# HISTORY OF

# UNCOMMON FERMENTED SOYFOODS

# (379 AD to 2012):

## EXTENSIVELY ANNOTATED

## BIBLIOGRAPHY AND SOURCEBOOK

**Including: Soybean Wine, Cantonese Wine Starter, Soy Ogi, Soy Dhokla, Soy Dosa / Dosai, Soy Idli.**

**Compiled**

**by**

**William Shurtleff & Akiko Aoyagi**


**2012**

**Published by:** **Soyinfo Center**
**P.O. Box 234**
**Lafayette, CA 94549-0234 USA**
**Phone: 925-283-2991 Fax: 925-283-9091**
**www.soyinfocenter.com info@soyinfocenter.com**

**ISBN** 9781928914495 (Uncommon Fermented Soyfoods without hyphens)
**ISBN** 978-1-928914-49-5 (Uncommon Fermented Soyfoods with hyphens)

**Printed** 21 Oct. 2012

Price: Available on the Web free of charge

**Search engine keywords**:
History of soy ogi
History of soy dhokla
History of soy dosa
History of soy dosai
History of soy idli
Bibliography of soy ogi
Bibliography of soy dhokla
Bibliography of soy dosa
Bibliography of soy dosai
Bibliography of soy idli

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# DEDICATION AND ACKNOWLEDGMENTS

**This book is dedicated to I.A. Akinrele of Nigeria, Keith H. Steinkraus of Cornell University, New York, and C.V. Ramakrishnan of India - pioneers in this field**.

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.

Stanford University: Molly Molloy, who has been of special help on Slavic-language documents.

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.

Library of Congress: Ronald Jackson, Ronald Roache.

Lane Medical Library at Stanford University.

Contra Costa County Central Library and Lafayette Library: Carole Barksdale, Kristen Wick, Barbara Furgason, Sherry Cartmill, Linda Barbero.

Harvard University's Five Botanical Libraries (especially Arnold Arboretum Library): Jill Gelmers Thomas.

French translation: Martine Liguori of Lafayette, California, for ongoing, generous, and outstanding help since the early 1980s.

Japanese translation and maps: Akiko Aoyagi Shurtleff.

Loma Linda University, Del E. Webb Memorial Library (Seventh-day Adventist): Janice Little, Trish Chapman.

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:

Irene Yen, Tony Jenkins, Sarah Chang, Laurie Wilmore, Alice Whealey, Simon Beaven, Elinor McCoy, Patricia McKelvey, Claire Wickens, Ron Perry, Walter Lin, Dana Scott, Jeremy Longinotti, John Edelen, Alex Lerman, Lydia Lam, Gretchen Muller, Joyce Mao, Luna Oxenberg, Joelle Bouchard, Justine Lam, Joey Shurtleff, Justin Hildebrandt, Michelle Chun, Olga Kochan, Loren Clive, Marina Li, Rowyn McDonald, Casey Brodsky, Hannah Woodman, Elizabeth Hawkins, Molly Howland, Jacqueline Tao, Lynn Hsu, Brooke Vittimberga.

Special thanks to Tom and Linda Wolfe of Berwyn Park, Maryland. And to Lorenz K. Schaller of Ojai, California.

■ For outstanding help on this Uncommon Fermented Soyfoods book we thank: Wayne Dawson on Tucson, Arizona, Robert W. Nave of India and Minnesota, Sumbo Abiose of Nigeria, and Sidi M. Osho of Nigeria.

■ 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 uncommon fermented soyfoods.**

**346-379 A.D.** – In *Shijiu* [Record of Fermented Black Soybean Wine], the author, Wang Hsi-chih says: When I was young I drank fermented black soybean wine (*shijiu*). It was very good.

**530 A.D.** – In *Shijing* [Food Canon (#1)], the section titled "How to make soybean (*dadou*) thousand year bitter wine" (*kujiu*) (preserved in Chapter 71, titled "Vinegar" in *Qimin Yaoshu*) describes the process.

**544 A.D.** – In *Qimin Yaoshu*, by Jia Sixie, Chapter 71 preserves the text of the *Shijing* (cited above), which had been lost by this time.

**1596** – *Bencao Gangmu* [The great pharmacopoeia], by Li Shizen refers to a type of soy wine named (*tou-lin chiu*) ("bean soak wine").

**1878 Feb.** – In the *Bulletin de la Societe d'Acclimatation* (France), an article titled *Sur les vins et eaux-de-vie fabriqués en Chine* [On the wines and brandies made in China], P. Dabry de Thiersant mentions Cantonese wine starter (*kiu-tsee* or *kiu-tsu*) which may well be the French transcription of *jiuzi*. Rice and soybeans are the two main ingredients used in Canton to make the wine.

In 1888 Ch. Lecerf in France is the first to write *Kiu-tsée* with an acute accent to refer to this solid Cantonese wine ferment.

**1911** – In the book *Chinese Materia Medica: Vegetable Kingdom*, by George A. Stuart (published in Shanghai, China) is a section titled "Bean ferment." The Chinese characters *tou-huang* [*dou-huang*] (which are given) mean "bean + yellow." This "Bean ferment" "is the fermentation pellicle (*Mycoderma*) which forms on the top of fermenting beans, as the mother-of-vinegar forms on the top of vinegar in its process of preparation."

In 1918 Shih Chi Yen mentions this same product, written with the same Chinese characters.

**1966** – I.A. Akinrele of Nigeria writes his PhD thesis at the University of Ibadan on "A biochemical study of the traditional method of preparation of ogi and its effects on the nutritive value of corn." *Ogi* is the Yoruba (western Nigerian) name for a sour, fermented maize / corn product widely consumed in southern Nigeria and West Africa. He found that when he fortified traditional ogi with 30% heat-treated whole soy flour, the protein quality (as measured by the protein efficiency ratio or PER) increased threefold. His innovation opened up a new world of research on using soy to fortify traditional fermented foods in developing countries.

**1967 June** – Keith H. Steinkraus of Cornell University publishes the first research on the use of soybeans to fortify the traditional Indian fermented food named *idli* in order to increase its protein quality and quantity.

**1970** – Akinrele coins the term "soy-ogi" and in 1975 Edem shortens it to "soyogi."

**1973 Nov.** – In Ceylon (today's Sri Lanka), the Ceylon Meals for Millions Foundation publishes a booklet titled *All About the Soy Bean*. The section on "Soya bean recipes" notes: "A new trend in the preparation of 'Thosai.' Soya bean as a substitute for black gram in preparing delicious 'Thosai'" [Dosai].

**1975 July** – In a publication by USDA's Northern Regional Research Center (Peoria, Illinois), the term "soy idli" is first used, and in 1976 Ramakrishnan et al. in India shorten this to "soyidli."

**1979** – In a research project in India funded by the U.S. P.L. 480 (Food for Peace) Program, C.V. Ramakrishnan of Baroda publishes the first research on the use of soybeans to fortify the traditional Indian fermented food named *dosa* in order to increase its protein quality and quantity.

**1979** – In an article in the *Baroda Journal of Nutrition* titled "Studies in Indian fermented foods," C.V. Ramakrishnan discusses *dhokla*, a traditional Indian fermented food, fortified with soybeans in order to increase its protein quality and quantity.

**1986 Nov. 22-23** – National seminar on Soybean Processing and Utilization in India is held in Bhopal. India, sponsored by the Central Institute of Agricultural Engineering (CIAE). Many of the papers are about fortification of tradition Indian fermented breakfast foods (such as *dosa / dosai, idli* and *dhokla*) with soybeans or soy flour.

The proceedings (436 p.) are published in July 1988, edited by Nawab Ali, A.P. Gandhi, and T.P. Ojha.

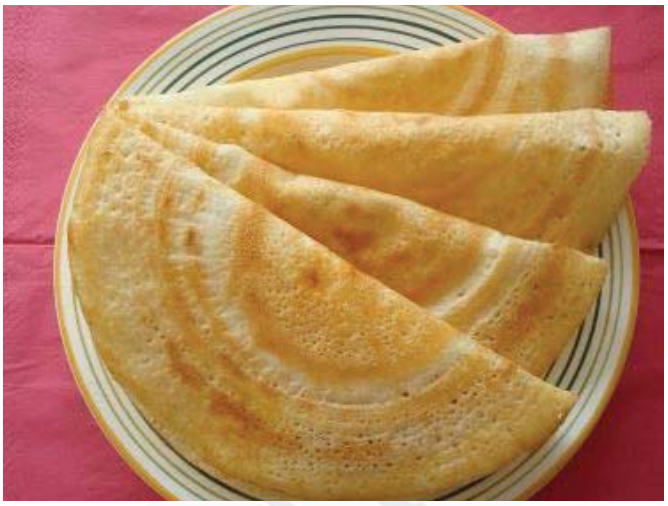
**2001** – Patil et al. in India coin the terms "soy-dosa," "soy-dosa mix, and "instant soy-dosa mix."

**Note on geography and origins in India**: Idli and dosa have been used as basic foods in South India since at least A.D. 1100 but they are now popular throughout the country. The

dominant organisms in idli are *Leuconostoc mesenteroides* and a number of *Lactobacillus* species. Dhokla is from west India, especially Gujarat; its origin is unknown.

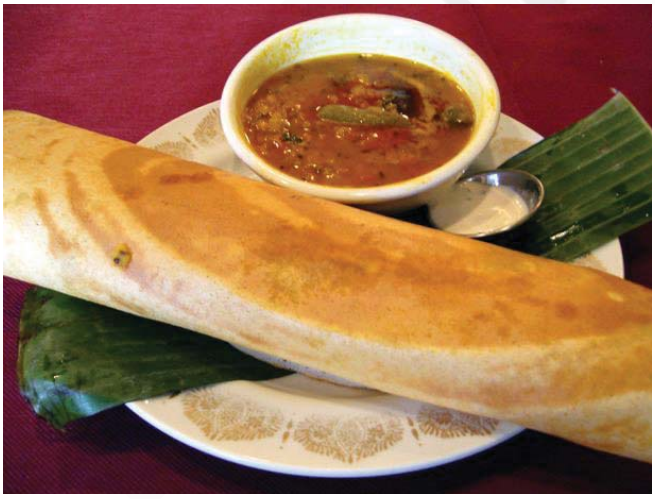
**Note on traditional ingredients and processes in India. Soybeans can be used to replace part of the traditional legume**:

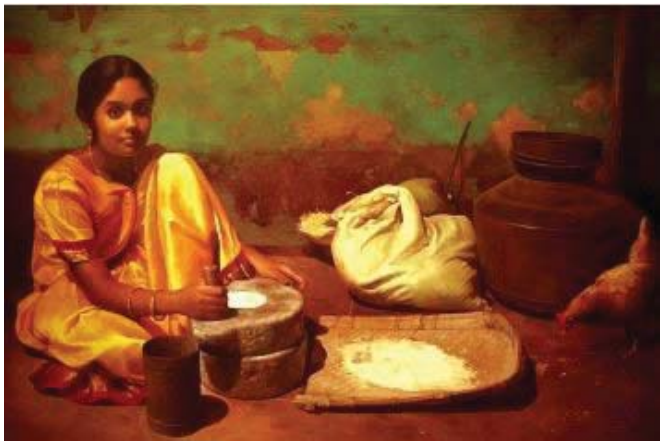
**Dhokla**: Main ingredients: Soak 4 parts rice and 1 part Bengal gram dal (chickpeas, garbanzo beans, *Cicer arietinum*) overnight. Grind the mixture to a coarse paste. Allow this batter to ferment overnight at room temperature. Steam in a pie dish, then cut into diamond shapes and garnish the top – as with chili peppers, grated ginger or thinly sliced coconut. Usually served at breakfast, hot, cold, or at room temperature. Note: Khaman is a similar gram flour-based food that is sometimes confused with dhokla.



**Dosa / Dosai**: Main ingredients: Rice and black gram (*Vigna mungo*) (other ingredients are also used). Method of preparation. Prepare water soaked rice and black gram dal. Mix them then wet grind to yield a smooth batter; allow it to ferment. Pan-fry the batter to make crepes or thin pancakes.

**Idli**: Main ingredients: Rice and black gram (*Vigna mungo*). Method of preparation: Water soaked rice (2 parts) and black gram dal (1 part). Wet grind separately in a stone mortar, the rice to a coarse texture and the black gram dal to a smooth gelatinous paste. Mix the two together with salt and allow the batter to ferment overnight at room temperature. Using a specially-devised idli steamer, steam in the shape of round, lens-shaped white buns.





**DOSA / DOSAI**

# 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
Illust. = 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
vs. = versus
W. = West
°C = degrees Celsius (Centigrade)
°F = degrees Fahrenheit
> = greater than, more than
< = less than

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**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.

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**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, soynut, soy flour companies, etc.

Other key organizations include Society for Acclimatization (from 1855 in France), American Soybean Association, National Oilseed/Soybean Processors Association, Research & Development Centers (Peoria, Cornell), Meals for Millions Foundation, and International Soybean Programs (INTSOY, AVRDC, IITA, International Inst. of Agriculture, and United Nations). Pioneer soy protein companies include Borden, Drackett, Glidden, Griffith Labs., Gunther, Laucks, Protein Technologies International, and Rich Products.

**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."

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

**Soyinfo Center**
**P.O. Box 234,**
**Lafayette, CA 94549 USA**
**Phone: 925-283-2991 Fax: 925-283-9091**
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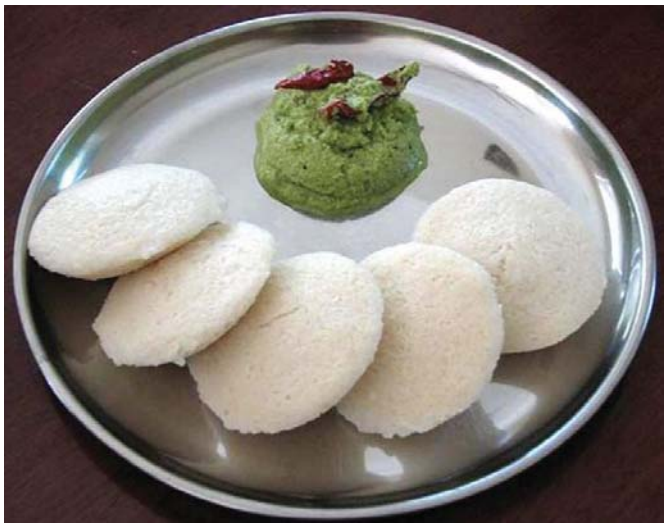

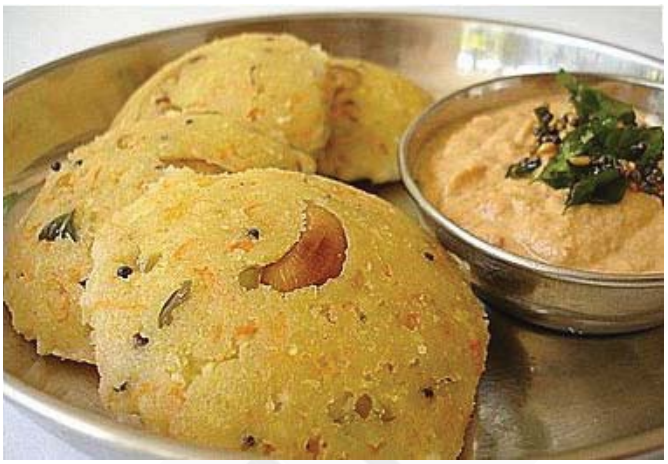

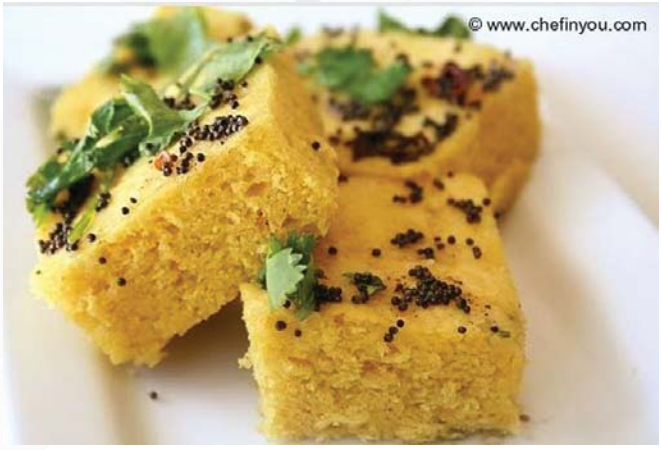


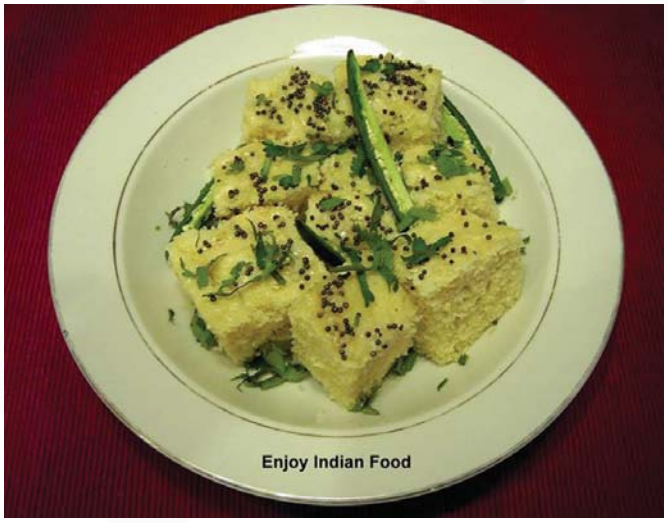


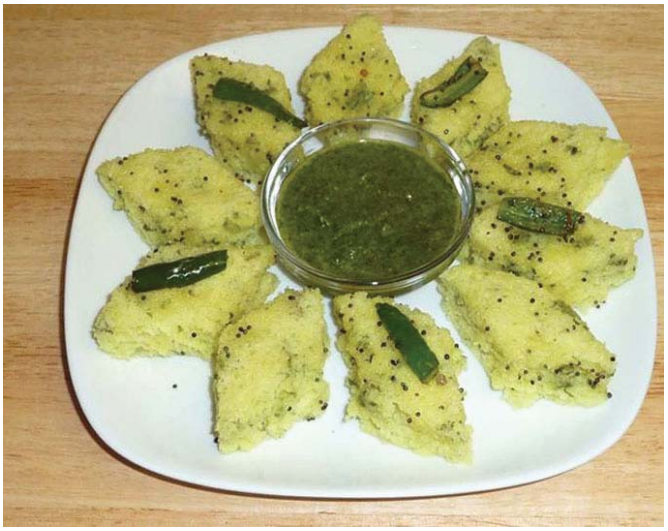

**IDLI & DHOKLA**

# HISTORY OF UNCOMMON FERMENTED SOYFOODS

1. Wang Hsi-chih. 346-379 AD. Shijiu [The record of fermented black soybean wine]. China. Modern rendering by Morohashi 1955, trans. p. 19. [Chi]*

• ***Summary:*** Wade-Giles reference: *Shih Chiu,* by Wang Hsi-chih. Eastern Jin dynasty; Sixteen kingdoms.

"When I was young I drank *shijiu* [W.-G. *shih chiu*] fermented black soybean wine. It was very good."

Note: This is the earliest document seen (Oct. 2012) that mentions soybean wine or black soybean wine or fermented black soybean wine. Address: China.

2. Shijing [Food canon (#1)]. 530? AD. China. Passage on soy reprinted in C.N. Li 1958 #294, p. 216. Undated. [Chi]

• ***Summary:*** Wade-Giles reference: *Shih Ching.* Northern Wei. There are several early Chinese books with this title. The original work has been lost, but its contents are partly preserved in the fermentation and food processing / food and drink chapters of the *Qimin Yaoshu* (QMYS). The author and date of this one are uncertain. The date was probably before that of the QMYS (+544); the date +530 is proposed here by Li. Authorship has been attributed to Cui Hao (W.-G. Ts'ui Hao), to his mother, or to Ma Wan–but these are just theories. One *Shijing* (Food canon), attributed to Cui Hao, in 9 volumes, is listed in the *Weishu* (History of the Northern Wei dynasty) (+554), in which only the preface remains. This preface, which has been translated in Huang (2000, p. 125), strongly implies that most of the *Shijing* was actually written by Cui Hao's mother. During a famine that lasted more than ten years, she realized "how ignorant the younger generation had become" in matters related to food preparation and the culinary arts. "The result is nine chapters of elegant and systematic descriptions that form this book." In his later years, Cui Hao unfortunately had a falling out with the Wei emperor; in +450 he and his entire family were put to death for high treason, and he was regarded as a traitor for the last 100 years of the Northern Wei dynasty. This was probably why his name is never mentioned in the CMYS and though many passages from the *Shijing* are quoted and the source cited, the CMYS never says *whose Shijing.* The author of the QMYS was a government official when Cui Hao was remembered as a traitor.

The section titled "How to make soybean (*dadou*) thousand year bitter wine (*kujiu*)" (preserved in Chapter 71, titled "Vinegar" in the QMYS) says: Take one pint (*dou*) of soybeans (*dadou*). Wash until very clean, soak until soft, then steam until cooked through. Dry in the sun. Then repeatedly pour wine (*jiu*) over the soybeans–so they impart their flavor to the final vinegar and aid the oxidation process. This section also describes other ways of making other kinds of vinegar–each with a unique flavor.

Note: This is the 2nd earliest document seen (Oct. 2012) that mentions a type of soybean wine.

The section titled "How to make fermented black soybeans (*shi*)" (preserved in Book 8, chapter 72 of the QMYS) describes three methods for making *shi.* The main method (the one described first in the QMYS and considered to be most important by the author) is for unsalted / bland fermented black soybeans (*danshi*). The method for making salty fermented black soybeans (based on the translation by Shih Shêng-han 1962, p. 86-87, and H.T. Huang 2000, p. 338-39) is as follows: Fermented black soybeans are usually made in the summer, from the 5th to 8th month; this is the best time. Take one *dan* (about 40 liters; later pronounced *shih*) of soybeans, wash / scour well, and soak overnight. The next morning, drain off the water then steam until the hulls / seed coats will slip off when you rub the beans. Spread on the ground (or on a mat if the ground is bad) to a depth of about 2 inches (*cun*). Wait until the beans are completely cool, then cover with a layer of rushes about 2 inches thick. After 3 days, inspect the beans to see if they are covered with a yellow coating [or mycelium, probably of *Aspergillus* mold]. If so, remove the rushes and spread the soybeans to form a thinner layer. Make groves with the fingers in this layer and shape into "plots." Mix again. After several hours, mix and make into "plots" again. Repeat this mixing and plot-making process 3 times a day for 3 more days.

Meanwhile, cook another batch of soybeans to get a thick, syrupy decoction. Make some glutinous rice koji (*nuqu;* W.-G. *nü ch'ü*). Mix 5 *sheng* (1 *sheng* = about 400 ml) of the glutinous rice koji and 5 *sheng* of good table salt into the yellow molded soybeans, then sprinkle with the syrupy decoction (soybean cooking liquid). Knead with both hands until some juice begins to run out between your fingers. Then place the mixture into an earthenware / pottery jar (*ping*) with a neck until full–but do not compress or pack. If the jar is not full, fill to the brim with wild mulberry leaves. Seal mouth of jar tightly with mud (*ni*). Leave jar in middle of courtyard for 27 days. Then pour out the jar's contents [probably onto a mat], spread, and dry in the sun. Steam it again, then sprinkle with a decoction of mulberry leaves. Steam it again for as long as is steaming raw soybeans, then spread it again and dry in the sun. After steaming and sun-drying three times, the fermented black soybeans will be ready.

Note 1. This is the earliest document seen (Nov. 2011) that mentions unsalted / bland fermented black soybeans (*danshi*). However the document no longer exists.

Yan-Kit So. 1992. *Classic Food of China* (p. 21). "Even

though Chinese historical and literary records on food go back to the Zhou dynasty (11th century to 221 BC), many of the books written on cookery before the 6th century AD have been lost to posterity, and it is not clear how or why they disappeared." We know of their existence only "through references in other books or fragments of what is left of them. The most poignant example is the *Shi Jing* or *The Book of Food*, written by Cui Hao, who was prime minister at the beginning of the Northern Wei dynasty (AD 386-534), but was executed for treason in AD 450. All of this book, save for the preface, has been lost." When China was going through turmoil, his mother dictated to her son all of her family recipes which she worried might be lost to future generations. He wrote nine chapters, but not even one recipe has survived.

Bo (1982): Mentions wheat chiang and mustard chiang.

The *Ch'i-min yao-shu* states that this work contains a recipe for "one thousand year bitter soy wine," which was apparently made by soaking fermented black soybeans in a grain-based alcoholic beverage or medicinal tincture.

Fukushima (1979, p. 3, 8-9, adapted from Bo 1982). "The manufacturing process of wheat chiang, appearing in *Chi-ching* (*Shokkei* in Japanese) by Hsieh Fêng (Sha Fu in Japanese), published in the Han dynasty (206 BC to 220 AD). Shi-ching has not survived to the present day, but the original Shi-ching process for making wheat chiang is cited in the Ch'i-min Yao-shu." In the process wheat is soaked, steamed, and spontaneously molded to make koji. The wheat koji is mixed with cooked wheat and salt water to make a firm mash. This is insulated and aged to make wheat chiang.

The work also describes how to make *shih* (fermented black soybeans): Soybeans are washed, soaked, drained, and steamed. The cooked soybeans are cooled, then spread, furrowed, and piled. The last 3 steps are repeated 3 times a day for 3 days until the beans have become spontaneously molded. The resulting soybean koji is mixed with soybean cooking liquid, barley koji, and salt, put into an earthen pot, sealed, and insulated. It is then dried in the shade, mixed with a mulberry leaf extract, and steamed. The last 3 steps are repeated 3 times, resulting in salted soybean shih.

Note 2. This is the earliest document seen (July 2012) that mentions soybean koji; in this case it is used to make fermented black soybeans (*shi, shih*).

Shih Shêng-han (1962), in his translation and interpretation of the *Qimin Yaoshu*, includes a lengthy analysis of the sources from which it is drawn. On pages 27-28 is a detailed discussion (with one excerpt) of this book (*Shijing*), whose title he translates as "Catering Guide or Nutrition Manual." He states that 33 quotations from the *Shijing* are mentioned in the *Qimin Yaoshu.* The Records of Classics and Other Writings in the *Suei Shu* mentioned nine books (all lost now) titled *Shijing.* One of these, written by the mother of Cui Hao (lived ?–450), the Prime Minister to the first Emperor of the later Wei dynasty, is definitely previous to the *Qimin Yaoshu.*

3. Jia Sixie. 544 AD. Qimin yaoshu [Important arts for the people's welfare (Continued)]. China. Translated by Shih Sheng-han 1958, 1962. [Chi]

• ***Summary:*** Continued: Wade-Giles reference: *Ch'i Min Yao Shu* (*QMYS*), by Chia Ssu-hsieh. Bo (1982): This is the world's earliest document describing techniques for processing agricultural products. The production methods for soybean chiang and shih (fermented black soybeans) are described in detail. In these descriptions, the author frequently used the terms "tou-chiang-ch'ing" (literally "soybean chiang refined") and "chiang ch'ing" (literally "chiang refined"), but unfortunately he didn't describe how these products were made. These terms are almost surely related to the term "ch'ing chiang" used in the *Ssu Min Yüeh Ling* by Ts'ui Shih of the Later Han. Shih was made from soybean koji. Using only soybeans (instead of soybeans and wheat, as for chiang) hydrolyzes the protein more efficiently, and was thus well suited for making fermented black soybean sauce (*kuki-jiru*). Thus this book contains about 70 recipes for using fermented black soybean sauce, many more than for soy sauce. Yet the book does not explain how to make fermented black soybean sauce.

The *Ch'i-min yao-shu* quotes from an even earlier non-extant work, the *Shih ching* (*The Classic of Food;* date and authorship unknown), giving the *Shih ching's* recipe for making "one thousand year bitter soy wine."

Note: This is the earliest document seen (Oct. 2012) that mentions "one thousand year bitter soy wine."

Sato (1963, p. 9), in his book titled "Documents on Fermented Black Soybeans, Chiang, Miso, and Shoyu," cites this as the third earliest Chinese document seen on the subject. Called the *Seimin Yojutsu* in Japanese, it was translated into Japanese in 1959 by Nishiyama Kakekazu and Kumadai Yukio. It is written entirely in Chinese characters (*Kanbun*).

Shih Sheng-han (1958). The first English-language (partial) translation of this book; revised 2nd ed. in 1962. For details see these two works. The section titled "Fish-pond" (1958 and 1962, p. 72) states: "There is a whole chapter (62) on fish-pond management... But the source and the calculations of the quotation are dubious. Anyhow we can infer from this chapter that fish-pond management was started in China earlier than the 6th century."

4. Congshu jicheng chubian [Collected collecteana]. 1473. China. [Chi]*

• ***Summary:*** Wade-Giles reference: *Ts'ung Shu Chi Ch'êng Ch'u P'ien.* An anthology with no author given. Ming dynasty.

The *Bencao Gangmu* (The great pharmacopoeia) (1596, by Li Shizhen) refers to type of soy wine called *tou-lin chiu* ("bean soak wine") which is described as a sake-like

fermented alcoholic beverage made from black soybeans. A recipe is given and it is stated that the *Ts'ung-shu chi-ch'eng ch'u-p'ien* (1473) said that it cures post-partum white sickness, apparently an affliction suffered after the birth of a child.

5. Li Shizhen. comp. 1596. Bencao gangmu [The great pharmacopoeia]. China. See p. 360-71. 1965 ed., reprint of 1885 edition, Peking. Also reprinted in 1916 by Shanghai Hong Pao Chai Book Co., Shanghai. [Chi]

• ***Summary:*** Wade-Giles reference: *Pên Ts'ao Kang Mu*, by Li Shih-Chen (lived 1518-1593). The author: Bretschneider (1882, in *Botanicon Sinicum*, p. 54-55) notes: "Li was born at K'i Chou in Hu pei probably in the first quarter of the 16th century, and died toward the close of the same century. His literary name was *Tung pi.* He wrote under the pseudonym *Pin hu.* As was the case with the majority of early Chinese physicians of note, Li Shi chen was not a professional medical man, but a civil functionary and a magistrate of the district of P'eng k'i (T'ung ch'uan fu, Sz' ch'uan [Szechuan]). Besides this, his principal work, Li left several medical treatises. "Li began compilation of this work in 1552, and after 26 years' labour he completed it in 1578. He wrote out the manuscript three times before he was satisfied to give it out as complete. The author died before it was published, and his son, Li Kien yüan, presented the manuscript to the Emperor, in 1596, who ordered it to be printed."

The work: Called *Honso Komoku* in Japanese, this is the most famous of the many Chinese herbals, and the most important Chinese work on materia medica and natural history. Also called a botanical encyclopedia, it is the first treatise of its kind in which the material is treated critically. Bretschneider (1882, p. 55) adds: "Several editions have been successively issued. The earliest now extant is, it seems, that of Shun chi 15 (A.D. 1658). All editions which I have had an opportunity of examining are printed on indifferent paper and are full of misprints, which make the book very inconvenient for reference... The preface is followed by a general index of the 52 books (chapters) of the work, enumerating the 16 divisions and the 62 classes under which the whole matter is arranged... It begins with a critical review of the 42 capital works on Materia media published" previously.

Concerning the year of publication: Huang (2000, p. 621) says 1596. Yokotsuka (1986, p. 198) says 1590 and cites this as the earliest Chinese work to mention *chiang-yu* and *tao-yu* (the liquid separated from soybean chiang). Wai (1964) says 1596. Reischauer and Fairbank (1960, p. 308) say it was completed in 1578. Li (1958) says 1578. Merrill & Walker (1938) say 1590. Bretschneider (1881) says: Completed in 1578 but published in 1596 or 1597.

Talk with H.T. Huang. 1992. March 23. The most current, and one of the best, editions of this work was published in 1982 in Beijing by The People's Health Press (2,977 pages). It is edited and extensively annotated by Liu Heng-ju. He compared several of the most important extant versions, and where they differ (e.g. where a word is written differently in different versions), he explains these differences in footnotes, and explains why he chose the word or text that he did for his basic text. There is no English translation of the *Pen-ts'ao kang-mu*, one of the great scientific works in China (and worldwide) because: (1) It is a huge book which would take a lifetime to translate; (2) A vast amount of research would be required for an accurate translation; and (3) The cost of the translation and publication, and the relatively limited demand for the finished work would probably make the venture unprofitable for a commercial publisher. Perhaps the Chinese Academy of Traditional Medicine would be able to undertake such a translation, working jointly with English-speaking Western scholars.

In the section on soybeans, this work refers to a type of soy wine called *tou-lin chiu* ("bean soak wine") which is described as a sake-like fermented alcoholic beverage made from black soybeans. A recipe is given and it is stated that the *Ts'ung-shu chi-ch'eng ch'u-p'ien* (1473) said that it cures post-partum white sickness, apparently an affliction suffered after the birth of a child.

Note. This is the earliest document seen (Oct. 2012) that mentions a type of soy wine called *tou-lin chiu* ("bean soak wine") as described above.

Wang and Fang (1987) write: The method of preparing chiang-yu (soy sauce) was first described in this work. Cooked soybeans were mixed with wheat flour, pressed into cakes, and left in the room until the cakes were covered with yellow mold growth. The molded cakes, or *ch'ü*, were mixed with salt and water and aged in the sun. After pressing, the liquid was known as chiang-yu. Li also described how to make a similar sauce (*shi-tche*) by boiling fermented black soybeans.

Needham (Botany, 1986, p. 318g): "The soya-bean, *Glycine Soja, ta tou*, was considered an antidote for indigestion and poisoned conditions of the intestinal tract, but Li Shih-Chen found that this never had any effect unless *kan ts'ao* (*Glycyrrhiza glabra*) was given with it (chap. 24, p. 4a)."

Fukushima (1979, p. 5-6): "The chiang-yu described in *Pen-ts'ao Kang-mu* (*Honso-Komoku* in Japanese), published in 1590 by Li Shih-chen (*Ri Jichin* in Japanese) in the Ming (*Min* in Japanese) dynasty, was also made with koji [*ch'ü*] manufactured by using soybeans and cereals (Fig. 4). (In this process soybeans were cooked in water, mixed with wheat, and spontaneously molded to form koji. Salt water was mixed in with a paddle, then the mash was insulated and aged. Finally it was filtered to make chiang-yu). The ratio of soybeans to wheat in the koji making was 3:2. This ratio is very close to that used in making regular Japanese shoyu,

which is made by using equal amounts of soybeans and wheat."

Wai (1964) notes that this book infers that soybean curd [tofu] was invented by Liu An.

Sato (1963, p. 20), in his book titled "Documents on Fermented Black Soybeans, Chiang, Miso, and Shoyu," cites this as the fourth earliest Chinese document seen on the subject. It was translated into Japanese by Suzuki Shintai.

Morohashi (1955) translated parts of the *Bencao* related to [soy] bean oil (*douyu*), bean sprouts (*douya, dounieh*), fermented black soybeans (*doushi*), tofu (*doufu*), [soy] bean flour (*doufen*), bean soak wine (*doulinjiu*), soybeans (*dadou*–production; there are black, white, yellow, dark brown, green, and speckled soybeans).

6. Dabry de Thiersant, Philibert. 1878. Sur les vins et eaux-de-vie fabriqués en Chine [On the wines and brandies made in China]. *Bulletin de la Societe d'Acclimatation* 25:90-102. Feb. [Fre]

• ***Summary:*** Note: This is the earliest document seen (Oct. 2012) that mentions Cantonese Wine Starter (*kiu-tsee*). The French transcription *kiu-tsee* (or elsewhere *Kiu-tsu*) probably referred to a Chinese term such as *jiuzi* (W.-G. *chiu-tzu*) or *quzi* (W.-G. *ch'u-tzu*). In Mandarin, *jiu* means "wine" or "alcoholic beverage," *zi* means "seed," and *qu* means "koji" or "starter."

The starter, used in Canton to make a grain-based wine and spirits, was made from 75 lb of rice, 27 lb of soybeans, 14 lb of the pulverized leaves of the Chinese glycosmis (*Glycosmis citrifolia*, called *Chan-kiue* in Cantonese; a shrub or small tree that grows mostly in Kwangtung province), and 4 oz of *kiu-tsee* from a previous fermentation. To prepare: Boil the rice and beans, spread the rice to cool on a large table, then sprinkle the well-cooked soybeans, dried and powdered leaves, and pulverized starter over the surface. Mix in a shallow vat, mash underfoot to a paste, then shape into 1-lb bricks in a mold 6 inches long and 1½ inches deep. Press grains of dry rice into the surfaces, arrange vertically on a board, and allow to mold for 4-5 days until covered with a whitish mycelium. Place on nets and allow to dry in the shade for 4-8 days, then in the sun on screens for 2-3 days. Store in a desiccator for use as wine inoculum.

Page 98 states: In *Leao-tong*, the brandy (*l'eau-de-vie*) is made with sorghum and *kiu-tsee*, in the proportion of 1,200 pounds of sorghum and 70 to 100 bricks of *kiu-tsee*, which is made with barley and soybeans (*Dolichos soja*). When the fermentation is finished, it is distilled in an alembic or still. The first distillation gives 100 to 120 pounds of the liquor. The residue is then re-heated, re-fermented and distilled again. Address: China.

7. Mene, Édouard. 1885. Des productions végétales du Japon [The vegetable products of Japan]. Paris: Au Siège de la Société Nationale d'Acclimatation. 592 p. Index. 24 cm. [34 soy ref. Fre]

• ***Summary:*** The title page states in small letters: *Extrait du Bulletin de la Société Nationale d'Acclimatation*, indicating that much of the material in this book is based on articles previously published in this French-language Bulletin. However many other early books on Japanese agriculture have also been consulted and are carefully cited.

In the Introduction, the author explains that he was appointed by the Society for Acclimatization to prepare this report on the vegetable products of Japan which had been exhibited at the Universal Exposition of Paris in 1878–in two parts. Those displayed by the Japanese firm Trocadero, and those displayed in the galleries of the palace at Champ-de-Mars. The author and many others were deeply impressed by this exhibition.

Grains (class 69, p. 31): Wheat or rice are mixed with beans or peas and fermented to make shoyu and miso. Shoyu is one of the most widely used condiments in Japanese cuisine. The method of production is described briefly. Among the condiments displayed in class 74 were a number of flasks of shoyu from Tokyo.

Legumes (p. 40-47): Discusses soybeans, tofu, azuki beans (*Phaseolus radiatus* var. *subtrilobata*, p. 42-44; incl. yayenari, red, white, black, and yellowish azuki, Dainagon azuki, azuki flour, an, yokan), shoyu, soybeans (*Pois oléagineux, Soja hispida*, p. 45-46; incl. Kuro-mame {Black soybeans}, various colors and shapes of dry soybeans {green, yellowish, large yellowish, greenish black, brownish red, white, large red}).

There is also a special, long section on soybeans (*Soja hispida. O mame: Daizu;* p. 270-83) and soyfoods. In the Japanese exposition, the display of useful products (*tableau des productions utiles*) designates: No. 24. *Kuro-mame.* Black-seeded soybeans, the size of an average sized haricot bean. No. 25. *Shiro-mame.* White-seeded soybeans, spotted / flecked / speckled / mottled (*tachetées*) with gray. No. 26. *Ao-mame.* Greenish-seeded soybeans. No. 34. *Gankui-mame.* Black-seeded soybeans, flecked with white.

The soybean (*Le Soja*) is cultivated in Japan, India, Ceylon, the Malacca peninsula [today's Malaysia], the Philippine islands, Borneo, Java, the kingdom of Siam, Cochin China, Tongkin (*Tong-King*), and throughout China, primarily in Mongolia and in the provinces of Henan / Honan, Liaoning (*Shenking*), Shandong / Shantung, and Shanxi / Shansi (*Chan-si*).

The Chinese exposition (class 73) contained samples of all the varieties of soya cultivated in all the provinces of the empire. Nos. 2991 to 3000. Green, white, black, yellow, striped or variegated, and reddish soybeans, provided by the Chinese customs office at Newchwang. Nos. 3014-16. Yellow, black, and green soybeans from the customs office at Tientsin. Nos. 3058-61. Yellow, green, and black soybeans from customs at Yantai / Chefoo. No. 3091. Yellow soybean from customs at Chinkiang. Nos. 3013-19. White, red, black,

and yellow soybeans from customs at Shanghai. Nos. 3125-28. White, black, red, and green soybeans from customs at Wenzhou / Wenchow. Nos. 3152-56. White, green, and black soybeans from customs at Kao-hsiung (*Takow*).

The soybean is one of the plants most widely used in Japan and China for both food and industrial purposes. As indicated previously, shoyu, miso, and tofu are indispensable to the Japanese diet. Samples of these products were displayed in the Japanese exhibit in class 74 (condiments and stimulants); they came from Tokyo and from the province of Hizen, mainly from the town of Nagasaki. In the Chinese exhibit, also in class 74, were samples of (*soye*) or (*soya*) which are similar to Japanese shoyu but are called *Chiang-yu* (*Tsiang-yeou*) in China. They were provided by the customs offices at Yantai / Chefoo, Ning-po, Wenzhou / Wenchow, and Canton. For aroma, the Chinese often add star anise, green anise, and orange peel. Chinese soy sauce is made from yellow soybeans (*Houang-téou*).

Note: This is the earliest French-language document seen (April 2012) that uses the term *Chiang-yu* to refer to soy sauce.

Note: This is the earliest document seen (Jan. 2006) describing a soy sauce made with star anise, green anise, orange peel or other spices or herbs outside of Indonesia.

A detailed description of the method for making Japanese shoyu is given, excerpted from the book *Le Japon à l'Exposition universelle de 1878* [Japan at the Universal Exposition of 1878] (1878, vol. II, p. 124). Additional excerpts concerning shoyu, miso, and tofu are taken from: Simon 1862, Kaempfer 1712, *Bulletin of the Society for Acclimatization* 1880 (p. 248), and Champion 1866.

In France, Mr. Vilmorin and Dr. Adrien Sicard (of Marseilles), who are both involved with soybean cultivation, have prepared soy cheese (*fromage de Soja*) numerous times. Dr. Sicard has made both the white cheese [probably tofu] and the red cheese; the latter is rolled in a powder made by grinding red sandalwood (*santal; Pterocarpus santalinus*), mace, and cinnamon (p. 276).

One of the most important soy products is the oil, which is obtained from the seeds–especially the large yellow soybeans that the Chinese call *Houang-téou.* The Japanese do not make soy oil (*huile de Soja*) but in China manufacture of this product gives rise to considerable commerce. Fremy (1855) found that soybean seeds contain 18% oil. The oil is a drying oil, yellow in color and with a special odor and a taste of dried legumes, similar to that of peas. It is used in cooking and illumination. In China, quite a few soy oil factories are found at Calfond in Henan, at Tsinan in Shantung, and at Tayeurn in Shanxi. But the center of soy oil production in China is Ning-po in Zhejiang / Chekiang. From the port of Ning-po and from a port on the island of *Tcheou-chan* [*Zhoushan?*] a large number of junks, carrying only soy oil, depart. Two other manufacturing centers are Newchwang and Chefoo. There follows a detailed description (p. 276-77) of how soy oil is obtained from soybeans.

Another common use is as fermented black soybeans (*Chi*) which (according to Stanislas Julien) contain soybeans mixed with ginger and salt. Kiu-tsee is a fermented soy product made in Canton; it contains red rice, soybeans, and the leaves of *Glycosmis citrifolia.* The Chinese also make a pasta and a sort of vermicelli from soybean seeds named *Hou-mi-téou.*

The stems and leaves make excellent forage. Black soybean seeds are often mixed with chopped soybean hay and fed to horses and mules in northern China and Manchuria.

In Japanese and Chinese medicine, black soybean seeds, ground and made into a decoction, are used to combat asthma attacks.

There follows a long history (p. 277-83) of the introduction of the soybean to Europe (starting at the Jardin des Plantes in Paris, in 1740 or 1779) and its acclimatization, based largely on articles from the *Bulletin of the Society for Acclimatization.* It includes a summary of the work of Prof. Haberlandt in central Europe.

Also discusses: Japanese plum trees (*Prunus mume*) and umeboshi salt plums (p. 52-54, 466-67). Sesame seeds and sesame oil (p. 54-55). Amaranths (p. 63-64). Job's tears (*Coix lacryma;* p. 214-15). Kudzu, kuzu powder, and kuzu cloth (*Pueraria Thunbergiana;* p. 283-85). Peanuts and peanut oil (*Arachis hypogæa, Tojin-mame;* p. 286-87). Sesame seeds and sesame oil (*Sesamum indicum, Goma;* p. 518-20). Hemp and hemp oil (*Cannabis sativa, Asa;* p. 558-59). Address: Médecin de la Maison de Santé de Saint-John de Dieu [Paris, France].

8. Lecerf, Ch. 1888. Sur la valeur alimentaire du Soya hispida [On the nutritional value of the soybean]. *Bulletin de la Societe de Medecine Pratique de Paris* p. 442-49. Meeting of April 26. Presided over by M. Laburthe. [Fre]

• ***Summary:*** Because of the difficulty many people have in tolerating gluten bread, we are anxious to find another food free from sugar and amylaceous materials for diabetics. I thought it would be interesting to do some trials on the use of the seeds of a bean used often in China, Japan, and Malaysia.

I had the occasion to study this bean under the direction of my master, Mr. Muntz, when I was at his laboratory at the Agronomic Institute (*l'Institut agronomique*). I wish to speak of soybeans (*Soya*).

In 1855, Mr. de Montigny, struck by the considerable nutritional value of soybeans, imported some to France, and submitted them to the Society of Acclimatization (*la Société d'acclimatation*), hoping that our farmers would make the best of this legume that is the foundation of the food of the poor classes of China and Japan. In these countries, the soybean equals the potato in our countryside, in consumption. We shall see, in a bit, that the bean of this legume (sub-order *papillonacée* [sic, papilionaceæ]) is richer

by far in nutritious elements than the tuber of Parmentier [the potato].

Since this attempt [by Mr. Montigny in 1855], many agronomical trials have been conducted, at different places in our territory [France and its colonies], and they have proven that the acclimatization of this plant, in France, is possible. They have also permitted us to hope that the climate of our regions is analogous to that of the Chinese and Japanese provinces where the soybean (*le Soya*) is cultivated on a large scale. Unfortunately, these trials had the goal of feeding animals rather than the introduction of this bean into the human diet.

However, eight years ago, Count Attems, who was busy with the cultivation of soybeans in Austria, wrote: "We fool ourselves when we think that soybeans are only an advantageous pasturage, or when we believe that they constitute a delicate dish only for the table of the rich. Soybeans have also been discovered for the large class of less idle consumers, for the country folk and the workers; and although it is a plant of ancient Asia, future generations will make a great case for them and without a doubt will call them "Haberlandt's bean" (*Haricot de Haberlandt*) in recognition."

Professor Haberlandt, who tested the cultivation of soybeans following the Exposition of 1873, published his results in 1878 and became the popularizer of their cultivation and use in Austria. Here is this author's [Haberlandt's] opinion on the nutritive value of this bean:

"I think that soybeans are a food too concentrated to be prepared alone and that, consequently, it is better to mix them with other foods, especially those containing starch... They can furnish armies with provisions of little volume, and enter with good right, as the best equivalent, in pea sausages."

In France, although many notes relative to the cultivation and use of soybeans have been addressed to the Society of Acclimatization, I believe that the first, if not the only monograph that was made of it, is that of Mr. Paillieux. This work was published in 1881; I have borrowed from him numerous times. As for me, it was in 1883 at the Agronomical Institute that I came to know soybeans, following the analyses and experience of Mr. Muntz, and of my dear friend, the late Levallois, from whom the Academy of Sciences received last April 3rd a posthumous communication on the composition of the beans that he harvested at the agronomic station in Nice, of which he was the director.

The name *Dolichos soya* was given by Linnaeus to this Chinese bean that Moench later named *Soya hispida.*

In Japan, they call it *Daïzu Mame,* that is, food seed *par excellence.* In China, it is known under the name *Yéou-téou;* its cultivation there is less important than in Japan, although it enters largely into the food of the working class and is used, as in Japan, for the commercial / industrial preparation of a variety foods.

The soybean is also cultivated and consumed in India, the Himalayas, Ceylon, Tonkin, Cochin China, and the Dutch possessions in Malaysia. In these different lands, it is eaten in its natural state (*en nature*), and used to make many food products, on the one hand the daily food of the poor, on the other condiments sought after by the rich.

Because of the high content of fatty materials in soybeans (17-18%), its flour emulsifies with water, giving with oil a certain quantity of *légumine* [a protein found in soybeans]. The mixture, passed through a cloth, yields, as a filtered liquid, a true milk (*vrai lait*), used like that of cows, goats, or sheep. This is the milk (*le lait*) of the Chinese.

This milk is used to prepare a cheese (named *Téou-fou* in China, *Tou-fou* in Japan), that resembles a white cheese known, in France, under the name of *fromage à la pie* (quark). The lightly heated milk is coagulated when it is warm with the help of a few spoonfuls of liquid nigari / pure sea water (*d'eaux mères de sel marin*). The curds (*caillé*) thus obtained are allowed to drain, then submitted to the action of flowing water. Note 1. The drained curds are first pressed to make tofu, then cut into cakes, which a placed into a container of cold, circulating water.

According to Mr. Champion, in China a piece of tofu (*fromage de pois*) as big as a fist sells for a cent (*un centime*). For many people of the working class, it constitutes the morning meal, either in a liquid state [as soymilk], or coagulated and fresh [as curds], or in a dried state [probably as pressed or firm tofu, or possibly as yuba] and fried in oil extracted from soybeans.

According to the analyses of Mr. Fremy, the soybean contains 18% of this oil, which is in the first rank among the 15-20 types of oils that the Chinese possess. It is of excellent quality and for Europeans, has the sole drawback of retaining the aftertaste of the raw bean.

In Canton [China], soybeans figure in the composition of a solid ferment, *Kiu-tsée,* that the Chinese use to make an artificial wine and their brandy (*eau-de-vie*).

Note 2. This is the earliest document seen (Oct. 2012) that contains the term *Kiu-tsée* (written with an acute accent), which it uses to refer to a solid Cantonese wine ferment.

Continued.

9. Lecerf, Ch. 1889. Le soya, sa valeur alimentaire et son emploi thérapeutique [The soybean. Its food value and therapeutic applications]. In: Compte Rendus, Congrès International de Thérapeutique et de Matière Médicale. 1889. Paris. 347 p. See p. 296-302. Meeting of Aug. 3. Therapeutic section. [4 ref. Fre]

• ***Summary:*** The soybean (*Le Soya or Soja*) is a legume of the group *Phaséolées,* widely cultivated in China, Japan, and the Far East, where it serves as a foundation of the food of the indigenous people.

The Dutch traveler Kaempfer, in 1712, first reported

on this plant, which he designated under the Japanese name Daïdsu. After that it was named: *Dolichos soja* by Linnaeus, *Soja hispida* by Moench, and *Glycine hispida* by Siebold. A detailed botanical description is given. It is an annual herbaceous plant, having slender stems about 80-90 cm in height. Its leaves are trifoliate with a special pattern of veins (*imparipennées- trifoliolées*), its leaflets / folioles are hairy and oval but pointed on the ends. Its flowers are small, papilionaceous corolla, varying in color from white to purple; they are disposed in axillary groups, etc.

The type that I have just described is the one that acclimatizes itself most easily to the European regions where the cultivation of corn / maize is possible. In Japan and China, there are numerous varieties of soya, having brown, black, or greenish seeds. In these countries, each of these varieties has a special use: One kind is used to make tofu (*le Téou-fou*), a kind of cheese of which the Chinese people are very fond. Another is used in the preparation of Shoyu, a kind of sauce which is (so to speak) indispensable to the Japanese. Yet another kind is employed by the Chinese to make Cantonese wine starter (*Kiu-tsée;* [from China]) a solid ferment, which is used in making wines and artificial brandies.

All that is known about the various uses of Soya, about the trials that have been made concerning the acclimatization of this plant in Europe, as well as the chemical composition of the plant and its seeds, can be found in an excellent monograph by Mr. A. Paillieux [1881].

In April 1888, in a communication to the Society for Practical Medicine (*Société de médecine pratique*), I called to the attention of the medical corps the services that this legume could render to diabetics and to invalids, and presented samples of bread made with soya flour.

I am happy to note that my idea did not remain without a response / an echo. Our learned president, Prof. Dujardin-Beaumetz, was kind enough to present to the Academy of Medicine (on 29 May 1888) the soya bread (*pains de Soya*), which I made with no flour other than non-soy flour; he was kind enough to conduct trials with this bread in his department at the Cochin hospital [a famous hospital in Paris].

Later, Mr. Blondel published (*Journal de pharmacie et de chimie*, 5th series, vol. 18, p. 537) a very interesting study on the structure of soybean seeds., and demonstrated the almost complete absence of starch in their tissues. Then Mr. Egasse, in an excellent article in *Bulletin général thérapeutique* (30 Nov. 1888) summarized the various works concerning Soya and its economic and therapeutic applications.

Not much attention was given to Soya [in Europe] until after the Exposition of Vienna in 1873, to which the Japanese brought numerous samples. Professor Haberlandt and Count Cettems were the principal popularizers, and even though they recommended its cultivation mainly from the viewpoint of feeding and fattening livestock, they opened the door to the idea that the seed could be of service if it were introduced as a human food.

In France, the Society for Acclimatization encouraged cultivation trials with Soya, which it sought to popularize; but in spite of the numerous trials that were made and of which the majority gave excellent results, its cultivation continued only in and around Étampes (Seine-et-Oise).

The analyses [of the chemical composition] of soybean seeds that have been made in Austria, Germany, and France are numerous. The writer then gives the composition (in two large tables on p. 299) of three samples of soybeans (from China, Hungary, and Etampes) and their ash as conducted by Mr. Pellet and published in the *Comptes Rendus des Seances de l'Academie des Sciences* (Paris) (1880, vol. 40, p. 1177).

The analyses of Mr. A. Muntz was based on French samples, whose content of starch and sugar was rather high. They contained 6.4% (p. 299).

The sweet material (*matière sucrée*) of the soybean was studied by Mr. Levallois, who also made comparative analyses of the proportion of phosphoric acid and nitrogen contained in wheat and in soybeans. His latter results are given in the form of a short table.

If we compare the chemical composition of Soya, according to the analyses of Mr. A. Muntz, and that of beef that has been defatted (as in a laboratory) according to the analyses of M. Lehmann, we see that the Soya contains more of the useful nutrients / principles than the meat. A table (p. 300) compares the amylaceous and sweet materials, proteins, fats, phosphoric acid, and water for the two foodstuffs.

Soya is therefore a precious plant, which, in a small volume, offers a large nutritive value. Its low starch content makes it very useful in diabetic diets.

The oil contained in the soybean seed, even though it is said that the Chinese use it as an edible oil, is a laxative and has a taste that is not very agreeable; this taste would make it hard to use, even as a substitute for castor oil. It is the oil, above all, which makes it difficult to make bread from Soya flour, and which gives this flour a disagreeable taste, which even cooking does not diminish noticeably. This oil is not, strictly speaking, a drying oil as is often said; it is a mixture of resin, fixed oil, and essential oil (*de résin, d'huile fixe et de huile essentielle*).

With the flour, from which most of the oil has been removed, I have succeeded in making a bread that is not disagreeable. It stays fresh for 4 to 5 days, and has the great advantage for sick people over gluten bread of having a good crumb (the soft, white part of a loaf, other than the crust), not to mention the insignificant amount of starch that it contains.

This bread, cut into slices and dried in a drying stove, furnishes biscuits; finally the flour, mixed with egg yolks, enables us to makes wafers / thin waffles than can be sweetened with saccharine.

Soya bread, in appearance, has a great similarity to rye

bread; its color darkens gradually as it ages. And it is easily digested, provided, as Mr. Dujardin-Beaumetz advises, one does not consume more than 250 gm per day.

In using this bread, a certain accommodation must be made; during the first few days it has a mild laxative effect, but this diminishes as one gets used to it.

Many sick people, having previously used gluten bread, have switched to Soya bread basted on its good taste. Then they discovered the additional advantages of a bread that absorbs and retains moisture well, and that stays fresh and soft for rather a long time. Note: At mealtimes, many French people used to dunk their bread (which is served next to the meal) into a hot, tasty liquid (soup, milk, coffee, gravy, etc.) and use it like a utensil to move or push other foods around, and clean the plate at the end of the meal.

The trials conducted to date do not yet allow us to say for sure, in diabetes mellitus, what the action of Soya is on the production of sugar. But we can affirm, already, that the quantities of glucose (*glycose*) do not increase when Soya bread is substituted for gluten bread. A fact that appears to remain constant with diabetics who use Soya, is a decrease in the volume of urine excreted in 24 hours.

If, by virtue of their low starch content, Soya preparations are useful to diabetics, the relatively large proportions of proteins and of phosphates which they contain make them a substantial food which can render a service to debilitated persons.

Discussion: Mr. Constantin Paul says–Concerning Soya biscuits, sweetened with saccharine, recently recognized as good for the feeding of diabetics, I would like to call the attention of the Congress to the services which can be rendered, in the diets of the sick, by the use of saccharine in general, so convenient to use to console the diabetics that that they do not have completely suppress all sweets...

Mr. Stokvis adds that saccharine has been recently used in Holland and he would like to make the same observation as Mr. Paul. As long as saccharine is used in a sufficiently alkaline milieu, no stomach problems are observed. Address: Pharmacist, Paris.

10. Paillieux, Auguste; Bois, D. 1892. Le potager d'un curieux: Histoire, culture et usages de 250 plantes comestibles, peu connues ou inconnues. Dieuxième édition [The inquisitive person's kitchen garden: History, culture, and uses of 200 edible, little-known or unknown plants. 2nd ed.]. Paris: Librairie Agricole de la Maison Rustique. xii + 589 p. See p. 502-49. Illust. Index. 24 cm. [2 ref. Fre]
• ***Summary:*** Contents of section on soy: Introduction: Work of the Society for Acclimatization with soy, structure of this book, excerpts on soy from past issues of the *Bulletin the Society for Acclimatization.* Botany of the soybean. 1. Soy in Japan: Kaempfer's writings, including miso and shoyu, Japan at the World's Fair of 1878, miso, shoyu, tofu. 2. Soy in Cochin China: Black soybeans, various foods. 3. Soy in China: Soy oil, tofu and fermented tofu, soy sauce, other uses. 4. Soy in Austria-Hungary. 5. Soy in France: Historical, varieties, cultivation, utilization.

The author's full name is Nicolas-Auguste Paillieux (lived 1812-1898; he died on 8 Feb. 1898 at age 85). An illustration (non-original line drawing; p. 503) shows a mature soybean plant bearing many pods, plus a close-up of three pods to the lower right of the plant (from an original in J.R.F. 1882). Note: Desire Bois lived 1856-1946.

Also discusses (listed alphabetically): arachide (peanuts, p. 26-28), haricot mungo (azuki, p. 201-09), kudzu or ko (p. 271-84), quinoa (p. 460-66), souchet comestible (chufa, p. 498-502, with illustration). Address: 1. Member of the Societe Nationale d'Acclimatation 2. Asst. de la Chaire de Culture, Museum d'Histoire naturelle de Paris.

11. Paillieux, Auguste; Bois, D. 1899. Le potager d'un curieux: Histoire, culture et usages de 250 plantes comestibles, peu connues ou inconnues. Troisième édition entièrement refaite [The inquisitive person's kitchen garden: History, culture, and uses of 250 edible, little-known or unknown plants. 3rd ed. completely redone]. Paris: Librairie Agricole de la Maison Rustique. xvi + 678 p. See p. 575-625. Illust. Index. 25 cm. [2 ref. Fre]
• ***Summary:*** The information about soy in this 1899 third edition is very similar to that in the 1892 second edition, but the page numbers are different. Contents of section on soy: Introduction: Work of the Society for Acclimatization with soy, structure of this book, excerpts on soy from past issues of the *Bulletin the Society for Acclimatization.* Botany of the soybean. 1. Soy in Japan: Kaempfer's writings, including miso and shoyu, Japan at the World's Fair of 1878, miso, shoyu, tofu. 2. Soy in Cochin China: Black soybeans, various foods. 3. Soy in China: Soy oil, tofu and fermented tofu, soy sauce, other uses. 4. Soy in Austria-Hungary. 5. Soy in France: Historical, varieties, cultivation, utilization.

The author's full name is Nicolas-Auguste Paillieux (lived 1812-1898; he died on 8 Feb. 1898 at age 85). An illustration (non-original line drawing; p. 576) shows a mature soybean plant bearing many pods, plus a close-up of three pods to the lower right of the plant (from an original in J.R.F. 1882). Note: Desire Bois lived 1856-1946.

Other related or interesting subjects (listed alphabetically): Adzuki (p. 224). Amande de terre: See Chufa. Amarantus / Amarante (p. 14-16). Arachide / Arachis hypogæa (p. 32-35). Chufa / *Cyperus esculentus / souchet comestible* (p. 571-75). Daikon (p. 173). Gado-gado [Salad with peanut dressing] (p. 224). Gobo (p. 45). Jinenjo (p. 246). Katakuri (p. 336). Koniaku [konnyaku] (p. 289). ko / kudzu (p. 300-315). Mioga (p. 396). Moyashi (p. 226). *Phaseolus radiatus* / azuki (p. 222-24). Pistache de terre: See arachide. Quinoa (p. 523-25). Udo (p. 448). *Voandzou / Voandzeia subterranea* (p. 650-53). Wasabi (p. 420). Yama gobo (p. 496). *Zingiber mioga* (p. 396). Address: 1.

Honorary member of the Council of the Societe Nationale d'Acclimatation 2. Asst. de la Chaire de Culture, Museum d'Histoire naturelle de Paris.

12. Mene, Edouard. 1910. La Chine a l'Exposition de Bruxelles [China at the Brussels Exposition]. *Bulletin de l'Association Amicale Franco-Chinoise* 2(4):336-46. Oct. See p. 340-43, 346. [Fre]

• ***Summary:*** 1. The Chinese pavilion: In the beautiful and grandiose Universal Exposition of 1910, that a frightful fire partially destroyed, the Chinese section merits special mention. It is not an official exposition organized through the care of the Chinese administration. Rather, it is an exposition organized by five Chinese merchants The last one, Mr. Tsu represents both soya and the ideal kite (*soja et cerf-volant idéal*).

Note: The meaning of *cerf-volant idéal* is unclear. The Chinese have long been known for their beautiful and well-designed kites, some with long, flowing tails. However, if Mr. Tsu was exhibiting kites, he would have used the plural form of the noun. Is he saying that soy is like a high-flying kite?

These exhibitors have gathered a certain amount of indigenous and modern objects, commercial and artistic in a pavilion located in the section reserved to foreign countries (start of p. 339).

In the back of the room, to the right are displayed by Mr. Tsu, the different products extracted from one of most utilized plants in China: *Soja hispida,* Houang-teou, the soybean of the leguminous family.

One can observe plates filled with soybean seeds (*graines*), looking like little round (broad) beans (*fèves*), and some dehulled soya beans; jars filled with white soya cheese, looking like quark [tofu], cheese in round boxes, looking like Camembert [fermented tofu]; a jar with the skin of the soya cheese [yuba]; a vial with soya casein [soy protein].

A display case is filled with jars of different types of yellow, green, and black soybeans, of soya flour, of semolina, of a brownish soya coffee in bean and powder form, of bottles of soymilk, of soy oil, and of Soy [sauce], this condiment so utilized in Chinese cuisine. On a table are displayed soya pastries resembling in their shape, the Commercy madeleines [small sponge cakes shaped like sea shells], some noodles, macaroni and soya bread that is prescribed to diabetics as well as a gruel of soya flour. On the floor are placed several square soybean cakes (*tourteaux*), residue of the soya oil production, of a grey-yellow color, to be used as fertilizer. A brochure on soya-based food products, excerpted from the book *The Soybean* (*Le Soja*) by Mr. Li Yu-ying is being handed out through the care of the exhibitor, Mr. Tsu.

This brochure, titled: 'Soya based Food Products' (*Produits alimentaires à base de Soja*), Caseo-Sojaine, rue Denis-Papin, les Vallées (Seine), describes these products and their preparation: soya milk, liquid or in powder form, derived from the grinding of the beans, after immersion, in water, for several hours. The grain content consisting of legumin or vegetable casein, is placed under a grindstone: one derives an homogenous, nutritive and digestible milk product. Fermented and powdered milk is produced, soya casein, extracted from the soya milk, with uses in food and in industry; soya flour, obtained by the grinding of the dehulled beans, completely deprived of their seed coat to lessen the proportion of cellulose and increase its digestibility. It does not contain any starch; soya bread, well utilized to feed diabetics; by perfecting fermentation, one makes a rather light bread, one that reminds one of rye bread; pasta / noodles; cookies, pastries, white- and pink-tinted pasta prepared with soya flour, soy sauce (Soy) with a bouquet that reminds one of burned onion that is used to enhance fish and vegetables; soya jam (*confiture de Soja*), similar in appearance and taste to chestnut cream (à la crème de marrons), soya oil for food use; green vegetable soybeans (*légumes de Soja*), whose sprouts may be used as a salad. As for the soybean cakes (*tourteaux*), these are used for animal feed and fertilizer.

In China, the *Soja hispida* (the soybean), with hairy pods, with yellow, reddish, black, green, white, variegated beans, whose taste echoes the green bean, the lentil, the pea, and that has a high content of culinary oil, is grown, on a large scale, in Mongolia, in Manchuria, and in the provinces of Henan, Zhejiang, Jiangxi (*Ho-nan, Tchokiang, Chan-si et Chang-tong*). It is one of the most utilized plants from the culinary and industrial point of views.

Soy sauce, called Soy in English and in Chinese *Tsiang-yeou,* is a greatly-appreciated condiment that is prepared with yellow soybeans named *Houang-teou* and that one flavors with star anise, green anise, and grated orange rind. It is a blackish liquid, lightly syrup-like used to enhance the flavor of fish, meat, and vegetables. Another Chinese condiment [fermented black soybeans] is made with soybeans mixed with salt and ginger. In Canton, *Kiu-tsu* [*jiuzi,* Cantonese wine starter, a ferment] is made with soybeans, red rice, and leaves of *Glycosmis citrifolia.* As for soya cheese, it is made as follows (see footnote): Soak the soybeans in water for 24 hours to make them swell; drain off the water, grind while adding fresh water to form a slurry that is run through a filter. Stir it by hand, then pour it into a caldron, where it undergoes a slow cooking. Let it cool in a tub and remove and foam with a big spoon.

A thick film [yuba] is formed on the surface. It is lifted off with a round wooden stick shaped like a long chopstick (*baguette*) and it is allowed to dry on thin ropes. This skin is called skin of soya cheese [yuba]. To the remaining soymilk, add a little water mixed with calcium sulfate (*plâtre*) and several drops of nigari, which is magnesium chloride derived from the salt in salt beds.

Footnote at the end of page 342: See (1) *Bulletin of the*

*Society for Acclimatation*, second series, volume 13, page 562, 1866, "On The production of tofu in China," by Paul Champion.

Stir in the liquid coagulant which will cause the casein in the soymilk to coagulate. Pour the warm mass into in a wooden frame or box lined internally with a fine cloth through which the liquid whey will seep. Atop the frame or box place a board loaded with weights to press the cheese which is of a grayish white color, looks like quark, and has a pea-pod taste (*à goût de pois*)*;* with the addition of salt, this cheese will keep; without this precaution, it spoils. It is used to feed the impoverished portion of the population: often, it is fried in soya oil. Soya cheese [tofu] is manufactured on a large scale near Peking and in most of the sea ports of Southern China. It is mostly the town of Ning-po that is the center of this production. Each year, thousands of junks (*jonques*) loaded exclusively with soya cheeses leave this town harbor to reach other Chinese harbors.

Besides cheese [tofu], the most important soya product is the oil that is extracted from its beans, mostly the yellow beans called *Houang-teou.* This yellow oil, which is siccative / drying, has a special smell and a pea-pod taste. At Kaifeng (K'ai-fong) in Henan (Ho-nan) province, at Tsi-nan in the Chan-tong, and at T'ai-yuan in the Chan-si, are located important soya oil manufacturing plants. But it is mostly Ningpo in the Tcho-kiang, that is the center for the production and the centralizing of soya oil. Much is also produced in Newchwang [Nieou-tchouang], and in Chefoo / Tantai (Tche-fou) in Shantung province. The soybean cakes (*tourteaux*), the by-products of soya oil processing, are a major export out of Newchwang and Chefoo; they are shipped to Swatow and Amoy to be used as fertilizer in sugar cane plantations.

These soybean cakes (*tourteaux*) are sought after as much as the beans themselves, and are to feed cattle, as are the pods, the stems and the foliage of the plant. The beans of *Hei-teou*, the black soya bean, mixed with cut up straw, are given as feed to horses and mules in Northern China and in Manchuria.

Note: This periodical was established to promote understanding and friendship among the people of France and China. Soja is mentioned on pages 341, 342, 343, and 346. Address: Dr.

13. Li, Yu-ying; Grandvoinnet, L. 1911. Le soja [The soybean]. *Agriculture Pratique des Pays Chauds* (*Bulletin du Jardin Colonial*) 11(105):459-74. Dec. [18 ref. Fre]
• ***Summary:*** Contents (continued): 2. The soybean in human nutrition. The soybean in general nutrition: From the viewpoints of physiology, economy, and gastronomy. The role of soybeans in special diets/regimens: Vegetarianism and vitalism, remineralization, anti-diabetic, others, lactose-free.

Foods made from soybeans (*Produits alimentaires à base de soja*)*:* 1. Soymilk and its derivatives: Soymilk (developed by the Chinese philosopher Whai Nain Tze {Liu An of Huai Nan} well before the Christian era, method of production, Chinese method, modern method used at Li's factory *l'Usine de la Caséo-Sojaïne* at Vallées (Seine)), cleaning the seeds, steps in soymilk preparation (grinding and filtration), the nature of soymilk (physical properties). A graphic illustration (p. 465) shows a comparison of nutritional elements between soybeans, tofu, and beef. A chart in outline form (p. 471) titled "Soy based food products" (*Produits alimentaires a base de soja*) shows the numerous and varied food products that can be derived from the soybean: I. Soymilk and its derivatives: Normal soymilk, concentrated soymilk, powdered soymilk, fermented soymilk (*lait fermenté*), soy cheese (*Caséo-Sojaïne; Fromage de soja* [*tofu*]), soy casein. II. Soy flour and its derivatives: Soy flour, soy bread for diabetics, whole-grain bread (*Pain complet*), cakes, biscuits (*Biscottes*). III. Soy oil and its by-products (cake). IV. The soybean used as a vegetable. V. Condiment products based on fermented soybeans. VI. Confectionery products: Soy confection, soy powder. VII. Soy coffee. Soy-based ferments: Kiu-tsee, lactic ferments based on soymilk. (*Ferments lactiques à base de lait de soja*).

Photos show: Inside view of Li's factory as the equipment is producing soymilk (p. 473). Microscopic view of soymilk, and of soy flour dissolved in water (p. 474). Also contains various tables, charts, and graphs from other sources.

Note: This is the earliest document seen (March 2000) written by Li Yu-ying which contains the term *Caséo-Sojaïne.* On p. 471 he states clearly that he uses it as a synonym for soy cheese (*Fromage de soja*) [tofu], which is made from soy milk–perhaps to avoid disputes over the word *fromage* with manufacturers of dairy cheese. On p. 472-73 he states that *Usine de la Caséo-Sojaïne* is the name of his modern factory at Vallées (Seine) which makes a variety of soy products. Address: 1. Counseiller de 1ere classe au Ministère de l'Agriculture de la Chine; 2. Ingénieur agricole (G.).

14. Stuart, George A. 1911. Chinese materia medica: Vegetable kingdom. Bean ferment (Document part). Shanghai, China: American Presbyterian Mission Press. 558 p. See p. 193-94. 23 cm.
• ***Summary:*** "Bean Ferment.–(Chinese characters given) (W.-G.: Tou-huang; pinyin: douhuang = bean + yellow). This is the fermentation pellicle (*Mycoderma*) which forms on the top of fermenting beans, as the mother-of-vinegar forms on the top of vinegar in its process of preparation. The pellicle contains, in addition to the *mycetes* of fermentation, various kinds of moulds and mildews." To make the product, "Take a peck of black beans and thoroughly steam them. Spread upon matting and cover with artemisia stalks, as in the process of preparing soy [sauce]. When the pellicle is formed on top, take it off, dry in the sun and powder, when it is ready

for use. The taste is sweet and cooling, and the substance is non-poisonous. It is specially recommended in the treatment of rheumatism, especially that of the knees, for the insufficient action of the five viscera, spleen, and stomach, giving strength to the body, lubricating the muscles and skin, improving the complexion, invigorating the marrow, and toning up the system generally, enabling one to eat fats. It is sometimes combined with pork fat and made into pills for producing flesh. A hundred pills should be take at one time. Fat people should not use this substance. Chewed into a paste and applied to eczema, it proves very efficacious."

Note 1. This is the earliest English-language document seen (Oct. 2012) that contains the term "Bean Ferment" or the Chinese term or characters "Tou-huang" or the word "pellicle" or the term "fermentation pellicle" or the word *Mycoderma,* which it uses to refer to a fermented specialty soyfood.

Note 2. Eczema, a skin disorder, was later recognized to be, in many cases, an allergic reaction. Address: Rev., M.D., Shanghai, China.

15. Li, Yu-ying; Grandvoinnet, L. 1912. Le soja [The soybean]. *Agriculture Pratique des Pays Chauds* (*Bulletin du Jardin Colonial*) 12(109):302-08. April. [2 ref. Fre]
• ***Summary:*** Contents (continued): Products and condiments based on fermented soybeans (continued): Tuong (an Annamese condiment that can replace nuoc mam or fish sauce; preparation with rice or corn/maize as described by Bui), Tao-yu (a condiment widely used in China and Japan, as described by Prinsen Geerligs; preparation, properties, chemical composition).

6. Confectionery products (*Produits de confiserie*)*:* Sweet soya preserves made from whole soybeans (*Confiture de soja,* such as soy-based *crème de marron,* a chestnut cream), soya powder (two types are made at Li's plant: one by drying soy pâté and one from roasted soybeans), soy chocolate. At Li's tofu factory (*l'usine de la Caséo Sojaine*) near Paris, soy chocolate (*Chocolat de soja*) is prepared using roasted soybeans, sugar, and cocoa butter [a pale-yellow, pure edible vegetable fat extracted from the cocoa bean]. From these one is able to obtain almost the same composition, appearance, and flavor as chocolate. But this product has the advantage of containing considerably less toxic theobromine.

7. Soya used as coffee (*Le soja employé comme café*). For a very long time, soybean seeds, dried and roasted, have been used in certain parts of Europe (Switzerland) to replace coffee. By an infusion of these roasted seeds, a liquid is obtained which resembles coffee in color and flavor. Moreover, under a different name [Cole's Domestic Coffee Berry, 1892], soybeans have been launched in the United States for this usage. This very special use of the soybean will be of interest to those who are forbidden to drink coffee, for they will now be able to enjoy it in a different way. A table shows the composition of Swiss soya coffee according to Kornauth.

8. Ferments or starter cultures for fermentation: Kiu-tsee (a special ferment from Canton described by M. Daby de Thiersant), lactic ferments (fermented soymilks).

Industrial uses of soybeans: Uses of the oil to make soap, wax candles (*bougie*), paint, or artificial rubber. Uses of the protein (*caséine de soja*) to give products resembling those made from milk proteins: sojalithe or soy stone resembling lactite, insulators for electrical apparatus, soy glues, etc. Illustrations (line drawings, p. 305) show cellular elements of different soya confections. Address: 1. Counseiller de 1ere classe au Ministère de l'Agriculture de la Chine; 2. Ingénieur agricole (G.).

16. Li, Yu-ying; Grandvoinnet, L. 1912. Le soja: Sa culture. Ses usages alimentaires, thérapeutiques, agricoles et industriels [The soybean: Its culture. Its food, therapeutic, agricultural, and industrial uses]. Paris: Augustin Challamel (Rue Jacob 17). 150 p. Illust. Index. 25 cm. Translated into French and expanded from the Chinese edition, published by la Societé Biologique d'Extréme-Orient (1910). [151 ref. Fre]
• ***Summary:*** One of the earliest, most important, influential, creative, interesting, and carefully researched books ever written about soybeans and soyfoods. Its bibliography on soy was larger than any published prior to that time. It was first published as a series of eight articles in *Agriculture Pratique des Pays Chauds* (*Bulletin du Jardin Colonial*) from September 1911 to April 1912. Before being published as a book, it was revised slightly by adding a table of contents at the back, dividing the material into 5 parts with 19 chapters, and adding several photos (p. 16-17), a world map showing the distribution of soybean cultivation (p. 21), and an interesting 2-page table (p. 66-67).

Contents: The soybean: Origin and history. Part I: Soybean culture. 1. Species and varieties of soybeans: Botanical characteristics, species, varieties (Chinese, Japanese, Indian, Indochinese, Hawaiian, USA, European). 2. Needs of the soybean: Climatic, geographical area of the soybean by region worldwide, agrological/soil needs, fertilizers, soil preparation, the place of the soybean in crop rotations. 3. Soybean seeds: Study of seeds (by weight, by germination rate, selection of seeds), time of planting, plant spacing, depth of seeding, rate of seeding per hectare, method of seeding (broadcasting, in rows, in mounds). 4. The soybean during its vegetative stage: Germination, transplanting, types of care (e.g., second dressings), irrigation, flowering and fruiting, enemies of the soybean (e.g., insects). 5. Harvest of soybeans: Time for harvest (forage or grain), methods of harvesting (forage or grain; mechanical mower), threshing (use of machine), yields of soybeans (forage and grain in various countries, ratio of seeds harvested to straw is about 1 to 2, yield of nutrients).

6. Fixation of atmospheric nitrogen by soybeans, and improvement of the soil. 7. The soybean in mixed cultures and alternate rows: With corn, cowpeas, rice, sweet sorghum, or millet.

Part II: Chemical composition of the soybean. 1. Composition of the plant: Minerals in the leaves and total plant. 2. Study of the seed: Composition, chemical composition, microscopic comparisons, table of analyses by 28 previous researchers, albumins, sugars, starch, dextrin or dextrine, diastase, lipids, ash/minerals.

Part III: The soybean as human food and animal feed. 1. The soybean as feed for animals: Green forage and hay. 2. The soybean in human feeding: From the viewpoints of physiology, economy, and gastronomy. The role of soya in special diets: Vegetarianism, remineralization, diabetic, and lactose intolerant.

Part IV: Food products based on soya. 1. Soymilk and its derivatives: Soymilk (Methods of manufacture, Chinese and modern at l'Usine de la Caséo-Sojaïne, nature and properties [physical and chemical] and composition of the milk, action of ferments and diastases (enzymes) on the milk, uses of the milk, the residue from the soy dairy [okara], condensed soymilk, powdered soymilk, fermented soymilk (kefir, yogurt, etc.)), tofu (called Caséo-Sojaïne, or fromage de soya; methods of production, coagulants, yield of tofu, storing tofu, composition and comparison with various meats, digestibility, culinary preparations made from tofu (smoked tofu, tofu pâté, tofu sausages)), Soy casein (food and industrial uses). 2. Soy flour and its derivatives: Soy flour, soy bread, wholemeal bread, other products based on soy flour (as biscuits and cakes for diabetic diets). 3. Soy oil and its by-products: Soy oil, physical and chemical properties, usage, residue of the oil mill: the cake, price, uses. 4. Use of the soybean as a legume: Whole soybeans (composition and digestibility), soy sprouts (*germes de soja*), green vegetable soybeans (*le soja frais*). 5. Fermented soy condiments: Solid condiments from Japan: Tokyo natto (*Le Tokio-Natto*) and Ping-Ming natto or tao-tche (*Le Ping-ming-Natto;* fermented black soybeans with salt, ginger, orange rind, etc. A similar product is made in China and called tao-tche). Paste condiments: Miso (four types and composition), tao-tjung (Chinese miso). Sauces: Shoyu (its production, varieties, properties, composition), chiang-yu (*tsiang-yeou*), ketjap [kechap, from Java], tuong (from Annam, with rice or corn), tao-yu (widely used in China and Japan, described by Prinsen Geerligs). 6. Confectionery products: Comparison with chestnuts, roasted soy flour to replace chocolate. 7. Soy coffee (with analysis by Kornauth). 8. Special fermented products: Kiu-tsee (a special commercial ferment from Canton described by Thiersant), fermented soymilks.

Part V: Industrial uses of soybeans. Oil based: soap, wax candles (*bougie*), and paint oils. Protein based: sojalithe or soy stone which corresponds to lactite, insulators for electrical apparatus, glue, etc. Conclusion. Addendum (*Complément*) to Part III, Chapter 1: Soybean straw and stems. Composition of various seeds, including soybeans. Soy flour. The cakes from oil mills. Soymilk and the cake from soy dairies (*tourteau de laiterie*, okara).

A very interesting table (p. 66-67, which does not appear in the original 8 articles) shows earlier nutritional analyses of the composition of soybeans by Steuf (from Hungary, Mongolia and China), Schroeder, Caplan, Pellet (from China, Hungary, Etampes), Muntz, Nikitin (black soybeans from Russia, 2 samples), Lipski [Lipskii] (yellow, from Russia), Giljaranski (yellow from Russia, China and Japan; black from China and Japan; green), König (*Hispida platycarpa* black, Tumida yellow, brown and black), Prinsen (white from Java and China), Goessmann, Kellner, USDA, Chemiker Zeitung (white from Java and China, 29 Jan. 1896), Scuff (misomame; miso soybeans), Zulkovski (yellow from China, reddish brown from Mongolia), Institut Agr. de Vienne (Austria; yellow from Vienna, reddish brown from Tirol), Ecole Imp. et Roy d'Ag. Hong (yellow from Mongolia and China, reddish brown from China), Chez M. Olivier Lecq (from Moravia), Lechartier (Etampes and black), Joulie (yellow), Stingl and Morawski, Bloch (yellow, green, and black), Balland, Cavendish Evelyn Liardet (yellow, brown, green, black, and white), Jardin Colonial (Laos, Tonkin, China), Aufray (Tonkin, Yun-nan), Homes Laboratory (black from China, or white). Photos and illustrations are the same as those referenced in individual sections of the book, except for the following: A field of soybeans (p. 16). A soybean plant growing in Europe (p. 17). Color illustrations appear facing pages 12, 22, and 64. Address: Li is from Societe Biologique d'Extreme-Orient (Chine). Grandvoinnet is from Ingenieur Agricole (G.).

17. Williamson, A.A. 1917. Soya beans for American mills. *Commerce Reports* [*USA*] (*Daily Consular and Trade Reports, Bureau of Foreign and Domestic Commerce, Department of Commerce*) 20(125):795-99. May 29. [1 ref]
• ***Summary:*** Discusses the Manchurian soybean industry with reference to the possibility of soybean imports for use in American mills. Contents: Introduction. Trade developed originally with England. Special regulations established. Arrangements for settling future deals. Advisable course for American buyers. Production in the Harbin consular district. Varieties of soya beans. Put to many uses in Far East (in central and western China it is ground into a flour to be made into vermicelli, and employed extensively in the manufacture of vinegar and bean curd). Dairen a center for oil industry. Places of production–export figures. Differences in quality of oil.

"Soya beans have never been shipped from Dairen to the United States so far as is known at the American consulate. Certainly they have never been among the declared exports, although they may have gone by way of a Japanese port...

"The soya bean first became known to world trade in

1908 when shipments to England were made by the Mitsui Bussan Kaisha, although it has long been an article of everyday use among the Chinese. In the boom that followed many evil practices arose, as a result of which losses of considerable amounts were sustained by firms interested in the business and not engaged in speculation, largely through the failure of some dealers and speculators to deliver merchandise contracted for in advance. By 1910 things had come to such a condition that whenever a ship came in to load for Europe the price of beans would soar far above the normal market prices, as it was known that several of the foreign firms had contracted to deliver beans but had not been able to obtain delivery of the 'future' beans they had bought. So it came about that the date of a ship's arrival was kept secret by its agents as long as possible to enable the charterers or special clients quietly to get together their cargo before the market began to rise. Several firms became bankrupt as a result of their losses, and the soya-bean business itself began to fall into bad repute.

"Japanese officials sought a remedy, and as a result the Dairen Staple Products Exchange and the Dairen Trust & Guaranty Co. were formed in June, 1913. By the regulations then put into force, all deals had to be made between licensed dealers, and both parties were protected...

"Beans are generally shipped in gunny bags holding 150 kin (198.42 pounds). The 100-pound bag favored by the American trade is not known here... The picul (133 1/3 pounds in China) is a standard weight in the Far East, 100 kin or catties making a picul...

"Soya beans, under the 1909 tariff, were subject to an import duty in the United States of 45 cents per bushel of 60 pounds. Oil was duty free. Under the 1913 tariff both are on the free list...

"The Dairen wharves are good and are well equipped to handle large ships. Although elevators and loading machinery are not employed here because of the cheapness of coolie labor and for other reasons, the work is done expeditiously, 17,000 tons having been loaded in one day, while about 10,000 tons may be put down as the average, without night work...

"Dairen is the center of the bean-oil industry, shipping about eight times as much each year as Hankow which is its nearest competitor... Japan takes practically all the bean cake exported. The United States takes none...

"The exports of soya beans from Hankow during 1915 were: Black 8,927 tons, green 10,513 tons, and yellow, 52,218 tons." Exports for 1916 are also given in a table. Address: Consul, Dairen, Manchuria.

18. Shih, Chi Yien. 1918. Beans and bean products. Shanghai, China: Soochow University Biology Dept. 13 p. 24 cm. [Eng]

• ***Summary:*** The author's name in pinyin is probably Shi Jiyan. At the head of each section, the name of each product or type of bean is written in Chinese characters. Contents: Introduction by N. Gist Gee of the Dept. of Biology, Soochow Univ., China.

Note 1. Soochow, also called Su-chou (formerly Wuhsien) is a city in southern Kiangsu (pinyin: Jiangsu) province, in eastern China, on the Grand Canal. Introduction and names of soy beans: Classical Chinese names, colloquial Chinese names, Latin names, and English name (Soja bean). Soy beans. The food products of soy beans. Bean curd (Cc). Tou fu koen. Po yeh. Yu tou fu [fried tofu]. Ju fu [fermented tofu]. Tsao ju fu [fried fermented tofu]. Ch'ing hsien ju fu. Tou chiang or bean sauce. Chiang yu. Bean ferment or tou huang. Bean Sprouts. Bean relish or tou shih [fermented black soybeans]. Bean oil.

Beans (Four varieties of *Phaseolus mungo* var. *radiatus:* chidou = dark-red [azuki] bean, baichidou = white dark-red bean, lüchidou = green red bean, and lüdou = green [mung] bean): The food products from the green [mung] beans (lüdou): Bean sprouts, green bean congee or lu tou chou, green bean soup or lu tou tang, green bean pudding or lu tou kao and lu tou sha. The food products from the red [azuki] bean (quite similar to those made from the green [mung] bean): Congee, rice, pudding, tou sha.

Hyacinth beans (*Dolichos lablab;* five Chinese varieties / names: biandou, baibiandou, qingbiandou, zibiandou, longzhao biandou). Asparagus beans [cowpeas] (*Vigna catiang;* four Chinese varieties / names: jiangdou, panxiang jiangdou, manli jiangdou, baimi jiangdou). The food products from Pien Tou and Chiang Tou. Medicine. Flowers and seeds of the Pai Pien Tou, the broad bean, windsor bean, or horse bean (*Vicia faba*); In China it has two names: (1) Ts'an Tou or silkworm bean, because it is harvested at the time the silkworm is making its cocoon; (2) Han Tou or cold bean, because it grows through the winter. The food products from Ts'an tou (broad bean): Bean shoot (tou miao), Ch'ing tou (as a vegetable), Ja tou (broad bean sprouts), Shien fan and fan bee (made from broad beans and mung beans), Tou sha. The section on the names of beans (p. 1) we will give the English name, Latin name, the classical Chinese names / colloquial Chinese names, and an English translation in parentheses, as follows: (1) Soja bean, *Glycine hispida:* heidou / heidou (black [soy] bean), huangdou / huangdou (yellow bean), yangyandou / yangyandou (sheep eye bean), maliaodou / maliaodou (horse material / feed bean),–/ guguo qingdou (bone wrap green bean),–/ jiajia sandou (pod pod three bean), xiangsidou (mutually think bean) / xiaqngzhidou (fragrant branch bean),–/ bayue baidou (8th month white bean). Soja bean: *Dolichos cultratus* quedou (magpie bean) / equedou (chirp magpie bean). Soja bean: *Phaseolus vulgaris* baidou (white bean) / shui bai dou (water white bean),–/ shidou (fennel bean) (Note 3. shiluo means "fennel"),–/ guashudou (melon ripe bean),–/ maquedou (sparrow bean),–/ niuta biandou (cow tread flat bean),–/ yadou (sprout bean),–/ shijia xiangdou (ten family fragrant bean),–/ xifeng qingdou

(west wind green bean),–/ shizi hedou (persimmon pit bean),–/ denglongdou (lantern bean).

Note 4. The large title "Soy Beans" at the top of this table, the right column which says that the English name of each variety is "Soja bean," and the next 8 pages which are only about soy beans, strongly indicate that all the colloquial names in this table refer to different varieties of soy beans. Moreover, all these colloquial names appear again on page 3 in a table on planting and harvest times of different varieties of [soy] beans. The bottom half of the colloquial names are probably from different parts of China, since Dr. H.T. Huang (a soybean expert) has never heard many of these colloquial names before. The most puzzling question is: What are *Dolichos cultratus* and *Phaseolus vulgaris* doing at the bottom of the "Latin name" column? *Dolichos cultratus* is not listed on either of the two comprehensive taxonomy databases (GRIN and ILDIS, which include all past Latin / scientific names). *Phaseolus vulgaris* refers to the common bean, such as the kidney bean, pinto bean, navy bean, frijole, etc.

2. Soy beans. "They were introduced into France during the reign of Ch'ien Lung about 1740 A.D. by a French Consul; into England in 1790, into Australia in 1875, into Germany 1881, and 1888 into America. They were known here from ancient times and were mentioned in the oldest books Pên Ts'ao Kong Mu, which were written by the Emperor Shen-nung in the year 2838 B.C., and the later Chinese Classics."

Note 5. This is the earliest English-language document seen (Aug. 2002) that treats Shen Nung as a real, historical figure, or that says the first written record of the soybean appears in a book written by him. The information about that book is wildly inaccurate. The *Bencao gangmu* (The great pharmacopoeia), perhaps China's most famous materia medica, was written by Li Shizhen (+1596). The above information, which is all wrong, has been cited again and again, down to the present day (2002), in connection with the supposed origin of the soybean.

"Even during the ancient times they were considered by the people to be the most important of the cultivated leguminous plants." Note 6. This is the earliest document seen (Aug. 2002) which states, incorrectly, that the date of Emperor Shen-nung's book is 2838 B.C.

"The methods of cultivation are as follows: In general all of the soja beans are planted in rows along the banks of canals and the boundaries of the fields, which separate the fields of one family from those of another, except those which are called oil beans or Eighth month white bean and Water white bean. These last are planted in large fields. The oil beans are planted early in June." The method of cultivation, harvest, and threshing is then described in detail. A table gives the time of planting and harvest for 18 varieties of Chinese soybeans, grouped into 6 types by planting and harvest dates: (1) Plant in latter part of April, harvest in latter part of Sept.: *Heidou* (black [soy] bean), huangdou (yellow bean), *maliaodou* (horse material / feed bean), *guguo qingdou* (bone wrap green bean), *jiajia sandou* (pod pod three bean), *xiangzhidou* (fragrant branch bean). (2) Plant in early part of June, harvest in middle part of Sept.: *bayue baidou* (8th month white bean), *shuibaidou* (water white bean), *maquedou* (sparrow bean). (3) Plant in early part of July, harvest in early part of Oct.: *equedou* (chirp magpie bean). *niuta biandou* (cow tread flat bean), *shijia xiandou* (ten family fragrant bean), *xifeng qingdou* (west wind green bean), *shizi hedou* (persimmon pit bean), *denglongdou* (lantern bean). (4) Plant in early part of April, harvest in early part of July: *guashudou* (melon ripe bean). (5) Plant in early part of April, harvest in latter part of July: *shidou* (fennel bean). (6) Plant in early part of April, harvest in latter part of June: *yadou* (sprout bean).

The rest of the work concerns the food products of the beans, including a detailed description of how each is made.

Note 7. This document contains the earliest date seen for soybeans in Australia or Oceania (1875). It is not clear whether or not these soybeans were cultivated in Australia; they may well have been. The source of these soybeans is unknown, as is the author's source of information concerning that early introduction, 43 years before Shih wrote this booklet. He is the first to give such an early date for the introduction of soybeans to Australia. Yet the date does not seem unreasonably early since there were 17,000 Chinese in Australia by 1855 (see Australian Department of Immigration and Ethnic Affairs. 1985. "A Land of Immigrants"). Address: Biology Dep., Soochow Univ., China.

19. Shih, Chi Yien. 1918. Beans and bean products: Bean ferment or tou huang (Document part). Shanghai, China: Soochow University Biology Dept. 13 p. See p. 7. [Eng]
• ***Summary:*** (Cc) = Chinese characters inserted in text; pinyin romanization has been added. "Bean Ferment or Tou Huang (pinyin = douhuang = bean + yellow). This is the fermentation pellicle which is formed on the top of fermenting beans. It is largely made from the black beans. The method of preparation is as follows:–The black beans are thoroughly steamed first and then spread upon matting and covered with the leaves of reeds just as in the process of preparing Tou Chiang or bean sauce. When the pellicle is formed on top of the beans [soybean koji] it is taken off, dried in the sun and then ground into powder, when it is ready for use.

"The taste is sweet and cooling. It is used to combine with pork fat and thus is made into pills for producing flesh." Address: Biology Dep., Soochow Univ., China.

20. Ochse, J.J. 1925. Tropische groenten. Geteelde en in 't wild groeiende gewassen, die door de Indische bevolking worden gegeten [Tropical vegetables: Cultivated and wild

plants eaten by the Indonesian people]. Weltevreden: Uitgave en Druk Volkslectuur. 215 p. July. See p. 92-95. Illust. Also listed as series #686. [Dut]

• ***Summary:*** This is the original Dutch-language edition, which was revised in 1931 as *Indische Groenten* and translated into English in 1931 as *Vegetables of the Dutch East Indies.* Ochse lived 1891-1970. After describing the plant, the author notes that there are two varieties of soybeans: one is yellowish brown and the other is black. The first is used to make tempeh and tofu; the second to make kétjap. Very popular soy products in the Indonesian market are tofu and firm tofu (*tahoe* and *takoäh*). Also discusses *tao tjo* (Indonesian-style miso; has a consistency like paste or porridge), tao dji (fermented black soybeans), témpé, and ontjom. The process for making each of these soyfoods is described.

Illustrations show: (1) A young soybean plant with leaves and pods (half size).

(2) A bamboo scaffolding or curing frame, in tripod form with 3 horizontal supports, used for drying bunches of soybeans.

Note: This is the earliest document seen (April 2001) that contains the word *takoäh.* Address: Buitenzorg [Bogor], Java.

21. Read, Bernard E.; Liu, Ju-ch'iang. 1927. Flora Sinensis. Series A. Volume 1. Plantae medicinalis Sinensis. 2nd ed. Bibliography of Chinese medicinal plants from the Pen Ts'ao Kang Mu... 1596 A.D. Peking, China: Dept. of Pharmacology, Peking Union Medical College. xi + 106 p. In collaboration with the Peking Laboratory of Natural History. [39 soy ref. Eng; chi]

• ***Summary:*** References related to soybeans are given in the chapter on Leguminosae under the genus *Glycine* on p. A.I.30. References are given for the soybean (*ta tou* or *huang ta to*), the wild soybean (*pai tou*), soy bean sauce (*chiang*), bean curd (*tou fu* [tofu]), bean ferment (*tou huang*), bean relish (*ta tou ch'ih* [fermented black soybeans]), and bean sprouts (*ta tou huang chüan*).

Also discusses kudzu (ko, 1: #372 *"Pueraria hirsuta Schneid."*), which is reported to grow in the provinces of Chihli, Shantung, Kiangsi, Kwangtung, Chekiang and Hupeh. Address: 1. Prof. and Head of; 2. Asst. of. Both: Dep. of Pharmacology, Peking Union Medical College, Peking, China.

22. Dorsett, P.H.; Morse, W.J. 1928. Agricultural explorations in Japan, Chosen (Korea), Northeastern China, Taiwan (Formosa), Singapore, Java, Sumatra and Ceylon (Log–unpublished). Washington, DC: Foreign Plant Introduction and Forage Crop Investigations, Bureau of Plant Industry, USDA. 8,818 p. Unpublished typescript log. Illust. Partially indexed. 28 cm.

• ***Summary:*** Also called the "Log of the Dorsett Morse Expedition to East Asia" and (by the National Archives) "Dorsett-Morse Expedition to the Far East, 1929-31," this is one of the most important documents ever produced on soybeans and soyfoods. Covering the period from late 1928 until 1932, it consists of 17 volumes of typewritten unpublished manuscript plus handwritten notebooks.

The two explorers, who were gone on the expedition for a little more than two years, initially planned to be gone for about three years. They took 3,369 photos of which 95% appear in the report; the original prints are pasted on the pages, each with a number and a caption. The first negative number is #43196 (p. 238) and the last is #46514. The last numbered page of the report is #8818, but most of the index pages are not numbered and some special reports at the end of the main report each start with page 1.

The first quarter of the pages (to about page 2,500) are indexed, using 4 separate indexes. The only original and 2 microfilm copies were at the American Soybean Assoc. (St. Louis, Missouri), however as of Aug. 2011 they are on permanent loan to Rare and Special Collections at the National Agricultural Library (Beltsville, Maryland)–which also has 7 photograph albums that accompany the 7 log books. A list of the missing pages has been compiled. One photocopy of a microfilm copy is at the Soyinfo Center (Lafayette, California). One microfilm copy is at the National Archives in Washington, DC, in Records of the Bureau of Plant Industry, Soils, and Agricultural Engineering, Record Group 54. See: "National Archives Microfilm Publication No. M840. Expedition Reports of the Office of Foreign Seed and Plant Introduction of the Department of Agriculture, 1900–1938." Rolls 16-20, volumes 56-73. These microfilm rolls may also be available for viewing or duplication at one of the various regional branches of the National Archives (e.g. San Bruno, California).

A brief itinerary of the trip is as follows: 1929 Feb. 18–The party of 5 people leaves Washington, DC, for Los Angeles by train. It consists of Morse, his wife Edna, their daughter Margaret (age 7), Dorsett, and his daughter-in-law Ruth (Bobbie; the widow of Dorsett's son, she served as Dorsett's secretary and general helper).

March 1–They sail from San Francisco to Yokohama on the S.S. *President Grant* of the Dollar Steamship Lines. March 29–Arrive in Yokohama, proceed directly to Tokyo, establish headquarters with rooms at the Imperial Hotel, and hire an interpreter, Mr. Suyetake, who works with them for the next 2 years. May 21–The Morses go to Hokkaido, the Dorsetts to Kyoto, by sleeper train. Morse returns to Tokyo.

Aug. 17–The entire party arrives in Hokkaido and establishes headquarters in Sapporo to study soybeans. Oct. 8–Leave Hokkaido for the Northeast Provinces, then arrive in Tokyo on Oct. 15. Oct. 22–Arrive in Keijo (Seoul), Korea, then take many side trips. Note: 1929 Oct. 29–Great Depression begins in USA with stock market crash. Dec. 8–Return to Japan via Kyushu, then to Tokyo to study

soyfoods. They buy and photograph many!

1930 April 1–Travel by steamer to Dairen, Manchuria, where they set up headquarters. Dorsett very sick from April 11 to June 11; taken to a Japanese hospital in Dairen, he almost dies of double pneumonia. Morse does the work of both men and does not inform USDA of Dorsett's critical condition. June 24–Morse takes a quick trip to northern Korea, via Mukden and Antung (Tan-Tung), to look for Zoysia grass.

July 1–Returns to Manchuria via Mukden. July 21. Dorsetts leave for Peking by train; Morses and Mr. Suyetake stay in Dairen. Aug. 21–Morse party travels to northern Korea, staying in Heijo (Pyongyang / P'yongyang); takes a 4-day side trip to Seoul. Sept. 28–Morse returns to Dairen, Manchuria.

Oct. 19–Morse party leaves Dairen, arriving in Peking the next day. Nov. 9–Morse party returns to Dairen. Nov. 30–Morse arrives in Harbin, north Manchuria, then passing through Mukden, returns to Dairen. Dec. 18–Morses leave Dairen for Japan, passing through Kobe on Dec. 21 and arrive in Tokyo on Dec. 23.

1931 Jan. 12–Travel to Kyoto, Himeiji, and Tatsuno Shoyu. Jan. 16–Visit Okazaki and Hatcho miso. Jan. 17–Return to Tokyo. Feb. 17–Morse party leaves Tokyo by boat for the USA, arriving in San Francisco on March 4. March 15–Dorsett party leaves Peking for Tientsin, Shanghai, and Hankow. March 27. Dorsetts sail from Shanghai to San Francisco.

Note 1. The title of this report is puzzling since the expedition never went to Taiwan, Singapore, Java, Sumatra, or Ceylon. It was proposed several times that they visit these places, but the plans did not work out.

Note 2. This is the earliest log (unpublished) seen (Oct. 2001) that mentions soy. Address: Agricultural Explorers, USDA, Washington, DC.

23. Ochse, J.J. 1931. Vegetables of the Dutch East Indies. Buitenzorg (Bogor), Java: Archipel Drukkerij. xxxvi + 1005 p. See p. 366, 389-93, 398, 407-08, 732, 943-71. An entirely revised and greatly enlarged second edition of his Tropische Groenten (1925). Translated by Mr. C.A. Backer. Illust. 25 cm. Index. [10 ref. Eng]

• ***Summary:*** This translation (by Mr. C.A. Backer, the reputed ex-Botanist for the flora of Java) of Ochse's classic "may be taken as an entirely revised and much enlarged second edition of *'Tropische Groenten'* (Tropical Vegetables), which booklet was published in July 1925." The author, a Dutchman who confined his research to Java and Madoera, described the tempeh-making process in detail, saying that the mold used was *Aspergillus oryzae* and that it was obtained from a former batch of tempeh.

Page 366 discusses ontjom (témpé boongkil in Javanese), tetèmpè, and dagè, all made from peanuts. Page 372 notes that the pigeon pea (*Cajanus cajan*) can be used to make témpé bosok.

Pages 389-93 discuss the soya bean, which has various names in local languages. Malay: Katjang djepoon or Kedele. Javanese: Dekeman or Dekenan, Dele, Demekan, Gadele, Kedele, Kedoongsool, or Dangsool. Sundanese: Kadele, Katjang booloo, Katjang djepoon, Katjang kadele. Madura: Kadhele, Kadhellee, or Kedeleh. A description of the plant is given.

Illustrations show: (1) A young soybean plant with leaves and pods (half size). (2) A bamboo scaffolding or curing frame, in tripod form with 3 horizontal supports, used for drying bunches of soybeans.

Soybeans come in two main forms: Light yellowish-brown seeds, and black seeds. The latter are used to make *ketjap* (Indonesian soy sauce). "Of the ripe seeds *pélas* (Jav.) is made, by mixing them with grated young coco-nut [coconut], salt, and other ingredients. The mixture is wrapped in a banana leaf and steamed.

"The seeds can also be roasted and afterwards pounded. The *boobook* [*bubuk*, roasted soy flour], *boobook* or *boobookan* (Jav.) is eaten in the shape of powder, usually with the addition of lombok and other ingredients.

"The seeds are mixed with a porridge of rice-meal and water and afterwards fried in coco-nut oil. This dish is called *rempeyek* (Jav.). It consists of brown slices in which the black *kedele*-seeds are scattered. *Rempeyek* is eaten either as a delicacy or with the rice table. "Témpé [tempeh, p. 391] is a much used product. In East- and Central-Java it takes the same place as the ontjom in West-Java. It is prepared in much the same way as *ontjom,* and the reaction is brought about by the same fungus, *Rhizopus Oryzae*, Went et Prinsen Geerligs, which is transmitted by *ragi.* The seeds are cooked and, after they have cooled, put in a basket. By stirring, rubbing and even by treading, coupled with repeated washing with fresh water, one tries to remove the testa [seed coat / hull] from the seeds. When this has been done, the seeds are put on hurdles (*sasak*) covered with banana- or waroo-leaves. Now the so-called *beeang*, i.e. rests of the fungus used for a former batch, is sprinkled over them and the mass is turned over on other sasaks. The *témpé*-cakes treated in this way are kept indoors and after two or three days the fungus has spread sufficiently for giving a light grey colour to the cakes, which then are soft and dry and ready for use. They are sold on the markets either cut into small pieces or divided at pleasure, according to the amount of money the buyer wishes to spend. *Témpé* is used, fried, in the *sayor* or prepared with all sorts of ingredients.

"Other products for the native market are *tahoo* [tofu] and *takoäh* [pressed tofu; Chinese: doufugan]. Both are eaten either boiled or cut into small slices, fried and added to *gado-gado* or, lombok rawit being added, as a side dish.

"For the preparation of *tahoo* or *takoäh* the seeds are soaked, ground fine, boiled and pressed through a cloth. The juice which is pressed out is mixed with salt, vinegar, coco-

nut milk or with unburned gypsum (so-called *batoo tao*), imported from China. By this treatment a white gelatinous mass is formed, which, after cooling, can be cut into pieces."

"Wet *tahoo* does not keep well for a long time. For this reason it is soon made into *takoäh.* For this purpose the *tahoo* is cut into pieces, folded in pieces of cloth, pressed in order to remove part of the water and next boiled in a decoction of koonir [turmeric]. The product obtained in this way has an intense yellow color and is a much relished delicacy, especially with lombok rawit [fiery dwarf chilies]."

*Taotjo* [Indonesian-style miso] is a porridge made of soybeans and rice meal. The soybeans are soaked, dehulled (the testa removed), cooked, and left to cool. Then they are mixed with the meal of rice (regular or glutinous), which has been previously roasted. "The porridge obtained in this way is poured on winnows (*tampah* [winnowing trays]) covered with waroo-leaves, sprinkled with *ragi* or *beeang*, probably of *Aspergillus Wentii*, Wehmer, and covered with leaves. The filled tampahs are piled on each other and left alone till the cakes are very mouldy. Then they are dried in the sun, soaked in brine and mixed with sirup of *arèn* [sugar palm] and with *tapè* [*tapai;* a sweet fermented cake] of rice or glutinous rice. Next the porridge is placed out of doors. After the seeds have become soft by this treatment, which takes three or four weeks, the *taotjo* is ready for use.

"*Taotjo* must be boiled, otherwise the smell is to strong. It is eaten with cooked or raw vegetables. It is used for dressing some dishes of meat or fish, whilst it is also a material of which diverse side dishes are made."

Note 1. This is the earliest English-language document seen (March 2009) that uses the word "taotjo" to refer to Indonesian-style miso.

"According to De Bie (1901), *tao djee* [*tao dji; doushi, douchi*] is *taotjo* alternating with layers of cooked whole *kadelè*-seeds. This stuff is put into a pot or basin with some salt and boiled arèn-sugar. The mass is left to itself during a few days till the *taotjo* has become pervaded by the salt and the sugar and has assumed a uniformly brown colour. Note 2. *Tao djee* [*doushi*] is fermented black soybeans, which are not the same as *Taotjo* [Indonesian-style miso]. De Bie (1901) seems to have made a mistake.

"Of the black *kadelè*-seeds *soya* [soy sauce] is made, exclusively by the Chinese and the natives. First the seeds are cooked in a strong solution of salt. After diverse manipulations the cooked seeds are mixed with arèn-sugar and so-called soya-condiments and the mixture is concentrated till the salt begins to crystallize. By diluting this product with more or less water one obtains the diverse qualities of *kètjap* or *soya* found in commerce."

The "Pemimpin Pengoesaha tanah" of 15 Jan. 1915 lists various ingredients that can be used with black soybeans in making ketjap. "Young seedlings, obtained, like *taogè* [*taugé,* soy / bean sprouts], by fermenting, are called *ketjambah kedele;* they are cooked and eaten as *petjel* (Jav.) with the rice (*ganteng,* Jav.)"

"Finally young leaves of *Kadele* can be eaten, raw or steamed, as *lalab.*

Page 398 describes *dagè* and *témpé bengook* made from these seeds of the velvet bean (*Mucuna pruriens*). Roasted tempeh are also discussed.

Pages 407-08 states that the seeds of the *Katjang oji* (rice bean) can be used for the preparation of tempeh.

Pages 414-15 state that, when they have no soybeans, the Chinese use mung beans (*Katjang eedjo*) to make tofu and takoah, but they are most widely used to make mung bean sprouts (*taogè*). Page 634 mentions témpé bosok (overripe tempeh) made with the foul-smelling bruised leaves of the plant *Paederia foetida.* Page 732 also mentions overripe tempeh.

Note 2. This is the earliest English-language document seen (Dec. 1998) which contains detailed information about tempeh, or which refers to tempeh as "témpé."

Note 3. This is the earliest English-language document seen (Feb. 2004) that uses the word "tahoo" or the word "takoäh" to refer to tofu. Address: Buitenzorg (Bogor), Java, Indonesia.

24. Ochse, J.J. 1931. Indische Groenten [Vegetables of the Dutch East Indies]. Buitenzorg (Bogor), Java: Department Landbouw. 1005 p. See p. 388-92. Index. Illust. 27 cm. [10 ref. Dut]

• ***Summary:*** For details, see the English-language translation, also published in 1931.

Under soybean utilization, the following food products are discussed in detail on pages 390-92: Tempeh (*tèmpè*), tofu (*tahoe*) and firm tofu (*takoä*), Indonesian-style miso (*taotjo*), fermented black soybeans (*tao dji*), and Indonesian-style soy sauce (*kètjap*). "Témpé is a much used product. In East- and Central-Java it takes the same place as the ontjom in West-Java. It is prepared in much the same way as *ontjom,* the reaction is brought about by the same fungus, *Rhizopus Oryzae,* Went et Prinsen Geerligs, which is transmitted by *ragi."*

On pages 943-970 is an alphabetical "List of Vernacular Names of Objects, Properties or Actions." For example: Kedele oongaran (p. 390, Jav.) is a soybean plantation on a sawah, immediately following the paddy [rice] harvest. Kedele apeetan (p. 390, Jav.) is the second harvest of the year or the second plantation in the same year of Kedele (soybeans; Glycine Soja). Address: Buitenzorg (Bogor), Java.

25. Read, Bernard E. 1936. Chinese medicinal plants from the "Pen ts'ao kang mu" of 1596. 3rd edition of a botanical, chemical and pharmacological reference list. Peking, China: Peking Natural History Bulletin. Sales Agent: The French Bookstore. xvi + 391 p. See p. 114-18.

• ***Summary:*** Contents: Introduction in Chinese.

Introduction to the third edition (Shanghai 1935). Provincial abbreviations. Abbreviations for parts of plants. Bibliographical abbreviations (journals and books). Secondary references helpful to a study of Chinese materia medica. Comparative table of Western, Japanese, and Chinese dates (1868-1935). Table of classes, general, and species for which references are listed. Index of Romanized Chinese names modified from Wade's system. Index of common English names, with foreign names given in italics. Latin index.

References related to soybeans are subdivided as follows (p. 114-18, 256): Soybeans, black variety (var. *nigra;* the fresh hulls used in medicine are known as *Ta Tou P'i*). Soybean sprouts, black variety (Ta Tou Huang Chüan). Bean relish, black variety (Ta Tou Ch'ih). Bean ferment, black variety (Tou Huang; Natto in Japanese). Yellow soybean (Glycine soja S. et Z., var. flava; Huang Ta Tou). Soybean oil (Tou Yu). Soybean sauce, yellow variety (Chiang Yu; thick or thin). Soybean paste (Chiang). Bean curd, yellow variety (Tou Fu). White soybean (Glycine soja, S. et Z., var. alba). Soy sauce made with wheat flour (p. 256).

References for azuki beans (red mung bean, P. mungo, L. var. subtrilobata, Fr. et Sav. [HN. Br.]) are given on page 122. References for wheat gluten (Mien Chin) are given on page 256.

This book is largely a list of references relating to plants listed in the Pen Ta'ao Kang Mu. It is not a translation or summary of the latter work.

Note: This is the earliest English-language document seen that uses the term "the fresh hulls" to refer to soy bran. Address: PhD, Head of the Div. of Physiological Sciences, Henry Lester Inst. of Medical Research, Shanghai, China.

26. Shih, You-Kuang. 1937. Study on the molds concerned in the fermentation of wheat gluten in China. *Lingnan Science Journal* 16(1):27-38. Jan. 13. [21 ref. Eng; chi]

• ***Summary:*** The author begins by discussing the research of others on "the well known foodstuff *Fu-Yu* [fermented tofu, 2 Chinese characters are given] or preserved soy bean curd. Wei (1930) isolated the same species of *Mono-Mucor* from different samples obtained from Shaoshing of Chekiang [province] and Suchow of Kiangsu Province.

He adds that P.W. Liu, in his unpublished work, "isolated a species of *Mucor* from Mei-Tou-Cha [meitauza; Chinese characters are given], or naturally fermented dregs of soy bean curd [i.e., naturally fermented okara], which is a common foodstuff in Wuchang and Hankow." It is prepared by frying in vegetable oil or animal fat.

"No mention of the so-called Minchin [W.-G. *mien chin*, pinyin *mianjin*] fermentation has been made as yet in literature. Minchin is, chemically speaking, the gluten of wheat." Rich in protein, it has a delicious taste. In some districts it is commonly eaten as a substitute for meat by Buddhists who do not eat meat. It is also occasionally used as a palatable dish at banquets. "Although we do not know definitely when it came to be used as an article of diet, it probably was at least hundreds or even thousands of years ago. Recently it has become a canning industry in large cities, San-Loh Wusih Minchin of Kiangsu province being a well-known example."

The author then gives a detailed description of how raw wheat gluten is made in China. To the high-protein wheat flour, about 0.5% to 1% by weight of table salt is added before any water is added in a large earthen jar. The dough is allowed to stand for 1-2 hours under water before the starch is removed in a strainer. A high grade of minchin is one that is almost free of starch content, pale in color, and very sticky and flexible.

Raw wheat gluten is typically made into one of four end products: (1) Fresh minchin: The raw minchin is kneaded into desirable shapes then boiled and seasoned for eating. When prepared for sale at a market in hot weather, it is usually preserved in water to prevent rapid spoilage by bacteria; (2) Roasted minchin is prepared by roasting raw minchin in a flat pan over a fire. A small mass of raw minchin will bubble up into a large globose shape with a very loose and porous texture. It is usually used to prepare soups, or cooked with other foods, and can be purchased even in small grocery stores in some localities; (3) Fried minchin is prepared by frying raw minchin with vegetable oil and seasoning. Recently the preparation of this kind of minchin has become a canning industry, as noted above. It has an excellent taste and is especially appropriate for travelers; (4) Fermented minchin (fermented wheat gluten) is made by putting fresh minchin into a suitable container, usually an earthen jar, and covering it tightly. After 2-3 weeks at room temperature, it will be overgrown with molds and bacteria. Then an excess amount of table salt (sodium chloride), more than 10% by weight of the molded minchin is added. After thoroughly mixing the salt into the minchin, it is allowed to stand for 2 more weeks to age. It is then commonly cut into thin strips and used as a condiment with other foods. Usually the fermentation is carried on during the winter because in hot weather it spoils rapidly due to bacteria.

Minchin is most commonly eaten by the people in northern China, however fermented minchin is rarely heard of except in Wuchang, Hankow and Hanyang of Hupeh Province so far as the author knows. According to the "Investigation of diet nutrition of Chinese in Manchuria" by Lu (1934), the average amount of Minchin consumed a day by one person of different classes, and its nutritive value are as follows (Table 1): Physicians 14.4 gm of minchin, 3.2 gm of protein; Members of the bank 13.8 gm, 3.1 gm of protein; Officials 11.2 gm, 2.5 gm of protein; School teachers 3.7 gm, 0.8 gm of protein; Middle class families 1.8 gm, 0.4 gm of protein.

Minchin appears to contain a mixture of molds including

*Paecilomyces varioti, Aspergillus flavipes, Cladosporium elegans, Fusarium orthoceras, Syncephalastrum racemosum, Trichothecium roseum,* and *Penicillium* species.

Note 1. This is the earliest English-language document seen (Oct. 2011) that uses the term "Fu-Yu" to refer to fermented tofu.

Note 2. This is the earliest document seen (Sept. 2011) concerning okara tempeh (which it calls Mei-Tou-Cha), and the earliest English-language document seen (Sept. 2011) that uses the term "Mei-Tou-Cha" to refer to okara tempe. Address: Lab. of Applied Mycology, College of Agriculture, Hokkaido Imperial Univ., Sapporo, Japan.

27. Shih, You Kuang. 1937. Untersuchungen ueber eine neue *Mucor*-Art auf "Meitauza" aus China [Investigations on a new type of *Mucor* mold on meitauza from China]. *Transactions of the Sapporo Natural History Society* 15(1):13-23. July. [51 ref. Ger]

• ***Summary:*** Contents: Introduction. 1. On the material to be investigated and its preparation. 2. Morphological. 3. Physiological: Properties of the culture, influence of temperature, influence of hydrogen ion concentration [pH], influence of the carbon source, influence of the nitrogen source, investigation of the fermentation of sugars, formation of alcohol and acids, saccharification of starches. 4. Diagnosis (conclusion).

Meitauza is okara, fermented with a *Mucor* mold. The product is traditionally made in many places in China such as Wuchang, Hankow, and Hanyang, preferably in winter, as follows: Form okara into round cakes 4½ to 5 inches in diameter, 1 inch thick at the center and 3/8 to ½ inch thick at the edges. Place the cakes in a vessel of the same size and allow to ferment in a room with moderate aeration until, after 10-15 days they are covered with a white mycelium of *Mucor meitauza* Shih. It is said that the best meitauza cannot be prepared in hot weather; it is usually prepared in winter. At higher temperatures bacteria can grow faster than the desired mold, and thus spoil the fermentation. Dry the cakes in the sun for several hours, then sell. Meitauza is served either fried (*gebraten*) in vegetable oil or cooked with vegetables then seasoned; it is widely considered to be tasty and nutritious.

"I received the research material [cakes] by post from Wuchang. It was still covered with a thick mycelium, which was downy and grayish white. Its form and size were about the same as described above. Through the usual culture methods, I isolated a type of *Mucor.* I then investigated its morphological and physiological characteristics."

Shih (working in the laboratory of Professor Dr. Jun Hanzawa in Hokkaido, Japan–with assistants Y. Tamura and S. Yoshimura) described the *Mucor* mold he isolated as a new species. He tried growing it on tofu (*Soja-Bohnenkäse*) but found that it grew best on moist rice and okara. The optimal temperature is 27-32ºC, and pH 5-6.

A full page of illustrations shows at least 9 views of *Mucor meitauza,* including the sporangiospores, columella, branching of the spore-carrying parts, and chlamydospores.

Note 1. Hesseltine (1965, p. 190) noted that from the fresh product, Shih isolated a *Mucor* which he carefully studied and described as a new species, *M. meitauza.* However a comparison of his species illustration and his observations indicate it is a synonym of *Actinomucor elegans,* already noted as one of the principal fungi involved in the preparation of fermented tofu.

Note 2. This is the earliest document seen (Sept. 2011) that contains the word "meitauza" (spelled like this, without hyphens).

Note 3. Meitauza is apparently a type of (or close relative of) okara tempeh. Address: Laboratory for Applied Mycology, Agricultural Institute, Hokkaido Imperial Univ., Sapporo, Japan.

28. Matagrin, Am. 1939. Le soja et les industries du soja: Produits alimentaires, huile de soja, lécithine végétale, caséine végétale [Soya and soya industries: Food products, soy oil, vegetable lecithin, and vegetable casein]. Paris: Gauthier-Villars. x + 390 p. Illust. 18 cm. [300 ref. Fre]

• ***Summary:*** Contents: Introduction. 1. The agricultural, industrial, and commercial history of soya: Asiatic origins and propagation in Europe, soya in America (its cultivation and industries), soya in Europe, Asia, Africa, and Oceania (1936) (1. Admission of soya in the agriculture and industry of European nations (p. 35): Soya in France, soy industry and commerce in central and northern Europe {England, Germany, Holland, Denmark, Sweden, Poland, Austria and Hungary, Switzerland}, penetration of soya into southern Europe {Iberian peninsula, Italy, Balkan countries of Dalmatia, Istria, Yugoslavia, Greece (p. 47), Bulgaria, Romania, Ukraine}, the grandeur and decadence of soya in Russia. 2. Soya in modern Asia (p. 51): China and Manchuria, Japan, Korea, Formosa, French Indochina {Tonkin, Cambodia, Cochin China}, the British and Dutch Indies {Siam, Assam, Bengal, Burma, Ceylon, India, Straits Settlements [later Singapore] / Malacca}, western Asia {Turkestan, Persia (p. 57)}. 3. Soya in Africa and Australia (p. 57-58): South Africa, Rhodesia, Nigeria, Gold Coast [later Ghana], Cote d'Ivoire, Dahomey, Togo, Algeria, Tunisia, Morocco, Egypt, Australia {Queensland, New South Wales, Victoria}, Tasmania, New Zealand, not yet in British New Guinea [later Papua New Guinea], Philippines, Java).

2. The botany and agronomy of soya: The plant, its names, its botanical characteristics, its varieties (original and created by selection), the cultivation of soya.

3. The general chemistry of soya: Chemical composition of the plant, structure and chemical composition of the beans.

4. Using soya in soyfoods and soyfood products: Whole soybeans (whole green, dry, sprouted, roasted and salted

{*soja á l'état vert, fève de soja sèche, fève grillée, fève salée de soja, fèves de soja salées,* p. 166-67}, soynut butter {*un mélange rappelant les beurres végétaux*}, soy coffee, soy confections {*confiture de soja*}, soy chocolate, soy sprouts {*fèves de soja germées, germes de fèves de soja*}), soymilk and tofu (*le lait et le fromage de soja;* soymilk cream, concentrated soymilk, soymilk powder / powdered soymilk, fermented soymilk {*lait fermenté, yoghurt, kéfir, koumys,* p. 189}, fermented tofu {*fromages de soja*}), okara (*pulpe résiduaire de la préparation du lait de soja*), fermented soy products (solid, paste, and liquid condiments; natto, miso, and shoyu [soy sauce]; kiu-tsee and lactic ferments), soy flour and bread.

5. The soy oil industry and products derived from it: Extraction and refining of soy oil, properties and use of soy oil.

6. The vegetable lecithin industry: Extraction of vegetable lecithin, properties and use of vegetable lecithin.

7. The vegetable casein industries and plastic materials based on soya: Soybean cakes and flours from which the oil has been removed, use of such cakes and flours, in the crude state, as a raw material for plastics, manufacture and use of vegetable protein, soybean cellulose for artificial silk, soya furfural and furfuraldehyde (phenolic resins). Conclusion: How to launch soya industries in France. Important terms. A bibliography appears at the end of each chapter.

Note 1. This is the earliest French-language document seen that uses the terms *Fève grillée, fève salée de soja,* or *fèves de soja salées,* "roasted soy beans" to refer to soynuts.

Note 2. This is the earliest French-language document seen (April 2005) that mentions soynut butter, which it calls *un mélange rappelant les beurres végétaux.*

Summary: Matagrin wrote two previous books: *Manuel du Savonnier* (Paris, no date given) and *L'Industrie des Produits chimiques et ses Travailleurs* (Paris, 1925).

Francis G. Beltzer, a practical chemist, became a major force in visualizing new industrial uses for the soybean in the West. By contrast, Li and Grandvoinnet (1912) paid little attention to soy oil in their book, devoting only 3 pages out of 150 to the subject, and only ½ page to industrial uses, while largely ignoring lecithin. These two books had a great influence on soy in France and they nicely complement each other (p. vi).

*The Soybean,* by Piper & Morse (1923), was published in both New York and London. Horvath was a Russo-American chemist. Italians who made important contributions to the soybean were professors Bottari, Mattei, Panatelli, and Tito Poggi (p. vii).

Leon Rouest, French the agronomist, wrote an important book titled *Le soja français et ses applications agricoles et industrielles* (Chateauroux 1936). Since 1920 he has devoted himself to the culture of soybeans and to the selection of acclimatized varieties. He was director of the Laboratory of Soja in the north Caucasus from 1930 to 1935, and in 1921 he had already published a book, *Le soja et son lait végétal*. His new (1936) book benefitted from the collaboration of Henry de Guerpel, an agricultural engineer and mayor of Percy-en-Auge, who was also an indefatigable prophet of soybeans in France, until his untimely death in Jan. 1937.

Anyone in the world can order (from the U.S. Government Printing Office in Washington, DC) the many U.S. publications about soybeans from the USDA or state agricultural experiment stations. These substantial works are based on careful research and enriched with numerous tables and photos–a fine example of the key role that governments can play in introducing and popularizing soya. Recently J.A. LeClerc (of USDA's Bureau of Chemistry and Soils) said the soybean has become a naturalized American (p. viii).

More than a century ago lord Byron wrote *Beppo,* the first Western poem on soy. It was an account of a carnival at Venice, Italy, in 1818. He advised the tourists to bring "Ketchup, Soy [sauce], Chili-vinegar."

Maurice Druel was one of the young engineers who worked with competence to launch a soy industry in France (p. x).

For an early chronology of soybeans and soyfoods in France (1856+, see pages 8-12). 1857-58: Lechaume planted soybeans at Vitry-sur-Seine and got encouraging results. A report by the National Society for Acclimatization declared: "The acclimatization of the soybean is complete."

1859–Setback for the first tests by Vilmorin with Chinese beans that were too late, but success by Dr. Turrel in le Var.

1862-69–Success of Mme. Delisse, in Gironde.

Then the Franco-Prussian war arrested these tests, so the center of interest moved to central Europe. The world exposition of Vienna in 1873 and Haberlandt. In his book one finds the first analyses of the seed by Steuf, of the cake by Woelker / Voelker, the results of texts by Berndt on oil extraction (p. 9).

Podolie is in the Ukraine.

Of Haberlandt's 148 trials in 1877, only 12 failed for lack of warmth. Much new agronomic information was accumulated.

Back in France: 1874-80–Society of Horticulture d'Etampes (Seine-et-Oise) grew a yellow Chinese variety which succeeded. This "soja d'Eampes" was studied intensively from the chemical and agronomic points of view by Lechartier and various authors. A doctor from the region prepared, for his personal use, a vegetable cheese (tofu). But the grain did not find buyers so its cultivation did not spread. There now remain only 2 or 3 innovators to cultivate soybeans and on 5-10 acres maximum. But Chinese soybeans mature in the region of Paris, as in 1879 at Marseille.

1880–While the tests of Boursier in l'Oise have succeeded. and while Olivier-Lecq, ardent propagator of soybeans, distributed 100 kg to farmers in the north, the national Society of Acclimatization organized cultural

trials all over France. Results were obtained in each of the regions, some with record yields. The general objection of the farmers was the difficulty found in using the soybean as a legume (it was too hard) or to find buyers.

As Paillieux said so well: "Our point of departure has not been happy one; the soybean has been presented simply as a new legume" (p. 10).

The German successes in soybean cultivation were studied by Wein in 1881 (p. 10).

In the 1880s there was a big growth of interest in vegetarian diets in Europe. Compare this with the USA (p. 11).

Li Yu-ying: After his 1905 speech, in 1908, he created a laboratory for studies, which soon founded the factory La Caseo-Sojaine at Vallees, near Colombes (Seine), administered by a French-Chinese company. This establishment made soyfoods using imported soybeans, especially tofu (p. 12).

Dr. Bloch of France recommended thin sheets of pressed tofu as a reserve ration for troops.

Lever Bros. soap works used lots of soy oil in Britain (p. 12).

The British did some cultural trials in India, Burma, Siam (Thailand), and South Africa.

Japan, in effect, annexed Korea in 1895.

It was only after 1905 that soybean tests took place, first in Guyana, where the soybean matured easily.

Soybeans were grown for forage more in the South of USA than in the north. Continued. Address: France.

29. Matagrin, Am. 1939. Le soja et les industries du soja: Produits alimentaires, huile de soja, lécithine végétale, caséine végétale [Soya and soya industries: Food products, soy oil, vegetable lecithin, and vegetable casein (Continued–Document part IV]. Paris: Gauthier-Villars. x + 390 p. 18 cm. [300 ref. Fre]

• ***Summary:*** Continued. Etymology: For "okara" Matagrin says *Pulpe residuaire de la preparation du lait de soja.*

Dr. Bloch showed okara contained 88.75% water. Beltzer gave a microscopic analysis. Mlle. Castet, in tests with okara in 1918 in Algiers, added sugar and cooked for at least one hour to get something like an almond paste, which she used in patisserie. Also in 1918 Holmes of the USA used dried okara in biscuits. Since then many recipes have appeared in America. Souffle, Salad with apples, Sandwich filling, etc.

Koenig did two analyses of miso, not stated when.

Matagrin gave many detailed descriptions of process for making various soyfoods by various authors in many countries.

Chinese Yeast, Kiu-tsee. This product, described by Daby de Thiersant, according to the practice in Kwantung.

Lots on soy flour; processes and recipes.

Berczeller carried on the work of Haberlandt in Central Europe. But did Berczeller know of Haberlandt?

Lecerf made bread entirely from soy flour and Bourdin, of Reims, made "soy gluten" bread rich in carbohydrates. Heudebert made dietetic products from soy flour. Breads for diabetics were made by Menudier (1890), Bloch, Labbe, Dujardin-Beaumetz, Martinet, Cazalis, Le Goff, etc.

By 1930 solvent extractors were processing 1,000 tonnes/day. The great oil mills of Hamburg-Harburg were processing up to 1,200 tons per 24 hours. A system consumes 5.5 tonnes of steam and 30 kwh of power per ton of soybeans.

At the Ford Motor Co., the Flumerfelt continuous extractor, inspired clearly by that of Ford (the former = U.S. Patent 1,920,499 of 1 Aug. 1933.) with a screw in a tube. For the Ford system it required only 1 man to process 1,800 kg in 8 hours. Remarkable! The Ford extractor is very economical and all manual. Ford hopes it can be sold for about $3,000.

Soy oil as food: In Haberlandt, C. Berndt submitted to pressure by Chinese soybeans, which he had made come to Japan and which also served as the first European analysis of soybean samples, due to Steuf. Without ignoring the eventual industrial interest, in this oil, Berndt was interested in food uses. He said: "And I have also found a large proportion of oil in the cake, the pressing having been insufficient. I had a fried food / fritter (*friture*) prepared with the oil and found not the least after taste." Better to translate directly from German. The experiment was not decisive. Nutritive properties of soy oil: Some (Dr. Petit among others) say soy oil is purgative. Kaempfer noted well in 1690 the medicinal use of black, dwarf? soybeans as an antiasthmatic powder. At Nutrition: Dr. Bloch showed that consumption of 100 gm of this oil causes no laxative effect. but rather a mechanical effect that lubricates the intestines.

The abundance of olive oil in France has led to limited adoption of soy oil.

As cottonseed declined, soy oil gradually replaced it. Is the decline of cotton related to synthetic fabrics or only to the boll weevil?

Soy oil is most widely used in soaps in the USA and USSR where cotton oil use is dropping and imports of palm oil and coconut oil are large; they do not use soy oil alone. Is it usually or often hydrogenated?

Tests on destructive distillation of soy oil started in Japan. In 1920-21 S. Satow formed a calcium soap with soy oil and submitted it to the usual procedure for cracking, obtained below 150ºC various fractions' 20% light oil; 150-300ºC 60% kerosene type oil; 300-330ºC heavy petrole fraction.

Artificial rubber: In about 1915 Grosse and Sauer in Germany developed a process for making artificial rubber from soy oil. In 1921 a Canadian process was developed (W.G. Wright, British patent 142,416).

Various processes for making plastics with soy flour. In 1920 Hager in Portland, Oregon, developed and patented

(British patent No. 140,781) a process for making a charge, for bandages, and rubber from soy flour.

The Ford Motor Co. uses annually in making its cars 2,500 kiloliters of soy oil (of which about 1,625 kl for paint and enamel and the rest for foundry cores) and will also absorb 2,180 metric tons of soybean meal (defatted), 3/4 of which for window pane frames–as of Jan 1937. Only at the River Rouge plant in Dearborn, Michigan.

In Japan in 1938 many of the big companies such as Nippon Denko Kaisha, Allied Showa Industry, Japan Oil and Fats, Hohnen Oil, and Bean Chemical Industry, which are starting to make soy casein (*caseine de soja;* p. 336.8).

Li Yu-ying who, at least, would point out "Sojalithe," soy glue, the fabrication of isolates (*isolants*) as applications of vegetable protein (p. 337). Preparation of vegetable casein (etymology). Beltzer wrote voluminously on this subject. So he may have preceded Li Yu-ying.

Page 342: Process of H. Beaufour, 1929 French patent for ultrafiltration for separation in colloidal solution, but no mention of soy.

Lots being done by 1939 with isolates for industrial use. Long chapter on it and many patents. Much of the information is from Beltzer's book *Les Industries de la caseine et du lactose.* Then we go on (p. 349). Utilization of *la caseine vegetale du soja.*

*A. Food and Pharmaceutical uses.* Curded products like tofu, long used in East Asia, are well suited for boulangerie and patisserie = for baking and making pastry. Their addition to flour creates no difficulties and gives a less special flavor than whole soy flour (*la farine entiere de soja*). Etymology. Who first used this. Li Yu-ying? `

It can be added to powdered foods such as milk, cocoa, or to food tablets. In the pharmaceutical industry, it serves also as an excipient (an inert substance that forms a vehicle, as for a drug). Presently several hundred tons a year are used in these two ways in Central Europe and the USSR.

*B. Technical uses of vegetable casein* (p. 350). In the US in 1936 consumption of vegetable casein approached 30,000 tonnes, nearly 2/3 going to paper making and to plywood glues. The rest going to paints or plastics. The future looks to be in plastics.

Manufacture and utilization of sojalithe: This as well as Galalith was invented by Spitteler (German Patent 127,942) when Trillat recognized in 1892 that formol hardened albumenoids. International Galalith of Harburg and Gennevilliers only perfected the demineralization of casein. From 1901 to the present, via many processes, mostly German and French, have perfected the initial method. Beltzer designed an entire factory, with floor plans and machinery for treating / processing 10 tonnes a day of soybean vegetable casein. It requires defatted soybean meal. Washed in cold water, coagulated with gypsum. Break curd into pieces and wash over cloth with cold water. The casein is then dissolved in, then reprecipitated with acetic acid. and run through a filter press. The vegetable protein, after swelling for 10-12 hr in hot water, can be pressed into tablets and made insoluble by formol gas, or mixed with an aqueous solution of 24-42% formaldehyde, then add phenol as in the Ford process.

Glues of vegetable protein: Add alkali to make it soluble. Paper glues. Glidden has a 1936 French patent.

Paints and coatings of casein. Water-based, or whitewash.

Soy cellulose for artificial silk.

Lots of research on plastics from soybean oil and meal done at Iowa State College. Dailey 1933. Enemark 1935. Forster 1935, Campbell 1926 (p. 365-66). Zenor and Tillson 1931; protein adhesives from soybean meal.

Serious explosions in the USA with soy oil extraction. In Chicago on 7 Oct. 1935, 11 workers were killed and 55 injured at the Glidden plant, while material damage was estimated at $600,000. Two months later an explosion of the same type in an extraction plant at Momence, Illinois, took four victims, killing 2!

Li Yu-ying was right in his vision for starting a soy processing industry in France at Caseo Sojaine. He threatened many commercial industries, arousing the hostility of the dairies.

This is a remarkable, fine, complete detailed book, covering on all aspects of soy. Address: France.

30. Jouven, Maurice. 1942. Les plantes des huiles [Oil bearing plants]. Paris: Editions de Montsouris. 160 p. See p. 82-101. Illust. No index. 18 cm. Series: Collection Rustica. [Fre]

• ***Summary:*** Contents related to soy: Part V: Exotic oil-bearing plants susceptible to cultivation in France. 1. The soybean–Characteristics of the plant, Origin and distribution. Importance of the crop. Varieties (overseas and developed for France). Composition of the plant (as for green forage). Climate. Nature of the soil. Elements needed from fertilizers. Manure / fertilizer (*engrais*).

2. Cultivation of soybeans–Place in the crop rotation. Preparing the soil. Planting. Transplanting. Nitrogenation, incl. inoculation and nitrogen-fixing bacteria. Cultural styles (*façons culturales*). Enemies of the soybean.

3. Harvesting the soybean–Threshing. Yield. Storage.

4. Utilization of the soybean–As animal feed. As human food. Soy flour. Soy bread. Soy oil. The soybean as a vegetable [green vegetable soybeans]. Condiments (made with molds, such as soy sauce. The Chinese consume each year 700 to 800 million liters of soy sauce). Various other products (soy chocolate, soy coffee, soy wine, fermented soymilk). Industrial uses (soaps, candles, paints, soy caseine for sojalithe, artificial petroleum, soy gasoline {by distillation of the petroleum}).

Organizations actively involved with soya: (1) Institut National du Soja, 5, rue de Logelbach, Paris 17eme. (2)

Institut Agricole et Industriel du Soja, 13, rue des Saussaies, Paris 8eme. (3) Centre National de Soja, 8, cours de Gourgues, Bordeaux. (4) *Revue Internationale du Soja*, (Editions E.-V. Letzgus, 97, rue Saint-Lazare, Paris 9eme).

Illustrations show: (1) A soybean plant with enlarged pods (p. 83). (2) A weeder (*Extirpateur*) (p. 89). (3) Many ways to plant soybean seeds (p. 93). (4) Devices for drying soybean forage (p. 96).

5. The peanut.

6. Castor-oil plant, sesame seed, and niger seed (*Guizotia oleifera / abyssinica*). Address: Ingenieur Agronome.

31. *American Magazine.* 1948. Interesting people (William Morse): Ice cream grows on bushes. Feb. p. 101.
• ***Summary:*** Shows a nice full-page photo (by Vincent Finnigan) of William Morse eating soy ice cream. "Ice cream, as indicated here by Dr. Morse, can be made from powdered soybean milk. To launch the soybean in America Dr. Morse spent 2 years in the Orient collecting 5,000 soybean samples." When he returned, he used his wife, daughter, friends and himself as guinea pigs to test the beans. They made entire meals out of soybeans, including soybean wine. The idea gradually caught on. Dr. Morse is a graduate of Cornell University, soft-spoken, shy and at 63 years old, still busy at the Department of Agriculture's experimental farm in Beltsville, Maryland. He feels the surface has hardly been scratched.

The photo was also run in *Soybean Digest*, April 1948, p. 41.

This digital photo was sent to Soyfoods Center by Joyce Garrison (William Morse's granddaughter) of West Hartford, Connecticut (July 2004).

32. Morizui, Mareyuki. Assignor to Scientific Research Institute, Ltd. 1955. [Synthetic wine (ingredients include defatted soybeans)]. *Japanese Patent* 4438. June 28. (Chem. Abst. 51:17091b). [Jap]*
• ***Summary:*** Defatted soybeans are treated with methanol, rice-malt and saccharifying agent, and fermentation is caused by addition of yeast to make the ethanol content 5-20%. The product is mixed with perfumes or pure wine. Address: Japan.

33. Shuzui, K.; Sakamoto, M.; Tajima, O.; Kojima, Y. 1957. Gôsei seishu no kômi zôkyô ni kansuru kenkyû. IV. Seisei dasshi daizu to kôso-zai or riyô shita gôsei seishu ni tsuite [Studies for increasing the flavor and aroma artificial sake. IV. Artificial sake brewed by utilizing refined defatted soybean meal and taka-diastase]. *Kagaku Kenkyujo Hokoku* (*Reports of the Scientific Research Institute, Tokyo*) 33(6):353-58. [2 ref. Jap]

34. Perissé, J. 1958. La consommation des légumineuses au Togo [The consumption of legumes in Togo]. Paris: Office de la Recherche Scientifique et Technique Outre-Mer. 20 p. Cote de Classement No. 4019. Rapport demandé par l'Organisation des Nations Unies pour l'Alimentation et l'Agriculture. [6 ref. Fre]
• ***Summary:*** Togo is sandwiched between Ghana on the east and Benin on the west. Prepared for FAO, this is the report of surveys conducted among the five major ethnic groups in Togo concerning the legumes they consumed and their nutritional contribution to each group's diet. One village from each group was surveyed in depth three times in 12 months. The groups are listed here from south to north: The Ouatchis eat mainly *haricot niébé* (*Vigna unguiculata*), plus small amounts of peanuts. The Ewes eat *niébé* (*Kasake*), *Phaseolus lunatus* (*Kpakpankui*), *le pois d'angole* (*nugune*), and peanuts. The Cabrais or Kabres eat (in order of importance) *haricot niébé*, peanuts, and *neré* (*Parkia biglobosa et Parkia oliveri*). Starchy foods include yam *igname*, taro, and manioc. A detailed description is given of how the *neré* are cooked, dehulled, fermented, and dried to make Soumbara [Soumbala]. The emigrant Cabrais eat *haricot niébé*, *le pois de terre* (*Voandzeia subterranea*) (*Suè*) (Bambarra groundnuts), peanuts, and *neré* (usually consumed in fritters–*beignets*). The Mobas (in the far north of Togo) eat the same legumes as the emigrant Cabrais. Peanut meal is used in fritters.

Soy is mentioned only in the Conclusion (p. 17): "For example, in the land the Outachis, it is probable that an improvement of the protein ration will be obtained more easily by an increase in the production of *haricot niébé* [*Vigna unguiculata*] which will be automatically accepted in the traditional form of *abobo* rather than asking the people to consume *néré* or soya–foods that would clash with the culinary traditions of thrift and with the tastes of the consumers."

Note: 1997. Jan. 23. According to the French Consulate, Science Section, this document may be ordered from the publisher: O.R.S.T.O.M., Attn: Bureau de Press et Communication, 213 Rue Lafayette, 75480 Paris, Cedex 10, France. Address: Pharmacien-Capitaine du Corps de Santé Colonial, Détache à l'Office de la Recherche Scientifique et Technique Outre-Mer [ORSTOM], 20, rue Monsieur, Paris VIII$^{o}$, France.

35. Shuzui, K.; Tajima, O. 1958. Gosei seishu no kômi zôkyô ni kansuru kenkyû. VII. Dasshi daizu ko riyô shu no umami seibun no kento (2). Ion kokan jushi bunbetsu ni yoru bunri kubun ni tsuite [Studies for increasing the flavor and aroma of artificial sake. VII. On delectable components in artificial sake made using defatted soybean powder (2)]. *Kagaku Kenkyujo Hokoku* (*Reports of the Scientific Research Institute, Tokyo*) 34(2):152-61. [4 ref. Jap]

36. Hsu, K.K.; Hong, W.H.; Chen, F.C. 1960. Studies on the

constituents of the seed of Glycine max Merrill. Isolation of bioflavonoid, genistin. *T'ai-wan Yao Hsueh Tsa Chih* (*J. of the Taiwan Pharmaceutical Association*) 12(2):87-89. Dec. [8 ref. Eng; chi]
• ***Summary:*** "The liquor produced by the fermentation of the seed of Glycine max *Merrill* has been widely applied as a precious nutriment for women after confinement in Taiwan. Thus it is very possible that there are some special components with estrogenic activity in it.

"An estrogenically active isoflavone, genistein, and its glycoside, genistin, were isolated from soybean meal... by E. Cheng... in 1953. The isoflavone was firstly isolated by Perkin and Newbury [*Journal of the Chemical Society* (London) 75:830 (1899)] from Dyer's Broom (*Genista Linctoria*) as early as 1899, and was proved as 5,7,4'-trihydroxyisoflavone by W. Baker and R. Robinson 27 years later. The glycoside, genistin, was proved as 7-d-glucoside of genistein by E. Walz in 1931, after isolation from soybean meal. Genistin is also known to exist in soybean flake[s]... Its estrogenic activity was shown to be about 0.00000444 [times] that of the synthesized diethylstilbestrol.

"From the ethanol extract of the seed of Formosan Glycine max *Merrill*, the authors obtained 2 crystalline substances, one of which was identified as genistin after the thorough examination of physical constants of the isoflavone and of its derivatives." Address: School of Pharmacy, National Taiwan Univ., Taipei, Taiwan, China.

37. Hesseltine, C.W. 1965. A millennium of fungi, food, and fermentation. *Mycologia* 57(2):149-97. March/April. [38 ref]
• ***Summary:*** A landmark, widely cited work on indigenous fermented foods. Interestingly, it makes no mention of amazake, or kanjang (Korean soy sauce). Contents: Tempeh. Ragi. Sufu (describes process, mentions pehtzes and the mold *Actinomucor elegans* NRRL 3104).

Color photos (sent by Dr. Clifford Hesseltine) show: (1) Luxuriant growth of *Actinomucor elegans* mold on some skewered cubes of tofu in an incubator; on the top row are uninoculated cubes. (2) Cubes of sufu in their final form after removal from brine.

Thamnidium (meat tenderizer and flavor enhancer from the mold *Thamnidium elegans*). Miso. Shoyu (incl. tamari. "In China, shoyu is more of the tamari type, that is, more soybeans are used and less wheat,..."). Tea fungus. Ang-kak (red fermented rice [red rice koji], p. 179-81). Advantages of fermenting foods. The future of food fermentations.

The glossary gives brief descriptions of aga-koji, akakoji, amylo process, anchu, angkak, angkhak, ang-quac, anka, ankak, arack, arak, arrack, atsumandie, awamori, bagoong, bakhar, beni-koji, benikoji, braga, brem, busa, chao, ch'au yau (Chinese name for shoyu), chee-fan (a type of Chinese cheese or sufu), chiang (Chinese equivalent of miso), chicha, Chinese cheese (sufu), Chinese red rice (ang-kak), chiu-chu (Chinese yeast), chiu-niang (Chinese term for koji), chou [*ch'ü*] (Chinese equivalent of koji), dahi, dawadawa (made from African locust bean–*Parkia filicoidea;* soy is not mentioned), dhokla, dosai, fermentation of citron, fermented fish, fermentation of maize, fermented minchin (wheat gluten), fermented soybeans ("a Chinese food prepared from small black soybeans." See A.K. Smith 1961 [fermented black soybeans]), fish paste, fish sauce, fish soy, fu-yu, fu-yue, fuyu (see sufu [fermented tofu] for all 3), ginger beer plant, grib, hamanatto, hon-fan [fermented tofu], hongo, hung-chu, idli, injera, jamin-bang, java yeast, jotkal, kaffir beer, kanji, katsuobushi, katyk, kefir, ketjap, kimchi, kishk, kisselo mleko, koji, kombucha (tea fungus fermentation), kome-miso, kuban, kumiss, kumys, kushik, kushuk, kvass, kwass, kyoku-shi, lao-chao, leben, lebeny, levain of khasia, levain of sikkin, lontjom (ontjom), magou, mahewu, maize fermentation of the maoris, mazun, medusen tee, meen, meitauza, meju (fermented soybeans of Korea), mén, mien (Chinese yeast), mirin, mish, miso, moromi, mugi miso, murcha, nappi, nata, natto, ngapi, nuoc-mam, nukamiso, ontjom, patis, paw tsay, peh-khak, pehtze, peujeum, peyem, poi, prahoc, pulque, raggi, ragi, ranu, red pepper sauce, red rice, red sufu, sajur asin, saraimandie, sekihan, shiro koji, shottsuru, shoyou, sho-yu, shoyu, soja japonais (shoyu), sonti (a rice beer wine of India), South African fermented corn, soy, soybean cheese [fermented tofu], soy sauce, sufu, su fu [both fermented tofu], sweet flour paste, taette, tahuli, tahuri [both "Philippine fermented soybean curd"], takuwan, tamari, tane koji, tao-cho [taotjo], taokoan [pressed or firm tofu, not fermented], tao dji (see taotjo {sic}), tao-si ([fermented black soybeans]; see Handbook of Philippine Agriculture. 1939. p. 132-43), tao-tjung, tao-yu, taotjo, tapej, tape ketan, tape ketella, tarhana, tea beer, tea cider, tea fungus, teekwass, teeschwamm, tempe, tempeh, tempeh bongkrek, tempeh kedelee, thamnidium, thumba, tibi, tien mien chang [chiang], tojo, tokua, torani, tosufu, toyo, trassi, tsue fan, tuwak, uri, u-t-iat, wunder pilz, yen-tsai.

Note 1. This is the earliest document seen (Oct. 2011) that mentions *Actinomucor elegans* in connection with sufu [fermented tofu]. In 1966 Hesseltine describes it as the best mold for use in making this fermented food.

Note 2. This is the earliest English-language document seen (Oct. 2011) that uses the terms "fuyu" or "fu-yue" or "chao" to refer to fermented tofu.

Note 3. This is the earliest document seen (July 2000) that mentions "mugi miso"–a type of miso made with barley koji. By the mid- to late-1960s, macrobiotic companies in the USA were importing barley miso from Japan and labeling it "Mugi Miso."

Photos show: (0) Clifford W. Hesseltine (portrait). (1-3) *Rhizopus oligosporus* mold, used to make tempeh (3 views). (4) Skewered cubes of sufu in an incubator, with one skewer of uninoculated tofu cubes and three rows of tofu inoculated

with *Actinomucor elegans* showing luxuriant growth of mold. (5) Cubes of Chinese cheese [fermented tofu] removed from brine. (6) Dilution plate of tane koji showing different types of *Aspergillus oryzae*. Address: NRRL, Peoria, Illinois.

38. Steinkraus, K.H.; Lee, C.Y.; Buck, P.A. 1965. Soybean fermentation by the ontjom mold *Neurospora. Food Technology* 19(8):119-20. Aug. [5 ref]
• ***Summary:*** The ontjom mold was compared with the tempeh mold. The former had a lower maximum growth temperature and grew more slowly but produced the same general changes in a soybean substrate as the latter.

Surprisingly, a tempeh-like product made with soybeans but inoculated with the onchom mold *Neurospora* was never traditionally made in Indonesia. The soybeans were used only to make tempeh, and the onchom was always made from peanut presscake or okara. The authors developed and describe an acceptable soy onchom, which resembled tempeh except that the flavor was more nutlike. Address: 1. Dep. of Food Science and Technology, Cornell Univ.

39. Li, Shih-chen. comp. 1965. Pen-ts'ao kang-mu [Collected essentials of herbs and trees. Illustrated compendium of pharmacopoeia with commentaries]. Hong Kong: Commercial Press. [Chi]*
• ***Summary:*** This 1965 edition of the classical work incorporates the following works on plants by earlier authors, now largely unpreserved, which were cited extensively by Schafer (1977) in his chapter: Chen, Ch'üan. *Yao hsing pên ts'ao.*

Ch'en, Ts-ang-ch'i. *Pên ts'ao shih i.*
Hsiao, Ping. *Ssu sheng pên ts'ao.*
Li, Hsün. *Hai yao pên ts'ao.*
Meng, Shen. *Shih liao pên ts'ao.*
Su, Kung. *T'ang pên ts'ao chu.*
Sun, Ssu-mo. *Ch'ien chin shih chih.*

40. Akinrele, I.A. 1966. A biochemical study of the traditional method of preparation of ogi and its effects on the nutritive value of corn. PhD thesis, University of Ibadan, Nigeria. *
• ***Summary:*** There are considerable losses of nutrients (especially protein and calcium) during ogi processing. The biological quality of the protein in ogi was so poor that it did not support growth in rats, but when it was fortified with 30% heat-treated whole soy flour, the protein efficiency ratio (PER) increased threefold, making the protein usability almost equal to that of casein.

Note: This is the earliest English-language document seen (Oct. 2012) in which Nigerian *ogi* is fortified with soy flour. Ogi is a fermented maize / corn product widely consumed in southern Nigeria. Address: Univ. of Ibadan, Nigeria.

41. Oke, O.L. 1967. Chemical studies on the Nigerian foodstuff "ogi." *Food Technology* 21(2):98-100. Feb. [10 ref]
• ***Summary:*** Recommends fortification of traditional ogi with soy flour. Ogi is a fermented maize product widely consumed in southern Nigeria. "Ogi is usually wrapped in leaves and sold in local markets. It can be mixed with boiling water to give a porridge or a semisolid product (eko) which is taken with vegetable soup or bean balls. This is perhaps the most popular breakfast, especially among the Yorubas." In the process of making traditional ogi, about 40% of the protein and 50% of the calcium and phosphorus are lost. Address: Chemistry Dep., Univ. of Ife, Ibadan, Nigeria.

42. Steinkraus, K.H.; van Veen, A.G.; Thiebeau, D.B. 1967. Studies on idli–An Indian fermented black gram-rice food. *Food Technology* 21(6):110-13. June. [12 ref]
• ***Summary:*** Idli is a steamed bread or buns typically prepared in southern India from a fermented batter of rice and black gram (*Vigna mungo*)–commonly called "urd beans" in the United States. The decorticated [dehulled] beans used in the preparation of idli are called black gram dhal.

Idli is unique and important in that it is a sourdough bread made without the use of wheat. Soybeans were substituted for all of the blackgram dal in idli using proportions of 1:2 or 1:3 (soybeans:rice) to yield satisfactory products with higher protein content than their traditional counterparts.

Note: This is the earliest document seen (Oct. 2012) that describes the use of soybeans as an ingredient in idli. Address: Cornell Univ.

43. Akinrele, I.A.; Bassir, Olumbe. 1967. The nutritive value of "Ogi," a Nigerian infant food. Nigeria. 2 p. Presented as research proposal submitted to the Federal Institute of Industrial Research, Oshodi. Nov. 1967. *

44. *SoyaScan Notes.* 1967. Chronology of soybeans, soyfoods and natural foods in the United States 1966-1967 (Overview). Dec. 31. Compiled by William Shurtleff of Soyfoods Center.
• ***Summary:*** 1966, April 9. Erewhon opens as a small (10-by 20-foot) macrobiotic and natural foods retail store at 303-B Newbury Street in Boston, Massachusetts. Aveline and Michio Kushi are the founders and Evan Root is the first retail store manager. Erewhon is the first food store of its kind in America, and it soon serves as a model for many other similar natural foods stores across America. Erewhon starts to grow in Oct. 1967 with the arrival of Paul Hawken.

The natural foods movement in America is in its infancy, advocating a return to traditional whole foods, naturally grown and processed. It's predecessor, the health foods movement (which started in the 1930s, based on the new public interest in vitamins), now largely sells vitamin,

mineral, and protein supplements.

1966, Nov. America's first soybean checkoff program voted in by North Carolina soybean growers, who will pay half a cent per bushel checkoff on the 1966 crop. This new income source marks the start of a new era for the American Soybean Association.

1967. The All-India Coordinated Research Project on Soybean is founded in India, after about 4 years of pioneering soybean work there by American Land Grant Universities, funded largely by the Rockefeller Foundation. This story is well told in Carroll P. Streeter's book A Partnership to Improve Food Production in India (1969).

1967. Soy idli developed by Steinkraus and van Veen at Cornell University, New York. These small steamed cakes are the first traditional Indian fermented soyfood to be fortified with soy flour. The fortification of basic foods in Third World countries with soy flour becomes popular.

1967. Philsoy brand soymilk launched in Los Baños, Philippines, with aid from Cornell University food scientists Bourne and Steinkraus.

1967. Proceedings of International Conference on Soybean Protein Foods published by USDA Agricultural Research Service. The conference was held 17-19 Oct. 1966 at Peoria, Illinois. Many of the 276 attendees were pioneers in the field. A similar conference on Soybean Products for Protein in Human Foods had been held in 1961 at the same location. A major theme at both is that protein malnutrition is now the world's most widespread deficiency disease.

1967. Soybean production in Latin America reaches 1 million metric tons (tonnes), up 10-fold since 1953.

45. Akinrele, I.A. 1967. Nutrient enrichment of gari. *West African J. of Biological and Applied Chemistry* 10(1):19-23. [7 ref]

• ***Summary:*** Gari, made of fermented cassava, is widely eaten in West and Central Africa and forms the staple food of at least 20 million people in the southern regions of Nigeria. An estimated 20 million tons were produced in Nigeria alone in 1962. Gari contains only 1.3% protein, and is very low in vitamins and minerals. The authors fortified gari with four locally-grown protein concentrates, including Lockhart's full fat soya flour. The recipe found most acceptable as a protein supplement for gari consisted of 70 parts full-fat soya flour, 20 parts full fat sesame flour, 5 parts defatted groundnut flour, and 5 parts dried yeast powder. When 1 part by weight of this supplement is added to 5.4 parts of gari (dry weight), the biological value (protein quality) of the gari was increased by 45% (to 68 from 47). It is estimated that fortified gari will cost about 1 penny per pound more than normal gari. "It is best to add the supplement to fermented cassava cake (50 per cent moisture) before 'garification' (a process involving gelatinisation and drying). This ensues that both the gari and supplement are gelatinised into a homogenous and inseparable product." Address: Federal Inst. of Industrial Research, Oshodi, Lagos.

46. Peppler, Henry J. ed. 1967. Microbial technology. New York, NY: Reinhold Publishing Corp. x + 454 p. Illust. 24 cm. Revised ed. 1979. 2 vols. [17 soy ref]

• ***Summary:*** Chapter 3, *"Lactobacillus acidophilus* cultures (by Arnold B. Storrs and Robert M. Stern, of Great Lakes Biochemical Co., Milwaukee, Wisconsin) notes that *Lactobacillus acidophilus* is known to retain its viability through the digestive tract and thus affords a means of implantation in the lower intestine. A brief review of the literature shows that it has been reported to bring beneficial results in about 70-80% of the gastrointestinal conditions that involve intestinal flora. It is essentially a normal remedy, which at best can do much good, and at worst can do no harm.

By contrast, *L. bulgaricus*, one of the principal microorganisms used in making yogurt, is usually not able to survive in the digestive tract.

"Sufu, or Chinese cheese, is fermented from tofu, or soy curd" (p. 94). A description of "Sufu (Chinese cheese) production" appears on pages 99-100. Address: Universal Foods Corp., Milwaukee, Wisconsin.

47. Indian Council of Agricultural Research. 1968. Proceedings of the First Workshop Conference on Soybean. New Delhi, India: ICAR. 8 p. Held 4-5 April 1968 at the Indian Agricultural Research Institute.

• ***Summary:*** Dr. M.S. Swaminathan, Director of the Indian Agricultural Research Inst., welcomed the delegates. Various University of Illinois personnel were present. He noted that that "the most significant point that hindered the progress of soybean introduction in Indian Agriculture in a big way in the pre and post World War II periods [was the] bottleneck in marketing and utilisation of the soybean that was produced in different parts of the country. In the current post-Independence period he pointed out that the" situation is different.

"In view of the special importance of soybean in the antibiotic industry and a rich and cheap source of meat-like protein and milk-like invigorating drink, Dr. Swaminathan stressed the need for agricultural scientists of diverse disciplines to bend their energies toward attaining expeditiously the goal of introducing into cultivation soybean varieties adapted to different latitudinal zones in this country."

He pointed out "the current urgent demands for large quantities of soybean meal and oil by the existing antibiotic industries in India. This point, at the request of the Chair, was elaborated by Dr. Thirumalachar, Chief Mycologist, Hindustan Antibiotics Factory, Pimpri, Maharashtra, who was present at the workshop by special invitation.

"The Chair also informed the gathering that seed multiplication of Bragg and Clark varieties that grew well

in the northern plains of India" will be accelerated by about 20 tonnes of imported seeds from the U.S.A. in the coming kharif season to be grown in isolation at Suratgarh (Rajasthan).

"At the request of the Chairman, Dr. Earl Leng of Illinois University, gave a talk on 'Soybeans for India–Promise and Problems.'

The chair later "related how soyabean could be a good substitute for *urid* [a pulse] and maize for rice in the preparation of *idli*, the nutritious breakfast food of south India.

"The inaugural session closed with a brief review of the working of the All India Soyabean Project during 1967, the first year of its operation, presented by the Project Coordinator, Shri H.B. Singh, who noted that he visited the various cooperating centers during the 1967 season. The trials at Pantnagar (U.P.), Jabalpur (M.P.), Kalyani (West Bengal), and Katrain (Himachal Pradesh) were all uniform and gave useful information.

Also discussed (with Dr. A.B. Joshi, Chair): Concluding session. Agronomic trials: Fertilizer trial, date of planting and plant population trial. Breeding (for the plains, for the hills, vegetable-type soybeans). Pests and diseases. Bacterial inoculation. Marketing. Address: Indian Agricultural and Research Inst., New Delhi.

48. Edwards, C.C. 1968. The use of soy-ogi in feeding programmes for rehabilitation. Paper presented at the Annual Conference of the Nutrition Society of Nigeria. 8 p. *

49. Akinrele, I.A.; Makanju, A.; Edwards, C.C. 1969. Effect of soy flour on the lactic fermentation of milled corn. *Applied Microbiology* 17(1):186-87. Jan. [2 ref]
• ***Summary:*** In black Africa, corn is eaten mainly in the form of a sour meal, named "ogi" in Nigeria. The most important fermenting microorganisms in ogi are the lactobacilli and *Saccharomyces cerevisiae.* Rather than enriching ogi with heat-treated soya flour, it is better to mill corn and raw soybeans together to make a slurry; the use of raw soybeans or the addition of raw soya flour significantly reduces the natural fermentation time of the ogi. The raw soya increases and accelerates the production of organic acids through the hydroclastic action of the Beta-amylase enzyme of soya beans on the starch and dextrin of corn. The acids thus formed also mask considerably the beany flavor of soya. Moreover, the soya increases both the quantity and quality of the protein in the finished ogi. Address: Federal Inst. of Industrial Research, Oshodi, Nigeria.

50. Hesseltine, C.W.; Wang, H.L. 1969. Oriental fermented foods made from soybeans. *USDA Agricultural Research Service.* ARS-74-50. p. 45-52. Feb. Proceedings of the Ninth Dry Bean Research Conference.
• ***Summary:*** Contents: Introduction. Koji. Shoyu or soy sauce. Miso. Hamanatto. Sufu. Tempeh. Natto. Idli. Conclusion. Flow sheets (without quantities of ingredients) show the basic process used in making the following foods: shoyu, miso, hamanatto, sufu (fermented tofu), and tempeh.

A photo taken in Aug. 1948 shows a miso plant in Tokyo, Japan, with large wooden vats in the foreground. A part of this plant was destroyed during World War II.

Note: No mention is made if using soybeans in idli, nor is there a flow sheet showing the process for making idli. Address: Northern Utilization Research and Development Div., USDA, Peoria, Illinois.

51. Kwon, Shin Han. 1969. Soybeans and soybean products in Vietnam. Saigon: Republic of Vietnam: Ministry of Land Reform and Development of Agriculture and Fisheries, Agricultural Research Inst. (Saigon). 113 p. 28 cm. [60 ref. Eng]
• ***Summary:*** Contents: Map of South Vietnam showing all provinces and their names. Preface, by the author. 1. Introduction: History of soybean, production and trade in the world and in Vietnam, utilization of soybean (uses, nutritive value of the soybean). 2. Botany of the soybean plant: Seed, stem and pubescence, leaves, flower parts, root and nodule bacteria, genetics. 3. Ecological requirement: Germination, temperature, rainfall, day length, soil. 4. Cultivation and storage: Planting (land preparation, depth of seeding, methods of seeding, rate of seeding, time of seeding, rotation, erosion), fertilizer (manure, nodule bacteria, nitrogen, phosphorus, calcium, potash, molybdenum, application), insects (maggot fly, soybean insects found in Vietnam, control), diseases (root disease, foliage disease, seed disease), weed control, harvesting and threshing (harvesting time, methods of harvesting, drying). 5. Variety improvement: Aims of improvement (high yielding variety, disease resistance, insect resistance, day length, varieties tolerant to unfavorable soil conditions, seed size, seed color, oil and protein content in seed, palatability), introduction method, pure line selection method, breeding method (making the cross, pedigree method, bulk method), regional trials, variety purification and multiplication (breeder's seed, foundation seed, stock seed, extension seed, maintenance). 6. Seed certification standard. 7. Bibliography.

The author thanks for their help: Dr. Thai-Cong-Tung, Director of the Agriculture Research Institute, and Mr. Nguyen-Huu-Quyen, Manager of Eakmat Experiment Station.

"The history of soybean in Vietnam is meager, but the references by Loureiro (1790) and Rumphius (1747) mentioned the cultivation of soybean in Malaysia and Vietnam. Harmand (1877) collected wild soybean (*Glycine laotica*) in the Hue and Bassac areas, and the herbariums [herbarium specimens] are still available at the Agricultural Research Institute, Ministry of Agriculture, Vietnam." Since the history of Vietnam is closely related to that of China, it

seems likely that the soybean has been cultivated for many centuries in what is today Vietnam (p. 1).

In Vietnam, the soybean is still not a very familiar crop to the majority of farmers. Although the acreage has gradually increased since 1958, production had not yet reached 10,000 tons by 1967. According to the *Agricultural Statistics Yearbook of Vietnam,* in 1966 in South Vietnam, total soybean acreage was 6,610 hectares and production was 7,585 metric tons, or 1.148 tonnes/ha (p. 7). The main soybean producing provinces are all in the southern half of South Vietnam: Long-Khanh (40% of total South Vietnamese acreage), An-Giang (20.4%), Chau-Doc, Kien-Phong, and Binh-Dinh (5%). In 1963 some 1,440 tones of soybeans were imported and in 1966 some 100 tonnes were exported (p. 6).

Table 4 shows an estimate of the costs and returns per hectare of growing soybeans at the Eakmat Agricultural Experiment Station in Ban-Me-Thuot in 1968. The net income or profit from one hectare was about VN$26,000, which is larger than for any other field crops, including: cassava (VN$22,766), mung beans ($20,267), sweet potatoes ($19,269), upland rice ($6,828), corn ($6,569), and peanuts (VN$5,100).

Uses: "In Vietnam, the soybean is not commonly used in daily food, but a number of foods such as soysauce, tuong [a soft kind of miso resembling Chinese chiang in consistency, and sold in crocks], bean curd, vermicelli, soymilk, soybean wine, chao [fermented tofu, sold in bottles], soybean oil, [soy] bean sprouts, and green pods [green vegetable soybeans] are available in the market and they are gradually becoming popular among Vietnamese.

Note: This is the 2nd earliest English-language document seen (Oct. 2011) that uses the word "chao" to refer to fermented tofu.

Photos (p. 11-12) show: (3) Bean sprouts and cooked beans with tomato sauce. (4) A shop that sells soybean products in a Saigon market. Soybean paste [tuong] is in big chars, chao [fermented tofu] is in bottles in front, and bean curds [tofu] are in the front left corner. (5) A Vietnamese girl frying bean curds in the market. (6) Bottles with labels showing various kinds of soy sauces made in Vietnam.

The highest yielding soybean varieties in Vietnam are presently Palmetto and E-32. In trials, they yield about 1 tonne per hectare. Address: FAO Agricultural Officer. Phone: Saigon 91.746.

52. Edwards, C.C. 1970. The use of soy-ogi in the treatment of Kwashiorkor. Paper presented at the Federal Institute of Industrial Research, Oshodi. 12 p. Held 7 Feb. 1970. *

53. Akinrele, I.A.; et al. 1970. The development and utilization of Soy-Ogi for infant feeding in Nigeria. Paper presented at the Third International Congress of Food Science and Technology. 16 p. Held 9-14 Aug. 1970 at Washington DC. *

54. van Veen, Andre G.; Steinkraus, Keith H. 1970. Nutritive value and wholesomeness of fermented foods. *J. of Agricultural and Food Chemistry* 18(4):576-78. July/Aug. [18 ref]

• ***Summary:*** Contents. Introduction. Materials and methods: Tempeh, ontjom, bongkrek, idli, fish sauces, fermented rice, yoghurt-wheat foods. Nutritive value. Digestibility. Vitamins. Acceptability. Wholesomeness of fermented foods.

Note: No mention is made of using soybeans in idli. "During the idli fermentation, the major ingredients are transformed into a thin dough which, when steamed, resembles a sourdough type bread. The acid and gas required for leavening are produced by *Leuconostoc mesenteroides* which is generally present on India black gram." Address: New York State Agric. Exp. Station, Cornell Univ., Geneva, New York.

55. Akinrele, I.A.; Adeyinka, O.; Edwards, C.C.A.; Olatunji, F.O.; Dina, J.A.; Koleoso, O.A. 1970. The development and production of soy-ogi (a corn based complete protein food). Federal Institute of Industrial Research, Research Report No. 42. Published by the Federal Ministry of Industries, Lagos, Nigeria. 63 p. 28 cm. [14 ref]

• ***Summary:*** "This report presents the series of investigation carried out in the Institute to establish the technological specifications for the manufacture of soy-ogi. Corn flour and soya flour are mixed in a proportion of 70 to 30 parts respectively and fermented anaerobically in a slurry inoculated with a 24 hour corn steep liquor. The sour product is fortified with vitamins and minerals and spray dried. Feeding tests have shown that soy-ogi is nutritious, compares very well with infant milk foods, well tolerated and accepted by adults and children alike. Data obtained from pilot plant production of soy-ogi indicate that a commercially viable project can be established with a capital investment of £132,000, assuring a return of 36% on investment. It is estimated that Soy-Ogi could be produced at one-third the cost of the branded infant foods commercially available in Nigeria.

"The product and the process of its manufacture are the subject of a United Kingdom patent No. 1,193,135 and will be registered in Nigeria."

Note: This is the earliest English-language document seen (Oct. 2012) that contains the term "soy-ogi." Address: Federal Inst. of Industrial Research.

56. Akinrele, I.A.; Edwards, Charity C.A. 1971. An assessment of the nutritive value of a maize-soya mixture, "Soy-Ogi", as a weaning food in Nigeria. *British J. of Nutrition* 26(2):177-85. Sept. [23 ref]

• ***Summary:*** Sour maize pap fortified with soya (Soy-Ogi) has been developed at the Federal Institute of Industrial Research, Oshodi, Nigeria. The traditional weaning food

used in this locality and by over 10 million Yorubas living in the western states of Nigeria is a maize preparation called "ogi" (pap). Soy-Ogi is a "complete protein food, suitable for feeding to children after weaning, and it compares favourably and economically with milk foods. It was successfully used to restore normal health to children suffering from kwashiorkor."

"It has been estimated that Soy-Ogi could be produced at one-third the cost of the branded infant foods commercially available in Nigeria... In a report prepared by Cadbury's (Nigeria) Ltd (1969, private communication), based on 600 consumer tests, it was stated that 'except for its unattractive container, the baby food powder (Soy-Ogi) was preferred to the other products compared.'"

Table 6 shows the cost in new pence of 20 gm of protein from various infant foods worldwide: Incaparina (Mexico) 0.8, Incaparina (Guatemala) 1.6, Pro-Nutro (South Africa) 2.0, Soy-Ogi (Nigeria) 3.0. These 4 foods are vegetable protein mixtures. The cost of popular infant foods that contain milk is: Lactogen (Nestle milk, 6.4), Farex (Glaxo cereal, 11.2), Nestum (Nestle cereal, 11.4). Address: Federal Inst. of Industrial Research, P.M.B. 1023, Ikeja, Lagos, Nigeria.

57. Hesseltine, C.W.; Wang, H.L. 1971. Fermented soybean foods. In: Y.M. Freitas and F. Fernandes, eds. 1971. Global Impacts of Applied Microbiology, GIAM III. India: Univ. of Bombay. See p. 403-20. Conference held in 1969 in Bombay, India. [11 ref]
• ***Summary:*** Contents: Introduction: Nine advantages of fermenting soybeans. Sufu. Hamanatto. Natto. Tempeh. Magou (from South Africa).

"In South Africa, an interesting fermented native food (*magou*) is now made on a modern industrial scale from fermented corn and soybeans. *Magou* is prepared by the fermentation of coarsely ground white corn meal (maize). Pure cultures of *Lactobacillus* used in this fermentation were isolated from native *magou.* The culture, which is not pure, is started in coarse whole wheat flour." Then it is used to ferment corn meal for 22-24 hours. "The mash from the fermentation tanks is mixed with defatted soybean meal, sugar, whey, or buttermilk powder and yeast. The soybean meals used contain at least 52 per cent protein. After thorough mixing of all the ingredients, the mix is spray dried. Currently this product sells for about 10 cents a pound in 50 pound bags... *Magou* is used principally for feeding miners and other workers employed in heavy industry. It is well adapted to being taken into the mines and reconstituted at the point of consumption." Address: NRRL, Peoria, Illinois.

58. Steinkraus, K.H.; van Veen, A.G. 1971. Biochemical, nutritional and organoleptic changes occurring during production of traditional fermented foods. In: Y.M. Freitas and F. Fernandes, eds. 1971. Global Impacts of Applied Microbiology, GIAM III. India: Univ. of Bombay. See p. 444-50. Conference held in 1969 at Univ of Bombay, India. [13 ref]
• ***Summary:*** Discusses tempeh, ontjom, Ecuadorian rice, fish paste, idli, flour kishk, bongkrek, and the wholesomeness of fermented foods. Address: Cornell Univ., New York.

59. Banigo, E.O.I.; Muller, H.G. 1972. Carboxylic acid patterns in ogi fermentation. *J. of the Science of Food and Agriculture* (*London*) 23(1):101-11. Jan. [27 ref]
• ***Summary:*** Ogi is a fermented Nigerian cereal porridge made from maize. Contains no mention of soybeans. Address: Procter Dep. of Food & Leather Science, The Univ., Leeds, LS2 9JT, England.

60. Akinrele, I.A.; Oniwinde, A.B. 1972. Soy-ogi: Its production and nutritional value. Presented at the First Medical Research Seminar, West African Council for Medical Research (WACMR). Held 1-4 Feb. 1972 in WACMR Compound, Yaba, Lagos. *

61. Federal Inst. of Industrial Research, Oshodi. FIIRO. 1973. Soy ogi: Nigerian traditional ogi enriched with protein. *Technical Information Bulletin for Industry* 3(4):1-4. Oct. * Address: Oshodi, Nigeria.

62. Ceylon Meals for Millions Foundation. ed. 1973. All about soya bean. Ceylon. 29 p. Nov. 11. 22 cm.
• ***Summary:*** In the middle of the cover a photo shows the upper part of a soybean plant with the pods and leaves. In the bottom one-third are illustrations of a bottle of [soya] milk, a can of condensed milk, a loaf of bread, a round cheese [tofu], and a tall glass with a straw and clear liquid in it.

Contents: Ad (full page) by Ceylon Oils & Fats Corporation. "We Purchase Soya Beans of Rs. 2000/- per ton delivered Seeduwa, subject to the following specifications:– Moisture 14% maximum. Damaged seed 1% maximum. Extraneous matter 3% maximum.

Preface, by Dr. C.C. de Silva, President, Ceylon Meals for Millions Foundation (dated 20 Nov. 1973). "The Ceylon Meals For Millions Foundation was organised in 1965. In its earlier form it stood as the Meals for Millions Council of Ceylon which was formed on the occasion of the meeting convened by the Junior Chamber of Commerce of Colombo on September 22, 1964 when the former Executive Director of the Meals for Millions Foundation, the late Miss Florence Rose, was on a brief visit to Sri Lanka to promote the use of locally available protein food sources for the betterment of the nutritional status of the population." The three objectives of the Foundation are given.

"Through every available means from the time of its inception in 1965 it has endeavoured to promote and popularise the cultivation of protein food crops, especially soya beans..." Florence Rose provided initial gift supplies

"through the Indian Freedom from Hunger Campaign. An additional supply of 5000 lbs. of multi-purpose foods was purchased by the Foundation from India for this purpose. With part of this food available a pilot survey... was conducted with the assistance of M/s Lever Bros. (Ceylon) Ltd... The public showed a favourable response to the food. The successful breeding of several varieties of soya-beans for cultivation in Sri Lanka through the indefatigable efforts of the officers of the Agricultural Dept. at the Dry Farming Research Station at Maha Illuppallama represents a partial fulfillment of the aims of this Organisation.

"A special word of thanks goes to the Hony. [Honorary] Secretary of the Foundation, Mr. N.D. Wijayanayake for his efforts to get the publication through the Press."

Soya bean: The miracle crop of the 20th century, by Dr. G.W.E. Fernando, Assistant Director of Agriculture (Research), Maha-Illuppallama (p. 13-20, cited separately).

Soya bean recipes: A new trend in the preparation of "Thosai." Soya bean as a substitute for black gram in preparing delicious "Thosai" [Dosai].

Note. This is the earliest English-language document seen (Oct. 2012) that mentions the use of the soya bean in preparing "Thosai"–the Ceylonese counterpart of Indian "Dosai."

Soya–The miracle bean (Extracts taken from the issue on soya bean by the Nutrition Society of India 1971). Address: Sri Lanka.

63. Oniwinde, A.B.; Akinrele, I.A. 1973. Toxicological evaluation of soy-ogi–a new infant protein food in Nigeria. *West African J. of Biological and Applied Chemistry* 16(3):29-34. Dec. [10 ref]

• ***Summary:*** In a long-term feeding trial with rats, soy ogi was found to be safe and free from toxicological problems. Protein deficiency is still the most common nutritional problem of infants in Nigeria. "One major factor for the high prevalence of kwashiorkor (a protein deficiency syndrome) is the widespread use of a low protein sour maize mash or pap (Ogi) for weaning...

"The product described as 'Soy-Ogi' is made from a mixture of 70 parts of corn to 30 parts of soya, wet milled, sieved before fermentation, pasteurisation and drying. The food is further enriched with vitamins and minerals and flavoured to improve its palatability. The gross protein content of the final product is about 20%." Address: Federal Inst. of Industrial Research, Oshodi, Lagos, Nigeria.

64. Steinkraus, Keith H. 1974. Research on traditional Oriental and Indian fermented foods. *Current Science and Technology, Special Report* No. 16. p. 10-13. April. (Cornell University). [13 ref]

• ***Summary:*** Discusses tempeh, ontjom, idli, Ecuadorian "yellow" rice, Indonesian tape (tapeh, tapé), fermented soy milks, and fish paste, including their nutritive value, digestibility (apparent digestion coefficient), vitamins, and acceptability, plus thoughts on the wholesomeness of fermented foods.

Nutritive value: "In no case have we observed an improvement in the protein efficiency ratio (PER) of the fermented over the properly heat treated raw materials."

Acceptability: "Organoleptic acceptability of the fermented foods is generally higher than it would be for the cooked raw materials."

"Indian idli is resistant toward development of food spoilage or pathogenic microorganisms because of its relatively low pH."

Note: The use of soybeans as an ingredient in making idli is not mentioned. Address: Prof. of Microbiology, Dep. of Food Science & Technology, New York State Agric. Exp. Station, Geneva, New York.

65. Ferrier, L.K. 1975. Simple processing of whole soybeans. *INTSOY Series* No. 6. p. 178-88. D.K. Whigham, ed. Soybean Production, Protection, and Utilization: Proceedings of a Conference for Scientists of Africa, the Middle East, and South Asia (College of Agric., Univ. of Illinois at Urbana-Champaign). [17 ref]

• ***Summary:*** A review of the work at the University of Illinois with drum-dried flakes, home cooked and canned soybeans, soybean beverages and beverage products (incl. soy ice cream, yogurt, custard, and margarine), spreads (incl. a chip dip and a "soybean butter" that resembles peanut butter), snack foods (incl. dry roasted soynuts resembling peanuts and puffed snacks). Soy ogi is also discussed.

"The drum-dried flakes are made by preparing a smooth slurry of the cooked soybeans in water and drum-drying the slurry on a double drum drier. If the final product contains other materials, such as fruit or cereals, these are mixed in the soybean slurry and the combination is drum-dried. The dried flakes may be ground to any fineness desired. These flakes may be used directly, as a weaning food, or they may be mixed into other food such as baked goods to increase the protein content."

Concerning soy beverages and beverage products: A simple process was developed at the University of Illinois which allows the use of blanched soybeans to produce a stable soy beverage with *no* beany flavor. (A patent has been granted in France and Belgium, and is pending in other countries.) The major advantages of this process are an excellent mild flavor, no off-flavor, destruction of antinutritional factors, and increased nutritional value relative to most other soybean beverages. The major disadvantage is the necessity of homogenization in order to produce a stable suspension. The beverage based has been used to replace milk in products such as soy ice cream, soy yogurt, custard, and diet margarine, all of which are prepared by conventional methods. Soy beverage base is presently marketed by G.B. Pant University, Pant Nagar, India. The

selling price (which allows some profit) is about one-third that of cow's milk. Address: Asst. Prof., Dep. of Food Science, International Soybean Program (INTSOY), Univ. of Illinois, INTSOY.

66. USDA Northern Regional Research Center. 1975. Summary of progress for extramural projects. *Report of the USDA Northern Regional Research Center.* p. 88-89. July. See p. 89.
• ***Summary:*** "A pure culture believed to be *Leuconostoc mesenteroides* has been isolated from soy idli, an Indian fermented food. The bacteria apparently secrete an enzyme that inactivates hemagglutinin in soy idli; ability of the enzyme to inactivate hemagglutinins in other edible legumes is under study." Address: NRRC/NRRL, Peoria, Illinois.

67. Edem, Edem U. 1975. Soybean in Nigeria (a review article). *Nigeria Department of Agricultural Research* (*Ibadan*), *Memorandum* No. 116. 8 p. Oct. [16 ref]
• ***Summary:*** This is a brief review of the literature. Contents: Introduction and chemical composition. General: Botanical description, classification. Introduction into Nigeria. Importance in Nigeria: Economic importance, soybean exports from Nigeria (1967-1972), nutritional importance. General cultural environment. Cultural methods. Research: Variety selections, agronomy. Federal Department of Agricultural Research soybean improvement programme: Variety improvement–proposed steps, agronomy. Conclusion.

Page 3 notes: "Soyogi [soy ogi] produced by the Federal Industrial Research at Oshodi may soon become a popular Nigerian baby food replacing costly imported baby food items. During the time of our National crisis 1967–1970 [The Biafran civil war], 'Formula Two' corn–soybean–milk meal helped to avert malnutrition in the war affected areas."

Note. This is the earliest English-language document seen (Oct. 2012) that contains the term "soyogi." Address: Federal Dep. of Agricultural Research, Ibadan, Nigeria.

68. Van Rheenen, H.A. 1975. Soybeans in the northern states of Nigeria. In: R.A. Luse and K.O. Rachie, eds. 1975. Proceedings of IITA Collaborators Meeting on Grain Improvement. Ibadan, Nigeria: International Institute of Tropical Agriculture. iii + 179 p. See p. 158-59.
• ***Summary:*** "The main centers of growing soybean in Nigeria are (a) Benue Province in Benue Plateau State, (b) Kwali–Koton Karifi area in Niger Province North Western State and Kabba Province of Kwara States, and (c) Southern Zaria Province of North Central State.

"The soybeans grown are of the indeterminate type, have a growing season of 130-140 days, are vigorous and tall (1.5–1.75 meters), susceptible to bacterial pustule and produce yellowish rather small seeds. The estimated yield of a good farmer's crop is 800-1,000 kg/ha.

"Almost all the seed is exported to Europe and the total export per year has varied over the last 20 years between 5,000 and 20,000 tons.

"Only recently has soybean started to be locally consumed. The Federal Institute for Industrial Research at Oshodi processes soybeans to flour and uses the flour in combination with different ingredients to form products for human consumption like soy-ogi, biscuits, etc. Dr. Theodore Kay of Ahmadu Bello University, Zaria, has successfully tried to popularize soybeans for the production of akara balls, moinmoin and other local foods.

"Research on soy beans is carried out at Samaru, Shika and Mokwa, with trials laid out at different Provincial Stations. Only three research workers study the crop and spend only part of their time on it.

"At Mokwa improvement work on soybeans started about 15 years ago by establishing a germplasm collection, which presently contains about 500 entries... In 1964 a breeding and selection program was initiated, using the cultivars C.N.S. and Malayan as parents." Malayan is the variety most widely grown in Nigeria's areas of soybean production.

Note: Jebba is in western central Nigeria, in the southwest of Northern Nigeria. Address: Agricultural Research Station, Mokwa via Jebba,.

69. Oguntunde, A.O.; Akinrele, I.A. 1976. The feasibility of substituting sorghum and millet for maize in the production of soy ogi. *Federal Institute of Industrial Research, Oshodi, Research Report* (*Lagos*) No. 50. 16 p. *
Address: Nigeria.

70. Ramakrishnan, C.V. 1976. Study of Indian Fermented Foods from Legumes and Production of Similar Fermented Foods from Soybean. Fourth annual report of Am-PL-480 Project No. FG-In-491. Biochemistry Department, Baroda University Baroda, India. *

71. C.V. Ramakrishnan, C.V.; Parekh, L.J.; Akolkar, P.N.; Rao, G.S.; Bhandari, S.D. 1976. Studies on soyidli fermentation. *Plant Foods for Man* 2(1/2):15-33. [19 ref]
• ***Summary:*** Soybeans were used in place of black gram (Phaseolus mungo), with rice, to give an acceptable idli, a fermented food from south India.

In India, whole legumes as referred to as pulses and the split, decorticated ones as dals.

"Soybeans, although they are superior to legumes in nutritive value, are not popular in this country [India] because they take much longer to cook than the popular dals. In addition, the presence in them of trypsin inhibitors and hemagglutinins is a factor that might limit their potential use."

Note. This is the earliest English-language document seen (Oct. 2012) that contains the term "soyidli." Address:

Dep. of Biochemistry, Faculty of Science, M.S. Univ. of Baroda [Gujarat], India.

72. Wang, H.L.; Mustakas, G.C.; Wolf, W.J.; Wang, L.C.; Hesseltine, C.W.; Bagley, E.B. 1976. An inventory of information on the utilization of unprocessed and simply processed soybeans as human food. Peoria, Illinois: USDA Northern Regional Research Center, Interdepartmental Report. AID AG/TAB-225-12-76. 197 p. AID contract report. Undated. No index. 27 cm. Spiral bound. [65 ref]

• ***Summary:*** Contents: Introduction. Home and village traditional soybean foods by country. 1. Soybean food uses and production in Asia. Soaking dry soybeans. In China: Tou chiang (soybean milk; preparation, ways of serving), tou fu (soybean curd; yen-lu is the Chinese name for nigari), tou fu nao (soft curd), tou fu kan (dry / firm bean curd), chien chang (pressed tofu sheets), yu tou fu (fried tou fu), tung tou fu (frozen tou fu), tou fu pi (protein-lipid film; yuba), huang tou ya (yellow bean sprout or soybean sprout), mao tou (hairy bean, green soybean, or immature soybean), dry soybeans (roasting and frying, stewing and boiling), roasted soybean flour. Fermented soybean foods. Production and consumption of soybeans (China and Taiwan).

Japan: Tofu (soybean curd), kinugoshi tofu, processed tofu products (aburage or age, nama-age and ganmo), kori tofu (dried-frozen tofu), yaki tofu (grill tofu), yuba (protein-lipid film), soybean milk, gô (ground soybean mash), daizu no moyashi (soybean sprouts), edamame (green vegetable soybeans), whole soybeans, kinako. Fermented soybean foods: Production and consumption.

Korea: Tubu (soybean curd), soybean sprouts, whole soybeans (green soybeans, parched or roasted soybeans, boiled soybeans), soybean flour, soysauce, bean paste [Korean soybean miso], natto (no Korean name is given), production and consumption of soybeans.

Indonesia: Tahu or tahoo (soybean curd), bubuk kedele (soybean powder), tempe kedele, tempe gembus [the name in Central and East Java for okara tempeh], oncom tahu [the name in West Java for okara onchom], other soybean products (soybean sprouts, green soybeans, roasted and boiled soybeans, kecap or soysauce, tauco or bean paste [miso]), food mixtures (Saridele, Tempe-fish-rice or TFR, Soy-rice baby food, soybean residue [okara]-fish-rice), production and consumption of soybeans.

Thailand. Philippines: Soybean sprouts, soybean coffee, soybean cake (made from equal amounts of soybean flour and wheat flour), soybean milk, tou fu and processed tou fu products, production and consumption. Burma. India. Malaysia. Nepal. Singapore. Sri Lanka (Ceylon). Vietnam. West Asia [Middle East; Iran and Turkey]. References–Soybean food uses in Asia.

2. Soybean food uses and production in Africa. Ethiopia: Injera, wots and allichas, kitta, dabbo, dabokolo, porridge. Kenya. Morocco. Nigeria: Whole soybeans, soybean paste, corn-soy mixtures (soy-ogi). Tanzania. Uganda. Production. References–Soybean food uses in Africa.

3. Soybean food uses and production in Europe [both Eastern and Western]. 4. Soybean food uses and production in Latin America. Argentina. Bolivia. Brazil. Chile. Colombia. Ecuador. Guyana. Paraguay. Peru. Uruguay. Venezuela (fried arepas with textured soy). Mexico: New village process, commercial developments of soy-based food products, Gilford Harrison, Ruth Orellana, Seguras Social. Honduras. Costa Rica. Panama. Dominican Republic. Jamaica. Haiti. Trinidad. References–Soybean food uses in Latin America.

5. Soybean food uses and production in North America. United States: Oriental populations, vegetarian communes, The Farm in Tennessee. Canada. References–Soybean food uses in North America. 6. Soybean food uses in Oceania. Australia. New Zealand. 7. Summary of soybean food uses. Traditional soybean foods: Soybean milk, soybean curd and processed soybean curd products, protein-lipid film, soybean sprouts, tempe (tempeh), green soybeans, boiled soybeans, roasted soybeans, soybean flour, soysauce, fermented soybean paste, fermented whole soybeans [Toushih, hamanatto], natto, fermented soybean curd. Experimental soybean foods: Whole soybean foods, soybean paste, soy flour, soy beverage. Production and consumption.

8. Recent simple soybean processes, other than traditional. Simple village process for processing whole soybeans: Equipment, process, sanitation requirements, quality of product, evaluation of product in formulas and procedures for family and institutional use in developing countries. NRRC village process. Foods from whole soybeans developed at the University of Illinois (drum dried flakes, canned and homecooked soybeans, soy beverages and beverage products, spreads, snacks).

Ways of cooking and serving soybeans in the American diet. 9. Industrial processes. Industrial production and selling prices of edible soybean protein products. 10. Barriers to acceptability and utilization of soybeans in food and research recommendations: Availability. Cultural and social factors. Texture. Flavor. Nutrition and food safety. Technology development. Technology transfer. Research recommendations [concerning each of the above barriers].

Concerning Morocco: Cereal-soy blends have been used extensively in Morocco; in fiscal year 1974 some 14.7 million lb were shipped to Morocco. Mmbaga (1975) reported that soy flour is being used in making porridge, with 1 part soy flour to 3 parts maize / corn flour.

Tables show: (1) Soybean production and imports in Taiwan, 1962-1975 (tonnes = metric tons, p. 33). Production rose from a 53,000 tonnes in 1962 to a peak of 75,200 tonnes in 1967, then fell to 61,900 tonnes in 1975. Imports skyrocketed from 62,400 tonnes in 1962 to a record 827,300 tonnes in 1975. (2) Consumption of soybean foods in Taiwan, 1964-1974 (kg/capita/year, p. 34). Total soybean

foods not including tofu rose from 1.08 kg in 1964 to a peak of 2.61 kg in 1972 then fell to 1.99 kg in 1974. Consumption of tofu (80% water) rose from 18.75 kg in 1964 to a peak of 33.89 kg in 1972, then fell to 32.04 kg in 1974. (3) Supply and disposition of soybeans in Japan, 1971-1974 (p. 49). Total supply is beginning stocks, plus domestic production, and imports. Total disposition is crushing, plus traditional foods and feed. In 1974 imports accounted for 87.5% of the supply, and crushing accounted for 71.0% of the disposition. (4) Whole soybeans used in the production of traditional foods in Japan, 1970-74 (tonnes / metric tons, p. 50). Tofu and others rose from 508,000 in 1970 to 539,000 in 1974. Miso rose from 177,000 in 1970 to 192,000 in 1974. Shoyu rose from 13,000 in 1970 to 14,000 in 1974. (5) Defatted soybean meal used in the production of traditional foods in Japan, 1970-74 (tonnes / metric tons, p. 51). Shoyu rose from 163,000 in 1970 to 176,000 in 1974. Tofu and others was constant at 130,000 from 1971 to 1973. Miso decreased from 4,000 in 1970 to 2,000 in 1974. (6) Production of traditional soybean foods in Japan, 1970-74 (tonnes / metric tons, p. 52). Tofu and others rose from 1,867,800 in 1970 to 2,264,900 in 1973. Shoyu rose from 1,334,1000 in 1970 to 1,455,800 in 1974. Miso rose from 552,200 in 1970 to 587,200 in 1974. (7) Production and food use of beans [various types] and consumption of some soybean products in Korea, 1964-1967 (p. 56-57). In 1967 consumption (in tonnes / metric tons) was: Bean curd 290,000. Bean sprouts 270,000. Bean sauce 69,700. Bean paste 27,700. Total: 11.6 kg per capita per year. (8) Soybean production in Indonesia, 1960-1974 (p. 65). It rose from 442,862 tons in 1960 to 550,000 tons in 1974. (9) Consumption of soybeans in various parts of Indonesia in 1970 (p. 66). (10) Production of soybean foods in the province of Central Java, 1968-1972 (tons, p. 67). Kecap rose from 914,695 in 1968 to 1,524,000 in 1972. Tahu decreased from 18,570 in 1978 to 17,000 in 1972. Tempe rose from 506 in 1968 to 39,000 in 1972. (11) Area planted to soybeans and total soybean production in Thailand, 1964-1974 (p. 70). Area rose from 213,000 rais (6.25 rais = 1 ha) in 1964 to 1,016,000 rais in 1974. Production (in metric tons) rose from 31,300 in 1964 to 252,400 in 1974. (12) Utilization of soybeans by soybean-consuming countries, 1964-66 (based on FAO 1971 Food Balance Sheets, 1964-66 average, p. 150). The countries leading in per capita consumption (kg/person/year) are: China (PRC) 6.7. Japan 5.1. Korea(s) 5.0. Singapore 4.3. Indonesia 2.8. Malaysia 2.6. Taiwan (ROC) 1.1. (13) Amounts of cereal-soy blends distributed under Title II, Public Law 480 in fiscal year 1974 (p. 152-155). (14) U.S. exports of full-fat soy flour, 1974-75 (p. 156).

Note: This is the earliest English-language document seen (Feb. 2004) that uses the word “tubu” to refer to Korean-style tofu. Address: Northern Regional Research Center, Agricultural Research Service, Department of Agriculture, Peoria, Illinois 61604.

73. Winarno, F.G.; Hardjo, S.; Rumawas, F. 1976. The present status of soybean in Indonesia. Bogor, Indonesia: FATEMETA, Bogor Agriculture University. xxiii + 128 p. 29 cm. [7 ref]

• ***Summary:*** The best and most comprehensive survey up to this time on the subject, it was done as part of the 1974 Industrial Census of the Central Bureau of Statistics. Full of valuable statistics and tables. Contents. Preface. Summary. List of tables. List of figures. I. Introduction. II. Objectives and survey methods: A. Objectives. B. Survey methods. III. Cultivation, product handling and protection: A. Botany of the soybean. B. Varieties. C. Growth requirements. D. Agronomy of soybean. E. Crop Management. F. Harvesting and product handling.

IV. Production: A. Harvested acreage, production and average soybean yield in Indonesia. B. Center production areas. C. Harvested acreage of soybean versus other food crops. D. Factors affecting soybean production. V. Farm management and soybean marketing in Indonesia: A. Farm management. B. Marketing of soybean.

VI. Soybean utilization (p. 52): A. Soybean products: Introduction, yuba, sere (from Bali: cooked whole soybeans, mixed with onions, hot pepper, turmeric, salt, and coconut presscake; molded into patties, sun dried, then deep fried), soybean milk, tofu (coagulated with *biang* or *sioko* {calcium sulphate}), soybean sprouts (*tauge*), soybean powder (soybeans that have been cooked, dried, dehulled, and pounded), soybean mixtures, kecap (Indonesian soy sauce), oncom (fermented soybean product, red or black), tauco (Indonesian-style miso), tempe. B. Soybean utilization: Utilization by farmer (in each of 6 provinces and total), utilization by processor (tempe, tofu, kecap, miscellaneous), census conducted by Central Bureau of Statistics, conversion factor for soybean products. C. Consumption of soybean and its processed products (by province). D. Other components. Appendixes.

Tables in body of text: (1) Brief description of recommended soybean varieties. (2-3). Insecticides used against Agromyza and *Phaedonia inclusa.* (4) Soybean harvest seasons in Indonesia (major harvest months, by province). (5-8) Harvested acreage, production, and average soybean yield during 1950-73, 1960-74, and in Java-Madura (1967-71, 1972, 1973, and 1974). (9) Soybean acreage in Java-Madura. (10) Major production areas in Java-Madura, and average 5-year yield, 1965-69. (11) Harvested acreage of soybeans vs. other crops in Java-Madura, 1971-72. (12) Production cost and value per hectare of soybeans. (13) Major trading and harvest months. (14-15) Percentage of farmer’s share and marketing cost of the trade price in various provinces. (16) Percentage of farmer’s share of the trade price. (17) Soybean utilization by farmers, 1975-76. (18-21) Production/consumption of tempeh, tofu, kecap, tauco, tauge, yuba, and sere.

(22-29) Raw material utilized by small-scale processors and by soybean home industries in Java and Jakarta. (30-31) Value of raw material and end products of small-scale industries over 3- and 12-month periods. (32) Conversion factor of soybean products to raw material. (33-36) Average daily consumption per capita of soybean and its process products at villages in Lampung, Yogyakarta, East and West Java, and in 4 other provinces. Address: FATEMETA, Bogor Agricultural Univ., Indonesia.

74. Yee, Vivien Chee-Nan Yeo. 1976. New products from soybeans. Meat extender, alcoholic beverage and protein rich flour. PhD thesis, Cornell University, Ithaca, New York. 92 p. Page 5596 in volume 37/11-B of Dissertation Abstracts International. [50+ ref]*

• ***Summary:*** The new products include two types of soy wines; one was made from soymilk and one from the whey left over after making tofu. Some 25% (w/v, weight-to-volume) of sucrose was added to the soymilk or tofu whey and the liquid was fermented anaerobically with a wine yeast, until the alcohol concentration reached 12% v/v or higher. With soymilk, the proteins precipitated out and had to be removed. Otherwise clarification and aging were the same as for any wine; the finished products were similar to sake. Address: Cornell Univ., Ithaca, New York.

75. *Times of India* (*The*) (*Bombay*). 1977. Kisans take keen interest in new strains, methods. Sept. 28. p. 4.

• ***Summary:*** Pantnagar (Uttar Pradesh)–Note: Kisan is probably the Indian word for a farmer or peasant.

At G.B. Pant agricultural university the soyabean is considered to be of immense importance to the agricultural economy of India. According to the university's vice-chancellor, Dr. K.G. Gollakota, the soyabean has found tremendous acceptance among the terai farmers, who are unable to keep up with the demand. A Rs. 1-crore (10 million rupees) plant has been constructed at Bareilly to process soyabean into oil and meal, and the farmers were expanding their cultivation to keep up with the plant's demand.

Soybean meal has been added to the ingredients for making "Mysore pauk" (based on chickpea powder or besan) and idlis (based on urad) without changing the flavour.

The boys and girls and the university's home science department have switched to drinking soyabean milk from Coca-Cola. The university, which developed a special variety of soyabean that gave a high yield of soyamilk, sold the franchise to two entrepreneurs in Delhi and Madhya Pradesh to produce something like 30,000 litres of soyamilk a day.

Note: It is unclear whether or not this soyamilk plant was every constructed.

76. Liem, Irene T.H.; Steinkraus, K.H.; Cronk, T.C. 1977. Production of vitamin B-12 in tempeh, a fermented soybean food. *Applied and Environmental Microbiology* 34(6):773-76. Dec. [14 ref]

• ***Summary:*** It is believed that the vitamin B-12 in tempeh is synthesized by a *Klebsiella* bacterium, which is a contaminating microorganism rather than one of the microorganisms responsible for the fermentation of the legume substrate. Therefore one may not be able to consider tempeh a reliable, consistent source of this vitamin.

Several varieties of soybeans generally contained less than 1 ng [nanogram] of vitamin B-12 per 100 gm... Pure tempeh molds obtained from different sources did not produce vitamin B-12. It was found that the major source of vitamin B-12 in commercial tempeh purchased in Toronto, Canada [made commercially by Tjing Giok Tan {Mr. Tjeng Giok Tan} of Toronto] was a bacterium that accompanies the mold during fermentation. Reinoculation of pure bacterium onto dehulled, hydrated and sterilized soybeans resulted in the production of 148 ng of vitamin B-12 per gm... Nutritionally significant amounts of vitamin B-12 were also found in the Indonesian fermented food, ontjom."

"Indonesian tempeh, a protein-rich vegetarian food, is one of the world's first meat analogs." Mycelia of *Rhizopus* molds "overgrow hydrated, dehulled, and partially cooked soybeans, knitting them into a firm cake, which can be sliced and deep-fat fried or cut into cubes and used in place of meat in soups."

"Ontjom samples from Indonesia were obtained through the courtesy of A.G. van Veen, Cornell University. Sample 1 was traditional ontjom made from peanut presscake and sample 2 was ontjom [okara tempeh] made from soybean residue."

Table 2 shows the vitamin B-12 content of commercial tempehs made in Toronto (6.3 mcg [micrograms] per 100 gm), Indonesia (sun dried, 1974, 2.9 mcg; oven-dried, 1975, 0.4 mcg), and California (freeze-dried 1.5 mcg per 100 gm).

Note: *Klebsiella pneumoniae* is the microorganism which causes bacterial pneumonia in humans. Address: Cornell Univ., Geneva, New York 14456.

77. Akolkar, P.N. 1977. Studies on soyidli fermentation. PhD thesis, M.S. University of Baroda, Baroda, India. * Address: M.S. Univ. of Baroda, Baroda, India.

78. Shinoda, Osamu. 1977. The history of Chinese food and diet. *Progress in Food and Nutrition Science* 2(10):483-97. [6 ref. Eng]

• ***Summary:*** Contents: 1. From antiquity to Confucius: Neolithic to Bronze Age. 2. From Battle Age to Han: The dawn of the Iron Age. 3. From South-and-North Dynasties until T'ang. The first cookery book. 4. Sung and Yüan: The Mongolian Empire. 5. Ming and Ch'ing: The Manchurians. 6. Contemporary China. 7. Sources of Information.

The liquid left after boiling soybeans may be used to make soy wine. Such a wine was developed during the Sung dynasty (960-1279); the liquid from cooking black or dark

soybeans was mixed with distilled liquor and sugar; it may have been fermented.

79. Eka, O.U. 1978. Chemical evaluation of nutritive value of soya paps and porridges, the Nigerian weaning foods. *Food Chemistry* 3(3):199-206. July. [30 ref]
• ***Summary:*** Paps and porridges fortified with soya bean milk or soy flour can serve as high-quality, low-cost weaning foods for children. Nutritionally they are comparable to "Soy Ogi" and other commercial foods such as Cerelac and Lactogen. Millet porridge fortified with soya bean milk had the highest content of protein and essential amino acids. Address: Dep. of Biochemistry, Ahmadu Bello Univ., Zaria, Nigeria.

80. Beuchat, Larry R. 1978. Traditional fermented food products. In: L.R. Beuchat, ed. 1978. Food and Beverage Mycology. Westport, Connecticut. AVI Publishing Co. xi + 527 p. See p. 224-53. Chap. 9. [69* ref]
• ***Summary:*** Contents: Introduction, Koji. Soybeans: Shoyu, miso, natto (incl. itohiki-natto, yukiwari-natto, and hama-natto / hamanatto), sufu, meitauza, témpé. Peanuts: Oncom. Rice: Lao-chao, ang-kak, idli. Maize: Ogi, kaanga-kopuwai, injera. Cassava: Tapé, gari. Taro (*Colocasia esculenta*): Poi. Cacao beans: Cocoa, chocolate, and chocolate liquor are products derived from cacao fruits (*Theobroma cacao*).

Tables show: (1) Some fermented foods of fungal origin. For each food is given: Product name, geography, substrate, microorganisms, nature of product, and product use. Soy-related products include: Chee fan, Chinese yeast, Hamanatto, ketjap, meitauza, meju, miso, shoyu, sufu, tao-si, taotjo, and témpé.

"Yukiwari-natto is made by mixing itohiki natto with rice koji and salt, and aging at 25 to 30ºC for about two weeks." Note 1. Yukiwari natto is natto resembling miso, featuring the stickiness (*nebari*) of natto and the sweetness of koji. It is made by a two-step fermentation. Another process: (1) Make the natto and the koji, separately. (2) Mince natto finely and mix it with koji, shoyu, and dashi made from kombu. Ferment at 30-33ºC for 30-40 days.

Note 2. This is the earliest English-language document seen (Aug. 2006) that mentions the term yukiwari-natto (or yuki-wari natto). Address: Dep. of Food Science, Agric. Exp. Station, Univ. of Georgia, Experiment, GA.

81. Onyekwere, O.O.; Edwards, C.C. 1978? Soy-ogi, a corn-soya Nigerian weaning food. *FIIRO* (*Federal Inst. of Industrial Research, Oshodi*), *Technical Memo* (*Lagos*) No. 30. 12 p. *
Address: Nigeria.

82. Wang, H.L.; Mustakas, G.C.; Wolf, W.J.; Wang, L.C.; Hesseltine, C.W.; Bagley, E.B. 1979. Soybeans as human food: Unprocessed and simply processed. *USDA Utilization Research Report* No. 5. iv + 54 p. Jan. Slightly revised, July 1979. Jan. No index. 28 cm. Compiled for USAID. [50+ ref]
• ***Summary:*** Contents: Introduction. 1. Soybean food uses in Asia. China: Soaking dry soybeans, tou chiang (soybean milk), tou fu (soybean curd), processed tou fu products, tou fu pi (protein-lipid films), huang tou ya (soybean sprouts), whole soybeans, fermented soybean foods, production and consumption. Japan: Tofu (soybean curd), kinugoshi tofu, processed tofu products, yuba (protein-lipid film), soybean milk, gô (ground soybean mash), daizu no moyashi (soybean sprouts), whole soybeans, fermented soybean food, production and consumption. Korea: Tubu (soybean curd), processed tubu product, soybean sprouts, whole soybeans, soybean flour, fermented soybean food, production and consumption. Indonesia: Tahu or tahoo (soybean curd), bubuk kedele (soybean powder), tempe kedele, tempe gembus [the name in Central and East Java for okara tempeh], oncom tahu [the name in West Java for okara onchom], other soybean products (soybean sprouts, green soybeans, roasted and boiled soybeans, kecap {soy sauce}, tauco {soybean paste}), food mixtures, production and consumption. Thailand: Tofu (*tauhu*), soy sauce, green soybeans in the pods (*tourae*). Philippines: Soybean sprouts, soybean coffee, soybean cake, soybean milk, tou fu and processed tou fu products, production and consumption. Burma. India. Malaysia. Nepal. Singapore. Sri Lanka (Ceylon). Vietnam. Middle East. References–Soybean food uses in Asia.

2. Soybean food uses in Africa. Ethiopia: Injera, wots and allichas, kitta, dabbo, dabokolo, porridge. Kenya. Morocco. Nigeria: Whole soybeans, soybean paste, corn-soy mixtures (soy-ogi). Tanzania. Uganda. Production. References–Soybean food uses in Africa.

3. Soybean food uses in Europe and U.S.S.R.

4. Soybean food uses in Latin America. Argentina. Bolivia. Brazil. Chile. Colombia. Ecuador. Guyana. Paraguay. Peru. Uruguay. Venezuela. Mexico: New village process, commercial developments. Honduras. Costa Rica. Panama. Dominican Republic. Jamaica. Haiti. Trinidad. References–Soybean food uses in Latin America.

5. Soybean food uses in North America. United States. Canada. References–Soybean food uses in North America.

6. Soybean food uses in Australia. 7. Summary of soybean food uses. Traditional soybean foods: Soybean milk, soybean curd and processed soybean curd products, protein-lipid film, soybean sprouts, tempe (tempeh), green soybeans, boiled soybeans, roasted soybeans, soybean flour, soy sauce, fermented soybean paste, fermented whole soybeans, natto, fermented soybean curd. Experimental soybean foods: Whole soybean foods, soybean paste, soy flour, soy beverage. Production and consumption.

8. Simple village process for processing whole soybeans: Equipment, process, sanitation requirements, quality of product, evaluation of product in formulas and

procedures for family and institutional use in developing countries. NRRC village process. 9. Industrial production and selling prices of edible soybean protein products.

10. Barriers to accepting and using soybeans in food: Availability. Cultural and social factors. Texture. Flavor. Nutrition and food safety. Technology development. Technology transfer. Address: NRRC, Peoria, Illinois.

83. Hesseltine, C.W. 1979. Some important fermented foods of Mid-Asia, the Middle East, and Africa. *J. of the American Oil Chemists' Society* 56(3):367-74. March. [34 ref]
• ***Summary:*** Contents: Abstract ("These fermentations, unlike those of the Orient, use bacteria and yeasts instead of filamentous fungi"). Introduction. Eight reasons for using a fermentation process in the production of acid foods. Idli. Kishk. Ogi (The Yoruba {western Nigerian} name for a fermented sour maize product found throughout Black Africa). Mahewu (Magou). Kaffir beer (Bantu beer, sorghum beer, mqombothi).

"When we think of food fermentations, aside from those we encounter daily such as cheese and bread, we think of those strange and exotic products like soy sauce, soybean paste [miso], and tempeh made in China, Japan, and the East Indies."

A photo shows Hesseltine. See also p. 380-81 of this March issue. Address: NRRC, Peoria, Illinois.

84. Shurtleff, William; Aoyagi, Akiko. 1979. The book of tempeh: A super soyfood from Indonesia. New York, NY: Harper & Row. 160 p. Illust. by Akiko Aoyagi Shurtleff. Index. July. 28 cm. [24 ref]
• ***Summary:*** Contents: Acknowledgments. What is tempeh? Preface. 1. Soybeans–Protein source of the future: Introduction, the causes of hunger and starvation–two analyses (*The Twenty-Ninth Day,* by Lester Brown–population, affluence; *Food First: Beyond the Myth of Scarcity,* by Lappé and Collins–population, narrow focus on increasing food productivity, international food exploitation, land monopolization and misuse, cash crop system of export agriculture). Ten reasons soy will be the protein source of the future: 1. Optimum land utilization. 2. Lowest cost protein. 3. High nutritional value. 4. Time tested. 5. Remarkably versatile. 6. Appropriate technology. 7. New dairylike products. 8. Hardy and adaptive. 9. Free nitrogen fertilizer. 10. Energy and resource efficient. "All of these ten factors work together synergistically, reinforcing one another, to give added weight to the prediction that soybeans will be a key protein source for the future on plant earth." Present patterns of soy protein utilization. New developments. An idea whose time has come.

2. Tempeh as a food. 3. Getting started (incl. basic preparatory techniques and 18 recipes, incl. a recipe for sweet Indonesian soy sauce {*kechap manis*}). Favorite tempeh recipes (13 Western favorites, 6 non-fried favorites, and 12 Indonesian favorites; also Suggestions for serving tempeh throughout the day). 4. Western-style and Oriental tempeh recipes (68 recipes). 5. Indonesian tempeh recipes (70 recipes). 6. Making tempeh at home or in a community. 7. Making tempeh starter. 8. The Indonesian tempeh shop. Map of Southeast Asia, including Indonesia. Map of Java, Madura, and Bali (p. 144). Appendix A: A brief history of tempeh East and West. Appendix B: Tempeh shops in the West. Weights, Measures, and Equivalents. Glossary. Bibliography. About the authors. About the New-Age Foods Study Center.

This book contains the first sizeable collection of American-style and Indonesian tempeh recipes (130 in all), the first illustrated descriptions of making tempeh, tempeh starter, and onchom on various scales in Indonesian tempeh shops, the first history of tempeh, detailed discussion of tempeh in Indonesian culture and of the many varieties of Indonesian tempeh, and the first recommendations for commercial names for the more than 30 types of tempeh that could easily be made in the West. It also contains chapters and reviews of the literature on tempeh nutrition and the microbiology and biochemistry of tempeh fermentation, plus the largest bibliography on tempeh to date (including many new Indonesian references), an annotated listing of 61 people and organizations around the world connected with tempeh, and the first list of tempeh companies in the West.

Page 26 states: "Modern soy-protein products, such as textured soy proteins, are increasingly available at supermarkets, often in forms that simulate the fibrous, chewy texture of meat.

Note 1. This is the earliest known book in any language worldwide devoted entirely to tempeh. Note 2. This is the earliest English-language document seen (Aug. 2011) that contains the term "modern soy protein products;" Shurtleff would soon start to use it to refer to defatted soy flour or grits, soy protein concentrates, soy protein isolates, and textured soy protein products.

Illustrations (line drawings; unnumbered, not including "spots"). Indonesian dancer in sarong and crown. Balinese lion mask dancer. Two Indonesian women dancing. Cuts of fresh tempeh on a woven bamboo tray. Woman in a traditional Indonesian kitchen cooking tempeh. Terraced rice patties in Java. Woman selling tempeh in Bali market. Masked Indonesian figure. Soybeans in the pod. A hand holding dry soybeans over a sack of such soybeans. Three women selling beans and grains in a Javanese market. Two men selling tempeh in a Javanese market. Balinese mask. Indonesian mortar and pestle. Traditional oil skimmer for deep frying. A wok. Tamarind paste and pods. Soy sprouts. Pieces of tempeh on a bamboo tray Gado-gado. Laos root & chilies. Palm sugar. Chilies. Indonesian woman carrying fruits in a bowl on her head. Salam leaf. Botok tempeh. Peté beans. Winged and masked Balinese figure. Indonesian spices. Soybean (enlarged). Cartoon of a fuzzy little critter

driving his tiny tractor over a cake of tempeh, inoculating it with a secret enzyme (The Farm, Summertown, Tennessee). Placing tempeh into a homemade Styrofoam incubator. Cross section of good tempeh and bad. Winged beans. Close-up of outside of a homemade tempeh incubator. Dry soybeans in pods on plant. Woman in the USA making tempeh. A deep woven bamboo basket for treading soaked soybeans. Ten steps in the process for making traditional soy tempeh in a small shop (GIZI, Bogor). Twenty steps in the process for making and delivering traditional soy tempeh in a large shop (Oeben, Bandung). Two views of a modern dehuller and dehuller-separator. Five steps showing making tempeh in plastic bags. Three steps showing making tempeh in banana-leaf wrappers. Fourteen steps in the process for making and delivering Malang tempeh.

Map of Southeast Asia. Map of Java, Madura, and Bali (incl. West, Central and East Java). Indonesian stilt house (house on stilts, famous among the Dayak in Borneo, the Minangkabu and Batak of Sumatra, and the Toraja of Sulawesi). Woman selling leaf-wrapped tempeh in a Balinese market (color, rear cover).

Numbered figures (line drawings unless otherwise stated. The number before the decimal refers to the chapter number). 1.1 Table: The changing pattern of world grain trade (exporters and importers). 1.2 Graph: Projected population densities in various regions of the world. 1.3 Bar chart: Per capita protein consumption in rich and poor countries. 1.4 Bar chart: Per acre yields of usable protein from various food sources (pounds per acre). 1.5 Graph: Word soybean production (1965-1977). 1.6 Bar chart: Protein consumed vs. protein returned from milk, eggs, chicken, pork, beef. 1.7. Where the world's money goes (yearly global and U.S.).

2.1 Table: Percentage of protein in various foods. 2.2 Table: Composition of nutrients in 100 grams of tempeh of different types. 2.3 Table: Protein quality (NPU) of various foods. 2.4 Table: Amino acid composition of tempeh compared with the FAO/WHO reference pattern. 2.5 Bar cart: Limiting amino acids in rice and tempeh. 2.6 Table: Combining foods to increase protein. 2.7 Bar chart: Grams of dietary fiber in 100 grams of various foods. 2.8 Table: Fatty acids in soy tempeh. 2.9 Table: Vitamins and minerals in soy tempeh. 2.0 Table: Price of one day's supply of usable protein from various foods.

3.1 Bar chart: Comparison of nutrients in brown and white rice. 3.2 Shoyu (natural soy sauce) in four wooden keg, can, bottle, and small dispenser. 3.3 Grating a coconut. 3.4 Mortar & pestle (two types). 3.5 Cross section of a coconut in the husk. 3.6 Making coconut milk (7 steps). 3.7 Ladies in a Javanese market selling chilies (in mounds). 4.1 Deep-frying tempeh, with all utensils shown. 4.2 Shallow-frying tempeh. 4.3 Seasoned crisp tempeh with dip. 4.4 Tempeh shish kebab. 4.5 Coriander & garlic crisp tempeh. 4.6 Tempeh fondue. 4.7 Making tempeh-filled pot-stickers or gyoza. 4.8 Tempeh pita bread sandwich. 4.9 Tempeh burger. 4.10 Tortilla with tempeh & guacamole. 4.11 Tempeh guacamole. 4.12 Tomatoes stuffed with tempeh.

5.1 Woman in an Indonesian village kitchen. 5.2 Woman grinding spices with a mortar. 5.3 Table: Indonesia's 7 most popular tempeh recipes, in descending order of popularity: Tempeh goreng, tempeh bachem, keripik tempeh, sayur lodeh, sambal goreng tempeh, terik tempeh, sambal goreng kering tempeh. Recipes for each are given. 5.4 Selling traditional banana-leaf wrapped tempeh in Yogyakarta, Java. 5.5 Deep-frying tempeh keripik in batter. 5.6 Deep-frying tempeh keripik in Javanese market. 5.7 Botok tempeh #1. 5.8 Botok tempeh #2. 5.9 Gadon tempeh. 5.10. Folding leaf wrappers for gadon tempeh. 5.11 Rolling leaf wrappers for pepes tempeh. 5.12. Pepes tempeh on broiler and packets ready to serve. 5.13 Folding leaf wrappers for Balinese pepesan. 5.15. Saté tempeh on broiler. 5.15 Saté vendor in Java. 5.16. Saté manis tempeh. 5.17 Tempeh sambal accompaniment for rice.

6.1 Flowchart for homemade soy tempeh. 6.2 Tempeh incubator (home-made). 6.3 Good soy tempeh (diagonally sliced). 6.4 Four types of homemade tempeh. 6.5 Wooden tempeh incubation tray designs. 6.6 Community tempeh incubator. 6.7 Graph: Tempeh incubation time versus temperature for soy tempeh (shows slow, moderate, and quick combinations).

7.1 Graph: Loss of tempeh starter potency when stored at various temperatures and humidities. 7.2 Sporulated tempeh for starter in bread pan. 7.3 Dry-strainer spore extraction. 7.4 Sporulated rice, pressure cooker, and Mason jar method of making tempeh starter. 7.5 Picking leaves from a hibiscus tree for tempeh starter. 7.6 Arranging inoculated soybeans on hibiscus leaves. 7.7 Covering hibiscus leaf sandwiches in trays. 7.8 Hibiscus leaves for tempeh starter ready to use. 7.9 Hibiscus inoculum leaves on round tray. 7.10 Drying inoculum leaves in sun on roof. 7.11 Tying inoculum leaves under rafters to dry.

8.1 Flowchart for basic Indonesian soy tempeh method. 8.2. A small Indonesian tempeh shop (floor plan). 8.3 Floor plan of the large Oeben tempeh shop in Bandung, Java. 8.4 Flowchart for Malang tempeh.

A color photo shows a high-quality cake of tempeh sliced on a plate. Address: New-Age Foods Study Center, P.O. Box 234, Lafayette, California 94549.

85. Shurtleff, William; Aoyagi, Akiko. 1979. The book of tempeh: A super soyfood from Indonesia. Professional hardcover edition (Continued). New York, NY: Harper & Row. 248 p. Illust. by Akiko Aoyagi Shurtleff. Index. July. 28 cm. [190 ref]

• ***Summary:*** Continued: Numbered figures (line drawings unless otherwise stated. The capital letter before the decimal refers to the appendix number). B.1 Table: Tempeh shops in Indonesia by province: Home-industry scale. B.2 Table:

Relative frequency of tempeh consumption in Indonesia (by province). B.3 Carrying tempeh to market in Java using a shoulder pole and trays stacked on two baskets. B.4 Cost of one day's supply of protein in Indonesia.

C.1 Table: Edible grain legumes. C.2 Map: Distribution of legumes in southeast Asia. C.3 Winged bean, showing leaves, pods, flowers and beans. C.4 Leucaena leaves and pods (*peté china*). C.5 Reduction in bongkrek toxicity from bongkrek acid during fermentation (Ko 1977). Okra. Packets of tempeh, ready to sell, wrapped in leaves and tied. A large soybean, with hilum showing.

D.1 Table: Soybean production in Indonesia (1950-1976). D.2 Table: Major Indonesian food crops, D.3 Table: Indonesian soybean production and yields (by province). D.4 Map: Major soybean producing districts in Java (1976; most are in East Java, led by Jemper and Pasuruan). Table: Daily per capita consumption of tempeh (by province, led by Central Java, then West Nusa Tenggara, Yogyakarta, and East Java). Table: Percent of dietary protein supplied by major food categories (led by cereal grains, then fish, nonlegume vegetables, and soy products). Table: Percentage of dietary protein supplied by soy products (by province, led by Central Java, then East Java, Yogyakarta, and West Java). D.5 Table: Statistics on production and consumption of basic Indonesian soyfoods (led by tempeh, then tofu, kechap, taucho). D.6 Star anise. Grinding soybeans for tofu using traditional push-pull stone mills. Pouring soy curds into cloth-lined forming box. Javanese shadow puppet (*wayang kulit*).

Table: Classification of *Rhizopus oligosporus.* E.1 Two stages in the germination of a spore (after 1½ and 10 hours). E.2 Two successive views of hyphal tip growth at half-hour intervals.

E.3 Rhizopus oligosporus (Frazier 1957, showing sporangium, columella, apophysis, sporangiophores, stolon, sporangiospores, node, rhizoid). E.4 *Rhizopus stolonifer.* A. Columella and attached spores. B. Collapsed (invaginated) columella (Webster 1970).

E.5 Life cycle of *Rhizopus* (Raven and Everet 1976). E.6 Graph: Changes in tempeh oil and moisture content during fermentation (Sudarmadji 1977). E.7 Graph: Three phases of tempeh fermentation (rapid, transition, and deterioration; Sudarmadji 1977). E.8 Graph: Changes occurring during tempeh fermentation (temperature, soluble solids, pH, soluble nitrogen, and reducing solids; Steinkraus et al. 1960). E.9 Graph: Yields of tempeh and of solids and different stages of the fermentation process (100 gm of whole dry soybeans yield 173 gm of tempeh on average; Steinkraus 1960; Murata 1967). E.10 Table: Loss of solids and protein during tempeh fermentation. E.11 Table: Percentage changes in composition of key essential amino acids during tempeh fermentation. E.12 Table: PER (protein efficiency ratio, a measure of protein quality for humans) changes during tempeh fermentation. E.13 Graph: Changes in concentration of three carbohydrates during tempeh fermentation (sucrose, stachyose, and raffinose, all decrease; Shallenberger et al. 1976). E.14 Table: Amount of B-complex vitamins in 100 gm of tempeh vs. 100 gm unfermented soybeans (all increase in tempeh except thiamine {vitamin B-1}). Changes in peroxide value and TBA value tempeh and soy flour during storage at 37ºC (98.6ºF; both rise rapidly in soybeans, but stay near zero and stable for tempeh; Watanabe et al. 1971).

H.1 Table: Foods known in Indonesia as "onchom" (made from peanuts or soybeans). H.2 Selling onchom in a Javanese market. H.3 Graph: Changes in soy onchom during fermentation (temperature, soluble solids, pH, soluble nitrogen, and reducing solids; Steinkraus et al. 1965). H.4 Flowchart for preparation of peanut presscake onchom. Unnumbered illustrations show 12 steps in the process of making onchom in a commercial shop in Indonesia. Neurospora: Budding conidia, conidiophore. H.5 Graph: Reduction in onchom aflatoxin during fermentation with *Neurospora* (Ko 1974). A thermometer, showing both Fahrenheit and Centigrade.

Glossary of Indonesian foods, spices, etc. Agar. Amaranth, Indonesian. Apem. Arak. Aren sugar. Aromatic ginger. Asam. Bananas (pisang). Basil. Bawang merah. Bawang putih. Bayam. Bean sprouts. Belimbing. Blachan. Brem. Bumbu. Candlenuts (kemiri). Carambola (belimbing). Cassava. Chabé. Chayoté. Chilies (red, green, fiery dwarf). Two-page spread (p. 220-21) showing illustrations of Indonesian natural foods. Choko. Citrus leaves. Cloves. Coconut. Coconut, grated. Coconut milk and cream. Coconut oil. Coconut water. Coriander. Cumin. Dageh. Daun asam. Daun jeruk purut. Daun salam. Daun seré. Daun-so. Durian. Fermented fish. Fermented fish sauce. Fruits. Galangal, greater. Galangal, lesser. Gingerroot. Indonesian amaranth. Jackfruit. Jaggery. Jinten or jintan. Kangkung leaves. Kecap (kecap) or ketjap. Kemangi leaves. Kemiri. Kenchur root. Ketjap. Ketumbar. Kluwak. Koji. Kolang-kaling. Krupuk. Kunyit. Labu siam. Laos root. Lemongrass. Lime leaves. Lombok. Melinjo leaves. Mochi, Indonesian (*uli*). Mung-bean sprouts. Nutmeg. Okara. Onchom or ontjom. Palm sugar. Pandanus leaf. Pasta. Pepper. Peté beans. Petis. Peuyeum. Prawn paste. Putjung nuts. Ragi. Rempeyek. Rice. Salam leaf. Sambals. Santan, Sayur asin. Seré or serai. Shallots. Shrimp crisps. Shrimp paste. Soursop. Soy sauce, Indonesian. Star fruit. Swamp cabbage. Tahu. Tamarind. Taocho, tauco, taoco, or taotjo. Taogé or taugé. Tape. Tapioca. Taucho or tauco. Terasi. Tofu. Trasi. Tuak or tuwak. Turmeric. Winged bean. Note on monosodium glutamate. A woman holding a tray of leaf-wrapped tempeh in Surinam. Photo of Shurtleff and Aoyagi on inside rear dust jacket. Address: New-Age Foods Study Center, P.O. Box 234, Lafayette, California 94549.

86. Ramakrishnan, C.V. 1979. Studies on Indian fermented foods. *Baroda J. of Nutrition* 6(1):1-54. *

• ***Summary:*** Discusses soyidli and soy-idli (p. 13 and 21)

as well as dhokla made using soybeans as a substitute ingredient. Note 1. This article is very similar to his 1979 PL-480 report.

Note 2. Khaman Dhokla is a Gujarati fast food made with a fermented batter of chickpeas.

Note 3. This is the earliest English-language document seen (Oct. 2012) that mentions "dhokla" made from soybeans. Address: Faculty of Science, M.S. Univ. of Baroda [Gujarat], India.

87. Pederson, Carl Severin. 1979. Microbiology of food fermentations. 2nd ed. Westport, Connecticut: AVI Publishing Co. ix + 384 p. Illust. Index. 24 cm. [38 soy ref]
• ***Summary:*** Chapter 11, on "Nutritious fermented foods of the Orient" contains (p. 310-33): Introduction. Soy sauce. Natto. Koji, ragi, and similar inocula. Miso. Sufu or Chinese cheese. Monosodium glutamate. Aroz fermentado of Ecuador. Tempeh ("The term catsup originated from the Chinese ketsiap, a salty condiment prepared from fish" {p. 325-26}).

Meitauza is made by fermentation of the solid waste material from the manufacture of Chinese cheese [okara]. It is pressed, cut into cakes, and fermented for 10-15 days until the cakes are covered with the white mycelia of *Mucor meitauza* (p. 321).

Fish sauces. Taro.

In India: "Soy-idli has become a staple" (p. 20). Address: Prof. Emeritus Cornell Univ. and New York State Agric. Exp. Station.

88. Peppler, Henry J.; Perlman, D. eds. 1979. Microbial technology. 2nd ed. Vol. 1. Microbial processes. Vol. 2. Fermentation technology. New York, NY: Academic Press. Vol. 1, 544 p. Vol. 2, 536 p. Subject index.
• ***Summary:*** Contents of Vol. 1: 1. Beer brewing. 2. Cheese. 3. Distilled beverages. 4. Mold modified foods, by Hwa L. Wang and C.W. Hesseltine (p. 95-129, cited separately; incl. soy sauce, miso, hamanatto, sufu, tempeh). 5. Wine. 6. Vinegar. 7. Ketogenic fermentation processes. 8. Mushroom fermentation. 9. Inocula for blue-veined cheese and blue cheese flavor. 10. Microorganisms for waste treatment. 11. Elementary principles of microbial reaction engineering. 12. Microbial culture selection. 13. Methods for laboratory fermentations. 14. Instrumentation of fermentation systems. 15. Computer applications in fermentation technology. 16. General procedures for isolation of fermentation products. 17. Use of immobilized cell systems to prepare fine chemicals. 18. Economics of fermentation processes. 19. Fermentation processes and products: Problems in patenting.

Page 111: "Sufu, a traditional Chinese food, is a soft cream cheese-type product made from cubes of soybean curd (tofu) by the action of a mold. In the Western world, sufu has been referred to either as Chinese cheese or as bean cake. Because of the numerous dialects used in China, the product is also known as fu-ju, tou-fu-ju, and others (Wang and Hesseltine, 1970a)." Address: 1. Universal Foods Corp., Milwaukee, Wisconsin; 2. School of Pharmacy, Univ. of Wisconsin, Madison.

89. Ramakrishnan, C.V. 1979. Study of Indian fermented foods from legumes and production of similar fermented foods from U.S. soybean. Terminal Report of PL 480-Project FG-IN-491. 58 p. 25 cm. [105 ref]
• ***Summary:*** Contents: 1. Introduction. 2. Traditional foods involving fermentation. 3. Suitability of fermented foods for young children and their acceptability. 4. Chemical changes during fermentation. 5. Biological evaluation of fermented foods. 6. Use of fermented foods for supplementary feeding programmes. 7. Microorganisms in fermented foods. 8. Summary. 9. References. 10. Appendices: Scientific names of food-stuffs mentioned in the text, glossary.

Idli and dosa have been used as basic foods in South India since at least A.D. 1100. The dominant organisms in idli are *Leuconostoc mesenteroides* and a number of *Lactobacillus* species. Dhokla is from west India, especially Gujarat.

Table 7 (p. 20) shows that "Soyidli" is made of rice and soydal. "Soybean which is not at present popular in this country was found to be well accepted and tolerated when given in the form of *dhokla* made of wheat and bengalgram [chickpeas, garbanzo beans, *Cicer arietinum*] to preschool children in Baroda... The children of Kerala, however, showed a preference for rice-soyidli" (p. 20).

Note. This is the earliest English-language document seen (Oct. 2012) that contains the word "soydal."

"Soyidli" is also mentioned on pages 36, 37, 38, 40, 42, 44, 48.

Table 4 (p. 14) states that "6. Dhokla" uses rice and Bengal gram as its main ingredients. However: "Wheat and soybean can be substituted for rice and black gram."

Table 6, "Different combinations for preparing traditional fermented foods" (p. 19) includes: (1) Dhokla, which uses rice and bengalgram as its main ingredients. "Substitutions found suitable: Soybean, peas, or mothbeans for bengalgram."

(2) Idli, which uses rice and blackgram as its main ingredients. "Substitutions found suitable: Soybean or greengram dal for bengalgram."

(3) Dosa or poora, which uses rice and blackgram as its main ingredients. "Substitutions found suitable: Sprouted peas, cow peas, field beans or soybean for blackgram." Address: Faculty of Science, M.S. Univ. of Baroda [Gujarat], India.

90. Jayawardene, Ellen. 1980. Sri Lanka soya recipes. Unpublished manuscript. 15 p. Undated. Unpublished typescript. [Eng]
• ***Summary:*** "In soyabean cookery, time is saved by using

broken soyabeans." Contains the following 29 recipes: Soya curry (with broken soyabeans). Soya sambol (with blanched roasted soybeans). Soya string hoppers (with soya flour). Soya waddai (with broken soyabeans). Soya milk (1, made from finely ground raw soya flour). Soya milk curry. Soya milk residue and wheat roti (with okara). Soya murukku (with "full fat soyaflour"). Soyabean milk (2, made from soyabeans). Soya pakoda [pakora] (with soya residue or soya flour). Soya tofu (made from 5 cups soya milk). Tofu curry. Soya milk watalappam (with jaggery or *kitul*). Soya rice thosai [Indian = dosa, dosai] (with broken soyabeans). Soya wheat thosai. Soya rice hoppers (with soya flour). Soya rice kanjee (kande, congee [from Tamil; rice porridge or gruel]; with soya flour or soya milk). Soya–rice keum (with blanched roasted soyabeans). Soya kurakkan roti (*karukkan* = millet; with processed soya flour). Soya groundnut sweet (with blanched and roasted soyabeans). Soyamilk with broken beans. Soya pittu (with soya milk residue). Soya kiri bhat (with soya milk). Soya vegetable mixed curry (with broken soyabeans). 25. Soya coconut chutney (Indian type; with blanched and roasted soyabeans). Fried soyabeans. Soya mixture (with fried soyabeans and flattened rice–*Habala Peti*). Soya rice aluwa [halva, halwa] (with dehulled soyabeans). Soya potato cutlets (with broken soyabeans).

91. Steinkraus, Keith H. 1980. Introduction: Food from microbes. *BioScience* 30(6):384-86. June. [12 ref]
• ***Summary:*** Contents: Meat analogs. The role of plants. Microbe production. Fermented foods: Tempeh, miso, soy sauce. Address: New York State Agric. Exp. Station, Geneva, NY 14456.

92. Vaidehi, M.P. 1981. A few soyabean products requiring better attention. *Lal-Baugh Journal* (*The*) 26(2). April/June. [Eng]
• ***Summary:*** "Soyabean should be considered not primarily as a meat substitute, but rather as a food ranking with meat, eggs, milk, and cheese, in protein content and supplementing these foods in the diet."

"The most popular south Indian fermented breakfast foods are 'idli' and 'dose'" [dosai]. Their batters are naturally fermented with wild yeasts present in the atmosphere. Soya dhal could be used as a partial replacement for black gram dhal in making either of these popular foods. A recipe is given.

Recipes are also given for making tempeh, tempeh chips, tempeh curry, soy milk, soy curd and butter milk, tofu (like paneer). Cow's milk paneer retails for over Rs. 25/- per kg. whereas tofu retails for Rs. 8-10 per kg–less than half the price.

Note. This is the earliest English-language document seen (Oct. 2012) that suggests the use of the soya dhal or soya bean in preparing "dose" [dosai]. Address: Univ. of Agricultural Sciences, Bangalore, India.

93. Batra, L.R. 1981. Fermented cereals and grain legumes of India and vicinity. *Advances in Biotechnology* 2:547-53. [12 ref]
• ***Summary:*** Waries, a black gram paste, made from *Phaseolus mungo* fermented with *Leuconostoc mesenteroides*, is somewhat like Japanese miso. Punjabi waries and chunna waries are used as adjuncts in cooking. The paste is heavily salted and fermented for 2-8 days, in North India or Pakistan.

Also describes rice beer, pachwai, murcha, bakhar, jalebies, na (flat leavened bread), pool waries, black gram products, idli (small fermented steamed cakes), dosa (pancakes), and hoppers (pancakes). Address: Mycology Lab., Plant Production Inst., USDA, Beltsville Agricultural Research Center, Beltsville, Maryland.

94. Nave, Robert W. 1982. Re: History of work with soyfoods and soybeans at SPRA in India. Letter to William Shurtleff at Soyfoods Center, June 5. 7 p. Typed (single spaced), with signature on letterhead.
• ***Summary:*** Gives details of his pioneering work, starting in 1968 when he was working at the Nave Technical Institute, Shahjahanpur, UP, India. In March 1970 Nave visited Joe Wenger and his plant in Sabetha, Kansas. He was impressed and the Wenger company then offered to give him the machinery (a Wenger X-25 extruder) necessary to set up a pilot project making extruded soy flour in India. During 1970 USAID in Delhi and the G.B. Pant University joined the proposed project. "From 1970 to late 1971 or early 1972 the project operated as NTI Soya Products. It was set up as a Part of Nave Technical Institute. After the University became a partner, the name was changed to Soya Production & Research Association. The association has been set up as a charitable company...

"SPRA produced Nutri Nugget (TVP), Protesnac (a soya-rice spiced snack), Protein Plus (a corn-soya weaning food), Nutriahar (a wheat-soya–fullfat [full-fat]–weaning food) and extruded fullfat soya flour. SPRA has not produced soymilk, tofu, etc. except on an experimental basis."

SPRA started building a factory in March 1971 at Bereilly. In July 1972 SPRA produced 40 tons of corn-soy weaning food for some feeding trials to be conducted by USAID in Madras state. Nutri Nugget (TVP) was the company's first product; the defatted soybean meal was originally purchased from Prag Ice & Oil Mills, and then from General Foods of Indore (owned by the Sahara brothers). In 1978 the company began having problems with its factory manager (George Grundy) and with production. Grundy and an electrical contractor, Kalim, had been approached by the Sahara brothers to build an extruder for them and set up a competing factory. "Grundy and Kalim then took our machinery apart on the pretext of maintenance and copied it, mostly at SPRA expense."

"Nutrela is produced by Ruchi. Ruchi is the name of one of Kailash Shahra's daughters after whom the company is named. The first extruder they used in this plant is the one made by Grundy as explained above. Unfortunately and in spite of their large media campaign their impact has been negative. They have gone so far as to provide retailers with new packages into which to fill the contents of the outdated packages which did not sell. Because they have little or no quality control, neither Meal Maker nor Nutrela sell well in the markets where Nutri Nugget is available. Both took the wordings used on their boxes and in their ads almost verbatim from the Nutri Nugget boxes and ads...

"Dr. Al Nelson was the key figure in setting up the soybean utilization lab at Pantnagar. Dr. Surjan Singh was head of the department of Food Science and Technology and in charge of the utilization lab. Both were key people in the University's roll in working with us when we were setting up the SPRA–although it had already existed for almost a year at NTI Soya Products.

"As far as I know, no one is extracting soy oil by expellers. All is being extracted by solvent. In Nagpur, someone who had been in the states for some time set up a soy milk project which has local distribution and was a private commercial effort...

"The government figures on soybean cultivation are not accurate. It is less than they say–largely because certain agricultural officers pad figures in order to make their efforts look better. However, cultivation is on the increase and will increase even faster when the market becomes adequately developed to assure sale of the crop.

"Almost as long as I can remember, it has been possible to get tofu in various foods in Chinese restaurants in India. I assume the Chinese were making this for their own limited use but did not try to market it outside.

"I have heard of soy flour being used in idli but think it is very limited if at all. Defatted soy flour and soybeans just aren't available in most places. I have never seen defatted soya flour on sale in retail stores anywhere. If it is now available, it has come very recently...

"TVP is the major soy food product in India. I imagine the total production of this is not much more than 200 tons per month at present but that this is more restricted by ability to produce than lack of market.

"I think the first solvent extraction of soy oil was in about 1969 or 1970.

"When I was in India last April 1982, the milk production at Pantnagar was closed and Sipso was not doing well. In both cases it seemed to be more because of management problems than anything else. The product was good. I have no knowledge of the Jabalpur plant.

"Possibly 50% of the people in India would eat eggs, meat, fish or poultry if they could afford them. Perhaps 20% eat these regularly. There is a great market for soy foods in India and it will grow at an increasingly rapid rate until India is one of the biggest users of soy foods in the world. It is a natural for soya foods if they are produced in a way that suits Indian tastes and conditions."

Attached is a 3-page news release (undated) about: (1) Dr. Vivian Erasmus, a native of India and general manager of SPRA in Bareilly, Uttar Pradesh, who will be in Minnesota from June 24 to July 13. A full-page biography is given. (2) SPRA in India; it is an association of the Methodist Church in India through the Nave Technical Institute (80% shares) and the G.B. Pant University of Agriculture (20% shares). The Methodist Church in India is affiliated to the United Methodist Church of the U.S. "All surplus earnings of the association are use to support charitable projects." The "main impact of SPRA has been in private homes through distribution and sales of its products in retail outlets. It now has nation-wide distribution. Its products include textured soy protein under the name of Nutri Nugget, a soy rice snack, a wheat soy weaning food and full-fat soy flour. Due to the pioneering work of SPRA, soybean based foods are now well established in India." Address: Compatible Technology, Inc, 7600 Harold Ave., Minneapolis, Minnesota 55427. Phone: (612) 545-0378.

95. Shurtleff, William; Aoyagi, Akiko. 1982. History of other fermented soyfoods. Soyfoods Center, P.O. Box 234, Lafayette, CA 94549. 7 p. July 18. Unpublished typescript. Available online at www.soyinfocenter.com.
• ***Summary:*** A comprehensive history of the subject. Contents: Introduction. Soy wine, 321 A.D. Cantonese wine starter (*kiu-tsee*), 1878. Soy fermentation pellicle (*tou-huang*), 1911. Meitauza (*Mucor*-fermented okara tempeh), 1937. Okara onchom, 1901. Soy onchom, 1965. Soy idli, 1967. Soy dosa (or dosai), and dhokla, 1976. Soy-ogi, 1966. Sere or seredele (Bali) discussed in chapter on whole dry soybeans.

Note 1. Shortly after this chapter was written, we decided to include the various types of onchom in the tempeh category.

Note 2. In 2011 we found that Meitauza was actually a type of okara tempeh (fermented with molds of the genus *Mucor*), so we moved it from this category into the tempeh category of fermented soyfoods. Address: Lafayette, California. Phone: 415-283-2991.

96. Murthy, V. Sreenivasa; Natarajan, C.P. 1982. Fermented foods and their industrial prospects in India. In: S. Saono, F.G. Winarno, and D. Karjadi, eds. 1982. Traditional Food Fermentation as Industrial Resources in ASCA Countries. xvii + 259 p. See p. 19-30. Proceedings of a technical seminar, held 9-11 Feb. 1981 at Medan, Indonesia. [8 ref]
• ***Summary:*** Discusses soy idli, soy tempeh, and groundnut + soybean tempeh. "Although Tempe is not yet known in India, some investigations were carried out at the Central Food Technological Research Institute, Mysore, with a view

to using indigenous raw materials." The results of this study, carried out under a PL-480 financed project, are summarized in Tables I to V. Address: Central Food Technological Research Inst. (CFTRI), Mysore, India.

97. Reddy, N.R.; Pierson, M.D.; Sathe, S.K.; Salunkhe, D.K. 1982. Legume-based fermented foods: Their preparation and nutritional quality. *CRC Critical Reviews in Food Science and Nutrition* 17(4):335-70. [125 ref]
• ***Summary:*** Contents: 1. Introduction. 2. Soy sauce. 3. Tempeh. 4. Meitauza. 5. Miso. 6. Natto. 7. Sufu. 8. Fermented soybean milk and other fermented legume milk products. 9. Kenima [sic, kinema]. 10. Oncom (fermented peanut press cake). 11. Waries. 12. Papadams. 13. Dhokla. 14. Khaman. 15. Idli. 16. Dawadawa. 17. Other legume-fermented foods. 18. Future of legume-based fermented foods. References. Nutritional composition is given.

Concerning Dawadawa: Made from the cotyledons of the seeds of the locust bean (*Parkia biglobosa*) it "is also known as 'kpalugu' by the Kusasis and Dagombas of northern Ghana, 'iru' in Nigeria, 'kinda' in Sierra Leone, and 'netetou' in Gambia." It is a protein-rich, "strong-smelling product" that is used as a supplement in soups, stews, porridges, and dumplings. It can be stored without refrigeration for about a year in the tropics. It is eaten in all northern areas of the coastal nations of West Africa: Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Togo, Benin, Nigeria, and Cameroun, and in the tier of countries above these including Bissau, Gambia, Senegal, Mali, Upper Volta, Niger, and Chad.

Note 1. Soybeans are not mentioned in connection with dawadawa.

Note 2. The source of the misinformation about "kenima" is Batra and Millner (1976). Address: 1-2. Virginia Polytechnic Inst. and State Univ., Blacksburg, Virginia; 3. Univ. of Arizona, Tucson; 4. Mahatma Phule Agricultural Univ., Rahuri, Maharashtra State, India.

98. Reed, Gerald. ed. 1982. Prescott & Dunn's industrial microbiology. 4th ed. Westport, Connecticut: AVI Publishing Co. xii + 884 p. Illust. Index. 23 cm.
• ***Summary:*** Chapter 12 (p. 492-538; 129 refs.), by H.L. Wang and C.W. Hesseltine, is titled "Oriental Fermented Foods." It discusses: Soy sauce, miso, tempeh, ontjom, Hamanatto (known as tou-shih in China, tao-si in the Philippines, and tao-tjo in the East Indies [No! Tao-tjo is Indonesian-style miso]), sufu (also called Chinese cheese or bean cake), natto, idli, ang-kak, fermented fish products (incl. nuoc-mam), absence of mycotoxin in fermented foods, summary. Address: Vice president, Amber Labs, Milwaukee, Wisconsin.

99. Wang, H.L.; Hesseltine, C.W. 1982. Oriental fermented foods. In: G. Reed, ed. 1982. Prescott & Dunn's Industrial Microbiology, 4th ed. Westport, CT: AVI Publishing Co. xii + 883 p. See p. 492-538. Chap. 12. [129 ref]
• ***Summary:*** Contents: Introduction. Soy sauce. Miso. Tempeh. Ontjom. Hamanatto. Sufu. Natto. Idli. Ang-kak. Fermented fish products (esp. nuoc mam). Absence of mycotoxin in fermented foods. Summary. Address: NRRC, Peoria, Illinois.

100. Abiose, Sumbo. 1983. Re: Soy ogi and other soyfoods in Nigeria. Letter to William Shurtleff at Soyfoods Center, Feb. 23–in reply to inquiry. 1 p. Typed, with signature on letterhead.
• ***Summary:*** Soy-ogi is not yet on the market as a commercial product, according to the Federal Inst. of Industrial Research, Oshodi, where Dr. Akinrele worked. An agreement was made with Nestle's Foods (Nigeria) Ltd. for commercialization but this fell through. About one month ago a new agreement was made with an indigenous company which will now hopefully commercialize the product.

"Apart from soy-ogi, nothing as far as I know is being done with soy foods in Nigeria. I am working presently on fermented *Parkia filicoidea* (African locust bean). The local name of the product is 'Iru'. A part of the work involves using soybeans as substitute raw material instead of locust beans." Address: Dep. of Food Science & Technology, Univ. of Ife, Ile-Ife, Nigeria. Phone: Ife 2291.

101. Steinkraus, Keith H.; Cullen, R.E.; Pederson, C.S.; Nellis, L.F.; Gavitt, B.K. eds. 1983. Handbook of indigenous fermented foods. New York, NY: Marcel Dekker. ix + 671 p. May. Illust. Index. 26 cm. Microbiology Series, Vol. 9. [200+ ref]
• ***Summary:*** Contents: Foreword by E.J. Da Silva. Preface. 1. Indonesian tempeh and related fermentations: Protein-rich vegetarian meat substitutes. 2. Indigenous fermented foods involving an acid fermentation: Preserving and enhancing organoleptic and nutritional qualities of fresh foods.

3. Indigenous fermented foods in which ethanol is a major product: Types and nutritional significance of primitive wines and beers and related alcoholic foods.

4. Indigenous fermented amino acid / peptide sauces and pastes with meatlike flavors (p. 433-571): Introduction.

(A) Soy sauces: Japanese shoyu: Koikuchi, usukuchi, and tamari; Chinese chiang-yu, by Tamotsu Yokotsuka (p. 437-51). Taiwanese soy sauce, by Liu (p. 451-56). Malaysian soy sauce: Kicap, by Ong, Mercian, Poesponegoro and Tanuwidja (p. 456-61). Indonesian soy sauce: Kecap, by Saono, Poesponegoro and Tanuwidja (p. 461-65). Korean soy sauce, by Chang (incl. homemade kanjang and meju, p. 465-66). Taiwanese black bean sauce: Inyu, by Jan et al. (p. 466-67). Philippine taosi [fermented black soybeans], by Steinkraus (p. 467).

(B) Fermented soybean pastes: Japanese miso, by Ebine, Shurtleff and Aoyagi (p. 468-79). Indonesian tauco, by

Saono et al. and Winarno (p. 479-82). Korean Doenjang and kochujang, by Chang, Shurtleff and Aoyagi (p. 482-87).

(C) Fermented fish-shrimp sauces and pastes (p. 487-526).

(D) Fish-soy sauce and fish-soy paste, by Ismail (p. 526-30).

(E) Miscellaneous Oriental fermentations. Japanese natto (itohiki natto), by Hayashi and Ota (p. 530-45). Japanese Hama-natto (hamanatto) and related products (incl. yukiwari natto, p. 545-47). Chinese red rice: Anka (Ang-kah [ang-kak, angkak]), by Lin, Su and Wang, Sooksan and Gongsakdi, and Pichyangkura (p. 547-53). Chinese sufu, by Su and L.-P. Lin (incl. nyufu, p. 553-61). Note: Chapter 4 contains about 195 references.

5. Mushrooms: Producing single cell (microbial) protein on ligno-cellulosic or other food and agricultural wastes.

6. General papers related to indigenous fermented foods: Contributions of the western world to knowledge of indigenous fermented foods of the orient, the importance of microbial genetics in indigenous food fermentations, new uses for traditional food fermentations, mycotoxin problems in indigenous fermented foods and new methods for mycotoxin analysis.

Less widely known fermented foods include: Idli, dosa (dosai, puda), dhokla, khaman (with soy, 131-35), enjera (162), tef/teff (164), wot (165), hopper (173), kishra (175), lambic (179), ogi (with soy, 189-98), mahewu (203), gari (208), dahi (249-57), srikhand and lassi (256-57), laban rayeb, laban zeer, yogurt (257-59; cultured soy yogurt is mentioned on p. 616), liban, mast, mass, taw (260), tairu (with soy, 260-65), kishk or kushuk (267), Metchnikoff (266), trahanas or tarhanas (271-76), rabdi, jalebi (275), koumiss (276), kefir (277-80).

Alcoholic beverages and foods: Honey wine, mead, metheglin (305), tej (306), sugar cane wines, basi, bubod, binubudan (307), palm wine or toddy (315-28), pulque (328-37), kaffir (344), tesguino (352), bouza (357), pito (358), busaa (365) sake (373-79), yakju and takju (379), tape = tapeh (381-400), ragi (381), tapuy (400), lao-chao (402), madhu (406), brem (408), tropical vinegar (410-14), nata (414-20), tea fungus (421), nuoc-mam (516-21).

Reviewed in Scientific American (Nov. 1983, p. 37), and in Bio/Technology (1984. p. 364). Address: Inst. of Food Science, Cornell Univ., Geneva, New York.

102. Steinkraus, Keith H. 1983. Fermented foods, feeds and beverages. *Biotechnology Advances* 1(1):31-46. [70* ref]
• ***Summary:*** Contents: Abstract. Indigenous fermented foods / beverages: Indian idli, dawadawa (daddawa), soy sauce (Thailand), Indonesian tape, fish sauces, Japanese koji, Nigerian millet beer (oyokpo), Kenyan uji. Microbial / single cell protein (SCP): Mushrooms.

Note: Dawadawa made from soybeans is not mentioned. Address: New York State Agric. Exp. Station, Geneva, NY 14456.

103. *Soyanews* (*Sri Lanka*). 1984. The Indonesian art of making soyafoods. 6(6):4-5, 9. Feb. [1 ref]
• ***Summary:*** "Recently the UNDP invited the Soyabean Foods Research Centre in Gannoruwa to send a team of food technicians to study the Indonesian experience. They have now returned to Sri Lanka after a two-month study tour which helped to acquaint them with the home and cottage level processing of soyafoods."

Fermented foods are highly developed and very important in Indonesia. "The only fermented preparation Sri Lankans are perhaps acquainted with is with the making of hoppers, thosai [dosai], and iddli [idli in south India]."

Those who took part in the two-month study course were: Miss Ellen Jayawardene, Miss H.M. Lalitha Padmini, Mrs. J.M.K. Jayaratna, Mrs. K.G.S. Ariyaratna and Mrs. Soma Weerasuriya.

Five large photos show soyfoods being made in Indonesia on a cottage level. The foods are tempeh, tofu, yuba, and soya sauce; one photo shows a shop that makes both tofu and tempeh. At least one person appears in each photo.

104. Chandrasiri, Vasina. 1984. Assessment of protein quality in soybean processed foods: Available lysine contents. *J. of the National Research Council of Thailand* 16(1):35-50. Jan/June. [18 ref. Eng; tha]
• ***Summary:*** Available lysine contents of soybeans and 10 soyfoods was determined as follows: raw soybeans 6.62 g/16 g nitrogen, cooked soybeans 6.12, white tofu 5.64, yellow tofu 6.24, soft curd tofu 5.63, tube tofu 6.17, yuba 8.13, soymilk 4.43, soy sprouts 3.79 (each g/16g N).

Values for fermented soyfoods were as follows: white soybean paste [miso] 4.72, black soybean paste 3.72, fermented curdcake (okara) 5.35. 30 minutes of boiling did not reduce the available lysine significantly. The study concluded that there was no reduction in available lysine content of soybeans before they were made into fermented or non-fermented soyfoods. There was no change in the amount of available lysine in the non-fermented soyfoods, but there was a small, statistically significant reduction in fermented soyfoods. Address: School of Home Economics, Sukothaithammatirat Univ., Thailand.

105. **Product Name:** Mamvy (Soy Flour) Soyabean Flour.
**Manufacturer's Name:** Odeiga and Company. Renamed Odegai and Company.
**Manufacturer's Address:** Umejei St., P.O. Box 100, Ibusa, Bendel/Delta State, Nigeria.
**Date of Introduction:** 1985. July.
**New Product–Documentation:** Letter from J.A. Ogbugwo, Chairman/Proprietor. 1993. April 12. Their company has been researching and processing soybeans since 1985.

"We have many local products/recipes from soyabeans at present."

Letter and label sent by Joseph O. Ogbugwo of Odegai & Company. 1993. May 24. This product was launched in July 1985. It is still on the market. Label. 4 by 5.5 inches. Black ink on white paper. "A high value vegetable protein. Happy dieting." Brief recipes are given for: Bread and cookie making (add 5-30 percent). Soyabean doughnuts, pancakes, biscuits, puff-puff, etc. Soy-ogi. Soyabean moi moi (Alele) and akara/beanball (kwosai). Cereals blend. Soyabean-plantain pudding. Soy-amala / Tuwo. The company name is given as "Odeigai Foods Ltd., P.O. Box 100, Ibusa, Bendel State, Nigeria." Note: This is the earliest known commercial soyfood product made in Nigeria.

106. Yacoumba, Doulaye. 1985. Un Burkinabé à Penne du Tarn [A man from Burkina Faso in Penne du Tarn]. *Lettre de l'ARTS* No. 2. p. 2. Summer. [Fre]
• ***Summary:*** For some years soybeans have been cultivated in small amounts by the peasants of Burkina Faso. Up until now they have been used to make Soumbala [sumbala], a ball-shaped fermented soy product, that is an important source of protein used for seasoning sauces. In hopes of diversifying the uses of soya in his country, where soybean acreage for food use is growing, the author worked at St. Paul de Mamiac during 16-23 July 1985 where he learned how to make tofu. He hopes to introduce tofu to Burkina Faso.

A photo shows Mr. Yakoumba, sent by the Minister of Agriculture of Burkina-Faso, and M.P. Boyer, mayor of Penne.

Note 2. This is the earliest document seen (Jan. 2012) that uses the word *Soumbala* to refer to dawadawa, a condiment made from soybeans instead of the traditional *Parkia* seeds. Address: Ministry of Agriculture, Burkina Faso, Africa.

107. Latzke-Begemann, Ute; Walker, Judith. 1985. Soybean household utilization in South Western Nigeria. In: Proceedings of Tropical Soybean Workshop. 164 p. See p. 69-91. Held 30 Sept. to 4 Oct. 1985 at IITA, Ibadan, Nigeria. Unpublished manuscript. [1 ref]
• ***Summary:*** Contents: Introduction. Recipes: Preparation of soypaste. Ground soybean with ogi. Ground soybeans with rice. Tuwo with ground soybean paste. Sweet potato with ground soybeans. Pounded yam with ground soybeans. Vegetable soup with soybean paste. Soybeans with maize. Yam porridge. Soymilk. Akara. Moyin moyin. Iru or dadawa.

Contains many photos, especially of soyfoods preparation at the Kersey Children's Home at Ogbomosho. The recipes were developed at this Home, a situation which is recognisable to many low income African families, both rural and urban. The recipes use the simplest kitchen technologies.

Note: This is the earliest English-language document seen (Jan. 2012) that uses the word "dadawa" or the word "iru" to refer to dawa-dawa, a close relative of Japanese natto. Address: Socio-Economic Unit, Farming Systems Programs, IITA, Ibadan, Nigeria.

108. Aubert, Claude. 1985. Les aliments fermentés traditionnels: Une richesse méconnue [Traditional fermented foods: An unrecognized richness]. Paris: Terre Vivante. 261 p. Index. 21 cm. Series: Collection les Vrais Aliments d'Aujourd'hui et de Demain. [173* ref. Fre]
• ***Summary:*** The author gives good, brief introductions to the fermented soyfoods tempeh, miso, miso pickles, shoyu, tamari, sufu, natto, soy idli, and hamanatto. Related foods that are also discussed include koji, amazake (amasaké), and ontjom. See especially chapter VII: The fermentation of legumes (p. 73-78). Part IV (p. 153-216) is a dictionary of fermented foods and beverages, in which they are listed alphabetically; basic information and references for each are given. Instructions are given for preparing many of these foods on a home scale, and for some foods (such as tempeh) even recipes are given (fried tempeh, tempeh goreng). The book contains many beautiful illustrations and an excellent bibliography. The author acknowledges his extensive use of the material in *Handbook of Indigenous Fermented Foods* (1983) edited by K.H. Steinkraus. Address: Ingénieur agronome de formation, France.

109. Duke, James A.; Ayensu, Edward E. 1985. Medicinal plants of China. 2 vols. Algonac, Michigan: Reference Publications, Inc. 705 p. Introduction by Edward S. Ayensu. 24 cm. Medicinal index (by disease). Common names index. Index to species. No. 4 in the series "Medicinal Plants of the World." [234* ref]
• ***Summary:*** The plants are grouped by family. Two families are tied for containing the largest number of medicinal species: Leguminosae (Fabaceae) and Compositae (Asteraceae) each have 354 species. The soybean (*Glycine max*) is discussed on p. 326-27. "Uses: Leaf: Bruised leaves applied to snakebite. Flower: Used in blindness and opacity of the cornea. Stem: Ashes of stalks applied to granular hemorrhoids or fungus growths on the anus. Fruit: Green hulls chewed to a pulp and applied to corneal and smallpox ulcers. Seed: Chinese herbals suggest that soybean is specific for proper functioning of bowels, heart, kidney, liver and stomach; antidote to *Aconitum* and *Croton.* Root: Decoction astringent. Plant: Bean sprouts ('Ta tou huang chuen') are considered constructive, laxative, resolvent, to help in alopecia [hair loss, baldness], ascites, and rheumatism.

"A salty relish 'Hsien-shih' [salted fermented black soybeans] is made by soaking the beans in water for three days, spreading them to ferment, with salt, ginger, peppers, orange peel, thyme, fennel, and apricot kernels, sealed in an earthen jar, and placed in the sun for one month. This relish

is said to be used for ague, bone diseases, chills, colds, cold feet, colic, dogbite, difficulty in breathing, dysentery, fever, headache, marasmus, melancholy, nausea, poisons, and ulcer. Bean ferment (tou huang) is used for rheumatism, especially of the knees. It is chewed to a paste and applied to eczema. Bean curd (tou fu) is prescribed in drunkenness, dysentery, ophthalmia, or swellings. Soy sauce ('Chiang,' 'Chiang yu,' 'Shih yu') is applied to burns, eczema, leprosy, scalds, and sores, and is considered useful in preventing abortion and the hematuria of pregnancy.

"Chemistry: Sitosterol, an anticancer active, replaces diosgenin in some hypotensive drugs. Stigmasterol used to be employed for stiffness. Lecithin derived from soybean may function as a vasodepressor and a lipotropic agent. Soybean oil, with unsaturated fatty acid, is recommended for hypercholesteremia."

The adzuki bean (*Phaseolus vulgaris*) is discussed on p. 336-37, and kudzu (*Pueraria lobata*) on p. 339-40. Address: 1. USDA Germplasm Services Lab., ARS B-001 R-133, Beltsville, Maryland 20705.

110. Odunfa, S.A. 1985. African fermented foods. In: B.J.B. Wood, ed. 1985. Microbiology of Fermented Foods. Vol. 1. Essex, England: Elsevier Science Publishing Co. xx + 371 + 14 p. See p. 155-91. [122* ref]
• ***Summary:*** In the middle belt of Nigeria, local soybean varieties are used in place of locust beans (fermented with *Bacillus subtilis*) to make iru (the Yoruba name for dawadawa), which resembles Japanese natto. Address: Dep. of Botany & Microbiology, Univ. of Ibadan, Nigeria.

111. Wood, Brian J.B. 1985. Miscellaneous food-related fermentations. In: B.J.B. Wood, ed. 1985. Microbiology of Fermented Foods. Vol. 1. Essex, England: Elsevier Science Publishing Co. xx + 371 + 14 p. See p. 213-35. [27 ref]
• ***Summary:*** Contains a good overview of tempeh, ontjom, and "New substrates for old technologies," as chickpeas for miso and tempeh, or soybeans for idli. Address: Dep. of Bioscience & Biotechnology, Univ. of Strathclyde, Glasgow, Scotland, UK.

112. Koleoso, O.A.; Kuboye, A.O. 1986. Traditional food, beverage and technology of Nigeria and other West African countries. In: V.H. Potty, et al. eds. 1986. Traditional Foods: Some Products and Technologies. 292 p. See p. 13-28. Aug. Presented at the UN University Workshop on "Traditional Food Technologies: Their Development and Integrated Utilisation with Emerging Technologies." Held June 1983 at CFTRI, Mysore, India. [14 ref]
• ***Summary:*** Page 16 discusses *Iru* (a Yoruba word), called *Dorowa* in Hausa or *Ogin-Igala* in Igbo or Ibo. It is a food condiment prepared by fermenting the dried seeds of the African Locust Bean tree (*Parkinsonia clapportoniana*) which is abundant in the Savannah areas of Nigeria. It is widely used in Nigeria for preparing vegetable soups and stews. The dried Locust Bean seeds are cooked under pressure for 30-60 minutes. The seedcoats are removed and the process is repeated for 30 minutes. The softened seeds are cleaned under running water. They are then fermented naturally in a calabash covered with muslin cloth. The Iru is ready for sale in 3-5 days.

Page 19 discusses soy ogi (made from maize and soybeans). The microorganisms isolated from soy ogi are: *Saccharomyces cerevisiae*, *Candida mycoderma*, *Lactobacillus plantarum*, and *Aerobacter cloacae*. Also discusses the organisms isolated from cassava-based gari, fufu, and lafun. Address: Federal Inst. of Industrial Research, Oshodi, Nigeria.

113. Egounlety, M. 1986. Study of ogi supplemented with tempeh. Nutrition Research and Development Center, Ministry of Health, Indonesia. (Internal Report). *

114. Reddy, N.R.; Pierson, Merle D.; Salunkhe, D.K. eds. 1986. Legume-based fermented foods. Boca Raton, Florida: CRC Press. viii + 254 p. Illust. Index. 26 cm. [585 ref]
• ***Summary:*** An overview with information on nutrition and processing of fermented soyfoods. Contents: 1. Introduction. 2. Soy sauce. 3. Miso. 4. Sufu. 5. Natto. 6. Tempe. 7. Fermented soybean milk and other fermented legume milk products. 8. Oncom (fermented peanut press cake). 9. Idli. 10. Dhokla and Khaman. 11. Dawadawa. 12. Papads. 13. Other legume-based fermented foods (Inyu, kecap, kenima, meitauza, Philippine tao-si). 14. Future of legume-based fermented foods. Address: 1-2. Dep. of Food Science & Technol., Virginia Polytechnic Inst. and State Univ., Blacksburg, VA; 3. Vice-Chancellor, Mahatma Phule Agricultural Univ., Rahuri, Maharashtra State, India.

115. Yee, V.; Wellington, G.H.; Olek, A.; Steinkraus, K.H. 1986. Production of a white wine and a protein-rich soy flour by yeast fermentation of soybean slurry, soybean milk and whey from tofu production. *Acta Biotechnologica* 6(3):209-14. [17 ref]
• ***Summary:*** "A dry white wine with an alcoholic content of 10 to 14% v/v was produced by yeast fermentation of slurried ground soybeans, soybean milk and whey from tofu production. Wines from whey and soybean milk were judged by a 20 member taste panel to be acceptable and comparable to a commercial chablis control. Chemical analysis indicated that the high fat and protein contents of soybeans do not cause a problem in the production of wines from soybeans as the lipids and proteins are precipitated by the acid and alcohol formed during the fermentation. The lees recovered following fermentation were dehydrated and ground to a flour having an enriched protein content due to the yeasts and an improved flavor resulting from the yeast fermentation." Address: Inst. of Food Science, Cornell Univ., Geneva, New

York 14456.

116. *Toyo Shinpo* (*Soyfoods News*). 1987. Kôji-kin baiyô okara aji, kaori, shokkan ryôkô. Okara shori ni idomu. Okara hanbaagu tanpaku na aji de katasa yoshi (ryo) [Culturing okara with koji molds. The taste, fragrance, and texture are good. Processing okara by chilling. Okara hamburger–light taste and good firmness]. Feb. 2. p. 2. [Jap; eng+]
• ***Summary:*** In this experiment, raw okara, white rice, bran, and konnyaku powder were cultured with koji molds (*Aspergillus oryzae*), *Rhizopus* molds (*kumonosu kabi*), and one other type. Afterwards, the mixture was used in deep-fried tofu burgers (*ganmo*), croquettes, and hamburgers. The best results occurred when ground pork was mixed in to make a hamburger. The end product had a light taste and a nice firm texture.

117. Snyder, Harry E.; Kwon, T.W. 1987. Soybean utilization. New York, NY: Van Nostrand Reinhold Co. xii + 346 p. Illust. Index. 23 cm. An AVI Book. [381 ref]
• ***Summary:*** Contents. Preface. 1. Production, marketing, and sources of information: Introduction, agricultural production, marketing, sources of information. 2. Morphology and composition: Morphology, chemical composition. 3. Processing of soybeans: Preparation, flaking, expellers, solvent extraction, oil refining, protein products. 4. Quality criteria for soy products: Protein and oil products. 5. Functional properties of soy proteins: Interactions of soy proteins with water, interactions of soy proteins with lipid, foaming, commentary on functionality. 6. Nutritional attributes of soybeans and soybean products: Inherent attributes of soybeans, changes due to processing.

7. Oriental soy food products: Traditional nonfermented soybean food products, traditional fermented soybean food products. 8. Soybean-supplemented cereal grain mixtures: Protein-rich food mixtures containing soy flours, composite flours containing soy flour, cereal blends containing soybeans. 9. Soy protein food products: Baked goods, meat products, dairy products, other foods containing soy protein. 10. Soybean oil food products: Salad and cooking oils, mayonnaise, and prepared salad dressings, shortenings, margarines and related products, soybean lecithin products. 11. Grades, standards, and specifications for soybeans and their primary products: Grades of soybeans, specifications for soybean meals and flours, trading specifications for soybean oils, specifications for lecithins, standards for the use of soy protein products in other foods. References in each chapter. Glossary.

This book is well written (though largely a repetition of previous works) in the area of modern soy protein products. It is weak and poorly researched in the area of "Oriental Soy Food Products," which comprises only 1 chapter (22 pages) of the total, making the book unbalanced. The author of this chapter seems to be almost completely unaware of the many major developments in the Western world during the past 10 years.

Note the following Korean soyfood terms: Fresh soybean = Put Kong. Toasted soy powder = Kong Ka Ru. Soy sprouts = Kong Na Moal. Soymilk = Kong Kook or Doo Yoo. Yuba (Soymilk film) = no name. Tofu (Soy curd) = Doo Bu. Tempeh (Fermented Whole Soybeans) = no name. Natto = Chung Kook Jang. Soy sauce = Kan Jang. Miso (Soy Paste) = Doen Jang. Fermented tofu (Fermented Soy Curd) = no name. Fermented okara (fermented soy pulp) = no name.

Note: This is the earliest English-language document seen (Dec. 2005) that uses the term "Toasted soy powder" to refer to roasted soy flour. Address: 1. Prof., Food Science Dep., Univ. of Arkansas, Fayetteville, AR; 2. Principal Research Scientist, Div. of Biological Science & Engineering, Korea Advanced Inst. of Science and Technology, Seoul, South Korea.

118. Karim, Mohamed Ismail Abdul; Hassan, Zaiton. 1987. Traditional fermented foods of Malaysia. In: Fujiharu Yanagida, ed. 1987. Traditional Foods and Their Processing in Asia. Tokyo: NODAI Research Institute, Tokyo Univ. of Agriculture. vii + 235 p. See p. 210-18. [12 ref]
• ***Summary:*** The authors discuss the preparation of a number of Malaysian fermented soyfoods, including tempeh, kicap kacang soya (soy sauce), and tauco (soybean paste).

Note: This is the earliest document seen (April 2012) that uses the term "kicap kacang soya" to refer to Malaysian soy sauce.

They also discuss other Malaysian fermented foods: budu or kicap ikan (fish sauce), cincaluk (fermented shrimp), belacan (fish/shrimp paste), pekasam (fermented freshwater fish), tapai (fermented rice or cassava), tempoyak (fermented durian), tairu / taire / taina (fresh cow's milk fermented by bacteria equivalent to sour milk or yogurt), dadeh (made from fermented buffalo milk), arak beras (rice wine), toddy (palm wine), idli (steamed pudding), dosai (pancake), dadeh (fermented sweetened milk), and jeruk buahbuahan & sayur sayuran (pickled fruits and vegetables). Address: Faculty of Food Science and Biotechnology, Universiti Pertanian Malaysia, Malaysia.

119. Singleton, Paul; Sainsbury, Diana. 1987. Dictionary of microbiology and molecular biology. 2nd ed. Chichester, New York, Brisbane, Toronto & Singapore: John Wiley & Sons, Ltd. xii + 1019 p. Illust. 25 cm. A Wiley-Interscience Publication.
• ***Summary:*** Contains entries for: fermentation, fermented foods, fermenter (fermentor), miso, natto, nitrogen fixation (dinitrogen fixation), ogi, oncom, shoyu (see Soy sauce), soy paste (see Miso), soy sauce (shoyu), sufu, tempeh, tofu (an intermediate in Sufu production). Address: London.

120. Weingartner, Karl E.; Dashiell, K.E.; Nelson, A.I. 1987.

Soybean utilization in Africa: making place for a new food. *Food and Nutrition* (*FAO*) 13(2):21-28.

• ***Summary:*** Contents: Introduction. Research into utilization. African governmental support. Commercial soy foods. Utilization in village homes. Soybean oil and animal feed.

"For the most part, the lack of attention to possible uses for soybeans has stemmed success of promotional efforts on the production side... Two international institutions are involved with soybean utilization in sub-Saharan Africa: the International Institute of Tropical Agriculture (IITA) at Ibadan, Nigeria, and the International Soybean Program (INTSOY) of the University of Illinois, Urbana, Illinois, USA. Research has focused particularly on problems at the small-holder and community level... In 1985, IITA started a programme to promote processing and utilization of soybeans. It has collaborated with INTSOY in the development of intermediate and home-level technology in the areas of oil technology, soy milk production and extrusion cooking." IITA has installed a dry extruder made by Insta-Pro International (Des Moines, Iowa) and is testing it.

The major soybean producers in sub-Saharan Africa are Zimbabwe (80,000 tonnes/year in 1986/87), Nigeria (75,000), Zambia (35,000), and Zaire (30,000). "In Zaire, soybeans are mostly used at the home level. In Zambia and Zimbabwe, soybeans are processed into oil and animal feed. In Nigeria, they are used in home consumption and to a lesser extent as animal feed."

Some governments are actively supporting soybeans. Burkina Faso encourages soybean growing by buying them directly from farmers. Zimbabwe sets a preplanting price. Nigeria has developed a nationally coordinated approach to soybean research and production involving farm research institutions. The planning section in the Kenya Department of Agriculture has recommended that 128,000 hectares in Kenya are suitable for growing soybean as a second crop after maize.

"There are still very few networks on soybean utilization in sub-saharan Africa. In 1987, the Nigerian Soybean Association was founded. In 1986 the National Oilseed Development Company (Zambia) Ltd. was formed to assist small-scale production of soybean. The Commercial Oil Seed Producers Association is promoting utilization in Zimbabwe. The Catholic community in Zaire has set up a loose network of cottage industries.

In Africa, soymilk has great potential as a consumer product, although there are presently only a few soymilk factories in Africa: Vitalait is made in Burkina Faso and Soyapro in Kinshasa, Zaire. "Possibly the most popular soy food in sub-Saharan Africa is a beverage called Mahewu which is manufactured by Nutresco in Harare, Zimbabwe." It is made from soy and maize. Popular soy-based infant baby foods are Nutrend (made by Nestlé in Lagos, Nigeria) and Cerevap (made by Victoria Associated Products [VAP] in Kinshasa, Zaire). "There are several soy/maize breakfast cereals available but they are less popular than the soy-based infant food. They include Nutri-Plus Soy made by Nutresco, Nutrima-10 [Nutrimax-10] by Smallette Foods (Ilorin, Nigeria), and Country Morning by Nestlé (Lagos, Nigeria).

"Soy flour, biscuits and cookies are also popular. In Zaire, several cottage industries including the Bisoka Company (Kananga, Kasai Occidental) use different proportions of soy, wheat and sorghum flour to produce sweet cookies which are especially popular with school children. Soy flour also is a popular commercial item in Zaire. The Centre de Développement Intégral grows soybeans in Bwamanda and processes them in Kinshasa. In 1986 it produced about 450 tonnes of soybeans. Of this, about 50 per cent was made into full-fat soy flour. In Benin, the Centre Horticole et Nutritionnel makes Farine Bébé."

"The most widely consumed soy-based food at the rural level in West Africa is made using fermented whole soybean and is called 'dadawa' (in Hausa [northern Nigeria]), 'iru' (in Yoruba [southwest Nigeria]) or "soumbala' (in Dioula [also spelled Jula, Dyula and Joola, a Mande / Manding language spoken in Burkina Faso, Cote d'Ivoire & Mali]). Dadawa was traditionally made from locust bean seeds, which are becoming scarce and are being replaced by soybeans. Kafanchan, in Kaduna State of Nigeria, is the processing and marketing centre for dadawa. From there, it is transported by traders throughout Nigeria and to Cameroon, Chad, Niger, Benin and Togo. Millions of West Africans use a small amount of dadawa each day to add flavour to their stews (similar in taste to a beef concentrate or seasoning cube). Dadawa may also be prepared at home. People in remote areas of northern Ghana have been observed growing soybeans in their compound gardens specifically for dadawa production.

"Soybeans have been used as an aid to medicine in missionary hospitals since early in the 1960s. In Zaire, the Catholic community encourages production and utilization of soybeans. A doctor with the Presbyterian community near Kananga (Kasai Occidental, Zaire) asks mothers of malnourished children to buy soybean flour as a condition for medical treatment."

In Ghana, roasted soybeans are used in the home preparation of tuubani; they are ground, mixed with water to form a paste, then steamed inside a folded leaf. In Nigeria, dawadawa and soybean paste are added to egusi (vegetable soup), and ground soybeans are added to ogi. In Zaire, people make roasted soy flour, then add it to bouille or bidia (a thick porridge). In Zambia, soy flour is mixed with mealie meal to make *nsima*, or added to cooked green vegetables to make a relish.

"Approximately 40% of the edible oil consumed in Zimbabwe is from locally grown soybeans. The LINT Company of Zambia (LINTCO), a quasi-government

group, is helping farmers with production and marketing of soybeans... A new soybean crushing plant in Makurdi, Nigeria, with a capacity of 72,000 tonnes/year is scheduled to open in early 1988." It should lead to increased demand for Nigerian-grown soybeans. Address: 1-2. IITA (International Inst. of Tropical Agriculture), PMP 5320, Ibadan, Nigeria; 3. Soybean Utilization Program Leader, INTSOY, Univ. of Illinois, Urbana, IL 61801.

121. Weingartner, Karl E.; Dashiell, K.E.; Singh, S.R. 1987. Soybean utilization in Africa. *Tropical Grain Legume Bulletin* No. 34. p. 2-6. [5 ref]
• ***Summary:*** The content of this article is very similar to that of: Weingartner, Karl E.; Dashiell, K.E.; Nelson, A.I. 1987. "Soybean utilization in Africa: making place for a new food." *Food and Nutrition* (FAO) 13(2):21-28. Address: International Inst. of Tropical Agriculture (IITA), PMB 5320, Ibadan, Nigeria.

122. Ali, Nawab; Gandhi, A.P.; Ojha, T.P. eds. 1988. Soybean processing and utilization in India: Proceedings of the national seminar on Soybean Processing and Utilization in India, 22-23 November, 1986. Bhopal, India: Soybean Processing and Utilization Project, Central Institute of Agricultural Engineering. v + 431 p. Illust. Authors index. 26 cm. [50+ ref]
• ***Summary:*** Organized by the Soybean Processing and Utilization Project, India. Contents: 1. Address by General Director, Dr. N.S. Randhawa. Session I: Opening session: 2. Soybeans as economic protein source, by Prof. A.C. Pandya. 3. Present status of soybean in India: Constraints and future strategies to increase its production and productivity, by Dr. P.S. Bhatnagar. 4. Present status of soybean processing and utilization in India, by Dr. Nawab Ali and Dr. A.P. Gandhi.

Session II: Harvesting, drying and storage (papers 5-16).

Session III: Physico-chemical and nutritional aspects (papers 16-21). Including: 17. Physical and cooking characters of soybeans, by T.S. Gourmama, D. Vijayalakshmi and Dr. M.P. Vaidehi. 20. Varietal variability on soypaneer preparation, by Dr. A.P. Gandhi and Dr. Nawab Ali. Note: Soyapaneer is tofu.

Section IV: Processing and oil extraction (papers 22-32). Including: 25. A simple soyapaneer pressing device for rural people, by Dr. A.P. Gandhi and Dr. Nawab Ali. 26. Soyflaking–A low-cost technology at rural level, by R.T. Patil, Dr. B.D. Shukla and Dr. A.P. Gandhi. 27. Simple technologies for making some soybased products–by Dr. A.P. Gandhi and Dr. Nawab Ali. 28. Full-fat soyflour-processing technology, storage and utilization, by H.N. Mishra and Dr. R.K. Mukherjee. 29. Preparation of soyblend snacks at domestic level, by K.M. Sahay and Dr. R.P. Kachru. 31. Extrusion process with special reference to soybean, by Dr. Nawab Ali and R.T. Patil. 32. Development of a mini-mill and its performance evaluation for soybean blended wheat flour, by B.S. Bisht.

Session V: Utilization as food and feed (papers 33-47). Most of these papers are cited separately.

The word "dosa" appears on 16 pages of this book including 4 times on page 386, 3 times each on pages 316, 384, and 385, twice on p. 388, and once each on pages 224, 268, 291, 306, 344, 381, 382, 387, 391, and 392.

The word "dosai" appears on pages 169 and 341 of this book.

The word "idli" appears on 19 pages of this book including 3 times each on pages 374, 386, and 291, twice on pages 316, 384, and 385, and once on pages 224, 291, 293, 306, 310, 341, 351, 373, 375, 382, 387, 388, and 391. Address: 1. PhD, Project Director, Soybean Processing and Utilization Project, Central Inst. of Agricultural Engineering (ICAR), Nabi Bagh, Berasia Road, Bhopal-462 018, India; 2. PhD, Soybean Processing and Utilization Project; 3. Central Institute of Agricultural Engineering.

123. Desikachar, H.S.R. 1988. Utilization of soybean for food uses in India. In: Nawab Ali, A.P. Gandhi, and T.P. Ojha, eds. 1988. Soybean Processing & Utilization in India. Bhopal, India: Central Institute of Agricultural Engineering (CIAE). v + 431 p. See p. 289-98. Held 22-23 Nov. 1986 at CIAE, Bhopal, India.
• ***Summary:*** Discusses the development in India of soybean foods such as soymilk, soyflour, soypaneer [tofu] and soyoil–and the possibility of replacing other pulses by soybean in common Indian foods. The need for simple, low cost processing techniques with a minimum of sophistication is emphasized.

Recently texturised soy products, paneer [tofu] made from soy milk and weaning foods made using soyflour have been on the market. Solvent extracted soybean oil and imported soy oil are used in making Vanaspathi [Vanaspati]. Almost all extracted meal is being exported.

Table 1 compares the proximate composition of black soybean (Kalitur) and pigeonpea (on a dry basis). The soybean contains 44.00% protein compared with 25.2% for the pigeonpea. The soybean contains 21.5% fat [vegetable oil] compared with 1.8% for the pigeonpea.

Table 2 compares the "Sugar content of black soybean (Kalitur) and pigeonpea (percentage)."

Another point that needs to be emphasized is that soybean or soybean meal will be most widely accepted when used for making indigenous food preparations used by most Indians in their daily diet instead of soya milk, tofu, meat analogs, etc. in which for it is likely to be used by relatively few people. With this end in view, work was initiated at CFTRI, Mysore, a few years ago to process soybean for use in making common Indian foods. "Soybean was first made into dal by removing the husk. In fact, it is much easier to make dal from soybeans than from other Indian pulses. A method and machine for making dal by a dry process was

standardized at CFTRI.

"The bitterish beany taste of soybean was also found to be modified by fermentation as normally practiced for *idli* and *dosa*. In fact, soybean batter was found to ferment faster and more easily than the blackgram, because of its higher sugar content (Fig. 1). It could replace blackgram by 50% in *idlis* and fully in *dosa"* (p. 291).

Table 3, "Comparative flatus [intestinal gas] production with raw, cooked and germinated pulses" (p. 293) gives values for seven raw, cooked, germinated, and cooked & germinated Indian pulses. Black soybean produced the most flatus (5.20) followed by bengalgram [chickpeas, garbanzo beans, *Cicer arietinum*] (5.18), blackgram (4.76), cowpea (4.03), pigeonpea (3.81), horsegram (2.66) and greengram (2.26).

Because of its flatus production when used in whole or split form, soybean is more difficult to digest. "The flatus effects could be minimised by addition of clove and/or cinnamon (Fig. 2) which are normally used in preparation of North Indian type dals. Germination and fermentation as normally practiced for *idli* considerably reduce galacto oligosaccharides and reduce the flatus producing properties of soybean and other pulses as well (p. 293; See Tables 4 and 5, Figs. 3, 4 and 5).

Table 4, "In vivo gas production on isolated carbohydrate fractions from black soybeans and pigeonpeas," shows that per 10 gm coming from soybeans in the diet, oligosaccharides produce the most intestinal gas (4.80), followed by hemicelluloses (1.58) and pectin (0.70).

Fig. 3 shows that germination of 7 common Indian legumes reduces the content of the raffinose family of sugars, and reduces intestinal gas. Address: Deputy Director (Retired), Central Food Technological Research Institute, Mysore. Currently Consultant, Paddy Processing Research Centre (Tamil Nadu) Society, Tiruvarur [Southeast India].

124. Geervani, P.; Krishna Kumari, K.; Shobha Reddy, A. 1988. Studies on organoleptic and consumer evaluation of selected traditional recipes incorporated with soybean flour. In: Nawab Ali, A.P. Gandhi, and T.P. Ojha, eds. 1988. Soybean Processing & Utilization in India. Bhopal, India: Central Institute of Agricultural Engineering (CIAE). v + 431 p. See p. 387-94. Held 22-23 Nov. 1986 at CIAE, Bhopal, India. [5 ref]

• ***Summary:*** This study is about the development of traditional, cereal, millet, and legume recipes by incorporating whole soybean at the 50% level to find out their organoleptic quality. The recipes were of traditional Indian breakfast items such as idli, dosa, and dokla; main meal items such as chapati, millet roti, and sambar; and snack items such as biscuits, chuduva, and pakoda. "In addition, sorghum soy roti and sorghum soy biscuits were used for consumer evaluation. The results indicate that all these products were acceptable without any significant difference among them. The incorporation of soyflour also reduced the cost and increased the nutritive value of the product." Address: Postgraduate and Research Centre, Faculty of Home Science, A.P. [Andhra Pradesh] Agricultural Univ., Rajendra Nagar, Hyderabad–500 030, India.

125. Gouramma, T.S.; Vijayalakshmi, D.; Vaidehi, M.P. 1988. Physical and cooking characters of soybeans, In: Nawab Ali, A.P. Gandhi, and T.P. Ojha, eds. 1988. Soybean Processing & Utilization in India. Bhopal, India: Central Institute of Agricultural Engineering (CIAE). v + 431 p. See p. 166-69. Held 22-23 Nov. 1986 at CIAE, Bhopal, India.

• ***Summary:*** Contents: Abstract. Introduction. Physical characters. Cooking quality of soybeans. Acceptability of soyproducts.

"4. Acceptability of soyproducts (p. 169): "Some typical products, mainly cooked dhal, mashed dhal, *dosai* and *vadai* which are typical Karnataka dishes were prepared by using soy in place of traditional pulses." These products were evaluated by a panel of 12 judges, and they were found to be acceptable even when soy was substituted up to 50% in place of traditional pulses.

Note: Vada (a food), also known as wada or vade or vadai (pronounced "wah-daa," vah-dey, or "vah-die") or Bara is a savory fritter-type snack from South India.

"Vada can vary in shape and size, but are usually either doughnut- or disc-shaped and are about between 5 and 8 cm across. They are made from dal, lentil, gram flour or potato.

"Although they are commonly prepared at home, vadas are as well a typical street food in the Indian Subcontinent and Sri Lanka. They are usually a morning food, but in street stalls and in railway stations... they are available as a snack all day" (Source: Wikipedia, at Vada). Address: Dep. of Rural Home Science, Univ. f Agricultural Sciences, Hebbal Campus, Bangalore 560 024, India.

126. Krishna Kumari, K.; Geervani, P. 1988. Evaluation of the protein quality of selected traditional recipes incorporated with soybean flour. In: Nawab Ali, A.P. Gandhi, and T.P. Ojha, eds. 1988. Soybean Processing & Utilization in India. Bhopal, India: Central Institute of Agricultural Engineering (CIAE). v + 431 p. See p. 381-86. Held 22-23 Nov. 1986 at CIAE, Bhopal, India. [2 ref]

• ***Summary:*** 1. Fermented batter products: Soybean was substituted for 50% of the blackgram dal in making idli. Soybean was substituted for 50% of the blackgram dal in making dosa. Soy flour was substituted for 50% of the bengalgram flour in making dhokla.

Baked products: Soy flour was substituted for 50% of the wheat flour in making wheat puka. Soy flour was substituted for 50% or 40% of the sorghum flour in making sorghum roti. Soy flour was substituted for 50% of the maida flour in making maida biscuits. Soy flour was substituted

for 50% or 40% of the sorghum flour in making sorghum biscuits.

Fried products. Soybean was substituted for 50% of the green gram dal in making pesarattu. Soy flour was substituted for 50% of the bengalgram flour in making pakodi. Soy dal was substituted for 100% of the bengalgram dal in making chuduva.

Boiled and roasted products: Soy dal was substituted for 100% of the redgram dal in making sambar. Soy dal was substituted for 50% of the bengalgram dal in making chutney powder.

Table 2 gives the number of grams of protein in each of these foods, the number of grams of four amino acids per 100 gm of protein, and the chemical score of each.

Table 3 gives the biological quality of the protein in each soy incorporated food as measured by PER, NPU, and TD (true digestibility). Address: Dep. of Foods and Nutrition, College of Home Science, A.P. [Andhra Pradesh] Agricultural Univ., Hyderabad 500 004, India.

127. Mital, B.K. 1988. Utilization of defatted soy flour for food. In: Nawab Ali, A.P. Gandhi, and T.P. Ojha, eds. 1988. Soybean Processing & Utilization in India. Bhopal, India: Central Institute of Agricultural Engineering (CIAE). v + 431 p. See p. 310-21. Held 22-23 Nov. 1986 at CIAE, Bhopal, India. [15 ref]

• ***Summary:*** Abstract: "This paper briefly describes the manufacture of soyprotein products and their food applications. The major products are defatted grits / flours, protein concentrates and protein isolates. The soybean protein products are used in food formulations as a dietary protein and also for their functional properties." Soy protein has "wide application in cereal foods such as chapati fortification, baked food, *idli*, *dosa*, and *dhokla*. Fermented and coagulated products such as soymilk, soyyogurt, soy paneer [tofu] and ice-creams are very popular. Texturised products could also be made from soybean."

Since the potential of soybean meal for feed or food has not been fully exploited in India, a major portion of the meal is exported. Soybean meal contains about 50-52% protein whose quality is close to that of milk protein. It is ironic that this protein-rich material which could be used effectively to combat malnutrition in India "is exported to affluent countries, where it is used as cattle feed."

4.1.3 "Idli, dosa, and dhokla" (p. 316): "Blackgram can be partly (50-75%) substituted with soybeans in the preparation of Indian products such as dosa. Idli and dosa mixes can be developed incorporating defatted soy flour. It will substantially enhance the nutritive value of such products." Address: PhD, Prof. & Head, Dep. of Food Science & Technology, G.B. Pant Univ. of Agriculture & Technology, Pantnagar, India.

128. Mukherjee, R.K. 1988. Soybean as food. In: Nawab Ali, A.P. Gandhi, and T.P. Ojha, eds. 1988. Soybean Processing & Utilization in India. Bhopal, India: Central Institute of Agricultural Engineering (CIAE). v + 431 p. See p. 299-309. Held 22-23 Nov. 1986 at CIAE, Bhopal, India. [8 ref]

• ***Summary:*** Soybean foods sold commercially in India include paneer, meat analogues (Nutrinugget, Nutrella, etc.), cereal-based items (biscuits, breads, chapatis, kinako), weaning foods (Protein Plus, Paustic Ahar, Nutri Ahar), and Others (Soy nuts , Protesnac, candies, shortenings, margarines, oil) (p. 300).

It would appear that protein fortification of cereals would result in better and more nutritious foods at relatively less cost. Traditional Indian foods such as *chapatis*, *parathas*, *puris*, *dosa*, *bada*, *idli* etc. can be made into highly nutritious foods by the incorporation of soy flour.

Studies conducted by Mishra and Mukherjee (1986) at the Post Harvest Technology Centre of the Indian Institute of Technology at Kharagpur have shown that wheat flour can be successfully fortified with full fat soy flour up to a level of 25% for chapati making without affecting adversely the flavour or overall acceptability of the chapatis. Bread, biscuits and other bakery products fortified with soy flour were found to have good consumer acceptance. Another important use of soybean would be soy dal which is a traditional" food in India. Yet it is not yet widely used because of the long cooking time (about 130-140 minutes) and the residual beany flavour. This small problem can be overcome by appropriate heat processing. 'Several other products such as soy milk, curd [tofu], 'srikhand' [sweet flavoured yogurt dessert] etc. may also be made using soybean."

Soy protein concentrates and isolates are also commercially available. "The evolution of soybean and soybean products is very timely in that more and more people are now turning to nonanimal protein" (p. 308). Address: PhD, Post Harvest Technology Centre, Indian Inst. of Technology (IIT), Kharagpur 721 302, India.

129. Patil, R.T.; Shukla, B.D.; Gandhi, A.P. 1988. Soyflaking–A low cost technology at rural level. In: Nawab Ali, A.P. Gandhi, and T.P. Ojha, eds. 1988. Soybean Processing & Utilization in India. Bhopal, India: Central Institute of Agricultural Engineering (CIAE). v + 431 p. See p. 222-32. Held 22-23 Nov. 1986 at CIAE, Bhopal, India. [5 ref]

• ***Summary:*** A low-cost technology for making whole soyflakes (flaked whole soybeans) has been developed. These soyflakes contain on average 44.43% protein and 19.10% oil. They are devoid of all anti-nutritional factors. The flakes are generally accepted and cost about Rs. 8.54 per kg.

A flow chart for making soyflakes is shown (p. 223). Raw soybeans (8-10% moisture) are cleaned (with CIAE cleaner), split (using a mini burr mill), winnowed (using CIAE cleaner) and the hulls removed. The resulting soydhal

[soydal] is blanched in boiling water for 40 minutes then dried (with CIAE dryer) to 25-30% moisture. They are then flaked (with CIAE flaking machine), dried to 8-10% moisture, and graded. The two grades are soyflakes and soygrits (for quick cooking dal, or idli mix).

Recipes for soyflakes are given: Instant soya curry. Filler for patties, rolls, etc. Dry soyflakes curry.

Photos show: (1) Blancher, CIA design. (2) Natural convection tray-type dryer. (3) CIAE soybean flaking machine, with tray underneath.

"Soyflakes grits can be used as quick cooking dal and also as [part of a] mix for making *idli, dosa* and other fermented foods" (p. 224).

The words "soydal," "soyflakes," and "soyproducts" are also used on page 224.

Note. This is the earliest English-language document seen (Oct. 2012) that uses the term "soyflakes" to refer to a food made from whole soybeans (not defatted) that has a flake texture–rather than a flour texture. Address: 1. Scientist-S2; 2. Scientist-S3; 3. Biochemist. All: Soybean Processing and Utilization Project, Central Inst. of Agricultural Engineering (ICAR), Nabi Bagh, Berasia Road, Bhopal-462 018, India.

130. Patil, R.T. 1988. Equipment and techniques for processing of soybean at rural level. In: Nawab Ali, A.P. Gandhi, and T.P. Ojha, eds. 1988. Soybean Processing & Utilization in India. Bhopal, India: Central Institute of Agricultural Engineering (CIAE). v + 431 p. See p. 253-68. Held 22-23 Nov. 1986 at CIAE, Bhopal, India. [9 ref]
• ***Summary:*** In India, there is very little equipment for wet grinding that could be used at the village level. It is therefore necessary to test the suitability of other available wet grinders (as used in Southern India for the preparation of *Idli* and *Dosa*) for wet grinding soybeans in the process of making paneer [tofu]. For the dry grinding of soybean, the pin mill is suitable as it has able to grind materials with a high fat content.

Contents: Abstract. Introduction. Cleaning and grading of soybean. Dehulling of soybean: Dry process, wet process. Detoxification of soybean (using moist heat to inactivate trypsin inhibitor activity {TIA} and urease activity {UA}). Wet grinding of soybean. Dry grinding of soybean. Specific purpose equipment. Conclusions (Dehulling of the soybean is very simple compared to other pulses).

Illustrations show: (1) Pedal operated air screen cleaner. (2) Rotary concave type dehuller. (3) Mini grain mill used for dehulling. (4) Hand grinder for dehulling. (5) Hull separator. (6) NDRI blancher. (7) GBPUAVT blancher. (8) Blanching unit, CIAE design. (9) Wet grinder developed by GBPUAVT, Pantnagar. (10) Colloidal mill for wet grinding. (11) Pin mill for dry grinding. (12) CIAE flaking machine. Address: Scientist-S2, Soybean Processing and Utilization Project, Central Inst. of Agricultural Engineering (ICAR), Nabi Bagh, Berasia Road, Bhopal-462 018, India.

131. Thomas, Sheila; Kamath, Savitri. 1988. Studies on fermented soybean (*Glycine max*) products. In: Nawab Ali, A.P. Gandhi, and T.P. Ojha, eds. 1988. Soybean Processing & Utilization in India. Bhopal, India: Central Institute of Agricultural Engineering (CIAE). v + 431 p. See p. 373-80. Held 22-23 Nov. 1986 at CIAE, Bhopal, India. [12 ref]
• ***Summary:*** Describes the preparation of fermented "soyproducts" such as idli, khaman and dhokla. Various recipes for each of these new soy products is given on pages 374-75.

"Conclusion: The improvement in the quality of soy protein by fermentation could be a point in favour of these newly developed products. So the popularising of soybeans will not only be beneficial from the point of view of protein quality and quantity but also from that of the housewife who could introduce variety in food preparation. Soy wheat idlis of high nutritive value could even be utilised for feeding infants and children." Address: Univ. of Agricultural Sciences, Hebbal, Bangalore-560024, India.

132. Vaidehi, M.P. 1988. Home level processing and utilization of soy based food products for rural and urban people. In: Nawab Ali, A.P. Gandhi, and T.P. Ojha, eds. 1988. Soybean Processing & Utilization in India. Bhopal, India: Central Institute of Agricultural Engineering (CIAE). v + 431 p. See p. 336-54. Held 22-23 Nov. 1986 at CIAE, Bhopal, India.
• ***Summary:*** "This paper presents some of the research work in soybean processing and utilization carried out at University of Agricultural Sciences, Bangalore."

Contents: Abstract. Introduction. Physico-chemical characteristics. Varietal effects and processing application of soy products: Green soybean variety Hardee is a nutritious palatable vegetable, Davis variety of soybean is superior to Hill variety in its nutritive components, cooking and sensory quality of soybean varieties, physical characteristics (10 varieties), cooking quality of soybeans (9 varieties), fat and protein contents of soybean varieties (10 varieties), cooking quality of soydal, acceptability of soy products, varietal effect on soymilk yield and organoleptic characteristics (19 varieties), use of black soybean (LBS-11) in comparison with Hardee and pigeonpea.

Use of soy in traditional foods: Nutritional value of Indian tandoori naans, rotis and bread blended with pulses and oilseeds, home and hosteliers use of soybean products. Use of soy in fermented foods: Preparation of tempeh culture for commercialization, nutritional and sensory evaluation of tempeh products made with soybean, groundnut and sunflowerseed combinations (with flow sheet), acceptability of soybean incorporated rice *idlis.* Use of soy in baked products: High protein biscuits made with ragi flour and oilseed flour blends (16 types of flour were prepared with

all purpose flour {maida}), cookies from malted cereals and oilseed flours.

Use of soy in beverage production for milk products and weaning foods: Protein and energy content of acceptable beverages prepared with blends of soy, skim milk, sesame, coconut and malts from wheat, ragi and green gram (blended malt beverages, chemical analysis), evaluation of tofu and its products prepared from soymilk in combination with sunflower seed milk and skim milk (with flow sheet for tofu). Consumer reactions to soy products: Consumer evaluation of tofu, tempeh, curd and Meal Maker in rural and urban areas, consumer evaluation of soy products in rural areas, consumer choice of fast foods from soybeans, supplementary foods (soy nuts for snacking), short term training program (3-day) for soy use in daily diet, community participation.

Table 4 "Ranking of different soy products by a panel of judges" shows (p. 341) which soybean varieties produce the highest quality recipes in which soy products are used to make dishes common to South India. For each food we will give only the top-ranking soybean variety, even though the table gives the top four. Cooked dal (KHSB-3). Mashed dal (PK-7392). Vadai (PK-7392). Idli (DS-7427). Dosai (Hardee).

Page 344: Costly chickpea or blackgram dal flour is replaced by hosteliers in part by soy flour–with good acceptance–in traditional Indian preparations like *dosa, pakodas, vade, bajjie,* and *bondas.* "The same could go to home level use by way of ready mixes with 30% soyflour incorporation." In outer coatings and batter preparations the substitution of soyflours is easily accepted by all. "Meatless meats (TVPs) and blends of soyflours in defatted form can be used in the preparation of mutton soup, cutlets, koftas, and meat loaves at 15% level substitution without any change in acceptability by consumers."

There follows a long discussion of tempeh.

Page 351: "Consumer evaluation of soy products in rural areas. One hundred rural housewives were served with several soy incorporated beverages and snacks for their evaluation. It was found that 80% of the rural people were unaware of soy bean and its uses."

Table 10 shows the pooled percentage of rural families who scored very good or good for soy dishes (in descending order of overall acceptability, which is shown in parentheses): Soy kheer (100). Soy idli (98). Tofu burfi [barfi, burfee, borfee; a sweet confection] (97). Soy butter milk (94). Soy sambar (87). Soy pakoda (76). Tofu curry (75). Tofu pakoda (67). Soymilk curds (66). Oriental flavoured milk (59). Flavoured soymilk (57). Soy chutney (52). Soymilk (41).

Conclusion: "For home level soybean use, easy availability of soy processed products is very important. Low prices, accessibility and proper education to bring awareness and importance of soy in daily diet would undoubtedly boost the use of soy products at home level." Address: PhD, Assoc. Prof. and Head, Univ. of Agricultural Sciences, Hebbal, Bangalore–560 024, India.

133. Obafemi Awolowo University, Institute of Agricultural Research and Training. 1988. Soyabean recipes: Integrated farming systems programme. Ibadan, Nigeria: Obafemi Awolowo University. ii + 30 leaves. Sept. 25 cm.

• ***Summary:*** Contents: Processing of soyabean for recipes utilization. Pre-preparation of soyabean (wet base for soyabean paste, or soya milk and residue [okara], or dry base for full-fat flour). Soya milk (homemade). Soyabean vegetable soup (with whole ground soybeans). Soya ewedu soup (with soyabean flour or okara). Soya gbegiri soup. Soya iru [dawa-dawa]. Soya ogi. Soya eko. Soya akara. Soya moinmoin. Soya pudding (with okara or soya flour). Soya ikokore (with soyabean paste). Soya amala (with soya flour). Pounded yam with soyabean paste. Soyabean meat bytes (with soyabean flour). Soya burgers (with soyabean paste). Soya meat (with soyabean paste). Soya snack (with whole dry soybeans). Plantain soya pancake (with soya flour). Soya banana fritters (with soyabean flour). Soyabean candies (with dehulled whole soybeans). Soyabean flour Queen cakes. High protein soyabean flour biscuits. Soyabean bread. Soya pancake. Soya puff-puff. Soya ojojo. Soya aadun. Guidelines for growing soyabean. Address: Inst. of Agricultural Research and Training, Obafemi Awolowo Univ., P.M.B. 5029, Moor-Plantation, Ibadan, Nigeria.

134. Fuguitt, Diana. 1988. Consumer analysis: Market segments for extruded corn-soya products in Njombe District [Tanzania]. Report for Soytec Research Foundation, Rochester, Michigan. 47 p. Unpublished draft copy. Nov. [30 ref]

• ***Summary:*** Soytech Research Foundation was begun by Prof. James D. Graham (Dept. of History, Oakland University, Rochester, Michigan 48309, as of 8/90) and colleagues with the vision of initiating a soy-processing project in Njombe, Tanzania, with the following goals: (1) To increase the consumption of whole and complementary vegetable-based proteins among rural Africans, especially among the malnourished; (2) To introduce new and appropriate technologies and techniques for encouraging the establishment and development of local soy-processing enterprises throughout rural Africa; and (3) To focus ongoing research activities on particular local development projects which emphasize expanded managerial and entrepreneurial roles for women in community-based resource-efficient agriculture–as well as in the processing, production, distribution, and marketing of soy-enriched staple foods.

Soytec has developed a proposed recipe and method of cooking corn and soybeans using low-cost extrusion technology to produce low-cost, nutrient-rich cereal-soy blends (CSBs) for weaning foods, textured vegetable proteins, and unrefined soybean oil. The CSBs are much

better weaning foods than the maize meal (ogi), which is currently most widely used for that purpose. Address: Project Analyst, Tanzania.

135. Hughes, L. 1988? Soybean food products for West Africa. Ibadan, Nigeria: International Institute of Tropical Agriculture. v + 10 p. Undated. *
• ***Summary:*** The preparation of the following soyfoods, using techniques suited for rural and urban West African households, is described: soy flour, soybean paste, soymilk, soybean meat, scrambled soybean meat, soy ogi, soybean snacks, soybean candies, soy moin moin, soy gbegiri soup, soybean vegetable soup, basic cake mix, soybean bread, soybean biscuits, and fermented soybean iru (dawadawa).

136. Ogundipe, H.O.; Osho, Sidi M. 1989. Soybean in Nigerian diets–Past, present and future. Paper presented at the Soybean Production and Utilization Workshop. 3 p. Held 13-15 Feb. 1989 at Lagos, Nigeria. [3 ref]
• ***Summary:*** "Soybean is reported to have been introduced into Nigeria in about 1908. It was mainly restricted to that part of Nigeria now referred to as Benue State and the Zonkwa-Abuja ecological zones." The earliest known use of soybean in the Nigerian diet was in the form of dawadawa, a fermented soup condiment traditionally made from the locust bean. Presently most of the dawadawa produced in Nigeria uses soybean as its raw material. Production has spread to various parts of the country and there has been a marked improvement in processing techniques. Soy ogi and soymilk have also been used as foods in Nigeria. Since 1984 the Kersey Children's Home in Ogbomosho has run a clinic to treat malnourished children. About 24,000 out patients were teated in 1984 while at any given time about 40 severely malnourished children are admitted and placed on a diet consisting mainly of soymilk and traditional foods fortified with soybeans.

In Nigeria, the lack of recognition of the potential of the soybean is now a problem of the past. The greatest potential is expected to lie in the preparation of Nigerian foods. A book titled "Soybean Recipes" has been published. People in rural households in Nigeria are now learning to use soybeans. "The extension work with soybean utilization commenced at 3 project sites in Oyo State, i.e. Igangan, Ikoyi, Ijaye. Training and demonstrations take place at these sites, in which the villagers participate. The program has since expanded to 27 other villages.

"As a result of these training programs over 25,000 people have been trained and now soybean is found in local markets. The demand for utilization is increasing.

"Also, within the past few years, there are in the markets several soy fortified products like Nutrend, Golden morn, Nutrimax, etc. There are also whole soy products like soy nuts, soybean oil and liquid soy maggi [HVP soy sauce]. It is expected that several others will still enter the market this year.

"The future: While emphasis is presently being placed on the preparation and utilization of soybean at home, there is likely going to be a shift to commercial control processing of soybean... With the reduction in the availability of groundnut coupled with its soaring prices, soybean will play a more vigorous role in the formulation of livestock feed, with the possibility of reduction in feed cost and consequently of livestock produce." Address: 1. International Inst. of Tropical Agriculture (IITA), PMB 5320, Oyo Rd., Ibadan, Nigeria; 2. Inst. for Agricultural Research and Training (IAR&T), Ibadan, Nigeria.

137. Hesseltine, C.W. 1989. Fermented products. In: Ruth H. Matthews, ed. 1989. Legumes: Chemistry, Technology, and Human Nutrition. New York and Basel: Marcel Dekker, Inc. x + 389 p. See p. 161-85. [29 ref]
• ***Summary:*** Contents: Introduction: Fermented legume products. A table lists about 85 products with the vernacular name, legume from which it is made, country, and microorganism(s) used. Products made from soybeans include: Miso (bean paste), Shoyu (soy sauce), Sufu (Chinese cheese), Ontjom (Oncom), Hamanatto, Idli (with and without soy), Natto, and Tempeh. Address: Human Nutrition Information Service, USDA, Hyattsville, Maryland (and NRRC, Peoria, Illinois).

138. Hesseltine, Clifford W. 1989. Fermented products. In: Ruth H. Matthews, ed. 1989. Legumes: Chemistry, Technology, and Human Nutrition. New York, NY: Marcel Dekker. x + 389 p. See p. 161-85. [29 ref]
• ***Summary:*** Contents: Introduction. Miso (bean paste). Shoyu (soy sauce). Sufu (Chinese cheese). Ontjom (oncom). Hamanatto (black beans [fermented black soybeans]). Idli. Natto. Tempeh (tempe).

Contains 3 tables and 9 figures (all flow sheets). Address: Retired, Agricultural Research Service, USDA, Peoria, Illinois.

139. Steinkraus, Keith H. ed. 1989. Industrialization of indigenous fermented foods. New York, NY: Marcel Dekker. xii + 439 p. 24 cm.
• ***Summary:*** This book contains the following chapters on soyfoods: 1. Industrialization of fermented soy sauce production centering around Japanese shoyu, by Danji Fukushima. 2. Industrialization of Japanese miso fermentation, by Hideo Ebine. It also contains chapters on the industrialization of the production of sake, tapai, African beers, magehu, ogi, and gari. The final chapter is titled "Industrialization of indigenous fermented food processes: Biotechnological aspects."

The book is dedicated "To the memory of Prof. Andre G. van Veen, a pioneer in the study of indigenous fermented foods." Address: Inst. of Food Science, Cornell Univ.,

Geneva, New York.

140. **Product Name:** Supplementary Food (Fortified Beverage).
**Manufacturer's Name:** Odeiga and Company. Renamed Odegai and Company.
**Manufacturer's Address:** Umejei St., P.O. Box 100, Ibusa, Bendel/Delta State, Nigeria.
**Date of Introduction:** 1990. June.
**New Product–Documentation:** Letter and label sent by Joseph O. Ogbugwo of Odegai & Company. 1993. May 24. This product was launched in July 1985. It is still on the market. Label. 4 by 5.5 inches. Black ink on white paper. "A high value vegetable protein. Happy dieting." Brief recipes are given for: Bread and cookie making (add 5-30 percent). Soyabean doughnuts, pancakes, biscuits, puff-puff, etc. Soy-ogi. Soyabean moi moi (Alele) and akara/beanball (kwosai). Cereals blend. Soyabean-plantain pudding. Soy-amala / Tuwo. The company name is given as "Odeigai Foods Ltd., P.O. Box 100, Ibusa, Bendel State, Nigeria."

141. Hachmeister, Kathleen A.; Fung, Daniel Yee-Chak. 1993. Tempeh: A mold-modified indigenous fermented food made from soybeans and/or cereal grains. *Critical Reviews in Microbiology* 19(3):137-88. [185 ref]
• ***Summary:*** An excellent review of the literature. Contents: Introduction. Mold-modified indigenous fermented foods: Miso, shoyu (soy sauce), hamanatto, sufu, fermented rice (sierra rice), tapé (lao-chao), ang-kak, ogi, tempeh, ontjom (oncom, lontjom), bongkrek (tempeh bongkrek), kenima. Processing developments in legume tempeh manufacture: Traditional tempeh fermentation, industrial production of tempeh, methods of preparation (cleaning, dehulling, hydration and acid fermentation, partial cooking, draining, cooling, and surface drying, inoculation, fermentation containers, incubation, harvesting, storage, and preservation, uses and preparation of tempeh). Organoleptic properties of tempeh. Microbiological aspects of legume tempeh: Microbial ecology, traditional and modern soaking methods, effect of soaking, acidification, and initial bean pH, effect of boiling prior to inoculation, effect of *Klebsiella* and *Enterobacter,* effect of lactic acid bacteria and yeasts, microbiological safety and quality, heating prior to consumption. Nutritional quality of legume tempeh. Chemical and biochemical changes in legume tempeh: Changes in protein and amino acids, changes in carbohydrates, changes in lipids, antioxidant potential, changes in minerals, changes in vitamins. Antinutritional factors associated with legumes: Flatulence-producing factors, protease inhibitors, tannins, phytic acid, hemagglutinins, other antinutritional factors. Cereal grain tempeh–practical applications: Background information, materials and methods, results and discussion, conclusions and future developments. Summary. References. Address: Dep. of Animal Sciences and Industry, Kansas State Univ., Manhattan, KS 66506.

142. Vaidehi, M.P. 1993. "Tempe"–A biotechnological boon for nutritionally rich foods. *Beverage & Food World* (*Bombay*) 20(4):35-36. Sept.
• ***Summary:*** Although Indians prepare many fermented foods (such as idli, dosa, dhokla, kadabu, curds, etc.), it was not until the author visited Indonesia that she realized there are many fermented foods of which Indians are unaware. "Tempe" is the "most impressive fermented food nationally adopted for improving nutrition and health of the children of Indonesia." The author learned about tempeh when she was offered a fellowship by the United Nations University to participate in a food fermentation technology and training / research course at the Nutrition Research and Development Centre, Bogor, Indonesia. After an extensive tour of many tempeh production places in Java, she concluded that tempeh is a food with great potential, and that in all countries it can be used "to improve the socio-economic, nutritional and health status of the great majority of the population."

A table shows the nutritional value of different types of tempeh and tempeh powders. A flow sheet for tempeh production is also given. Address: Dr., Prof. and Head, Dep. of Rural Home Science, Univ. of Agricultural Sciences, Bangalore, India.

143. Osho, S.M. 1994. The role of research in the development of soybean based small and medium food enterprises scale. Paper presented at the Small and Medium Scale Agro-food Enterprises Seminar. 34 p. Held 12-14 Sept. 1994 at Dakar, Senegal.
• ***Summary:*** "Abstract: Protein deficiency is still a major problem in Africa particularly among the low income group. Soybean has the potential for alleviating malnutrition in African diets via soybean based industries. The paper discusses the role of soybeans in the development of soybean based small and medium scale food enterprises in Nigeria. The IDRC funded soybean utilization project jointly implemented by IITA and National Institutes in Nigeria has been successful through research extension activities, in developing several food uses for soybean and disseminating these technologies to industries. Several people have received training on soybean technologies and over fifty industries are processing soybean into weaning foods, breakfast cereal, extruded products, fermented soybean products, soybean soups and condiments. The success of the soybean project is based on dissemination of developed technologies on soybean."

Contents: Introduction: Research for development. The role of International Institute of Tropical Agriculture (IITA) in international agriculture research (It was founded in 1976 at Ibadan): Soybean research at IITA as it focuses on nutrition in Africa, nutritional value of soybeans, soybean

processing, utilization, and dissemination model (product development research, training and extension activities, assessment of impact), development of household and small scale processing technologies, soybean food options and technology (soybean beverages and ice cream, soybean based baby foods and breakfast cereals, defatted cake processing and soybean oil extraction using mechanical screw press technology: IITA concept, extrusion cooking: IITA concept, other advantages of extrusion processing). Impact of soybean utilization project: Constraints in research, policies and programmes that affect soybean research at IITA. Conclusion ("The future of soybean looks bright in Africa").

Selected tables show: (3) Yield and quality of soy oil as affected by processing temperature. (4) Nutrient composition of selected soy flours from the extruder and the screw press. Defatted and full fat; four types.

(6) Forty nine soybean products that are being processed and marketed by companies in Nigeria (Feb. 1994). The soy percentage of the product is given in parentheses. In Lagos: Betamarks, Soybean flours (100%). Farina, Soy beverages (100%). Lisabi Foods, Soy custard (30%). Smallette, Sogi (30%). Glaxo Nigeria, "Babeena" baby food (30%). Nestle Foods, "Nutrend" baby food and "Golden Morn" breakfast food (each 30%). Cadbury Nigeria, "Dash" candles (10%). Morrison Ltd., Extruded products (100%). Goodings Health Goods, "Nutrela" texturized vegetable protein (100%). Niger Dock, Soymilk (100%). Al-Bahamas, Baba Ogi (30%). Odichie Bakery, Soybread (10%). Pfizer Nigeria Ltd., Livestock feed (30%). Buckingham Ltd., Mama Joy baby food (30%). Cocoa Industries, Chocolate bar (10%). Green Source Nigeria Ltd., High protein cake (100%). Golden Compass Foundation, Babyfood (100%). CAPL, High protein cake (10%). NAINTO Ltd., Soymilk (10%).

In Oyo: DLOB, Soy oil / High protein cake (100%). Milkman, Soy milk (100%). Oja Farms, Soy oil / High protein cake / Casasoy (30%). Uncle Segun Food Proc. & Preserv. Co., Soy powder (100%). Jomartex, Soy milk (100%). Deagbo Industries, Soyvita (beverages) (100%). Tella Food Industries, Soymilk (100%). Orman Industries Co. Ld., Extruded full-fat soy, Defatted soycake (100%). Morgan, Soyflour (100%). Alphatec, Soyoil & Livestock feed (100%). Florets Ltd., Soyflour / Babyfood (100%). Vita soy, Soymilk (100%). Dare foods, Soyflour (100%). Sarah Farms, Soyflour (100%). Benny Commercial Co. Ltd., High protein cake (100%).

In other locations in Nigeria: Kofa Agric. Venture (Kawara), Soy oil / High protein cake (100%). Taraku Oil Mills (Benue), Soy oil / High protein cake (100%). Funta Oil Mills (Kaduna), Soy oil / High protein cake (100%). Imo Health Foods (Imo), Soy beverages (100%). Tuns Oil (Osun), Soy oil / High protein cake, Extruded products (100%). Akiibiti Farms (Ondo), Extruded products (100%). Jof Ideal Family Farm (Ondo), Vegetable oil (100%). Termitope Biscuit Industry Ltd. (Ogun), Soybiscuit (10%), Baby food (30%). Rainbow Manufacturing Industries (Ogun), Soyflour / High protein cake (100%). Babs Ventures (Ondo), Soymilk / Cassory (100%). Parakletos Co. Ltd. (Osun), Soyflour / Baby food (100%). IBOL (Osun), High protein cake (100%). Oyalemi Farm (Ondo), Soy vegetable oil (100%). Women's Group (Jos), Soyflour (100%). Golden Oil Industry (Anambra), Soy oil / Cake (100%).

(7) Summary of number of markets and retail outlets for soybean and products in Ibadan, Nigeria (1987 to 1994). The survey was conducted in January of each year. In Jan. 1987, 2 markets and 4 retailers were selling soy. Soybeans cost 1.50 Naira per kg; only soybeans (seeds) were sold. In Jan. 1990, 19 markets and 419 retailers were selling soy. Soybeans cost 4.25 Naira per kg; soybeans (seeds) and soy flour were sold. In Jan. 1994, 64 markets and 1,017 retailers were selling soy. Soybeans cost 20.00 Naira per kg; soybeans (seeds) and soy flour were sold.

Figures show: (1) Comparative prices of selected commodities that are sources of protein in Nigeria (1987-1994). Soybeans are by far the least expensive source of protein and milk powder is by far the most expensive. Inflation increased dramatically after 1990. (2) Schematic diagram of commercial soymilk production (UHT and aseptic). (3) Schematic diagram of soybean processing by extrusion / expelling.

(5) Processing of soybeans and cereals by dry extrusion. Includes full fat soy flour and snack foods. (6) Number of indigenous soy processing companies in Nigeria (1987-1994). The number increased from about 2 in 1987 to about 22 in 1991 to about 52 in 1994.

Soymilk yoghurt and frozen soy lollies (ice cream on a stick) are sold commercially in Nigeria. Six companies are involved in soy beverages. About 7 large-scale companies and several small ones in Nigeria are using soybean as part of the raw material in the manufacture of baby foods and breakfast cereals (p. 13). Address: PhD, Food Technologist & Coordinator, Soybean Utilization Project, International Inst. of Tropical Agriculture, Oyo Road, PMB 5320, Ibadan, Nigeria.

144. Osho, Sidi M. 1995. Developed soybean technologies for household small-scale and industrial levels. Paper presented at the Third Bi-Annual SoyAfrica Conference. 32 p. Held 3-5 Oct. 1995 at Johannesburg, South Africa. Organized by Aproma.

• ***Summary:*** Contents: Introduction. Soybean food options and technology: Use of soybean at house level, soybean beverages and ice cream, soybean based baby foods and breakfast cereals, weaning / baby food, extrusion cooking (IITA concept), other advantages of extrusion processing. Impact of soybean utilization project. Conclusion.

Tables: (1) Chemical composition of soy milk from seven milk processors: IITA, IAR&T, Jomatex, Tella Food Industries, Mini Opic milk, Samalic Industries, Milk man,

Deagbo Industries. The protein content ranges from 3.01% (Deagbo) to 4.99% (Milk man). (2) Proximate composition of some baby food manufactured by Nigerian companies. Those containing soy are Nutrend, Babeena, Golden Morn, Mama Joy, and Joy Vita; their average price in 1994 is 87 Naira. Non-soy (mostly imported) are SMA, Similac, Nan, and Nan; their average price is 192 Naira–more than twice as expensive. (3) Yield and quality of soy oil and affected by processing temperature. (4) Nutrient composition of selected soy flours from the extruder and the screw press. (5) Physico-chemical characteristics of crude, partially and fully refined soy oil.

(6) Forty nine soybean products that are being processed and marketed by companies in Nigeria (Feb. 1994): In Lagos: Lisabi Foods Soy custard, Smallette Sogi, Glaxo Nigeria "Babeena" baby food, Nestle Foods "Nutrend" baby food and "Golden Morn" breakfast food, Goodings Health Goods "Nutrela" texturized vegetable protein, Niger Dock Soymilk, Al-Bahamas Baba Ogi, Odichie Bakery Soybread, Buckingham Ltd. Mama Joy baby food. In Oyo: Milkman Soy milk, Deagbo Industries Soyvita (beverages), Tella Food Industries Soymilk.

(7) Summary of number of markets and retail sale outlets for soybean (seeds & flour) in Ibadan, Nigeria. Gives figures collected by IAR&T for January each year from 1987 (2 markets, 4 retailers, price 1.50 Naira/kg) to 1994 (64 markets, 1,017 retailers, price 20.00 Naira/kg) to 1994.

Abstract: "Protein deficiency is still a major problem in Africa particularly among the low income group. Soybean has tremendous potential for alleviating protein energy malnutrition in root crops / cereal based African diets via soybean based industries. This paper discusses the soybean technologies available for household, small scale, and industrial level."

In African diets, almost 60% of the proteins comes from cereal grains. Soybeans can be used in traditional recipes and foods in a wide variety of forms including whole soybeans, soymilk, tofu, soy splits (split soybeans), soy flour (raw and heat-treated), soy paste (cooked soybeans ground to a paste), soymilk residue (okara), etc. Traditional Nigerian dishes that were found to benefit from addition of soy are *moinmoin, akara, kuni, fufu, eba, etc.* Soy milk, soy yogurt, and soy ice cream have become readily acceptable and available in Nigerian markets.

"Conclusion: The future of soybean looks bright in Africa. With increasing demand and the increasing costs of protein foods, soybean offers one of the best solutions for improving human nutrition in Africa; particularly the problem of protein energy malnutrition. There is need for more research and training in the area of soybean processing and utilization." Address: Food Technologist and Coordinator, Soybean Utilization Project, International Inst. of Tropical Agriculture (IITA), Oyo Road, PMB 5320, Ibadan, Nigeria. Phone: 234 2 241 2626.

145. Idowu, I.A.; Osho, Sidi. 1995. An update of soybean food technology generation and transfer problems in Nigeria: A review of experiences. Paper presented at Conference on Postharvest Technology and Commodity Marketing in West Africa. 8 p. Held 27 Nov.-1 Dec. 1995 at Accra, Ghana. [8 ref]

• ***Summary:*** Published in 1998 under the title "A review of experiences with soybean food technology generation and transfer in Nigeria," in Ferris, R.S.B., ed. 1998. *Postharvest Technology and Commodity Marketing in West Africa. Proceedings of a Conference...*

Contents: Introduction. Agricultural technology generation and transfer concepts. The issue of untapped human resources for technology generation and transfer. The prospects for soybean production in Nigeria. Processing and utilization of soybean. Utilization classes and forms of soybean products (fermented products such as soy-ogi or dawadawa, soy-milk, meat substitutes). Important points on soybean processing and utilization: Acceptability of soybean product, suitability of equipment, misinformation about soybean products, profitability. Improving the status of soybean production, processing, and utilization in Nigeria. Address: 1. Coordinator, lecturer of the Dep. of Agricultural Extension and Rural Development, Univ. of Agriculture, Abeokuta, Nigeria and Socio-Economic Consultant on the IDRC/IITA Soybean Utilization Project; 2. Food Technologist, Grain Legumes Improvement Programme, IITA, Ibadan, Nigeria and Coordinator, IDRC/IITA Soybean Utilization Project.

146. Tamang, Jyoti Prakash. 1996. Fermented soybean products in India. In: Alex Buchanan, ed. 1996. Proceedings of the Second International Soybean Processing and Utilization Conference: 8-13 January 1996, Bangkok, Thailand. Bangkok, Thailand: Printed by Funny Publishing Limited Partnership. Distributed by The Institute of Food Research and Product Development, Kasetsart University. xviii + 556 p. See p. 189-94. [10 ref]

• ***Summary:*** Contents: Abstract. Introduction. Indigenous fermented soybean food: Kinema, hawaijar. Modified fermented soybean food: Soy-idli (a rice-based breakfast food in south India), soy-dhokla (a wheat-based snack in west India), soy rabadi (a butter milk staple of west India). Non-fermented soybean products: Green [vegetable] soybeans (a snack in north-eastern India), roasted soybean [soynuts] (a snack throughout India), soybean chutney (a condiment / pickle made from whole soybeans in north-eastern India). Commercially available soybean foods: Soymilk, soypaneer [tofu], soysuji / soy-suji (a snack in Central India), soy fortified biscuit (using soyflour).

Kinema and hawaijar are similar to natto of Japan and thua-nao of Thailand; the principal microorganism in both is *Bacillus subtilis.* Two strains were selected to give the

best quality kinema. The main determinants of quality are high viscosity, long sticky strings, and solubilized protein. The optimum fermentation is for 20 hours at 40ºC. "The optimized process can be promoted to popularize more consumption of fermented soybean products as a sustainable supply of low-cost nutritious foods."

Kinema is consumed in eastern Nepal, "in the Darjeeling hills of West Bengal, Sikkim and north-eastern hills of India as a meat substitute in the local diet."

"The preparation of hawaijar is similar to kinema except the wrapping materials used are leaves of the fig plant (*Ficus hispida* L.) and the fermentation time is prolonged for 3-4 days.

To make soybean chutney, whole dried soybeans are soaked, deep-fried in vegetable oil, then mixed with salt and chilies. This chutney is then consumed like a pickle with boiled rice.

Soypaneer is a very good substitute for traditional dairy paneer, a semi-soft mild-flavoured fresh cheese, which is significantly more expensive than its soy counterpart. Soypaneer is deep fried, mixed with vegetarian curry, and sometimes used to make paneer pakoda [pakora], a local recipe.

Note: A pakora is a fritter–any kind of food coated in batter and deep fried.

Soysuji can be used to replace up to half of the wheat suji in the preparation of traditional Indian recipes.

"Cereal-based Indian diets are generally deficient in protein and calories. The protein intake in the local diet is not enough due to high prices of meat and dairy products as well as religious taboos."

Tables: (1) Soybean-based foods in India. The four columns are: Four types of products and 12 specific product names. Substrate (whole soybean, soybean-rice, etc.). Use (breakfast, snack, etc.). Consumption area. (2) Chemical composition of kinema (two types with very different composition).

Fig. 1 (p. 194) is a flow sheet of the traditional method of preparing kinema in a Sikkim village. After cooking and draining, the soybeans are crushed lightly by a wooden pestle. Firewood ash may be added. Wrap the soybeans in fern leaves, and ferment for 1-3 days to make kinema. Fry to make curry or soup. Address: Microbiology Lab., Dep. of Botany, Sikkim Government College, Gangtok 737 102, Sikkim, India.

147. Hunter, Jean B.; Steinkraus, K.E.; Drysdale, A.E. 1996. Value of fermented foods for lunar and planetary stations. Paper presented at 26th International Conference on Environmental Systems. SAE Technical Paper 961416. Held July 1996 at Monterey, California. [35 ref]

• ***Summary:*** Contents: Abstract. Introduction: What is food fermentation, brief description of the BLSS (bioregenerative life support systems) diet without fermented foods, prior work on CELSS (closed ecological / environmental life support systems–an acronym increasingly replaced by BLSS), diets and menus, escaping the constraints of the CELSS diet, alternatives to food fermentations, particular opportunities for fermented foods, upgrading edible biomass, improved hedonics, convenience advantages, nutritional advantages, top dozen food fermentations for the space program (in descending order of total score): Yeast-raised wheat bread, single-cell lipids (from *Apiotrichum curvatum;* formerly *Candida curvata* D), amasake [amazake] (sweetener), mushrooms from residues, tempeh & related products–tempeh gembus (meatlike texture), vinegar, tapé/tapuy [tapeh], pickled vegetables, idli / dosa breads, dawadawa / natto (meaty flavor), rice wine, soy yogurt (sogurt) and other soy dairy replacers (dairylike).

This paper begins: "Three significant problems with food supply in bioregenerative lifesupport systems are addressable through use of fermented foods. The quantity of inedible and marginally edible biomass can be reduced; the hedonic quality of the diet can be enhanced; and food storage constraints can be relaxed due to the superior keeping qualities of fermented products."

"The crew diet for the lunar and planetary stations is likely to be based on four crops–wheat, soy, and white and sweet potato–which will make up the majority of calories consumed. Rice, salads and a few vegetable crops will add micronutrients and some variety. No animal foods or sugar crops will be produced, and no fruits except possibly strawberries."

"At the lunar station we expect that 85% of calories will be produced on site, with only 15% supplied from Earth. The resupply must include all flesh and dairy foods, spices and flavorants, luxury foods such as coffee and chocolate, imported fats and sweeteners, fruits, nutritional supplements and religious foods to be consumed in the CELSS."

"We are aware of only two sets of work on CELSS menus. Frank Salisbury has published an instructive and highly relevant survey of vegan and vegetarian dietary practices in the context of the space program, based on his 1994 workshop at JSC. One key point is that vegan cuisine and its ingredients–including fermented ingredients–deserve greater attention by CELSS planners because of their importance to high-closure lifesupport systems." Address: Cornell Univ., Dep. of Agricultural & Biological Engineering, Room 218 Riley Robb Hall, Ithaca, New York 14853. Phone: 607-255-2297.

148. Steinkraus, Keith H. ed. 1996. Handbook of indigenous fermented foods. 2nd ed., revised and expanded. New York, Basel, and Hong Kong: Marcel Dekker, Inc. xii + 776 p. Illust. Index. 26 cm. Food Science and Technology Series, Vol. 73. Index. 26 cm. [350 + soy ref]

• ***Summary:*** This 2nd edition is about 108 pages longer than the original 1983 edition. Contents: Introduction

to indigenous fermented foods. (1) Indonesian tempe and related fermentations: Protein-rich vegetarian meat substitutes. (2) Indigenous fermented foods involving an acid fermentation: Preserving and enhancing organoleptic and nutritional qualities of fresh foods. (3) Indigenous fermented foods involving an alkaline fermentation. (4) Indigenous fermented foods in which ethanol is a major product: Type and nutritional significance of primitive wines and beers and related alcoholic foods (incl. Chinese koji (big *qu* {bricklike in shape and made from barley or wheat and soybeans, inoculated with *Aspergillus*} molds), and small *qu* ({spherical, plate-circular or rectangular in shape and made from rice or rice bran with various herbs, inoculated with *Mucor* and/or *Rhizopus* molds}, p. 449), Japanese amazake (p. 480-81).

(5) Indigenous amino acid / peptide sauces and pastes with meatlike flavors (p. 509-654): Introduction.

(A) Soy sauces: Japanese shoyu: Koikuchi, usukuchi, and tamari; Chinese chiang-yu, by Tamotsu Yokotsuka (p. 511-17). Biochemistry of *Saccharomyces* (*Zygosaccharomyces*) *rouxii*, by Steinkraus, Franta, and Ayres (p. 517-24). Umami flavor, by Kawamura and Kare (p. 524-28). Chinese fermented products related to soy sauce (big *qu*, small *qu*, and jiang, by Chen & Ho, p. 528). Taiwanese soy sauce, by Liu (p. 528-33). Malaysian soy sauce: Kicap, by Ong, Mercian, Poesponegoro and Tanuwidja (p. 531-39). Indonesian soy sauce: Kecap, by Saono, Poesponegoro and Tanuwidja (p. 539-43). Korean soy sauce, by Chang (incl. homemade kanjang and meju, p. 543-44). Taiwanese black bean sauce: Inyu, by Jan et al. (p. 544). Philippine taosi, by Steinkraus (p. 544-45).

(B) Fermented soybean pastes: Japanese miso, by Ebine, Shurtleff and Aoyagi (p. 545-56). Indonesian tauco, by Saono et al. and Winarno (p. 556-59). Korean Doenjang and kochujang, by Chang, Shurtleff and Aoyagi (p. 559-64).

(C) Fermented fish-shrimp sauces and pastes (p. 565-606).

(D) Fish-soy sauce and fish-soy paste, by Ismail, p. 607-11).

(E) Miscellaneous Oriental fermentations. Japanese natto (itohiki natto), by Hayashi and Ota (p. 611-24). Japanese Hama-natto (hamanatto) and related products (incl. yukiwari natto, p. 624-26). Chinese red rice: Anka (Ang-kah), by Lin, Su and Wang, Sooksan and Gongsakdi, and Pichyangkura (p. 626-33). Chinese sufu, by Su and L.-P. Lin (p. 633-41). Preserved duck eggs / Century eggs, Chinese pidan (p. 641-42). Pidan are made by a chemical process, not by fermentation. Note: Chapter 5 contains about 240 references. Much of the text in this chapter is similar to that in the original 1983 edition, although this chapter is 7 pages longer and contains 3-4 new sections.

(6) Mushrooms: Producing single-cell (microbial) protein on lignocellulosic or other food and agricultural wastes.

(7) General papers related to indigenous fermented foods. Address: Inst. of Food Science, Cornell Univ., Geneva, New York.

149. Osho, S.M.; Obatolu, V.A.; Uwaegbute, A.C.; Ndaeji, C.F.; Olowoniyan, F. 1997. Food uses of soybean in Nigeria: Opportunities and constraints. In: Napompeth, Banpot, ed. 1997. World Soybean Research Conference V: Proceedings. Soybean Feeds the World. Bangkok, Thailand: Kasetsart University Press. xxiv + 581 p. See p. 422-30. Held at Chiang Mai, Thailand, 21-27 Feb. 1994. [6 ref]

• ***Summary:*** Contents: Introduction. Past uses of soybeans in Nigeria. The present uses of soybeans. Results and discussion: Composition of some Nigerian traditional foods with and without soybean fortification. Inactivation of the trypsin inhibitor at household level. Development of a soybean-cassava product (soy gari). Soybean tofu processing (soywara or soycheese). The processing of a soy beverage (kunu). Soybean oil. Extrusion cooking (IITA concept). Achievements. Impact.

Tables: (1) Nutritional composition of selected home-made soy-based products compared with products from traditional preparation method (Soy ogi, soy milk, soy moinmoin, soy akara). (2) Phytic acid, tannin, and trypsin inhibitor levels of raw and processed soybean products (the 4 products shown in table 1). (3) Time, temperature, and treatment necessary for complete inactivation of soybean trypsin inhibitor at the household level: Boiling under pressure (with or without soaking), boiling with soda or kaun, boiling whole without pressure (with or without soaking), boiling with prior processing (grits, dehulled soybeans, flour), roasting whole (in sand, in pan). (4) Composition of local gari and fortified soybean gari (fortified with okara, or with whole soybean paste). (5) Sensory evaluation of these three types of gari. (6) Nutritional composition of local cheese (*warankasi*) and tofu. (7) Sensory evaluation of local cheese (*warankasi*) and tofu. (8) Nutritional composition of *kunuzaki* and soy *kunuzaki.* (9) Nutrient composition of selected soy flours from the extruder and screw press (defatted, extruded full fat, defatted extruded, extruded defatted). (10) The percentage of farmers/households producing and utilizing soybean in IDRC project sites (1987, 1991, 1992; Oyo State, Niger State, Kaduna State, Enugu State). (11) 33 soybean products that are being made and marketed by companies in Nigeria (Feb. 1992). For each is given: Name of manufacturer. City or state of manufacture. Product name or description. Percentage of soybean used in the product. (12) Summary of number of markets and retail sale outlets for soybean in Ibadan, Nigeria (each January from 1987 to 1993): Increased from 2 markets and 4 retailers in Jan. 1987 to 42 markets and 824 retailers in Jan. 1997.

Flowcharts show the processing of: (1) Soybean gari. (2) Tofu. (3) Soybean kunuzaki. (4) Soybeans by extrusion

or expelling. (6) Soybeans and cereals by extrusion. Address: 1. Soybean Utilization Project, International Inst. of Tropical Agriculture, PMB 5320, Ibadan; 2. IAR&T, PMB 5029, Ibadan; 3. Univ. of Nigeria, Nsukka; 4. NCRI, PMB 8, Badeggi; 5. NAERLS, PMB 1067, Zaria. All: Nigeria.

150. Osho, Sidi M. 1998. Re: CIDIS Ltd. and work with soyfoods in Nigeria. Letter to William Shurtleff at Soyfoods Center, June 25. 3 p. Typed, with signature on letterhead.
• ***Summary:*** "After I returned to Nigeria [from a trip last year to Atlanta, Georgia]. it was difficult in deciding whether to continue looking for a job or follow my dream.

"I then decided to follow my dream. I registered a company called CIDIS Ltd in 1997 [RC 311981]. We undertake consultancy services on Agriculture and Food Processing. Our focus however is soybean processing and utilization. We conduct training at rural and urban levels, i.e., State government levels in order to promote the use of soybean and improve the nutrition of our people in Nigeria. For paid training, i.e. train the trainers, we collect a fee and award certificates to the trainees. The trainees are either community development officers; or Agriculturists at government parastatals.

"In order to generate income, we introduced into the market some processed soybean products, e.g. Soy Gari, Soy Fufu, Soy Lafun, Soy Ogi, Soy Milk, Soy Elubo, Soy Vita, Soybean, Vegetable oil, Roasted Soybean Flour, and High Grade Soybean Flour. There is high demand for the products when we create awareness. We also have started a market outreach program where we do training in the local language free at a market four times a week. At the end of the awareness program, we retail some of our products. Attached are the labels from the processed products. These products are made in a building which I rented, and also retailed in the CIDIS Soymart Stores. Some of the equipment used for processing is locally fabricated."

"It has been very difficult for me to get the funds to start my business. I wrote proposals to the Nigerian Government, National and International NGOs, funding bodies, but I did not get any positive response. Then I decided to take a bank loan... I took a risk in a cause I believe in and I am very sure."

(2) A color photo of Sidi, surrounded by four men in company uniforms, two holding her soy products, standing in front of a building with "CIDIS SoyMart" written in large blue letters over the front door.

Enclosed are: (1) Large labels (printed in dark blue on white, with the nutritional composition, directions for use, and the name address of the manufacturer–but no ingredients). Address: No. 32, Awolowo Ave., Bodija; G.P.O. Box 38619, Dugbe, Ibadan, Nigeria. Phone: 810-0301.

151. Wood, Brian J.B. ed. 1998. Microbiology of fermented foods. 2nd ed. 2 vols. London: Blackie Academic & Professional / Thompson Science. An imprint of Chapman & Hall. [300+ ref]
• ***Summary:*** Soybeans are discussed extensively in Vol. 1, especially in the chapter titled "Fermented protein foods in the Orient: shoyu and miso," by Yokotsuka and Sasaki (p. 351-416). This and other chapters that mention soy are cited separately.

Soybeans are also discussed on pages 769-70 (soy idli and soy dhosa in India), 806 (maize-soybean porridge as a fermented weaning food), and 849-50 (genetic engineering of soybeans). Address: Dep. of Bioscience and Biotechnology, Univ. of Strathclyde, Glasgow, Scotland, UK.

152. Osho, Sidi M. 1999. Update on work with soyfoods in Nigeria (Interview). *SoyaScan Notes.* Aug. 23-24. Conducted by William Shurtleff of Soyfoods Center.
• ***Summary:*** Dr. Sidi Osho's new business, named Cidis Ltd., is headquartered in Ibadan, Nigeria in a big, old house which she began to lease in Oct. 1997; they signed a 5-year lease. Sidi does not know the size of the building. They converted the "boy's quarters" in the back of the building into the soy processing space, and the garage in the front into the soy supermarket–which is called Cidis Soyamart. The company is a corporation whose shares are owned entirely by Sidi and her husband.

Their first two products, sweetened soymilk and vegetable oil (soy oil) were introduced in Dec. 1997. Sidi made the soymilk at her home. They moved into the building in January 1998 and that month they established their first kiosk nearby in the Bodija market, the main market in Ibadan. Each kiosk is staffed by a company employee, and sells only Cidis' products. They now have six kiosks, all in Oyo State in western Nigeria.

Today the company's best-selling product is soymilk, of which there are four flavors: sweetened (the best-seller), chocolate, vanilla, and plain (mostly for diabetics). Immediately after the soymilk is made, it is run into sterilized plastic bottles, then placed in a refrigerated storage room. Before being sold at the kiosks, many bottles are packed in ice in a cooler chest then delivered in a van. The next most popular product is soy flour–both roasted (like kinako) and plain whole-fat. Other products include Soya Fufu and Soya Ogi (both fermented). The company presently has 16 employees.

In Jan. 1999 Sidi filled out the papers and completed the first registration for a nonprofit NGO named Cidis Foundation. The final papers and approval came through in Aug. 1999. The Foundation, which works closely with Cidis Ltd., conducts training and educational programs, and disseminates information on soyfoods. The Foundation also helps to reduce year-end taxes, because some of the company's profits are put into the Foundation and used for philanthropic activities.

Cidis makes its own expeller-pressed soybean oil using

an InstaPro-600 Junior. It is unrefined and filtered several times. Address: PhD and founder, Cidis, Ltd., No. 32 Awolowo Ave., Bodija. G.P.O. Box 38719, Dugbe, Ibadan, Oyo State, Nigeria. Phone: 234-0281-00301.

153. Patil, R.T.; Jha, Krishna; Singh, Jaswant; Bargale, P.C. 2001. Testing of a convection type cylindrical dryer for production of instant soy-dosa mix. *J. of Food Science and Technology* (*Mysore*). 38(2):111-15. March/April. [5 ref]
• ***Summary:*** A "dryer was evaluated for drying a soy-cereal blended slurry to get instant soy-dosa mix. Blanched soybean splits (10 and 20%) were used in combination with rice and blackgram. Dosa is important in the diet of Indians, especially those from South India. The combination of rice and blackgram are used in different proportions, the most common being 2:1 or 3:1. The fermentation process usually adds valuable nutrients not found in the original raw materials, such as vitamin B-12. Fermentation does not significantly change the amino acids in cereals and soybeans, but it often increases the availability of proteins. Moreover, the undesirable beany flavor is destroyed when soybeans are fermented. The instant product was used to make a "good quality instant soy-dosa." A flow chart shows the basic process.

Note 1. This is the earliest English-language document seen (Oct. 2012) that contains the term "soy-dosa" or the term "soy-dosa mix" or the term "instant soy-dosa mix."

Note 2. The term "Soy dosa" appears six times on page 111 and once on p. 654. Address: 1-2&4. Soybean Processing and Utilization Centre, Central Inst. of Agricultural Engineering (CIAE), Nabi Bagh, Bhopal–462 038, Madhya Pradesh, India; 2. All India Coordinated Research Project (AICRP), Jaggery and Khandsari, IISR, Dilkusha, Lucknow–226 001, India.

154. Singleton, Paul; Sainsbury, Diana. 2001. Dictionary of microbiology and molecular biology. 3rd ed. Chichester, New York, Weinheim, Brisbane, Singapore & Toronto: John Wiley & Sons, Ltd. xi + 895 p. Illust. 25 cm.
• ***Summary:*** Contains entries for: fermentation, fermented foods, fermenter (fermentor), fungi, miso, natto, ogi, oncom, shoyu (see Soy sauce), soy paste (see Miso), soy sauce (shoyu), sufu, tempeh, tofu (an intermediate in Sufu production). Address: London.

155. Steinkraus, Keith H. ed. 2004. Industrialization of indigenous fermented foods. 2nd ed. Revised and expanded. New York, NY & Basel, Switzerland: Marcel Dekker. xix + 796 p. Illust. Pseudo-Index. 24 cm. Series: Food Science and Technology No. 136. [508 soy ref]
• ***Summary:*** This book contains the following chapters on soyfoods: 1. Industrialization of fermented soy sauce production centering around Japanese shoyu, by Danji Fukushima. 2. Industrialization of Japanese miso fermentation, by Hideo Ebine. 4. Industrialization of Japanese natto, by Kan Kiuchi and Sugio Watanabe (incl. yukiwari-natto, a special product of Yamagata prefecture, p. 196). 11. Industrialization of tempeh fermentation, by Kapti Rahayu Kuswanto. 12. Tempe production in Japan, by Michio Kozaki. It also contains chapters on the industrialization of the production of sake, tapai, African beers, magehu, ogi, gari, Mexican pulque, Thai fish sauce (nam pla), Thai fermented fish and related products, and Myanmar fish paste and sauce.

The final chapter is titled "Industrialization of indigenous fermented food processes: Biotechnological aspects."

Soy-related chapters are also cited separately.

Note: Cornell Prof. Emeritus Keith H. Steinkraus died on 13 Nov. 2007 at age 89. He was a specialist in indigenous fermented foods and food microbiology. Address: Inst. of Food Science, Cornell Univ., Geneva, New York.

156. Keller, Elizabeth. 2007. Professor Emeritus Keith H. Steinkraus dies at age 89 (Web article). *www.news.cornell.edu/stories/Nov07/obit.Steinkraus.html.* Nov. 13.

• ***Summary:*** "Cornell Professor Emeritus Keith H. Steinkraus, a specialist in indigenous fermented foods and food microbiology, died Oct. 23. He was 89.

"Steinkraus, who joined the faculty of the New York State Agricultural Experiment Station in 1952, graduated cum laude from the University of Minnesota in 1939 and earned a Ph.D. in microbiology in 1951 from Iowa State University. He was promoted to full professor in 1962 and retired as professor emeritus in 1988, although he remained active in his field and at Cornell for many years afterward.

"At Cornell, the experience of mentoring international students who had come from Asia, Central America and Africa to study the microbiology of their native foods prompted Steinkraus to study fermented foods, including

tempe [tempeh], tape, trahanas, idli / dosa and the fermented fish sauces and soy products of the Far East, including miso and tofu.

"In 1959 Steinkraus was invited by the Interdepartmental Committee for Nutrition for National Defense to participate in surveys of the nutritional status of military personnel, their dependents and the general populations of South Vietnam, Ecuador and Burma. The project was later extended to include Indonesia, the Philippines, Korea, Taiwan, Thailand and Malaysia.

"Over the course of his career, Steinkraus maintained and developed his connections with Asia as a consultant on food processing issues in Indonesia and as a teacher and researcher at the University of the Philippines College of Agriculture. He lectured in Indonesia, Thailand, Singapore, London, Germany and Switzerland. His *Handbook of Indigenous Fermented Foods*, published in 1983, was the first comprehensive and authoritative book on the subject.

"Steinkraus was the American delegate to the United Nations Environmental Program, United Nations Educational, Scientific and Cultural Organization and International Cell Research Organization panel on applied microbiology and biotechnology and worked as a consultant to the United Nations Industrial Development Organization to determine how genetic engineering and biotechnology could be used to help developing countries in Africa. He was honored in 1985 with the Institute of Food Technologists' International Award and was a fellow of the American Association for the Advancement of Science and the American Academy of Microbiology.

"A memorial service will be held Sunday, June 8, at 2 p.m. in Sage Chapel." Address: Part-time writer for the College of Agriculture and Life Sciences, Cornell Univ.

157. Spots: Fermented specialty soyfoods. 2012. • ***Summary:*** (a-d) Dosai or dosa (thin Indian crepes). (e-f) Idli (steamed round Indian breads). (g) Dosa and idli. (h-j) Dhokla (steamed).

An asterisk (*) at the end of the record means that SOYFOODS CENTER does not own that document.
A plus after eng (eng+) means that SOYFOODS CENTER has done a partial or complete translation into English of that document.
An asterisk in a listing of number of references [23* ref] means that most of these references are not about soybeans or soyfoods.

## SUBJECT/GEOGRAPHICAL INDEX BY RECORD NUMBERS