were suitable for processing became apparent.

“The appreciation of this need culminated in 1936 in the establishment of the U.S. Regional Soybean Laboratory at Urbana, Illinois. Through the years since, the staff of this laboratory has done outstanding work in soybean genetics, pathology, and physiology. In cooperation with workers in the state experiment stations they have turned out 15 or more superior varieties for use in the various soybean growing regions of the United States. Significantly, a very high proportion of the present soybean acreage of the country is planted to these varieties. They are tangible witness to the value of cooperative research.

“Oh obviously the research team is well organized and effective. Let us now turn our attention to the proposition of breeding soybeans for the present world market. And in this regard perhaps we would do well to include our domestic demands as a part of this market, since we are still ‘our own best customer.’ What are the objectives of the soybean breeder of 1962? Are they different from 30 years ago or even 20 years ago, and how?

“Toward 60-Bushel Yields: It goes without saying that the need for high yield of harvestable seed continues much the same as in the past. This of course means undiminished attention on the breeder’s part to proper maturity, plant height, standing ability, and resistance to lodging as well as to the actual components of yield. In respect to these attributes we hope that in the foreseeable future we shall be able to select for them under environmental conditions that will permit average yields of 60 to 70 bushels per acre instead of the 30 to 40 bushel yields we now commonly encounter in our experimental plots.

“I should probably emphasize that I am referring to yields in experimental plots which for a number of reasons nearly always are at a higher level than yields in general. The essential point which I wish to make is that we hope to learn enough about the soybean plant through basic physiological and nutritional research to be able to specify the cultural treatments necessary to produce consistently the 60 or 70 bushels we on rare occasions obtain by chance.

“Once this so-called environmental yield barrier is broken we shall be in a much better position to raise the genetic ceiling on yield. That is, we can then proceed to select the varieties that will produce really superior yields under optimum environmental condition. This in turn means that we can perhaps provide the soybean grower with the varieties and the cultural specifications necessary to make soybeans really competitive with corn or any other crop.

“The soybean breeding plans of the future will include much emphasis on resistance to diseases. A great deal of progress has been made in recent years particularly with respect to Phytophthora root rot, bacterial pustule, frog eye leaf spot, target spot, and cyst nematode. Certain other troubles, however, such as bacterial blight, root rots other than Phytophthora, and physiological diseases such as iron chlorosis have received relatively little attention. Breeding
for disease resistance is a never-ending battle because of the appearance of new diseases and of new races of old disease organisms, but it is a battle well worth waging in terms of economic importance.

“The Shift in Emphasis: Up to this point in the discussion the objectives of the breeding program of 1962 are very little different from those of the programs of 20 or 30 years ago. When we come to the matter of the appearance and internal quality of the beans themselves, however, we are forced to stop and ponder. Whereas the American soybean industry was born in an era of vegetable oil shortages in this country and flourished under heavy war and post-war demands for oil, it now finds itself in increasing difficulty disposing of the oil in a world market that is well supplied with edible fats and oils of various kinds.

“On the other hand, soybean meal, once considered a byproduct, has come to be recognized both at home and abroad as an excellent protein source in livestock and poultry rations and its market at reasonable prices seems nowhere near saturated. Moreover, increasing amounts of whole beans are apparently moving into the foreign protein market for direct consumption as human foods.

“Looking back, the directive to the breeder in the 1930’s seemed clear. Higher oil content was called for even at the expense of lower protein. And I must point out parenthetically that any appreciable genetic increase in oil content is almost invariably accompanied by a reduction in protein.

“In 1962 the directive is not so clear cut. To be sure, a pound of oil still sells for more than a pound of protein but not nearly so much more as it once did. Moreover, the pound of oil would seem to be selling on a less substantial basis; in other words, it is much more dependent on government support than is the pound of protein. In short, it would appear that the world needs soybean oil less than it does soybean protein.” Continued. Address: Agric. Exp. Station, Univ. Farm, St. Paul, Minnesota.


- Summary: Contents: I. Introduction: World production (958,275,000 bushels in 1960), United States production trends, utilization (processing to obtain oil and meal, hay and green manure). II. Soil and climatic adaptation: Areas of production in the United States, soil requirements, climatic
adaption (effect of temperature on plant growth, effect of temperature on composition of seed, effect of light on plant growth, effect of photoperiod on flowering and maturity, effect of soil moisture on growth). III. Time of planting and varietal adaptation: Effect on plant characters (maturity, plant height, lodging, seed quality, size of seed, seed yield), effect on composition of the seed. IV. Planting methods and equipment: Seedbed preparation (conventional, minimum tillage, deep tillage), row width and planting rate (row width, planting rate), double cropping (after fall-sown grain crops, after peas), special methods of planting, types of equipment. V. Rotation practices and erosion control: Effect on soybean yields, effect on the following crop, effect on weed population, soil residues from herbicides, erosion control. VI. Weed control: Effect of planting time on plant growth and weed competition, methods of cultivation, chemical weed control (pre-emergence herbicides, post-emergence herbicides). VII. Seed quality and seed treatment: Factors affecting seed quality and germination, seed treatment. VIII. Nutrient requirements: Nitrogen requirements and nodulation (effectiveness of nodulation as a source of nitrogen, methods of inoculation, survival of bacteria in the soil, effect of seed treatment on inoculation, effect of nitrogen applications), liming and pH levels (pH and plant development, calcium and magnesium requirements), phosphorus, potassium, trace elements, fertilizer practices and recommendations. IX. Water requirements and utilization: Water needs in relation to plant growth and development, irrigation and soil management. X. Growth-regulating chemicals. XI. Harvesting: When to harvest, harvesting methods. XII. Seed storage. XIII. Discussion. The USA now produces about 57% of the world’s soybeans, followed by China (PRC; about 33%), Indonesia, Japan, Korea, USSR, Brazil, and Canada, in that order. By 1920, U.S. production was 3,000,000 bushels and the leading states were North Carolina, Virginia, Alabama, Missouri, and Kentucky–North Carolina producing 55% of the total. By 1931, the center of production had shifted to the North Central States, where it is at present. Address: 1. United States Regional Soybean Lab., Urbana, Illinois; 2. Stoneville, Mississippi.


Section E, “Induction of mutations,” is an excellent review of the literature on this subject. It begins: “Humphrey (1951) studied plants from soybean seed that had been subject to irradiation for different periods of time and identified the treatments as ‘1000, 1500, 2500, and 3000 roentgen units of neutron irradiation.’ No effect from the 1000 r and 1500 r treatments was obtained in the first generation following irradiation. Plants to seed subjected to 2500 r and 3500 r treatments were markedly different from normal plants. Young plants had a grayish appearance, venation of the leaves was very coarse, and the leaves were somewhat rugose. The plants later turned very dark green, but the leaves remained rugose. Maturity was delayed appreciably. The effects of the higher irradiation treatment were notably greater than those of the 2500 r treatment.

“Only a few mutations were observed in the second generation after the two lower irradiation treatments, but 228 mutant plants of 4200 were observed in the second generation following the two higher treatments. No indication of how these were distributed between the two treatments was given. The mutations involved leaf color, stem size, flower color, internode length, sterility, maturity, and leaf texture, shape, and pubescence. Seven plants showing a marked increase in vigor over normal plants were also observed.” Address: 1. USDA, Beltsville, Maryland; 2. United States Regional Soybean Lab., Urbana, Illinois.

530. Strayer, George M. 1962. Market development on U.S. soybeans and soybean products. In: USDA Northern Regional Research Laboratory, ed. 1962. Proceedings of Conference on Soybean Products for Protein in Human Foods. Peoria, IL: USDA NRRL. iii + 242 p. See p. 29-37. • **Summary**: “Among producers of major agricultural products in the U.S. producers of soybeans are in a unique position. Despite increases in production which are out of all proportion to normal expectations the markets for the crop have grown in approximate proportion to the production and there have never yet been surpluses of a proportion to justify classing the crop in the same surplus category with wheat, corn, cotton, tobacco, and other major U.S. crops.”

As the production of soybeans in the United States continued to grow during the postwar years it became evident that we could produce in this country more soybeans than we could consume advantageously. At the same time it began to appear that other countries in the world might adopt U.S. soybeans into their economies, and that we had something which might offer potential export markets, either in the form of bean or as oil, meal, flour, or other end products.

“In 1949, I made my first trip overseas to explore market possibilities. J.L. Carter of the U.S. Regional Laboratory at Urbana [Illinois] and I went into several of
the northern European countries to determine what the soybean production potentials might be—and what our market possibilities looked like. In 1952, I went back again and at that time made a careful study of potentials in 10 European countries. In 1954, I went back as a member of a Foreign Trade Team sent by USDA to determine why we were losing our foreign markets for U.S. farm products.

“During 1954, Public Law 480 was passed by Congress, providing for the sale of U.S. surplus farm commodities for foreign currencies, with a portion of the proceeds to be made available to trade groups to enlarge and expand the markets for U.S. agricultural commodities. Soybeans were not in surplus, and were not made available for sale for foreign currencies. However, this did not preclude use of money accumulated from the sale of wheat, cotton, tobacco, butter, lard, and other commodities from being used to sell soybeans and/or soybean products.

“By the time P.L. 480 became operative a sizable group of people in the soybean industry had become aware of overseas market potentials for our products. We knew that potential markets existed, and that it was our responsibility to go after them. We decided to do just that.

“By 1955 Japan had become our largest single customer for U.S. soybeans. We were hearing complaints on quality, especially on foreign material content. Our varieties were strange to them, our methods of mechanical handling not understood and our grades and grading standards were confusing. Japan appeared to be an even bigger potential customer if we could help them solve some of the problems of using our product.

“Recognizing the situation, the Agricultural Attaché in Tokyo requested that the American Soybean Association, representing the soybean producers, send someone to Japan to work with the trade in that country. The Fats and Oils Division of Foreign Agricultural Service concurred, and it was my personal pleasure to spend 6½ weeks in Japan in late 1955. Out of that visit came the organization of a joint operational agency, called the Japanese-American Soybean Institute. Mr. Shizuka Hayashi was employed as managing director in early 1956, and since he will appear on this program later I will not describe in detail that organization or its operations.

“Since early 1956 the American Soybean Association, in conjunction with Foreign Agricultural Service and five Japanese trade groups has been operating this market development project on soybeans in Japan. The major activities have been in the field of education of the housewife on the place of protein and edible oil in the diet of the members of her family. Soybeans have been grown and used in that country for centuries, but the intake of both protein and oil were far below minimum standards, especially in the rural areas. Animal products were not available, and would not become available in quantity in the foreseeable future. Increased intake of protein and oil had to come from vegetable sources. The Japanese consumer was familiar with miso, tofu, shoyu, natto, kinako, and a long list of soybean protein products, and also with soybean oil for a cooking and salad oil. The services of trade organizations, governmental and quasi-governmental agencies, prefectural governments, and many other groups were enlisted. Throughout Japan the story of soy products and their value to health were repeated in a myriad of ways. Demonstrations, movies, training schools, extension workers, nutritionists, mobile demonstration buses, and a host of other avenues of approach have been used. Millions of housewives have been told the story in many ways and in many places.

“Results are the only true measurement of success or failure in an endeavor of this type. In the 1955 crop year U.S. exports of soybeans to Japan were 20,402,000 bushels. In the 1959 crop year, the last on which export figures are available, Japan’s imports of U.S. soybeans had increased to 40.8 million bushels—every bushel sold for dollars. And this increase came under very strict governmental currency controls which greatly limited soybean imports into Japan. At least partially as a result of the buildup of demand for U.S. soybeans by foods manufacturers in Japan, created by demand for soybean oil and soy protein products, the Japanese government on July 1, 1961, for the first time since World War II, placed soybeans on the Automatic Allocation basis. It is our expectation that imports of U.S. soybeans into Japan will increase materially above present levels as a result of this action. In fact, at our recent American Soybean Association convention Mr. Hayashi predicted a virtual doubling of Japanese imports of U.S. soybeans in the next decade.

“Our experiences in Japan demonstrated to us early in the game that soybean markets could be expanded by expanding consumption of products. Our Japanese experience suggested that in many areas of the world the job was an industry-wide job, rather than a job for producers alone. We visualized that soybean handlers, soybean processors, exporters of soybeans, exporters of soybean oil and exporters of soybean meal all had a stake in expanding our overseas markets. In 1956, I made an intensive study of the potential markets for U.S. soybean products in 10 European countries. As a result of this study a series of committee sessions and industry conferences were held, resulting in the formation of an industry-wide nonprofit promotional organization, the Soybean Council of America. Financed by a voluntary check-off on the basis of bushelage or tonnage of soybeans crushed, handled or exported, the Soybean Council of America, Inc. now has active promotional programs launched in over 20 countries, and has 15 overseas offices scattered from India to Denmark to Peru, where staff members are stationed to do educational and promotional work designed to increase the markets for U.S. soybean products and soybeans. We recognize that in those countries where processing facilities are located they
will buy soybeans and produce their own end products. We also know that many countries have need for oil and not for protein, and that other countries have adequate supplies of oil but are badly in need of protein supplies. As representatives of the U.S. soybean industry we consider it our function to sell the products the buyer wants in the form in which he desires them. Cooperation among producers and processors of soybeans in the financing of the Soybean Council program has been gratifying. The dollar expenses of the promotional programs are borne by the U.S. soybean industry, and through the cooperative program with Foreign Agricultural Service of the U.S. Department of Agriculture, as will be explained by Mr. Hougen, your next speaker, foreign currency funds are made available in certain countries for payment of market promotional and development expenses within those countries..."

This talk continues for 2 more pages and contains 3 tables: (1) U.S. soybean production and usage by crop years (Oct. 1 through Sept. 20) from 1924-25 to 1961-62. (2) U.S. soybean oil exports 1951-52 to 1959-60. (3) U.S. soybean meal exports 1950-51 to 1959-60. Address: Executive Vice President and Secretary-Treasurer, American Soybean Assoc., Hudson, Iowa.


• Summary: Near bottom of title page: “United States Department of Agriculture. Agricultural Research Service. Crops Research Division, cooperating with State Agricultural Experiment Stations.”


• Summary: (Continued): “Varietal differences in response to other nutrients also are known. Under some conditions some varieties will take up sufficient zinc to kill them while other varieties under the same conditions will perform normally. Some varieties will accumulate enough chloride in their leaves to kill them under conditions where other varieties perform normally. Some varieties perform normally in soils that render iron so unavailable to other varieties that the plants die. Some varieties develop chlorosis when inoculated with certain strains of nodulating bacteria, and others do not. Still other selections produce no nodules on their roots under conditions favorable to good nodulation of most varieties.

“In spite of all these gross differences in response of soybeans to specific nutrients, soybeans often do not respond well to applied fertilizer. Obviously we need to know more about this overall response of soybeans to nutrients. Once we have sufficient information it may well be that we will breed soybeans for response to specific nutrients or to a combination of nutrients. Without the information, however, a breeder has no way of knowing which combination of responses is desirable.

“In 1963 a new plant physiologist position was added at the U.S. Regional Soybean Laboratory at Urbana, Illinois, and Dr. Ray E. Johnson is currently doing research in this position. He is primarily concerned with research on the nutrition of the soybean plant with special emphasis on the nitrogen nutrition of the plant. From his research we hope to accumulate information that will permit us to understand the response of soybeans to nutrients.”

Photos show: (1) A portrait photo of Herbert W. Johnson. (2) “Newly appointed plant physiologist Dr. Ray Johnson observes a nitrogen utilization experiment conducted by the USDA Regional Soybean Laboratory at the University of Illinois’ agronomy south farm at Urbana, Illinois Before coming to Illinois, Dr. Johnson held a post-doctoral appointment with the USDA research laboratory at Beltsville, Maryland.” Address: Research Agronomist, Crops Research Div., Agricultural Research Service, USDA, Beltsville, Maryland.

• Summary: Dr. C.R. Weber has done outstanding research in soybean genetics. He received his B.S. and M.S. degrees from the University of Illinois and his Ph.D. from Iowa State University. He became associated with the U.S. Regional Soybean Laboratory as a student assistant shortly after it was organized in 1936. His entire work career as an agronomist, except for duty with the U.S. armed services, has been with the Laboratory. He was placed in charge of soybean research work in Iowa shortly before World War II.

“Dr. Allan K. Smith is an international authority on soy protein and its uses. He was a pioneer investigator in the field. His basic work has provided insight into the chemical nature and physical properties of the complex protein systems found in soybeans. His work has assisted industry in the development and use of isolated soy protein, protein concentrates, soy flour and other products for food, feed and industrial uses. Processes and products developed under his supervision are used by the paper industry in paper coating, adhesives, sizing and lamination, and in the food industry. He contributed to the use of identity-preserved soybeans in the export market and the development of the process of making Gelsoy and other soy food products which are now used in Japan.

“Dr. Smith received his B.S. degree in chemistry at Coe College, Cedar Rapids, Iowa, in 1919; and his M.A. and Ph.D. from Columbia University in 1924 and 1926. He was guest lecturer at the University of Minnesota from 1932 to 1934, and research chemist at the U.S. Regional Soybean Industrial Products Laboratory from 1937 until 1942. He has been senior chemist and investigations leader at the Northern Regional Research Laboratory since 1942.

“Dr. Smith made two extensive surveys of the Orient in 1948 and 1957 to learn more about soybeans in foods. His first monograph on Chinese, Korean, and Japanese uses of soy foods is used throughout the world. His second, on the use of U.S. soybeans in Japan and subsequent research by Dr. Smith, helped to clarify many objections raised by the Japanese to U.S. soybeans.”

Portrait photos show Dr. C.R. Weber and Dr. Allan K. Smith.

Note: The title of Allan K. Smith’s 1926 PhD thesis from Columbia University was “The rate of interdiffusion of sodium hydroxide and hydrochloric acid by a calometric method.”


• Summary: “Soybean acreage was stimulated by the droughts of the 1930’s and by corn acreage allotments which made land available for beans... In 1929 a soybean laboratory was established in Ohio to conduct research aimed at the development of varieties high in oil and protein. The U.S. Regional Soybean Industrial Products Laboratory was located at Urbana, Illinois in 1936. It carried on industrial utilization research and, in cooperation with the experiment stations of the North Central states, it also conducted agronomic studies in the development of improved varieties.”

Soya Lecithin “has become almost the traditional example of Chemurgy whereby an agricultural by-product of little value is upgraded and is found to have value as the result of scientific investigation. Lecithin is nature’s wetting agent...” In pharmaceuticals, lecithin is a source of choline and inositol. “In the cosmetic industry, it is again a satisfactory and safe emulsifying agent. In soaps, it improves lather stability and represses alkalinity. In paint products, it acts as a wetting and dispersing agent and improves milling, paint leveling and brushing qualities. In rubber, it acts as an antioxidant and as a dispersing agent for the filler. As an additive to lubricating oils, it helps counteract bearing
corrosion and otherwise lengthens the life of the product. In gasoline, it is an anticult and anti-corrosive agent. It helps produce softer, silkier leather products.” Address: Honeymead Products Co., Mankato, Minnesota.


• Summary: Contents: 1. Introduction: World production, United States production trends, utilization (processing to obtain oil and meal, hay and green manure). 2. Soil and climatic adaptation: Areas of production in the United States, soil requirements, climatic adaptation (effect of temperature on plant growth, effect of temperature on composition of seed, effect of light on plant growth, effect of photoperiod on flowering and maturity, effect of soil moisture on growth). 3. Time of planting and varietal adaptation: Effect on plant characters (maturity, plant height, lodging, seed quality, size of seed, seed yield), effect on composition of the seed. 4. Planting methods and equipment: Seedbed preparation (conventional, minimum tillage, deep tillage), row width and planting rate (row width, planting rate), double cropping (after fall-sown grain crops, after peas), special methods of planting, types of equipment. 5. Rotation practices and erosion control: Effect on soybean yields, effect on the following crop, effect on weed population, soil residues from herbicides, erosion control. 6. Weed control: Effect of planting time on plant growth and weed competition, methods of cultivation, chemical weed control (pre-emergence herbicides, post-emergence herbicides). 7. Seed quality and seed treatment: Factors affecting seed quality and germination, seed treatment. 8. Nutrient requirements: Nitrogen requirements and nodulation (effectiveness of nodulation as a source of nitrogen, methods of inoculation, survival of bacteria in the soil, effect of seed treatment on inoculation, effect of nitrogen applications), liming and pH levels (pH and plant development, calcium and magnesium requirements), phosphorus, potassium, trace elements, fertilizer practices and recommendations. 9. Water requirements and utilization: Water needs in relation to plant growth and development, irrigation and soil management. 10. Growth-regulating chemicals. 11. Diseases: Foliar, root and stem, seed. 12. Insects and spider mites: Leaf feeders, above-ground stem feeders, pod feeders, root feeders. 13. Nematodes: Root knot, cyst, others. 14. Harvesting: When to harvest (moisture content of seed, chemical defoliation, losses from respiration after maturity), harvesting methods (historical, combine harvesting). 15. Seed storage. 16. Discussion. The USA now produces about 57% of the world’s soybeans, followed by China (PRC; about 33%), Indonesia, Japan, Korea, USSR, Brazil, and Canada, in that order. By 1920, U.S. production was 3,000,000 bushels and the leading states were North Carolina, Virginia, Alabama, Missouri, and Kentucky–North Carolina producing 55% of the total. By 1931, the center of production had shifted to the North Central States, where it is at present.

The subsection titled “Seed treatment” (p. 193) states: “Seed treatment with a fungicide is not recommended as a general practice when seed with high germination is planted. Stands may be increased by seed treatment when seed having a germination of 85 per cent is planted. Although seed treatment seldom results in increased seed yields,... the improved stands resulting from seed treatment aid in giving soybeans a competitive advantage with weeds. Studies by Howard W. Johnson et al. (1954) show that seed may be treated at any time between harvest and planting with equal effectiveness. The most satisfactory time for treating seed would be as it is cleaned. The materials Arasan, Captan, and Spergon have proved to be most satisfactory for treatment of soybean seed. Before any lot of seed is treated, it may be a good practice to check the germination with and without the fungicide to determine the beneficial effect of seed treatment on each seed lot.”

The section titled “Harvesting methods: Historical” (p. 219) states: “The earliest harvester designed specifically for soybeans was a two-wheeled, horse-drawn machine which straddled the bean row (Piper & Morse, 1923, p. 94). This special harvester was common in Virginia and North Carolina, but was never commonly used in the North Central States. Harvesting losses ranged from 20 per cent under favorable conditions to as high as 60 per cent under unfavorable (Sjogren, 1939). In small-grain growing areas, the binder and thrasher were adapted for soybean harvest. Harvest losses for using the binder or mower for cutting and then threshing ranged from 16 to 35 per cent of the total yield, with an average loss of 24 per cent (Sjogren, 1939).

“The combine harvester was first used for soybeans in the mid-twenties. The combine harvester has been a major factor in the expansion of soybean production. This machine required less labor than earlier methods and was more efficient.” Address: 1. Agronomist-in-charge, U.S. Regional Soybean Lab., Crops Research Div., ARS USDA, Urbana, Illinois; 2. Research Agronomist, U.S. Regional Soybean Lab., ARS USDA, Stoneville, Mississippi.
The storage protein provides an energy reserve and carbon skeletons in a role comparable to those of starch and fat, but is not metabolically active as are the proteins in leaves, roots, etc.

“Large structures, identified histochemically as protein, appear in electron micrographs of developing cotyledons about 35 days before maturity and increase in number until they nearly fill the cells at maturity. These structures are considered to contain mostly storage protein, but the presence of some metabolic protein is indicated by small inclusions interpreted as lipoidal material. Other particulate matter identifiable in the micrographs also show the dual nature of protein in developing seeds.

“Metabolic measurements on immature seeds reflect the changing status and distribution of nitrogen and protein during development. Oxygen uptake per seed parallels seed weight until the start of ripening. But when expressed on a weight or protein basis, it falls from an early rate of several thousand microliters of oxygen per gram dry weight to a few hundred at the start of ripening and to virtually zero at maturity. The decline during ripening is correlated with loss of moisture, but particulate protein decreases percentage-wise throughout development and on a per-seed basis during ripening. Oxidation by isolated mitochondria show trends similar to oxidation of whole seeds or cotyledons and account for a third to a half of intact cotyledon respiration.

“The cytoplasmic protein in the centrifuge fractions referred to as ‘mitochondria’ and ‘microsomes,’ i.e., those precipitating at about 15,000 g and 50,000 g, respectively, is interpreted as metabolic protein. Most of that in solution at 50,000 g is considered storage protein. The protein in mitochondria and microsome fractions generally parallels seed weight until ripening begins, then declines rapidly while soluble (storage) protein increases during the ripening process.”

This presentation is followed by a discussion.

Note: This is the earliest English-language document seen (Jan. 2016) that uses the word “micrographs” or “electron micrographs” in connection with changes in soy protein. Address: U.S. Regional Soybean Lab., Crops Research Div., Urbana, Illinois.

Crops Research Division, cooperating with State Agricultural Experiment Stations.”


• Summary: Except for the cover, this document is typewritten.


The Introduction begins: “The program of the U.S. Regional Soybean Laboratory has been directed toward the development of improved strains of soybeans and the obtaining of fundamental information necessary to the efficient breeding of strains to meet specific needs. In the Southern Region, fundamental studies and breeding programs are conducted at three locations, Stoneville, Mississippi; Raleigh, North Carolina; and Gainesville, Florida. After promising new strains are developed at these breeding centers, or by any other cooperating agency, they are advanced to the preliminary and uniform regional tests, conducted in cooperation with the Southeastern States. This testing program enables the breeder to evaluate new strains under a wide variety of conditions, and permits new strains to be put into production in a minimum amount of time.

“Ten uniform test groups have been established to evaluate the better strains developed in the breeding programs. The Groups 00 through IV are adapted in the northern part of the United States, and the Group IV through VIII are grown in the southern part. Within their area of adaptation, there is a maturity range of 12 to 18 days within each maturity class. The best standard variety available of each maturity class is used as a check variety with which to compare new strains as to seed yield, chemical composition, maturity, height, lodging, seed quality, and reaction to diseases. For the groups grown in the southern area, the check varieties are Kent, Hill, Hood, Jackson, and Bienville. At Stoneville, Mississippi, where all maturity classes will mature, the approximate maturity dates of these varieties when planted during the first half of May are: Kent, September 8; Hill, September 20; Hood, October 8; Jackson, October 25; and Bienville, November 1.” Address: 1. Agronomist; 2. Statistical Clerk [Stoneville, Mississippi].

• Summary: At very high levels of phosphorus the soybean variety Chief grew normally, whereas the variety Lincoln soon became chlorotic and severely stunted. Subsequently, many varieties were classified for their response to high levels of phosphorus. “Most were tolerant or slightly sensitive.”


• Summary: Geneticist Leonard Williams has had a part in the development of most of the newer Cornbelt varieties of soybeans. He was primarily responsible for the Lincoln, the first soybean variety to be developed and released by the U.S. Regional Soybean Laboratory. At one time, Lincoln was grown on 75% of the soybean acreage in Illinois, and on a very substantial acreage in surrounding states. Williams was also responsible for making the crosses that led to such varieties as Clark, Shelby, Ford, Kent, and Chippewa. Williams received his B.S., his M.S. and his Ph.D. degrees
Dr. A.J. Ohlrogge is a recognized authority on soybean fertility. He has helped to bring about a better understanding of the physiological processes of the soybean as they relate to mineral nutrition. He has been a member of the Purdue University staff since 1937, and has been a professor of agronomy since 1958. Photos show Williams and Ohlrogge.

• Summary: "Robert W. Howell, Urbana, Illinois, has been named leader of soybean investigations for the Crops Research Division, Agricultural Research Service, U.S.D.A. He succeeds Herbert W. Johnson who accepted the position of head of the department of Agronomy and Plant Genetics at the University of Minnesota. Dr. Johnson was leader of soybean investigations since 1953.

“Dr. Howell, a native of Mississippi, received his B.S. degree in Botany from Mississippi College and his M.S. and Ph.D. degrees in Plant Physiology from the University of Wisconsin. He was employed as soybean plant physiologist at the U.S. Regional Soybean Laboratory at Urbana, Illinois, after graduation in 1952. He served as the only U.S.D.A. soybean physiologist from 1952 until 1963 when Dr. Ray Johnson was added to the staff. Dr. R.W. Rinne was employed also at the Regional Laboratory in 1964. Further expansion of soybean physiological investigations is anticipated.

“Dr. Howell will remain at Urbana while expansion of the physiology research centered there is continued. Dr. Johnson was located at the U.S.D.A. station at Beltsville, Maryland.

“There are 20 scientists located in 8 states engaged in soybean production investigations in the U.S. Department of Agriculture. This is an increase of 4 scientists since 1951 when the soybean crop was less than half the acreage and value estimated for 1964.

“Soybean production research was stimulated by the establishment of the U.S. Regional Soybean Laboratory with headquarters at the University of Illinois in 1936. Early U.S.D.A. research with soybeans, prior to 1900, was directed toward improving the crop for forage. Emphasis now is on improving seed yield and quality. The current ‘Investigations Team’ include plant physiologists, plant breeders, geneticists, pathologists and chemists.”

A portrait photo shows Dr. Robert Howell.

• Summary: Dr. Allan K. Smith, pioneer and international authority in research on uses for soybean protein, retired Dec. 1. He had been with the U.S. Department of Agriculture’s Northern Utilization Research Laboratory, Peoria, Illinois, since 1942. In 1932, he began studying soybean protein at the Institute of Paper Chemistry, an industrially financed laboratory at Appleton, Wisconsin, and continued this research from 1936 to 1942 at USDA’s soybean laboratory, Urbana, Illinois.

“His basic studies on isolating the protein of soybean meal were the first published that provided basic information on solubility, precipitation, and adhesive properties. These publications enabled other scientists to isolate the protein and study it further and laid the groundwork for industrial processes.

“The most recent development under Dr. Smith’s leadership is the increased use of U.S. soybeans in traditional Oriental foods such as shoyu (soy sauce) and tofu (gelatin-like food used in soup or for frying). This research at the Northern laboratory and in Japan, under Public Law 480, shows promise for finding high-protein foods to supplement diets in countries where meat, eggs, and other sources of
protein are in limited supply.

“Dr. Smith’s work has taken him all over the world: Japan, China, and Korea—1948; England, Italy, India, and Japan—1962; and Japan—1957, 1961, and 1964.

“Earlier, Dr. Smith led research on separating sugars and other non-protein components from soybean protein by a process of washing soybean meal with alcohol. A food product of this research, called ‘gelsoy,’ is manufactured and used in Japan today. Soy protein, used in meat products in this country, is an outgrowth of the alcohol-washing studies.

“Dr. Smith’s studies at Appleton were among the first on using soybean protein as paper sizing and coating adhesive. Most paper-coating adhesives now contain soy protein.

“In 1963, the Northern laboratory chemist was elected to honorary life membership in the American Soybean Association. He received USDA’s Superior Service Award in 1957.

“Dr. Smith is a member of the American Association of Cereal Chemists (AACC) and chairman of its soybean activities committee. This committee is providing a forum in the cereal chemists’ organization for chemists who study the proteins of oilseeds such as soybeans. He will keynote the soybean session at the AACC golden anniversary meeting in Kansas City next spring.

“Dr. Smith expects to continue writing, editing, and consulting in his field. He and Mrs. Smith have moved to 6 Japonica Drive, Pass Christian, Mississippi.”

A small portrait photo shows Dr. A.K. Smith.


• Summary: Dr. Leonard F. Williams, research agronomist at the U.S. Regional Soybean Laboratory, Columbia, Missouri, was killed instantly in a car-truck collision near Sikeston, Missouri, Jan. 13. Dr. Williams participated in the development of most of the newer soybean varieties in the Cornbelt. “He was primarily responsible for the Lincoln, first of the soybean varieties to be developed and released by the U.S. Regional Soybean Laboratory in cooperation with the state agricultural experiment station.” A brief biography follows. A photo shows Leonard Williams.


• Summary: “The untimely death of Leonard Williams, in charge of the soybean breeding work at the Missouri station, in an automobile accident recently is to be greatly regretted. He had contributed much to the development of better soybean varieties in the United States. While at Illinois, and after his transfer to Missouri, he was regarded as one of the best soybean geneticists in the nation. To his family goes our sympathy in their bereavement.

“And his death brings into focus a major problem. In terms of today’s soybean crop, the supply of qualified and expert soybean geneticists and breeders is grossly inadequate. There was a generation of these men—most of whom entered the picture when the U.S. Soybean Laboratory was first established to centralize the soybean breeding work. We were then growing less than 100 million bushels of soybeans. Now we grow 700 million bushels. But we have very few additional men working in this field. We need another generation of these men. They are badly needed.”

A small portrait photo shows George Strayer.


• Summary: Near bottom of title page: “United States Department of Agriculture. Agricultural Research Service. Crops Research Division, cooperating with State Agricultural Experiment Stations.”


• Summary: Except for the cover, this document is typewritten.


**Summary:** The authors studied ribonucleic acid (RNA) and total free nucleotides in radicles, cotyledons, and seed coats of immature soybeans, measuring how they changed as the seeds developed. In the radicles, total RNA increased throughout development from seed dry weight of 35 mg to maturity, but the percentage RNA on a dry weight basis decreased by about one-third during this period. In contrast, total RNA of the cotyledons increased only moderately during the early developmental period, and decreased during ripening. At maturity RNA percentage was about one-fifth that of the youngest stage. In the seed coats RNA decreased on both an absolute and percentage basis.

Also discusses changes in total free nucleotides.

Address: Dep. of Biological Sciences, Western Illinois Univ., Macomb, IL; U.S. Regional Soybean Lab., Urbana, Illinois.


**Summary:** “Jackson L. Cartter retired as director of the U.S. Regional Soybean Laboratory, Urbana, Illinois, on Dec. 30. His retirement ended a professional career in soybeans spanning nearly 40 years.

“Mr. Cartter began his work on soybeans in 1928, joining the late W.J. Morse, who was among the pioneers in bringing the potential of soybeans to public attention. Mr. Cartter worked first at Holgate, Ohio, where the first soybean laboratory was established. He later worked at Arlington, Virginia, before moving to Urbana in 1936 when the U.S. Regional Soybean Industrial Products Laboratory was established. He has been in charge of the soybean production research since that time and has been director of the Urbana laboratory since the utilization research was moved to the Northern Regional Research Laboratory at Peoria, Illinois, in 1942.

“He is an author of many research papers and is one of the most widely known authorities on soybean production problems. His early research established the range of adaptabilities that exist in the soybean variety collection and contributed to the basis for the maturity group concept that has been so valuable in the variety development program. He also led in determination of oil and protein and while at Holgate set up a chemistry laboratory and, conducted a vigorous study of oil and protein in soybean varieties.

“To an unusual degree, Mr. Cartter is able to see the ‘big picture’ and to understand the interaction of different scientific disciplines. Thus his leadership has continued its effectiveness as the soybean research staff has grown to add first chemists, then plant pathologists, physiologists, geneticists and biochemists to the nucleus of agronomists who began the regional research program in the thirties.

“His interests and talents are remarkable in their extent. He is not the only person to design and do most of the work in building his house but he has done it twice: his beautiful home in Urbana and another on a lake near Danville, the latter referred to quite inaccurately as a ‘cabin.’ Few can match his feat of rebuilding a baby grand piano—a magnificent job, lacking only the name plate to be a duplicate of a factory-new instrument. He had a remote control device to eliminate TV commercials before these were stock items.

“Mr. Cartter is a very human person who is equally at ease with the great and the humble. He is sympathetic to the problems and aspirations of all of his associates and on many occasion has led young men into useful and rewarding careers.

“He was active in the Exchange Club for many years, serving in various offices including president. He is a real pillar in his church and for a long time has conducted a weekly service at the Veterans Hospital in Danville.

“About the only thing you can fault Mr. Cartter on is his distaste for in-activity. Although he is giving up his responsibilities in soybean research, it is expected that he will continue to lead a full life of service to mankind.”

A small portrait photo shows Cartter.


**Summary:** “Mr. Jackson L. Cartter terminated more than 37 years of service for the U.S. Department of Agriculture in soybean production research and administrative duties on December 30, 1965. A native of Missouri, ‘J.L.’ as he is known to his friends, received his B.S. degree in Agronomy from Montana State College in 1925, his M.S. degree in Agronomy from Iowa State College in 1927, and did additional graduate study in agronomy and plant physiology
at the University of Wisconsin in 1927 and 1928. He started as a soybean breeder for U.S.D.A. in Ohio in 1928, transferred to Virginia in 1933, and moved to Illinois in 1936 to become director of agronomic research in what is now the U.S. Regional Soybean Laboratory.

“Mr. Carter’s outstanding service to the soybean industry was recognized in 1956 through his election to honorary life membership in the American Soybean Association. He has served as a member of the Advisory Board to the National Soybean Crop Improvement Council since its inception in 1948. In 1949 Mr. Carter represented the U.S.D.A. abroad in studying the possibility of expanding the soybean crop and markets in several European countries.

“Mr. Carter has made outstanding contributions to agronomic science as related to soybean production and breeding. He has contributed to the solution of soybean production problems through his publications, the cooperative research projects, the introduction of new varieties, and the exchange of breeding materials. He is author and co-author of many publications and has been called ‘one of the outstanding workers and leaders in breeding research on soybeans.’

“Dr. Richard L. Bernard, research geneticist, was appointed Acting Director of the U.S. Regional Soybean Laboratory to succeed Mr. J.L. Carter who retired Dec. 30.

“Dr. Bernard received his B.S. and M.S. degrees from Ohio State University. He earned his Ph.D. in plant breeding at North Carolina State College and joined the staff of the U.S. Regional Soybean Laboratory in 1954.”


• **Summary:** “Dr. Robert W. Howell succeeded Dr. L.M. Pultz as Chief of the Oilseed and Industrial Crops Research Branch, C.R.S., A.R.S., U.S.D.A. on Dec. 30, 1965.

“Dr. Howell has been Leader of Soybean Investigations in U.S.D.A. since August, 1964. Prior to that time he was plant physiologist at the U.S. Regional Soybean Laboratory, Urbana, Illinois, since 1952. Until 1963, Dr. Howell was the only plant physiologist employed in Soybean Investigations.”


• **Summary:** New Jersey’s newest variety gives excellent seed quality and performs particularly well in that state, where it is classified as a midseason variety that matures later than Hawkeye but earlier than Clark.

“Adelphia was developed by crossing Lincoln soybeans and Ogden (25% each) with Adams (50%).” Work on Adelphia “began about 10 years ago, under the direction of A.A. Probst at the Purdue (Indiana) Agricultural Experiment Station, in cooperation with the U.S. Regional Soybean Laboratory.” A photo shows Dr. John C. Anderson at Rutgers Univ. standing in a field of Clark and Adelphia soybeans. Address: Manager, New Jersey Crop Improvement Assoc., Allentown, New Jersey.


• **Summary:** Near bottom of title page: “United States Department of Agriculture. Agricultural Research Service. Crops Research Division, cooperating with State Agricultural Experiment Stations.”


• **Summary:** Except for the cover, this document is typewritten.


• **Summary:** Protein or nitrogen solubility measures the amount of undenatured protein and acceptability of meal for protein isolation. Address: 1-3. NRRL, Peoria, Illinois; 4-5. U.S. Regional Soybean Lab., Urbana, IL.


• **Summary:** Note: This is the earliest document seen (May 2009) with the term “Maturity Groups” (or “Maturity Group,” regardless of capitalization) in the title. Address: Stoneville, Mississippi.


• **Summary:** Dr. Richard L. Cooper, of St. Paul, Minnesota, has been appointed agronomist-in-charge of the U.S. Regional Soybean Laboratory, Urbana, Illinois, effective Jan. 3. The Laboratory, a cooperative activity of the Agricultural Research Service and 25 State Agricultural Experiment Stations, is a part of Soybean Investigations, Crops Research Division, U.S. Department of Agriculture. Dr. Cooper succeeds J.L. Cartter, who retired.

  “As agronomist-in-charge of the Laboratory, Dr. Cooper will provide leadership in research activities of soybean research throughout the United States. He will have direct responsibility for the operation of the Laboratory which consists of 10 scientists at Urbana. He will also assist in the coordination of the total research program which has USDA soybean production personnel located in 9 states, and state collaborators in 30 states and 2 Canadian Provinces.

  “Dr. Cooper has been active in soybean breeding and production research since he joined the University of Minnesota in 1961. He has given special attention to soybean production practices for Minnesota. He has been active in the genetic aspects of resistance to bacterial blight. More recently, Dr. Cooper has been concerned with carbon-dioxide levels in soybean fields and its role in soybean production.

  “In addition to his duties at the Laboratory, Dr. Cooper will continue his interest in breeding and soybean production physiology.”


• **Summary:** “Dr. Richard L. Cooper of St. Paul, Minnesota, was appointed agronomist-in-charge of the U.S. Regional Soybean Laboratory, Urbana, Illinois, effective January 3, 1967. The Laboratory, a cooperative activity of the Agricultural Research Service and 25 State Agricultural Experiment Stations, is a part of Soybean Investigations, Crops Research Division, U.S. Department of Agriculture. Dr. Cooper succeeds Mr. J.L. Cartter, who retired.

  “As agronomist-in-charge of the Laboratory, Dr. Cooper will provide leadership in research activities of soybean research throughout the United States. He will have direct responsibility for the operation of the Laboratory which consists of 10 scientists at Urbana. He will also assist in the coordination of the total research program which has USDA soybean production personnel located in 9 states, and state collaborators in 30 states and 2 Canadian Provinces.

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  “In addition to his duties at the Laboratory, Dr. Cooper will continue his interest in breeding and soybean production physiology.”

Dr. Cooper is a native of Newton County, Indiana, and a graduate of Brook High School. He received his B.S. degree from Purdue University and Ph.D. from Michigan State University.

“Dr. Cooper is the son of Mr. and Mrs. Wilbert Cooper who currently reside on their farm near Brook, Indiana. Dr. and Mrs. Cooper, and their four charming daughters (ages 3-13) will reside in Urbana, Illinois, after January 1, 1967.”
A portrait photo shows Dr. Richard L. Cooper.


• Summary: Near bottom of title page: “United States Department of Agriculture. Agricultural Research Service. Crops Research Division, cooperating with State Agricultural Experiment Stations.”


Page 38: Hark is the progeny of an F-8 plant and was developed in Iowa by C.R. Weber. A history of its development [starting in 1952; released in July 1966] is given below.” This is the earliest document seen (May 2009) that mentions the soybean variety Hark (one of two documents).

Page 39: “Disoy, Magna, and Prize. Three large-seeded varieties, Disoy (Group I), Magna (Group II), and Prize (Group II), were developed by C.R. Weber at Ames, Iowa, and released this year [in early Feb.]. A history of their development is given below.”

Note: This is the earliest document seen (Aug. 2013) that mentions the soybean varieties Disoy, Magna, and Prize. Address: U.S. Regional Soybean Lab., Urbana, Illinois.


• Summary: Except for the cover, this document is typewritten.


• Summary: “Nuclear magnetic resonance spectroscopy (NMR) has been shown to be rapid and accurate for determining oil content of partially dried seeds” (Conway & Earle 1963). “Very close agreement has been obtained (Collins, unpublished data), between NMR analysis and conventional extraction methods for oil content in soybeans grown in a number of environments. NMR analysis is nondestructive and a sample size may vary from a single seed to 25 g.” Address: North Carolina & Urbana, Illinois.


• Summary: “The soybean industry and the Department of Agriculture’s research on using soy products, now conducted at the Northern Utilization Research Laboratory, Peoria, ‘grew up’ together. The Northern Lab will be one of the stops on the field day during the ASA convention in August. Visitors will have an opportunity then to see some of the Lab’s longtime research on soybeans. Reports of work by Northern Laboratory scientists show almost 30 years’ direct continuity not only in new products and processes but in personal experience and development of research programs.

Leonard L. McKinney, for example, who is now assistant director for program development, and Allan K. Smith, who retired in 1964, studied soybean uses at the Regional Laboratory at Urbana before they and their work were transferred to Peoria.

“Among the Northern Laboratory’s oldest publications is an April 1938 report on water content of plastics made from soybean protein. Mr. McKinney is an author on this paper.

“In June 1942, less than a month before the Urbana soybean studies and staff were transferred to the Northern Laboratory, the Soybean Digest published an article on soy meal in plastics, Mr. McKinney’s eighth paper in one area alone: industrial uses of soy protein. In March and April this year, he spoke at meetings of experiment station scientists and of soybean and cottonseed oil millers on soybeans as a source of food protein.

“Dr. Smith’s first report as a USDA scientist was published in June 1938. Dealing with extraction of nitrogenous materials from soybean meal, it is one of 80 papers published during his soy protein research career.

“Others who transferred from soybean research at Urbana and are at the Northern Laboratory now include: Fontaine R. Earle, head of new crops screening; Glen E. Babcock, doing research on cereal proteins; Charles R. Scholfield, in soybean oil studies; Kenneth R. Majors, in charge of federal extension work from the Northern Laboratory; and Ordean L. Brekke and Virgil F. Pfeifer, both
engineers, now doing research in cereals.

“In February 1938, Mr. Earle and Reid T. Milner, then director of the Urbana laboratory, published a paper on the occurrence of phosphorus in soybeans. Dr. Milner was director of the Northern Laboratory from 1948 to 1954 and now is in charge of food science at the University of Illinois. Mr. Majors and Dr. Milner published a paper on iodine number and refractive index of crude soybean oil in December 1939.

“John C. Cowan, now chief of oilseed studies, reported to work in July 1940 and shortly after began experiments with vegetable oils in quarters on the Bradley University campus.

“The new USDA laboratory opened in December 1940. The first soybean-related research in the new building was reported in a paper on polymerizing drying oils, published in 1942 by Dr. Cowan and other Northern Laboratory scientists.

Photos: (1) Leonard L. McKinney, assistant director for program development. (2) John C. Cowan, chief of oilseed studies at USDA's Northern Regional Research Laboratory at Peoria. Both have been a part of the Lab's soybean research programs for many years. Both men have appeared as speakers at ASA conventions.


Introduction: “This index has been prepared to guide research workers in finding information on the soybean strains that have been tested in the cooperative testing program coordinated by the U.S. Regional Soybean Laboratory.

“The results of the Uniform Soybean Tests for maturity groups 00 to IV in the northern states have been reported in a mimeographed publication (usually issued in February or March of the year following the tests) for each year of testing beginning with the 1941 tests. The first two years of the Uniform Tests, 1939 and 1940, were reported in the Annual Reports of the U.S. Regional Soybean Industrial Products Laboratory issued in April of 1940 and 1941. In this index the reports are referred to by the year the tests were grown rather than the year of issue.

“Named varieties and C strains are indexed to include testing under their strain designations prior to release of their CX number prior to assignment of C number.

“Tests listed under other strain designations include only testing under that designation, but cross-references are provided to indicate subsequent designations for the strain or reselections from the strain.

“A, L, S, U, and W strain designations, which included the last digit of the year of selection as a prefix to the identifying number, are listed here with the last two digits to avoid confusion between decades. For example, L6-2132 is listed as L46-2132.

“Parentages in a few cases have been corrected or simplified. An attempt has been made to express parentage in the form that will show relationships to other strains that have been in the Uniform Tests.”


“In 1939 and 1940, Uniform Tests II, II, and IV were called Uniform Early, Midseason, and Late Tests, respectively“ (p. 3).


Note: A soybean strain becomes a variety when it is named and released. Address: Urbana, Illinois.

• Summary: Near bottom of title page: “United States Department of Agriculture. Agricultural Research Service. Crops Research Division, cooperating with State Agricultural Experiment Stations.”

Contents: Soybean investigations personnel (in the

A map, facing the table of contents, shows the locations of the Uniform Soybean Tests, Northern States, 1967.


• Summary: Except for the cover, this document is typewritten.


Page 2: “Cooperating agencies and personnel for the Southern Region.

“Soybean Investigations, Beltsville, Maryland: B.E. Caldwell, Leader


• Summary: “Techniques for rapid analysis of fatty acid composition and oil content of seeds are now available. Furthermore, these techniques do not destroy the seeds. For example, oil content of single seeds can be obtained by nuclear magnetic resonance spectroscopy without reducing viability.” The composition can also be determined by gas-liquid chromatography.

“It was found that oil content and the fatty acids (oleic, linoleic, and linolenic) of the oil are determined primarily by the genotype of the maternal parent. The pollen parent had little influence on oleic and linoleic acids of seed oil, but in certain crosses the genotype of the male parent influenced the linolenic acid fraction...”

Note: This is “Publication No. 511 of the U.S. Regional Soybean Laboratory.” Address: North Carolina and Urbana, Illinois.


A map, facing the table of contents, shows the locations of the Uniform Soybean Tests, Northern States, 1968.


UniformSoybeanTests/68soybook.pdf

*Summary:* Except for the cover, this document is typewritten.

Near bottom of title page: “United States Department of Agriculture. Agricultural Research Administration. Bureau of Plant Industry, Soils, and Agricultural Engineering, Division of Forage Crops and Diseases, cooperating with State Agricultural Experiment Stations.”


*Summary:* See next 4 pages. “A collection of introduced and domestic soybean strains obtained over the past sixty years is maintained by the U.S.D.A. for use by breeders, pathologists, and other research workers. Strains in maturity Groups 00 to IV are maintained by R.L. Bernard at the U.S. Regional Soybean Laboratory, Urbana, Illinois, and those in Groups V to VIII by E.E. Hartwig at the Delta Branch Experiment Station, Stoneville, Mississippi.

“This report includes data on the 1,157 strains in maturity Groups III and IV in the Collection as of 1960, distributed as follows: Maturity Group III: 41 U.S. and Canadian varieties, 13 FC strains, and 523 PI strains. 577 Total. Maturity group IV: 48 U.S. and Canadian varieties, 18 FC strains, and 514 PI strains. Total: 580 Total. Grand total: 1,157. For each strain is given: Name. Foreign name or parentage. Origin. Year released. Maturity group.

“Flower color (P = purple, W = white).

“Pubescence color: T = tawny (brown), G = gray.


“Pod color: Bl = black, Br = brown, Tan.

“Seed coat luster: D = dull, S = shiny, I = intermediate.

“Seed coat and hilum color: Y = yellow, Gn = green, G = gray, Ig = imperfect gray, Bl = black, Br = brown, Rbr = reddish brown, Ib = imperfect black, Bf = buff, Tan.

“Mottling score: Estimated percent of the seed coat (hilum excluded) which was dark-pigmented, recorded as a score: 1 (0 to trace), 2 (trace to 10%), 3 (10 to 25%), 4 (25 to 50%), and 5 (over 50%).

“Other: Abh = imperfect abscission of hilum, Dab =
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*“-”* in Methionine column indicates dark seed coat

© Copyright Soyinfo Center 2017
delayed abscission of leaves, Def = defective seed coat, Fleck = brown flecks on black seed coat, Gracilis = plant and seeds resemble the semi-wild type of G. max formerly classified as G. gracilis, Gn cot = green cotyledon, Nar lf = narrow leaf, Ring = black stripes (or rings) on brown seed coat, Saddle = saddle-shaped dark pigment on seed coat, Wa lf = wavy leaf margin.

“Performance data were gathered from a test grown at Urbana, Illinois. There were two replications of each group, one planted May 20, 1965 in field S700 and one planted May 26-27, 1966 in field S600. Plot size was 80” x 8’ (two paired rows eight feet long, row spacing 40 inches). Yields may be somewhat overestimated from the effect of the four-foot alleys since plots were not trimmed at maturity, but when converting to yield per acre the plots were considered to be 10 feet long to partially compensate for this. There were no border rows and, therefore, the Group III strains were grown in one block and Group IV in another to minimize competition effects. In order to simplify finding strains and to group material from the same source, strains of the two maturity groups are listed together in one series in this report. Data should be fairly comparable between the two groups, although comparisons are not as precise as those within group. Check varieties are listed in the order in which they occurred in the field and are, for Group III: Harosoy 63 (II), Adams, Shelby, Wayne, and Clark 63 (IV), and for Group IV, Shelby (III), Clark 63, Kent, Scott, and Hill (V): The traits are defined below:

“Flowering: Date that 50% of plants begin to flower.
“Maturity: Date that 95% of pods are ripe.
“Lodging: Scored 1 (erect) to 5 (prostrate).
“Height: Plant height in inches.
“Stem Termination: Scored 1 (very determinate) to 5 (very indeterminate).
“Branching: Scored 1 (rarely branching) to 5 (profusely branching).
“Seed Quality: Scored 1 (good) to 5 (poor), considering wrinkling, defective seed coat, greenishness, and moldy or rotten seeds.
“Shattering: Estimated percent of pods open at harvest, shortly after maturity. Score based on percent of open pods as follows: 1 (no shattering), 2 (1 to 10%), 3 (10 to 25%), 4 (25 to 50%), 5 (over 50% shatted).”
“Seed Weight: Grams per 100 seeds.
“Yield: Bushels per acre.
“Seed Composition: (Based on a composited sample from the two replications, analyses by F.I. Collins and O.A. Krober at the U.S.R.S.L.)
“Protein: Percent of dry weight of seed (Kjeldahl method).
“Oil: Percent of dry weight of seed (nuclear-magnetic-resonance method).
“Protein Composition:
“Methionine: Percent of total protein (using Krober’s modification of the McCarthy-Sullivan colorimetric method using enzymatic hydrolysis).

“Oil Composition:
“Palmitic, Stearic, Oleic, Linoleic, and Linolenic Acid: Percent of oil (using gas-liquid-chromatography (GLC)).
“Iodine Number: Calculated from GLC fatty acid composition on a crude basis.

“Disease Reaction:
“PR = Phytophthora rog caused by Phytophthora megasperma var. sojae.
“R = resistant, S = susceptible (based on data obtained from artificial inoculations by K.L. Athow [named varieties] and F.A. Laviolette [FC and PI strains] at Purdue University, Lafayette, Indiana).”


Note the spelling “maturity Groups” and “... the Group III strains were grown in one block and Group IV in another.” But twice in the middle of a sentence we find “more appropriate maturity groups...” and “strains of the two maturity groups are listed together...” Note: This is the earliest document seen (July 2000) that mentions the soybean variety Charlin.

Note from Dr. R.L. Bernard. 1999. July 15. “I was still resisting use of ‘germplasm’--a strange word, hard to define--but later give in to the popular use by management and the press. This document shows the extension of the use of “maturity Groups” beyond the Uniform Test, as also does the 1949 USDA Farmers’ Bulletin No. 1520. ‘Maturity Group’ was well- and long-established with the soybean germplasm when I came in 1954.” Address: 1. Research Geneticist; 2. Agricultural Research Technician. Both: U.S. Regional Soybean Lab., Oilseed and Industrial Crops Research Branch, Crops Research Div., Agricultural Research Service, USDA.


**Summary:** Percent protein is inversely related to seed yield. “Unilateral selection for agronomic traits has been used widely in plant breeding, frequently with retrograde or less than optimum results because of inadequate knowledge of interrelationships among these traits. Selection indices provide a method for integrating information on several traits for selection purposes.” Phenotypic ranking can serve as a selection index with subjective weights assigned to the component traits. Address: Iowa Agricultural and Home Economics Experiment Station, Ames, Iowa.


**Summary:** “Phenotypic selection for agronomic characters such as height, lodging, and maturity has been extensively and successfully practiced in soybeans... This selection has generally been practiced in early generation material to eliminate undesirable agronomic types prior to extensive yield testing.

“Correlations of agronomic and chemical characters with yield in soybeans have been presented by several authors...”

Two lines of soybean crosses were evaluated for nine characters in three environments. “Heritability was relatively consistent across environments for all traits except seed yield. For yield, heritability was greatest under favorable growth conditions and least when moisture stress was alleviated by irrigation.”

Percent protein is inversely related to seed yield; the greater the seed yield, the less the protein in each seed. Address: Iowa Agricultural and Home Economics Experiment Station, Ames, Iowa.


**Summary:** Near bottom of title page: “United States Department of Agriculture. Agricultural Research Service. Crops Research Division, cooperating with State Agricultural Experiment Stations.”


**Summary:** Except for the cover, this document is typewritten.


**Summary:** Contents: Introduction. The trend to yellow seed. Common objectives of soybean breeders: High yield, high oil content, high protein content, disease resistance, improved seed quality, maturity to fit rotations, shattering resistance, desirable plant height, lodging resistance, high podding from soil level. Threat of root rot. Reasons for yields of 100 bushels/acre.

Before 1920, the soybean was used mostly as a forage crop. It was “used extensively for hay, and to a lesser extent for soilage, silage, green manure, lambing- or hogging-off when grown as a companion crop with corn, and for direct feeding of the beans.” In 1924 the first official U.S. production statistics showed that of the 1,782,000 acres produced, only 448,000, or 25%, were harvested for beans. “It was not until 1941 that 5,881,000 acres harvested for beans surpassed the 5,510,000 acres grown for all other purposes.

“The development of the soybean processing industry was nudged into being mainly by World War I when there was such a shortage of fats and oils in the U.S. that it was necessary to import Manchurian soybean oil.”

“Well over 10,000 introductions have been brought into the U.S. since 1898. Approximately 4,775 introductions were brought in by W.J. Morse and P.H. Dorsett who spent 2½ years during 1929-1931 on an agricultural exploration trip in Japan, Korea, and Manchuria.

“The germplasm collection today numbers about 3,200 types plus nearly 300 named varieties.”

“Through 1940 most varieties were released either as direct introductions, rogued introductions, or selections from introductions. Some selections from introductions may
have been of hybrid origin. A few varieties developed from introductions which played an important role in the rapid expansion of acreage planted for processing 20-50 years ago included Dunfield, Illini, Manchu, Richland, Mukden, Mandarin, Habaro, Boone, Patoka, and Roanoke. All vegetable-type varieties up to 1956 were introductions.

“Only a few varieties released through 1940 are known to have come from artificial hybridization-breeding programs. These include Mamloxi, Mamotan, Mamredo, Ogden, Volstate, Tennessee Non-pop, Oloxi, Pee Dee, and Yelredo.

Of this group, only Ogden, with numerous good qualities sought in varieties today, was grown extensively for a long period. The popularity of Ogden was such that nearly 30 years after its release in 1941 some of it was still being grown commercially.

“Following 1940, and especially after 1950 there have been few varieties released which have come directly from introductions.”

“The establishment of the U.S. Regional Soybean Industrial Products Laboratory (now the U.S. Regional Soybean Laboratory) in 1936 at Urbana, Illinois, brought about a tremendous increase in soybean breeding. Variety development immediately lost its provincialism and went “big league” to have an immediate impact nationally and eventually internationally.”

“A recent listing of the leading soybean varieties for the U.S. and Canada included 39, plus seven special-use varieties, five of which were vegetable types and two were high-protein types.

“Since 1943 over 80 varieties have been or are in the process of registration by the American Society of Agronomy or, more recently, the Crop Science Society of America.

“The major part of soybean-variety development in the past has been accomplished by public agencies, particularly the agricultural experiment stations and the U.S. Department of Agriculture. At least one private company has been breeding soybeans for many years; a few for shorter periods.

“During the past few years, a few number of private companies have entered the field of soybean breeding.”

Two main factors have led to yields of 100 bushels/acre or more: Better soybean varieties combined with improved cultural practices.


578. USDA Northern Regional Research Laboratory. 1970. 50 years of soy use research: A contribution from USDA’s Northern Laboratory. Soybean Digest. Aug. p. 71-76.

• Summary: Construction for the Northern Regional Research Laboratory; now called the Northern Utilization Research and Development Division, Peoria, Illinois, began in 1939 (above). Congress, in the Agricultural Adjustment Act of 1938, directed the Secretary of Agriculture to establish four laboratories and to develop new uses and ‘new and extended markets for farm commodities and products and byproducts thereof.’

“Soybeans became one of the commodity responsibilities in 1942 when chemical and engineering studies at the 6-year-old U.S. Regional Soybean Industrial Products Laboratory, Urbana, were transferred to the Northern Laboratory.

“During these years, 1936-42, a depression was ending and a war was beginning. People, especially farmers, may have been ready for miracles. The soybean appeared to some as a hay crop transformed into a ‘gee-whiz’ industrial raw
material—a farm counterpart of ‘coal, air, and water’ said to be used in making nylon.

“In the years that followed, the soybean proved as versatile as men’s imaginations and more versatile than their needs. Despite popular interest, research effort and industrial successes in making inedible materials—plastics, glues, paints—from soy components, the bean now appears destined as food–protein and oil–life and energy for the world’s population.

“The reports on 50 years of soybean use research on following pages were compiled at the Northern Laboratory.

A photo shows the Northern Regional Research Laboratory, in Peoria, Illinois, under construction in 1939. Address: NRRL, Peoria, Illinois.

579. USDA Northern Regional Research Laboratory. 1970.

• Summary: A brief chronology of major food and industrial developments with soy proteins from 1917 to 1969.

“From fertilizer and cow feed, glues and plastic Fords to spun fibers and meat analogs is the story of soy protein uses from 50-some years ago into the future.

“This ‘bean hull’ sketch of studies on meal and protein uses in the U.S., excluding whole beans and full-fat products, begins in 1917. W.J. Morse described ground soy cake as yellow, with a sweet, nutty flavor and containing 46% to 52% protein and 5% to 8% oil. ‘Considerable quantities’ of domestic meal were going into fertilizers; value in stock feed was ‘well established’ by practical experience and research and ‘extensive tests’ had been conducted by USDA in making bread and pastry. Morse used ‘soy-bean meal’ and ‘soy-bean flour’ interchangeably in the Yearbook article.

“1926 Soy glue industry founded by I. F. Laucks (Soybean Digest, May 1942). Yearbook dropped reference to fertilizer use. Stated food use ‘has been very limited.’ Implied livestock feed was chief use.

“1933 Research had established soy protein has good amino acid balance. Meal used in feed for hogs, sheep, dogs, rabbits as well as cattle; oil content satisfactory for hogs. ‘Considerable quantities’ of meal going into glue for veneer, plywood, insulating materials, water paint, bakelite substitute. Meal used in ‘flour’; diabetic, health, and breakfast foods; malted milk.

“1935 Commercial isolation of protein for paper coatings.

“1938-47 Soy protein plastics, basic and applied studies at Urbana Soybean Lab. and Northern Lab., Peoria. Items that follow are USDA utilization research developments if not otherwise identified.

“1939-41 Protein precipitation from water-alkaline dispersions, basic to commercial development of protein isolation.

“1940-41 Plastics, fibers by Robert A. Boyer, Ford Motor Co.

“1942 Heat denatured protein in meal.

“1942-44 Soy protein adhesives for wood, paper.


“1946 Water-soluble protein by Borden Co.

“1948 Edible isolates by Central Soya.

“1950 Swift & Co. launches research leading to improvement patents on vegetable protein in food, films. Cold-setting glue.
“1952-61 Defatted, full-fat soy flours in bread.
“1954 Protein adhesives. Flash desolventizing minimizes protein denaturation.
“1955-58 Toxicity of trichloroethylene-extracted meal.
“1956-57 Gelsoy in sausages.
“1957 Protein stabilizer in rubber-based paint.
“1959 Whey proteins.
“1959-61 Amino acids of meal, protein, hull.
“1961 Soy sodium proteinate whips and gels.
“1963 Purified soy protein.
“1964-66 Studies on growth inhibitors, saponins. 70% protein concentrate by Central Soya.
“1965 Soy protein glue for southern pine plywood.
“1969 General Mills wins 20th Kirkpatrick Chemical Engineering Achievement award for soy protein meat analogs.
“1970 Soy protein isolate replaces milk solids in Central Soya’s frozen all-vegetable dessert. Industrial research increases.”

Photos show, from left: (1) Soy protein adhesives in shotgun shells, A.K. Smith and Glen Babcock, Northern Lab. (2) 1966 General Mills launches research leading to meat analogs. (3) Typical entrees made from textured vegetable protein. Photos (2) and (3) courtesy General Mills. (4) 1944 Isolated soy protein produced in Northern Lab pilot plant by alcohol extraction. Address: Peoria, Illinois.


**Summary:** A brief chronology of major developments

Norepol, 1942 rubber substitute, and Norelac, 1943 resin, typify inedible products of soy utilization studies: I—Inedible products must compete with foods and feeds for a share of the soy oil or meal raw material. Development of Norepol, for example, was curtailed because war demanded soy oil for food.

2—Food-feed demands sustain oil and meal prices at levels that are generally higher than the costs would be if oil and meal were not used in food and feed.

3—Many inedible soy products are not, themselves, end products but are industrial intermediates or components that can be used in making several new products. Norelac, for example, has been used in adhesives for almost everything from paper to stone, concrete patching, paints and other coatings, printing inks, rocket heat shields, shrink-proofing wool.

“Almost 30 years after the original development, the Northern Laboratory continues to receive reports of new applications by companies like General Mills and Emery Industries.

“As early as 1917, scientists knew that soy is a semidrying oil and reported it ‘most suitable’ for paint. “It was first used in the U.S. in its crude state, principally in the manufacture of soft soaps,” W.J. Morse reported in the 1917 Yearbook [of the U.S. Department of Agriculture]. ‘Other uses for which this oil is employed are in the manufacture of explosives, linoleum, varnish, and foodstuffs.’ In 1926, he added enamels, lubricating oil, printing ink, waterproof goods, and substitutes for rubber to a list of oil products. In the forties the list grew with results from the Regional Soybean Laboratory, Urbana, the Northern Laboratory in Peoria, and elsewhere. Listed items are USDA utilization developments unless otherwise identified: “1937-41 New paints, varnishes.

1941 Norepol (rubber substitute).
1943 Norelac.
1950 Epoxidized soy oil.
1951 Coating compositions.
1953 Modified soy lecithin.
1953-54 Synthetic lubricants.
1960-61 New industrial intermediates, ozonized soy oil, fatty acids.
1962 Plasticizers for nitrile rubbers.
1965 Insulating foams by modifying soy dimer acids. Crosslinked polymers (glass coatings, adhesives) from ozonized soy fatty acids.
1966 Plasticizers for polyvinylchloride [polyvinyl chloride].
1968 Soy nylon.
Photos show: (1) 1942 A person with his hands full of unprocessed Norepol. (2) 1955 Gel paint contains Norelac;
no drip. (3) 1966 Plasticizers for polyvinylchloride. Address: NRRL, Peoria, Illinois.


*Summary:* This is a brief chronology of major developments with soy oil in the USA from 1916 to 1969.

“Research on food oil and other utilization studies were underway in 1916-17. Soybeans were grown for hay at this time, but the beans were not a significant domestic crop.

1916–Secretary of Agriculture D.F. Houston wrote, “A systematic study of the soybean... has been underway for several years... Through the efforts of the Department, cotton oil mills crushed during the past season over 100,000 bushels of southern-grown soybeans with satisfactory results from the oil standpoint.”

1917–W.J. Morse, USDA assistant in forage crops wrote in the 1917 Yearbook [of Agriculture] that soybean oil had been “found to compare favorably with the more common table oils with respect to digestibility... This oil has a good color, has but a faint odor and is rather palatable... Until the present season it (the soybean) has been grown primarily as a forage crop.”

1929 Soy oil, protein lab established at the Bureau of Plant Industry.

1933 Yearbook: Effect of light on rancidity in foods... Properties qualify soy for use as cooking oil, shortening, margarine, salad oil; prejudice against domestic crude oil, said to be inferior to Manchurian product, has been ‘entirely overcome.’

1934 Yearbook: Grass-green or black wrappers or containers proposed to delay rancidity in foods, including salad oils.

1936 U.S. Regional Soybean Industrial Products Laboratory (SBL), Urbana, established. Miami Margarine Co., Cincinnati, Ohio, makes the first 100% soy oil margarine.

1938 Northern Regional Research Laboratory (NRRL), Peoria, one of four authorized in Agricultural Adjustment Act.

1938-41 Series of reports on soy oil composition, SBL.

1939-43 Quality of oil from green, damaged beans.

1940-59 Series on “The Stability of Vegetable Oils” and on soybean oil solvent extraction.

1942 SBL chemistry and engineering research transferred to NRRL. First of NRRL research reviews published in Soybean Digest.

1954 Processing capacity increased to meet war needs through screw-press speedup. (Items not otherwise identified are Northern Laboratory research developments.)

1946 German use of citric acid reported.

1947 Human use of citric acid explained; other metal inactivators studied.”

“1948 Soy oil fractionation by liquid-liquid extraction.

1949 Color in edible oil

1951 Minute amounts of iron, copper accelerate flavor deterioration. Linolenic acid confirmed as primary source of off-flavors, thus a primary target of flavor stability studies. Iron, copper in commercial oil determined by spectrochemical method.

1952 Processing shown to increase metal content of oil.

1955-56 New edible spreads from soybean oil.

1958 Heat frees metals; affects oil flavor stability. Tritium labeling of fatty acids.”

1959-60 Hydrogenated, winterized soy oil appears on retail market. (Commercial.)

1960 Hydrogenation of linolenate, first of a series on removing the primary source of off-flavors. Low linolenate soy variety gives a more stable oil.


1964 Analog computer and nuclear magnetic resonance spectroscopy in oil studies.


1967 Platinum-tin and other hydrogenation catalysts.

1968 Improved method of determining copper in soy oil.

1969 New oil washing method saves water, reduces pollution.”

A photo shows a person pouring soy oil onto a salad. Caption: “Returns from USDA soy oil flavor studies have been estimated at more than $900 million for the period 1945-1946.” Address: NRRL, Peoria, Illinois.


*Summary:* “Yukio Sakaguchi is president of Nisshin Oil Mills Co. and president of the Japan Oilseed Processors Association. He has been associated with this leading Japanese oilseed processing firm since 1924 and president since 1955. And he has been president or vice president of the Japan Processor Association continuously for 21 years.

“Mr. Sakaguchi was most instrumental in establishing the joint U.S. Department of Agriculture-American Soybean Association market development project for soybeans in Japan in 1956. The program has had the complete support of Mr. Sakaguchi and of JOPA. His help is undoubtedly a reason the Japan project for soybeans has become one of
the most important market development projects for farm products.”

Mr. Sakaguchi “helped to found the new Japan Protein Food Institute and is president of the Institute.”

Dr. Jean W. Lambert has long been known as “Mr. Soybean” in Minnesota. He is currently a professor of agronomy and plant genetics at the University of Minnesota. He made a trip to Japan in 1963 to obtain an agronomist’s view of the Japanese food market for soybeans, for the American Soybean Association. He is a native of Nebraska.

John Reiser is a farmer who is the most consistent winner in the history of the Illinois 5-acre Soybean Yield Contest. Since the contest began in 1964, he set the all-time contest record of 82.7 bushels per acre and holds a 6-year average of 73.6 bushels. He is a native of Ashland, Illinois.

Dr. Richard L. Bernard is “one of the world’s leading soybean geneticists... Probably his greatest contribution has been through his breeding work and development of new varieties.

“Since 1954 he has released the varieties Shelby, Harosoy 63, Hawkeye 63, Clark 63, Chippewa 64, and Wayne, which was the leading U.S. soybean variety in 1968.

“He took the leadership in adding phytophthora root rot resistance to varieties adapted for production in the more humid part of the Corn-belt.

“Dr. Bernard obtained his Ph.D. from North Carolina State University. He has been associated with the U.S. Regional Soybean Laboratory at Urbana, Illinois since 1954. He is now soybean geneticist and breeder at the laboratory and associate professor in the department of agronomy at the University of Illinois.”

Photos show Harris H. Barnes, Yukio Sakaguchi, Dr. Jean W. Lambert, John Reiser Jr., and Dr. Richard L. Bernard.


• Summary: An extremely valuable report. Contents: Introduction:

“A collection of introduced and domestic soybean strains obtained over the past seventy years is maintained by the U.S.D.A. for use by breeders, pathologists, and other research workers. Strains in maturity Groups 00 to IV are maintained at the U.S. Regional Soybean Laboratory, Urbana, Illinois, and those in Groups V to VIII at the Delta Branch Experiment Station, Stoneville, Mississippi.

“This report brings together data on the Group 00 to IV named varieties from four previous reports. It contains information on descriptive characters, agronomic performance, and seed composition for each variety and is part of a series of evaluation reports which provide background data on the strains in the U.S.D.A. Soybean Collection to guide research workers planning to use material from this collection.

“There are 213 United States and Canadian named varieties (including two or more strains of some varieties) in the Group 00 to IV Soybean Germplasm Collection at Urbana [Illinois] as of December 1970.”

A table (p. i) shows the number of varieties in each of the six maturity groups; the greatest number (54) is in Group IV. Definitions of column headings follow on page ii-iii.

Table 1 (p. 1-3): Checklist of U.S. and Canadian varieties, groups 00 to IV. Lists variety name (alphabetical), maturity group, and code. At the end is a description of the code sequence.

Table 2 (p. 4-17): Origin of groups 00 to IV varieties. Lists variety name (alphabetical), prior designation, source, year named or released, developer or sponsor & year selected. An appendix to this table (p. 16-17) adds 21 more varieties.

Table 3 (p. 18-19): Agronomic evaluation and seed composition data on 63 Group 0 and 00 soybean varieties grown at St. Paul, Minnesota, in 1963. For each variety is given: Maturity group, flowering date, maturity date, lodging score, height (inches), stem termination score, branching score, seed quality score, shattering score, weight of 100 seeds, yield (bu/acre), seed composition (protein, oil), protein composition (methionine, soybean trypsin inhibitors), oil composition (% linolenic acid, % linoleic acid), reaction to phytophthora rot disease (resistant or susceptible), mottling score.

Table 4 (p. 20-23): Agronomic evaluation and seed composition data on 22 Group I and I soybean varieties grown at Urbana, Illinois, in 1964.

Table 5 (p. 24-29): Agronomic evaluation and seed composition data on 89 Group III and IV soybean varieties grown at Urbana, Illinois, in 1965 and 1966.

Table 6 (p. 30-31): Agronomic evaluation and seed composition data on 37 Group 00 to IV soybean varieties grown at Urbana, Illinois, in 1968.

HISTORY OF U.S. REGIONAL SOYBEAN LABORATORY (1936-2017) 321

Harly, Harman, Harosoy, Harosoy 63, Hawkeye, Hawkeye
63, Henry, Hidatsa, Higan, Hokkaido, Hongkong, Hooiser,
HP-963, Hurrelbrink, Illington, Illini, Ilsoy, Imperial,
Jefferson, Jogun, Jogun (Ames), Kabott, Kagon, Kanrich,
Kanro, Kanum, Kent, Kim, Kingston, Kingwa, Korean,
Kura, Lincoln, Lindarin, Lindarin 63, Linman 533, Little
Wonder, Macoupin, Madison, Magna, Manchu, Manchu
(Lafayette), Manchu (Lafayette) B, Manchu (Madison),
Manchu-Hudson, Manchu-Montreal, Manchu 3-Wisconsin,
Manchu 606-Wisconsin, Manchu 2204, Manchukota,
Manchuria, Manchuria 13177, Manchuria 20173, Mandarin,
Mandarin-Ottawa, Mandarin 507, Mandell, Manitoba Brown,
Mansoy, Medium Green, Mendota, Merit, Midwest, Miller
67, Mingo, Minsoy, Monroe, Morse, Morsoy, Mukden,
Norichief, Norman, Norredo, Norsoy, OAC 211, Ogemaw,
Ontario, Osaya, Ottawa, Pagoda, Pando, Patoka, Patterson,
Peking, Pennsoy, Perry, Poland Yellow, Polysoy, Portage,
Portugal, Prideways 57, Prize, Protana, Provar, Rampage,
Renville, Richland, Roe, Ross, Sac, Sanga, Sato-3, Scioto,
Scott, Seneca, Shelby, Shingto, Shiro, Sioux, Sooty, Sousei,
Soysota, SRF300, Taste, Toku, Toroise Egg, Traverse,
Verde, Viking, Virginia, Wabash, Waseda, Wayne, Wea,
Willomi, Willomi B, Wilson, Wilson B, Wilson-5 [Wilson-
Five], Wilson-5B, Wilson-6, Wing Jet, Wirth, Wisconsin
Black, Wolverine, Yellow Marvel.

Note the capitalization in the text: “Strains in maturity
Groups 00 to IV are maintained at the U.S. Regional
Soybean Laboratory, Urbana, Illinois, and those in Groups V
to VIII at the Delta Branch Experiment Station, Stoneville,
Mississippi.”

Note 1. This is the earliest document seen (Nov. 2003)
that contains the term “Soybean Germplasm Collection”
(regardless of capitalization).

Note 2. This is the earliest document seen that mentions
the soybean varieties Anoka (Aug. 2000), or Provar (Aug.
1999). Anoka (p. 32-33) was licensed or released in 1970.
Developer: Minnesota AES and USRSL. Provar (p. 52-53)
was licensed or released in 1969. Developer: Iowa AES and
USRSL. Address: Urbana, Illinois.

Uniform Soybean Tests, northern states, 1970. RSLM (U.S.
Regional Soybean Laboratory Mimeo, Urbana,
PDF

• Summary: Near bottom of title page: “United States
Department of Agriculture. Agricultural Research Service.
Crops Research Division, cooperating with State Agricultural
Experiment Stations.”

Contents: Soybean investigations personnel. Uniform
Test participants. Introduction. Methods. Uniform test
locations. Uniform test 00. Preliminary test 00. Uniform
test 0. Preliminary test 0. Uniform test I. Preliminary test
“R.L. Bernard, Urbana, Illinois
“D.R. Browning, Carbondale, Illinois
“V.D. Luedders, Columbia, Missouri
“Elmer Counce, Martin, Tennessee
“J.R. Overton, Jackson, Tennessee
“E.E. Hartwig, Stoneville, Mississippi
“L.A. Duclos, Portageville, Missouri
“C.E. Caviness, Arkansas
“Curtis Williams, Baton Rouge, Louisiana
“R.N. Flint, St. Joseph, Louisiana
“J.L. Rabb, Curtis, Louisiana
“J.H. Davis, Crowley, Louisiana
“G.L. Kilgore, Columbus, Kansas
“J.S. Kirby, Oklahoma
“K.B. Porter, Bushland, Texas
“D.F. Owen, Halfway, Texas
“R.D. Brigham, Lubbock, Texas
“J.P. Craigmiles, Beaumont, Texas.”

“Strain identification: The strains designated by number carry a letter prefix [in this report]. This letter identifies where each strain was selected
“Co–Coker’s Pedigreed Seed Co., Hartsville, South Carolina
“D–Delta Branch Exp. Station and U.S. Regional Soybean Laboratory
“F–Florida Agric. Exp. Station and U.S. Regional Soybean Laboratory
“Ga–Georgia Agricultural Experiment Station
“L–Illinois Agric. Exp. Station and U.S. Regional Soybean Laboratory
“La–Louisiana Agricultural Experiment Station
“Md–Maryland Agric. Exp. Station and U.S. Regional Soybean Laboratory
“N–North Carolina Agric. Exp. Station and U.S. Regional Soybean Laboratory
“R–Arkansas Agricultural Experiment Station
“S–Missouri Agric. Exp. Station and U.S. Regional Soybean Laboratory
“UD–Delaware Agricultural Experiment Station
and private breeders is being placed on the development of shorter, semidwarf varieties, which are better adapted to highly productive environments. These varieties will have greater lodging resistance and will put a greater percentage of the dry matter produced into seed, rather than into excessive vegetative growth.

“Lodging is not the only factor that influences light use efficiency. Canopy shape, leaf angle, leaf shape, total leaf area, and photosynthetic rate per unit leaf area are other variety characteristics which influence light use efficiency. Theoretically, a variety with an open canopy, erect, small or narrow leaves, and high photosynthetic rate per unit leaf area, combined with adequate but not excessive total leaf area, would be an optimum plant type from the standpoint of light use efficiency.

“Such traits are currently being studied in cooperative efforts between plant physiologists and plant breeders. This research may well lead to the development of such plant types in future varieties.

“One cannot adequately discuss light use efficiency without considering plant distribution. Planting patterns (row spacing and population per acre) have a major effect on light use efficiency. The optimum planting pattern may be quite different for new semidwarf varieties than for existing varieties. For example, solid seeding (6- or 7-inch rows) at two plants per foot, giving approximately equidistant plant spacing, may be necessary to maximize yields with these new plant types.

“More efficient use of moisture: Most years, and on most soils, moisture plays an important role in limiting soybean yields. Varieties of the future will make more efficient use of available moisture. One of the best ways to increase moisture use efficiency (bu/acre inch of water) is by development of higher yielding varieties.

“A more direct approach is to develop varieties with more extensive root systems, more efficient vascular systems and lower transpiration rates (a function of rate/unit leaf area and total leaf area). These traits are currently being studied by the plant physiologists, and ultimately may be included in future varieties by the plant breeder.

“Better soil management practices, to improve moisture penetration and water holding capacity, will also play an important role in improved water use efficiency. With semidwarf varieties of the future, use of irrigation on soybeans may become more widespread. With current varieties, severe lodging often occurs under irrigation with yields leveling off at 50 to 60 bu/a. With new, semi-dwarf varieties, yields of 80 to 90 bu/a and higher may be possible, making irrigation of soybeans more attractive economically.

“Increased response to fertility: It is well established that top yields are produced on soils with high fertility. It is also well established that economic responses can be obtained from P and K fertilization on soils testing low in P and K. Much less understood, however, is the response of soybeans to soil nitrogen.

“Nitrogen, combined with the development of varieties with greater lodging resistance, has played a key role in yield breakthroughs of corn, wheat, and rice. Thus there is reason to suspect that nitrogen may also play a key role in a yield breakthrough in soybeans.

“Yet yield responses from N fertilization of soybeans have, in general, been small. Failure to achieve larger yield responses may be due to numerous factors. For example, in some studies, nitrogen fertilization has stimulated early vegetative growth, resulting in increased early lodging which may have cancelled out the potential benefit of the applied nitrogen.

“Another factor is that the addition of 100 to 200 pounds of N fertilizer/a tends to reduce nitrogen fixation; and hence these two sources of nitrogen tend to cancel out each other with no net gain in total nitrogen to the plant.

“Soybeans are a legume, and as such, when nodulated with Rhizobium bacteria, are able to obtain part of their nitrogen from the air (nitrogen fixation). Considerable research is currently underway to develop better Rhizobium strain x soybean variety combinations that will fix nitrogen more efficiently and thereby increase soybean yields.

“Just how much of the nitrogen demand of the plant is met through fixation and how much is taken up from the soil is an uncertainty. It is, in part, a function of the nitrogen level of the soil. The higher the soil N, the lower the percentage fixed. Recent estimates, using a new assay technique (acetylene-reduction), have indicated that fixation may account for about one-half of the total nitrogen need of field-grown soybeans. The rest must then be obtained from the soil.

“Recent research evidence suggests, that with currently grown varieties, which were selected under a system of nodulation, some method of nitrogen application or form of nitrogen must be found that will make soil nitrogen and N-fixation complimentary if maximum yields are to be obtained. An alternative approach might be to develop Rhizobium strains tolerant to high soil nitrogen. Yet another approach is to develop non-nodulating soybean varieties which obtain all their nitrogen from the soil and are as responsive to nitrogen fertilizer as many nonlegume crops.

“All these approaches to improve the nitrogen metabolism of soybeans are currently being explored. The approach that proves to be most successful will be a major factor in determining the genetic makeup of future varieties.

“Pest resistance: The longer any crop is grown, the greater the possibility that pests will develop that will attack the crop. This is true of soybeans—for example, the development of phytophthora root rot, bacterial pustule, and cyst nematode.

“Fortunately, plant breeders, in cooperation with plant pathologists and nematologists, have been quite successful in development of varieties resistant to these pests. However, it
is a never-ceasing battle, where new diseases occur or more virulent strains of already existing pests develop, which break down the resistance of previously resistant varieties (e.g., the new strain of cyst nematode).

“Insects have long been a problem in the South and may be becoming more important in the North. A source of Mexican bean beetle resistance has recently been discovered and may be an important breakthrough in breeding for resistance to this pest. Leafhoppers can cause considerable damage in northern states on varieties with less than normal pubescence (hairs). Experimental lines with dense pubescence are available and this trait may play an important role in insect resistance of future varieties.

“Future varieties may also have resistance to such common diseases as brown stem rot, downy mildew, charcoal rot, and bacterial blight, to mention a few. The necessity for resistance to the numerous plant pests, i.e., fungi, bacteria, viruses, nematodes, and insects, will become of increasing importance in future varieties.

“Weeds are another class of plant pests, in that they compete with soybeans for light, moisture, and nutrition. With development of more reliable herbicides, the necessity of breeding plant types for competitiveness with weeds may diminish.” Continued. Address: Research agronomist, Plant Science Research Div., Agricultural Research Service, USDA, and Assoc. Prof., Dep. of Agronomy, Univ. of Illinois, Urbana, Ill. 61801.


**Summary:** (Continued): “In some ways this may be desirable in that those varieties most competitive with weeds may require a larger percentage of their dry matter in the vegetative plant parts, hence reducing the percentage of dry matter in the seed. Also, such plant types may have excessive leaf area resulting in considerable mutual shading and reduced light use efficiency.

“Varieties of the future, bred for increased light use efficiency, may well be less competitive with weeds, making chemical weed control an essential part of the management system if maximum yields are to be obtained.

“Special use varieties: Breeding for higher yield will continue to be the major objective of most plant breeders. But a portion of their efforts has been, and will continue to be, directed to the development of special use varieties, even if some sacrifice in yield may be necessary. Examples of such varieties are high protein varieties (up to 50% protein), high oil varieties (up to 25% oil), varieties with oil of vastly different fatty acid composition, and large-seeded varieties for specialty food markets.

“Also, as more is learned about amino acid composition and protein quality of soybeans, varieties for special food uses may be developed. Such varieties will continue to be a fairly small part of the total production, however.

“Hybrid soybeans: The recent discovery of male sterility in soybeans has generated much excitement about the potential of hybrid soybeans. There are many obstacles to overcome in the route to hybrid soybeans. Whether this approach will be successful, and whether the yield advantage of hybrid soybeans will be sufficient to justify the higher cost of seed, remains to be seen.

“In the meantime, the use of male sterility by the plant breeder, as a tool to make many more crosses and to obtain many new genetic combinations, may result in development of new, higher yielding pure line varieties, making it increasingly difficult to develop hybrid varieties which are superior in yield.

“Source of future varieties: In the past 5 years the number of private breeders has increased, and with the passage of the new Plant Protection Act, to permit protection of new varieties, there is reason to believe this trend will continue.

“However, I do not foresee a sudden drop in breeding efforts by public breeders, although emphasis may gradually shift to more fundamental studies. It can take up to 10 years to get a new breeding program established to the point of releasing new improved varieties; and even then there is no guarantee that the initial crosses made will produce superior varieties.

“In an attempt to shorten the varietal development period, some private breeders are contemplating release of nonpure lines which may contain considerable variation in plant characteristics (e.g., flower, pubescence, and hilum color). Whether such varieties will be acceptable remains to be seen.

“I would anticipate that public agencies will continue to release new varieties which are developed as a normal part of their research programs to better understand the soybean.

“Private blends, brands, and a few varieties have already begun to reach the market and many more will be marketed in the near future. Initially, some companies began by marketing blends of publicly developed varieties. Then other companies began marketing publicly developed varieties under brand name with the variety name unstated. This has led to a rapid proliferation of private blends and brands.

“Because of the numbers involved, it has been difficult, and will be more difficult in the future, for any one testing group to provide good performance data on all blends, brands, or varieties being sold. In an attempt to provide some information on private releases, a number of states have set up a fee testing program for private varieties on a volunteer basis. This information is available on request from the various state experiment stations for use in evaluating new varieties.

“In absence of this information a grower can use the procedure he has adopted for testing corn hybrids, on-the-
farm strip tests. In this manner he can determine which varieties are most productive for him. Use of publicly developed varieties, with known parentage, can serve as useful reference varieties in evaluating the performance of private blends, brands, and varieties. Care should be taken to use a reference variety of similar maturity to the private entry being tested, and to grow them side by side in order to obtain a fair comparison of performance.

“As the breeding programs of private breeders become better established, I would anticipate the release of increasingly improved varieties, necessitated by the keen competition that will develop.”

Photos: (1) A small portrait photo of Richard L. Cooper. (2) A new straight-stem variety and one of the older branching types—growing side by side in a field.

Address: Research agronomist, Plant Science Research Div., Agricultural Research Service, USDA, and Assoc. Prof., Dep. of Agronomy, Univ. of Illinois, Urbana, Ill. 61801.


*Summary:* Except for the cover, this document is typewritten.

Near bottom of title page:

“United States Department of Agriculture.

“Agricultural Research Service.

“Plant Science Research Division.

“Cooperating with State Agricultural Experiment Stations.”


1. Agronomist; 2. Statistical Clerk [Stoneville, Mississippi].


*Summary:* “Average seed protein, oil, fatty acid contents and weight of seed from (subgenus Glycine) Glycine clandestina, G. falcata, G. tabacina, G. tormentella (subgenus Bracteata) G. wightii and (subgenus Soja) G. ussuriensis were determined and compared with those of seed from (subgenus Soja) G. max, the soya bean... Seeds in the subgenus Glycine averaged about 30 per cent protein, while those of G. ussuriensis and G. wightii contained about the same amount of protein (41 per cent) as U.S. soya bean cultivars. Seeds of G. wightii had the lowest oil content in the genus, about six per cent; those of the other wild species averaged about 12 per cent.” Table 2 shows that the seeds of various wild perennial Glycine species are very small, ranging from 0.4 to 2.2 grams per 100 seeds (compared with about 17.5 gm average for typical domesticated U.S. soybeans).

This is also Publication No. 671 of the U.S. Regional Soybean Laboratory, Urbana, Illinois 61801. This paper is based on a thesis submitted by R.G. Palmer in part fulfillment of his MSc degree. Address: Dep. of Agronomy, Univ. of Illinois, Urbana, Illinois. Palmer present address: Crops Research Div., Agricultural Research Service, USDA, Ames, Iowa.


*Summary:* Registration No. 94. Williams, developed in a cooperative breeding program of the U.S. Regional Soybean Laboratory and the Illinois Agricultural Experiment Station, was released in 1971.

Note: This is the earliest document seen (Dec. 2004) concerning Pioneer Hi-Bred Corn Company in connection with soybeans. Address: 1. Research geneticist, ARS, USDA, and Prof. of Plant Genetics, Dep. of Agronomy, Univ. of Illinois, Urbana, IL; 2. Formerly agronomist (research asst.), ARS, USDA, now Research Station Manager, Pioneer Hi-Bred International Inc., Plant Breeding Div., St. Joseph, IL.


*Summary:* “Dr. Richard L. Bernard, U.S.D.A. research geneticist at the U.S. Regional Soybean Laboratory, Urbana, Illinois, went to Japan and Korea in September to collect exotic soybean germ-plasm. He will spend approximately a month searching for strains to add to our world soybean germplasm collection. Wild species to be used in expanding genetic diversity will be searched for in eastern Asia.

“Dr. Bernard’s work for the past 17 years with the northern germplasm collection makes him especially qualified for this mission. He has provided the original crosses for several of our most prominent northern commercial varieties.”


Chapter 1, titled “The Natural Plastics,” begins: “Today many people consider the synthetics as plastics. Actually the plastics industry started with animal horn and hoof, tortoiseshell, bone, ivory, gutta-percha [made from the latex of several Malaysian trees; it resembles rubber], shellac, glue, and other compounds which necessitated the use of these materials in a variety of industries. The plastics industry developed from these natural materials and ultimately led to the development of synthetics.”

The section in this chapter titled “Soybean Plastics” states: “The U.S. Regional Soybean Industrial Products Laboratory at Urbana, Illinois, studied the potential for soybean materials for plastics products in the middle thirties. When mixed with formaldehyde, soybean meal is moldable. Good products required the addition of phenolic resin also, and this was highly publicized by Ford Motor Company at one time, who used it for a few molded parts. It had high moisture absorption, poor dimensional stability, and was short lived as an industrial material.”

The real pioneer of the plastics industry was John Wesley Hyatt (1837-1920), inventor of Celluloid and many of the plastics processing methods. A chronology of the development of cellulose is given. The first synthetic plastics were Baekeland’s phenolic resin. Address: President, Mykroy Ceramics Corp., Craftsman Farms, Morris Plains, New Jersey.

Summary:
The following information is based on an interview with Dr. R.L. Bernard, USDA soybean breeder at the University of Illinois. Dr. Bernard is in charge of the U.S. soybean germplasm collection. He went to Japan and Korea last September on the first major collection mission since 1931.

Less than 40 varieties account for over 99% of the commercial soybean acreage of the United States and Canada. Furthermore, many of these are closely interrelated. Only about 20 introduced varieties comprise the complete ancestry of today’s commercial varieties. Faced with this rather narrow germplasm base, does the soybean breeder turn for breeding material to produce higher yielding varieties for the future and for resistance to disease and insect pests?

USDA Soybean Collection: The USDA has maintained since 1949 a germplasm collection of soybeans brought from all over the world and especially from eastern Asia where the soybean originated. Today there are approximately 3500 strains in this collection, 2500 early ones (maturity


group IV or earlier) maintained at the U.S. Regional Soybean Laboratory, Urbana, Illinois, and 10000 late ones (group V or later) at the Delta Branch Experiment Station, Stoneville, Mississippi. Thousands of seed packets of these strains are sent out each year to breeders and other researchers throughout the U.S. and the world. They are tested for yielding ability, disease or insect resistance, seed composition, etc., and the promising ones are being put into breeding programs to develop new varieties.

“How good is this collection and does it have sufficient diversity to sustain continued variety improvement? Compared to other major crops (such as wheat with over 15,000 lines in the USDA wheat collection), the soybean collection is rather small. This is especially critical since the U.S., with 75% of the world’s soybean production and most of the rest of it in communist China, cannot rely on breeding work and collections in other countries as with more widely grown crops.

“In the last 20 years we have done an adequate job of maintaining the soybean collection and making it available to researchers, but no large-scale attempt to gather all soybean germplasm has been made since the Dorsett and Morse expedition to Asia in 1929-31. These two USDA researchers spent two years traveling through Japan, Korea, and northern China (including Manchuria) and collected about 4500 soybean strains. Unfortunately the soybean was not yet an important crop here and all but about 1,000 of these were discarded before the present collection was established.

“Native wild species and varieties disappearing: In the countries of eastern Asia where soybeans have been grown for centuries, farmers have grown a great diversity of varieties and types in the past. We don’t know for sure just how much diversity is still present in these countries that is not represented in the USDA collection. We do know that this diversity is rapidly disappearing as improved experiment station selections replace the diverse primitive varieties, and unless researchers preserve it in germplasm collections it will be lost forever.

“Another and largely untapped source of diversity in eastern Asia is the wild soybean. Although of no economic value in itself, it will cross readily with cultivated soybeans and is therefore a potential source of disease or insect resistance and possibly other traits of usefulness in soybean breeding. It, too, is disappearing in some areas as a result of man’s agricultural or building developments.

“Base expanded 30-50 percent by Bernard mission: In view of this, plans have been proposed to have soybean breeders from this country visit all of the countries of ancient soybean culture during the next few years and obtain all available soybean varieties and wild soybeans. As a start, Dr. Richard Bernard of the U.S. Regional Soybean Laboratory visited Japan and Korea this fall, collected wild soybeans from over 100 places, and met with Japanese and Korean soybean breeders, who have generously agreed to supply us with perhaps as many as 2000 native varieties.

“Collection opportunities: Major collecting jobs that remain to be done are:

1. More thorough collecting of wild soybeans and direct collecting of native varieties in Japan and Korea.

2. Collecting of soybean varieties and wild soybeans in China, which is the original home of the soybean and the center of genetic diversity. This makes it the most important area in the world for soybean germplasm. Almost all of U.S. commercial varieties trace their origins to China. Current political developments suggest that travel to China may be possible in the near future.

3. Other areas of eastern Asia where soybean collections should be made:

3a. North Korea along with China is a center of genetic diversity and its latitude corresponds with our Midwest production center. We have as yet no wild soybeans from there.

3b. In Siberia adjacent to China very early soybeans have been grown for a long time. Also the very earliest wild soybeans come from there.

3c. Taiwan and the Ryukyu Islands of Japan have some very primitive soybeans and are the southermost range of the wild soybean and the northermost range of wild perennial species closely related to soybeans.

3d. Southeast Asia has some areas of ancient soybean culture and some wild perennial species related to soybeans.

4. Other parts of the world (Africa, South America, Europe) may contain soybean germplasm not now available in its eastern Asian homeland. Australia, Africa, and Oceania contain perennial species closely related to soybeans that are of interest to those studying the evolutionary history of the soybean. These are not well known and are in need of more research.

“If these proposed trips can be carried out, it will make a major contribution to the procurement and preservation of soybean germplasm which is so essential to future variety development and to the maintenance of stable and efficient soybean production in this country.”

A small portrait photo shows Dr. Richard Bernard.

Note: After this article was written, Prof. Theodore Hymowitz (soybean geneticist at the Univ. of Illinois) took many expeditions collecting wild perennial relatives of the soybean. Address: Univ. of Illinois.

On the first page, which is unnumbered, is an outline map of the southern part of the United States, from Texas on the west to the East Coast from Maryland down to Florida. The title: “Locations of Cooperative Uniform Soybean Tests, Southern States, 1973.” A small black circle is used to indicate the location of each test. The map is divided by broken lines into five broad areas based mainly on soil type, as explained in the Introduction.


Pages 4-5: “Introduction: “Introduction: The Soybean Production Research Program has been directed toward the development of improved strains of soybeans and the obtaining of fundamental information necessary to the efficient breeding of strains to meet specific needs. In the Southern Region, fundamental studies and breeding programs are conducted at three locations, Stoneville, Mississippi; Raleigh, North Carolina; and Gainesville, Florida. After promising new strains are developed at these breeding centers, or by any other cooperating agency, they are advanced to the preliminary and uniform regional tests, conducted in cooperation with research workers in the Southeastern States. This testing program enables the breeder to evaluate new strains under a wide variety of conditions, and permits new strains to be put into production in a minimum amount of time.

“Ten uniform test groups have been established to evaluate the better strains developed in the breeding programs. The groups 00 through IV are adapted in the northern part of the United States, and the groups IV-S through VIII are grown in the southern part. Within their area of adaptation, there is a maturity range of 12 to 18 days within each maturity class. The best standard varieties available of each maturity class are used as check varieties with which to compare new strains as to seed yield, chemical composition, maturity, height, lodging, seed quality, and reaction to diseases. For the groups grown in the southern area, the major check varieties are: Kent, Hill, Dare, D64-4636, Lee 68, Bragg, Hampton 266A and Hardee. At Stoneville, Mississippi, where all maturity classes will mature, the approximate maturity dates of these varieties, when planted during the first half of May, are: Kent, September 8; Hill, September 20; Dare, October 1; D-64-4636, Oct. 6; Lee 68, October 16; Bragg, October 22; Hampton 266A, November 1; and Hardee, November 6. “A wide range of soil and climatic conditions exist in the regions. As an aid in recognizing regional adaptation, the region has been subdivided into five rather broad areas which still represent a wide range of soil types. These are: (1) the East Coast, consisting of the Coastal Plain and Tidewater areas of the eastern shore of Maryland, Virginia, North Carolina, and the upper half of South Carolina; (2) the Southeast, consisting primarily of the Coastal Plain soils of the Gulf Coast area, but also including similar soil from South Carolina southward; (3) the Upper and Central South, including the Piedmont and loessal hill soils east of the Mississippi River; (4) the Delta area, composed of the alluvial soils along the Mississippi River from southern Missouri, southward; and (5) the Southwest, comprising Arkansas and Louisiana (outside the Delta), and Oklahoma and Texas. In the Southwest area, the potential soybean-growing areas would include the alluvial river soils, the Gulf coast of Louisiana and Texas, and the high plains of Texas. In this area, several of the tests receive supplemental irrigation. A map is included to illustrate the five production areas. On nearly all of the soils other than the alluvial soils along the Mississippi River, Fertilization is essential for satisfactory soybean production. In the Western area, irrigation is necessary for successful production. A table showing soil types, soil test information, and rate of fertilization is included.

“The soil test information is based upon analyses run by laboratories within the states. Different methods are used for extraction and reporting by the various laboratories. An attempt is being made to report phosphorus and potash on a high, medium, and low basis, since pounds per acre may have different meanings in accordance with the methods used. In most cases, soil samples were taken after the soybeans were mature.”

Pages 5-7: A table with 12 columns titled “Location of soybean nurseries along with soil type, soil analysis, and fertilization.

Pages 8-9: Methods: Tells how the following are measured: Planting rate. Yields. Shattering. Chemical composition. Seed size. Lodging. Height (of plants). Maturity. Seed quality (rated from 1 to 5). Disease ratings (given on a scale of 1 to 5) for Foliar, root and stem, root knot [nematode], purple stain. Statistical analyses (by analysis of variance). Address: Delta Branch Experiment Station, Stoneville, Mississippi 38776.


• Summary: Near bottom of title page: “United States Department of Agriculture. Agricultural Research Service,
cooperating with State Agricultural Experiment Stations."


• Summary: The title page states: "This is a progress report of cooperative investigations containing data the interpretation of which may be modified with additional experimentation."

Contents: Preface by Richard L. Cooper, conference chairman. List of conference participants. March 6, morning. Plant breeding and genetics division: Germplasm old and new (Germplasm sources of southern varieties, germplasm sources of northern varieties, new additions to the germplasm collection, tropical germplasm in breeding programs), new tools in breeding and genetics. March 6, afternoon. Crop production division. March 6, evening. Committee meetings of the Uniform Regional Test participants (Northern, Southern).


Note: Lindsy Ribble, reference librarian at the University of Illinois ACES library, who found this document, states: "This is the only report on a National Soybean Research Conference that we have. I searched the WorldCat database for similar proceedings and this was the only one that came up... So it appears as though the National Soybean Research Conferences did not continue, and if there was a first one, there were no published proceedings."

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“Ryder, G.J. Ohio State University, Columbus, OH 43210.
“Schilling, J. Univ. of Maryland, Agronomy Dept., College Park, Maryland 20740.
Germplasm Sources of Southern Varieties–Kuell Hinson. Six varieties (Dare, Davis, Lee, Pickett, Bragg, and Hampton) were grown most extensively in southern states in 1972. The following twelve old varieties and introductions are included in their pedigrees more than 30 times: CNS, S-100, Arksoy, Tokyo, PI 54610, Dunfield, Roanoke, Peking, Haberlandt, Palmetto, Mammoth Yellow, and Laredo. New varieties now coming into production and many older varieties going out of production also derive substantial portions of their germplasm from these same twelve sources. The four sources of cytoplasm for southern varieties came from Dunfield, S-100, Tokyo, and Roanoke.
“Because of their proven performance, the six varieties listed above (or other genotypes closely related to them) are likely to provide the ‘hard core’ germplasm for further variety improvement in the South. As weaknesses in this basic germplasm become apparent, approximately 750 germplasm entries are available as potential sources of genes to correct these weaknesses. The role of the germplasm entries in recent years has been to supply specific traits such as resistance to Phytophthora rot, resistance to cyst nematodes, etc., rather than to supply germplasm for broadening the genetic base of improved varieties. The role of germplasm entries is not expected to change appreciably in the future. The present genetic base, although narrow, appears to be very well adapted to present and future production locations and techniques.

“Germplasm Sources in Northern Soybean Varieties—C.R. Weber. The northern U.S. soybean belt and Canada have about 70% of the soybean acreage in North America. At present there are 20 soybean varieties that occupy over 90% of the northern acreage. All of the 20 varieties are of hybrid origin and most of them are from the second and third cycle of recombination since introduction. The parentage of these 20 traces to only 10 ancestral varieties. These 10 ancestral varieties are: Mandarin, Richland, Manchu, Illini, Mukden, Dunfield, No 171 (Capital), CNS, Ogden, and Patoka. Eight of these ancestral varieties originated as introductions from Manchuria (N.E. China) between 40 and 50 degrees N. Lat. and represent Uniform Groups I through III. CNS and Ogden came from farther south in China and Japan, respectively.

“Mandarin, Richland, Manchu, Illini, Mukden, and Dunfield form by far the major basis of our present northern soybean germplasm. Mandarin cytoplasm is represented in 12 of the 20 leading soybean varieties. Illini and Mukden cytoplasm is represented in almost all of the remaining varieties. From the foregoing, we have a narrow germplasm base represented in our commercial varieties. When hybrid populations were made with the basic 6 ancestral Manchurian varieties, they provided better genetic populations from which to select even though many other crosses were made of diverse parental origin.

“Crosses of adapted X adapted strains will on the average produce more good lines than will crosses of adapted X unadapted or unadapted X unadapted strains. However, there is still need to introduce periodically new germplasm, not only for specific genes, but also genes for adaptiveness.”


• Summary: Dr. Clare S. Markley, age 77, died on Monday [3 July 1973] in Rio de Janeiro, where he had lived since 1960, after retiring as a vegetable oil chemist with the U.S. federal government.

His research focused on the better use of farm products and by-products, especially vegetable oil.

Born in Philadelphia, Pennsylvania, he earned a bachelor’s degree and master’s degree from George Washington University, then a doctorate in Chemistry from Johns Hopkins University.

From 1927 to 1937 he worked for the Agriculture Department [USDA]; in 1937 he was named chief of the U.S. Regional Soybean Laboratory’s oilseed section at Urbana, Illinois. In 1939 he became chief of the oilseed division of the Southern Regional Research Laboratory in New Orleans, Louisiana. “In 1945, he was scientific consultant to the Joint Chiefs of Staff serving in Europe” [to learn the secrets of German soybean crushing plants].

In 1952 he joined the U.S. Agency for International Development as a vegetable oil consultant; he worked in Paraguay, Guatemala, Venezuela, and Brazil. In 1960 he retired but continued to work as a consultant [and to live in Brazil]. He was the author of numerous classic books and technical papers. He served as president of AOCS. He is survived by his wife, Carmen de Mello Markley, of Rio de Janeiro, and two sisters. A portrait photo shows Dr. Clare S. Markley. Address: USDA.

• Summary: Contents: Results and discussion: Field loss categories, effect of weeds, effect of population and row spacing, header comparisons, combine header component losses, field survey of combine harvest losses. Summary. Literature cited.

The introduction states: “During the last few years, soybeans have become the leading cash crop in the United States. More than a billion bushels are produced on over 40 million acres in 30 states. Even though they have attained this position, soybeans are generally planted and harvested with equipment designed for other crops. When present-day grain combines are used for soybeans, harvesting losses are generally more than 8 percent of the crop yield. Reduction of these losses to 4 percent would result in approximately 50 million bushels more for soybean farmers.”

This survey showed that the average soybean producer loses 8-10 percent of his soybean crop in the harvesting operation. “Our project was initiated to find ways of reducing losses by improved equipment and harvest techniques.”

Most soybean losses are caused by the combine header. Weeds cause a reduction in soybean yield, but they do not cause significant combine losses if case is used at harvest and ground speed is reduced when harvesting weedy soybeans. In most cases, yield is not significantly affected by plant population and row spacing.

“Reduced harvest losses were obtained by using a floating cutterbar attachment as compared to a standard header. An air assist along with the floating cutterbar provided even greater reductions in harvest losses.”
The rust organism attacks Hemisphere but currently not found in North America. Sydow) is destructive and widely distributed in the Eastern cc: H.J. Dutton. R.J. Dimler. J.J. Rackis. E.L. Grif and he will do so. Mr. West extended an invitation for me to contact the U.S. Soybean Laboratory in Urbana for samples obtain suggestions on displays, samples, etc. We agreed that by the Chamber of Commerce with extensive support from City on September 7 and 8 from 2-9 p.m. It is sponsored to both cultures. Uredospore germination occurs in the range of strains to meet speci needs. In the Southern Region, soybean rust: A potential threat. In: Report of the Second National Soybean Conference. Urbana, Illinois: USRSL. RSLM No. 775. See p. 24. Summary: “Soybean rust (Phakopsora pachyrhizi Sydow) is destructive and widely distributed in the Eastern Hemisphere but currently not found in North America. The rust organism attacks Glycine species and species in a number of other genera of legumes. At the onset of disease, chlorotic or gray brown spots appear, primarily on leaves, These darken and enlarge with time. Uredia, and later telia, develop within these areas. Uredospores capable of starting secondary cycles of disease may be released within 10 days of initial infection. Uredospore production within a single uredium may continue for weeks. The disease causes premature leaf fall and reduces number of pods, number of beans, and weight of beans. The role of the teliospore is not known. Pycnia and aecia have not been reported and it is not known whether an alternate host is involved. “We are currently working with rust isolates from Australia, India, Indonesia, and Taiwan. The Australian and Taiwanese isolates have infected and sporulated on the nine major U.S. commercial varieties tested (Amsoy, Clark, Corsoy, Cutler, Dare, Kent, Lee, Lee 68, and Wayne) and on accesses PI 200490 and PI 200492. The varieties Corsoy, Dare, Kent, Lee, and Wayne have also been tested to the Indonesian culture and the Indian culture. All are susceptible to both cultures. Uredospore germination occurs in the range 9 to 28°C with a broad optimum of about 12 to 20°C. A dew period temperature of 20°C is more favorable for infection than that of 22.5, 25, or 27.5°C. We have not obtained infection at 30°C. Temperatures below 20°C have not been investigated. “We conclude that rust is a threat to soybean production in the United States. Soybean rust causes significant damage in the Orient. The rust fungi, as a group, have repeatedly bridged geographical barriers to become epiphytotic in newly invaded regions. The fungus can germinate, penetrate, and sporulate under temperature and moisture conditions commonly found in U.S. soybean areas. Major U.S. commercial varieties and germplasm reserves are susceptible to the rust pathogen.”


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• Summary: This is the first report of the Uniform Soybean Tests–Southern States that was not compiled by the U.S. Regional Soybean Lab. However at the bottom of page 2 (“Cooperating Agencies and Personnel”) we read: “Oil and protein determinations were made at the U.S. Regional Soybean Laboratory, Urbana, Illinois, under the supervision of Mr. Stephen J. Gibbons.”

On the first page, which is unnumbered, is an outline map of the southern part of the United States, from Texas on the west to the East Coast from Maryland down to Florida. The title: “Locations of Cooperative Uniform Soybean Tests, Southern States, 1973.” A small black circle is used to indicate the location of each test. The map is divided by broken lines into five broad areas based mainly on soil type, as explained in the Introduction.


Pages 4-5: “Introduction: The Soybean Production Research Program has been directed toward the development of improved strains of soybeans and the obtaining of fundamental information necessary to the efficient breeding of strains to meet specific needs. In the Southern Region, fundamental studies and breeding programs are conducted at three locations, Stoneville, Mississippi; Raleigh, North Carolina; and Gainesville, Florida. After promising new strains are developed at these breeding centers, or by any other cooperating agency, they are advanced to the preliminary and uniform regional tests, conducted in cooperation with research workers in the Southeastern States.
This testing program enables the breeder to evaluate new strains under a wide variety of conditions, and permits new strains to be put into production in a minimum amount of time.

“Ten uniform test groups have been established to evaluate the better strains developed in the breeding programs. The groups 00 through IV are adapted in the northern part of the United States, and the groups IV-S through VIII are grown in the southern part. Within their area of adaptation, there is a maturity range of 12 to 18 days within each maturity class. The best standard varieties available of each maturity class are used as check varieties with which to compare new strains as to seed yield, chemical composition, maturity, height, lodging, seed quality, and reaction to diseases. For the groups grown in the southern area, the major check varieties are: Kent, Essex, Mack, Forrest, Pickett 71, Lee 68, Bragg, Hutton, and Hardee. At Stoneville, Mississippi, where all maturity classes will mature, the approximate maturity dates of these varieties, when planted during the first half of May, are: Kent, September 8; Essex, September 25; Mack and Forrest, October 1; Pickett 71 and Lee 68, October 16; Bragg, October 22; Hutton, November 1; and Hardee, November 6.

“A wide range of soil and climatic conditions exist in the regions. As an aid in recognizing regional adaptation, the region has been subdivided into five rather broad areas which still represent a wide range of soil types. These are: (1) the East Coast, consisting of the Coastal Plain and Tidewater areas of the eastern shore of Maryland, Virginia, North Carolina, and the upper half of South Carolina; (2) the Southeast, consisting primarily of the Coastal Plain soils of the Gulf Coast area, but also including similar soil from South Carolina southward; (3) the Upper and Central South, including the Piedmont and loessial hill soils east of the Mississippi River; (4) the Delta area, composed of the alluvial soils along the Mississippi River from southern Missouri, southward; and (5) the Southwest, comprising Arkansas and Louisiana (outside the Delta), and Oklahoma and Texas. In the Southwest area, the potential soybean-growing areas would include the alluvial river soils, the gulf coast of Louisiana and Texas, and the high plains of Texas. In this area, several of the tests receive supplemental irrigation. A map is included to illustrate the five production areas. On nearly all of the soils other than the alluvial soils along the Mississippi River, Fertilization is essential for satisfactory soybean production. In the Western area, irrigation is necessary for successful production. A table showing soil types, soil test information, and rate of fertilization is included.

“The soil test information is based upon analyses run by laboratories within the states. Different methods are used for extraction and reporting by the various laboratories. An attempt is being made to report phosphorus and potash on a high, medium, and low basis, since pounds per acre may have different meanings in accordance with the methods used. In most cases, soil samples were taken after the soybeans were mature.” Address: Delta Branch Experiment Station, Stoneville, Mississippi 38776.

• Summary: Near bottom of title page: “United States Department of Agriculture. Agricultural Research Service, cooperating with State Agricultural Experiment Stations.”


Note: 300 copies of this issue were printed. Address: 160 Davenport Hall, Univ. of Illinois, Urbana, Illinois. Phone: 217-344-0622.

• Summary: Urbana, Illinois–The soybean plant that Richard Cooper holds has taken him five long years of research to produce. “The plant is a dwarf soybean, and from it may spring the first generation of super-productive soybeans.” At the USDA’s regional soybean laboratory, where Mr. Cooper is chief researcher, he has discovered that dwarf soybeans are more productive than normal soybeans growing four feet high. It is very important but very difficult to get significant yield increases from the soybean plant.

“For millions of Asians the bean—as a protein curd called tofu–has long been an integral part of a largely vegetable diet.”

“The failure to increase soybean yields is beginning to result in ‘a deteriorating world supply and a great deal of worry about future protein supplies,’ says Lester Brown of the Overseas Development Council, a Washington [DC]-based think tank. ‘I doubt whether there is a greater global research priority than this.’” Address: Staff reporter for the Journal.

• Summary: Mentions the Regional Soybean Laboratory in Urbana, Illinois.

610. Martin, R.J.; Wilcox, J.R. comp. 1975. The Uniform
Contents: [outline map of the north central USA plus parts of Canada. In Manitoba tests are conducted in Brandon, Portage la Prairie, and Morden. In Ontario tests are conducted Harrow, Ridgetown, Elora, and Ottawa].
Note: With this issue, both the U.S. Regional Soybean Laboratory and its RSLM periodical have apparently ceased to exist. Neither is mentioned on the cover or first few pages of this annual report, which is now compiled and published at Purdue University, Indiana. However on page 8, for example, titled “Uniform Test Participants,” R.L. Bernard, D.W. Chamberlain, and R.L. Cooper are all listed as: “ARS, USDA, U.S. Regional Soybean Lab., University of Illinois, Urbana, Illinois 61801.”
Talk with Ted Hymowitz. 2004. Oct. 26. At about the time of Dr. Richard Bernard’s retirement, compilation of the test results was moved to Purdue from the University of Illinois. After that move, the name of the Laboratory ceased to used, even though soybean researchers on the USDA payroll continued to work at the University of Illinois. Dr. J.R. Wilcox retired about 4 years ago, so other compilers at Purdue took his place. The cost of sending out the soybean seed for the uniform tests was paid by the USDA; almost all other expenses were paid by the various state experiment stations. Address: Agricultural Research Service, USDA, Agronomy Dep., Room 2-318 Lilly Hall, Purdue Univ., West Lafayette, Indiana 47907. Phone: 317-749-2891.

• Summary: Demonstrates that for soybeans, the single seed descent method proposed by Brim (1966) is the most efficient selection procedure.

Publication No. 770 of the U.S. Regional Soybean Lab., Urbana, Illinois


This article is based on observations made by the U.S. Plant Studies Delegation on their recent visit to China (26 Aug. to 23 Sept. 1974), and on conversations with the many scientists contacted. A more detailed report will be published by the National Academy of Sciences. Among the delegation members was Richard Bernard, U.S. Regional Soybean Laboratory, Urbana, Illinois.

Concerning soybeans: “In the central and southern areas, soybean culture is largely limited to small fields, gardens, ditch banks, and other waste lands. Only in the northeastern provinces does it become an important field crop. Here it is grown in pure stands or interplanted with other crops, primarily corn or sorghum.

“Soybeans are used for food in the green stage, but the more common use is in the manufacture of soy sauce and the various bean curd products. The vines, pods, and waste grain are also used as livestock feeds.

“Some soybean breeding work is done at the Genetics Institute in Peking, but the major breeding effort is concentrated in the northeastern provinces of Kirin, Heilungkiang, Liaoning, and at the Northwest College of Agriculture in Shensi province.” Address: Dep. of Agronomy, College of Agriculture, Univ. of Illinois, Urbana.


Photos show: (1) Dr. Richard Bernard of the Regional Soybean Lab at Urbana, Illinois, in a field, examining an ancestor of today’s soybean plant. (2) A young soybean seedling that has just broken ground. (3) Two researchers standing between rows of soybeans in a field, with two REP machines that measure respiration, evaporation, and photosynthesis.

• Summary: This is an excellent historical overview of soybeans in America. Contents: Introduction. Travels in Manchuria (Dorsett and Morse, U.S. Regional Soybean Industrial Products Laboratory, U.S. Regional Soybean Lab. at Urbana, O.S. Aamodt of USDA who was Morse’s immediate superior, Herbert W. Johnson, Lincoln variety released in 1943, Richard Bernard, C.R. Weber, E.E. Hartwig). Phytophthora rot (The first major threat to the soybean crop, first observed in 1948). China variety saved day (Peking variety contained resistance to cyst nematode).
Living together (nitrogen fixation, chemical control of weeds, mechanized agriculture). Deodorizers developed (deodorized soybean oil, shortening & margarine, food uses of soybeans, Sybil Woodruff and Olive Zwerman of Illinois). Beans and the world scene (India, INTSOY, NSPA, National Soybean Crop Improvement Council).

“By 1973, soybeans had become our No. 1 cash crop, the leading export commodity, the major alternative crop of midwestern and southern farmers, the world’s most effective producer of protein per acre, and the hope of starving millions for a better diet.

“How was this miracle achieved? It was made possible by a combination of fortuitous conditions... a need for oil and protein, accentuated by war-time demands and post-war population growth... land newly available as production of other crops outpaced demand, partly because there were fewer draft animals and thus less need for land for feed grain production... the ability of soybeans to adapt to a wide range of climates and to farming methods already known to corn and cotton farmers... and removal of legal restrictions on margarine.

“But there was another element, just as important or even more so. First a few and then many more men and women of vision, imagination, energy, dedication--remarkable people and institutions who saw the potential of the soybean and worked hard to make that potential a reality.”

“In 1961 the Minnesota legislature authorized several soybean research positions. This was the first State action specifically directed toward building a soybean research program” (p. 242).

“A significant private (commercial) soybean breeding effort began during the 1960s. Stuart and Hampton varieties were developed at Coker Pedigree Seed Co. in South Carolina. In 1964 a group of seed producers organized Soybean Research Foundation, Inc. to conduct a breeding program based at Mason City, Illinois. In 1967 a soybean breeding program was initiated by Peterson Seed Co. of Waterloo, Iowa, now a division of Pioneer Seed Co.”

“Enactment of the Plant Variety Protection Act in 1970 stimulated more companies to begin breeding soybean varieties.” (p. 235).

Photos show: (1) Geneticist Richard L. Bernard. (2) A food plant making spun soy protein fibers. Address: Head, Dep. of Agronomy, Univ. of Illinois.


• Summary: Harvesting is one of the most critical steps in profitable soybean production. In 1973 the U.S. produced 1,500 million bushels of soybeans. At a price of $6 per bu, soybean producers could save $360 million each year if harvest losses were reduced from a level of 8% to 4%. Since 1968 USDA and University of Illinois researchers have concentrated on improvements in soybean harvesting equipment.

An air-jet device for reducing soybean harvesting loss at the combine cutterbar was designed and tested. On a 15-foot header equipped with a floating cutterbar, at soybean seed moisture contents below 13%, air jets reduced header losses by 45% in 30-inch rows and by 67% in 8 inch rows. “The adoption of the floating cutterbar and air-jet concept by the farm equipment industry could reduce soybean harvesting loss to less than 3 percent regardless of plant moisture at harvest. This reduction in harvesting loss could result in a saving of 134 kg/ha (2 bu/acre) of soybeans for producers with soybeans averaging 2.7 Mg/ha (40 bu/acre).” Address: 1. Agricultural engineer, Regional Soybean Lab., North Central Region, Agricultural Research Service, USDA; 2. Professor, Agricultural Engineering Dep., Univ. of Illinois. Both: Urbana, Illinois.


• Summary: Page 1 is the author’s personal resume.

Education: He received his B.S. in chemistry (with Phi Beta Kappa) in 1934 from the Univ. of Chicago, Illinois, his M.S. in chemistry in 1939 from the Univ. of Illinois, Urbana, and his PhD in chemistry from the Univ. of Chicago in 1941.


Pages 2-3 list 30 of the author’s main publications. Address: Director, Protein Research, Anderson Clayton Foods, W.L. Clayton Research Center, Richardson, Texas.


Weeds that infest soybean fields may be classified as perennial grasses, sedges, broadleaf (dicotyledonous) weeds and annual grasses, sedges, and broad-leaf weeds.

In the northern soybean production areas of the USA, the annual weeds that most commonly escape control in soybeans are common cocklebur (Xanthium pensylvanicum Wallr.), smartweed (Polygonum spp.), velvetleaf (Abutilon...
theophrasti and annual morningglory (Ipomoea spp.). “In some localized areas, wild mustard (Brassica kaber {D.C.} L.C. Wheeler), wild common sunflower (Helianthus annuus L.), common ragweed (Ambrosia artemisifolia L.), and giant ragweed (Ambrosia trifida L.) infest soybean fields and are very difficult to control.”

In the southern soybean production area of the United States, some of the most widespread and difficult-to-control weeds are common cocklebur, annual morning-glories, sicklepod (Cassia obtusifolia {Sw.} D.C.), hemp sesbania (Sesbania exaltata {Raf.} Rydb.), prickly sida (Sida spinosa L.), common ragweed, and Florida beggarweed (Desmodium tortuosum {Sw.} D.C.). In both the North and the South, pigweeds (Amaranthus spp.) are prevalent and are widely considered very troublesome weeds in soybeans. Address: U.S. Regional Soybean Lab., ARS, USDA, Urbana, Illinois.


• Summary: Registration No. 116. Woodworth, developed in a cooperative breeding program of the U.S. Regional Soybean Laboratory and the Illinois Agricultural Experiment Station, was released in 1974. Address: 1. Research geneticist, ARS, USDA, and Prof. of Plant Genetics, Dep. of Agronomy, Univ. of Illinois, Urbana, IL; 2. Formerly agronomist (research asst.), ARS, USDA, now Research Station Manager, Pioneer Hi-Bred International Inc., Plant Breeding Div., St. Joseph, IL.


“The amazing progress made in soybean breeding since 1936 can be largely credited to the organization in that year of the United States Regional Soybean Laboratory at Urbana, Illinois, and to the development of cooperative breeding projects in participating states. This laboratory was developed cooperatively between the United States Department of Agriculture and the agricultural experiment stations in the states of Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Nebraska, Kansas, Missouri, North Dakota, and South Dakota.”

In 1942 the agronomic studies were extended to twelve southern states. Address: Univ. of Missouri.


• Summary: Near bottom of title page: “United States Department of Agriculture. Agricultural Research Service, cooperating with State Agricultural Experiment Stations.”


• Summary: “The history of soybean pathology in the United States would encompass only 35 years if it had not been for one person, Samuel George Lehman (1887-1973). His entire professional career was spent at North Carolina State University... Dr. Lehman did more than any other person for soybean pathology.

“The modern era of soybean pathology began in 1943. In that year, William B. Allington (1912-1976) joined the USDA Regional Soybean Laboratory at Urbana, Illinois as the first full time soybean pathologist.


Important bacterial disease of soybeans in the United States was first reported as follows: Bacterial blight 1919, bacterial pustule 1922, wildfire 1925, bacterial crinkle leaf 1965.

Important virus diseases of soybeans in the United States were first reported as follows: Soybean mosaic 1921, bud blight 1941, bean yellow mosaic 1948, bean pod mottle 1958, cowpea chlorotic mottle 1968.

Important nematode diseases of soybeans in the United
States were first reported as follows: Root-knot nematode, 1923; sting nematode, 1951; cyst nematode, 1954; root lesion nematode, 1956; reniform nematode, 1967; lance nematode, 1968. Address: Purdue Univ., Indiana.


• Summary: “To satisfactorily discuss soybean varietal development over the past fifty years, some attention should be given to developments prior to 1928.

“Interest in soybeans had become great enough by 1907 for the U.S. Department of Agriculture to hire a man to spend most of his time on soybean research. Along with his work with soybeans, W.J. Morse had responsibilities for cowpeas, mung beans, and several other annual legumes. In addition to his own plantings in the Washington [DC] area and on a farm near Monetta, South Carolina, W.J. Morse distributed seed of new introductions to anyone expressing an interest in soybeans. This program served to get many of our older varieties established. Among his closest contacts at the State Experiment Stations were C.B. Williams in North Carolina and W.L. Burlison at Illinois.

“All varieties grown in 1928 to be harvested for seed, were to a great extent the result of someone primarily involved in some other activity planting soybean seed that was sent to them by W.J. Morse. It is also quite likely that W.J. Morse visited these plantings and permitted his quiet enthusiasm to somehow influence the individual toward thinking he was growing a crop with a great potential.

“About 1928, the U.S. Department of Agriculture employed a second man to do research with soybeans. However, J.L. Carter’s role was primarily to evaluate the many soybean introductions from eastern Asia for their composition of oil and protein. At this time soybeans were a forage crop. That a man was employed to study the composition of the seed indicates that men in a leadership role within the research organization of the U.S. Department of Agriculture recognized the future of the soybean to be in utilization of the seed for oil and protein rather than in the use of the entire plant in an immature stage for forage. In their book, The Soybean, by Piper and Morse published in 1923, the authors express optimism of soybeans becoming a major farm crop but state ‘but not as a forage crop.’

“In 1936 the U.S. Regional Soybean Laboratory was established to serve the 12 North Central States. The concept of this Laboratory was never fully financed. Plans called for production research and research to develop industrial uses for the beans. The first research programs for improvement of soybeans by breeding were included in the production research program.

“The breeding research was supported in a rather limited manner. Martin Weiss, who had completed work toward a Master of Science degree, was employed on a full-time basis to work cooperatively with the Iowa Agricultural Experiment Station, but was allowed to continue his studies toward a PhD degree. Upon the retirement of W.J. Morse in 1950, Martin replaced Morse as Investigations Leader for soybean research within the Agricultural Research Service. This then became a full-time position as responsibilities for cowpeas, mung beans, etc. were directed elsewhere.

“One-half time positions for varietal development work were established in cooperation with the Illinois, Indiana, Ohio and Missouri Agricultural Experiment Stations. Leonard Williams was hired at Illinois and he became a full-time employee after completing studies leading to a PhD degree in 1937. Al Probst at Purdue was also one of the original employees, but did not become a full-time employee until 1938.

“A cooperative program for the Southern States was initiated in 1943 with research located at Stoneville, Mississippi and Raleigh, North Carolina. Paul Henson, now famous as the father of Jim Henson of the Muppets, was located at Stoneville until he was transferred to other work at Beltsville [Maryland] in 1948. I was located at Raleigh, North Carolina until I transferred to Stoneville. Herbert Johnson then took over at Raleigh. In 1955 a third location for breeding research was established at Gainesville, Florida.

“By 1954 U.S. soybean acreage harvested for beans had reached 17 million with an average yield of 20 bushels per acre. At that time there were six people employed by the U.S. Department of Agriculture as soybean breeders. It was another 10 years before any State Experiment Station had an employee giving full time to soybean breeding research.

“The Coker Pedigreed Seed Company of Hartsville, South Carolina has given some attention to soybean selection and breeding for about 50 years [i.e. since about 1929]. They have had a full-time breeding program with soybeans since the mid-fifties. For many years Coker’s were the only commercial seed company actively engaged in soybean breeding. After establishing the Plant Variety Protection Act in 1971, many commercial companies became interested in soybean varietal development. The number of federal, state, and private plant breeders is now approximately 75. However, the 29.5 bushels per acre average on over 63 million acres harvested in 1978 was made with varieties developed by the 12 to 15 breeders on the job in the mid-60’s.

“Morse and Carter, in 1939, described 108 varieties of soybeans. All were introductions from Asia, selections from introductions, or natural crosses that had occurred among introductions. Of the 108 varieties described, 37 were considered to be seed producing types. Only 14 of these were grown on any appreciable acreage. Dunfield, Illini, Macoupin, Manchu, Mandarin, Mandel, Mukden, Richland, and Scioto were the principal varieties grown in the North Central States for seed production. Arksoy, Haberland,
Mammoth Yellow, Tokyo, and Woods Yellow were the major varieties planted for seed harvest in the South. Several of these varieties are in the parentage of varieties now in production.

"Since 1942 one hundred twenty-four soybean varieties have been registered by the Crop Science Society of America. Of these number five of the older varieties were selections from introductions. All other were selections from segregating populations resulting from planned crosses.

"Introductions from the northeastern providences of China were the source for varieties such as Dun, Field, Illini, and Mukden which were some of the more widely grown varieties in the north central region. A major step in varietal improvement was made with the release of Lincoln in 1944. Lincoln resulted from a cross made by Woodworth at Illinois and selected jointly by Williams and Woodworth. Lincoln had a 4-year average yield 17% greater than the mean for Dunfield and Illini, the varieties it replaced. Lincoln was also superior to these two varieties in resistance to lodging and in oil content of the seed. Another variety having a major impact on production was Hawkeye, released in 1948. Hawkeye was earlier in maturity than Lincoln. It remained a major variety for approximately 20 years.

"In addition to the impact Lincoln had on soybean production, it also played an important role as a parent. Leonard Williams crossed Lincoln with Richland and then backcrossed to Lincoln. Four major varieties came out of this material—Clark of maturity group IV, Chippewa of maturity group I, and Ford and Shelby of maturity group III. In 1965 these four varieties were estimated to be grown on approximately 30% of the U.S. acreage. Lincoln parentage is very evident in the highly productive and widely grown variety Williams.

"In the South, the first variety to have a major impact on production was Ogden, released from the Tennessee Agricultural Experiment Station about 1943. Ogden produced well but was weak in seed holding and had green seed coats. The green seed coat was disturbing to Japanese buyers after purchasing yellow soybeans. Lee released in 1954 had an even greater impact on production in the South. Lee yielded well, held its seed extremely well, and was resistant to several foliar diseases which were responsible for reducing seed yield. Because of Lee’s performance acreage began to increase. For several years Lee was grown on about 85% of the soybean acreage in the South. Lee or lines closely related are in the background of most varieties now grown in the South. Bragg, released in 1963, had a sister line of Lee as one parent. Bragg was 10 days later than Lee and soon became one of the major varieties in the U.S.

"Soybean production in the U.S. covers a range of over 20 degrees latitude. This means that productive varieties were needed of different maturity classifications and with production qualities to fit the different production regions.”

Continued. Address: ARS, SEA, USDA, Delta Branch Exp. Station, Stoneville, Mississippi 38776.


• Summary: (Continued): “As soybeans were grown in Asia with small units and hand culture, shattering was no problem. In fact, varieties that shattered could perhaps be trampled out more readily. Planting for machine harvest and at higher fertility required that our varieties have greater standability as well as an ability to hold their seed for several weeks after reaching harvestable maturity.

"Foliar diseases and root-knot nematodes were recognized as factors limiting yield as research on variety development began in the South. Consequently parents were selected to contribute resistance to major disease problems. Less attention was given to disease resistance in the North until phytophthora rot was recognized as a problem in the area of northeast Indiana–northwest Ohio in the early 1950’s. Breeding programs were modified to permit incorporating resistance to phytophthora rot. Several varieties were modified by back-crossing. Harosoy 63 and Clark 63 were among the first phytophthora rot resistant varieties to be released.

"Breeding varieties with resistance to phytophthora rot continues to receive major attention in the central south as well as the north central region. We now recognize nine races of the organism causing phytophthora rot. The variety Tracy is resistant to all of these races. However, additional isolates have been found which will kill Tracy when the hypocotyl is inoculated in the greenhouse. Thus the plant breeder must be continually alert to new strains of pest problems.

"Identification of the soybean cyst nematode in North Carolina in 1954 has made it necessary for plant breeders to search the germplasm collection for sources of resistance. A productive resistant variety was supplied to Foundation Seed Stocks organizations in four states within 10 years after a source of resistance was identified. Second cycle varieties such as Forrest and Centennial not only had good resistance to the more common forms of cyst nematodes, but are top producers in the absence of cyst nematodes. However, as cyst resistant varieties came into production we recognized another strain of the cyst which reproduced readily on varieties such as Forrest and Centennial. Another search for resistance had to be made and a new program initiated to incorporate this resistance. The variety Bedford, resistant to the newly recognized strain of cyst nematodes as well as the old, was released in 1977.

"Although resistance to cyst nematodes is important for a variety to be grown on infested soil, it now appears that much of the yield depression attributed to cyst nematodes in the central south, is the result of low fertility resulting from continuous cropping of soybeans with inadequate
In order to make progress in developing more productive soybean varieties, the plant breeder must recognize factors which limit yield. The physiologist has offered little assistance in identifying factors which would contribute to increased yield. Thus, incorporating resistance to pest problems has been one of the major approaches for improving seed yields or reducing the hazards to production. Pest problems have offered greater limitations to production in the South than in the North.

In addition to resistance to fungi, bacteria, viruses, and nematodes, we have also identified good resistance to foliar-feeding insects. No varieties have been released from this program, but progress is well underway. We have recognized a considerable range in rate of insect development among varieties now in production.

Loss from stink bug feeding is severe in some areas each year. Feeding by the stink bug on the developing soybean seed may cause the pod to fail to develop or for the seed to be of lower quality. The grower suffers a loss in soybean seed may cause the pod to fail to develop or for each year. Feeding by the stink bug on the developing soybean seed to be of lower quality. The grower suffers a loss in soybean seed through blossom drop, pod drop, and seed damage. We have recognized a considerable range in rate of insect development among varieties.

Seed quality is frequently a problem where varieties mature under conditions of high temperature and frequent light rains. An impermeable seed coat character has been transferred from the wild soybean to a productive cultivated type. Pilot studies show greatly reduced deterioration in the field. The normal harvesting operation gives sufficient scarification for most of the seed to germinate. Further scarification will occur in seed processing and handling.

At times we read that the germplasm base for soybean varieties is narrow and thus our varieties are vulnerable to destruction. Variability in itself does not insure protection. High levels of resistance to pest problems are usually rare and must be identified in carefully conducted research programs. Once the resistance is identified it must be transferred to a productive type in a well managed breeding program. For example, in developing a variety with resistance to race 4 of the soybean cyst nematode, we screened over 35,000 F2 seedlings in 3 cycles of a modified backcrossing program to obtain 125 agronomically desired types for advancing to replicated tests for yield evaluation.

Many germplasm lines have been used in breeding programs. Unless a specific quality is obtained or high productivity they are not continued in the breeding program. It is the lines with the Lincoln or Lee backgrounds that give the productivity. There is no reason for a farmer to select a variety with a 10% lower yield level just to achieve diversity, since diversity in itself offers no protection. In the U.S. we have people of many backgrounds. With an outbreak of influenza we see little protection from diversity.

Where protection is needed we do have diversity, but this diversity was identified and incorporated in a planned program covering a 30-year period. The variety Forrest has in its background several strains from northeast China, two strains from south central China, plus strains from Korea and Japan. However, Forrest is widely accepted because of its productivity, not because of its diverse background. Forrest is resistant to two species of root-knot nematodes, two races of soybean cyst nematodes, reniform nematodes, to the major foliar diseases that we have in the South, and has a moderate level of resistance to phytophthora rot.

Progress has been made in developing highly productive types higher in protein and lower in oil than the general trend of varieties in production. These types may have a place in our production program should sunflower, palm oil, or other oilseed crops be greatly expanded. High protein types may also have a specialty market for direct food uses.

Interest has been expressed in greatly modifying soy oil composition. The variability within the soybean germplasm collection does not offer promise for rapid progress in this regard.

Any variety developed by a plant breeder must be productive if it is to be grown. At times appearance factors may influence acceptance. However, we must realize that U.S. markets frequently offer discounts, never premiums. Thus, however seed composition may be modified, seed yield cannot be sacrificed. Similarly as we build in protection against pest problems, yield cannot be sacrificed.

Soybean varieties have been available for production in the northern latitude of the U.S. for some time. This year we will have several thousand acres of soybeans grown in the Rio Grande Valley [of southern Texas]. This gives us a series of productive varieties covering a latitude range of about 48° to 26°. As the plant breeder develops more productive varieties, he must have the help of other disciplines in identifying factors which limit productions. As these limiting factors are identified, then our germplasm collection becomes an even more valuable asset as a place to search for characters which can permit us to improve our breeding material.

Variety development is a continuous building program. As new limiting factors are recognized the character to correct these factors must be added, not substituted for other desired qualities. In the past 30 years the number of soybean breeders has increased manyfold. However, we will probably continue to depend on a few moderately well financed research centers for major varietal improvements. Address: ARS, SEA, USDA, Delta Branch Exp. Station, Stoneville, Mississippi 38776.

624. National Soybean Processors Assoc. 1979. Selected events, quotes, and highlights in the history of NSPA.
Washington, DC. 7 p. Aug. 24. 28 cm. [5 ref]

**Summary:** An in-depth chronology of this important organization consisting of 64 individual events from 1930 to 1978. The trade group was named National Soybean Oil Manufacturers Association from 1930 to 1936. The entries read:

“1930: First rules to govern the purchase and sale of soybean oil adopted; the association officially adopts the spelling of the word ‘soybean’ as one word, rather than ‘soya bean.’

“1930: First General Meeting of Members. Getting involved right away with government matters, it was recommended that ‘the association exert its influence in having an Act of Congress passed providing for the marketing of soybeans under the Grain Marketing Act instead of under the Seed Division.’

“1930: From minutes of an Executive Committee meeting: ‘A general discussion ensued in connection with the recent ruling at Washington permitting colored margarine to be sold with a tax of ½ cent per pound when made of imported palm oil.’ Dairy interests wanted a tax of 10 cents per pound to discourage the import of palm oil, but NSPA felt that ‘would be rank discrimination.’ Besides, it would also discourage the use of soybean oil.

“1930: The association published a pamphlet on ‘soybean oil meal.’ It was agreed that the association’s research program was ‘so vast an undertaking that no one academic institution was equipped to handle the problem,’ thus a number of universities were contacted. It was thought advisable to hire an Executive Secretary, and pay for him by making an assessment on the basis of the bushels crushed.

“1932: The association decided to systematically support the American Soybean Association, and appealed to processors to ‘make a contribution of $5 or $10 or less to help meet the deficit incurred by our sister association on account of bank failures.’

“1933: NSPA total dues receipts were $659.51; expenditures were $272.12 (of which the largest was a $150 contribution to ASA), with a surplus of $387.39 on the year.

“1933: The association filed a protest with the Institute of American Meat Packers, which had published a bulletin warning that the feeding of soybean meal resulted in soft pork.

“1934: The University of Illinois dramatized its campaign for soy oil utilization by painting all of its agricultural buildings with soybean oil paint.

“1935: An Iowa Congressman assured the association that soybean processing would continue to be exempt from the agricultural processing tax (later declared unconstitutional by the Supreme Court anyway), because soybeans were a ‘non-basic commodity.’

“1936: A report to the Executive Committee recommended a permanent, centralized office staff, in part because of the need for continuous government relations activity. ‘Our Washington problems are more likely to increase than to decrease, and it is confidently believed that an effective organization for handling these problems can and should be built up without delay.’

“1936: The National Soybean Processors Association is officially adopted as the association’s name-changed from the National Soybean Oil Manufacturers Association. The new Executive Secretary–Edward Dies–insisted on the name change as a condition of his hiring.

“1936: USDA approved establishing a U.S. Regional Soybean Industrial Products Laboratory at the University of Illinois.

“1937: Total sales of NSPA member firms was $32.4 million.

“1937: NSPA asked the U.S. Tariff Commission to slap 50% duties on the importation of foreign soybean oil and meal.

“1937: NSPA established a Soybean Nutritional Research Council, principally to disseminate proper information about the uses of soybean meal.

“1938: NSPA examined the ‘uneconomic and perilous practice of making long time commitments on soybean oil meal at a flat price, thus incurring severe carrying charge losses.’

“1938: NSPA established a Crop Development Committee, to bring about larger crops, ‘especially in Iowa.’

“1939: NSPA first exhibited at another association’s meeting, namely, the World Poultry Congress, convened in Cleveland [Ohio].

“1939: From the President’s Report: ‘No other agricultural, processing or merchandising group enjoys greater friendship with the growers than exists between our Association and the American Soybean Association, and I regard the continuance of this mutual assistance policy one of our major responsibilities.’

“1940: NSPA began distribution of growers’ literature through the vocational agricultural education program.

“1941: NSPA defeated an attempt by the Bureau of Marine Inspection and Navigation to classify soybean meal and cake as a hazardous article.

“1941: NSPA effectively countered ‘ugly rumors’ that feeding soybean meal caused yellow fat and dark colored meat in beef cattle.

“1941: NSPA was first investigated by the Federal Trade Commission, on the basis of complaints that members conspired to sell soybean oil at a fixed price. Result: the allegations were found baseless.

“1942: NSPA established an Edible Soybean Committee, and the government asked for a bid on 25,000 pounds of ‘edible soybeans’ for use in the tropics.

“1942: From the President’s Report: ‘A few years ago some authorities looked upon a hundred million crop as the saturation point. This past year such a crop was handled with comparative ease. We now face a crop twice as large. It
constitutes a challenge to the ingenuity and operating talent of our industry.’

‘1943: The annual meeting was held in September for the first time (it had always been in October), and a by-law was approved permitting September meetings, since ‘members had found it difficult to attend a meeting right after the crop starts moving.’

‘1943: NSPA went on record for the first time deploring the ‘wholly inadequate’ commitment of research money by USDA to soybeans, and requesting an increase in the appropriation from $33,000 to $100,000. (USDA responded with an increase to $68,000.)

‘1943: NSPA’s Soybean Nutritional Research Council had to warn agronomists to stop breeding soybeans designed to produce oils with higher iodine value (thereby to enhance the paint-manufacturing characteristics), but rather to start breeding varieties that would enhance the oil’s edible value.

‘1945: NSPA formed a Special Committee on Margarine, to develop ways to include ‘the greater use of soybean meal in the manufacture of margarine.’

‘1945: NSPA’s President also served as chairman of the board of the new Soy Flour Association, which got the Food and Drug Administration to allow the inclusion of 3% soy flour in white bread.

‘1945: Two shortages plagued the industry: fuel oil and freight cars. Plus ca change, plus c’est la meme chose.

‘1945: From a memorandum to the NSPA Board: ‘It has become increasingly clear that most businesses today are living in a fool’s paradise by thinking that they are to be freed of government control and supervision. The real trend is in the other direction. The industries that exercise continuous vigilance in Washington... will improve their position over those industries which take an indolent or negative attitude.’

‘1945: NSPA establishes a Washington office by retaining a permanent representative in the capital city.

‘1945: NSPA retains legal counsel for the first time.

‘1946: The effectiveness of NSPA trading rules were ‘severely tested,’ because: ‘With the return of free trading and the violent fluctuations experienced during this past year, the trading rules again assumed considerable significance.’

‘1947: The first U.S. government purchases of soybean oil and soybean meal for overseas relief went to Greece, Austria and Italy.

‘1948: The National Soybean Crop Improvement Council (NSCIC) is established by NSPA, and Ward Calland is named its Managing Director.

‘1951: From the annual report of NSPA’s Washington representative: ‘Although it is a theorem of political science that government regulation deadens the urge of private initiative, I question whether I have ever seen such a display of the exercise of private initiative as was everywhere evident while we were all calculating our price ceilings under the General Ceiling Price Regulation. If all the man


• Summary: “As I told you by phone, I discussed your need for information regarding Mr. W.J. Morse with Dr. E.E. Hartwig, Stoneville, Mississippi,... and he sent a series of papers on the history of soybean development and improvement in the U.S. over the past 50 years. Dr. Hartwig wrote the first paper.

‘Dr. Hartwig states that W.J. Morse began his work with USDA in 1907. I can recall him describing some of his activities starting in about 1912... soybeans introduced to the U.S. in earlier times were mostly adapted to our southern states and were mostly grown for hay. But a few varieties were also good producers of beans, as proven in W.J.’s test plots at Arlington Farm (land on which the Pentagon is now standing [in Virginia]). After the seed of these varieties was increased adequately, W.J. told how he would take a few large bags and head for the Carolinas via train. Upon arrival he would go to a livery stable and rent a spring wagon and horses, and set forth across the countryside.

‘When he observed a farmer in the fields planting corn or hay-type soybeans, he would tether his horses to a post, climb over the fence and visit with the farmer. If interested, he would give the farmer enough seed to plant a few rows to determine their productivity. That was the beginning of growing soybeans for beans rather than hay. At first, the soybeans were fed directly to livestock, as there were no oil-extraction plants adapted for soybeans. Troubles ensued. The high level of unsaturated oil in the beans was laid down in
the fat of hogs and gave ‘soft pork.’ But cottonseed crushing and oil extraction was practiced in the South and soon adapted for soybeans as their production was increased.

“Hartwig mentions that testing of soybeans and some of the other seed legumes (cowpeas, mung beans, etc.) was conducted at Monetta, South Carolina. This was the result of W.J.’s finding the [Joseph M.] Johnson family very interested in these new crops and highly cooperative. The family consisted of a brother and two sisters, and a colored man who did most of the field work. By the time I succeeded W.J. (Jan. 1, 1950) the brother and colored man had passed away but I learned to know Bessie and Mae—a delightful pair of southern ladies who continued their interest and still wanted test plots on their farm. (Mae is now deceased but Bessie is still living although, I hear, in poor health). Our research workers stationed at Raleigh, North Carolina, continued for some time to use their farm as a test site. As the Hartwig article describes, Mr. Dorsett, a plant explorer, introduced a number of soybean types from the Orient. It became evident in the late 1920’s that soybeans had distinct promise in the U.S. so in each of two years (1929 and 1930, I believe) a team—Mr. Dorsett and W. J. Morse (the soybean “expert”) conducted extensive, systematic collection trips, particularly in northern China, known as Manchuria at that time. I’m sure W. J. considered this the highlight of his career. He took many photos of fields, harvesting and processing operations. He described this collection effort to me as being a bonanza so far as obtaining a diversity of germ plasm.

“Each village they visited had three or four distinct varieties—one or two for oilseed production, a large seeded type to produce soybean sprouts, a mild flavored type for green vegetable production, etc. And, unlike American farmers, they didn’t look across the fence and decide the adjacent village had a better variety and start growing it—that would be sacrilegious! The varieties they grew had been handed down by their honorable ancestors and they wouldn’t dream of growing a variety handed down by some else’s ancestors! And this practice had been followed for many generations. A true bonanza for a germ plasm collector. So more than four thousand collections were made and sent to the U.S. For the sake of completeness Dorsett and W.J. also collected in Japan and Korea, but these varieties were mostly of the vegetable types.

“The numerous collections were grown in 1932 at a branch station at Holgate, Ohio, by J.L. Carter, W.J.’s only professional employee at that time, and a technician, Joe D. Vasvery (who is retired, lives near me, and is my fast friend). The varieties which showed agronomic promise were again grown in 1934. As the Hartwig article describes, the U.S. Regional Soybean Laboratory was founded in 1936 with headquarters at the University of Illinois. Fresh with an MS degree in genetics and plant breeding, I became its first full-time field employee, located at Iowa State University. Part-time employees stationed at the University of Illinois and Purdue [West Lafayette, Indiana] were made full-time upon completion of advanced degrees and somewhat later the Ohio employee became full-time. Mr. Cartter and Mr. Vasvery were transferred from Holgate to Urbana, Illinois. And they told us of the extensive collections, seed of which was stored in paper bags in the attic of a barn at Holgate. So, the samples were brought to Urbana.

“This part of my dialogue does not pertain particularly to W.J. I will insert it only as background of the early soybean development which was under W.J.’s direction. In early 1937 the assembled field representatives of the Laboratory pored through these collections and each took a sample of seed of those varieties he wished to grow. With my background in genetics, I had a mania for genetic diversity, so I took a sample of each one. But the seed was 5 years old and the high oil content of soybeans causes rapid deterioration of germination. So many of the 1932-grown samples germinated as little as 1%, and a few gave no germination at all. But, after 2 years of increase I had over 3,000 types! Success story? But wait. Then came World War II and Uncle Sam decided my commission in the artillery reserves was needed more than my plant breeding skills. And labor was extremely scarce at the Agricultural Experimen Stations. So my seed aged. In 1946, I tried to revive the varieties, but could get germination of less than 1500. But those are in today’s germ plasm bank. But how many genes giving resistance to new pests and diseases, which breeders are frantically searching for now, went down the drain? That’s why, when I succeeded W. J., I initiated the soybean germ plasm bank!” Continued. Address: 11122 Emack Rd., Beltsville, Maryland 20705.


• Summary: Mr. Cartter first got involved with soybean research in 1928 at the Ohio Agric. Exp. Station farm, Holgate, northern Ohio; his work was to evaluate soybean introductions under northern Ohio conditions. He first came under William Morse’s supervision in the fall of 1929 when Morse placed him on an Ohio Experimental Farm, Elyira, Ohio, to work on soybeans. He was Mr. Morse’s only employee on soybean production research. At the time, Morse was in charge of all USDA’s forage legume research. In 1933 the Ohio research, including a chemical laboratory, was transferred to Arlington Farm. In 1936, when the U.S. Regional Soybean Laboratory was organized at the University of Illinois at Urbana, he first became in charge of the soybean breeding program for the 12 midwestern states.

It has been said that many of the more than 6,000 soybean varieties that Morse brought back from East Asia during 1930-31 were lost, discarded, or not grown out. This is not true. Morse grew out and carefully evaluated all
varieties at Arlington Farm, and he (Carter) did the chemical analysis on many of these soybeans. He had a couple of men growing them out at the farm. The good varieties were kept and later distributed to agricultural experiment stations throughout the USA for further evaluation and industrial use. “The U.S. soybean germplasm was consistently maintained prior to, during, and after World War II. I know; I helped to do it.”

During the early years, small packets of seed, including the vegetable types, were distributed to farmers for growing. Of the poor ones, small packets of seed were kept, but they had to get rid of some material. They were not lost. He has been retired for 15 years.


• Summary: Continued: “Later years in America (1931-1959): Morse returned to America in March 1931 with great enthusiasm and interest in transmitting to America all that he had learned in East Asia. He was now a principal agronomist at the USDA Bureau of Plant Industry. With the stage set for the fruition of years of work and research that would transform the place of the soybean in the Western world, let us pause for a minute to ask, ‘What kind of a man was Bill Morse?’

“In appearance, he was tall and lean, with a kind face and soft features. Farmers all over America, with whom he had met and talked in their fields, might remember his baggy suspended pants, loose tie, and slouched hat, his great interest in their problems and successes.

“George Strayer, editor for 27 years of the American Soybean Association’s Soybean Digest, who had known Morse since 1927, said of him: ‘He was a quiet, unassuming, yet brilliant fellow, not particularly dynamic as a speechmaker, but intensely interested in seeing soybeans progress. He would sit up half the night talking with people about soybeans and soyfoods.’

“An article by Mary Burr Pieters in the September 1944 Soybean Digest described Morse as ‘modest and retiring but sure and right as rain... He studied, he traveled, he toiled, he experimented—he exhorted—and the result of all of this singleness of purpose and devotion surely borders on fantastic.’

“Edward J. Dies, his close colleague, described him in Gold from the Soil as ‘heedless of material gain or personal honor, shy, modest, agreeable, and easy going, but with the repressed intensity of a crusader.’ Martin G. Weiss, who worked under Morse for many years and succeeded him when Morse retired, said of him: ‘He was a kindly man, always willing to encourage and give moral support to his subordinates. He was loved by all, and his employees worked hard—they never wished to disappoint him.’ His daughter Margaret described him in 1980 by saying: ‘He was a gentle, soft-spoken person, who liked others and they liked him. He liked to tease, and the secretaries at his office all loved it. He was a very easy person to get along with; he was slow to anger and never cursed. He wasn’t aggressive; where some might push, he would give in. He was intelligent. His work came first. He was not financially ambitious.’

“After returning from East Asia, Morse was more interested than ever in soyfoods, and much of the subsequent increasing interest in America derives from his efforts. He expanded his work with the USDA Office of Home Economics in Washington, D.C. and interested researchers in the Department of Home Economics at the University of Illinois to get involved with research on soyfoods, especially on use of the large-seeded, vegetable-type soybeans he had brought back from East Asia. He encouraged development of soyfoods recipes suited to American tastes and talked a lot about soyfoods at American Soybean Association meetings and many other gatherings. Working with others, he was largely responsible for the development of soy flour and grits. One entire wall of Morse’s Washington office was covered with floor-to-ceiling shelves, filled with soyfood samples from Asia.

Except for Dr. Harry Miller, Morse was probably the first soy researcher in America to make soyfoods a regular part of his diet. While in East Asia, he and his family had become very fond of Oriental cooking, and especially of soyfoods, and they enjoyed them often after returning to America. Of the many recipes they brought back from the Orient, Morse’s favorite was sukiyaki. He built a low sukiyaki table with a hot plate on top and cushions around it on the floor in his home and at every opportunity would invite over guests to serve them his specialty which of course featured tofu and sprouts. He also liked to take family and friends out to a good Chinese or Japanese restaurant. The family enjoyed using soy flour when making breads, muffins, or waffles. Morse’s mother [Edna] liked to cook him fresh green soybeans and his wife regularly fixed him her favorite Boston Baked Soybeans. Morse loved soymilk ice cream; one magazine ran a full-page photo of him happily eating it. He also regularly enjoyed tofu, soymilk (plain and acidophilus), and soymilk yogurt, and these foods became increasingly important in his largely meatless diet after he found he had an ulcer. In fact he once told George Strayer that, with his ulcer, he felt these soyfoods had greatly extended his life and good health.

“Morse also actively continued his soybean selection and propagation work at the Arlington Farm. He realized more than ever that if the soybean was to become a national crop that hundreds of different varieties, adaptable
to different latitudes, soils, and climates, would have to be found and developed by breeding. He was especially interested in working with farmers and the USDA to stimulate research and development on the vegetable-type soybeans, which had been little more than a curiosity prior to his trip to East Asia. While Morse was the first to popularize the vegetable-type soybeans, he was not the first to introduce them. The variety Easycook (which took less than half as long to grow as most field-type soybeans to become tender after boiling) was introduced to the U.S. in 1894 and the Hafto was introduced in 1915. Morse mentioned both of these in *The Soybean* in 1923 but did not mention the term 'vegetable-type soybeans,' and was apparently unaware of their significance. Many of the vegetable-type soybeans that Morse brought back from East Asia were grown out and starting in 1934, distributed to various state agricultural experiment stations for trial.

“Up until 1928, Morse, in charge of soybean research, had been the only USDA employee working full time in this field. In 1928 the USDA hired a second full-time soybean researcher, Jackson L. Cartter, who had just graduated with a master’s degree from Iowa State College. From 1928 to 1933 Cartter did soybean research on a farm in Holgate, Ohio that was managed by the Ohio Experiment Station. From 1933 to 1936 Cartter worked directly under Morse at the USDA Experiment Station, Arlington Farm, Virginia; he tested, grew out, and classified many of the soybeans from Morse’s trip to East Asia. In 1936 Cartter helped to organize the U.S. Regional Soybean Laboratory at the University of Illinois. He became the first director of its agronomic division and was placed in charge of the soybean breeding program for the 12 Midwestern states; he studied the soybean’s oil and protein composition, and served as director of the laboratory until his retirement in 1965.

“Unfortunately the long-term results of Morse’s collection efforts in East Asia are not what they might have been. It was estimated in 1980 that only 25,000 acres of the 70.1-million-acre U.S. soybean crop were planted in vegetable-type soybeans, a mere 0.04 percent of the total. They have never become popular here for various reasons; they give 20 to 30 percent lower per-acre yields than field-type soybeans, tend to shatter easily at maturity and are thus hard to harvest, and consequently sell for 12 to 18 percent more than other soybeans. If they were less expensive, large amounts would probably be used in East Asia to make tofu, soymilk, tempeh, and miso by producers who already buy their beans from America.” Continued. Address: Soyfoods Center, P.O. Box 234, Lafayette, California.

• **Summary:** The change from selection to hybridization in soybeans started with the variety Lincoln in about 1940; it was released in 1943. It started many years earlier with other crops. The variety Chief may have been the first to come out of the public breeding program. Soybeans are not true hybrids in the sense that corn varieties are hybrids. Corn is a naturally cross pollinated plant whereas soybeans are self-pollinating. Address: Curator, USDA Germplasm Collection, Univ. of Illinois.

• **Summary:** A comprehensive history of the subject.


• **Summary:** A comprehensive history of the subject.

Contents: Introduction. University of Illinois and INTSOY: Home Economics Department’s work (in the 1930’s, 1940-1961, and 1974-1981), Food Science Department (1955-1981), International Soybean Program (INTSOY) founded July 1973, large number of talented faculty made the Univ. of Illinois one of the world’s top soy research centers. Iowa State University. Cornell University: First work with soy 1883, first soyfoods work in 1927 (soymilk thesis by Y.T. Chiu), one of leading centers of U.S. soyfoods research during World War II (see chapter on Clive and Jeanette McCay), rebirth of interest in soyfoods in late 1950’s, 1960 paper on tempeh, soymilk work 1963-1980, other soyfoods
studied, arrival of Dr. Van Veen in 1962 (had studied tempeh since 1932, had lived in Indonesia, and had a lifelong interest in tempeh), renewed program of soybean development and production initiated in New York state in 1964. USDA Northern Regional Research Center (NRRC): Originiated with 1929 USDA soybean lab in Ohio, 1936 soybean lab in Urbana, IL, transferred to Peoria, IL, 1942, expanded research on food uses of soybeans and soy oil, fermentation division headed by Langlykke, work on soy sauce, life of Dr. A.K. Smith, at NRRC from 1942-1964, arrival of Drs. Watanabe and Shibasaki, Smith one of first American researchers to realize the potential of tofu, work with miso, 1960 arrival of respected Indonesian microbiologist Ko Swan Djien, work on tempeh, NRRC hosted 2 of first major conferences on soy protein foods in 1961 and 1966, sponsorship of overseas contract work, expansion of research in 1960’s, soy flour extrusion, Rackis’ work with oligosaccharides (flatulence-causing factor in soybeans), life of Dr. C.W. Hesseltime, 1962 arrival of Dr. H.L. Wang at fermentation lab, Mustakas’ studies on soymilk, NRRC’s interest in soyfoods steadily growing, legitimizes soyfoods to people in U.S. and around the world. INTSOY: Founding, 5 basic objectives, main accomplishments with soybeans, main accomplishments with soyfoods. Address: Lafayette, California. Phone: 415-283-2991.


• **Summary:** Discusses each of the leading early breeders and the varieties they developed. Note the difference between a breeder (who develops commercial varieties) and a geneticist (who studies inheritance). Martin Weiss was the first full-time soybean breeder in the U.S. There never was a separate building for the U.S. Regional Soybean Lab; it was just integrated into the university, like INTSOY, located in Davenport Hall. It was never officially discontinued. They just stopped using the name. Address: Dep. of Agronomy, Univ. of Illinois.


• **Summary:** "Dr. W.L. Burlison was an ardent proponent of the importance of plant physiology to agronomy. In his presidential address to the American Society of Agronomy on November 17, 1927, he said, ‘Agronomy... must ally itself with those sciences that are basic in the interpretation of plant function, namely, chemistry, physics, and plant physiology.’ It is no coincidence that the USDA soybean program included a physiologist from the earliest days and that physiology has had a prominence in Agronomy at Illinois that is unequalled.

“E.B. Earley was the first physiologist in the U.S. Regional Soybean Laboratory at Illinois and Missouri from 1937 to 1944, when he joined the University of Illinois faculty. He published a paper on soybean reaction to zinc, and one on temperature of the root environment of soybeans. Most of his career was devoted to corn research.

“D.F. McAlister came to the Laboratory after World War II. His research concerned mineral nutrition, and the effects of defoliation. He left in 1951 to become a department head at the University of Arizona, later serving that University in Brazil and as assistant director of the Agricultural Experiment Station.

“I succeeded McAlister in 1952, continuing until I became investigations leader for USDA soybean work in 1964. My research concerned phosphorus nutrition and metabolism, oil synthesis, and effects of temperature on seed development and composition.

Several physiologists joined the USDA during the 1960s: R.E. Johnson, mineral nutrition; R.W. Rinne, oil metabolism; W.L. Ogren, photosynthesis; J.E. Harper, mineral nutrition; C. Sloger, nitrogen fixation; C.F. Tester, biochemistry.

“Soybeans have been the object of study by many physiologists whose primary focus was not the plant itself, but some key physiological processes. This trend goes back to the work of Garner and Allard, who identified photoperiodism in the 1910s, and to Borthwick, Parker, and Hendricks in the 1930s and later H.J. Evans, now at Oregon State, and R.H. Burris, of Wisconsin, made basic contributions to understanding of nitrogen fixation in soybeans. The system of Maturity Groups (00 to X) to identify the areas of adaptation of soybean varieties is based directly on the photoperiod research of Borthwick and Parker. Borthwick is one of the few agricultural scientists to be elected to membership in the National Academy of Sciences, a recognition of the fundamental significance of his work in photoperiodism, much of it with ‘Biloxi’ Soybeans. J.C. Brown, and C. Foy wrote several outstanding papers on comparative iron metabolism, based on a variant type reported about 1940 by M.G. Weiss.

“Soybeans were ‘discovered’ by crop physiologists around 1960. R.M. Shibles began work on soybeans at Iowa State about that time, as did I.C. Anderson. A student of Anderson’s was J.W. Tanner, who went to Canada and pioneered soybean physiology at Guelph” (Ontario province).

“Very recently, research groups concentrating on photosynthesis have been created, building on the foundation established in soybeans. Work in soybeans provided the basis for understanding photosynthesis, virtual absence of which in maize and a few other grasses, explains much of the difference in potential productivity of soybeans and corn. Photosynthesis is ‘like a leak’ by which much of the product of photosynthesis is lost before storage.

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“Likewise, much of the theory of symbiotic nitrogen fixation has evolved from work on soybeans. In another instance, differences in expression of physiologic traits (iron and phosphorus nutrition) have been shown to be controlled in some cases by very simple and traditional genetic mechanisms.

“With the growth in number of soybean physiologists and the increased understanding of complex processes, it has become more difficult to render simple physiological explanations of questions of growth. The goal of ‘helping the breeders’ has been elusive. There has not been identified a key process, measurement or improvement of which would replace conventional testing. However, with the advent of genetic engineering the interface between physiologists and breeder/geneticists is becoming less clear. The skills for cell and tissue culture, protoplast fusion, and the other marvels of genetic engineering are those of the physiologist, perhaps now coming to fruition in partnership with the geneticist/breeder.” Address: Head, Dep. of Agronomy, Univ. of Illinois.


• Summary: “Information on the origins of introduced United States and Canadian named varieties and all strains identified by FC numbers and PI numbers introduced through 1977 (PI 420.388).

“This is a working paper. Please report any errors to R.L. Bernard, Turner Hall, Univ. of Illinois, Urbana, Illinois 61801. A final document will be issued later in 1981.

“Soybean Germplasm Manual 1.”

Gives contact information for the Northern Collection (Maturity Groups 000 to IV, Richard Bernard and Randall Nelson) at the Univ. of Illinois, and the Southern Collection (Maturity Groups V to X, Edgar Hartwig and Calton Edwards) at Stoneville, Mississippi.

This detailed work consists of a 3-page introduction followed by many tables.

This “collection of soybean cultivars, herein referred to as strains, from throughout the world” is maintained by the USDA “in cooperation with the Illinois and Mississippi Experiment Stations. The collection is in two sections, the northern or early-maturing strains... at Urbana, Illinois, and the southern or late-maturing ones... at Stoneville, Mississippi. The collection was established in 1949 with the objective being to obtain and maintain all significantly different soybean strains from throughout the world with emphasis on land races of eastern Asia, where soybeans originated. It was initially assembled by L.F. Williams at Urbana and E.E. Hartwig at Stoneville under the supervision of M.G. Weiss, leader of USDA Soybean Investigation, and J.L. Cartter, director of the U.S. Regional Soybean Laboratory [at Urbana, Illinois].

“The strains of the collection may be divided into three parts corresponding to their designations: 1. United States and Canadian named varieties (cultivars)...

“2. FC strains consisting of foreign introduction and domestic strains identified by a series of numbers assigned by the former Forage and Crops section of the USDA. This series was used until about 1956.

“3. PI strains, consisting of foreign introductions identified by the system described in the following section.

“In addition to the soybean germplasm collection...”

“3. PI strains, consisting of foreign introductions identified by the system described in the following section.

“In addition to the soybean germplasm collection outlined above, collections of genetic types and isolines, wild soybeans (Glycine soja), and perennial Glycine species are maintained, and lists of this material are available from the curator at Urbana.”

“In 1949 when this collection was established they were able to gather from the USDA and various state experiment stations 1,521 strains, which is 19% of the original 7,873 introductions made through 1944.”

“The last page of Table 1 [p. viii] shows the results of the two large Asian collecting expeditions, the first by USDA plant explorer P.H. Dorsett [and his son, Jim] in 1924 to 1927, and the second by Dorsett and USDA soybean specialist W.J. Morse in 1929-1931. The soybeans obtained by them (5,417 varieties) represent 69% of the total received from 1900 to 1944 and make up 82% of the pre-1945 strains in the present collection.”

“The major additions in recent years have been the 861 from Japan in 1977 and the 1,823 from South Korea in 1976.”

“Maturity Group 00 was split into 000 and 0 in 1981 with the earliest ones in 000.”

“The varieties introduced up until about 1908 (36) are mostly hay-type varieties. Those from 1910 to 1927 (61) are mostly grain-type and include virtually all of the introductions ancestral to the present U.S. commercial varieties. Those of 1929 and 1932 (41) were from the Dorsett and Morse expedition and are mostly vegetable types released for human food and home-garden use.”

Tables: (1) PI numbers assigned by year, and number of strains in the USDA Soybean Germplasm Collection. The last page of Table 1 shows that from 1924 to 1927 Dorsett sent back 966 soybean PI numbers of which 260 (26.9%) are still in the collection. From 1929 to 1932 Dorsett and Morse sent back 4,451 soybean PI numbers of which 986 (22.2%) are still in the collection.

(2) A statistical history of soybean introduction.

(3A) Soybeans introduced from 1900 to 1944 by country and within country by year.

(3B) Soybeans introduced from 1945 to 1977 by country and within country by year.

(4) Number of strains in the Collection by country.

(5) Number of strains in the Collection by maturity group.

Origins of introduced soybeans which became U.S.
Canadian named varieties.
Origins of soybean strains identified by FC numbers.
Origins of soybean strains identified by PI numbers.
Note: This unpublished typescript was updated and published in two volumes in 1987 as INTSOY Series No. 30 and in 1989 as INTSOY Series No. 31. Both are extremely useful and interesting. Address: Urbana, Illinois.


• Summary: A good, detailed biography of this pioneer soybean breeder, taken from many sources. Dr. Woodworth was the first soybean geneticist. In this chapter is printed the memorial tribute, from Dr. D.E. Alexander’s files, to Dr. Woodworth by his colleagues at the time of his passing.

“Agricultural science and the Illinois farmer lost immeasurably in the passing of Clyde Melvin Woodworth on May 23, 1960. A quiet, sincere, modest, tireless worker, Dr. Woodworth had devoted 36 years to the service of agriculture in the University of Illinois College of Agriculture and the Agricultural Experiment Station when he retired on August 31, 1956. Born in Fulton County, Illinois, in 1888 and reared in Oklahoma, he received his undergraduate training at Oklahoma A. and M. College. He pursued graduate studies at the University of Wisconsin, where he received the M.S. degree in 1914 and the Ph.D. degree with a major in genetics in 1920.

“Dr. Woodworth was assistant in agronomy at South Dakota State College for three years, instructor in genetics at the University of Wisconsin for six years, scientific assistant in the U.S. Department of Agriculture for one year, and assistant pathologist in the U.S. Department of Agriculture for one year. He came to Illinois in 1920 as assistant professor of plant breeding, and he was appointed associate professor in 1923 and professor in 1929. His title was changed to professor of plant genetics in 1931.

“As chief of the Plant Breeding Division of the Agronomy Department, Dr. Woodworth made many contributions as a teacher. Being kindly and approachable, he was sought out by students, whom he always found time to advise and counsel. During his period of active service he directed the training of 39 graduate students who obtained their Ph.D. degrees, besides a large number of master’s degree students. These individuals are now teaching, doing research, or serving in administrative positions in many states and foreign countries.

“Through his chosen field of work, plant genetics, he made many contributions to the improvement of crop plants. He was solely responsible for developing the Illini and Chief varieties of soybeans, and he had a large part in developing the Lincoln soybean, which was released jointly by the University and the U.S. Regional Soybean Laboratory. He also devoted much time and energy to the improvement of broomcorn. Two new varieties came from his efforts, the Okaw released in 1952 and the Clyde in 1958. He also conducted extensive research in the genetics of corn and soybeans. For his work he was widely recognized and was made the recipient of high honors.

“He was the author or joint author of 52 scientific publications. Most of them report the results of genetic and plant breeding research with corn, soybeans, wheat, Datura, barley, oats, castorbeans, and broomcorn. He was senior author of an important research paper titled ‘Fifty Generations of Selection for Protein and Oil in Corn.’

“Biographical sketches of Dr. Woodworth appear in Who’s Who in America and in American Men of Science. He held membership in the American Association for the Advancement of Science, the American Society of Naturalists, the Genetics Society, the American Breeders Association, and the American Society of Agronomy, of which he was a Fellow. He was also a member of Alpha Zeta, Phi Sigma, Gamma Alpha, Gamma Sigma Delta, Phi Kappa Phi, and Sigma Xi [pronounced “kai”]. He was past president of the Illinois chapters of Gamma Sigma Delta and Sigma Xi.

“Being cooperatively minded, Dr. Woodworth was appointed to serve on many departmental and all-University committees. He was an active church man, being a member of the Presbyterian Church of Urbana since 1920 and an elder since 1927. He took an active part in organizing the Illinois Seed Producers Association and the Illinois Crop Improvement Association. He was an honorary member of the American Soybean Association and the Illinois Seed Dealers Association.

“We, his colleagues, express our respect and appreciation of him both as a member of the staff of the University of Illinois and as a friend and associate. We also record our sense of loss in his death. We move the adoption of this brief memorial and recommend that copies be sent to the members of his family.


• Summary: A good, detailed biography of this pioneering USDA soybean breeder and germ-plasm collection curator.

“Soybean Genetic Improvement In the Midwest
“It was the writer’s great pleasure to interview one of our nation’s top geneticists, on a beautiful sunny morning in mid-June, at the Agronomy South Farm. Dr. Bernard greeted us with a friendly smile, and after exchanging pleasantries I was immediately aware that here was a man who is tremendously enthused with the work he chose to make his life’s vocation. During the span of our interview, I found Dr. Bernard to be a modest man, quick to praise his colleagues and fellow research geneticists, minimizing the brilliant work he himself has done.

“During the interview the writer learned that Funks Seeds International had presented Dr. R.L. Bernard with an award for his work in plant genetics. For our story about Dr. Bernard’s work, we are reprinting, by permission, much of the information that was prepared by Dr. R.L. Bernard relating to his work. Here are his comments:

“Dr. Bernard said he arrived in Illinois in 1954, when soybeans were already a well-established crop, occupying 4.3 million acres in the state or 27 percent of the nation’s total acreage. Although it was generally regarded as a ‘new’ crop (by some of his colleagues as a temporary crop, somehow the result of war-time shortages and disruption) it actually had been well established in Illinois since 1922, the year in which Illinois became the leading state both in total production and in area, a position which it has held ever since.

“Because of the long-term importance of the soybean crop in Illinois, the University of Illinois was a natural choice for a major center of soybean production research. The U.S. Regional Laboratory was established here in 1936, and through its cooperative research program with state agricultural experimental stations throughout the soybean growing area, it became the coordinating center for the public soybean breeding program. It also became a focal point for soybean production research by serving as an analytical laboratory for protein, oil, and other constituents for soybean researchers throughout the United States by distributing reprints and other publications, by providing seed and information from a large soybean germplasm collection, and especially by sponsoring periodic regional meetings of soybean researchers.

“Dr. Bernard said he was hired by Herbert Johnson, head of soybean investigations for USDA in Beltsville, Maryland. His research in soybean breeding and genetics at the regional soybean laboratory was closely integrated with the national USDA soybean production research effort. As a young beginner, Dr. Bernard worked under the guidance of Dr. Johnson and J.L. Carter, who was head of the laboratory until 1966. His work was coordinated with that of other members of the research team—Physiologist Robert W. Howell, Pathologist Donald Chamberlain, Oil Chemist Floyd Collins, and Protein Chemist Orland Krober.

“There was close coordination between Dr. Bernard’s work and that of Leonard Williams, whose program of breeding and genetic research at the University of Missouri was related to what Dr. Bernard was undertaking. Dr. Bernard said Williams’ experience was invaluable to him, as was that of Dr. Albert Probst at Purdue University, Dr. Robert Weber at Iowa State University, and Dr. Edgar Hartwig in Mississippi.

“Regional Testing Program: One of Dr. Bernard’s major duties in the soybean laboratory was to coordinate the Northern Uniform Soybean Tests, which had been established by Dr. Carter and Dr. Williams. These were the final tests before varieties were released to the farmer. Dr. Bernard said each spring they procured, packeted, and mailed out seeds and prepared pertinent entry lists and instruction sheets for 30 to 45 cooperators in 19 states and two provinces in Canada.

“Ruth Lawrence worked in his laboratory many years and directly supervised the seed handling and tabulated the data. She had a region-wide reputation for diligence and the attention to detail and accuracy that were so important to the success of these tests. After her retirement in 1970, preparation of the seeds and summarizing of the regional data was ably handled by Donald A. Lindahl. Working with them, Dr. Bernard coordinated the tests from 1954 to 1973, when the job was transferred to J.R. Wilcox at Purdue to allow Dr. Bernard to concentrate on the ever-growing germplasm collection.

“During the 1954-1973 period the varieties released from this regional program occupied virtually all the acreage in the northern United States and Canada. Major midwest breeding programs during this period consisted of one here and three in Missouri, Indiana, and Iowa as already mentioned, and that of J.W. Lambert at the University of Minnesota. It was unusual for such a large and important crop to be served by so few variety developers. The new varieties produced were usually better than the Chinese varieties they replaced in lodging resistance, shattering resistance, higher oil content with acceptable protein content and, of course most important, improved seed yield.
“Illinois Breeding Program: Dr. Bernard’s breeding program to some extent followed up on work begun by his predecessors Leonard Williams, 1928 to 1950, and Robert Osler, 1950 to 1953. From material they had initiated, the variety Shelby was released in 1958 and Wayne in 1964. Wayne was particularly successful and became, for a time, the most widely-grown variety in the midwest.

“A very important goal of Dr. Bernard’s breeding effort was to develop pest resistance. In one of his early projects, resistance to phytophthora root-rot was transferred to several commercial varieties by the first successful use of the backcross method in soybeans. This disease, first identified in Illinois in 1955, was causing considerable damage in low-lying areas of the state and much more extensive damage in northeastern Indiana, in Ohio, and in Ontario. A few commercial varieties were resistant to phytophthora, but several of the most-popular varieties at that time were unusually susceptible, and this disease caused severe economic losses in the 50’s and early 60’s.

“Dr. Bernard’s initial work with phytophthora root-rot was done with James Gerdemann and Maurice Kaufmann, plant pathologists at the University of Illinois. They developed a quick inoculation technique by which resistance could be ascertained within ten days after planting the seeds in the greenhouse, and soon identified a major gene for resistance. Using the back-cross method, Dr. Bernard transferred this gene to several of the major commercial varieties, including Clark 63, Harosoy 63, and Chippewa 64 (the year of release of the disease-resistant version was added to the name of the susceptible variety to distinguish it). Charles Creemens, USDA agricultural technician working with Dr. Bernard, did or supervised most of the cross-pollination and disease inoculation, and Donald Chamberlain, USDA pathologist, provided the inoculum. The new disease-resistant varieties were rapidly accepted by farmers and by 1966 these and other Illinois-developed varieties occupied over 60 percent of the midwest acreage and over 90 percent of the acreage in Canada.

“During this period, several other backcross-derived phytophthora-resistant varieties were developed and made available to breeders as germ-plasm releases. These included resistant versions of the susceptible varieties Adams, Chippewa, Clark, Harasoy, Wayne, Kent, Lindarin and Shelby, the latter three developed in cooperation with the Purdue team of Albert Probst, Kirk Athow and Francis Laviolette. Some of the varieties also had added bacterial pustule resistance and yellow hilum, instead of black hilum, which is undesirable for some human food uses.

“For several years it seemed the phytophthora problem had been solved, but then root-rot occurred in some fields of resistant varieties and was identified as a new race of phytophthora. On further study, pathologists identified several distinct races of pathogen. Fortunately resistance to each race has been found in the germ-plasm collection; however, the breeder is faced by the multiple task of breeding for resistance to all races. Mr. Creemens and Dr. Bernard are working on the problem and the Illinois Agricultural Experiment Station is releasing two of their varieties this year, Williams 79 and Corsoy 79, which are resistant to seven of the nine known races” (Continued).


• Summary: (Continued): “Another major disease, only recently widely found in the midwest, is soybean cyst-nematode. In 1966, although it was present in Illinois in only a few southern counties, Dr. Bernard began a breeding program for cyst-nematode resistance in cooperation with the Missouri Delta Center at Portageville, Missouri. Testing for cyst reaction is done in winter in the Delta Center’s greenhouses under the direction of Dr. Grover Shannon, and agronomic evaluation is done in Illinois. Last year, Franklin was released from this program to replace the old variety Custer, the only other northern variety (maturity Group IV or earlier) with resistance to soybean cyst-nematode. Earlier varieties with resistance are now being tested. Some have advanced to the regional tests and will be released for commercial production as soon as the most satisfactory one or ones can be identified.

“Other pests that have received attention include leaf-spot diseases, brown stem rot, and the Mexican beetle. Clark 63 (developed cooperatively with Dr. Williams in Missouri), Wayne, Williams, Woodworth, Union, and Franklin were also selected as resistant to bacterial pustular leaf spot. They have become the major Group III and IV varieties in the southern part of the midwest, and that formerly prevalent disease has become a rarity. On the other hand, downy mildew leaf-spot has become very prevalent in the area because of the high susceptibility of Clark 63, Wayne, Williams, and Woodworth.

“Dr. Bernard has identified a gene for complete resistance to downy mildew leaf-spot and has incorporated it into the variety Union, giving some hope for complete control of this disease as additional resistant varieties are released. Brow stem-rot is one of the most prevalent soybean diseases and appears to increase with frequency of soybean growing. They have been successful in developing productive varieties with resistance to brown stem-rot, discovered by Dr. Chamberlain, at Urbana.

“An extensive program has also been launched for breeding resistance to Mexican bean beetle in cooperation with entomologists here, at Purdue University in Indiana,
and at Beltsville Agricultural Research Center in Maryland. Mexican bean beetle has not heavily infested Illinois soybean fields yet, but with heavy infestations in nearby Indiana and Kentucky, as well as in Maryland, it seems wise to start this effort before the problem actually develops here, especially since it will take many years to produce a commercially accepted resistant variety.

“In addition to working on specific pests, Dr. Bernard has been breeding for improved seed quality, especially in varieties adapted to southern Illinois, where quality is so frequently a problem. The related varieties Williams, Woodworth, and Union have come out of this program. While there is room for much more improvement, they are superior in seed quality to the varieties they replaced, and are also more resistant to lodging and shattering. All three varieties have gained wide farmer acceptance. Williams is currently the most popular American variety and is grown on about 9,000,000 acres annually (1979-1980 figures). Dr. Bernard’s efforts are now being turned toward selection for resistance to diaporthe, a fungus involved in the seed-quality problem, and for resistance to soybean mosaic and bean-pod mottle, two virus diseases Dr. Bernard also suspects contribute to the seed-quality problem.

“Germ-Plasm: Maintenance of the northern section of the USDA’s soybean germ-plasm collection has been one of Dr. Bernard’s major responsibilities. The USDA’s collection was initiated in 1949, when soybeans had become an important enough crop to justify a permanent collection of all available varieties from throughout the world.

“Before then, many hundreds of soybean varieties had been introduced, especially from eastern Asia, the native homeland of the soybean, but most of them had been discarded if not found immediately useful. In 1949, at the instigation of Martin Weiss, head of the USDA soybean investigations, the USDA and the experiment stations were solicited and all varieties of soybean still in existence in this country were gathered together. They totaled about 2,000. The early-maturing ones were to be maintained at the University of Illinois by Leonard Williams of the U.S. Regional Soybean Laboratory, and the late ones (Group V and later) were to be maintained by Edgar Hartwig at the Delta Branch Station in Mississippi.

“Thus, when Dr. Bernard arrived in 1954, the collection was just about four or five years old and there was much cataloging, identification, and purifying of varieties to be done. In the next few years, performance tests were run for all 2,000 varieties and evaluation reports were circulated to soybean researchers throughout the world. Thousands of seed packets are sent each year to researchers and these have been the basis for successful searches for resistance to many pests and of other research requiring diverse germ-plasm.

“At first, the collection grew rather slowly. Foreign varieties were sent to the United States from time to time, but few active solicitations were made. In the past eight years, the collection has grown much more rapidly, partly because of trips Dr. Bernard made to Japan and South Korea in 1974. While in those countries Dr. Bernard collected specimens himself and made contact with researchers and institutions that had soybean collections. Subsequently we have received a large number of varieties from Korea and Japan. The Urbana collection, which totaled about 2,000 varieties when Dr. Bernard began working with it, now includes over 6,000 domestic and foreign varieties of cultivated soybeans. Just within the past year the Soviet Union sent us over 1,500 additional varieties, which are being added to our collection.

“During Dr. Bernard’s trip to Japan, Korea, and China, he collected some samples of the wild soybean (Glycine soja), which had never received much attention here or in Asia. From seven accessions previous to 1968 the wild soybean collection has grown to include 558 strains, which provide an interesting subject of study for those interested in the evolution of the soybean, and are a diverse potentially new source of pest resistance and other traits desired by U.S. soybean breeders. In addition to the wild soybean, there are several other species in the genus ‘glycine,’ all of them perennial and native to Australia, with the range of some extending to southeast Asia and the nearby Pacific islands. When the collection was begun, most American soybean researchers were unaware of these near relatives of the soybean. One or two accessions of what was then known as Glycine javanica, the ‘perennial soybean,’ were in the initial collection at Urbana, and we have since obtained several dozen accessions. Although the taxonomists have now removed this species to the genus Neonotonia it still has some interest as a not-too-distantly related legume species and also is a forage crop in its own right in many tropical areas.

“The other species of the genus were completely unknown to American agronomists until Dr. Bernard obtained some seeds of Glycine tabacina, originating in Australia. These were planted in the agronomy greenhouse in January, 1958, and produced a small, delicate, viney plant with soybean-like flowers and very small pods and seeds. Seeds of several other species have been received and grown in the greenhouse in subsequent years, and this collection has stimulated the study of Glycine in this country. Theodore Hymowitz and Christine Newell of the Department of Agronomy, have been particularly active in taxonomic and cytological studies of perennial Glycine species. Their work has greatly enlarged the collection of these species and augmented our knowledge about them.

“Current and Future Plans: Today, as more and more researchers at both public institutions and private seed companies are getting into soybean breeding, Dr. Bernard is concentrating more on resistance to pests important to the Midwest, or of potential importance, and on basic genetic studies which he hopes will be useful to the many now engaged in soybean research. In addition, Dr. Bernard
which provided food and important crops were cotton, maize, tobacco, and wheat were settling and developing the Americas. The historically "Soybeans were not an important crop when Europeans western Europe and Japan, and developing markets in Latin major export commodity serving strong and stable markets in crop produced in the U.S., exceeded only by maize, and are a example of a crop that advanced in importance as quickly past, nor in the history of civilization, is there another agricultural and economic sectors. Nowhere in the country's with which it grew to play a dominant role in the nation's economic foundation of the New World. "The soybean industry in the United States is unique for the speed with which it grew to play a dominant role in the nation's agricultural and economic sectors. Nowhere in the country's past, nor in the history of civilization, is there another example of a crop that advanced in importance as quickly as the soybean. Soybeans now are the second most valuable crop produced in the U.S., exceeded only by maize, and are a major export commodity serving strong and stable markets in western Europe and Japan, and developing markets in Latin America and elsewhere.

“Soybeans were not an important crop when Europeans were settling and developing the Americas. The historically important crops were cotton, maize, tobacco, and wheat, which provided food and fiber, and were items of commerce that formed the economic foundation of the New World. The first report of soybeans in the U.S. was 1804, when soybeans were referred to briefly in an article by J. Mease, a physician in Pennsylvania who was an enthusiastic gardener. Mease did not report the source of the soybeans in his garden but presumably they came from Asia via Europe. [* Footnote. See ‘Introduction of the soybean to North America by Samuel Bowen in 1765,’ by Hymowitz and Harlan, in Economic Botany, vol. 37 (in press)]. By the end of the 19th century, the crop was known throughout the eastern and central parts of the U.S.

“How did the soybean miracle come about? How and why was it possible for soybeans to penetrate and dominate agricultural economic systems that had been stable for centuries?

“The soybean story is an illustration of the right commodity in the right place at the right time. Many factors came together to create a market and a new product which could respond to demand. Mechanized agriculture was reducing the use of animal power. The number of draft animals was declining, releasing millions of hectares that had been used to produce feed for horses and mules. Synthetic fibers were replacing cotton. Production of surplus crops was being curtailed by government policy. Meanwhile, a national shortage of vegetable oils was becoming more severe as population grew. There was growing appreciation of the importance of well-balanced protein in human and animal diets. It was known that soybeans were processed for oil and meal in China. The situation was favorable for a new crop that would maintain farm income and contribute to the national economy. Soy-beans could satisfy market demand, and proved well adapted to existing farming systems, especially in the maize system of the northern states and the cotton system of the south. The fact that soybeans yield two products, highly unsaturated oil and protein with amino acid distribution similar to cow’s milk, brought acceptance by different groups of users and provided stability as markets for oil or protein meals fluctuated. The most important single event in soybean history in the U.S. was the appointment of W.J. Morse in 1907 as director of soybean research in the U.S. Department of Agriculture (USDA). Earlier, C.V. Piper initiated work on soybeans in the USDA. For more than 40 years, Morse promoted research, education, production, and marketing of soybeans. He was instrumental in the organization of the American Soybean Association in 1921 and served three times as its president. Morse traveled widely in the U.S., offering seed and persuading farmers to try this new crop. He spent 1929 to 1931 in China collecting soybean seeds. He led the cooperative research program of the USDA and state agricultural experiment stations, which began in 1936, until 1949.

“Soybean research began at the University of Illinois, as at many other universities, before the beginning of the 20th century. Our first research bulletin concerning soybeans was published in 1897. Soybeans have been grown at the Agronomy South Farm every year since the farm’s establishment in 1903. The first breeder/geneticist with primary responsibility for soybeans at the University of Illinois was C. M. Woodworth, who joined the faculty in 1920. Woodworth was a geneticist and constructed the first chromosome map for soybeans. He developed the cultivars Illini and Chief and made the cross which led to the development of the cultivar Lincoln. Lincoln, released jointly by the University of Illinois, USDA, and several other universities in 1943, was the first cultivar to be developed from a purposeful hybridization, and the first to be produced from the cooperative program formalized in 1936.

“A contemporary of Woodworth, J.C. Hackleman, was a crop extension specialist in Illinois from 1919 until he retired in 1956. Hackleman was one of the organizers of the Illinois Crop Improvement Association and an ardent supporter of soybeans. He and his extension colleagues in other
states appreciated the potential of soybeans and strongly encouraged farmers to try them. Along with Hackleman and Woodworth, W.L. Burlison, head of the Department of Agronomy at the University of Illinois from 1921 to 1951, was among those instrumental in establishing Illinois as the principal soybean producing state.

“Developments in Illinois were paralleled in other universities and states where interest in soybeans was growing. J.L. Carter, a graduate student at the University of Wisconsin, was hired by USDA as a soybean agronomist in 1928 and stationed at Holgate, Ohio. In 1935, Congress enacted the Bankhead-Jones Act which provided for regional research on major agricultural problems. In 1936, under the authority of this act, the U.S. Regional Soybean Industrial Products Laboratory was established at the University of Illinois, and Carter moved to Illinois to lead the production research at the Laboratory. In 1942, the utilization research was transferred to the Northern Regional Research Laboratory at Peoria, Illinois. The production research program remained at the University [in Urbana]. Plant breeders were employed by USDA and stationed at Illinois, Iowa State, and Purdue (Indiana) universities, and later at Stoneville (Mississippi), North Carolina State University, and the universities of Florida, Minnesota, and Missouri.

“The cooperative production research program of USDA and the states has had a strong foundation in breeding and genetics. Until recently, virtually all soybean production in the U.S. involved cultivars developed in the cooperative program of USDA and state breeders. Clark, Hawkeye, Lee, Wayne, and Williams are examples of cultivars developed in the cooperative program which have achieved dominant positions in various soybean producing areas. Some originated in Canadian programs with which U.S. researchers have cooperated closely and effectively. The group of pioneering soybean breeders, who deserve much of the credit for the success of soybeans, included R.L. Bernard, E.E. Hartwig, A.H. Probst, C.R. Weber, M.G. Weiss, and L.F. Williams. Approximately 25 states participate in the cooperative program and have designated agronomists as collaborators. However, few had active state-employed breeders prior to 1960. One state breeder who should be mentioned with the above is J.W. Lambert, University of Minnesota.

“After the retirement of Morse, Weiss was leader of soybean investigations in USDA from 1949 to 1953. Then came H.W. Johnson, who, next to Morse, probably had the greatest influence on the development of soybean research. Johnson led soybean investigations from 1954 to 1964, a period during which the soybean cyst nematode was found for the first time in the U.S., the first disease-resistant cultivars were developed, and a significant increase in size and scope of soybean research staff occurred.

“Prior to 1965, the only company with a soybean cultivar development program was Coker’s Pedigreed Seed Co., South Carolina, where H. Webb was the soybean breeder. In 1965, a group of midwestern seed companies formed the Soybean Research Foundation, Inc., and employed A.L. Matson of Missouri as a soybean breeder. Following enactment of the Plant Variety Protection Act of 1970, which enables the developer to retain ownership and control of a cultivar as if it were patented, several companies established soybean cultivar development groups. The act stimulated interest in new techniques, such as genetic engineering, and it is probable that company-developed cultivars will occupy more of the market in the future.

“B. Koehler, a contemporary of Woodworth at Illinois in the 1920’s, was one of the first pathologists to become interested in soybean diseases. A few years after establishment of the cooperative program with breeders in 1936, plant pathologists were added. W.B. Allington joined the USDA group at Urbana during World War II and D.W. Chamberlain joined in 1947. Pathologists have worked closely with soybean breeders since breeding for disease resistance has proved to be a powerful means of controlling soybean diseases. Soybeans so far have been spared the ravages of a major pestilence, due at least in part to vigilance of soybean workers and some brilliant research to deal with emerging problems. Phytophthora rot devastated fields in parts of Ohio and Indiana and was beginning to appear elsewhere about 30 years ago.” Continued. Address: Prof. Emeritus and former head, Dep. of Agronomy, Univ. of Illinois, and former leader, soybean investigations, USDA.

638. University of Illinois (Urbana), College of Agriculture, Dean’s Office, Subject Files, 1895-1983, Record Series No. 8/1/2 (Finding aid for archival collection). 1983. Urbana, Illinois: University of Illinois. 17 boxes relate to soybeans. • Summary: Record Series No.: 81/2. Record Series Title: Subject Files, 1895-1983. Record group: Agriculture. Subgroup: Dean’s Office. Arranged: By type of material and chronological thereunder. Date received: 1966-1967/02, 1971/11, 1993/03. Volume 270.3. Description: Subject files including photographs, correspondence and programs, publications, clippings, scrapbooks, obituaries, etc. (p. 2-3)


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Box 156–USDA–Regional Laboratories, Soybean Laboratory, 1936-1953. See also: Project Coop Soybean Lab.

Box 158: Soybean Laboratory (General), Reports-Annual, 1955-1964. See also: Project Cooperative, Soybean Laboratory (Regional).


• Summary: “As a commercially significant crop in this country, soybeans have a short history and have been important in the north-central states only since 1922. They were grown earlier in the southeast, especially North Carolina, as a forage crop. Breeding in those early years consisted of field trials of cultivars introduced from Asia and choosing those best adapted and most productive for the local farmers.

“Soybeans were experimented with in small plantings and occasionally grown on a commercial scale during the 1800’s. According to Piper and Morse (1923) no more than eight cultivars were grown in the U.S. prior to 1898. In that year the U.S. Department of Agriculture (USDA) began a program of recording introduced cultivars of crop plants under “PI” designations. Through this system, large numbers of soybeans were introduced and grown in experimental plots. The better ones were sent out to various state experiment stations for further testing.

“From 1898 to 1923 more than 1,000 cultivars were introduced, most sent by research stations or grain merchants in Asia, or brought in by agricultural explorers, diplomats, missionaries, or other travelers to Asia (Table 1). Some of the most successful cultivars were introduced into the U.S. during this period. As a result of the increasing success of soybeans, the USDA sent plant explorers to Asia (notably P.H. Dorsett and later W.J. Morse) and from 1924 to 1932, 6,651 soybean accessions were introduced. During the next 40 years little effort was made and only a few soybeans were introduced each year. With renewed interest since 1975, more than 5,000 strains have been introduced.

“During the early periods of introduction no attempt was made to save all the strains introduced and a majority of them were discarded. Only the best were kept along with some of the unusual types. In 1949, in recognition of the

<table>
<thead>
<tr>
<th>Period</th>
<th>Years</th>
<th>Number of soybean PI numbers</th>
<th>Rate/yr</th>
<th>Number in germplasm collection</th>
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</thead>
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<td>26</td>
<td>1,053</td>
<td>40</td>
<td>132</td>
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<td>1924-1928</td>
<td>5</td>
<td>1,878</td>
<td>375</td>
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<td>1,193</td>
<td>1,051</td>
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<td>1945-1974</td>
<td>30</td>
<td>2,556</td>
<td>85</td>
<td>2,095</td>
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<td>1975-1980</td>
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<td>Total or average</td>
<td>83</td>
<td>15,430</td>
<td>186</td>
<td>9,251</td>
</tr>
</tbody>
</table>
need to preserve the germplasm of this important crop and make it readily available, the USDA established a soybean germplasm collection. The early strains (Group IV and earlier) are maintained at the University of Illinois at Urbana-Champaign and the later ones (Group V and later) at the Delta Branch Experiment Station, Stoneville, Mississippi. The collection was initiated by M.G. Weiss, head of USDA’s soybean production research, and J.L. Cartter, head of the U.S. Regional Soybean Laboratory at Urbana. The original curators were E.E. Hartwig at Stoneville and L.F. Williams at Urbana. Hartwig is still curator of the southern collection. R.D. Osler succeeded Williams in 1951, and I became curator of the northern collection in 1954.

“The guiding principle has been to maintain the basic genetic diversity of the soybean and its wild relatives by maintaining all cultivars and introductions representing different germplasm, regardless of their apparent economic worth, and to make them readily available for research purposes.

“In 1949 and 1950, the USDA and state agricultural experiment stations were requested to submit samples of all introduced strains and old U.S. cultivars. From the 7,873 PI strains introduced before 1945, 1,659 strains were obtained, including 138 old U.S. cultivars that originated from introductions (Table 1).

“Introducted strains plus American-developed cultivars have been added to the collection since then, until today the number of soybean entries totals over 9,500 about 70% are in the northern collection and 30% in the southern one. They were drawn from 60 countries, but the majority came from eastern Asia and especially from China (1,202 strains), Japan (1,721), Korea (3,041), and the Soviet Union (1,847). Soybeans from these four countries comprise 83% of the collection and many of the strains received from other countries originated from these four. At Urbana, in addition, there is a genetic collection (mutations, oddities, isolines, etc.) of several hundred lines of interest in qualitative genetic studies. We maintain also a collection of wild soybeans, Glycine soja. The wild soybean accessions range in maturity from Group 00 to X and were obtained in the USSR (34 accessions), China (28), China (Taiwan, 2), Korea (313), and Japan (183). Because they can be crossed with cultivated soybeans, they are an interesting potential source of useful germplasm. We have also a collection of six perennial species of Glycine. These species are native to Australia and some range into the south Pacific islands and south China. Though not closely enough related for easy crossing with soybeans, these species are of interest in studies on the origin of soybeans and botanical relationships within the genus. If the crossing barrier can be overcome, they may supply the soybean breeder and geneticist with some interesting and diverse material.

“The soybean germplasm collection is used actively by researchers throughout the U.S. and from many other countries. In 1982, from the collection at Urbana, we sent out over 40,000 seed lots.

“We hope to obtain as much of the world’s wild soybean germplasm as possible, and to complete our collections from Europe, the USSR, southern Asia, South Korea, and Japan. Our greatest need is for further collections from North Korea and China, especially southern and western China, since most Chinese strains in the present collection have come from northeastern and north-central China.

“Beginning in the late 1930’s and 1940’s, soybean breeders in the USDA-state experiment station breeding programs, through hybridization and selection, developed improved cultivars with higher yielding ability and resistance to lodging and shattering and to prevalent diseases.

“In the future, soybean pests and diseases will likely be an even more important factor in soybean production. Soybean breeders will be putting more emphasis on increased cultivar resistance and will be selecting for multiple resistance to different races and types of diseases. Breeders constantly are looking for the traits that contribute to improve yield. Because of the low heritability of yield, selecting for component traits rather than directly for yield might improve breeding efficiency. Unfortunately, except for pest and disease resistance, no helpful physiological or morphological traits have been found.

“Improvement in yield through improved soybean cultivars has been slow but steady over the past 50 years. No slowdown has yet occurred and presumably further improvement is possible working with the rather narrow base of just 20 ancestral cultivars. A major problem for the breeder is how to effectively use the large number of germplasm lines and find sources for further improvement.

“Today over half the acreage in the north central states is planted to varieties developed by private seed companies. However, the varieties trace their pedigrees directly to some of the recently widely grown public varieties. Thus they represent not a change in direction but the latest round in the process of variety improvement. It has continued steadily for the past 50 years.

“Advances in the future will be more difficult than in the past, but with the large number of specialists working on the problem, the prospects are bright.” Address: Research Geneticist, ARS-USDA and Agronomy Dep., Univ., of Illinois.


• Summary: An excellent historical overview. “Perhaps the most important person in soybean history in the United States was William J. Morse, who was appointed in 1907 to be in charge of soybean research in the US Department of Agriculture.” Morse “led the development of the cooperative
During this period "the soybean cyst nematode was found for the first time in the United States, the first disease-resistant soybean varieties were developed, and a significant increase in the size and scope of soybean research staffs occurred, including the beginnings of the major increase in research on soybean physiology."

Before 1965, the only U.S. company “with a soybean development program was the Coker’s Pedigreed Seed Co. of South Carolina, where Henry Webb was the soybean breeder. In 1965 a group of midwestern seed companies joined to form the Soybean Research Foundation, Inc. (S.R.F.), and employed A.L. Matson of Missouri as a soybean breeder. During the 1970s many companies established soybean variety development groups following enactment by Congress of the Plant Variety Protection Act of 1970. Consequently the number of varieties available to farmers has increased manyfold. In 1983 it is estimated that at least 300 different varieties were offered for sale in Illinois alone.”

Also discusses protecting soybeans from diseases, insects, nematodes and weeds, as well as plant physiologists who worked on soybeans (he pioneering work being done by Garner and Allard on photoperiodism). The Northern Regional Research Center at Peoria, Illinois; since 1942 soybean utilization research as been based here. International programs including INTSOY. Growing interest in food uses of soybeans (tofu, soymilk) including the Soycrafters Association. Rise of the soybean processing industry. The American Soybean Association. Address: Emeritus Prof., Former Head, Dep. of Agronomy, Univ. of Illinois, Urbana, IL.


• Summary: A comprehensive history of the subject. Contents: Introduction: Passed North Carolina in 1924 to become America’s largest producer of soybeans, produced over 50% of nation’s soybeans in 1930’s, reasons for success. The early years (1890’s-1919): First research April 1896, slow advancement in early 1900’s, learned of importance of nitrogen-fixing bacteria, soybean inoculation, and nodulation, slow expansion of soybean acreage until late 1910’s when demand for oats and hay decreased due to replacement of horses and mules. The 1920’s: Rapid growth to stardom, Univ. of Illinois prime supporter of American Soybean Association (ASA) from its 1920 founding, establishment of U.S. Regional Soybean Industrial Products Laboratory at Urbana campus in 1936 a major event in the university’s soybean history, cooperative effort of the 12 north central states and the USDA, establishment of northern branch of the U.S. soybean germplasm collection at the Univ. of Illinois in 1949, founding of International Soybean Program (INTSOY) from work with India. Burlison, Hackleman, and
Woodworth: Agronomists and soybean missionaries from the Univ. of Illinois. W.L. Burlison: Head of Dep. of Agronomy from 1920-1951, one of 2 prime pioneers in development of soybean industry in U.S. (with J. Morse), early life and education, one of organizers and president of ASA, worked at Univ. of Illinois. J.C. Hackleman: Extension agronomist at Univ. of Illinois, called the “soybean’s greatest missionary,” early life and education, work with soybeans, one of founders and president of ASA, publications, honors, death in 1970 at age 81. C.M. Woodworth: America’s leading early soybean breeder and first soybean geneticist, early life and education, work prior to 1920, invited to Univ. of Illinois by Prof. Burlison in 1920, new varieties of soybeans introduced, published first list of soybean genes in 1932, other work (supervision of 39 graduate students who got Ph.D.’s, 52 publications, membership in societies, organization of associations), retired 1956, died 1960. Address: Lafayette, California. Phone: 415-283-2991.


*Summary:* Dr. Circle started work at the U.S. Regional Soybean Industrial Products Laboratory (in Urbana, Illinois) in March 1937 as a junior chemist working on soy protein. Dr. A.K. Smith, head of the group, hired him. That laboratory had groups doing research on at least four different aspects of soybeans: The oil group, the protein group, the analytical group (run by Dr. Reid Milner), and one other. When most of the Lab moved to Peoria, they left only the analytical group active in Urbana. In 1942 Dr. Circle moved with his group to Peoria, but a month or so later he left and went to work for Hiram Walker in Peoria as a research chemist; the company planned to diversify into soybeans and soy protein, but it never worked out. So in 1945 he transferred to The Glidden Co. “to get back into the field that I liked.”

He began work at Glidden on 1 Aug. 1945 as Head of Protein Research under Dr. Percy L. Julian, a brilliant black scientist with a PhD—which was very unusual at the time.

Dr. Circle coined the name “Promine” and initiated the product. Initially his job was to improve on Alpha Protein and to develop new industrial applications. But management at Glidden was worried. New synthetics, such as modified resins, were starting to compete with Alpha Protein and casein for use in coatings. One big one was latex, although it was not water resistant. At that point, in 1948, he realized the future of isolates lay in food applications. So he convinced Percy Julian to let him work on edible applications. Not until 1953-54 was he able to get a pilot plant while still working on improving industrial products. The pilot plant was in the building next to the lab.

Glidden made the world’s first non-modified edible soy protein isolate. He worked for Glidden and then Central Soya until 1958. He worked for Anderson Clayton from 1967; they built a plant to make edible isolates in 1971. Address: 404 Lawndale, Richardson, Texas 75080. Phone: 214-231-4092.


*Summary:* Griffith Laboratories was founded in 1918 by a salesman of baking supplies named Enoch L. Griffith. The main first product was Aquatex, a gelatinized starch sold to the bakery trade. The company specialized in bakery supplies. The son of the founder, C.L. Griffith, is now age 92, and still active in the business.

Lou Sair was born in Canada in 1910. He graduated from the University of Manitoba with BS and MS degrees in cereal chemistry, then earned a PhD degree from McGill University (McDonald College). After working at the National Research Council on a meat problem, then Ogilvie Flour Mills and the Corn Industries Research Foundation in Missouri (on starch and cereals), he went to work for Central Soya Co. in about 1944 and began his first research on soy.

After World War II started, egg albumin (egg white) was selling for $5 a pound. In 1939 the Glidden Co.’s Soy Products Division had started making a whipping compound named Albusoy, then in 1944 Soybean Products Co. in Chicago had started selling a similar product named Soyco that was made elsewhere for them. The Regional Soybean Industrial Products Laboratory in Urbana, Illinois (after 1942 called the USDA Northern Regional Research Laboratory) in Peoria, Illinois, played a leading role in the research on whipping compounds. Sair recalls that Albusoy yielded a fairly coarse foam, so while at Central Soya he was assigned the job of coming up with a good whipping compound. He made isolated soy protein, then used a pepsin digestion to convert the isolate to a fat free compound that whipped nougats and candy very well. Used in cakes, it rose beautifully during baking, then collapsed, since it was not denatured by heat. This product, also called Soy Whip, was of excellent quality and in 1945 it was commercialized. During the 2 years that Sair was at Central Soya, he thought that soy isolates might have a place in human foods or in the food supply, other than in frills such as whipped toppings. No thought was given to using soy protein isolates in sausages, breakfast cereals, etc.

In 1946 Sair left Central Soya and Ken Gunther took over research on whipping compounds. Soy Whip continued to be a commercial product, sold to good candy accounts. Then in 1949 Dale McMillan, founder of Central Soya, decided that there was no future for vegetable proteins at Central Soya so he shut down the whole operation and licensed the rights to the whipping compound to Ken Gunther, who established his own company in 1949 in
In 1946 Sair went to work for Grif and Turner, a salesman. He was Mr. Turner, a salesman.

In 1950 Sair and Rathman (both from Central Soya) were issued a patent on an improved process for making a soy-based whipping agent. He thinks he got 2-3 patents at Central Soya on Soy Whip. Another author on one may have been Mr. Turner, a salesman.

In 1946 Sair went to work for Griffith Laboratories, where he worked in many areas. He got over 50 patents at Griffith. He thinks he has more patents as a food chemist than anyone in USA. Griffith is involved in almost everything. But his mind kept going back to the work he did at Central. Griffith had a big business in binders for sausage products, so he began to wonder if they couldn’t use a soy protein in sausages. Since Griffith was not a soybean crusher, nor a manufacturer of isolates (which have a very low yield and cause major waste disposal problems), he hit on a very simple idea called the ‘isoelectric (water) wash process’ (different from the alcohol extraction process) to make a soluble soy protein concentrate (as they named it). The yield was 70%. Sair got the first patent. He began working on development of such a product in about 1950. This was long before Sidney Circle began working on this at Glidden (note at Glidden; Circle’s was insoluble with an alcohol wash). It has a sandy texture, a completely different product. Extracting the sugars from soy with alcohol denatures the protein, so it has no emulsifying properties. It is a flaker with poor nutritional properties. But it has little functional value.

The Griffith process started with defatted soy flour, purchased from the A.E. Staley Mfg. Co., which sold them several hundred million pounds over the years. The protein was extracted from the flour, the pH lowered to 4, the sugars washed out with water, the protein neutralized, and then the protein was spray dried. The Nitrogen Solubility Index of the protein was 70%. A pound of the concentrate would do about the same job in terms of binding power as an isolate but it was much less expensive.

They went to the USDA and, after a long process, got the first approval to use soy protein concentrate in sausage—at a fairly low level.

In 1956 Griffith Laboratories introduced America’s first commercial food-grade soy protein concentrate. The demand was great for their small production. At that time Griffith was also manufacturing a lot of sodium caseinate. They couldn’t supply the market for caseinate for some applications. So Sair went to Glidden and bought some isolate. Sair thinks they were the first company that bought any soy isolate with the intention of putting it into a food. But the taste was so terrible (it was high in sulfur from Glidden’s paper coatings), that it almost ruined a few Griffith accounts. Griffith bought large quantities then gave it up because it was absolutely useless as food. Griffith was using the isolate before it was modified (ask Ed Meyer).

Years later Ralston Purina went to Griffith and asked to purchase a license on their concentrate. Griffith refused.

In the 1920s Griffith Labs got involved with manufacture of hydrolysates at their East Coast plant in Newark, New Jersey. Initially everything was made from wheat gluten. In about 1965 they began to hydrolyze soy. George Inglett was in charge, under Sair for 2-3 years doing research on hydrolysates; George is now at NRRC in Peoria, Illinois.

One of Griffith’s most interesting stories is in textured soy proteins. One of Sair’s patents may even be before ADM’s TVP. He made what was called a “structured protein.” In 1976 it was name GSVP (Griffith Structured Vegetable Protein). It is made by using soy flour by a controlled extrusion process; they controlled the pressure along the length of the extruder and at the exit from the die to give a good structure. He thinks it is greatly superior to TVP.


• Summary: 1980 Oct. 22. First Table of Contents for Soyfoods History. I started this book because Nahum Stiskin of Autumn Press refused to let us use material from our tofu and miso books in our next book, titled Soyfoods, and it’s hard to write the history portions of soyfoods. Inspired by Dr. Harry W. Miller and Henry Ford.

Dec. 9. Start to put bibliographic records on 3 x 5 inch file cards.


May 15. Make Overview into four chapters. Add Soybean Chronology, Sri Lanka, History of Soybean Production, Asian History, Berczeller, USDA.


June 6. Make Chronology Chapter 1. Make History of Soybean Production a separate chapter. Add McCoy, Soyfoods Producers in the West (Listing of companies), changed title from Soyfoods History to History of Soyfoods.

August 21. Four Soybean Processors (Staley, ADM, Ralston Purina, Central Soya), Hymowitz, Bureau of Plant Introduction.

change the order of many chapters.


Nov. 7. Set up first 3+2 character cataloging codes for Soyfoods Center library and documents, e.g. Hym-81.


Feb. 2. Microbiotics and Soyfoods, Kikkoman.


June 18. Separate Fermented Tofu and Fermented Soymilk.

July 22. Separate Soy Oil and Soybean Meal from Hydrogenated Soy Oil Products.


Oct. 25. Start using % instead of percent in Margarine chapter.

Nov. 19. Decide to do separate chapter on Lecithin.

Rettile each country from “History of Soyfoods in X” to “History of Soybeans and Soyfoods in X.”

1983 Jan. 1. Switch from 3-letter codes to 4-letter.

Hymo-73.

April 17. Changed “at” to KW = (keyword) on cards.

May 5. Dr. Fearn.

Nov. Added Cereal-Soy Blends at Flour chapter, Iowa State University, History of Soyfoods and Health Foods in Los Angeles.

1984 March. Meals for Millions, SFM-Rodale.


Oct. 31. Completely restructure Soybean Production chapter into 16 parts. Discuss each by decade.


1985 Jan. 19. Change ModProt to ProtMod, ProtIsol, etc.


April 17th. Redo outline, giving each company its own line and bibliography, like Adventists. Print outline vertically. Address: Director, Soyfoods Center, Lafayette, California 94549. Phone: 510-283-2991.


• Summary: The title page states: “Information on the origins of soybean and wild soybean germplasm including introduced and old United States and Canadian domestic varieties and foreign and domestic strains identified by FC and PI numbers up to PI 150,000 acquired through 1944 and maintained by the United States Department of Agriculture.”

Note: PI can stand for either “Plant Inventory” or “Plant Introduction.”

Contents: Foreword. Curator staff. The USDA soybean germplasm collection: Introduction, history, PI numbers, divisions of the collection, maintenance of the collection, statistical summaries, United States and Canadian varieties, foreign introductions, appendixes, abbreviations (EAS, ARS [Agricultural Research Service], ES, INTSOY, USDA, and USRSL).

Statistical tables: 1. Number of strains by maturity group (MG, p. 4). This table is divided vertically into north (MG 000 to IV), south (MG V to X), and wild soybeans. There are columns for: Old domestic varieties (before 1946), FC strains (mostly from USA), PI strains to 150,000, and total. The three maturity groups with the greatest number of strains are III (479), II (436), and IV (376)–all in the north.

2. Number of strains by country of origin (p. 5). This table is divided vertically into old domestic varieties (before 1946), FC strains, PI strains to 150,000, grand total, and wild soybeans to PI 150,000. The countries that have contributed the most strains to the U.S. collection are: China 871, Korea 335, and Japan 288.

3. Number of PI strains by year from 1898 to 1945 (p. 6). Columns show: Year. Plant Inventory volume. Initial PI designation for all crops. Number of soybean PI designations plus number of domestic varieties derived from them. Number of strains in collection each year. Accumulative total. A total of 7,867 PI soybean strains were introduced out of a total 150,209 plant introductions (about 5.2% of the total was soybeans). 413 domestic varieties were derived from these soybean introductions. The most active years for soybean introduction were 1926-1932. In 1954 there were 1,524 soybeans in the collection, or only 19.4% of those introduced with PI numbers. The rest were lost or discarded.


5. Soybean instructions from major collecting expeditions (p. 7). Frank N. Meyer in China, Korea, and USSR from 1906 to 1917 collected 114 soybean PI strains—including 1 wild soybean in 1913. P.H. Dorsett in China from 1924 to 1927 collected 969 PI strains—including 5 wild soybeans in 1925. P.H. Dorsett and W.J. Morse in China, Korea, and Japan from 1929 to 1932 collected 4,451 PI strains.

8. Source and identification of individual strains: PI strains (by year, 1907-1944, to PI 150,000; p. 24-59). A sample entry (p. 34) states: Collected in Japan by P.H. Dorsett and W.J. Morse, USDA Agricultural Explorers, in April to June 1929. Obtained at Nishigahara, Tokyo, on April 15. PI 80.466. Maturity Group V. 32 seeds. ‘Okura Maru Daizu,’ originally from Hokushu, used candied and the product is called ‘Mimame’ [sic, Nimame]. Note: Right below this is PI 80.468. Tsurunoko Daizu.

Source and identification of individual strains: Wild soybean strains (by year, 1925-1940, to PI 150,000).

Appendices: 1. PI strains from which old domestic varieties were derived. 2. Old domestic varieties introduced without PI designation. 3. Old domestic varieties of hybrid or unknown origin. 4. FC strains summarized by country and year. 5. PI strains summarized by country and year: 1898 to 1944 (PI 1 to PI 150,000). 6. Chinese location names. 7. Korean location names.


For each of these 191 varieties, a table gives the following information: Variety name, maturity group, source and other information [such as country of origin and year of introduction to the USA], prior designation [usually a PI number], year named or released, developer or sponsor, literature. The last column refers to a list of 20 bibliographic references in chronological order (from 1907 to 1977) on p. 18-19. Address: Univ. of Illinois.


• Summary: History (p. 1): “Prior to 1949 no consistent attempt was made to preserve soybean germplasm, and many introductions and old domestic varieties were discarded. The Soybean Germplasm Collection was established in 1949 with the objective to collect and maintain all significantly different soybean strains from throughout the world, with emphasis on the landraces of eastern Asia, where the soybean originated. The Collection was initially assembled by three USDA agronomists, J.L. Carter and L.F. Williams at the U.S. Regional Soybean Laboratory, Urbana, Illinois, and E.E. Hartwig at Stoneville, Mississippi.

“When the Collection was established in 1949, all available strains were obtained from the USDA and state and Canadian agricultural experiment stations. A total of 1,524 PI strains or domestic varieties derived from PI strains were recovered and are now in the collection. This compares with 7,867 introductions made from 1898 to 1944. Also recovered at that time were most of the 90 FC strains and 63 other old domestic varieties now in the collection. Many of these strains had changed because of mixture, outcrossing, selection (deliberate as well as accidental), and misidentification. Such changes have been minimized in material introduced since 1945 (numbers above PI 150,000).

The only PI strains now received but not maintained are obvious duplicates or inviable seeds.

“The PI Numbers: Each plant variety or strain introduced into the United States through the USDA system is assigned an identifying number by the Plant Introduction Office, Germplasm Introduction and Evaluation Laboratory, USDA-ARS, BARC-West, Beltsville, Maryland 20705, USA. The series began with number 1 in 1898 and passed 500,000 in late 1985.”

Divisions of the Collection: It is divided into six parts:
1. Domestic (United States and Canadian) varieties. Volume 1 includes introduced varieties named in the United States or Canada and other varieties developed before 1945.

2. FC strains. These include foreign introductions and domestic strains, many of unknown origin, and are identified by a series of numbers assigned by the Forage Crops Section of the USDA. This series was used until about 1957.

3. PI strains. These consist of foreign introductions identified by numerical designations assigned by the Plant Introduction Office of the USDA. Strains up to PI 150,000 (introduced prior to 1945) are included in this volume.

4. Wild soybeans. These are also identified by PI numbers, and strains up to PI 150,000 are included in Volume 1.

5. Genetic collection.


Division 5 and 6 are not included in this publication. Information on them is available from the curator at Urbana." Address: Univ. of Illinois.


**Summary:** As early as 980 A.D. the Chinese were using soy oil, mixed with tung oil, for caulking boats. It was widely used as an illuminant in homes and temples lit with wicked oil lamps, until the 1920s, when it was replaced by kerosene. By the 1920s it was widely used in China to make soft soaps (that were known for their ability to give a good lather in hard water), lacquers, paints, printing inks, and waterproof cloths and umbrellas.

By the 1500s, soybean cake began to be widely used in China as a fertilizer, primarily as a source of nitrogen and organic matter, but also for its content of phosphorus and potassium.

The earliest document seen that mentions industrial uses of soybeans in the West appeared in 1880, when L.C. Bryan, an American, noted that soy oil could be used as a substitute for linseed oil in paints or be burned in lamps. In 1909 soybeans were first imported in significant quantities to Europe; they were purchased solely for their oil, most of which was made into soap. The world’s first use of soy oil to make soap was in 1909 in England or Sweden. Manchuria was also soon using large amounts of soy oil in soaps. In 1909 Goessel, a German, developed and patented the first rubber substitute from soy oil. That same year, Henry A. Gardner of the Paint Manufacturers Assoc. of the U.S. began extensive research on the use of soy oil to partially replace linseed oil in paints and varnishes. In 1912 Beltzer, a Frenchman, developed a soy protein plastic, Sojalithe, which he soon produced commercially on a large scale.

By 1916 the main use of soy oil in America was in soaps, where it replaced cottonseed oil. In 1917 Satow, a Japanese, published the first of many articles from that country on the use of soybean proteins to make plastics.

The heyday of interest in industrial utilization of soybeans took place in America during the 1930s and Great Depression, spurred largely by the work of Henry Ford (who began focusing on soybean research in Dec. 1931), the Farm Chemurgic Council (founded in 1935), the Chemurgic movement, and the U.S. Regional Soybean Industrial Products Laboratory (founded 1936 at the University of Illinois). The goal was to make industrial products from farm crops to help depressed farmers. The soybean was one of the great success stories of the Chemurgic movement. In 1933, the peak year percentage-wise, a remarkable 70% of all soy oil in the USA went into industrial, non-food uses—primarily paints and varnishes, followed by soaps, linoleum, and oilcloth. Large amounts of soy flour were made into plywood glue, especially by the I.F. Laucks Co. In 1936, the peak year for publications, some 59 publications on industrial uses appeared. In 1935 the Glidden Co. in Chicago built the first small plant for production of industrial grade soy protein isolate, which they called “Alpha” protein.

Active work in this field accelerated during World War II, when soybeans were used to make products that were in short supply. In 1941, after imports of tropical oils from Southeast Asia had been suddenly cut off by the Japanese military, use of soy oil in industrial products skyrocketed to its historical peak in absolute terms; 74.25 million lb were used that year. Of this, 56% was used in paint and varnish, and 33% in soap. But by 1944 industrial uses of soy oil had fallen to only 17 million lb. During the 1950s, a period of huge surpluses for most U.S. farm crops (and of predicted soybean surpluses... which never materialized), research focused on industrial products that could alleviate the surpluses. During the 1960s, as surpluses disappeared, the concern for world hunger and protein shortages grew, and petroleum came to dominate industrial utilization, research switched from utilization to production.

This focus continued until the mid-1980s, when foreign soybean competition, largely from Latin America, and huge surpluses of soy oil led to a rebirth of interest in research on soybean utilization, especially industrial utilization, that could lead to new value-added products for new markets. Promising applications included soy oil for printing inks, dust suppressants, diesel fuels, and the like.

There was little interest, however, in food utilization research (other than soy oil) in the U.S. since the total amount of soybeans used in foods was still quite small, and soybean farmers feared that the resulting products would compete with meat and dairy products, which require the use of more soybeans.

Summary: Registration No. 226, PI 518675. The Carter variety of soybean was developed by the USDA’s Agricultural Research Service (ARS) and the Illinois and Missouri Agricultural Experiment Stations in a program to provide cultivars that are resistant to soybean cyst nematode (SCN) (*Heterodera glycines* Ichinohe) and adapted to the Midwest. Carter is named for the late Jackson L. Carter who directed production research of the U.S. Regional Soybean Laboratory at Urbana, IL, from its establishment in 1936 until his retirement in 1966.

Carter was released in 1986 to foundation seed organizations. Address: 1. USDA-ARS and Dep. of Agronomy; 2. USDA-ARS and Dep. of Plant Pathology. 1-2: Univ. of Illinois, 1102 S. Goodwin, Urbana, IL 61801; 3. Univ. of Missouri Delta Center, Portageville, MO 63873; 4. Asgrow Seed Co., P.O. Box 210, 155 North, Marion, Arkansas 72364, formerly Univ. of Missouri Delta Center, Portageville.


- **Summary:** This history starts in the 1920s and focuses on the USA, with several mentions of Japan. Discusses: Henry Ford (whose soybean suit woven of soy fibers cost an estimated $39,000), soy fiber production in Japan (in 1939 the Japanese produced 900,000 to 1,200,000 lb of it), soybean plastics, Azlon made of soy protein fiber [by The Drackett Co., Cincinnati, Ohio], the Northern Regional Laboratory (at Peoria, Illinois), soy flour adhesives for plywood, soy adhesives used in fiberboard boxes and shotgun shells, soy oil as a drying agent in paints (especially alkyd paints) and linoleum, soy protein paper coating, soy oil in fire fighting foams, as a rubber substitute (Norepel), as an anti-foaming agent, in fuels, printing inks, as a carrier for agricultural chemicals (with probable environmental advantages over petroleum-based carriers), and for control of explosive grain dust (at reasonably cool temperatures, it doesn’t readily go rancid).

One of the first major thrusts of the U.S. Regional Soybean Industrial Products Laboratory, established in 1936, was development of soybean plastics. “Isolated soybean plastic was first attempted, then abandoned. The Laboratory had difficulties increasing its water resistance. But the intractable problem was that the protein isolate plastic didn’t flow well enough to allow molding in injection dies.

“So they tried plastic made from soy meal instead. But it was even less water resistant than the protein isolate plastics, and had to be expensively treated to remove sugars and salts as well as heat-treated to denature the protein... Today over 100 million lb of epoxodized soy oil is used as a plasticizer and stabilizer for vinyl plastics. “Soy oil is an anti-foaming agent in the aerated plastics of penicillin, streptomycin and tetracyclines. An added plus is that soy oil provides nutrients to markedly increase the yield of antibiotic... Soy oil is not nearly so good a fuel as it is an anti-foaming agent. For one thing, it is too viscous for good fuel injection. It must be converted to simple alkyl esters.” But these form varnish deposits on cylinder walls and fuel inlets.

“Soy oil is coming into its own as a printing ink, relatively cheaper than the soy protein dispersions that proved too expensive in the 1940s. Soybean oil is clear so that pigment shows through better than in petroleum based inks, and soy oil ink doesn’t smudge onto your fingers like regular newsprint.

“And the use of soy ink in rural newspapers, and soy oil in agricultural chemicals and grain elevators brings an immeasurable public relations benefit to people who do business with farmers. This public relations benefit frequently offsets any additional cost of using soy oil. For instance, over 1,000 newspapers now print with slightly more expensive soy oil.

“Possibly the major factor in charting the soybean’s course was the discovery of vitamin B-12 not long after World War II. No longer was animal protein needed in poultry and swine rations. It could simply be inserted into formulations of only corn and soybean meal. Demand for soybean meal skyrocketed, and became the chief soybean product.” Address: American Soybean Assoc., St. Louis, Missouri. Phone: 314-432-1600.


- **Summary:** Martin G. Weiss, age 78, died on 24 March 1990 at Walter Reed Army Medical Center. A former division director of the USDA’s Agricultural Research Service and a retired colonel in the Army Reserve, he had lived in Beltsville, Maryland.

Born in Iowa, he was a graduate of Iowa State University. He also received a MSc degree in plant breeding and a PhD degree in genetics and plant breeding at Iowa State.

From 1936 to 1942, he worked at the U.S. Regional Soybean Laboratory at Urbana, Illinois. While there he developed three soybean varieties, including the popular Hawkeye soybean.

He served with the U.S. field artillery during World War II, then later retired from the reserves in 1971. Dr. Weiss came to the Beltsville area and began his career with the Agricultural Research Service in 1950 as an agronomist in the soybean research program. Later he became an associate director of the Crops Research Division and was an assistant to the agency’s administrator before becoming Chief of the International Programs Division in
1971; he held that position until retiring in 1973.

“In 1956 Dr. Weiss became a charter member of the International Commission for the Nomenclature of Cultivated Plants.”

“From 1974 to 1977 he worked as a consultant. His clients included the government of Iran, the United Nations Food and Agriculture Organization, and the Congressional Office of Technology Assessment.”

“His marriage to Jean S. Weiss ended in divorce.”

Address: USDA.


• Summary: “A revolution in soybean utilization has been gaining momentum since the late 1980s in the United States. It is described by phrases such as the ‘New Uses Movement,’ ‘value-added soy products,’ or ‘industrial uses of soybeans.’ But few people alive today realize that this is the third–and probably the biggest–wave of a revolution that has taken place at least twice before. The first wave, which had no name, lasted from 1909 until the end of World War I. The second wave, called the farm Chemurgic Movement, began in 1929 (at the start of the Great Depression), reached its peak from 1936 to 1941, and subsided in the late 1940s after World War II.

‘Industrial utilization of soybeans refers to uses other than for food and feed. The oil may be used, for example, as an ingredient in printing inks, diesel fuels, paints, resins, soaps, as a dust suppressant, etc. The protein may be used to make adhesives, plastics, artificial wool, paper coatings/sizings, fire fighting foams and a host of other products. Soy oil has always been more widely used in industrial products than soy protein. ‘This is the most comprehensive book ever published about industrial utilization of soybeans. It has been compiled, one record at a time, over a period of 19 years, in an attempt to document the history of this subject. Its scope includes all known information about this subject, worldwide, from A.D. 980 to the present.

“This book is also the single most current and useful source of information on this subject, since 81% of all records contain a summary/abstract averaging 181 words in length.”

“A Brief History of Industrial Utilization of Soybeans–As early as 980 A.D. the Chinese were using soy oil, a semi-drying oil, mixed with tung oil, for caulking boats. It was widely burned as an illuminant in oil lamps to light homes and temples, until the 1920s, when it was replaced by kerosene. By the 1920s it was also widely used in China to make soft soaps (that were known for their ability to give a good lather in hard water), lacquers, paints, printing inks, and waterproof cloths and umbrellas.

“By the 1500s, soybean cake began to be widely used in China as a fertilizer, primarily as a source of nitrogen and organic matter, but also for its content of phosphorus and potassium.

“The earliest known reference to industrial uses of soybeans in the West was in 1880, when Bryan, an American, noted that soy oil could be used as a substitute for linseed oil in paints, or be burned in lamps.

“The first use of the soybean for industrial purposes in the western world began in about 1909, when the price of linseed and cottonseed oils skyrocketed worldwide. Soy oil began to be used in large quantities in soaps, and experimentally in paints, first in England, then in the United States. Henry A. Gardner of the Paint Manufacturers Assoc. of the U.S. began extensive research on the use of soy oil to partially replace linseed oil in paints and varnishes. By 1916 the main use of soy oil in America was in soaps, where it replaced cottonseed oil. Manchuria also used large amounts of soy oil in soaps.

“In 1909 Goessel, a German, developed and patented the first rubber substitute from soy oil. In 1912 Beltzer, a Frenchman, developed soy protein plastic, Sojalicthe, which he soon produced commercially on a large scale. In 1917 Satow, a Japanese, published the first of many articles from that country on the use of soybean proteins to make plastics.

“The heyday of interest in industrial utilization of soybeans took place in America during the 1930s and the Great Depression, spurred largely by the work of Henry Ford, the farm Chemurgic Council (founded in 1935), the Chemurgic movement, and the U.S. Regional Soybean
Industrial Products Laboratory (founded in 1936 at the University of Illinois, Urbana). The goal was to make industrial products from farm crops to help depressed farmers. The soybean was one of the great success stories of the Chemurgic movement. In 1933, the peak year percentage-wise, a remarkable 70% of all soy oil in the USA went into industrial, non-food uses—primarily paints and varnishes, followed by soaps, linoleum, and oilcloth. Large amounts of soy flour were made into plywood glue, especially by the I.F. Laucks Co. In 1936, the peak year for publications, some 59 publications on industrial uses appeared. In 1935 the Glidden Co. in Chicago built the first small plant for production of industrial grade soy protein isolate, which the called ‘Alpha’ protein.

“Active work in this field accelerated during World War II, when soybeans were used to make products that were in short supply. In 1941, after imports of tropical oils from Southeast Asia had been suddenly cut off by the Japanese military, use of soy oil in industrial products skyrocketed to its historical peak in absolute terms: 74.25 million lb. were used that year. Of this, 56% was used in paint and varnish, and 33% in soap. But by 1944 industrial uses of soy oil had fallen to only 17 million lb.

“During the 1950s, a period of huge surpluses for most U.S. farm crops (and forecasts of soybean surpluses... which never materialized), research focused on industrial products that could alleviate the surpluses. During the 1960s, as surpluses disappeared, the concern for world hunger and protein shortages grew, and petroleum came to dominate industrial utilization, soybean research switched from utilization to production.

“The mid-1980s in America saw a rebirth of interest in research on soybean utilization, especially industrial utilization. Foreign competition from Brazil and Argentina, and huge surpluses of soy oil drove U.S. farmers, led by the American Soybean Association, to develop new value-added products for new markets.

“Statistics compiled by the U.S. Dept. of Commerce, Bureau of Census, Industry Div. (Reprinted in Soya Bluebook ‘94, p. 234) show that in the year beginning Oct. 1992 (the latest statistics available), the main industrial uses of soy oil were in resins and plastics (95 million lb.), paint and varnish, fatty acids and ‘other inedible’ (163 million lb.). These nonfood uses totaled 296 million pounds in 1992/93, accounting for 2.5% of total U.S. domestic soy oil utilization. Rapidly growing new uses included printing inks, diesel fuels, and dust suppressants—to mention but a few.

“One of the shining examples of industrial uses of soybean oil in the USA is in soy inks. In 1987 the oil from 9,000 bushels of soybeans went into soy inks, but by 1993 this figure had skyrocketed to 4,000,000 bushels—a 444-fold increase in just 7 years! In 1994 about 10% of all U.S. printing inks, about 44 million pounds, were made from soy oil. About 90-95% of all daily newspapers used soy inks for color and one-fourth of the estimated 50,000 commercial printers regularly used it.” Address: Soyfoods Center, P.O. Box 234, Lafayette, California 94549. Phone: 510-283-2991.


• Summary: When Dr. Bernard arrived at the University of Illinois in 1954, the Regional Soybean Laboratory (RSL) was located in Davenport Hall, on the campus. Jackson L. Carter was the director. Dr. Bernard thinks he was the first USDA employee who was dedicated to doing research on soybeans only. The Laboratory occupied a number of rooms, including the director’s office, a physiology lab, and analytical lab, and a seed lab.

In the late 1970s and early 1980s, the USDA regionalized its research on all farm crops—including the soybean. This effectively killed the national soybean program. In about the early 1980s, the RSL ceased to exist, but it was never formally closed. Much of the work was transferred to the University of Ohio. At this time, Dr. Bernard salvaged many of the files, containing drawers full of letters, correspondence, publications, etc.—that were about to be discarded. They are now housed at the Soybean Building at the university farm/agricultural experiment station—located about ½ mile off campus.

Among the documents salvaged were the RSLM series, which stood for Regional Soybean Laboratory Mimeograph series. These started in 1936, and some contained routine details of the daily RSL operations. Address: USDA/ARS Soybean Germplasm Collection, Room 229 EASB, 1101 W. Peabody Drive, Univ. of Illinois, Urbana, IL 61801.


• Summary: Contents: Introduction. About the tables. List of tables: Maturity groups 000 to 0: Tables (1.0) Identification and origin information for USDA soybean germplasm in maturity groups 000 to 0, FC 01.547 to PI 266.807: PI Number, accession name, country of acquisition, country of origin, year introduced or released, maturity group. (2.0) Descriptive data for USDA soybean germplasm in maturity groups 000 to 0, FC 01.547 to PI 266.807: Entry (variety name, FC number, or PI number), maturity group, stem termination (determinate, indeterminate, semi-determinate), flower color, pubescence (color, form, density), pod color, seedcoat (luster, color) buff, black, black hilum with brown outer ring, brown, gray, green, greenish brown, imperfect
black, reddish brown, tan, yellow), hilum color (same choices as seed color), other traits (seed, leaf, plant). (3.0) Agronomic data for USDA soybean germplasm in maturity groups 000 to 0, FC 01.547 to PI 266,807, grown at St. Paul, Minnesota: Entry, flowering (days after May 31), maturity (days after May 31), lodging (score), height (cm), stem termination score, shattering score, seed (quality score, weight {100 gm/seed}, yield {1000 kg/ha at 13% moisture}). (4.0) Seed composition data for USDA soybean germplasm in maturity groups 000 to 0, FC 01.547 to PI 266,807, grown at St. Paul, Minnesota: Entry, maturity group, seed composition (oil %, protein %), protein composition (methionine as a percentage of total protein), oil composition [fatty acids] (linoleic %, linolenic %).

Maturity groups I and II: The tables are identical in format to those above except that the soybeans were grown at Urbana, Illinois, and there is information on disease reaction to phytophthora rot and pythium rot.

Maturity groups III and IV: The tables are identical in format to those above except that the soybeans were grown at Urbana, Illinois, and there is information on disease reaction to phytophthora rot and pythium rot.

“Introduction: This publication consolidates information contained in U.S. Regional Soybean Laboratory Manuals 223 (July 1965), 230 (September 1966) and 238 (April 1969) on the origin, descriptive characteristics, agronomic performance, seed composition and disease reaction data of soybean (Glycine max (L.) Merrill) germplasm accessions FC 01.547 to PI 266,807 in maturity groups 000 through IV. Also included are cultivars, in these same maturity groups, developed at public institutions in the United States and Canada, and released by 1966. The data presented in Tables 3 and 4 are the same as in the original publications except that units on weight and height have been changed to metric and some maturity groups have been changed. In Table 1, some changes have been made for accession name and country of origin based on more recent information. The pedigrees of domestic cultivars are not included but are available in USDA Technical Bulletin 1746. Some origin details for named cultivars and FC accessions were removed but are available in the USDA Soybean Germplasm Collection Inventory, Volume 1, INTSOY Series Number 30. In Table 2, data on stem termination was added, the information on pubescence was expanded and some descriptions have been updated. These data can also be obtained through the Germplasm Resources Information Network (GRIN), Database Management Unit, USDA-ARS [Agricultural Research Service], BARC West, Beltsville, Maryland 20705. Evaluation publications for PI numbers higher than PI 266.807 can be obtained from the Curator, USDA Soybean Germplasm Collection, USDA-ARS, 1101 West Peabody Drive, University of Illinois, Urbana, IL 61801.”

Named varieties in maturity groups 000 to 0: Acme, Agate, Capital, Comet, Crest, Early White Eyebrow, Flambau, Goldsoy, Grant, Hardome, Hidatsa, Kabott, Mandarin (Ottawa), Manitoba Brown, Merit, Minsoy, Norchief, Ogemaw, Pagoda, Pando, Poland Yellow, Sioux.


• Summary: Since about 1980 it has been fashionable in American politics to say that the government is the cause of many of America’s problems, and that the solution is to have less government. We must not forget the key role that the U.S. state and federal governments have played in introducing the soybean to America and building it into the nation’s second largest farm crop. The sequence, in very brief scope, is: (1) The first soybean seeds were collected and widely disseminated to farmers across America by the Agricultural Division of the U.S. Patent Office. (2) State agricultural experiment stations played the leading role in testing and improving the new crop, and in publishing scientific information about how to grow it. Most of the soybean varietal development up to the 1970s was done at agricultural experiment stations. (3) Extension workers
at these stations and Land Grant colleges educated the farmers and showed them how to grow the crop. (4) The U.S. Department of Agriculture assigned may specialists to focus on soybean research, starting with Charles V. Piper and William Morse. The vision and hard work of these men was essential to the crop’s early success. (5) Starting in 1898, the Section of Foreign Seed and Plant Introduction, within the U.S. Department of Agriculture, started bringing in new soybean varieties from East Asia. This work has continued to the present day. (6) During World War I, the U.S. Office of Home Economics did extensive research on the nutritional value and food uses of soybeans. (7) In 1923 *The Soybean*, by Piper and Morse, was published by McGraw-Hill (New York, xv + 329 p.); it was the first major book about this relatively new crop published in the United States, and it remained the most important English-language publication on the soybean for many decades. (8) Government tariffs in the early years, especially the Smoot-Hawley Tariff of 1930, were crucial in protecting the fledgling soybean industry. (9) The Dorsett-Morse Expedition to East Asia was the source of many new soybean varieties and much new knowledge about soybeans and soybean industries. (10) The U.S. Regional Soybean Laboratory (Urbana, Illinois) and the USDA Northern Regional Research Lab in Peoria, Illinois, have found important new ways to use soybeans, creating new jobs, products, and industries. (11) When World War II started, major government programs encouraged the expansion of soybean production in America. (12) Right after World War II, government programs were essential in promoting soybean exports.


- **Summary:** One hundred years ago, in 1898, the USDA Section of Foreign Seed and Plant Introduction began to introduce seeds and plants to the United States. The key figure behind this work was David Fairchild. This was also the fiftieth anniversary of the first U.S. germplasm collection and preservation station—which was established in 1948 at Iowa State University, Ames, Iowa (the north central region). One could argue that there were small germplasm collections at various locations in the USA before this time, but this was the first one that was systematic, government sponsored, based on modern principles, and included a broad spectrum of crops. The federal law establishing four Regional Plant Introduction Stations was passed in 1946. Other similar germplasm collection stations for seed crops were started that year or a few years later in Geneva, New York (eastern); Experiment, Georgia (southeastern; later became Griffin, Georgia), and Pullman, Washington (western). They collected all types of germplasm. Specialized collections (as for soybeans) did not start until 4-5 years later. In 1949, Martin G. Weiss of the USDA and Jackson L. Carter of the U.S. Regional Soybean Laboratory at Urbana, Illinois, initiated the development of America’s first comprehensive soybean germplasm collection. In 1951 Edgar E. Hartwig became curator of the southern soybean germplasm collection located at Stoneville, Mississippi. Richard Bernard became curator of the Urbana collection in 1954. It was the lack of such germplasm collection stations that explains why most of the soybeans collected by Dorsett and Morse no longer exists. There was no purposeful national collection of germplasm in the USA until 1948.

Earlier this year, Ted attended a celebration of both the 100th and 50th anniversaries at Ames, Iowa—which is the headquarters of the north central region of the USA. He represents Illinois in the North Central Plant Introduction Technical Group—which meets every year at Ames. There are four such groups in the USA, one for each of the four regions. The meeting this year was informal, with no proceedings or anything else published, but there were many interesting discussions and much fun.

Modern soybean varieties are built on the narrow genetic base of a relatively small number of varieties. But this base is somewhat protected, since most soybeans are sensitive to latitude and daylength, and different varieties do best at different latitudes. This is not the case, for example, with corn. Address: Prof. of Plant Genetics, Dep. of Crop Sciences, Univ. of Illinois, Urbana, Illinois.


- **Summary:** He encloses a list of some additional soybean varieties that Shurtleff may wish to consider for inclusion in his “large-seeded” list. He also encloses a report he made at this year’s soybean breeder’s conference that includes a table for food-type US and Canadian public varieties and their year of release.

He includes key pages from several RSLM [Regional Soybean Laboratory Mimeograph] documents showing when the term “Maturity Group” was first used. “If you consider ‘Maturity Group I’ and ‘Group I Maturity’ to be roughly equivalent, then the 1953 report RSLM 168 is the first, since it was the first germplasm report (‘Maturity Group’ was used for the Uniform Tests much earlier).

Page 2, titled “Additional varieties to consider.”

Hahto released in 1918 by USDA. Copy of publication enclosed.

Agate released in 1937 by USDA.

Morse & Carter 1937.

Tortoise Egg released in 1938 by Illinois AES [Agricultural Experiment Station], listed in Woodruff &
Klaas.
Kabott released in 1939 by Ag Canada (new name), Ottawa, in 1949 Bulletin 1520.
Also listed in Bulletin 1520 and in most cases in Morse’s 1948 list of “Soybean varietal names used to date” (RSLM 148, 9 p.):
Etum, released by 1941 by USDA, 23 gm per 100 seeds.
Green & Black, released in 1941 by private, Tennessee, 24 gm per 100 seeds.
Hidatsa, released in 1941 by private, North Dakota, 18 gm per 100 seeds.
Jefferson, released in 1941 by private, Tennessee, 33 gm per 100 seeds.
Kanum, released by 1941 by USDA, 19 gm per 100 seeds.
Sac, released in 1941 by Iowa AES, 26 gm per 100 seeds.
Sanga, released in 1945 by private, Illinois, 28 gm per 100 seeds.
Tastee, released by 1941 by USDA, 22 gm per 100 seeds.
Wolverine, released in 1941 by USDA, 26 gm per 100 seeds.
“I’ve used a secondary source of info, so you’d better check the original publication in each case. Hope this is useful. Dick B.”
Address: Prof. of Plant Genetics (Retired), Dep. of Crop Sciences, AW-101 Turner Hall, Univ. of Illinois, Urbana, IL 61801-4798.

*Summary:* From the time when the cooperative soybean trials began in the late 1930s and early 1940s, the cooperating breeders from the various northern states and Canada would meet once a year, typically near at the University of Illinois. They would discuss basic issues, such as which strains should go into the next year’s variety trials, issues of disease resistance, protein and oil content, etc. Ted attended some of the early meetings; 30-40 people were there. Then the meetings got too large, so they were moved to St. Louis, Missouri.

Most of this took place before the major rise of private commercial soybean production following the Plant Variety Protection Act of 1970. Address: Retired Prof. of Plant Genetics, Dep. of Crop Sciences, Univ. of Illinois, Urbana, Illinois.

*Summary:* Richard ‘Dick’ Lawson Bernard, 86, of Champaign, passed away on December 20, 2012 in Danville, Illinois. He was born to Clarence and Ilda Bernard in Detroit, Michigan in 1926.
“Dick was an internationally-recognized soybean research geneticist and worked for 34 years for the U.S. Department of Agriculture, National Soybean Research Lab at the University of Illinois at Urbana-Champaign. He was curator of the USDA Soybean Germplasm Collection and Professor Emeritus in the Department of Crop Sciences.

“After his official retirement in 1988 from the USDA, he continued his work, switching his focus from field soybeans to developing improved vegetable-type soybeans known as edamame. His Gardensoy varieties were widely distributed to home gardeners and small vegetable farmers across the United States and overseas.

“He was a member of the First Baptist Church of Urbana, The American Legion, and the Moose and Elks lodges. He enjoyed dancing and was a veteran of the U.S. Army Air Force.

“Dick is survived by his sister, four children, nine grandchildren, and one great-grandchild. He was preceded in death by his parents and brother.

“A visitation will be held at Heath & Vaughn Funeral Home, 201 N. Elm, Champaign, at 1:00 p.m. on Dec. 29, with funeral services following at 2:00 p.m.

“Memorial donations may be made to the ‘Richard L. Bernard Soybean Improvement Award’ in the Department of Crop Sciences at the University of Illinois at Urbana-Champaign.

“Condolences may be offered online at www.Heathand Vaughn.com.” A small color portrait photo shows Dick Bernard.

*Summary:* (Continued):
1941 July Etum or Eatum (large seeded)–Yellow (straw), hilum light brown
1941 July Green and Black (large seeded)–Green and/or black
1941 July Jackson (large seeded)–Green, with black hilum and green cotyledons
1941 July Jefferson (large seeded)
1941 July Kanum (large seeded)–Yellow (straw), hilum light brown
1941 July Sac (large seeded)–Yellow (olive), hilum black

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1941 July Seminole (large seeded)–Yellow (straw), hilum brown
1941 July Tastee (large seeded)–Yellow (olive), hilum black
1941 July Wolverine (large seeded)–Yellow (straw), hilum pale to light brown
1941 July Yellow Marvel (large seeded)–Yellow
1941 July—“Shanghaied. a Super Food,” by W.J. Morse is published in Soybean Digest (p. 4-5, 10). The “super food” is green vegetable soybeans from large-seeded edible-type soybeans. A table shows 42 “edible varieties classified according to maturity.” Ten of these are first mentioned here.
1942 Apr. Cherokee (large seeded)–Green, hilum brown
1943 Mendota (large seeded)–Yellow (straw), hilum light brown to brown
1945 Jan. Sanga (large seeded)
1945 June Delsoy (large seeded)–Yellow (straw), hilum dark brown
1948 May—“Soybean Varietal Names Used to Date,” by W.J. Morse is published as Appendix to the mimeographed report of the Fourth Work Planning Conference of the North Central States Collaborators of the U.S. Regional Soybean Laboratory, Urbana, Illinois. RSLM 148 (9 p.). A treasure trove of soybean variety names, P.I. numbers, and synonyms
1948 Aug.—“Soybean Varieties: Descriptions, Synonyms and Names of Obsolete or Old and Seldom Grown Varieties,” by USDA Production and Marketing Administration [Grain Branch] is published as a 25-page booklet. It contains: Description of varieties (129 varieties). Synonyms of variety names (120 synonyms). Obsolete or old or seldom grown varieties (149 varieties).
1949–The Soybean Germplasm Collection is established in two locations: Urbana, Illinois and Stoneville, Mississippi. The objective is “to collect and maintain all significantly different soybean strains from throughout the world.” “Prior to 1949 no consistent attempt was made to preserve soybean germplasm, and many introductions and old domestic varieties were discarded.” “A total of 1,524 PI strains or domestic varieties derived from PI strains were recovered and are now in the collection. This compares with 7,867 introductions made from 1898 to 1944.” The collection is divided into six parts, including wild soybeans and perennial Glycine species (Bernard et al. 1987. p. 1).
1953 June Harosoy (large seeded)
1956 Apr. Kanrich (large seeded)–Yellow, hilum yellow
1956 Apr. Kim (large seeded)–Green with black hilum
1967 Feb. Disoy (large seeded)–Yellow, hilum yellow
1967 Feb. Magna (large seeded)–Yellow
1967 Feb. Prize (large seeded)–Yellow, hilum pale/clear
1967 May Verde (large seeded)–Green, hilum light buff, with green cotyledons
1969 May Provar (high protein)–Yellow (dull), hilum brown and large
1969 Aug. Protana (high protein)–Yellow (shiny), with imperfect black hilum
1970 Feb. Kahala (large seeded)
1970 Feb. Kaikoo (large seeded)
1970 Feb. Kailua (large seeded)
1970 Feb. Mokapu Summer (large seeded)
1975 July Emerald (large seeded)–Green (green cotyledons), hilum black
1976 Apr. Grande (large seeded)–Yellow (light with dull luster), hilum light tan
1977 Maple Arrow—Yellow
1978 Oct. Vinton (large seeded)–Yellow (dull), hilum yellow
1981 Aug. Vinton 81 (large seeded)–Yellow (dull), hilum yellow
1984 Dec.—“Dorsett-Morse soybean collection trip to East Asia: 50 year retrospective,” by Theodore Hymowitz is published in Economic Botany (p. 378-88). The two plant explorers collected 4,451 soybean accessions and sent them to the USA to be given SPI numbers. Until about 1950 the collection was used primarily for the development of vegetable type soybean cultivars. During this period many of the accessions were lost. As of 1984 only 945 of the original 4,451 accessions are available in the United States soybean germplasm collection. The entire trip cost about $25,000—an investment that has repaid itself many times over.
1986 Jan. Merri max (large seeded)–Yellow (glossy), hilum buff
1988 Oct.—“Origins and Pedigrees of Public Soybean Varieties in the United States and Canada,” by Richard L. Bernard et al. is published as USDA Technical Bulletin No. 1746. 68 p. Excellent—maybe the single best work on this subject. Tables 3 and 4 (p. 4-30) correspond to the information in this book, however the “Year named or released” is not nearly as accurate as the dates given in the present book.
1989 Nov. Harovinton (large seeded)–Yellow (dull), hilum yellow
1991 Apr. Proto (high protein)–Yellow (dull), hilum buff
2000 May Gardensoy (large seeded)–Green. Address: Soyinfo Center, P.O. Box 234, Lafayette, California 94549. Phone: 925-283-2991.


**Summary:** This is the most recent of the Uniform Soybean Tests–Southern States that were started by the U.S. Regional Soybean Lab in 1943 during World War II and are still being continued by the USDA’s Agricultural Research Service. An archive is maintained. This document is “coordinated and edited by: Anne M. Gillen and Gary W. Shelton.”

Soybean nursery information: Location contact and tests, planting dates, harvest dates, agronomic characteristics of locations, weather station information.

Methods: Cultural practices, maturity, harvest, and yield, pest assessment, statistical analyses.


The Introduction states: “The Uniform Soybean Testing Program has been directed toward the testing of elite breeding lines that ultimately leads to the release of varieties. Breeding lines are developed and evaluated in several participating federal and state research programs. As breeding lines demonstrate specific qualities in the individual programs, they are advanced to the preliminary and uniform regional tests conducted in cooperation with research workers in the southern states. This testing program enables breeders to evaluate new strains under a wide variety of conditions, and permits new strains to be put into production in a minimum amount of time. Lines are usually entered only once in the Preliminary Test and then are either dropped or advanced to the Uniform Test for a maximum of three years if performance warrants further testing.

“Eleven uniform test groups have been established to evaluate the best strains developed in the breeding programs. The groups 00 through IV are adapted in the northern part of the United States, and the groups IV-S through VIII are grown in the southern part. Within their area of adaptation, there is a maturity range of 12 to 18 days within each maturity class. The best varieties available in each maturity class are used as check varieties with which to compare new strains as to seed yield, chemical composition, maturity, height, lodging, seed quality, and reaction to diseases and nematodes. For the groups grown in the southern area, the check varieties are: AG4232RR2Y, AG4632RR2Y, LD06-7620, AG3934(RR2), AG4835(RR2), Ellis, AG4933(RR2), Osage, JTN-5203, UA5612, AG5332RR2Y, AG5534(RR2), AG5535(RR2), NC-Roy, NCC06-1090, AG6534, NCC07-8138, AGS738RR, AG7733, N7003CN, NCC06-899, AGS828RR, AG7934, N05-7432, and N8001.

“A wide range of soil and climatic conditions exists in the regions. As an aid in recognizing regional adaptation, the region has been subdivided into five rather broad areas which still represent a wide range of soil types. These are: (1) the East Coast, consisting of the Coastal Plain and Tidewater areas of the eastern shore of Maryland, Virginia, North Carolina, and the upper half of South Carolina; (2) the Southeast, consisting primarily of the Coastal Plain soils of the Gulf Coast area, but also including similar soil from South Carolina, southward; (3) the Upper and Central South, including the Piedmont and loessial hill soils east of the Mississippi River; (4) the Delta area, composed of the alluvial soils along the Mississippi River from southern Missouri, southward; and (5) the West, comprising Arkansas and Louisiana (outside the Delta), Kansas, Oklahoma, and Texas. In the West, the potential soybean-growing areas would include alluvial soils, and the Gulf Coast of Louisiana.”

Address: USDA Agricultural Research Service, Crop Genetics Unit, P.O. Box 345, Stoneville, Mississippi 38776.

662. SoyaScan Notes. 2016. Issues of RSLM (Regional Soybean Laboratory Mimeograph) owned by the National Agricultural Library (NAL; Beltsville, Maryland) (Overview). Dec. 29. Compiled by William Shurtleff of Soyfoods Center.

• Summary: RSLM was the main periodical published by the U.S. Regional Soybean Industrial Products Laboratory (Urbana, Illinois).

The National Agricultural Library owns the following issues (some are bound; many are loose and in very poor shape): 12, 32, 34, 36, 46, 55-57, 62-64, 73, 74, 76-79, 81-83, 100, 105, 106, 108, 112, 123, 126, 127, 130, 132, 133-135, 137, 140, 142, 144-145, 148, 151, 152.

These do not include the long issues on Results of the Cooperative Uniform Soybean Tests–north and south.

The NAL call number is 1.9 C49292Rs. Only the early issues are in poor shape.

An asterisk (*) at the end of the record means that SOYINFO CENTER does not own that document. 2016A plus after eng (eng+) means that SOYINFO CENTER has done a partial or complete translation into English of that document. 2016An asterisk in a listing of number of references [23* ref] means that most of these references are not about soybeans or soyfoods.
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