FRIEDRICH HABERLANDT -

HISTORY OF HIS WORK WITH SOYBEANS AND SOYFOODS

(1876-2008):

EXTENSIVELY ANNOTATED

BIBLIOGRAPHY AND SOURCEBOOK

Compiled

by

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This book, now doubt and alas, has its share of errors. These, of course, are solely the responsibility of William Shurtleff.

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)
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

FRIEDRICH HABERLANDT - HISTORY OF HIS WORK WITH SOYBEANS AND SOYFOODS

1. Haberlandt, Friedrich. 1876. Der Anbau der rauhhaarigen Soja oder Sojabohne (Soja hispida Moench) [The cultivation of the hirsute soybean]. *Wiener Landwirthschaftliche Zeitung* 26(9):87-89. Feb. 26. [Ger]
• ***Summary:*** Contains a detailed account of Haberlandt's first trials and analyses of the oil and protein content of the soybean's seeds.

"Among the seeds that the teaching staff of agronomy at the Royal College of Agriculture *(Lehrkanzel des Pflanzenbaues an der Wiener Hochschule für Bodencultur)* in Vienna, acquired at the Viennese World Exposition of 1873, were a number of varieties of soya (Soja), gathered from the Chinese, Japanese, Mongolian, Transcaucasian, and East Indian expositions." An illustration shows a soybean plant with pods.

Note 1. This is the earliest document seen (July 2008) by Prof. Haberlandt about soybeans or that mentions Prof. Haberlandt in connection with soybeans. Also subsequently published in *Biedermann's Centralblatt* (June 1876, p. 441-45).

Note 2. This is the earliest document seen (July 2002) concerning soybeans in Austria, or the cultivation of soybeans in Austria. This document contains the earliest date seen for soybeans in Austria (1873), or the cultivation of soybeans in Austria (1875). The source of these soybeans is the various expositions at the World Exposition in Vienna of 1873.

Note 3. This is the earliest document seen (April 2008) concerning soybeans in Transcaucasia, or the cultivation of soybeans in Transcaucasia–which is a region roughly equal to that occupied in 2008 by the countries of Armenia, Azerbaijan, and Georgia. This document contains the earliest date seen for soybeans in Transcaucasia, or the cultivation of soybeans in Transcaucasia (1873). The source of these soybeans is unknown. We cannot be certain that soybeans were being cultivated in Transcaucasia by 1873, although Haberlandt says in 1878 that these soybeans were "from Transcaucasia" so they were almost certainly being cultivated there–especially since they were seen as being important enough to take to this Viennese World Exposition. Moreover, Wuchino (1901) states that soybeans were first grown in Transcaucasia in the 1870s. We learn later (1878) that Haberlandt got black soybeans from the Transcaucasian exposition.

Note 4. This is the earliest document seen (May 2008) concerning soybeans in Central Asia (Transcaucasia), or the cultivation of soybeans in Central Asia. This document contains the 2nd earliest date seen for soybeans in Central Asia, or the cultivation of soybeans in Central Asia (1873). The source of these soybeans is unknown.

Note 5. This is the earliest document seen concerning soybeans in Mongolia, or (probably) the cultivation of soybeans in Mongolia (one of two documents). It is possible, but unlikely, that these soybeans came from the nation that since 1911 has been called Mongolia (formally Mongolian People's Republic, also called Outer Mongolia). It is more likely that they came from what is today called Inner Mongolia, which is part of China, an autonomous region in northern China bounded on the north by the Mongolian People's Republic. Address: Prof., Wiener Hochschule fuer Bodencultur, Vienna.

2. Haberlandt, Friedrich. 1876. Der Anbau der rauhhaarigen Soja oder Sojabohne (Soja hispida Moench) [The culture of the hirsute soya or soybean (Soja hispida Moench)]. *Biedermann's Central-Blatt fuer Agrikulturchemie* 5:441-45. June. [3 ref. Ger]
• ***Summary:*** This is a summary of an article, with long quotes, originally published in *Wiener landwirthschaftliche Zeitung* 1876, No. 9, p. 87-89. Address: Prof., Landwirtschaftliche Laboratorium, K.K. Hochschule fuer Bodenkultur, Vienna.

3. Rauch, A. 1876. Die Soya [The soybean]. *Fundgrube (Die) (Monatschrift fuer die gesammten praktischen Beduerfnisse und Interessen des taeglichen Lebens, von Dr. A. Rauch, Bamberg)* 3:177-78. Oct. [Ger]
• ***Summary:*** The soybean *(Soya hispida* or *Dolichos Soya;* many German writers use the name "Soja") is a creeping and climbing bean *(rankendes Bohnengewaechs)* that is

native to Japan, and in all of southern Asia, especially in China, is likewise widely cultivated, like the common bean in Germany. The seeds, which are distinguished by an especially good taste, are used as very popular food in the countries where soybeans are grown, which is found at almost every meal. They are also part of a significant commercial product, since they are used to make a strong sauce, which is much sought after in fine kitchens / cuisine. In England, for example, each year more than 1,200,000 lb *(12,000 Zentner)* of the beans and significant quantities of the Soya sauce*, which is made in China, are imported. Footnote: *"Some sauces sold as 'Soya sauce' in England do not contain any of the actual sauce."

In Europe, various attempts have already been made to acclimatize the soybean. But these have so far been unsuccessful, in that the plants, at best, flower, but never bear seeds. "Previously I received several seeds of various soybean varieties from Japan, from my longtime friend, honorable [Philipp] v. Siebold, who died at an early age. However my attempts to cultivate them was unsuccessful. The plants came up, and some of them bloomed, but so late (in September) that none ripened seeds.

"I was therefore quite astonished to read an article in the *Wiener Landwirthschaftliche Zeitung*, by Dr. Haberlandt, professor at the Royal College of Agriculture in Vienna *(Wiener Hochschule für Bodencultur);* he reported that soybean cultivation at he Agricultural Experiment Garden *(landw. Versuchsgarten)* in Vienna, during the summer of 1875, had completely succeeded." Describes the pioneering work of Friedrich Haberlandt with soybeans in Austria.

Note: Bamberg is a city in Bavaria, in south central Germany on the Regnitz River 30 miles west of Bayreuth. Address: Germany.

4. Graf H. Attems'sche Samenkulturstation St. Peter bei Graz. 1876. Culturversuch mit Soja hispida [Agronomic trial with the soybean (Soja hispida)]. *Wiener Landwirthschaftliche Zeitung* 26(48):552-53. Nov. 25. [Ger]
• ***Summary:*** Through the goodness of Prof. Haberlandt, in early 1876, the station obtained 200 soybean seeds, in 2 varieties–brown seeds from China and yellow seeds from Mongolia. These seeds came from the Vienna World Exposition. The seeds were planted at the station on May 18. On 11 October 40 plants of the yellow-seeded variety were harvested, on 16 October 15 plants of the brown-seeded variety and on 24 Oct. 18 more of the brown-seeded variety (total 33 plants) were harvested. Many of these were still green. Yield: Of the brown variety, 870 gm of ripe seeds and 187 gm of unripe and still soft seeds (only the former can be counted in the yield). Of the yellow variety, 642 gm of ripe seeds.

Quality of the harvest: The weight of the seeds harvested was less than the weight of those planted. 1,000 harvested seeds of the brown variety weigh 161.7 gm, and 1,000 seeds of the yellow variety weigh 111.25 gm. As for the planted seeds, based on the weight of 50 seeds, 1,000 planted seeds of the brown variety weigh 277.7 gm, and 1,000 seeds of the yellow variety weigh 234.4 gm. Of the dark brown seeds that were planted, less than half were dark brown when harvested; the rest were lighter in color.

On the whole, these oil beans *(Oelbohne* [soybeans]) do not seem to be more delicate / sensitive than the well known and widely planted varieties. They distinguish themselves by their high yield, especially on our trial plots when planted with other legumes. Only yellow and blue lupins gave higher seed yields. Calculated per 100 square meters *(Ar,* a square 10 meters on a side) or per *Joch* (an old unit of land area equal to about 5,750 square meters), the yield of soybeans was equivalent to a very good yield of peas: Comparing soybeans to peas, they yield respectively 16 and 21 kg per 100 square meters *(Ar)* or 920 and 1,207 kg per *Joch.* We are convinced that this bean [the soybean] has a future as a fodder plant *(Futterpflanze).* An analysis of its nutritional value and general usefulness will appear soon.

Note 1. This is the earliest document seen (March 2003) concerning quantitative research conducted on soybeans in Europe, and the second earliest such document seen worldwide. The data collected are the most extensive and interesting seen to date.

Note 1. Graz is the capital of Styria, Austria, on the left bank of the Mur River, 87 miles south-southwest of Vienna. Note 2. Count Heinrich Attems is the owner of the a seed testing station *(Samenculturstation)* in St. Peter bei Graz

Note 3. This is the earliest document seen concerning soybeans in Mongolia, or (probably) the cultivation of soybeans in Mongolia (one of two documents). It is possible, but unlikely, that these soybeans came from the nation that since 1911 has been called Mongolia (formally Mongolian People's Republic, also called Outer Mongolia). It is more likely that they came from what is today called Inner Mongolia, which is part of China, an autonomous region in northern China bounded on the north by the Mongolian People's Republic. Address: [St. Peter bei Graz, Steiermark [Styria], Austria].

5. Haberlandt, Friedrich. 1877. Neure Erfahrungen ueber den Anbau der rauhhaarigen Sojabohne [Recent experiences with the cultivation of the hirsute soybean]. *Wiener Landwirthschaftliche Zeitung* 27(4):32-35. Jan. 27. [Ger]
• ***Summary:*** Based on a lecture presented on 21 Dec. 1876 at the Club of Farmers and Foresters *(Club der Land- und Forstwirthe)* in Vienna. Contains a detailed account of the author's early soybean trials and analyses of the oil and protein content of the seeds. This is basically a summary of the information written by Prof. Haberlandt in Jan. 1877

and published later that year as "*Der Anbau der rauhhaarigen Sojabohne* [The culture of the hirsute soybean]" in *Landwirthschaftlichen Versuchs-Stationen* 20:247-72.

In early 1876 Prof. Haberlandt then sent samples of seeds to seven cooperators in central Europe, who planted and tested the seeds in the spring of 1876, with good or fairly good results in each case. He sent soybeans to: W. Köhler (Title: Chief-gardener, *Obergärtner)* in Ungarisch-Altenburg [Hungarian Altenburg, formerly Magyarovar, today's Mosonmagyarovar in Hungary about 22 miles northwest of Györ]. He was involved in cultivation research. The yellow and reddish-brown soybean types *(rothbraunen Sorten)* ripened at the same time as they had in Vienna. They ripened even though they had been completely eaten off by rabbits when younger–which showed their superior viability.

A. Stojics (Title: Owner of a farm estate, *Gutsbesitzer)* in Gross-Becskerek in Hungary. He planted yellow soybeans and harvested them in mid-September. Note 1. This is the earliest document seen (Feb. 2005) concerning soybeans in what is today Hungary (though Hungary was not officially created until 1918), or the cultivation of soybeans in Hungary (one of two documents).

A. Tomaszek [Tomasek] (Title: Official / Administrator for Agriculture, *Oekonomie-Beamter / Verwalter)* in Napagedl in Mähren [Moravia, a region in today's Czech Republic]. He was involved with agricultural experiment operation in the domain of Count Stockau, and he harvested his first soybeans from mid-September until October.

Dr. Nikolaus Dimitriewicz, a former student *(Hörer)* at the Royal School of Agriculture in Vienna, and now a farmer *(Oekonom)* in Bukowina [Bukovina or Bucovina, a former Austrian crownland, now divided among the Ukraine and Romania]. He received 100 seeds which he sent to 6 farmers he knew in four nearby locations in the district of Kotzman *(des Kotzmaner Bezirks).* [Note 2. As of 1994, Kotzman is the town and district of Kitsman in the southwestern Ukraine, just north of the border with Romania. Also spelled Kotzmann, Cotman, Cozmeni, Kosman, Kozmeny, or Kucmeh, it is located 19 miles northwest of Chernivtsi (also spelled Chernovtsy, Chernowitz, or Czernowitz)]. Note 3. This is the earliest document seen (July 2002) concerning soybeans in the Ukraine, or the cultivation of soybeans in the Ukraine (one of two documents).

Graf. H. Attems, owner *(Eigenthümer)* of a seed testing station *(Samenculturstation)* in St. Peter bei Graz in Steiermark [today's Styria, capital of Graz in Austria].

Prof. Dr. Kulisz, a teacher of agriculture in Tetschen-Liebwerd in Böhmen [Bohemia, now in the Czech Republic]. The soybeans ripened in spite of the unfavorable weather conditions during the year. He harvested the reddish-brown variety on Oct. 5 and the yellow variety on Oct. 21. Note 4. This is the earliest document seen (Feb. 2005) concerning soybeans in what is today the Czech Republic (though it was not officially created until Jan. 1993), or the cultivation of soybeans in the Czech Republic (one of two documents).

W. Janig (Title: Prince Rohan's Privy Councillor, *fürstl. Rohan'scher Hofrath)* in Prague in Böhmen [Bohemia]. He was sent 200 seeds which he sent to 5 locations (including in Sichrow, Swijan [on the Iser or Jisera River], and Darenic) in Bohemia [now in the Czech Republic] for planting. Note 5. The term *fürstl. Rohan'scher Hofrath* refers to Louis Prince von Rohan, the first cardinal and bishop of Strassburg; he lived 1734-1803. This was his property. A *Hofrat* was a privy councillor / minister of this prince's court. Note 6. Swijan, as of 2003, is named Svetice and is located about 18 miles southeast of Prague, the capital of the Czech Republic. The current names of Sichrow and Darenic cannot be found.

And A. Schnorrenpfeil, administrator of the farm estate *Gutswirthschaft* at the Agricultural Academy in Proskau *(Landwirtschaftlichen Akademie Proskau)* [now named Proszkow, in today's southwest Poland] in Preussisch-Schlesien [Prussian Silesia, a Prussian province later divided into upper- and lower Silesia]. Note 7. Proszkow is a market town located 7 miles southwest of Oppeln (now Opole), in southwest Poland at north latitude 50º40'. This is further north than any point in the continental USA, and even a bit north of Winnipeg, Manitoba, Canada. Note 8. This is the earliest document seen (Feb. 2005) concerning soybeans in Poland, or the cultivation of soybeans in Poland (one of two documents).

Note 9. This is the earliest European / Western document seen (Aug. 2006) that mentions rabbits (or any other type of rodents) as an enemy of soybean plants. Address: Prof., Hochschule fuer Bodencultur, Austria.

6. Haberlandt, Friedrich. 1877. Der Anbau der rauhhaarigen Sojabohne [The culture of the hirsute soybean]. *Landwirthschaftlichen Versuchs-Stationen* 20:247-72. [5 ref. Ger]

• ***Summary:*** Haberlandt submitted this article in Jan. 1877 from Vienna. The original soybean seeds were obtained at the Vienna World Exposition of 1873 then grown out in the garden of the Royal College of Agriculture *(Hochschule für Bodencultur)* in Vienna. The seeds grown in Vienna and harvested in 1875 and 1876 were larger and heavier than those obtained at the Exposition.

"Among nutritional plants, the hirsute soybean *(der rauhhaarigen Soja)* is of the first rank. For no other legume nourishes so many people, and has such great nutritional value, and multiple food uses" (p. 247). On p. 248 Haberlandt shows that he is familiar with the soybean work of the Society for Acclimatization in France. "In France the

soybean is known as the oil pea, and it is cultivated at various points in the departments of Ariège and Haut-Garonne... Many years ago attempts were made to grow *Soja hispida* in Hohenheim [Germany], but the plants were barely brought to a blooming state. People also had the same experience in other places. Dr. A. Rauch of Bamberg [Germany] (see *Die Fundgrube von Dr. A. Rauch. III. Jahrgang. Bamberg* 1876), on several occasions, received seeds of various soybean varieties from Japan. They were sent by his long-time friend, Colonel [Philipp Franz] von Siebold, who died at an early age. But every trial by Dr. Rauch was unsuccessful.

In 1875 Prof. Haberlandt conducted soybean trials at the Royal College of Agriculture in Vienna. In early 1876 he published detailed results of these trials in the *Wiener Landwirthschaftliche Zeitung.* Nutritional analyses of these seeds were published.

In early 1876 Prof. Haberlandt then sent samples of seeds to seven cooperators in central Europe, who planted and tested the seeds in the spring of 1876, with good or fairly good results in each case. These men reported the details of their agronomic trials *(Anbauversuche)* to Haberlandt, who quotes from their reports (p. 253-59). Haberlandt sent soybeans to: Master-gardener W. Köhler (p. 253-54) in Ungarisch-Altenburg [Hungarian Altenburg, formerly Magyarovar, today's Mosonmagyarovar in Hungary about 22 miles northwest of Györ]. He planted 100 seeds in mid-May, 1876, in a sunny place in the botanical garden, in a bed 5 meters long by 2 meters wide. All the seeds germinated *(Alle Samen keimten)* and the plants developed luxuriantly. But one night, when they were 5-6 cm tall, all the young plants were eaten by rabbits. However they grew back and yielded 1.6 kg of seeds.

Landowner *(Gutsbesitzer)* A. Stojics (p. 253-54) in Gross-Becskerek in Hungary. He planted 100 brownish-red *(braunrothen)* and 100 yellow soybeans in mid-April. In mid-September he harvested 0.33 kg seeds of the former and 0.32 kg of the latter. Note 1. This is the earliest document seen (Feb. 2005) concerning soybeans in today's Hungary (though Hungary was not officially created until 1918), or the cultivation of soybeans in Hungary. This document contains the earliest date seen for soybeans in Hungary, or the cultivation of soybeans in Hungary (mid-April 1876) (one of two documents). The source of these soybeans was Friedrich Haberlandt in Vienna.

Landowner Graf. H. Attems (p. 253-55), owner of a seed testing station *(Samenculturstation)* in St. Peter bei Graz in Steiermark [today's Styria, capital of Graz in Austria]. On 19 May he planted 50 brownish-red *(braunrothen)* seeds from China and 50 yellow seeds from Mongolia. He harvested the seeds between Oct. 11 and 24, obtaining 0.870 kg of the brownish-red and 0.642 kg of the yellow.

Mr. A. Tomaszek [Tomasek] (p. 253, 255-56, 260, 263), farmer and civil servant *(Oekonomie-Beamter / Verwalter)* in Napagedl in Mähren [Moravia, a region in today's central Czech Republic]. He planted 25 yellow and 25 reddish-brown soybeans on April 29. The yellow yielded 1,400 seeds and the reddish-brown 1,350 seeds. Note 2. This is the earliest document seen (Feb. 2005) concerning soybeans in what is today the Czech Republic (though it was not officially created until Jan. 1993), or the cultivation of soybeans in the Czech Republic. This document contains the earliest date seen for soybeans in the Czech Republic, or the cultivation of soybeans in the Czech Republic (29 April 1876) (one of two documents). The source of these soybeans was Friedrich Haberlandt in Vienna.

Note 3. Concerning Mähren (Moravia): from 1849 to 1918 it was a separate crownland of Austria, with capital at Brno. In 1918 it was organized as a province of Czechoslovakia.

Princely Privy Councillor *(Hofrath)* W. Janig (p. 253, 256-57) in Prague in Böhmen [Bohemia]. He was sent 200 seeds which he sent to 5 locations (including in Sichrow, Swijan [on the Iser or Jisera River], and Darenic) in Bohemia [now in the Czech republic] for planting. All but 5% sprouted. In Sichrow, 25 seeds planted in early May yielded 2,500 seeds in October. Continued. Address: Mittheilungen aus dem landwirthschaftlichen Laboratorium und Versuchsgarten der k.k. Hochschule fuer Bodencultur in Wien [Vienna].

7. Haberlandt, Friedrich. 1877. Der Anbau der rauhhaarigen Sojabohne [The culture of the hirsute soybean (Continued–Document part II)]. *Landwirthschaftlichen Versuchs-Stationen* 20:247-72. [5 ref. Ger]

• ***Summary:*** Continued from p. 253. Prof. Dr. Kulisz (p. 253, 257) in Tetschen-Liebwerd in Böhmen [Bohemia, now in the Czech Republic] planted 150 seeds of 3 varieties. Despite snow, rain, and frost in May, 98 plants survived, yielding 660 seeds. The tallest plant was not over 50 cm high.

Dr. Nicolaus Dimitriewicz (p. 253, 257-58), a former student at the Royal College of Agriculture in Vienna, and now a farmer *(Oekonom)* in Bukovina [Bukowina or Bucovina, a former Austrian crownland, now (2005) divided between the Ukraine and Romania]. He received 100 seeds which he sent to 6 farmers he knew in four nearby locations in the district of Kotzman *(des Kotzmaner Bezirks).* [Note 1. As of 1994, Kotzman is the town and district of Kitsman in the southwestern Ukraine, just north of the border with Romania. Also spelled Kotzmann, Cotman, Cozmeni, Kosman, Kozmeny, or Kucmeh, it is located 19 miles northwest of Chernivtsi (also spelled Chernovtsy, Chernowitz, or Czernowitz)]. The seeds were planted late, on April 20 or later, and some were killed by frost. Others, protected from the frost, grew fairly well.

For example, the second farmer harvested 669 seeds from 19 plants. The 64 plants which survived yielded less than 2.821 kg of seed. Note 2. This is the earliest document seen (Feb. 2001) concerning soybeans in the Ukraine, or the cultivation of soybeans in the Ukraine (one of two documents). This document contains the earliest date seen for soybeans in the Ukraine, or the cultivation of soybeans in the Ukraine (20 April 1876). The source of these soybeans is unknown.

And A. Schnorrenpfeil (p. 253, 258), Administrator of *Gutswirthschaft* at the Agricultural Academy in Proskau *(Landwirtschaftlichen Akademie Proskau)* [now named Proszkow, in today's southwest Poland] in Preussisch-Schlesien [Prussian Silesia, a Prussian province later divided into upper- and lower Silesia]. He planted 50 seeds of two varieties in late April. Note 3. Proszkow is a market town located 7 miles southwest of Oppeln (now Opole), in southwest Poland at north latitude 50º40'. Note 4. This is the earliest document seen (Feb. 2005) concerning soybeans in Poland, or the cultivation of soybeans in Poland (one of two documents). This document contains the earliest date seen for soybeans in Poland, or the cultivation of soybeans in Poland (20 April 1876). The source of these soybeans was Prof. Haberlandt in Vienna.

Joh. Stua (p. 263-64), of the Technolog. Laborat. der k.k. [kaiserlich-königliche] Hochschule für Bodencultur [Imperial-Royal College of Agriculture] in Vienna, conducted a detailed nutritional analysis of the yellow Mongolian, yellow Chinese, and brownish-red *(braunrothe)* varieties. The first 3 columns of a full-page table (p. 264) show percentages in air-dried soybeans of (1) the original soybean seed sample, (2) soybeans grown the first year, and (3) soybeans grown the second year. Columns 4-6 show the same information adjusted as if the soybeans had a 10% water content. For each variety, data are given for water, protein, fat, nitrogen-free extract (Stickstofffreie Extractivstoffe), crude fiber, and ash *(Aschenbestandtheile).* Note 5. This is the earliest German-language document seen (Oct. 2004) that mentions red soybeans (actually brownish-red) or that uses the word *braunrothe* to refer to the color of soybeans. In many other documents by or about Prof. Haberlandt, the term "reddish-brown" *(braunrothen)* is used to describe the color of a type of soybean he obtained from China.

Tomaszek (p. 263) wrote Haberlandt that he was astonished by the high oil and protein content of the soybeans he grew and harvested and had analyzed by a chemist at the sugar factory. So he had the analyses repeated by Prof. K. Zulkowski of the technical university at Brünn, and got similar results. Zulkowski found (table, p. 263) that the air-dried of yellow soybeans from China contained 16.99% fat, 40.19% protein, and 6.43% nitrogen. The brownish-red soybeans from China contained 16.68% fat, 44.93% protein, and 7.19% nitrogen. Note 6. This is the earliest document seen (April 2003) that mentions Zulkowski.

These analyses are in close accord with those published by Senff in 1872 (table, p. 265). Soybeans are compared with lupins and other legumes.

On pages 270-71 Haberlandt discusses food uses of soybeans. "The soy sauces, which were imported from India and spread from England over Continental Europe, could in no way awaken a favorable opinion of the flavor of the soybean, for these sauces have a strong flavor of browned *(gebräuntem)* sugar, perhaps also mixed with other ingredients, so that the soybean's own flavor is completely masked *(verdekt wird).* Because of their complete lack of starch, soybeans do not become soft through cooking, so it is necessary to crush and rub the half-soft cooked seeds before their further preparation... Best would be a use [of soybeans] which imitates that of corn kernels *(Maiskörner),* from whose flour the people of southern Europe prepare their beloved dish, Polenta. Soybeans roasted at 160ºF taste delicious and surpass all other plants that have heretofore been used as coffee substitutes."

Note 7. Tables from this article are described in a separate record. Address: Mittheilungen aus dem landwirthschaftlichen Laboratorium und Versuchsgarten der k.k. Hochschule fuer Bodencultur in Wien [Vienna].

8. Haberlandt, Friedrich. 1877. Der Anbau der rauhhaarigen Sojabohne [The culture of the hirsute soybean: Tables (Document part)]. *Landwirthschaftlichen Versuchs-Stationen* 20:247-72. [5 ref. Ger]

• ***Summary:*** Tables show: (1–p. 260) The weight in grams of 1,000 original seeds compared with the first progeny in 1875 and the second progeny in 1876. Yellow soybean from Mongolia: 81.5, 126.0, and 163.6. Note the significant increase in seed weight. Yellow soybean from China: 92.5, 148.0, 143.0. Reddish brown soybean from China: 105.0, 154.5, 141.8. Black soybean from China: 101.6, 110.6,–(no value given).

(2–a full-page table, p. 261) Prof. Haberlandt's results in testing 7 different types of soybeans in 1876: Yellow from Mongolia (progeny), yellow from China (progeny), reddish-brown from China (progeny), black from China (one original, one progeny), black from Mongolia (original), and black from Japan (original). For each variety is given: Size of the trial plot in square meters (range 4.0 to 11.0), Planting date (April 25 to May 5), successful emergence of sprouts (May 19 to June 2), first flowering (June 20 to July 3), start of ripening (Aug. 25 to Oct. 24), date of harvesting (Sept. 26 to Nov. 6), number of plants harvested (52 to 339), weight of the harvested seeds in grams (570 for black from Mongolia to 3,710 for yellow from China), weight of the air-dry straw in grams (1,920 for black #1 from China to 7,270 for yellow from China), calculation of weight of seeds per hectare (in kg) (1,111.1

for black from Japan to 3864.6 for yellow from China), calculation of weight of straw per hectare (in kg) (4,062.5 for black #1 from China to 6,025 for black from Mongolia), number of seeds per plant (40.5 to 124.4 for black #1 from China), weight of 100 air-dry seeds in grams (101.6 from black #1 from China to 163.6 for yellow from Mongolia).

(3–p. 268) The total heat units *(Wärmesummen)* required for 7 different types of soybeans in 1876 to the start of ripening and to harvest: Yellow from Mongolia (progeny) 1824ºC, 2230ºC. Yellow from China (progeny) 1887ºC, 2253ºC. Reddish brown from China (progeny) 1699ºC, 2293ºC. Black from China (original) 2844ºC, 3175ºC. Black from China (progeny) 2661ºC, 3175ºC. Black from Mongolia (original) 2905ºC, 3175ºC. Black from Japan (original) 2954ºC, 3175ºC. Note that the yellow varieties (the first two) required the fewest heat units, while the black varieties required the most.

Note 1. This is the earliest document seen (Jan. 2000), worldwide, that contains information on the weight of soybean seeds. Haberlandt measured the weight in grams of 1,000 soybean seeds.

Note 2. This is the earliest document seen (Oct. 2004) that clearly mentions soybean straw, which the stems, leaves, and empty pods left after the plants have been thrashed for seed. Soybean hay is the whole dry plants with the beans left in the pods, cut at any time from the setting of seed until the leaves begin to turn yellow. Address: Mittheilungen aus dem landwirthschaftlichen Laboratorium und Versuchsgarten der k.k. Hochschule fuer Bodencultur in Wien [Vienna].

9. *Zemledel'cheskaya Gazeta.*1877. Iz inostrannykh gazet i zhynalov [From foreign newspapers and journals]. No. 6. p. 89-92. Feb. 5. See p. 89. [Rus]
• ***Summary:*** This article is about various crops. A paragraph (p. 79) about the soybean states: *Soja hispida,* a newly cultivated plant. At the Vienna Agriculturists' Club, Prof. Haberlandt presented a very interesting report about cultivation experiments with a newly cultivated plant–the so-called hirsute *Soja hispida* Mönch. Haberlandt found that one variety of Soja, from the many present at the Vienna World Exhibition, ripens in 5 months, and then reliably grows in our climate. Its value, which increased during the two subsequent years of cultivation, can best be seen in comparison with the composition of peas:

A table shows percentage of air-dried substance. The columns are substances, crude protein, fat, nitrogen-free extract, crude fiber, and ash. The substances are both seeds and straw: Seeds: Peas, initial Soja, Soja after 1 year cultivation, soja after 2 years cultivation. Straw: Peas, Soja. Concerning crude protein: Pea seeds had 23.2% vs. 30.6%, 34.4%, and 35.0% for soybean seeds during three years of cultivation. Concerning fat: Pea seeds had 1.8% vs. 15.8%, 18.2%, and 18.4% for soybean seeds during three years of cultivation. Soybean seeds also contained almost twice as much ash and only 77% as much crude fiber.

Soybean straw contained about 24% more protein and 19% more fat that pea straw, plus 2½ times as much ash and only 86% as much crude fiber.

Prof. Haberlandt believes that in the near future, every agriculturist will cultivate *Soja hispida* in the same quantity that they now cultivate bread [wheat], potatoes, etc., since soya has the highest nutritional value in its seeds and straw compared with other plants–the only exception being lupines.

Note: This is the earliest Russian-language document seen (June 2003) that mentions the soybean–which it calls *Soja hispida* and *Soja.*

10. Haberlandt, Friedrich; Koehler, W.; Stojics, A.; Tomasek, A.; Dimitrievicz, -; Attems, Heinrich; Kulisz, -; Janig, W.; Schnorrenpfeil, A.; Schwackhoefer, Fr.; Zalkowsky, K. 1877. Neue Erfahrungen ueber den Anbau der rauhhaarigen Sojabohne [New practical experience with the cultivation of the hirsute soybean]. *Biedermann's Central-Blatt fuer Agrikulturchemie* 6:381-87. May. [6 ref. Ger]
• ***Summary:*** This is largely a summary of Haberlandt's article titled "Der Anbau der rauhhaarigen Sojabohne [The culture of the hirsute soybean]," written in Jan. 1877 and published in *Landwirthschaftlichen Versuchs-Stationen* 20:247-72. Address: 1. Hochschule fuer Bodencultur, Vienna.

11. *Landwirth (Der): Allgemeine Landwirthschaftliche Zeitung (Breslau).*1877. Die rauhhaarigen Sojabohnen [The hirsute soybeans]. 13(48):261. June 15. [Ger]
• ***Summary:*** At the Vienna World Exposition of 1873, many varieties of soybeans from Mongolia, China, and Japan were represented. They are widely cultivated in those countries. Subsequently, at the Royal School of Agriculture in Vienna, trials were made to study the growth and yield of the plant. The results from the year 1876, according to Prof. Haberlandt–as reported in the *Wiener Landwirthschaftliche Zeitung*–lead to the conclusion that the soybean can only mature seeds where the medium level of summer warmth is a little over 140 R. and where neither grape tendrils nor maize *(Mais;* corn) are able to ripen more. In Austria-Hungary, early-ripening soybeans can be cultivated. The small number of trials seem to indicate that large-scale cultivation would produce good yields. The experimenters noted the remarkable fruitfulness of the soybean. In Bukowina [Bukovina or Bucovina, a former Austrian crownland, now divided among the Ukraine and Romania], each seed yielded 188 seeds. Moreover, analyses show that the seeds are of great nutritional worth, and the progeny of the original seeds have more protein and fat than their forbears. The straw also has high value as a feed, and

feeding trials show that cows like not only the green plants but also the straw. Since soybeans are widely used for food among the people of East Asia, Prof. Haberlandt hopes that this plant, because of its great fruitfulness, will become widely cultivated in Europe within a few years, and will been seen as competing in importance with the various cereal grains, potatoes, and corn.

Note: Breslau (see Journal name; the German name for Wroclaw [pronounced vrot-SLAF]) came under the control of Prussia in 1741, and remained part of Germany until 1945, when it was assigned to Poland by the Potsdam Conference.

12. Schollmayer, Franz. 1877. Die rauhaarige Soja oder Sojabohne (Soja hispida Moench) [The hirsute soybean]. *Oesterreichisches Landwirthschaftliches Wochenblatt* 3(47):533. Nov. 24. [Ger]

• ***Summary:*** The author obtained soybean seeds from Prof. Haberlandt of the Imperial-Royal College of Agriculture in Vienna *(k.k. = kaiserlich-königliche Hochschule für Bodencultur in Wien).* A nutritional analysis of Haberlandt's seeds and straw (several generations) is given and compared with that of peas. The author obtained 200 brown-seeded soybeans from China, 200 black-seeded soybeans from China, and 200 yellow-seeded soybeans from Mongolia. He planted the seeds on 16 May 1877 about 26 cm apart in a grid pattern at the experimental farm in Ljubljana. After several days, all of the seeds germinated and emerged well *(In wenigen Tagen schossen die jungen Pflänzchen... in die Höhe).* By the end of May about 90% of the plants (180 of each variety) were up and growing well, the rest having been consumed by moles and field mice. They grew well during the summer, attaining an average height of 65 cm. The plant tops soon formed a canopy so that few weeds could grow. The stems becoming very sturdy and the pods filling nicely with seed. The lower pods on the plants ripened in mid-September and the higher pods in mid-October. The 180 brown-seeded plants yielded 6,660 seeds (37-fold increase) weighing 1,061½ gm. The 180 black-seeded plants yielded 7,814 seeds (43.41-fold increase) weighing 816½ gm. And the 180 yellow-seeded plants yielded 16,371 seeds (90.95-fold increase) weighing 1,925½ gm. These increases are so much larger than can be obtained from regular Austrian runner or French beans, that the soybean (especially the yellow variety) must be urgently recommended for expanded cultivation. Moreover, the nutritional value of the seeds and the hay is greatly superior. The yellow is also better for cooking, since the black variety makes an unappetizing black soup. "To the untiring researcher, Prof. Haberlandt, goes our greatest thanks for this new crop plant, which I also, as his former student, express to him with full conviction."

Note 1. Laibach is the German name for Ljubljana (also Lyublyana), a city which is presently (early 1993) the capital of Slovenia, located on the Sava River. According to the *Columbia-Lippincott Gazetteer* (1880), in 1877 Laybach (also spelled Laibach) was a town in Austria. It had been the capital of the kingdom of Illyria from 1816-1849. Also called Ljubljana, it became part of Yugoslavia in 1918. In ancient times it was named Æmona or Emona.

Note 2. This is the earliest document seen (July 2007) concerning soybeans in Slovenia, or the cultivation of soybeans in Slovenia. This document contains the earliest date seen for soybeans in Slovenia, or the cultivation of soybeans in Slovenia (16 May 1877). The source of these soybeans was Prof. Haberlandt in Vienna, but they originated in China and Mongolia. Address: Versuchshof-Administration in Laibach [Austria].

13. *Mittheilungen ueber Gegenstaende der Land-, Forst-, und Hauswirtschaft (Organ der k.k. Landwirthschaftgesellschaft fuer Kaernten).*1877. Zur Sojabohne [The soybean]. 34(23):183-84. Dec. 1. [Ger]

• ***Summary:*** Upon his request, the Inspector of the Experimental Farm in Ljubljana *(Laibach),* Mr. Franz Schollmayr, received in the spring from Prof. Haberlandt 200 seeds of brown soybeans and 200 seeds of black soybeans from China, and 200 seeds of coarse yellow soybeans originating from Mongolia, all for experimental cultivation.

These were planted on May 16 in such a way that the seeds were spaced 10 inches *(Zoll)* from each other and approximately 1½ inches deep in rather thin, ordinary topsoil (diluvial gravel / rubble, *Dilluvialschotter)* that had been lightly fertilized with barnyard manure and that had previously been prepared to be completely even and ready.

In a few days, the young, dark green baby plants shot up quite superbly without a seed having remained. By the end of May, approximately 10% of the plants had fallen to the ground because of voles and moles, and thus approximately 180 plants of each of the aforementioned varieties remained. During the summer, these plants were cultivated once. Since the growth of the firm stems with thick foliage is rapid, this planting soon filled in, adequately shaded the ground, and allowed few weeds to come up. The plants achieved a height of 25 inches (65 cm) and were more stocky (full stemmed) than elongated. They were covered with abundant pods. The lower pods matured in mid-September, followed by those further up in mid-October.

After precise counting and weighing, the yield of these three varieties is as follows: 180 beans of the brown soybean from China yielded 6,660 seeds weighing 1,061½ grams. 180 beans of the black soybean from China yielded 7,814 seeds weighing 816½ grams. And 180 beans of the yellow soybean from Mongolia yielded of 16,731 seeds weighing 1,925½ grams.

In comparison with the yield of our native varieties of green beans *(Fisolenarten),* the brown soybean in Ljubljana yielded 37 times as much; the black soybean yielded 43.41 times as much, and the yellow soybean yielded 90.95 times as much. This is therefore so high that the soybean must be very highly recommended for the most extensive cultivation, all the more so since, upon chemical analysis, the nutritional value of the beans and the straw comes to light as being significant.

As for the yield of straw, the brown soybean weighed 2 Viennese pounds *(2 Wiener Pfund),* the black and the yellow soybean also yielded 2 Viennese pounds of air-dried straw.

Mr. Schollmayr is of the opinion that the yellow soybean is first and foremost to be preferred, followed by the brown variety, and then the black. He arrives at this conclusion not only as a result of the yields of the yellow and brown soybeans, but also because of their preferred colors in commerce, the full roundness of the beans, and the pleasant shape of both varieties mentioned.

The black soybean is elongated and flattened, and furthermore the black color is not desirable in commerce for the reason that when they are boiled, the beans impart an unappetizing black color to the soup. Address: Austria.

14. Graefl. H. Attems'sche Gemuesebau- und Samenkulturstation in St. Peter. 1877. Zweiter Culturversuch mit der chinesischen Oelbohne in St. Peter bei Graz [Second agronomic trial with the Chinese oilbean (Soybean) in St. Peter near Graz]. *Wiener Landwirthschaftliche Zeitung* 27(49):557. Dec. 8. [Ger]

• ***Summary:*** From the preceding year's harvest of soybeans *(Soja),* which was described in issue no. 48 of the *Wiener Landwirthschaftliche Zeitung* of 1876 [Nov. 25, p. 552-53] and which was attained at Count Attems' Seed Multiplication Station *(Graf Attems'sche Samenkulturstation)* in St. Peter near Graz, the healthiest seeds were selected for planting in 1877. In doing this with 1,000 seeds, and increase in weight was achieved amounting to 5 gm with the yellow variety and 8 gm with the brown variety. Note: A *Samenkulturstation* (seed multiplication station) exists to sell this seed to neighbors; it is usually not involved with seed breeding, nor is it a commercial seed company.

The seeds were planted on May 18 in 32 centimeter squares on terraces. Exactly 2 seeds were planted per sowing area, and therefore the quantity of seed per are (1 are = 100 square meters) was 236 gm for the yellow variety and 260 gm for the brown variety. The field was in its third planting. The first planting was with cabbage, the second with winter wheat, then it had been drained in the fall of 1876. The soil consisted of 7 meters of potent, sandy loam that is deposited upon diluvial debris, and whose topsoil is rather humus-like. The climate is generally damp. According to the meteorological observation station in Graz, the number of heat units *(Wärmemenge)* from May 1 until the end of September of the same year amounted to 2,658; the amount of rain was 611 millimeters. The average monthly temperature in May, June, and July was from 1 to 2ºC. above normal. On the other hand, as early as September 17, an early frost of -2ºC arrived, and was followed by lasting cool weather until the end of September.

The development of the plants was vigorous as early as their juvenile period. They closed over to form a canopy as early as the beginning of July, and therefore the land could be hoed twice and kept loose and clean thereafter. Flowering began in the middle of July and continued until the middle of August. As in the previous year, pod-setting was also unusually abundant this year. At the time of the early frost, the beans in the pods were still juicy and beginning to lose their color. Effects of frost were not noticeable upon them, but the uppermost leaves were damaged. Because of the continuation of the cold weather, the harvest was carried out at the end of September, and the plants that were still somewhat succulent were spread out in a ventilated room to finish ripening. By the middle of November, the beans were completely ripened and could be threshed.

The yield of good, picked-over seeds amounted to 13 kg of the yellow and 14 kg of the brown variety. The waste from each type amounted to over 3 kg. The results per are (1 are = 100 square meters) are similar to those from a very good harvest of peas. Mr. Pittoni of Gorizia *(Görz)* has reported to us that he achieved a 63-fold yield with soybeans *(Oelbohne)* there. In the development of its beans, the always later-ripening brown variety remained far behind that of the planted seed; 1,000 seeds at harvest weighed only 113 gm. On the other hand, the yellow variety achieved precisely the quality [weight] of the selected seed for planting, 116 gm per 1,000 seeds. The soybean straw was eaten by cows and fattened sheep with great eagerness. Even this year the soybean *(Sojabohne)* showed itself to be no more delicate than the long-cultivated *Phaseolus* varieties, which is why it can be expected with certainty that because of its enormous fertility and richness in nutrients, which in the meantime Prof. Haberlandt has proven through several analyses, it will soon be universally accepted among our useful plants.

According to the analyses mentioned, the air-dried seeds contain (table): 31% proteinaceous materials, 16.6% fat, 32.2% nitrogen-free nutrients, 4.8% crude fiber, 4.9% ash, and 10% water.

The composition of the straw should be similar to that of peas. Besides the yellow and brown varieties, we also brought a black-seeded variety for planting this year– for which we are also grateful to Prof. Haberlandt for his kind participation. Under the same conditions, with simultaneous planting, they only flowered in the first third

of August and remained unripe at the time of the early frosts. A green-seeded variety, which we had received as the "Japanese bush bean" *(Japanische Buschbohne)* from another source, did not flower at all. We therefore consider the yellow and brown soybeans *(Oelbohne)* to be a definite achievement and include them with our estimable plants for cultivation. Address: St. Peter bei Graz, Steiermark [Styria, Austria].

15. *Landwirth (Der): Allgemeine Landwirthschaftliche Zeitung (Breslau).*1877. S. Domslau, 17. December. [Vereinssitzung.] [S. Domslau, Dec. 17. Meeting of the Society]. 13(102):535-36. Dec. 21. [Ger]
• ***Summary:*** Yesterday the Domslau agricultural rural society held its last meeting of the year. Events of the year were summarized. The men who had planted soybeans earlier in the year were asked to report on their results. Inspector Scholtz from Linz [the capital of Upper Austria on the Danube River, 95 miles west of Vienna] became aware of this new plant, imported from the south, through articles in issues no. 2 and no. 48 [15 June 1877] of this periodical, *Der Landwirth.* Through the good offices of Prof. Haberlandt in Vienna, who is himself interested in the acclimatization of this plant, the Domslau society was able to obtain 200 soybeans. Since the soybean, as the analyses in issue no. 48 of this periodical show, has great value as a livestock fodder, everyone in the society wanted to learn how to grow and use it. So 150 of Prof. Haberlandt's seeds were divided among various members of the society and Mr. Scholtz kept 50 for himself. Ten seeds were planted on May 1, and more were planted on May 28. A frost in early September hurt their development. The harvest on Sept. 17, yielded 530 well-developed seeds and 342 gm of dry straw.

Note 1. In 1878 the town of Domslau was located in Prussia, about 5 miles south of Breslau. As of 1994 Domslaw, now spelled Domaslaw, is in Poland. Breslau (the German name for Wroclaw [pronounced vrot-SLAF]) came under the control of Prussia in 1741, and remained part of Germany until 1945, when it was assigned to Poland by the Potsdam Conference.

Note 2. This is the second earliest document seen concerning soybeans in Poland, or the cultivation of soybeans in Poland. This document contains the second earliest date seen for soybeans in Poland, or the cultivation of soybeans in Poland (1 May 1877). The source of these soybeans was Prof. Haberlandt in Vienna.

16. *Illustrierte Landwirtschaftliche Zeitung (Leipzig).*1877. Die Sojabohne [The soybean]. 39(31):258. [1 ref. Ger]
• ***Summary:*** Issue No. 29 (1876) of this periodical called attention to the soybean. According the *Wiener Landwirthschaftliche Zeitung*, during the year 1876, cultural trials with this plant have been conducted in Hungary, Mähren [Moravia], Bukovina, Steiermark [Styria], Böhmen [Bohemia], and Proskau in Upper Silesia *(Oberschlesien)* [probably in Prussia, Germany]. It was found that, on average, in Austria-Hungary and in southern Germany, the beans ripened / matured completely. Haberlandt obtained 2,354 kg/ha of seeds and 5,236 kg/ha of straw, which has high value as a fodder.

Note: In 1945 the region of Bukovina was divided between what is today (2005) southern Ukraine and northern Romania. It is impossible to tell from this 1877 publication in which of those two countries the soybeans were cultivated. Moravia is in the Czech Republic. Styria is a state in Austria; its capital is Graz. Bohemia is part of the Czech Republic; its capital is Prague. Proskau (Proskowetz, now Proszkow), is in today's SW Poland.

17. Schollmayer, Franz. 1877. Die rauhhaarige Sojabohne *(Soja hispida* Moench) [The hirsute soybean]. *Illustrierte Landwirtschaftliche Zeitung (Leipzig)* 39(49):397-98. [Ger]
• ***Summary:*** A summary of the work with soybeans done by Prof. Haberlandt of Vienna. Address: Administrator des Versuchshofes zu Laibach in Oesterreich [Austria].

18. Mach, E. 1878. Culturversuch mit Soja hispida an der landw. [landwirthschaftliche] Landesanstalt in St. Michele [Agronomic trial with soybeans at the agricultural institute in St. Michele (in Tirol, Austria)]. *Wiener Landwirthschaftliche Zeitung* 28(1):5. Jan. 5. [Ger]
• ***Summary:*** Through the kindness of Professor Haberlandt we received seeds of the Soja hispida [soybean] at the beginning of this year. There was a yellow, a brown, and a black variety. These seeds, which together weighed about 200 gm, were planted on April 30 by the teacher, Mr. Samek, in one of our organization's experimental fields, in a clayish loam *(lehmig),* freshly manured, still somewhat raw soil. The seeds were planted 16 cm apart in rows which were 25 cm apart. The plants developed with very luxuriant growth *(sehr üppig).* The yellow variety stood stiff and upright, as did the brown. The black variety grew so tall it lodged (fell over), and required support. The vegetation was not damaged by insects. The yellow variety was harvested in full maturity on Oct. 1. The brown and black were harvested on Oct. 18, and only some seeds were completely mature, while some seeds of the black soya *(der schwarzen Soja)* were still soft and unripe.

Looking at the climatic conditions, the "heat units" *(Wärmesumme;* "warm temperature summation") from May 1 to Oct. 1 was 3030ºC, and there were 559.2 millimeters of rain.

The quantitative results of the harvest were excellent. 252 plants of the yellow and brown varieties (about 40 grams of seeds) gave a harvest of 3.2 kg of seeds, thus an 80-fold yield. 504 plants of the black soya yielded 6.7 kg of seed. Per hectare, this was the equivalent of 3,888

kg of the yellow and brown varieties, and 3,333 kg of the black.

The qualitative results were also very favorable, in ways better than those of Prof. Haberlandt or the Attems seed station. The following table shows the composition of our 3 soybean varieties, based on analyses by the assistant, Mr. C. Portele, of our station. For example–Yellow: Specific weight: 1.279. Weight of 1 hectoliter: 76 kg. Weight of 1,000 seeds: 124.1 gm. Water 8.1%. Ash 5.4%. Nitrogenous materials: 36.8%. Fat 17.6%. Crude fiber 4.8%. The yellow variety contains an extraordinarily high level of protein.

In order to evaluate the suitability of the soybean *(der Sojabohne)* for use as food, we tried preparing them in various ways. We must confess that especially the yellow and brown varieties (but also the black after dehulling), were easily cooked and used whole or as a purée, with vinegar and oil as a salad, were extremely tasty, almost better than peas or lentils. The black variety with the hulls on gave a deep, dark sauce or gravy. We must note that long cooking is required before the beans become soft.

It is interesting to note that the soybean *(die Soja)*, and especially the brown variety, has long been known under the name "Coffee Bean" *(Kaffeebohne)* in South Tirol, and is cultivated here and there in small amounts, to be roasted for use as a coffee substitute. A table shows the composition of a locally grown soya "Coffee Bean" (38.1% protein).

These results show us that this plant allows itself to be acclimatized with many advantages, and that agronomic trials should be widely conducted, especially in our southern provinces. In terms of the soybean's composition, which in many ways approaches that of the best oilcakes *(Oelkuchen)*, it should be regarded as a concentrated feed *(Kraftfutter)*, especially for calves or heifers. Early in the coming year, we plan to expand our cultivation of soybeans, and we are ready to share a small quantity of soybean seeds with farmers who wish to make their own trials.

Note: This is the earliest document seen that contains the word *Wäermesumme* ("heat units"). Address: Director, Public Institute of Agriculture (landw. Landeslehranstalt) at St. Michele [on the Etsch river in Tirol, Austria].

19. Haberlandt, Friedrich. 1878. Ernteergebnisse der Sojabohne im Jahre 1877 [Results of soybean harvests in the year 1877]. *Wiener Landwirthschaftliche Zeitung* 28(2):13. Jan. 12. [Ger]
Address: Prof.

20. Caplan, C. 1878. Ueber die rauhhaarige Sojabohne (Soja hispida) [About the hirsute soybean (Soja hispida)]. *Oesterreichisches Landwirthschaftliches Wochenblatt* 4(3):26-27. Jan. 19. [1 ref. Ger]

• ***Summary:*** The author obtained his soybeans from Dr. J. Moser. The original soybeans came from Dr. Haberlandt in Austria. Address: Assistent an der k.k. landwirthschaftlich-chemischen Versuchsstation in Vienna.

21. Goethe, H. 1878. Anbauversuch mit Sojabohnen an der steiermaerkisch Landesobst- und Weinbauschule bei Marburg [Culture trials with soybeans at Steiermark provincial school for fruit and wine cultivation near Marburg (Letter to the editor)]. *Wiener Landwirthschaftliche Zeitung* 28(5):49. Feb. 2. [Ger]
• ***Summary:*** The organization received from Prof. Haberlandt in Vienna for its trial 100 seeds of the early ripening soybean, 50 gm (345 seeds) of the early ripening yellow soybean, and 50 gm (425 seeds) of the late ripening black soybean. Address: Director.

22. Thausing, Jul. 1878. Anbauversuch der Sojabohne am "Francisco Josephinum" in Moedling 1877 [Cultural trial with the soybean at the "Francisco Josephinum" in Moedling, 1877]. *Oesterreichisches Landwirthschaftliches Wochenblatt* 4(8):76-77. Feb. 23. [Ger]
• ***Summary:*** The Francisco Josephinum is an agricultural institute in Mödling, Lower Austria. The 200 yellow soybeans that were sent to Prof. Thausing from Prof. Haberlandt were divided among two parcels.

A. Some 140 seeds were planted on 22 May 1877 in a parcel of the experimental field, in rows about 50 cm apart; the seeds were drilled 6 inches deep. The soil of this field is a lime-rich loam (containing 20.14% lime). The subsoil is composed of dense, lime-free clay. The field was sloping slightly to the east; to the west it is protected by a ridge of hills. In 1876 this parcel was not manured and was planted to potatoes; the soybeans were fertilized with cow manure. On June 4 all the plants had broken ground, on June 15 they were hoed *(behackt)*, on July 2 soil was put on top *(behäufelt)*, and on July 12 again cleared of weeds. On July 22 the plants were in full bloom and on Sept. 6 the first pods were harvested.

B. At the Institute's garden, in a field that had been formerly dedicated to growing vegetables, 60 soybean seeds were planted (drilled) in a row. This garden soil is a rather rich is humus and lime / calcium, but it is not as heavy as the soil in the experiment field. The soybeans were not directly fertilized.

The seeds were planted on 22 May 1877, and on June 2 the plants had broken ground. On on June 15 and July 10 they were hoed; the plants were in bloom on July 2. From the middle until the end of August they gradually ripened and then were harvested.

In spite of having been watered often before germinating and during the vegetative phase, the plants did not develop as strongly as they did in the trial fields.

A table shows the shows the following weather conditions (according to reports from the local meteorological station) for the last week in May, June, July, and August, and the first week in September: Three temperatures in degree Celsius–Average maximum, average minimum, and overall average–and precipitation (in mm). July was by far the wettest and August was the warmest month.

During germination, from May 22 through June 2 and 4 respectively, the average temperature was 15.6 and 15.11 degrees Celsius, and precipitation was 0.6 mm.

Observations concerning the plants: Medium-strong plants at the time of flowering were 30 cm tall, whereas strong plants were 40 cm tall. The stems were strongly branched and showed up to 20 secondary or lateral axes. The foliage was unusually abundant. Stems and leaves, the latter especially on the underside, were extremely hairy. The blooming plants gave off a strong but pleasant aroma which, from the freshly dried plants, was especially intense.

Measurements taken on one of the medium well-developed plants in full bloom (on July 22) showed: Stem length 30 cm. Taproot length 29 cm. Fifty 3-inch leaves with a surface area of about 2,475 square cm. The root system of the soybean was very similar to that of the yellow lupine.

It is especially noteworthy that young soybeans are able to tolerate very well the hot, dry weather of the month of June, which clearly damages broad beans / horsebeans *(Pferdebohnen)*, peas, vetches *(Wicken)*, chick-peas *(Kichererbsen)*, lupines, etc. During that period the soybeans demonstrated a continually fresh, abundant appearance. There is no doubt that precipitation during the first half of June would have favorably influenced the growth of the height of the plants.

The soybean was not damaged at all by any of the insects, which have caused significant damage on these experimental fields every year and especially on legumes this year. Plant parasites were also not to be found on soybeans.

From the 200 seeds, a total of 1.3 liters weighing 1,065 gm was harvested. Without considering the fact that a new system of measurements was used, the weight of 100 liters of the soybeans planted here was 81.92 kg. Address: Prof., hoeh. landw. Lehranstalt, Moedling, Lower Austria *(Nieder-Oesterreich)*.

23. Lehmann, Julius. 1878. Ueber den Anbau der rauhhaarigen Sojabohne [On the culture of the hirsute soybean]. *Zeitschrift des Landwirthschaftlichen Vereins in Bayern* 68:61-64. Feb. [1 ref. Ger]

• ***Summary:*** For an English-language translation of this article, see: Cook, G.H. 1879. "The soja bean; a new forage plant." *Rutgers Scientific School (New Jersey), Annual Report* 15:54-58.

This document contains three analyses of soybeans by Schwackhöfer of Vienna; they were original seeds, seeds from the first harvest, and seeds from the second harvest–plus soybean straw. Address: Landwirtschaftliche Central-Versuchsstation fuer Bayern.

24. *Mittheilungen der Section fuer Acclimatisation des Landwirthschaftlichen Central-Vereins des Herzogthums Braunschweig.*1878. Die Soya-Bohne [The soybean]. 2(1):31-32. Feb. [1 ref. Ger]

• ***Summary:*** Note: Braunschweig (Engl. Brunswick) is a former duchy and capital city in north-central Germany, about 35 miles east of Hannover (Engl. Hanover), now part of Lower Saxony.

One cultural trial with the soybean was conducted by the head man *(Hauptmann)* C. Rambousek of Zborow [Austria]; his report follows: "The soybean *(Soyabohne)* seeds were of two varieties: Brown seeded (from China) and yellow seeded (from Mongolia); both came originally from the Vienna World Exposition *(Wiener Weltausstellung)* [of 1873]. On 2 May [1877] I obtained 60 brown and 60 yellow seeds of *Soya hispida*, which were planted immediately in rows spaced 40 cm apart, with 21 cm. between seeds in each row, in a sandy clay soil relatively rich in humus, over detritus / diluvium. The climate was quite wet.

"All the seeds sprouted, and the plants developed quickly and powerfully. Without needing any support, they grew to a height of 82 cm. Flowering began at the end of June and seemed to continue without end. The initial stage of seed-bearing is enormously rich, an often on branches there were 4-5 pods, with usually 2-3 seeds per pod. The seeds began to ripen in mid-September, and the plants were cut toward the end of October. They yielded 1,759 completely hard brown seed weighing 281 gm, and 2,805 yellow seeds weighing 536 gm. These seeds were the same size and color as those that were planted.

"Because of the high nutritional value of the seeds, as well as the high fodder value of the stems, I am convinced that this oilseed has a solid future as a forage plant."

25. Wrba, -. 1878. Anbauversuch mit der Sojabohne in Eibenschitz [Culture trials with soybeans in Eibenschitz]. *Wiener Landwirthschaftliche Zeitung* 28(10):111. March 9. [Ger]

• ***Summary:*** Early last year, the Agricultural College at Eibenschitz *(Eibenschitzer Ackerbauschule)* received from Prof. Haberlandt 300 soybean seeds, weighing 40.23 gm, for agronomic trials.

Note: According to a German gazetteer from the 1880s, Eibenschitz (also named Ewancice or Wancice) is a

town in Moravia, in the circle of Znaim, 12 miles west-southwest of Brno (German: Brünn or Bruenn), on the Iglawa (Jihlava) River at the confluence of the Ostawa (Oslava) River. As of 1994 it is located in the southeast Czech Republic, not far north of the border with Austria. Address: Director, Ackerbauschule, Eibenschitz (Eibenschitzer Ackerbauschule).

26. Boetticher, Emil. 1878. Culturversuch mit der Sojabohne auf erzherzoglichen Domaine Seelowitz [Culture trials with soybeans in the archducal domain of Seelowitz]. *Wiener Landwirthschaftliche Zeitung* 28(14):162-63. April 6. [Ger]

• ***Summary:*** The author planted 100 gm of soybeans on 9 April 1877.

Note: According to the *Columbia-Lippincott Gazetteer,* Seelowitz (formerly also spelled Selowitz) is the German name for a town in Moravia [in the Czech Republic as of Feb. 2005], currently known as Zidlochovice, and formerly (1898) also spelled Zidlockowice. Located on the Svratka River (spelled Zwittawa in 1880), about 11 miles south of Brno, it has a population of about 2,500. In 1849 Moravia (Czech = Morava, German = Mähren) became a separate crownland of Austria, with its capital at Brno. In 1918 it was organized as a province of Czechoslovakia. Address: Distriktsverwalter in Schabschitz, Domaine Seelowitz.

27. Hansel, Julius. 1878. Anbauversuche mit der Sojabohne an der Landes- Obst- und Weinbauschule bei Marburg [Agronomic trials with soybeans at the Agricultural, Fruit-Growing, and Wine-Growing School at Marburg]. *Steirische Landbote (Der) (Graz)* 11(8):60-62. April 11. [1 ref. Ger]

• ***Summary:*** This article was first published in the *Jahresbericht der steirmaerkischen Landes- Obst und Weinbauschule bei Marburg* for the school-year 1877-1878. Address: Assistant (Adjunkten), Marburg, Germany.

28. Wolfes, -. 1878. Mittheilungen vom Versuchsfelde der Ackerbauschule zu Dargun: Die Sojabohne [Reports from the experimental fields of Dargun Agricultural College, Mecklenburg, Germany: The soybean]. *Landwirthschaftliche Annallen des Mecklenburgischen Patriotischen Vereins* 17(16):127-28. April 19. New Series. [1 ref. Ger]

• ***Summary:*** With the numerous complaints from farmers that the peas in their fields were no longer flourishing, the reports from Professor Haberlandt in Vienna about the agronomic trials carried out by him with the soybean *(Soja hispida)* were absolutely of the greatest interest, particularly since with it the hope could be cherished that it very soon could and would supplant and in some way replace the field pea *(Felderbse = Pisum sativum arvense)* that is so unreliable in many locations. Upon my request made for that reason, through the kindness of Professor Haberlandt, I came into the possession of soybeans which I planted at this experimental field on May 9. The soil was humusy, sandy, rather damp loam with good resilience. All of the seeds sprouted very evenly and quickly, and the plants reached an average height of 1 to 1.25 meters. The first flowers appeared on August 11 and formed from 60 to 90 pods on every plant on which each had 2-3 beans. Since, however, the entire period from the end of July through the end of October was just a nearly uninterrupted rainy period during which the temperature remained significantly below the average that otherwise prevails here, the beans were only mature to a slight degree and had to be harvested in the middle of October whether mature or not. Even though the beans still after-ripened quite extraordinarily after the harvest, it is nevertheless not entirely possible to give details about the results of the harvest with the beans. With regard to the dried straw, the 50 plants yielded 2.57 kg which was eagerly eaten by both cows and sheep.

Professor Haberlandt makes the merits of cultivating each of the cultivated plants dependent upon the two questions: “Is the plant capable of achieving complete maturity in average years?” and “Are the products of the harvest of such a nature both quantitatively and qualitatively that its cultivation appears to be worthwhile?” At first glance, the results that have been achieved here with the cultivation of the soybean have turned out to be less than favorable. One must take into consideration, though, that with respect to the weather, the past year must in no way be considered normal but rather as abnormal to the highest degree. Both the pole beans *(Stangenbohnen)* and the bush beans *(Buschbohnen)* planted on the experimental field that otherwise mature in time every year also likewise did not achieve maturity this year. Moreover, an additional 140 agronomic trials that were experimenting with the soybean at other locations, some of which were located significantly further north, have provided a result that is very favorable in every respect. Thus, after the failure of this single agronomic trial, one may not pass judgment about the merits or demerits of the soybean for our area without taking into consideration the abnormal weather of last summer. If, through several years of trials, it should turn out that it achieves maturity with us in average years, then it would absolutely be of great value for our agriculture because, on the one hand, it promises to provide a very large yield in beans and straw, as mentioned above, and, on the other hand, the beans, just like the straw that is heartily eaten by cows and sheep, have an extremely high nutritional value, as can be gathered from the following analyses published by Professor Haberlandt.

Tables compare the nutritional composition (as percentages) of: (1) Peas and soybeans *(Sojasamen)*– including: Nitrogen-containing substances [protein] 23.18 vs. 34.37. Fat 1.85 vs. 18.25. Crude fiber 5.94 vs. 4.30. Ash

2.59 vs. 4.76. (2) Pea straw and soybean straw *(Sojabohnenstroh).* Proteins 7.56 vs. 9.43. Fat 2.17 vs. 2.51. Crude fiber 42.47 vs. 29.45. Ash 4.13 vs. 10.14.

Whether the soybean will incidentally be in the position to supplant and reduce our field pea, which we highly respect primarily as a previous crop to the winter rye, may appear to be more than doubtful since its maturation at the various locations experimenting with the agronomic trials fell between the middle of September and the end of October, that is, even in the most favorable case too late for the field to still be properly left to a winter rye.

Through the kindness of Professor Haberlandt, a large number of soybeans was recently sent to me for additional agronomic trials. I will cultivate these on our experimental field next summer and provide a report about the results in these pages at that time.*

* Footnote: After the report of Mr. Wolfes, an article by Prof. J. Lehmann in Munich about the significance of the soybean will follow in one of the next issues of the annals. Editor. Address: Vorsteher, Versuchsfeldes der Ackerbauschule zu Dargun in Mecklenburg, Germany.

29. *Landwirth (Der): Allgemeine Landwirthschaftliche Zeitung (Breslau).*1878. Die Sojabohne [The soybean]. 14(33):177-78. April 24. [Ger]

• ***Summary:*** A major article about the soybean, prompted by and summarizing the work and publications of Prof. Friederich Haberlandt, and the earlier work of the botanist Englebert Kaempfer.

30. Marouschek, F. 1878. Die rauhaarige Sojabohne *(Soja hispida)* [The hirsute soybean *(Soja hispida)]. Prager Landwirthschaftliches Wochenblatt* 9(17):181-82. April 27. [Ger]

• ***Summary:*** (Original) We farmers are especially flooded these days, both verbally and in writing, with a host of claims about the most varied sort of innovations and varieties of agricultural plants for cultivation, of which each is extolled as the “absolute most perfect” or “absolutely most profitable and most worth growing” (the most beautiful woodcut convinces us of that right away).

Seeds, tubers, and roots are then bought more often–a few kilos at an expensive price–and then planted in joyous hope. And wonder of wonders–they don’t come up! This makes us cautious. We then receive the exaggerated praise for the next novelties with reservation and with more apathy.

With regard to the value of the soybean *(Sojabohne)* though, and its desirable introduction as a plant for agricultural cultivation in Central Europe, numerous economists and shrewd experts have already expressed themselves. From many agronomic experiments, it may be established that the northern boundary of the soybean’s distribution ranges further than that of the corn plant.

The greatest contribution to the acclimatization of this early-maturing soybean *(Soja)* in Austria-Hungary is indisputably due to the researcher who is especially tireless and of great merit in the area of plant cultivation, Friedrich Haberlandt, Professor at Imperial-Royal College of Agriculture in Vienna *(k. k. Hochschule für Bodencultur in Wien).* In the spring of 1877, I received 200 seeds of yellow-seed soybeans sent by this gentleman.

Since correct analyses are available about the high nutritional value of the seeds and the straw and about the excellent fodder value of the green plant, which ought to allow this bean to take the top position among native legumes, the purpose of these lines shall only be to report about the agronomic trial carried out last year in Mnichovo Hradistì *(Kloster-Münchengrätz).*

On May 8, I planted 200 seeds of the soybean over an area of 13 square miles. The field occupied a sufficiently protected location without incline, and it consisted of alluvial soil with a permeable gravelly subsoil. Its capillarity was an advantage because of the proximity of a stream.

In 1876, the field had been planted with sugar beets [*Rübe*–generally called *Zuckerrübe],* and barn manure had been used for their fertilizer. During the winter, molasses residue was worked into the soil that was left in rough furrows.

The seeds began to break ground on May 24 and received their first cultivation on June 5 and second cultivation on July 16 without the soil being heaped up. Their formation and that of the pods were astonishingly large, the branching from the stalk was extremely abundant, and the average plant height was 60 cm. The plant thickness developed very densely and the planted area soon appeared covered with the plants standing upright. New shoots, new flowers, and new pods were constantly being formed, the soil was naturally completely shaded, and no weeds emerged. No damage to the plants from insects was ever observed.

Unfortunately, the frost on September 19 of -2.5ºC (-2ºR. = -2º *Réaumur)* caused considerable damage on many still immature pods and substantially affected the abundance of the leaves of the plants (which still had many delicate leaves).

The *Phaseolus* beans located on the adjoining plot were, however, more damaged by this frost and suffered far more with precisely the same soil conditions.

The harvest took place on October 4. In spite of significant consumption by mice, I received 2.5 kg of beans and 27 kg of straw. Losses as a result of the ripe beans falling out of the pods did not take place, nor was a bursting / shattering of the pods observed.

The straw, which was produced at a low level of quality because of the frost and subsequent rainy weather

and as a result of the prolonged drying over a frame, was eaten immediately by the livestock.

Since this experiment cannot be characterized as completely successful–in part as a result of the somewhat tardy planting and in part because of the calamities that have already been mentioned–although the beans that were produced possess their complete ability to germinate, I will repeat the cultivation experiment this year with the quantity that was gained *(erfechsneten* [sic] = *erfechteten?)* and will then take the liberty of reporting about the result at that time.

For the time being, though, the following conclusions may nevertheless be drawn from the experiment that was carried out:

1. The yellow-seed early-ripening soybean *(Soja)* reaches maturity with us under normal climactic conditions. 2. The soybean demonstrates a greater ability to resist frost than the runner bean *(Fisole).* 3. The soybean far surpasses other native legumes in the yield of both beans and straw. 4. The soybean has a soil-improving effect through fully shading the field and keeping it free of weeds *(Reinhaultung).* 5. The soybean requires a lower expenditure in seeds and cultivation costs. Kloster, March 10, 1878, Administrator Marouschek. Address: Kloster-Muenchengraetz, Bohemia (Boehmen).

31. *Gospodarski List (Farmer's Newspaper, Zagreb, Croatia).*1878. Socivica soja [Soy beans]. 26(9):65. May 1. [Cro]

• ***Summary:*** "Having reported about soybeans twice already, we had not known that a smart and diligent husbandman had already conducted his own soybean experiments in Croatia. Recently we received the following letter from Mr. [Dragutin] Strazimir of Zelina:

"'The esteemed editors mentioned and recommended in issue No. 8 of this newspaper the legume soybean, which has been grown due to its high yields and advantages. I conducted an experiment last year sowing this legume. After reading in the agricultural journal from Vienna the recommendation for soybeans, I asked the secretary of our agricultural society to provide me with some seeds for the trial. After I had received 19 seeds of each of the three varieties (yellow, brown, and black) I got the following results, indicating the plant's great productivity.

"'At the end of April I planted each variety separately in three test plots in the garden, at a sufficient distance from one another. In 10-14 days all the seeds germinated, except for one of the brown seeds and two of the black ones.

"'So final emergence resulted in plants from 19 yellow, 18 brown, and 17 black seeds. During the season, due to severe drought in two places, 2 yellow, 3 brown, and 3 black plants failed to develop, so there remained 17 plants from yellow soybeans, 15 from brown soybeans, and 14 from black soybeans. After I noticed the impact of drought on the development of the plants, I started irrigating up to the end of August–but not every day. Some plants were very vigorous and no pests were observed. On only one morning did I notice some leaflets being damaged by a parasite, which I could not find. On about September 25, all the plants were ripe and I got 2,527 healthy seeds weighing over 247 gm (actually weighing 14.125 *lots;* 1 lot = 17.5 gm) from 17 plants from the yellow soybeans, 1107 seeds weighing 157.5 gm from the brown soybeans, and seeds weighing about 100 gm from the 14 black soybeans (I forgot to count these seeds). The brown variety gave very large, healthy seeds, the yellow variety gave seeds with a lower test weight and some seeds were wrinkled, perhaps become some plants were lodging, but in general the seeds were well developed. The black variety gave oblong depressed seeds–I don't like this variety.

"'You can now calculate soybean yields on say a quarter or half of a *jutro* [an old unit of area; 1 *jutro* = 5,755 square meters]. This trial of mine indicates that the soybean has a future in our country, so it could be sown here with great success.* (Footnote: *"'I must mention that the plants in the southern part of my garden did not develop as vigorously due to drought and high temperatures. The 3 plants of each variety grown in the northern shady part of the garden yielded more than all the other plants in the southern part of the garden. If all plants had developed like those in the northern shady part of the garden, the yield might have doubled.)

"'I hoed my plants three times and, as already mentioned, I irrigated since the drought last year was too severe. This spring, I plan to sow all three varieties again, selecting the largest and healthiest seeds. After this first trial, I can recommend that everyone grow soybeans, especially the yellow and brown varieties. It has been reported that cattle like the soybean straw, but I did not manage to make a trial. So much for my first trial; maybe some will be able to make use of this report.'"

"We thank Mr. Strazimir for this letter, which is really a surprise, since it describes results which were not obtained in other trials in Europe. Prof. Haberlandt collected a lot of data about soybean trials and calculated that in Germany one seed yielded a mean of 34 seeds, and in Hungary 73 seeds, yet we may calculate that each of Mr. Strazimir's seeds in Croatia yielded over 140 seeds.

"In this way we are repeatedly pleased. Our society has succeeded in obtaining from Mr. Auchman enough soybean seeds, which will arrive in all society branch offices in at least 8 days. We may point out to everybody intending to grow soybeans that they should be planted as single seeds, and whoever does not plant but sows them will have to thin the plants after emergence and replant double plants, since replanting could be successful. The soils

should not be heavy and cold, but they should be inclined toward the sun; in other respects soybeans are not demanding." Translated by Dr. Joze Spanring of Ljubljana, Slovenia. Address: Zagreb (Zelina), Croatia.

32. *Wiener Landwirthschaftliche Zeitung.*1878. Professor Friedrich Haberlandt [Obituary: Prof. Friedrich Haberlandt]. 28(18):211-12. May 4. [Ger]

33. Lehmann, Julius. 1878. Ueber den Anbau der rauhhaarigen Sojabohne [On the culture of the hirsute soybean]. *Landwirthschaftliche Annallen des Mecklenburgischen Patriotischen Vereins* 17(23):182-84. June 7. New Series. Reprinted from Zeitschrift des landwirthschaftlichen Vereins in Bayern. [3 ref. Ger] Address: Professor, Munich, Germany.

34. Dreisch, Dr. 1878. Proskauer Anbauversuche [Culture trials in Proskau]. *Landwirth (Der): Allgemeine Landwirthschaftliche Zeitung (Breslau)* 14(48):263. June 15. [Ger]

• ***Summary:*** Near the top of column 1 of this article we read that one variety of soybean was cultivated at Proskau in 1877. Near the top of the middle column, we read: "The soybean *(Die Sojabohne)* seems to have no future for northeastern Germany. In any case, it is not a plant that is sure to bear fruit. Planted at the beginning of May, the plants first broke ground on May 22, had already bloomed by the end of August, but the seeds did not ripen on either light or heavy soil. Despite the good start, only 0.410 kg of unripe seeds were harvested from about 40 plants. Nevertheless, the trials shall be continued using these seeds."

Dreisch is from the Landwirtschaftlichen Akademie Proskau, which is now in Poland, and called Proszkow. Proskau is a market town in Prussia, in Silesia, 7 miles southwest of Oppeln (now Opole), in southwest Poland at north latitude 50º40'. This is further north than any point in the continental USA, and even a bit north of Winnipeg, Manitoba, Canada.

Note: This journal was published by the Landwirthschaftlicher Centralverein für Schlesien in Breslau, which is now Wroclaw, a province in southwest Poland; before 1945 it was Lower Silesia in Germany. Address: Landwirtschaftlichen Akademie Proskau, Schlesien.

35. Haberlandt, Friedrich; Kaudelka, C.; Rauch, A.; et al. 1878. Weitere Mittheilungen ueber Anbauversuche mit der rauhaarigen Sojabohne (Soja hispida) und deren Erfolge [Further communications on culture trials with the hirsute soybean (Soja hispida) and its successes]. *Biedermann's Central-Blatt fuer Agrikulturchemie* 7:594-610. Aug. [20 ref. Ger]

• ***Summary:*** This is a summary of various reports on soybean cultivation in central Europe during the past 2 years. Friedrich Haberlandt obtained soybeans at the World Exposition at Vienna. He first conducted his own agronomic trials in Vienna and grew out a fairly large quantity of seeds. Then he sent samples of soybean seeds to many other agriculturists in Central Europe, who also tested the seeds. Each of the men whose names are listed below is also listed below the title of this article as a co-author.

"In Therasburg in Lower Austria *(Niederösterreich),* the farmer [Oekonom] Kaudelka harvested from 300 yellow soybeans 3.8 kg of seeds and 11 kg of leaves and stems.

"In Osterburg in Lower Austria, the tenant farmer *(Gutspächter)* C. Rauch harvested from 200 yellow soybeans 3 kg of seeds, and from 200 brownish-red soybeans 5.4 kg of seeds.

"In Muenchendorf in Lower Austria the clergyman *(Pfarrer)* Richl harvested from 100 yellow soybeans 2.38 kg of seeds.

"In Eibenschitz in Moravia (Mähren) [in the Czech Republic as of Jan. 1993], the agricultural school director Wrba harvested from 300 yellow soybeans 3.045 kg of seeds (see also p. 604).

"In Kwassitz in Moravia, Emanuel Ritter von Proskowetz obtained from 700 yellow soybeans 6.75 kg of seeds and 11.5 kg of straw.

"In Rabensburg in Moravia, the Principality of Liechtenstein's estate management *(fürstl. Liechtenstein'sche Gutsverwaltung)* obtained from 700 soybeans not less than 41.6 kg seeds and 30 kg chaff and straw. Note: This is the earliest document seen concerning soybeans in connection with (but not yet in) Liechtenstein. As of 1994 Rabensburg would be in central Czechoslovakia, more than 240 miles northeast of Liechtenstein.

"In Kloster-Münchengrätz in Bömen [Bohemia; in the Czech Republic as of Jan. 1993], the farmer F. Marousek harvested from 200 yellow soybeans 2.5 kg of seeds.

"In Chrudim in Bömen the agricultural school director Eckert obtained from 200 soybeans, 1.75 kg of seeds.

"In Zubeza bei Lemberg in Galicia (Galizien), the forester Praun *(Förster Praun)* harvested from 50 yellow soybeans 0.54 kg of seeds, and from 50 brownish-red soybeans 0.57 kg of seeds.

"In Luka czestie [Lukaczestie] in Bukovina [Bukowina or Bucovina, a former Austrian crownland, now divided between the Ukraine and Romania], the landowner Kl. Botkouski obtained from 160 yellow soybeans 1.36 kg of seeds (p. 596). Note: Lukaczestie is a village in today's (2005) Romania, 16.5 km east of Gura Humorului. Note: This is the earliest document seen (March 2005) concerning

soybeans in Romania, or the cultivation of soybeans in Romania. This document contains the earliest date seen for soybeans in Romania, or the cultivation of soybeans in Romania (1878). The source of these soybeans was Friedrich Haberlandt at the Royal College of Agriculture *(Hochschule für Bodencultur)* in Vienna, Austria.

"In Ritzlhof in Upper Austria *(Ober-Oesterreich)*, the agricultural school obtained from 100 soybeans 0.8 kg of seeds.

"In Salzburg, k.k. *[kaiserlich-königliche]* Major von Kempf harvested from 50 soybeans not less than 1.978 kg of seeds.

"In Planta bei Meran in South Tirol *(Südtirol)*, Hauptmann Erttel obtained from 100 yellow soybeans 1.886 kg of seeds, from 100 brownish-red soybeans 2.003 kg of seeds, and from 100 black-seeded soybeans 2.240 kg seeds.

"In St. Michele in South Tirol *(Südtirol)*, the director of the agricultural school *(landw. Lehranstalt)* Dr. E. Mach obtained from 252 plants grown from yellow and brownish-red soybeans 3.9 kg of seeds, and from 504 plants grown from black soybeans 6.7 kg of seeds.

"In St. Johann bei Pettau in Steiermark, Hans Graf Haller harvested from 50 yellow and 50 brownish-red soybeans not less than 2 kg of seeds.

"In Marburg in Steiermark, the Fruit- and Wine-Growing School *(Obst- und Weinbauschule)* harvested from 345 yellow soybeans 3.2 kg of seeds and from 100 brownish-red soybeans 1.25 kg of seeds.

"In Friesach in Kaernthen (Kaernten or Kärnten) [also called Carinthia], the mayor *(Bürgermeister)* Fiala obtained from 300 yellow soybeans 1.75 kg of seeds– despite the fact that he planted them at 2,012 meters above sea level (versus the typical 700 meters) and the half-ripe standing crops were covered with snow.

"In Klagenfurt [in 1992 the capital of Carinthia in Austria near the Yugoslav border], C. Schütz, secretary of the agricultural society *(Landwirthschaftsgesellschaft)* obtained from 20 soybeans 1 kg of seed.

"In Capro d'Istria [Capodistria, called Koper in 1992] in Istria (Istrien; in Slovenia in late 1992), the intermediate school teacher *(Hauptschullehrer)* Kristan harvested from 100 yellow soybeans 0.835 kg of seeds, from 100 brownish-red soybeans 2.00 kg of seeds, and from 100 black soybeans 3.21 kg of seeds. On single plants he counted 200 to 300 pods containing ripe seeds and another 100 to 400 empty pods.

"In Rubbia near Gorizia (Rubbia bei Görz; in 1992 a province in Italy or the capital city of the commune Gorizia on the Isonzo River in Italy near the border with Yugoslavia), Freiherr von Bianchi harvested from 50 gm of black soybeans 7.9 kg of seeds, etc.

"Haberlandt also reported on the favorable results of soybean trials in Hungary and Germany, as follows.

"In the Neograder Comitat in Hungary, Eugen, Freiherr von Nyári, obtained *(erbaute)* from 16 square meters of land not less than 15 liters of soybean seeds, which would be equivalent to the amazing yield of 9,400 liters (94 Hektoliter) per hectare.

"In Schlanz, in the administrative districts of Breslau *(Regierungsbezirke Breslau)*, Dotzauer obtained from only 4 soybeans, which weighed 0.2 gm and which he planted after May 20, 136 gm of soybeans, two-thirds of which were twice as large as the seeds he planted; that is to say, if the harvested seeds had been the same size as those planted, he would have harvested 2,720 seeds.

There follows a report on soybean trials from Franz Schollmayer, Administrator of the experimental farm at Laibach [Ljubljana] in Austria [since 1991 the capital of Slovenia].

Then another report from the Count *(Graf)* H. Attems Vegetable and Seed Multiplication Station *(Gräfl. H. Attems'schen Gemüsebau- und Samenkulturstation)* at St. Peter by Graz [Graz is the capital of Styria, Austria, on the left bank of the Mur River, 87 miles south-southwest of Vienna]. This report includes information from Mr. Pittoni in Gorizia (Görz).

Then comes a predominantly chemical-analytical report from C. Caplan, an assistant working under the direction of Prof. J. Moser at the Royal Chemical Research Station in Vienna *(k.k. chemischen Versuchsstation in Wien)*.

E. Mach at St. Michel in Tirol (mentioned above), received yellow, brown, and black soybean varieties in early 1877 from Prof. Haberlandt. These seeds, weighing about 200 gm, were grown out by a teacher *(Lehrer)* named Samek. The results were very favorable: 252 plants of the brown and yellow varieties (from about 40 gm of seeds) yielded about 3.2 kg of seeds (an 80-fold return), and 524 plants from black soybeans yielded 6.7 kg of seeds. The respective yields were 3,888 kg/ha for the brown and yellow varieties and 3,333 kg/ha for the black. A table by K. Portele gives a a nutritional analysis of these seeds and the weight of 1,000 seeds. The brown seeds were the largest (1,000 weighed 179.1 gm), and the black seeds the smallest (1,000 weighed 106.2 gm). In Tirol the soybean is called the Coffee Bean *(Kaffebohne)* and used to prepare a coffee substitute. [Question: When, how, and from where did these soybeans arrive in Tirol?]

In 1877 soybean trials were conducted at the steiermärkischen Landesobst- und Weinbauschule at Marburg. Two excellent reports summarized the results of these trials, a lengthy one by Julius Hansel, an assistant, and a shorter one by H. Göthe [Goethe], the director (p. 603).

Emil Bötticher, district administrator in Schabschitz, reported on soybean trials in the archducal domain of Seelowitz (p. 605).

Rambousek, the head man *(Hauptmann)* at Zborow in Austria (Oesterreich), reported on the results of his trials,

as did administrator Marousek in Kloster Münchengrätz in Böhmen, and Wolfes, head of the experimental fields at the agricultural school at Dargun in Mecklenburg.

And an excellent, detailed report was submitted by Dr. Eugen Wild [sic, Wildt], director of the agricultural experiment station at Posen (p. 608-09).

Finally, a report on unfavorable results with soybeans was submitted by Dr. Dreisch, who conducted trials in 1877 at the agricultural academy of Proskau in Schlesien (p. 609). Address: 1. Vienna, Austria.

36. Wein, Ernst. 1878. Ueber den Anbau der rauhhaarigen Sojabohne in Bayern. I. Ernteresultate der auf der Versuchstation angestellten Culturversuche [On the cultivation of the hairy soja bean in Bavaria. I. Harvest results from culture trials in agricultural experiment stations]. *Zeitschrift des Landwirthschaftlichen Vereins in Bayern* 68:469-74. Dec. [Ger]

• ***Summary:*** Professor Haberlandt, who died earlier this year in Vienna, had successes with acclimatization trials using the hairy/hirsute soybean in the various crownlands of the Austrian-Hungarian monarchy. These became the stimulus for the cultural trials with this plant conducted by Prof. Dr. J. Lehmann in all the administrative districts of the Kingdom of Bavaria. Some 69 farmers took part in these trials and most of them reported their results.

Here the writer would like to report the results of the cultural trials conducted at the experiment station. Most of the seeds for these trials came from the Austrian trials, but a small portion were original seeds from Japan. Planting took place on April 30, with 10 seeds planted 3 cm deep per square meter. These were transplanted into 21 square meters of humus-rich soil in the garden. Two varieties of seeds were planted, one light-yellow (white) and one brown. These were of various sizes, so each variety was divided into small and large seeds. On parcel I were planted 720 small yellow (white) seeds weighing 94.7 gm. On parcel II were planted 560 large yellow seeds weighing 93 gm. On parcel III were planted 420 small brown seeds weighing 47.9 gm. On parcel IV were planted 412 large brown seeds weighing 75.5 gm. On parcel V were planted 500 yellow original seeds weighing 69.2 gm. The plants broke ground (emerged) on May 6. Flowering on the first 4 parcels lasted from July 24 to Aug. 4, which the 5th parcel first bloomed in October. The plants developed slowly at first due to the cold, moist weather, but later they developed and grew well.

The average temperature from May 1 to Oct. 1 was 16ºC. The plants showed early on that they had been planted too densely. Results of the harvest are given for each parcel. For example: Parcel I. Small yellow variety. Date of harvest: Oct. 17. Number of plants harvested: 629 (629 seeds weighed 82.7 gm). Number of seeds harvested: 23,498. Average number of seeds per plant: 37. Weight of the seeds: 2,758 gm. Weight of the pods: 1,212 gm. Weight of the straw 9,142 gm. Total weight harvested: 13,112 gm. One thousand seeds weighed 117 gm.

A table (p. 473) shows the main figures for parcels I-IV. Parcel IV gave the best results, yielding 49,429 seeds which weighed 6,846 gm, etc.

Note: In 1878 the Kingdom of Bavaria was ruled by Ludwig II (lived 1845-1886; reigned 1864-1886), who built the beautiful fairy-tale castle Neuschwanstein, was close friends with Richard Wagner, and was declared mad and deposed in 1886. Address: Dr., Central Agricultural Experiment Station, Bavaria, Germany.

37. Wildt, Eugen. 1878. [Culture trials with soybeans?]. *Landwirthschaftliches Centralblatt fuer Posen* 6(25):119. [Ger]*

• ***Summary:*** Meagan says this periodical started in 1887, yet Haberlandt cited it in 1878! Address: Dirigenten, landwirtschaftlichen Versuchsstation, Posen, Germany.

38. Haberlandt, Friedrich. 1878. Die Sojabohne: Ergebnisse der Studien und Versuche ueber die Anbauwuerdigkeit dieser neu einzufuehrenden Culturpflanze [The soybean: Results of studies and trials on the potential for growing this newly introduced crop plant]. Vienna, Austria-Hungary: Carl Gerold's Sohn. ii + 119 p. 28 cm. [30 ref. Ger]

• ***Summary:*** This is the first book about soybeans written in the western world. An extremely important, classic work, it discusses the introduction of soybeans to Europe, by many cooperators.

Contents: Foreword. Part 1 (p. 1-15). Introduction: The possibility of increasing the number of our cultivated plants from the legume family. Prospects opened to us by the cultivation of soybeans. Previous soybean agronomic trials in Hohenheim, Bamberg (by Dr. A. Rauch using seeds from Japan supplied by Siebold), Hainsberg-Deuben in Saxony *(Sachsen)* (by Carl Berndt, a velvet manufacturer), and Coswig bei Messen (in 1872) in Germany. Acclimatization of the soybean in France. Sporadic, heretofore unnoticed occurrences of soybeans in South Tirol (also spelled Tyrol), Istria (or Istrian Peninsula; now in Slovenia), Dalmatia [now mostly in Croatia; see Note below], and Italy. The collection of soybeans, obtained at the Vienna World Exposition *(Wiener Weltausstellung)* of 1873 from China, Japan, Mongolia, Transcaucasia, and Tunis [North Africa], and their use in wider agronomic trials. Enumeration of authors who have cited *(anführen)* the soybean under different names and planned for its dissemination. Characteristics of the soybean plant. Description of the seeds and their anatomical structure. Their high nutritional value in comparison with ordinary legumes. Their use in Japan, according to Kaempfer. Obtaining oil and cake from the soybean.

Part 2. Agronomic trials in the years 1875 and 1876 (p. 16-35; see Document part for details). Source of the

supply of the various soybean varieties used in the original trials. Trials at the Royal College of Agriculture *(Hochschule für Bodencultur)* in Vienna in 1875. Results from 1876 from Hungarian Altenburg and Gross-Becskerek in Hungary, in St. Peter bei Graz in Steiermark [Styria], in Napagedl in Mähren [Moravia; in the Czech Republic as of Jan. 1993], in Sichrow, Swijan, Darenic, Tetschen-Liebwerd in Böhmen [Bohemia], in Bukowina [Bukovina or Bucovina, a former Austrian crownland, as of 1994 divided among the Ukraine and Romania], in Proskau [now Proszkow in today's Poland] in Preussisch-Schlesien [Prussian Silesia], and in the experimental garden at the Royal School of Agriculture. Comparison of the resulting seeds with the original seeds. Chemical analysis of the seeds and straw. Evidence of the "heat units" (Wärmesummen; "warm temperature summation" or "warm sum," similar to U.S. maturity groups) which the soybean was able to use for their development in Vienna, St. Peter, Tetschen-Liebwerd, and Proskau.

Part 3. Agronomic trials in the year 1877 (p. 36-86). Results of the soybean agronomic trials in Austria-Hungary, Germany, etc. in 1877. Extracts from 14 reports of various trial locations in lower Austria, and 11 trial locations in Mähren [Moravia]. Extracts from 19 reports from Bohemia, 10 from Austrian Silesia (Oesterr.-Schlesien), Galizien [Galicia; a former Austrian crownland; after World War II the western half was made part of Poland and the eastern half was made part of the Ukranian S.S.R. in the Soviet Union], Bukowina, and Russian-Poland, 6 reports from upper Austria, Salzburg, and Tirol, 11 reports from Steiermark, Krain [Carniola; now mostly in Slovenia], and Kärnthen [Kaernten or Carinthia, an Austrian crownland; now a state of southern Austria, bordering on Italy and Yugoslavia], 12 from Istria, Dalmatia, and the Grafschaft [county and earldom] of Görz, 40 from Hungary and Croatia [formerly part of Yugoslavia], 23 from Germany, 1 from Switzerland, and 1 from Holland.

Part 4 (p. 87-113). Comparison of the value of the three different colors of soybeans (yellow, reddish-brown, and black) used in the trials. Time of planting. Ability of hydrated seeds to withstand freezing. Width of planting. Condition and care of the soil. Requirements for light and warmth. Need for moisture. Time that the harvests took place and general remarks on the weather in 1877. The quantity of planted and harvested soybeans in 1877 and the yields. Animals [incl. insects, especially the so-called Drahtwurm, the larva of *Agriotes segetis]* and parasites that damage soybeans. Chemical composition of the soybeans [by Dr. Mach and asst. Portele in S. Michele {South Tirol}, and by Caplan in Vienna]. Feeding trials with the straw and preparation of the seeds as a food for humans. Retrospective and conclusion.

Note 1. Austria-Hungary is a former "dual monarchy" in central Europe formed in 1867. It included what is now Austria and Hungary, Bohemia, Moravia, Bukovina, Transylvania [now in northwestern and central Romania], Carniola, Kustenland, Dalmatia, Croatia, Fiume [later named Rijeka in Croatia], and Galicia. After the treaty of Berlin in 1878, it administered the Turkish provinces of Bosnia and Herzegovina, which it annexed in 1908. It was a member of the triple alliance with Germany and Italy from 1882 to 1914. It collapsed as a result of defeat in World War I. In 1918 it was divided into many independent republics, including Austria, Hungary, and Czechoslovakia.

Note 2. Dalmatia, a former Austrian crownland, is a region on the Adriatic Sea, largely in today's Croatia. It extends from Zadar on the north to near the border of Montenegro, and contains a small southern portion of Bosnia and Herzegovina (Jan. 1993). It is mountainous and contains many island and good harbors.

Note 3. Carniola (German: Krain) is a region that lies in today's Slovenia. The chief town is Ljubljana. It is bounded on the west by the Julian Alps and on the northwest by east end of the Carnic Alps. It was a duchy of Austria until 1849, then an Austrian crownland from 1849 to 1918. It was divided after World War I with 80% of the area going to Yugoslavia and 20% going to Italy. A 1947 treaty placed it entirely within Yugoslavia.

Note 4. This document contains the earliest date seen for soybeans in Hungary, or the cultivation of soybeans in Hungary (April 1876) (one of two documents). The source of these soybeans was Prof. Friedrich Haberlandt in Vienna.

Note 5. Details on parts I and IV are given in separate 1878 "Document Part" records in this database.

Note 6. This is the earliest document seen that contains the word *Wärmesummen* ("heat units").

Note 7. This book, surprisingly and unfortunately, contains no illustrations.

Note 8. A portrait of Dr. Haberlandt (oil painting) is owned by the University of Mosomagyarovar in Hungary. Soyfoods Center owns a black-and-white photo of the painting.

Note 9. The Vienna World Exposition opened on 1 May 1873 and closed on 1 November 1873. So it lasted for 6 months. Address: Hochschule fuer Bodencultur, Vienna, Austria.

39. Haberlandt, Friedrich. 1878. Erste Abtheilung [Part 1, pages 4-6 (Document part)]. In: F. Haberlandt. 1878. Die Sojabohne [The Soybean]. Vienna: Carl Gerold's Sohn. ii + 119 p. [4 ref. Ger]

• ***Summary:*** Page 4 begins: "Even though the soybean has already found its way to Europe several times, attempts to cultivate it have failed completely because the seeds were from Japan, southern parts of China, and from India. Consequently they were late-ripening seeds. Many years ago attempts were made to grow *Soja hispida* in Hohenheim [Germany], but the plants were barely brought to a blooming state. People also had the same experience in other places. Dr. A. Rauch of Bamberg [Germany] (see *Die Fundgrube von Dr. A. Rauch. III. Jahrgang. Bamberg* 1876), on several occasions, received seeds of various soybean varieties from Japan from his long-time friend, Colonel *(Oberst)* [Philipp Franz] von Siebold, who died at an early age. But every trial by Dr. Rauch was unsuccessful. The plants came up and some even blossomed, but the blooming happened so late in the year (starting in September) that it was unthinkable that the seeds would ripen fully.

"Mr. Carl Berndt, who owned a silk factory at Hainsberg-Deuben in Saxony was also one of the first to conduct agronomic trials *(Anbauversuche)* with soybeans in Germany. He had no success. He wrote to me about it as follows: 'I had received 8 piculs of those beans [Note: a picul is a Chinese unit of weight = 133.33 pounds] (some green and some yellow), which I obtained through an official order of Governor *(des Minister-Präsidenten)* Dr. Weinlich of Shanghai via our local consul. I sent samples of those all over with the request that the recipient inform me of the results of his agronomic trials. Unfortunately I have waited in vain and I assume that the outcome was as unfavorable as it had been in my case and in my neighborhood. Although some gardeners and I managed to raise a few plants and harvest a few seeds, they rotted after being replanted and therefore could not germinate.'

"One type of soybean that requires warmer weather must have been the one which was introduced to France by M. de Montigny from China. In France it is called oil pea *(pois oléagineux)* and is cultivated at several locations in the districts of Ariège and Haut-Garonne. It is said to have the capacity for rapid growth and resistance to drought*. (Footnote: *Gustav Heuzé: "Les plantes alimentaires." Paris, p. 382, vol. 2).

"During the last German-French war [Franco-Prussian War, 1870-72, France lost], Otto Wehrman, captain in the artillery, found one of those acclimated soybeans in the botanical garden of Montigny near Metz. He liked the plant and took four or five seeds back home. On his estate in Coswig near Meissen he conducted an agronomic trial in 1872 and harvested 80-100 seeds in the fall. He wrote me that in the year 1873 he did the planting sooner, around mid-April, and obtained a fairly decent harvest. In the year 1874 he discontinued the cultivation because he had no use for the harvested beans. Meanwhile, his neighbors became interested in the soybean, so he decided to start growing the plant again in 1875. He harvested 3 liters of seed, which he replanted in April 1876. As a result of the long drought that year, the plants became stunted and the majority of pods had not yet full ripened when early frosts set in and destroyed the crop completely. The quantity of seeds harvested was smaller than that sowed. Its quality was far worse, which caused Wehrman to give up further trials with this variety of soybean.

"Even though the soybean has already spread here and there in the south of Austria, it still hasn't become known in broader circles. Thus, last summer, Dr. E. Mach, director of the agricultural academy *(Lehranstalt)* in South Tyrol [Tirol], sent me a sample of a plant which was supposed to be already long known in that area, and it was none other than a soybean plant. In that area it is called 'coffee bean' *(Kaffeebohne)* and its seeds are used for the preparation a coffee substitute *(Kaffesurrogat)*. Likewise, Mr. Josef Kristan, teacher in a primary school in the Istrian Peninsula *(Capodistria in Istrien)*, reported to me that he had discovered that the soybean could already be found in Istria and its seeds are used as a coffee substitute. A friend of his assured him that there wasn't any difference between these and real coffee. He also received several seeds from Albona [named Labin as of 1988; a commune in western Croatia, on the Istrian Peninsula, 21 miles northeast of Pula], where people grow it from time to time in their gardens without knowing its value. Acquaintances of his stated as well that they had seen the same plant in Dalmatia and in southern Italy. All of the above information only came to my attention after I had been conducting soybean

agronomic trials for two years. I had been in correspondence with the authorities mentioned above in order to send them small samples so that agronomic trials could be continued at other locations as well.

"The soybeans which I had used in my first tests in 1875 had been acquired at the Vienna World Exposition in 1873, and were in part from Japan and China, and in part from Mongolia, Transcaucasia, and Tunis [later renamed Tunisia]. There were, in total, no less than 20 varieties *(Sorten)* as follows (table): Five yellow-seeded, three black-seeded, three green-seeded, and two brownish-red-seeded varieties from China. One yellow-seeded and three black-seeded varieties from Japan. One black-seeded variety from Trans-Caucasia. And one green-seeded variety from Tunis.

"During the first year of trial (1875) it had already become apparent that among those were several types that could be recommend for further agronomic trials because they ripened early. Among these were yellow-seeded varieties from both Mongolia and China, and a reddish-brown variety from China. One black variety each from China, Japan, and Transcaucasia ripened poorly. The remaining varieties either didn't bloom at all or only started to bloom in the late fall. Still others developed only a small number of unripe or poorly ripened pods with stunted grains that couldn't germinate."

Note: This is the earliest document seen (March 2004) concerning soybeans in Tunis (Tunisia). This document contains the earliest date seen for soybeans in Tunisia (1873). The source of these soybeans in unknown. Address: Hochschule fuer Bodencultur, Vienna, Austria.

40. Haberlandt, Friedrich. 1878. Erste Abtheilung [Part 1, pages 6-7 (Document part)]. In: F. Haberlandt. 1878. Die Sojabohne [The Soybean]. Vienna: Carl Gerold's Sohn. ii + 119 p. [4 ref. Ger]

• ***Summary:*** "Different authors have given the soybean many different names. It gets its most extensive and earliest recognition in the famous work of Kaempfer, *Amoenitatum exoticarum politico-physico-medicarum,* which comprises 5 volumes and was published in 1712 in Lemgo [Germany, in today's North Rhine-Westphalia]. The work includes a detailed description of Kaempfer's travels in Persia and Central Asia. He calls the soybean by that vernacular name "Daidzu" or "Mame," a name still common today in Japan, which means legumes, so called because of its superiority. He describes it as an upright type of bean with pods that resemble those of the lupine and a white seed like larger peas: 'Four feet long but more luxuriant or lush *(üppiger)* than *Phaseolus,* it winds straight up with its many-branched, unevenly round and rough stem. The leaves look like those of the green bean except that the underside is more bristly. The small flowers, somewhat gathered on short stems, bloom in August. They are bluish-white, small, and similar to the lentil, with a straight flag and barely spread wings *(mit gerader Fahne and kaum ausgebreiteten Fluegeln).* The stems that bear the abundant pods are long and bristly, similar to the pods of the lupine. They contain 2 or sometimes 3 seeds and resemble in shape, size, and taste the garden pea. But they are somewhat compressed with a protruding hilum *(Nabel).*

Linné [Linnaeus] chose for this legume the name *Glycine Soja.* In his *Icones plantarum rariorum,* N.J. Jaquin [Jacquin] gives its name as *Dolichos Soja* and gives an illustration, which however is inferior to the one by Kaempfer. Dr. Ph. von Siebold and Dr. J. Zuccarini cite it in their *Florae Japonicae familiae naturalis* (vol. 4, part 2, 1846) as *Glycine Soja.* Other than that, it can be found as *Soja japonica, Savi.* and *Soja hispida, Mönch.*

"De Candolle, in his *Prodromus syst. nat.,* notes that the soybean is distributed across Japan, South India *(Süden Indiens)* [sic, East Indies, *India orient],* and on the Moluccas. Franchet and Savatier state in their *Enumeratio plantarum in Japonia sponte crescentium,* p. 108, that it grows in the mountainous regions of Kyushu [Japan's southernmost main island], the valleys of Kawara, the Janca? mountains, near Nagasaki. Maximovicz [Maximowicz, Maksimovich] mentions in his *Primitiae florae Amurensis,* page 47, that it is cultivated along the upper Amur River, near Aicho, where it covers entire fields. Ditmar found it on 19 July 1856 in Ana [Aua] on the Ussuri River, and in Chinese gardens in bloom on 10 Aug. 1855. Roxburgh pays respect to the soybean in his *Flora indica* and mentions its occurrence in the Moluccas." Address: Hochschule fuer Bodencultur, Vienna, Austria.

41. Haberlandt, Friedrich. 1878. Erste Abtheilung [Part 1, pages 10-15 (Document part)]. In: F. Haberlandt. 1878. Die Sojabohne [The Soybean]. Vienna: Carl Gerold's Sohn. ii + 119 p. [4 ref. Ger]

• ***Summary:*** "The value of soybeans results from their high content of the most important nutrients. The first analysis that made the composition of these seeds known in Germany was carried out by [Mr.] Senff using seeds obtained directly from Japan by Mr. [Carl] Berndt. The results of this analysis* (Footnote: *See the journal *Chemischer Ackersmann* ("Chemical Farmer") 1872, p. 123) showed that 100 parts of air-dried soybeans have the following composition:" A table (p. 11) based on two samples and their average shows: Water 6.91%, protein 38.29%, oil *(Fett)* 18.71%, nitrogen-free extract 26.20%, crude fiber 5.33%, and ash (minerals) 4.56%.

A second table (p. 11) which compares the nutritional composition of soybeans, common beans *(Fisole),* peas, lentils, fava beans *(Pferdebohne = Vicia faba* = "horse beans") and yellow lupins, shows that soybeans have a much higher content of protein (38.29%, followed yellow lupins at 35.32%), oil (18.71% followed by yellow

lupins at 4.97%), and ash (minerals, 4.56%, followed by yellow lupins at 3.78%).

"There are few statements in the pertinent literature concerning soybean utilization. But there is no doubt that, in their native countries, they have heretofore been used exclusively as foods. In *Synopsis der Pflanzenkunde* ("Synopsis of Experience with Plant Culture;" 1877, Hannover, Vol 2, p. 413), Dr. Johannes Leunis says that soybeans taste good and are also used to make a thick brown sauce, which is added to almost all foods in India, China, and Japan, and is also an article of commerce in Europe, used to improve sauces and gravies. However the sauce now available in Germany is said to be made of other ingredients rather than soybeans, namely mushrooms. From England, where this soy sauce is imported from India by the firm Grosse [sic, Crosse] & Blackwell in London, its use is spreading to the continent and is available in Vienna. Kaempfer, who describes the soybean plant so excellently in the classic work on his travels, also gives detailed information about its use as foods in Japan, which has since appeared in numerous other writings, such as Oken's *Allgemeine Naturgeschichte aller Stande* ("General Natural History of All Places") [1841] vol. III, part 3, page 1661."

Haberlandt then quotes in their entirety Kaempfer's descriptions of miso and soy sauce (about 200 words each). He also indicates a vague knowledge of tofu.

"It is reported that in China a type of food is made from the oilcakes or perhaps from soybeans directly, that superficially resembles a soft cheese or Quark (a European white unfermented cheese; *nach dem weichen Käse oder dem Quark ähnliche Speise machen)* presumably the original mush is subjected to a fermentation process and then mixed with pepper and other spices. A large part of China's population is said to use this staple food." Note 1. This is also the earliest German-language document seen (Feb. 2004) that uses the word "Quark" in connection with tofu.

He goes on to describe the chemical composition and uses of the oil presscake in China.

Page 14: "Since the oil content *(Oelgehalt)* of the soybean is lower than that of other oilseeds, it must be assumed in advance that its application for the production of oil *(Oelgewinnung)* must be disregarded. This also became evident through a test which Mr. Carl Berndt conducted on the rest of the soybeans that hadn't been used for agronomic trials. He was kind enough to give me the following report: 'Although I should have expected that one could not determine the full quantity of oil from a relatively small quantity of seeds, I was still astonished that there was not more than 6%. The analysis had resulted in 16 to 18%, and therefore the mechanical quantity was estimated at 10-12%.

"'Actually it was quite difficult to locate an oil miller who would clean his mill sufficiently that one received pure oil. Moreover, these people didn't proceed with the interest and care that are necessary, since I found lots of oil in the presscakes, indicating that they had not been pressed sufficiently. In terms of quality, I am more satisfied than I had expected to be. I had someone prepared baked goods where oil was used in the recipe and I could not detect the slightest after-taste. As a cross-check, I had another part of the baked goods prepared with Provenzer oil, but I could not tell the difference between the two.

"'To what extent the [soybean] oil could be used for industrial [non-food] purposes, especially as a mordant *(Beize)* for the dyeing of Turkish-red, which uses very old, spent oil (that is soluble in carbonic potassium) can only be established when a sufficient quantity of oil becomes available.'"

Note 2. This is the earliest document seen (Oct. 2001) concerning special industrial uses of soybean oil as a non-drying oil, as a mordant for dyeing. Address: Hochschule fuer Bodencultur, Vienna, Austria.

42. Haberlandt, Friedrich. 1878. Zweite Abtheilung. Anbauversuche im Jahre 1875 und 1876 [Part 2: Culture trials in the years 1875 and 1876 (Document part)]. In: F. Haberlandt. 1878. Die Sojabohne [The Soybean]. Vienna: Carl Gerold's Sohn. ii + 119 p. See p. 16-35. [30 ref. Ger] • ***Summary:*** Contents of Part II: Source of the supply of the various soybean varieties used in the original trials. Trials at the Royal College of Agriculture *(Hochschule für Bodencultur)* in Vienna in 1875. Results from 1876 from Hungarian Altenburg and Gross-Becskerek in Hungary, in St. Peter bei Graz in Steiermark [Styria], in Napagedl in Mähren [Moravia; in the Czech Republic as of Jan. 1993], in Sichrow, Swijan, and Darenic [Czechoslovakia], Tetschen-Liebwerd in Böhmen [Bohemia; in the Czech Republic as of Jan. 1993], in Bukovina [Bukowina or Bucovina, a former Austrian crownland, as of 2005 divided among the Ukraine and Romania; by Dr. Nik. Dimittrievicz], in Proskau [now Proszkow, in southwest Poland] in Preussisch-Schlesien [Prussian Silesia], and in the experimental garden at the Royal School of Agriculture. Comparison of the resulting seeds with the original seeds. Chemical analysis of the seeds and straw. Evidence of the "degree days" or "heat units" (Wärmesummen; "warm temperature summation" or "warm sum," similar to U.S. maturity groups) which the soybeans needed for their development in Vienna, St. Peter, Tetschen-Liebwerd, and Proskau.

In 1875 Prof. Haberlandt conducted the first agronomic trials with the 19 soybeans he obtained at the Vienna World Exposition *(Wiener Weltausstellung)* of 1873. On 2 May 1875 he planted three varieties of seeds at the Royal School of Agriculture in Vienna. The brownish-red variety (plot #1) from China blossomed on June 28, the light-yellow variety (plot #2) from China blossomed on July 1, and the light-yellow variety (plot #3) from Mongolia

blossomed on June 29. The seeds of all three varieties ripened on Sept. 11. On plot #1 grew 27 plants, that yielded 249.2 gm of seeds (equivalent to 2,769 kg/hectare). On plot #2 grew 25 plants, that yielded 336.5 gm of seeds (equivalent to 3,739 kg/hectare). On plot #3 grew 15 plants, that yielded 196.9 gm of seeds (equivalent to 2,177 kg/hectare).

Prof. Haberlandt then sent samples of seeds to seven cooperators in central Europe, who planted and tested the seeds in the spring of 1876, with good or fairly good results in each case. These men reported the details of their agronomic trials to Haberlandt, who quoted from their reports. For details see: F. Haberlandt. 1877. "Der Anbau der rauhhaarigen Sojabohne." *Landwirthschaftlichen Versuchs-Stationen* 20:247-72.

In addition, on April 25 and May 5 Prof. Haberlandt planted 7 varieties (some original seeds, some reproductions; 4 black, 2 yellow, and 1 brownish-red *[braunrothe])* in the experimental garden at the Royal School of Agriculture. A table (p. 26) gives his detailed results. Comparison of the resulting seeds with the original seeds showed that individual seeds in each new generation generally weighed more than those in the previous generation. Page 29 shows a chemical analysis of the seeds and straw. Haberlandt then calculated (p. 33) the "degree days" or "heat units" *(Wärmesummen;* "warm temperature summation" or "warm sum," similar to U.S. maturity groups) which his different soybean varieties needed for their development. For the seeds to begin to ripen they seem to need a total of 1824 to 5924 heat units (ºC), and to be ready for harvest 2230 to 3174 heat units. The minimum need at Proskau was 2246.9. The soybean can be grown as a green fodder plant at locations with less heat units. A table on p. 34 shows the mean temperature for each month, the northern latitude, and the elevation (meters above sea level) at Vienna, Graz, Tetschen-Liebwerd, and Proskau. Graz had the lowest latitude (47º4') and Tetschen-Liebwerd the highest (50º44'). Vienna and Graz had the warmest temperatures in May, June, and July. Address: Hochschule fuer Bodencultur, Vienna, Austria.

43. Haberlandt, Friedrich. 1878. Dritte Abtheilung. Anbauversuche im Jahre 1877 [Part 3: Culture trials in the year 1877. Part I (Document part)]. In: F. Haberlandt. 1878. Die Sojabohne [The Soybean]. Vienna: Carl Gerold's Sohn. ii + 119 p. See p. 36-60. [Ger]

• ***Summary:*** Contents: Excerpts from 14 reports of various trial locations in lower Austria *(Nieder-Oesterreich),* and 11 trial locations in Moravia *(Mähren).* Excerpts from 19 reports submitted from Bohemia, 10 from Austrian Silesia *(Oesterr.-Schlesien),* Galicia *(Galizien)* [a former Austrian crownland; after World War II the western half was made part of Poland and the eastern half was made part of the Ukraine], Bukowina, and Russian-Poland, 6 reports from Upper Austria, Salzburg, and Tirol [Tyrol], 11 reports from Steiermark, Krain [Carniola; now mostly in Slovenia], and Kärnthen [Kaernten or Carinthia, an Austrian crownland; now a state of southern Austria, bordering on Italy and Yugoslavia], 12 from Trieste *(Triest)* [an Austrian crownland from 1867 to 1919, when it was ceded to Italy by the Treaty of St. Germain], Istria, Dalmatia, and the Grafschaft [county and earldom] of Görz (Goerz), 40 from Hungary and Croatia [formerly part of Yugoslavia], 23 from Germany, 1 from Switzerland, and 1 from Holland.

In lower Austria soybeans were tested by: Mr. Zurakowski (Title: Administrator of a archducal farm estate, *erzh. [erzherzoglich] Gutsverwalter.* Note: The archduke was a prince of The House of Austria) in Gmünd (Gmuend), Mr. Ruzicka in Essling, Baron *(Freiherr)* von Tschudi in Jacobshof, Ferd. Ritter v. Erb in Grinzing near Vienna, Graf Christ. Kinsky in Matzen, Mr. H. Weyringer in Simmering near Vienna, Mr. Kaudelka in Therasburg, Mr. von Maygraber of k.k. Major in Altlengbach, Mr. Carl Rauch in Osterburg, Mr. Pfarrer Engelbert Richl in Münchendorf (Muenchendorf), Mr. G. Simon in Hirschstetten near Vienna, Prof. Jul. Thausing of the agricultural teaching institute in Mödling (Moedling), Dr. F. Leithner in Krems [lower Austria, on the Danube River, 38 miles west-northwest of Vienna], and Dr. Ditz (Title: Agricultural Administration of princely Liechtenstein, *fürstl. Liechtenstein'schen Oekonomieverwaltung)* in Wilfersdorf. Note: As of 1994, Wilfersdorf is in the northeast corner of Austria, about 25 miles north-northeast of Vienna and about 335 miles northeast of Liechtenstein.

Agronomic trials in Mähren [Moravia] by: J. Hoch of the Agricultural School in Gross-Meseritsch, Mr. Turecek in Mistek, Prof. Schmerz of the educational establishment in Brünn (Bruenn; Brno in the Czech Republic as of 1994), A. Tomasek in Napagedl, Mr. Vrba [Wrba] of the agricultural institute in Eubenschitz [Eibenschitz, as of 1994 in the Czech Republic], Mr. Emanuel Ritter of Prosskowetz [Proskowetz] in Kwassitz, Mr. J.B. Uhlirz director of the agricultural middle-school in Prerau, Prof. Dr. A. Zöbl (Zoebl) of the agricultural middle-school in Neutitschein, farmers of the princely Economic Administration of Liechtenstein in Eisgrub bei Lundenburg and in Rabensburg using seeds sent by Dr. Ditz, Norbert von Baratta in Budischau.

Agronomic trials in Bohemia (Böhmen) by: Mr. A. Fritsch in Stenonitz, Mr. Friedrich (Title: Agricultural administrator of a farm estate, *Gutsverwalter)* in Krizanau (45 km northwest of Brünn / Brno), the Marquis de Bellegarde in Schloss Niemes, Jos. Dolzer in Hohenfurt, Ludwig von Beer in Vojnic, Mr. Rothe (castle-gardener) in Schönpriesen (Schoenpriesen), Dr. Hanamann Director of the research station in Lobositz, Mr. Klimetschek of the princely Schwarzenberg trial-school in Zittolieb, Mr. J. Susta of the princely Schwarzenberg domain of Wittingau,

Mr. Ferd. Marouschek [Marousek] in Kloster-Münchengrätz (Muenchengraetz), Mr. Pachmayer in Luzan, Dr. Nickerl of the Physiokrateum [Faculty of Natural Sciences] in Prag [Prague], Mr. M. Schlöcht (Schloecht) in Dobrai, Prof. Dr. Kulisz of the agricultural middle-school in Tetschen-Liebwerd, Prof. A. Nowoczek of the agricultural teaching institute in Kaaden, Mr. F. Honilec of the agricultural school in Klattau, Planic, and Kout, Ad. Eckert Director of the agricultural school in Chrudim, Mr. A. Svoboda [Swoboda] (Title: Owner of an estate, *Hofbesitzer)* of Schnackhof bei Zamrsk, and the princely Schwarzenberg Wirthschafts-Direction in Frauenberg.

A large table (p. 26) shows Prof. Haberlandt's results in testing 7 different types of soybeans in 1876: Yellow from Mongolia, yellow from China, brownish red *(braunrothe Sorte)* from China, black from China (2), black from Mongolia, and black from Japan.

Agronomic trials Austrian Silesia *(Oesterr.-Schlesien)*, Galizien [Galicia], Bukowina [Bukovina], and Russian-Poland by: Baron von Tschudi of the Swiss Confederation in Vienna wrote of trials on his land in Schönbach (Schoenbach) in Austrian Silesia, Mr. Bischof of the Baron Brunicki Domain in Zaleszczyki in East Galicia, Mr. Seling [Seeling] Ritter von Saulenfels in Szdebnik bei Lekawice, Johann Ritter von Breuer in Suchawola, Mr. A. Praunn (a forester in Stadt Lemberg) in Zubrza bei Lemberg, Mr. S. Jakubovszki in Tarnow, Mr. Ritter von Stavinsky in Kleczy, Mr. Klemens Botkouski (Title: Owner of an aristocratic estate, *Gutsbesitzer)* in Lukaczestie (or Luka-czestie, Bukovina [in today's {2005} Romania, 16.5 km east of Gura Humorului]), M. C.W. Ambrosius in Radautz (Bukovina), Mr. Stanislaus von Trebicki in Kurowice bei Sterdyn (Russian Poland).

Agronomic trials in Upper Austria *(Oberösterreich)*, Salzburg, and Tirol by: Baron von Thysebärt at Schloss Grünau (Gruenau) bei Ried-Mauthausen in Upper Austria, Mr. E. Klusak (castle-gardener) in St. Wolfgang bei Ischl in Upper Austria, Mr. C. Braunbart director of the agricultural school at the Ritzlhof in Upper Austria, Mr. von Kempf (k.k. Major) in Salzburg, Mr. Alfr. Erttel in Planta bei Meran in southern Tirol, Dr. Eduard Mach director of the agricultural teaching institute of San-Michele in South Tirol.

Agronomic trials in Steiermark, Krain [Carniola], and Kaernthen [Kärnten, Kaernten or Carinthia] by: Mr. Hans Graf Haller in St. Johann bei Pettau in Steiermark, Mr. J. Rothschädl (Rothschaedl) in Reitenau in Steiermark, Mr. Fr. Auchmann (a maker of champagne and coffee-substitutes) in Marburg in Steiermark, the seed cultivation station in St. Peter bei Graz (owned by Graf H. Attems), Ad. Baumgartner director of the agricultural school in Grottenhof bei Graz (he cooked the seeds for use in a salad and as a vegetable), Mr. Goethe director of the Obst- und Weinbauschle in Marburg, Burgermeister J. Fiala in Friesach in Carinthia, Mr. Cos. Schütz (Schuetz) secretary of the agricultural society in Klagenfurt, Baron von Ankershofen in Klagenfurt, Mr. J. Mach in Slateneg in Krain [Carniola], Mr. Franz Schollmayer in Laibach [as of 1994 Ljubljana, the capital of Slovenia; summary of his 1977 article]. Continued. Address: Hochschule fuer Bodencultur, Vienna, Austria.

44. Haberlandt, Friedrich. 1878. Dritte Abtheilung. Anbauversuche im Jahre 1877 [Part 3: Culture trials in the year 1877. Part II (Document part)]. In: F. Haberlandt. 1878. Die Sojabohne [The Soybean]. Vienna: Carl Gerold's Sohn. ii + 119 p. See p. 60-86. [Ger]

• ***Summary:*** Continued (p. 60): Agronomic trials in Trieste, Istria, Dalmatia, and the Grafschaft [county and earldom] of Görz (Goerz) by: Mr. Josef Kristan at the Istrian Peninsula *(Capodistria)* in Istria, Mr. J.C. Ritter v. Pittoni of k.k. Truchsess in Görz, Baron von Bianchi of Rubbia in Görz, Dr. Alb. Levi [Lewi] in Villanuova [Villanova] bei Gradisca in Görz, Baron von Ritter Zahony's estate *(Zahony'sche Gutsverwaltung)* at Monastero in Görz, the seed schools *(Saatschulen)* in Trieste, Görz, and Rodik, the Wine Cultivation School at Parenzo in Istria, by members of the agricultural societies *(Comizio agrario)* in Sign, Scardona, Scolta, and Ragusa in Dalmatia (via the k.k. Statthalterei in Zara).

Agronomic trials in Hungary and Croatia (p. 66-76) by: Mr. von Deak, on the farm of J. von Deak, in N. Pann, Mr. R. Skrkanek in Markusfalva *(Zipser Comitat)*, Mr. Leop. Langfelder in Dohnau, Prof. Deininger and master-gardener W. Köhler (Koehler) in Hungarian Altenburg, Mr. C. Tekusch, Mr. Alex Heuffel, and Mr. Sig. Szloboda on Baron Sina's estate in Szt. Miklos (3 locations incl. Sandorhaz), Mr. Heykal in Pápa (#93), Mr. Adalb v. Otocska in Kövesd (#94; or Kövesdö, a small village presently named Kamenicná (near Komárna)). Mr. von Czech in Szanto, Friedrich Karoly in Kajar, Hofrichter [Estate judge] Sporschill in Korompa, Mr. Joh. Handler in Urmeny [Uermeny], Mr. Jaroslaw Fleischer in Csasztkocz (#99 Császtkócz is now Cásta, near Bratislava), Mr. Hermann Schulz in Szucsany, Mr. Isidor Trosztler in Szucsany (#100 and #101 Szucsany is now Sucany, in Slovak transcription), Mr. Alois Baron *(Freiherr)* von Baratta in Poltar (#102 Poltár is near Lucenec), F. Gröber (Groeber) & Sons in Erlau, Mr. M. Pöschl (Poeschl) in Balvanyos (#104. Bálványos is now Balvany, near Levice), Mr. Josef Mosdosy in Kapolnas-Nyek (#105 Kápolnás-Nyék is now Kaplná, near Bratislava).

Note: Eight of the above trials (each followed by the number preceding it in the book), were conducted in the region that became Slovakia / the Slovak Republic after 1 Jan. 1993. Notice that the names of some villages have been changed, as indicated after each number. This is the earliest document seen (Feb. 2005) concerning soybeans in what is

today Slovakia (though it was not officially created until 1 Jan. 1993), or the cultivation of soybeans in Slovakia. This document contains the earliest date seen for soybeans in Slovakia, or the cultivation of soybeans in Slovakia (18 April 1877, #100). The source of these soybeans was Friedrich Haberlandt in Vienna.

Mr. Edmund Ammon in Sulz (Sooskut), Mr. Arthur Ade in Sarbogard, Freiherr von Ambrozy in Tana, Mr. Victor Ritter von Hebra in Szerdicza, Mr. Edw. Egan in Bernstein bei Steinamanger, Freiherr v. Werlhof in Schachendorf, Mr. Franz Marc (director of the Animal- and Plant Acclimatization Union) in Budapest, C.G. Schulz in Fugyi near Grosswardein, Mr. A. Stojics [Sztojics] in Grosswardein [Gross-Becskerek], Mr. C. Pollak in Arad, Mr. Paul Rimler in Bekes-Csaba, Mr. Brückl (Brueckl; Prince Thurn-Taxis' Rentkammervorstand) at Banija in Croatia, Mr. A. Vichodil of the agricultural society at Agram, Count von Alten Hemmingen in Huszt (Marmaroser Comitat), Prof. Deininger in Hungarian-Alterburg in various places (agricultural teaching institute in Kaschau [the German name; called Kosice in Czech and Kassa on Hungarian. Part of Slovakia in 1995], and Debreczin, Perberte Szt. Miklos, Lekehalma, Dr. Farkas Mihaly, Karl Fazekas, agricultural teaching institute in Keszthely; a table shows the results).

Agronomic trials in Germany (p. 76+) by: Mr. Wolfes director of the test field at the agricultural school in Dargun-Mecklenburg, Prof. Dr. v. Liebenberg at the agricultural university institute at Königsberg (Koenigsberg), Dr. Mirus in Leisnig, Prof. Dr. Lehmann (Director of the Central Agricultural Research Station for Bavaria) in Munich, Mr. Schuster at the Agricultural Academy in Weihenstephan [near Munich], Prof. Dr. Rees at the University in Erlangen, Mr. H. Hirschberg in Sondershausen, Prof. Dr. Hellriegel in Bernburg (He planted 105 soybean seeds, which began to emerge on May 28. The growth was rather rank *(die Pflanzen rankten ziemlich stark).* They began to bloom at the beginning of August. He harvested 2,600 ripe or nearly ripe seeds weighing 285.5 gm. He submitted an in-depth report. Note: This is the earliest document seen that mentions Dr. Hellriegel in connection with soybeans. The discovery of the fact that the nodules of legumes enabled them to fix "free nitrogen" is usually ascribed to research by Hellriegel and Wilfarth published in 1888.), Mr. J. Butterbrodt [Butterbrod] in Hindesheim, Mr. Burkhardt in Duesseldorf, Mr. von Cordes *(Rittmeister)* in Ehrenberg bei Leipzig, Dr. Hugo Tobisch director of the agricultural school in Friedberg (Oberhessen), Dr. Stutzer, director of the agricultural research station in Bonn, Mr. Carl Berndt, Sr., a velvet manufacturer *(Sammtfabrikant)* at Deuben in Saxony *(Sachsen),* Mr. Schnorrenpfeil administrator of lands at the imperial Academy in Proskau, Mr. E. Kühne (Kuehne) at the Kleutsch manor in Prussian-Silesia *(Preuss.-Schlesien),* Mr. D. Wildt–director of the agricultural-chemical research station in Posen [Poznan, in Poland since 1918], Mr. Meyer–director of the agricultural school at Nieder-Briesnitz in Prussian Silesia, Mr. C. Vogt–meteorological observer at Claussen bei Arys in East Prussia, Th. Scholz in Klein-Tinz bei Domslau im Kreise Breslau [Wroclaw, Poland], Mr. Boer (Inspector) in Plaschwitz, Mr. Dotzauer in Schlanz (Administrative district of Breslau [Wroclaw, Poland]), Prof. Anderegg at Chur [or Thur; Italian: Coira; French: Coire] in Switzerland, and Prof. Dr. Adolf Mayer, Director of the Agricultural Academy at Wageningen in Holland (p. 82).

In Switzerland (p. 82) Prof. Anderegg received 50 yellow and 50 brownish-red seeds. They were planted late, on May 20. By June 5-10 all had germinated *(hatten alle gekeimt).* Some plants reached a height of 95 cm, others only 47 to 73 cm. The first blossoms appeared on July 20. A frost on Sept. 27, which destroyed the leaves of all the grape vines, corn *(Mais),* common beans, pumpkins, gourds etc., did little damage to the soybeans. The harvest on Oct. 16 was successful. For each seed planted, 91.5 seeds were harvested Some plants bore 90-132 pods (p. 82). Note: This is the earliest document seen (Feb. 2001) concerning soybeans in Switzerland, or the cultivation of soybeans in Switzerland. This document contains the earliest date seen for soybeans in Switzerland, or the cultivation of soybeans in Switzerland (20 May 1877). The source of these soybeans was Prof. F. Haberlandt in Vienna.

Dr. Adolf Mayer wrote from Holland that during the unfavorable summer, the plants that were tested did not ripen, so he will repeat the trial (p. 82).

Agronomic trials in the garden of the Imperial-Royal College of Agriculture *(k.k. = kaiserlich-königliche Hochschule für Bodencultur)* in Vienna in the year 1877 (p. 83+; 4-page summary with a table). This very interesting table (p. 84, reproduced in part in Piper & Morse. 1923. *The Soybean.* p. 156) shows that Haberlandt planted 20 seeds of one variety at Vienna at intervals of one week for 11 even weeks throughout the season (from March 31 to June 9) and attempted to correlate the number of days to maturity (life periods) with several variables shown below. Relatively few seeds sprouted and emerged. The seeds planted first emerged first (May 7) and those planted last emerged last (June 15). The first batch began to bloom on June 23, and the last batch on July 18. The first batch was harvested on Sept. 29 and the last batch on Oct. 26. The table shows the number of plants that survived, the number of full and empty pods, the weight (in grams) of the seeds, pods, and stems and leaves, and the number of pods (maximum and minimum). The largest yield of seeds came from the plants sown from April 14 to May 5. The weather was unfavorable and one type of pest *(Webermilbe; Tetranychus telarius*– probably the spider mite, now called *Spinnemilbe)* was a big

problem. Continued. Address: Hochschule fuer Bodencultur, Vienna, Austria.

45. Haberlandt, Friedrich. 1878. Vierte Abtheilung. 9. Chemische Zusammensetzung der Sojabohne, Fuetterungsversuche mit dem Stroh und Zubereitung der Samen als Nahrungsmittel fuer den Menschen [Part 4, Section 9. Chemical composition of the soybean, feeding trials with the straw, and preparation of the seeds as human food (Document part)]. In: F. Haberlandt. 1878. Die Sojabohne [The Soybean]. Vienna: Carl Gerold's Sohn. ii + 119 p. See p. 87-110. [4 ref. Ger]

• ***Summary:*** A table (p. 95, continued from p. 84, and reproduced in part in Piper & Morse. 1923. *The Soybean.* p. 156) shows that Haberlandt planted seeds of one variety at Vienna at intervals of one week for 11 even weeks throughout the season (from March 31 to June 9) and attempted to correlate the number of days to maturity (life periods) with the number of heat units *(Wärmesumme / Wärmesummen,* in ºC) required for three different stages of growth–germination, blossoming, and maturity. The life period ranged from 182 days for the seeds planted first to 138 days to the seeds planted next to last. The seeds planted first (March 31) required the most heat units to come to maturity (2,972ºC) whereas those planted last (June 9) required the fewest heat units (2,322).

Note 1. This is the earliest document seen (March 2003) concerning the scientific study of soybean germination, or the relationship between heat units and germination.

In 1877 several new analyses of the soybean were conducted, to add to those from past years. One was communicated by Mr. A. Tomasek in Napagedl [in Mähren / Moravia, a region in today's central Czech Republic], the other by Dr. Eduard Mach in St. Michele [South Tirol]. The first was conducted by the sugar factory chemist, Mr. Schroeder, in Napagedl (p. 103). For air-dried reddish-brown *(rothbraun)* and yellow soybeans he found the following: Protein: 36.12% / 35.87%. Nitrogen: 5.78% / 5.74%. Fat: 17.50% / 18.25%.

Dr. Mach had his analysis conducted in the agricultural education center by his assistant C. Portele. He examined 3 varieties (yellow, reddish-brown, and black) obtained from Haberlandt and grown out in San Michele, and a fourth reddish-brown variety, which is grown in southern Tirol (Tyrol) as the Coffee Bean, has been acclimatized there for a long time, and until now has remained entirely unknown and unrecognized. The composition of the four is as follows: Water: 8.1 / 9.4 / 9.9 / 10.1%. Ash: 5.4 / 5.1 / 4.8 / 5.2%. Protein: 36.8 / 31.6 / 31.2 / 38.1%. Fat: 17.6 / 17.4 / 18.1 / 17.8%. Crude fiber: 4.8 / 4.3 / 4.2 / ?%. (p. 103-04).

Also Mr. C. Caplan (p. 104), assistant at the agricultural chemistry research station in Vienna, conducted analyses of the seeds, their pods, and the leaves and stalk. His results were published in 1878 in the *Oesterreichisches landw. Wochenblatt* (No. 3, p. 26): Water: 14.0 / 14.0 / 14.0%. Protein: 32.32 / 4.64 / 6.08%. Fat: 16.76 / 1.29 / 2.03%. Nitrogen-free extract: 26.56 / 41.87 / 37.12%. Crude fiber: 5.57 / 30.45 / 22.79%. Ash: 4.76 / 7.79 / 9.31%.

"It is unnecessary to emphasize the importance of the soybean as a food for man and his animals. Not only is there high nutritional value in the beans and straw, they also have a flavor such that eating them takes no special effort.

"A considerable number of taste experiments have been made and it can be stated that nobody's sense of taste has revolted against food uses of soybeans.

"Dr. F. Leithner complains that they are not easily cooked softly enough. 'I tasted them with oil and vinegar, sort of baked bean style, and as a soup. In oil and vinegar they seemed to have a slightly sweet aftertaste, like sweet peas. Also as soup they reminded me of regular bean soup with a slightly sweet flavor. One of my guests liked them very much.'

"Mr. Alfred Erttel, captain of the royal-imperial army in Planta near Meran wrote: 'Cooking experiments were highly satisfactory; the soybean is finer and has a better flavor than regular beans.'

"Director A. Baumgartner in Grotenhof had them prepared as a salad and as a vegetable. He found them to be very much like regular beans.

"Director D.E. Mach commented about the taste experiment he conducted: 'In order to come to a valid opinion about the savoriness of the soybean and its value as a food, we tried to have them prepared in various ways. We must admit that they were very tasty cooked whole or as a puree, as well as with oil and vinegar, yes, even finer than peas or lentils. It must be mentioned however that soybeans take a long time to cook soft.'

"By adding that no negative opinion about the soybean has come to my attention, I would also like to state: I believe that the seeds of the soybean by themselves are too concentrated a food and they would be best mixed with other foods, which are less concentrated and contain mostly carbohydrates. The Chinese and Japanese have instinctively been led toward that. They add their 'miso' or their soy mush to most of their other dishes in a certain ratio without eating soy by itself. Kaempfer describes a way that the Chinese and Japanese prepare miso which is very complicated; the cooking takes a lot of time and money. So it would seem simplest to use soybeans in the kitchen in a finely ground form. I had soy grits of that kind added to various potato dishes, for example mashed potatoes and rice. I mixed soy grits with wheat grits, cooked with milk or water, and I had soy grits added to mashed potatoes to make a dish resembling Polenta. This might be called Sojenta. My family also experimented with adding soy meal to wheat flour to make bread, with and without the addition of milk,

and in all cases we were highly pleased with the results. This opinion about the taste of soy was shared by others, who shared in the tasting."

Note 2. This is the earliest document seen (Oct. 2001) concerning what is probably whole (full-fat) soy flour. Note 3. This is the earliest document seen (Sept. 2004) that describes a cereal-soy blend, or the use of soy flour to make bread.

Note 4. At this point (p. 107-08) Haberlandt adds a lengthy footnote from his friend and colleague Professor W. Hecke who followed with great interest the progress of soy culture in Austria and who had conducted taste tests with soy grits. Hecke encouraged the use of soy with potatoes to make a nutritionally balanced, inexpensive, tasty, and easily accepted basic dish. One part of soy flour or grits and two parts fresh potatoes were cooked separately, then mixed into a fairly stiff mush / porridge. Salt and fried onions were added as seasonings. The milk and fat, ordinarily added to mashed potato dishes could be omitted.

Haberlandt then continues: "If used in this way, the soybean will someday play a major role in the diets of the poor. It will be more than salt for potatoes. With its fat *(Fett*, i.e., oil) it will replace lard [Note 5. Soybean oil was later used to make lard compounds, lard substitutes, and shortening] and with its protein it will supply strength. Appropriate mixtures will be easily developed according to the other ingredients used.

"As grits or fine meal (flour) it will also move into the palaces of the rich, in whose kitchens from India and China is already a common item. It will only be a question of finding suitable ways of preparing them. The flavor of half-cooked soy grits resembles that of poppy seeds or almonds, and should be suitable as an addition to the finest foods otherwise made from meals (flour).

"The soybean could be of major importance in the provisioning of forts and ships and in supplies for armies. It could justly be used as a better substitute for peas in 'Pea Sausage' *[Erbstwurst,* a cooked food containing pea meal fixed with fat pork and salt.] It will compete effectively as a coffee substitute with other plant products now used for this purpose. Soy coffee is already produced in South Tirol (Austria) and Istria (now a peninsula in Croatia and Slovenia). Mr. Franz Mark of Budapest [Hungary] pointed out the possibility of using soybeans as a chocolate substitute, for which it would undoubtedly serve better than the peanut, which, in Marseilles [port in southern France], is mixed with sugar to make an inexpensive chocolate substitute."

Note 6. This is the earliest document seen (Aug. 2002) concerning the use of soy as a meat extender (in Pea Sausage).

Note 7. This is the earliest document seen (Oct. 2004) that mentions the possibility of using soybeans as a chocolate substitute. Address: Hochschule fuer Bodencultur, Vienna, Austria.

46. *Hamburger Garten- und Blumenzeitung.*1878. Die Sojabohne [The soybean]. 34:238-39. [2 ref. Ger]
• ***Summary:*** The section titled "Feuilleton" (light reading) states that the soybean (Soya hispida Moench), which is a common food in East Asia, is used on the English ships that travel there in the form of a very popular prepared, sharp, mustardlike sauce–according to the *Communications of the Royal Imperial Agricultural Society for Kärnten (Mittheilg. der k.k. Landwirthschaftsgesellschaft für Kaernten)* [also called Carinthia, an Austrian crownland; now a state of southern Austria, bordering on Italy and Yugoslavia]. The soybean can be considered as a new crop plant for Kärnten, since in previous years, it has done well at the Agricultural School *(Landesbauschule)* in Ehrenhausen, with abundant yields of pods and seeds. From 20 seeds that were planted, 19 plants grew and yielded 5,800 completely developed seeds that were harvested–a 235-fold increase. The plant that grows like a bushbean is darker than the previous one. The trifoliolate leaves are a little more pointed and longer.

Nothing has yet been communicated concerning their taste and utilization. However Prof. Haberlandt's chemical investigations showed they have a greater nutritional value than our other indigenous legumes. Moreover the soybeans grown in Europe have a greater nutritional value than the original Asiatic soybean seeds.

Also discusses: *Prunus mume* Siebold and Zuccarini, the tree fruits from which *umeboshi* are made (p. 238).

47. Photograph of a painted portrait of Prof. Friedrich J. Haberlandt of Vienna (1826-1878). 1878.
• ***Summary:*** Prof. Haberlandt was a pioneer in introducing soybean cultivation to Europe. A well-known professor of agronomy at the Royal College of Agriculture *(Hochschule für Bodenkultur)* in Vienna, Austria-Hungary, he was the author of *Die Sojabohne* (The Soybean) which was published in 1878 in Vienna. The first entire book about the soybean in the Western World, it detailed his experiments with soybean cultivation throughout Europe in the 1870s.

While researching and writing a chapter on the life of Prof. Haberlandt, William Shurtleff tried to locate a photograph of him. On 15 April 1981 he wrote Verena Krieger (a tofu maker in Lucerne, Switzerland, with an interest in soybean history) to request help. Her address: Bruchmattstr. 24, CH-6006, Luzern [Lucerne], Switzerland. She wrote Doz. Dr. R. Gretzmacher, a professor of agriculture at the same organization where Prof. Haberlandt once worked. His address: *Institut für Pflanzenbau und Pflanzenzuechtung, Universitaet für Bodenkultur* (Inst. of Agronomy and Plant Breeding, Univ. of Agriculture), XVIII, Gregor Mendel-Strasse 33. 1180 Wien (Vienna),

Austria. On June 3 Dr. Gretzmacher replied in German, which Verena translated: "After a long search in the Institute and in the archives of the university, we found to our astonishment that we do not have a picture of Prof. Haberlandt. However, I know of an oil painting which is hanging in the University of Mosomagyarovar (Hungary)."

On 21 July 1981 Dr. Gretzmacher wrote Dr. F. Bainter at the University of Mosomagyarovar in Hungary, where an oil painting portrait of Dr. Haberlandt was on display. Dr. Painter made a 24 mm black-and-white negative of the painting and on July 27 sent it to Dr. Gretzmacher, who on Aug. 10 sent it to Verene Krieger, who promptly sent it to William Shurtleff. He had one 8-by-10-inch and two 3½-by-5-inch black-and-white photos made, and deposited in the Soyfoods Center Library. The photo shows a portrait of Prof. Haberlandt, dressed in a coat and bow tie, looking to his left.

Prof. Haberlandt died on 1 May 1878 at the relatively young age of 52. The painting was therefore created before that time. The portrait may be in Hungary because Prof. Haberlandt studied at the agricultural college in Hungarian Altenburg, where he was active from 1851 to 1853 as assistant professor and from 1853 to 1869 as professor.

48. *Oesterreichisches Landwirthschaftliches Wochenblatt.*1879. [Questions and answers: Question No. 20]. Jan. 25. [Ger]*

• ***Summary:*** Question No. 20. Who has a store that sells the soybean seeds recommended by Prof. Haberlandt? Can one obtain only a part of them?

Answer: As you can see from the insert No. 25 in the *Austrian Agricultural Journal (Oesterreichisches Landwirthschaftliche Wochenblatt)* (1878, p. 612), the administration of the Altenburg Academy of Agriculture in Hungary, sells soybeans. The cost for either the light-colored or the brown variety is 50 *kreutzer* per kg.

49. Podoba, Ivan Grigor'evich. 1879. Iz zametok po opytam kul'tury novovvodimykh v Novorossiiskom krae rastenii [Notes on experiments of newly cultivated plants in the Novorossiiskya region of southern Russia. III]. *Zemledel'cheskaya Gazeta.* No. 6. p. 82-85. Feb. 10. [Rus]

• ***Summary:*** The section on leguminous plants *(Bobovyya rasteniya)* (p. 83-85) begins with a long table which shows the following for 22 plants that Podoba tested: Collection No., Name of plant, weight planted, weight harvested, net weight, important notes. The plants included two lentils, two flax varieties, two horse beans *(Pferde-Bohne, Vicia Faba,* one each from Scotland and Algeria), various lupins and *Lathyrus* species, and Japanese peas *(Japanische Erbse* [possibly soybeans]).

At the end of this table is a section titled *Soja hispida (soya;* the soybean) which states: "From the family Papilionaceae, with little flowers. In the spring of 1877, along with 25 seeds of *Lallemantia Iberica,* I received 50 seeds of *Soja* from Professor Haberlandt of Vienna. Concerning the productivity of this plant, it is possible to draw the clear conclusion that 45 seeds yielded 20 ounces (40 *lot;* 1 lot = ½ ounce). The second year's harvest was also wonderful, however due to rabbits, which ravaged the planted area, I was able to obtain only two pounds of seeds. The yield of pods per plant stalk (up to 2 feet in height) of this Chinese plant surpasses the yield of all our other leguminous plants. The seeds [of soya] resemble those of small haricot beans and according to foreign chemical analyses, soybean seeds contain 34-35% crude protein (peas have 23%) and 18.2 to 18.4% fat (peas have 1.8%). Thus, according to the composition data, soya is a more nutritious [and better for feeding] than peas (see No. 6 of *Zemledel'cheskaya Gazeta,* 1877).

"I am cultivating two varieties of soybeans: No. 151. With yellow seeds–more productive and ripens at the end of July. 152. With dark-red seeds–ripens later and not as fruitful."

In the previous section B, titled "Oil-bearing and other industrial plants," is a numbered list of seeds, which the author received from various places. The scientific name (in Roman letters), source, and (usually) a description of the cultivation and harvest is given. The plants include: 121. Linseed. 122. *Lallemantia Iberica.* "In the spring of 1877, at my request, Prof. Haberlandt sent me 25 seeds, of which I planted 22." 123. Sesame *(Sesam orientalis),* sent by a Russian consulate in Persia. 124. *Madia sativa.* 126. Opium poppy *(Papaver somniferum).*

Under 122. *Lallemantia Iberica* the author notes: Due to the absence of this plant from both commercial seed catalogs and reports of cultural trials, it is assumed that it was first cultivated in Europe. In 1873, Haberlandt introduced several varieties of seeds from Persia to the Vienna World Exposition for acclimatization. In the spring of 1877, at my request, Haberlandt sent me 25 seeds, of which I planted 22. After two harvests, I have 22 pounds of the plant–not including the amount I gave away.

Note 1. This is a continuation of an article in issues No. 2 and No. 4 (p. 57) of this periodical.

Note 2. This is the earliest Russian-language document seen (March 2003) concerning the soybean, and the earliest document seen (March 2003) concerning the soybean by I.G. Podoba.

Note 3. Novorossiisk / Novorossiysk is a seaport city in western Krasnodar Kray, in southern Russia in Europe, on the northeast shore of the Black Sea, about 65 miles west-southwest of the city of Krasnodar. Address: Tavricheskaia [Ukraine as of 2002].

50. Reitmann, -. 1879. Keine Sojabohnen [No more soybeans left]. *Oesterreichisches Landwirthschaftliches*

Wochenblatt 5(8):94. Feb. 22. [Ger]
• ***Summary:*** This tiny (4.5 by 2.5 cm) ad states: "Because of the large number of requests for soybeans, we hereby announce that we no longer have any soybeans available for delivery. Imperial Hungarian Agricultural Academy at Altenburg" *(Kön. ung. landw. Akademie, Ung. Altenburg) = [Koeniglich ungarischen landw. Akademie, Ungarisch-Altenburg]*.

Note: Ungarisch-Altenburg / Hungarian Altenburg, formerly Magyarovar, is today's Mosonmagyarovar in Hungary about 22 miles northwest of Györ. Address: Dr.

51. Braungart, R.; Hagen, -. 1879. Die Cultur der Sojabohne in Weihenstephan im Jahre 1878. I. Bericht von Professor Dr. R. Braungart. II. Bericht von dem k. Inspektor Hagen von Weihenstephan [Soybean culture in Weihenstephan in 1878. I. Report of Prof. Dr. R. Braungart. II. Report of the Royal Inspector Hagen of Weihenstephan]. *Zeitschrift des Landwirthschaftlichen Vereins in Bayern* 69:60-64. Feb. [1 ref. Ger]
• ***Summary:*** The soybean has been cultivated in Weihenstephan [near Munich] for several years. In the spring of 1878 Prof. Braungart received 3 soybean varieties from the central experiment station in Munich, a brown, round-seeded variety from Hungarian Altenburg, and two oblong, yellow-seeded varieties, one from Ravensburg in Lower Austria *(Niederösterreich)*, the other from St. Peter near Graz. These were planted on 4 May 1878, along with 17 other numbers which he received from Professor Haberlandt in Vienna, in the agricultural botanical garden. Results are given.

In Part II, Royal Inspector Hagen reports that in the Feb. 1878 issue of this periodical Prof. Dr. Lehmann requested that farmers in the various districts of Bavaria conduct some small cultural trials to help determine the properties and worth of the hirsute soybean *(der rauhhaarigen Sojabohne)*. He was kind enough to offer to send out the seeds of this plant. Hagen obtained 350 seeds of two different varieties–one light-yellow and the other dark-brown (though only a few seeds of the latter type). He planted them in the test garden of the royal central school *(kgl. Centralschule)*. The method of cultivation and results are given. Address: Prof., Dr., Bavaria, Germany.

52. Wollny, E. 1879. Anbauversuche mit der Sojabohne (Soja hispida Mnch.) [Culture trials with the soybean]. *Zeitschrift des Landwirthschaftlichen Vereins in Bayern* 69:56-60. Feb. [Ger]
Address: Professor, Munich, Germany: Mittheilungen aus dem landwirthschaftlichen Laboratorium und Versuchfelde der technischen Hochschule in Muenchen.

53. Haberlandt, G. 1879. Ueber die Stellung der Soja als Culturpflanze [The place of soybeans as a crop plant]. *Oesterreichisches Landwirthschaftliches Wochenblatt* 5(9):98. March 1. [Ger]
• ***Summary:*** The present discussion was brought about by Prof. Leydhecker in Tetschen-Liebwerd in issue No. 6 of this periodical. In this trial comparing soybeans with haricot beans, the latter performed better. Address: Dr.

54. Hecke, W. 1879. Die Sojabohne im Jahre 1878. I. [The soybean in the year 1878. I.]. *Wiener Landwirthschaftliche Zeitung* 29(9):84. March 1. [Ger]
• ***Summary:*** The first report of soybean cultural trials conducted by Prof. F. Haberlandt in the year 1875 appeared in the *Wiener Landwirthschaftliche Zeitung* (No. 9, 1876). Results of the 1876 trials were published in this same periodical (No. 4, 1877). These communications concerning the yield of the soybean and its outstanding chemical composition did not fail to arouse the attention of farmers, and by the year 1877 numerous cultural trials in the various districts of Austria-Hungary and Germany were already underway. In his monograph *The Soybean* (1878, Vienna, Carl Gerold's Sohn), Prof. Haberlandt was able to confirm that the acclimatization of early-maturing soybeans had already completely succeeded. The yellow variety, which ripened the earliest, could be cultivated successfully as far north as the northernmost limit for maize.

At the invitation found in issue No. 6 of this periodical, a large number of reports from the various districts were submitted–for which Prof. Hecke sends his deepest thanks. He then summarizes these.

Analysis of the nutritional value of soybeans was conducted by Prof. F. Schwackhoefer (Prof. of chemical technology at the Royal College of Agriculture in Vienna *(Hochschule für Bodencultur in Wien))*. A table shows results for seeds grown in Munich (yellow vs. brown) and in Vienna from 1876 (yellow #1 and #2, brown). A second table shows results for hulls and straw grown in Munich (yellow vs. brown) and Vienna.

We see that soybeans are exceptionally high in protein, about a third higher than peas, lentils, dry beans (Phaseolus), or fava beans *(Pferdebohne = Vicia faba =* "horse beans"). Moreover, they contain six to seven times as much oil as most legumes, and about the same amount as most oilseeds. And the plants bear seeds in great abundance. Address: Prof. [Vienna].

55. Tschuschner, Fr. 1879. Sojabohne [Soybean (Letter to the editor)]. *Oesterreichisches Landwirthschaftliches Wochenblatt* 5(11):128. March 15. Supplement (Beilage). [Ger]
• ***Summary:*** "Last year I received free of charge from Prof. Haberlandt seeds of the yellow soybean for a cultivation trial, with a request to let send him a report concerning the results of the trial." He apologizes for his lateness. "I now report that the seeds of the yellow soybean were cultivated

last year with great success at Leitmeritz [Litomerice, as of 2002 in the northern Czech Republic on the Labe / Elbe River], with enough to distribute gratis to schools and to small landowners for more culture trials.

Signed: Prof. Fr. Tschuschner. Address: Stefanvorstadt No. 402, Leitmeritz.

56. Strazimir, Dragutin. 1879. Soja fazolica in pa resasti gabez "symphytum asperrimum." [The soybean and comfrey, *Symphytum asperrimum]. Novice Gospodarske, Obrtniske in Narodne (The Farmers', Tradesmen's, and People's Newspaper, Ljubljana)* 37(16):121. April 16. [Slv]
• ***Summary:*** This article discusses the work of Prof. Friedrich Haberlandt with soybeans.

Note: Comfrey is any of a genus *(Symphytum)* of plants of the borage family with coarse hairy entire leaves and flowers in one-sided racemes. *Symphytum officinale* is widely used as a medicinal herb; a decoction of the roots or a poultice of the fresh leaves are believed to have medicinal properties. Address: Ljubljana.

57. *Societe des Sciences, Agriculture et Arts de la Basse-Alsace, Bulletin Trimestriel.*1879. Communìcation de M. Wagner sur la fève Soya [Mr. Wagner's communication on the soybean]. 13(2):183-84. [Fre]
• ***Summary:*** Concerning various communications, Mr. Wagner submits to the Society some soybeans *(fèves soya)* that he harvested last year in his garden. This plant, that the Botanical Garden of Strasbourg *(Jardin botanique du Strasbourg)* has possessed for almost 50 years, is of Chinese origin, has been known as a forage plant in Europe only since the Vienna Exposition of 1873, when Dr. Haberlandt first cultivated it and obtained some unexpected results. The tests made on a large and small scale rapidly yielded such favorable results that the newspapers in Austria could not recommend enough the cultivation of this plant. Here are the advantages that are found in this new legume, whose seeds are smaller than ordinary peas but resemble them, except for the color, which is quite variable: some are yellowish green, some red *(des rouges),* some white, and some even black.

Their yield is superior to that of all other legumes; they bear up to 200 pods per stem, and each contains 2 or 3 beans. The beans, the hay, and even the straw distinguish themselves by an extraordinary richness in nourishing principles. They resist the drought of summer as well as frosts; they succeed in all soils, but do better in light soils than in clay, and recommend themselves because of this to relatively poor terrains. One must especially avoid freshly manured soil. By its beans as by its stem and leaves, the soybean promises a forage of the first order. It should be sown from April 15-20, in rows spaced 40-50 cm apart with 40-50 cm between beans in each row. One lone bean would suffice, but it is more prudent to plant two. Bury them about 4 cm deep; there is no need for support, the stalk being strong and rigid. It ripens in the end of August and September. According to an agricultural journal of Breslau, here is the chemical composition of the soybean, that, compared to other legumes, shows an extraordinary richness in protein and fat: A table compares soybeans, lentils, vetches, lupines, and peas according to their content of water, nitrogenous materials *(Matières azotées,* protein), fat, starchy material [carbohydrates], cellulose, and ash.

Mr. Buchinger wonders if this legume, of Indian rather than Chinese origin, is really suited for our climate in Alsace.

Mr. Wagner makes the observation that up to now the soybean has succeeded well in Austria, and that in 1878 he was unable to plant his seed until mid-May and it nevertheless ripened completely.

After this communication, Mr. Wagner distributes to various members a certain quantity of this bean, the product of his last year's harvest, so that each can try some.

Note 1. This is the earliest French-language document seen (Dec. 2002) with the word "Soya" in the title.

Note 2. This is the earliest French-language document seen (Aug. 2003) that uses the term *Matières azotées* to refer to nitrogenous materials / proteins in connection with soybeans.

Note 3. This is the earliest French-language document seen (Oct. 2004) that mentions red soybeans.

58. *Societe des Sciences, Agriculture et Arts de la Basse-Alsace, Bulletin Trimestriel.*1879. M. Fuehrer lit un compte-rendu d'un mémoire qui a été publié dans la *Wiener Landwirthschafliche Zeitung* par M. le professeur Hecke sur la fève soja [Mr. L. Führer reads a report of an article on the soybean published in the *Wiener Landwirthschafliche Zeitung* by Prof. Hecke]. 13(3):355-62. [Fre]
• ***Summary:*** Gentlemen, I should inform you of the report published in the journal *Wiener Landwirthschafliche Zeitung* by Prof. Hecke on the agronomic trials done in Austria, Bavaria, and Silesia of the bean, introduced following the Universal Exposition of Vienna and known to former botanists by the name Dolichos bean of Japan *(Dolic du Japon)* [the soybean]. The beans of this plant are used in Japan to make a type of sauce that is served as a condiment called *Soja.* The plant was first placed in the botanical system in the genus Dolichos, from which it takes its name, and which is found in Theophrastus, from a variety of beans having very elongated pods. This genus, differing from true beans *(haricots)* only because their carina *(carène)* is not twisted in a spiral, contains 60 species, all exotic, including *Dolichos lablab,* the famous Egyptian lentil for which the patriarch Esau had to give up his right of primogeniture [to his younger brother Jacob]. Our plant had taken the name of *Dolichos soya* within the genus, and later, the genus

Dolichos having acquired too many species, it served as a model for a particular genus known as *Soja hispida* [the soybean]. Note 1. In botany, the word "carina" refers to the two conjoined lower petals of a bean, pea, or other legume flower that enclose the stamen and style. It is derived from the Latin word *carina*, meaning the hull or keel of a boat.

Soy sauce *(la sauce du soja)* was well known in Europe; it was even stylish *(à la mode)* at the turn of the century [ca. 1800] in London and Paris, but no one there had the plant. It was only after the Universal Exposition of Vienna where Dolichos beans of all [sic, several] countries figured, that the attention of some farmers and notably that of Professor Haberlandt had been called to these beans. Some agronomic trials were done; it was soon recognized that the species or varieties coming from Japan and north China were those that could adapt themselves most easily to the climate of central Europe, and the yellow variety was recognized as being preferable to any other.

Let us also recall that at last April's meeting, our colleague Mr. Wagner made a rather large distribution of seeds coming from his own crop. It will be then possible to obtain exact information on the merit of the new legume.

The journal *Isis*, which also contains an article on soy *(soja)*, publishes a table comparing the composition of different edible beans. It compares the water, albumin, non-protein extracted material, and ash content of the soybean, haricot bean, pea, lentil, broad bean / faba bean *(fève)*, and lupine.

It is certain that a great number of plants have been extolled for agriculture and we should have expected marvelous results. Yet very few justified the reputation that had been made of them, and in the majority of cases the plants in use for centuries prevailed over their new competitors. But it is not less true that to agronomic trials of exotic plants we owe wine, potatoes, tobacco, and many others. These trials would merit encouragement then, even if of 50 new plants only one succeeds, and could improve our agriculture. It is for this reason that I wish to call the Society's attention to another plant which I mentioned earlier–the *Dolichos lablab* or Egyptian lentil *(le lentille d'Égypte)*.

Note 2. Mr. L. Führer is a member of this Society and responsible for publishing the Bulletin and for the "Initiative / Information Commission" *(commission d'initiative)*. Address: France.

59. *Bulletin de la Societe d'Acclimatation.*1879. IV. Bibliographie. II. Journaux et revues. 1879. 3e fascicule.–*Le Soja hispida* [IV. Bibliography. II. Journals and Revues. 1879. 3rd volume of *Le Soja hispida]*. 26:666-71. Nov. [Fre]

• ***Summary:*** This section contains a summary of the main articles from other periodicals that are connected with the work of the Society for Acclimatization. In the *Bulletin de la Société des Sciences de la Basse-Alsace* (1879, Vol. 3) is an article titled *Le Soja hispida*.

"In the meeting of 3 Sept. 1897, Mr. Fuehrer read the report of a scientific treatise published recently by M. Hecke on the agronomic trials conducted in Austria, Bavaria, and Silesia [Part of Austria-Hungary in 1879; part of Poland after 1945] of a legume which would have been introduced following the Vienna World Exposition of Vienna, the *Soja hispida*, and from the seeds of which is made, in Japan, a type of sauce that is served as a condiment.

"According to this work, soy sauce *(la sauce du Soja)* was well known in Europe, and it would have even been stylish, at the beginning of this century, in London and Paris, but no-one possessed the plant. It was only after the Vienna Exposition that the attention of some agriculturists, and especially that of Professor Haberlandt, were called to this legume. Some cultural trials were conducted; it was quickly recognized that the varieties originating in Japan and northern China could be best adapted to the climate of central Europe, and the yellow variety was recognized as preferable to all others. The good yields produced by the soybean led to its good acceptance by farmers; even more, chemical tests showed that this legume contained one-third more protein than other protein-rich indigenous legumes. And it contained 6 to 10 times more oil. It could even be classified as an oilseed. The author believes that it should be introduced as a food. He took as an example the diet of a family of workers from Silesia, and he concluded that by replacing 3 kg of potatoes (of 9 consumed per day) and 1 kg of rye flour (of 2.21 kg consumed) with only one kg of soybeans, this family would find itself adequately nourished.

"Let's add again, to analyze this treatise, that in 1878 the plant was attacked by the fungus *Septoria sojina*, and by the caterpillars of the Belle-Dame *(Vanessa carduci)* and well as by the nocturnal moth *(Acroncyta rumicis; Noctuelle de la Patience)*. Rabbits searched avidly for soybeans, chickens like the soaked seeds, and sheep are very fond of the straw, which has 203 times the nutritive value of the straw of peas.

"However, we must note, the introduction of this plant into Europe is not as recent as was thought in Vienna. In April 1854, Mr. de Montigny, the French consul at Shanghai, sent back the first seeds to the Society for Acclimatization in France, and they arrived under the name 'oil peas of China' *(Pois oléagineux de la Chine)*. This plant belonged to the legume family and to the genus *Soja* (Moench), a relative of Dolichos; its species was *Soja hispida*. Let us add that in the report that had preceded the creation of the *Jardin du Bois* at Bologne, read at the meeting of 7 May 1858, Mr. F. Jacquemart verified that the naturalization of this legume was complete.

"At this time, in effect, the plant was imported and its cultivation had succeeded. It had been reproduced from seeds produced in France. The role of acclimatization was finished. Now it was up to agriculture and industry to see what role it could play, to study whether it could be used in place of peas, lentils, and haricot beans, or whether it could render services other than those of these similar legumes. Each introduction takes a long time, and many obstacles must be overcome before a newly discovered plant can be claimed a success. We will watch with pleasure as the horticulturists occupy themselves anew with *Soja hispida*. We should add that if Mr. Quihou declares to have tried the cultivation of this legume many times without success (this Bulletin, 1873, p. 489), Mr. Blavet verifies that it has been cultivated for three years at Étampes (Seine-et-Oise) (Footnote: Seeds harvested at the Garden of Hyères and sent by the Society for Acclimatization to the Horticultural Society of Étampes on 29 Nov. 1874). It is found there growing very rustically and giving extraordinary yields; the pods are very easily threshed with a flail, and the pea weevil *(la Bruche des Poids)* has not yet attacked it *(Bulletin de la Société d'Horticulture d'Eure-et-Loire,* 25 Feb. 1879). Note: Eure-et-Loire is a department in north-central France.

"We would not need to return to the numerous studies published on the subject of soya in our *Bulletin*, especially from 1855 on; but since much more will be said about this new plant, perhaps we owe it to our colleagues to save them some research.

"The soybean *(Le Soja)* is an essential oilseed, but one which is also used for food.

"This bean is cultivated on a large scale in the fields of north China, where the climate is quite similar to that of our colder provinces, and much commerce is based on the products made from it:

"1. The oil, which is preferable to colza- and to rape-seed oil *(de Colza et de Navette)*. However it has a taste of dry legumes and leaves an aftertaste of beans or peas. Yet, with the addition of a small proportion of lard, it becomes quite similar to commercial second-grade olive oils.

"2. The residues from making the oil, which form soybean cakes, used by the Chinese to fatten their livestock and fertilize their fields.

"3. A food for the poor, quite similar to fresh white cheese, called *fromage à la pie* in France, which is generally fried in oil–including soybean oil.

"4. A seasoning *(assaisonnement)* much appreciated by the rich. In this case, the paté of soybeans *(la pâte de Pois)* [tofu] is subjected to fermentation, after the following have been added to it: pepper, salt, powdered bay/laurel leaves, and powdered thyme and other aromatic substances. During the fermentation, the producer sprinkles soybean oil on the paté. After several days of fermentation, the preparation is ready. It (fermented tofu) is a powerful digestive (aid to digestion) and an aperitif, which no one can resist because it is extremely tasty (Report by Baron de Montgaudry, *Bulletin*, 1855, p. 16)." (Continued). Address: France.

60. Cook, G.H. 1879. The soja bean; a new forage plant. *Rutgers Scientific School, Annual Report* 15:54-58. [1 ref]
• ***Summary:*** "When in Munich last year, I saw the soja bean in cultivation, as a new crop, and probably a desirable addition to our forage products. It was seen in the grounds of the Bavarian Agricultural Experiment Station, and was in very vigorous growth. The gentleman in charge gave me a few seeds; and seeds of several other varieties of the same plant were procured at Vienna by my friend Mr. James Neilson. We have planted them, and gathered crops of the different kinds this year. The following is a translation of the paper sent out from the Bavarian Experiment Station to those who were growing and testing the capabilities of the plant." Note 1. See: Lehmann, Julius. 1878. *"Ueber den Anbau der rauhhaarigen Sojabohne. Zeitschrift des Landwirthschaftlichen Vereins in Bayern* 68:61-64. Feb.

"On the Cultivation of the Hairy Soja Bean."–"The exertions made in the last decade to naturalize foreign useful plants in Germany, and by their cultivation to increase the income from farm lands, have so far been without result. This has been the case with sorghum, ramie, Siberian fodder, water rice, &c., for each of which great hopes have been excited; but nothing now remains but the remembrance and the proof of the difficulties in the way of our agriculture.

"Fortunately the success of this pursuit depends less on such attempts, than on increasing the quantity of our well-known crops, by good cultivation and heavy manuring–by careful selection of seed and proper care of the plant. All farmers taking these precautions, and using discoveries in these directions, will surely gain satisfactory profits even without new plants.

"Yet the progressive farmer will be interested and make personal experiments, of these attempts at acclimating, if the plant promises to fill some want. We now seem to have such a one for our increasing cattle raising. We need a fodder for young cattle, for milk cows and for bullocks, whose seeds contain, in proper amount, albumen and fat, with a pleasant taste. In cereals and their brans, and also in leguminous seeds, we have fodder containing albumen but not fat enough. The addition of oil-cake is not entirely satisfactory, because the proportion of fat in it varies, and its cost is too great.

"Two years ago Prof. Haberlandt, of Vienna, an untiring botanical experimenter, introduced to us a plant whose pleasant-tasting seeds are rich in albumen and fat, in very digestible forms. This plant is the hairy soja bean *(Soja hispida, Mönch.)* Prof. Haberlandt found samples of the seed at the Vienna Exposition among the agricultural

products of China, Japan, Mongolia, Transcaucasia and India. He says this plant has been cultivated from early ages. It grows wild in the Malay Archipelago, Java and the East Indies, and is cultivated extensively in China and Japan. Its seeds, boiled or roasted, have a pleasant taste, and form an almost daily part of the food in India, China and Japan. The soja is an annual leguminous plant."

"In 1876, twenty experiments were made in various parts of Bohemia, Moravia [both in the Czech Republic as of Jan. 1993], Southern Austria, Styria [a state in Austria, called Steiermark in German], Hungary, and Upper Silesia [a region mostly in southwest Poland]. From the well-ripened seeds of these crops, one hundred and thirty-five trials were made the next year under various climatic influences. Prof. Haberlandt has written us that only twelve of the experiments failed, and most of the results were unusually good.

"According to Professor Haberlandt there are several varieties of the soja, which vary much in their time of ripening. For the climate of Middle Europe the early kind is best. Sown early in May the seeds mature at the end of September or October. Its time of growth is like that of the horse bean. (This is the *Vicia faba*, the horse bean or Windsor bean of Europe, which is cultivated there for feeding domestic animals, and, like it, ripens after harvest.) It differs from this bean in its productiveness and its non-liability to harm from insects. It has harvested from thirty-three to fifty-five bushels of seed, and two and one-third tons of very nutritious straw to the acre."

"Prof. Schwackerhofer of Vienna, has analyzed the original and harvested seed [two crops], and the soja straw, with the following results." A table shows that the original seed contained 30.56% albuminoids and 15.81% fat. The first and second crops contained and average of 34.56% albuminoids and 18.32% fat–both much higher. The soja straw contained 4.43% albuminoids and 2.51% fat.

A second table (p. 58) compares the composition and comparative value per 100 pounds of 12 feed and fodder crops. Soja beans were found to contain 4.8% ash, 34.7% albuminoids (second highest value after cotton-seed cake (decorticated)), 18.3% fat (the highest), 28.3% carbohydrates, and a comparative value of 2.55 (the highest, with clover hay taken as 1.0).

"In this table the soja bean is shown to have the highest value of any of the substances named, and by mixing it with oat straw or cured corn-fodder, it will make a rich and healthful fodder for cattle, and one which can be afforded in greater quantity and at less expense than first quality timothy or clover hay. It would form, too, a proper crop to be in the rotation between corn and wheat, instead of oats or potatoes, as now practiced. It is not subject to the same difficulties in curing as our common field bean, as the beans do not easily shell out, and coarser stalks enable it to be cured [to make hay] like Indian corn. And being a sowed crop, it is cultivated with the minimum of labor."

Note 2. Prof. George Hammell Cook was instrumental in establishing the New Jersey State Board of Agriculture at Rutgers on 7 April 1872; he was appointed its first secretary. Rutgers thus become one of the early state institutions that conducted agricultural research. On 10 March 1880 the New Jersey Agricultural Experiment Station was established at Rutgers College (New Brunswick)–with state funding only (no federal aid). On 2 March 1887 the Hatch Act created state agricultural experiment stations with federal grants. This is the earliest document seen (Jan. 2005) concerning soybean research by a state research institution or agricultural experiment station.

Note 3. This is the earliest document seen (June 2007) concerning soybeans in New Jersey, or the cultivation of soybeans in New Jersey. This document contains the earliest date seen for soybeans in New Jersey, or the cultivation of soybeans in New Jersey (1879). The source of these soybeans was Bavaria, Germany, and Vienna, Austria.

Note 4. This is the earliest document seen (March 2001) describing cultivation of soybeans by a U.S. land grant institution.

Note 5. This is the earliest document seen (Feb. 2008) that uses the word "albumen" (or "albumens") or the word "albuminoids" (or "albuminoid") in connection with soy. The word "albumen" usually refers to the white / protein of an egg, but here it refers to protein of the soja bean "whose seeds are rich in albumen" (protein). The word "albumin" (first used in 1869) refers to any of numerous simple heat-coagulable, water-soluble proteins that occur in muscle, egg whites, milk, and other animal substances, and in many plant tissues and fluids.

Note 6. This is the earliest English-language document seen (April 2002) that refers to soynuts. Discussing the soybean, it says: "Its seeds, boiled or roasted, have a pleasant taste, and form an almost daily part of the food in India, China and Japan." It is also the earliest document seen (March 2001) concerning the etymology of soynuts.

Note 7. This is the earliest document seen (April 2001) that uses the term "hairy soja bean" to refer to the soybean.

Note 8. This is the earliest English-language document seen (Sept. 2006) with the word "soja bean" (or "soja beans") in the title.

Note 9. This is the earliest English-language document seen (Jan. 2002) related to soybeans that uses the word "forage" in the title.

Note 10. This is the earliest document seen (March 1999) that mentions Mr. James Neilson who, in 1878, obtained several soybean varieties in Vienna, Austria,

brought them back to the United States, and planted them at Rutgers University in New Brunswick, New Jersey, in 1879.

Note 11. This is the earliest document seen (May 2000) that uses the word "rotation" or discusses crop rotation in connection with soybeans.

Note 12. This is the earliest English-language document seen (Sept. 2001) that mentions the word "carbohydrates" in connection with soybeans.

Note 13. This is the earliest annual report seen (Oct. 2001) that mentions soy.

Note 14. This is the earliest document seen (July 2002) that mentions feeding soybean fodder to milk cows, however none has yet been fed.

Note 15. This is the earliest document seen (Nov. 2005) that mentions cotton-seed cake (any spelling). It is also the earliest English-language document seen (Nov. 2005) that contains the term "cotton-seed cake" or "decorticated" in connection with such cake or meal.

Note 16. This is the earliest English-language document seen (Oct. 2004) that uses the word "cured" in connection with making soybean hay. Address: New Brunswick, New Jersey.

61. Haberlandt, Friedrich. 1879. Der allgemeine landwirthschaftliche Pflanzenbau [General agricultural plant cultivation]. Wien [Vienna]: Verlag von Faesy & Frick. ix + 760 p. Index. 23 cm. [200* ref. Ger]

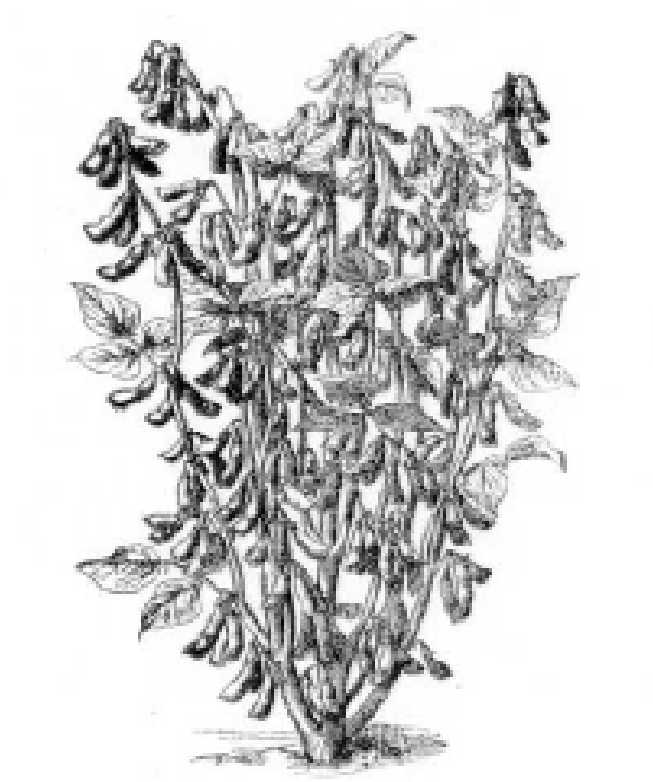
• ***Summary:*** An excellent, very original and creative book. Even though it was written by the man who wrote the first book on soybeans in the Western world (published one year earlier, in 1878), this book has no entry for soybeans in the index, although they are mentioned several times in the text–for example on pages 28, 106, 309, 311, 679, etc.

Note 1. This book was published after Prof. Haberlandt's untimely death by Wilhelm Hecke, his colleague and a professor of agricultural administration at the same Imperial-Royal College of Agriculture in Vienna.

Note 2. Also mentions alfalfa, hemp, lupin, sesame, and many other plants. Address: Prof., Imperial-Royal College of Agriculture in Vienna (Ordentliche Österreich Professor an der kaiserlich-königlichen Hochschule fuer Bodencultur in Wien).

62. Kraemer, A. 1879. Die Soja-Bohne. Ein Cultur-Versuch aus dem Jahre 1878 [The soybean. A culture trial from the year 1878]. *Schweizerische Landwirthschaftliche Zeitschrift ("Die Gruene")* 7(3):149-65. [Ger]

• ***Summary:*** Begins with a long summary of the soybean research conducted by Prof. Haberlandt in Vienna and his co-workers throughout central Europe. An illustration (line drawing, p. 155) shows a soybean plant with pods. Address: Zurich, Switzerland.



63. Postelt, A. 1880. Dalji pokusaji "sojom"* [Further attempts with soybeans]. *Gospodarski List (Farmer's Newspaper, Zagreb, Croatia)* 28(4):26-27. Feb. 20. [Cro]

• ***Summary:*** A footnote (p. 26) referring to the title states: "In accordance with the statement we have repeated so often, that soybean trials need to be continued, we are publishing this report of soybean trials kindly received from Mr. Postelt, who also sent several nice treatises to the German journals."

"In 1875 the late professor Haberlandt proved with trials in the experimental fields of the agricultural faculty [Vienna], that soya *(soja* [the soybean]), the most important legume in East Asia due to its good yields and high nutritional value, also has in our climatic environment, the required minimum conditions for good growth.

"From that year onward, soybeans began to be planted in all Austro-Hungarian crown lands, demonstrating that Haberlandt was not unrealistic in hoping that soya would establish itself and maybe become one of the leading agricultural crops in our country.

"Also this report of successful trials with soya in our country hopefully will be of interest to the readers of *Gospodarsky List* and stimulate further testing.

Trials included in this report are from the years 1878 and 1879. These two years, during which there were extremely different weather conditions, are very appropriate to demonstrate how this crop adapted itself to cold, moist

weather on the one hand, and to hot, dry conditions on the other.

"In the spring of 1878 I received soybean seed samples from 3 donors. First, 100 seeds of an early Mongolian variety from Prof. Haberlandt, who has regretfully passed away. Second, 100 seeds of the same kind from a seminary at St. Peter near Graz. And third, 100 brown seeds of Chinese origin sent by a friend in Lower Austria; these were seeds from his own harvest from a sample he had obtained a year earlier from Prof. Haberlandt.

"Due to the small number of seeds, I decided to start the trial in our own garden in a place which had not recently received manure, but still had good fertility power. The texture of this alluvial soil on undrained subsoil belongs to heavy loamy clay. In the fall before sowing I cultivated the plot and the next spring, in March, I leveled it. On 1 April 1878 soybean seeds were planted, one seed at a time, 35 cm apart, so that the yellow soybeans covered 25 square meters and the brown soybeans 12 square meters.

"Almost every seed emerged after 3 weeks; young plants were hoed twice, carefully surveyed, and all weeds eliminated. The plants were growing exceptionally well, reaching a height of 1 meter. (Editor: Nowhere else in Croatia were plants so tall.) By mid-June some flowers started to appear at each stem node. But due to quick growth, rainy weather, and too narrow a stand, lodging started, and the lower part of the foliage started turning yellow, so I cut strait branches and supported each plant, as is done with peas.

"By mid-August the yellow variety started ripening, although the foliage was still completely green. The brown variety lagged behind by about a fortnight. When all the plants were ripe, they were harvested, roots and all, dried, and then threshed.

"The yield was outstanding. The yellow variety yielded 12 kg, which is equivalent to 4,900 kg/ha, and the brown one yielded 7 kg, which is equivalent to 5,800 kg/ha. The rest of the plant was given to the cows, which eagerly ate all parts but the stems, even though they were on good green forage at that time. Aware that such a small trial could not be compared with field production, I decided to plant soybeans next year on an arable field which had the same soil type but was very poor in nutrients.

The spring of 1879 was extremely wet; water in the fields with undrained subsoil stagnated in the furrows until June, which prevented preparation of the soil in time to plant soybeans. I almost decided to stop the trial on this field that year, but the desire to see how the new legume would grow under such bad conditions led me to plant soybean seeds on June 10th in a roughly prepared seed bed; 200 square meters were planted with each variety–this time in holes in a grid pattern 45 cm apart in each direction, with 3 seeds in each hole.

"Immediately after the soybeans were planted, the weather switched dramatically from extremely wet to extremely dry. Not a drop of rain fell, so I guessed that the crop would fail. Emergence of the plants was uneven, and especially in the brown variety very poor. The cracked soil surface did not allow good cultivation, but I barely managed to hoe half of each plot, leaving the rest unhoed for comparison to see how the plants would compete.

"The height of the plants reached about 25 cm, but despite the bad conditions, flowers and pods were abundant, as if somebody had clustered them on the stems.

"The yellow variety was ripe on Sept. 20, and the brown on Oct. 3. The seed was so dry that no additional drying was required for storage. The yellow variety yielded 45 kg, which is equivalent to 2,250 kg/ha, and the brown one yielded 15 kg, which is equivalent to 750 kg/ha.

"These yields could not be considered normal since the soils were poor, the planting time late, and weather so bad that it could not be worse. This is particularly true for the brown variety due to poor emergence in such bad soil.

"Taking into account all circumstances of these two years of trials, I would conclude, regarding the final yield, that the trials to introduce soya into Croatia have succeeded completely. Soybeans will tolerate a high degree of excess moisture as well as extreme drought, while outyielding all other legumes and being at the same time of higher nutritional value than all the others. Thanks to an abundance of proteins and fats, soybean seeds, which are also tasteful, represent a good source of food for humans and feed for animals, especially for fattening cattle, swine, and poultry. Also soybean straw is very good, and better accepted by other animals than the straw of other legumes.

"Regarding the soil, this crop is not demanding; fresh manure may be avoided, the number of seeds required is moderate, and there are no difficulties in fertilization. Diseases are absent, and the plant is not frequented by harmful insects. The only enemy is game, especially rabbits, which are abundant here in Croatia, but against which we are able to protect the plants. All of these soybean traits support the conclusion that it pays not to disregard the soybean. Indeed, more and more of our advanced peasants and farmers should start to grow it."

Translated by Dr. Joze Spanring of Ljubljana, Slovenia. Address: Demerje.

64. Kuehn, L. 1880. Empfehlt sich die Kultur der Sojabohne fuer unsere badische Landwirthschaft? [Is the cultivation of soybeans recommended for our Baden agriculture?]. *Wochenblatt des Landwirthschaftlichen Vereins im Grossherzogthum Baden* No. 11. p. 84. March 17. [Ger]
• ***Summary:*** The hirsute soybean, *Soja hispida*, has already been the object of several experiments in Europe. Its cultivation had a bright future–according to the recently

deceased Prof. Dr. Haberlandt of Vienna, with economic significance, which has not yet been realized.

65. *Wiener Landwirthschaftliche Zeitung.*1880. Fragekasten [Question box]. 30(39):312. May 15. [Ger]
• ***Summary:*** Question No. 185. According to the book *The Soybean (Die Sojabohne),* by Friedrich Haberlandt, soybean plants can be easily and safely transplanted. Has the transplant of large numbers of plants *(im Grossen)* been proven to stand the test? When, in what stage of growth, should it be carried out? At what stage of development should the soybean plants be thinned? an plants which have been pulled out be transplanted? Asked by: A. v. K. in M, near N (Hungary).

66. Sempolowski, A. 1880. Zur Kultur und Verwerthung der Sojabohne [On the culture and use of soybeans]. *Fuehlings Landwirtschaftliche Zeitung* 29(5):278-81. May. [Ger]
• ***Summary:*** It is well known that Prof. Dr. Fr. Haberlandt, who obtained soybeans in 1873 at the Vienna Exposition (and unfortunately died at too young an age), conducted many soybean trials in order to find varieties that yielded well in Austria and bordering countries. The best varieties proved to be the yellow-seeded ones that originated in Mongolia. Later, in other areas many more trials were conducted.

"I conducted my first trials with soybeans two years ago [i.e., in 1878] at 53-53º north latitude. The yield was satisfactory, however I had to let the harvested plants finish ripening indoors." Further trials were conducted in former years in several places in Posen [Poznan; a very old city and province in west central Poland, part of Prussia 1793-1918]. A table (p. 279) shows where soybeans were grown (at Oswiezem, Twno, Zabikowo, Prusinowo, and Zabikowo), the number of seeds planted, the dates of planting (April 24-May 15) and harvest (Oct. 4-16), the seed spacing, yield (in kilograms and number of seeds), seeds harvested per seed planted (maximum 146 to 1, minimum 22 to 1), and quality of the harvested seed. This table shows the extraordinary fruitfulness of the soybean.

"In China and Japan, soybean seeds are used as food. Almost daily they are enjoyed as vegetables, like our beans *(beinahe tagtäglich als Gemüse, gleich unseren Bohnen, genossen wird),* or they can be used to prepare various sauces, which are known as tasty and digestion-promoting additions to the other dishes and which have been shipped to Europe." The process for making soy sauce is described. Soybeans are used as a source of oil, especially in the provinces of Newchwang and Cheefo, where there are many oil mills. The method for pressing out the oil is still very primitive (see a report on the agricultural part of the Paris Exhibition of 1878; Berlin 1879, page 57). Soybean cake is used as fertilizer on sugar plantations. Cooked soybeans are also tasty, as in a salad with oil and vinegar, or in soup. It must be noted that it takes a long time to cook soybeans until they are soft–at least 24 to 48 hours. A table shows the nutritional composition of soybeans (9.23% water and 33.35% protein). Because the leaves and hulls are also quite nourishing, the soybean has a great future as a fodder plant.

Note: This is the earliest German-language document seen (July 2001) that clearly mentions green vegetable soybeans, which it describes as shown above. Address: Dr.

67. Hansel, Jul. 1880. Kleinere mittheilungen: Das verpflanzen der Sojabohne [Short communications: Transplanting soybeans. Answer to question #185]. *Wiener Landwirthschaftliche Zeitung* 30(44):349. June 2. [Ger]
• ***Summary:*** The opinion of Haberlandt, that the soybean can be transplanted easily, has been confirmed by trials at the Marburg School of Viticulture *(Marburger Weinbauschule)* [wine-growing], and other places. Transplanting is most easily done when the small soybean plant has its first two real leaves (in addition to its two cotyledons) and is about 10-12 cm tall. Address: Marburg an der Drau [Slovenia].

68. Hecke, W. 1880. Die Sojabohne im Jahre 1878 [The soybean in 1878]. *Fuehlings Landwirtschaftliche Zeitung* 29(1):329-31. June. Extract from his article in Wiener Landwirtschaftliche Zeitung (2 June 1880). [1 ref. Ger] Address: Prof. in Vienna.

69. *Mondes, Les (Le Cosmos. Revue des Sciences et de leurs Applications).*1880. Le soya ou soja hispida [The soybean or Soja hispida]. 52(9):302-03. May/Aug. Series 2. [Fre]
• ***Summary:*** "The new oil peas *(pois oléagineux),* in which there has been so much interest since last year, have shown in agronomic trials that they can be easily acclimatized. Mr. Olivier Lecq, the able agronomist mechanic from Templeuve (Nord), was kind enough to give us information on these trials. First, he claims that the name of this legume is *soya,* not *soja* a term used by Dr. Haberlandt in his work on this subject. Mr. Lecq has submitted the soybean *(le soya)* to chemical analysis, which has given the following results: Nitrogen almost 6%, protein 37.13%, fats 49.70, nitrogen-free organic materials 27.60%, salts 4.3%.

"The soya is therefore one of the most nutritive materials in the vegetable kingdom. If we can agree that its products are abundant and that its cultivation is not overwhelmingly demanding, then agriculture should rejoice in this new conquest."

Note: As of 1997, Nord is a department in northern France; its capital is Lille (130 miles north-northeast of Paris).

70. Carrière, E.-A. ed. 1880. Chronique horticole: Café de Soja [Horticultural chronicle: Soy coffee]. *Revue Horticole: Journal d'Horticulture Pratique (Paris)* 52:341-45. Sept. 16; 52:423-24. Nov. 16; 52:441-42. Dec. 1. [1 ref. Fre]
• ***Summary:*** This record contains three separate but linked sets of comments about soy coffee. (1) Page 344: *"Emploi des graines de Soja* (Use of soybean seeds)." "At the moment when, not without reason, we are preoccupied with the diseases which afflict the coffee plant at various points on the globe, and for which we search for substitutes, we call attention to a preparation which, in this effect, was presented by M. Paillieux. It concerns the seeds of the soybean *(Soja)* which, when roasted, one is assured, can replace coffee... M. Paillieux invokes the facts and the testimony of competent people, for example those of professors Friedrich Haberlandt, and above all that of M. Joseph Kristan, professor at Cape d'Istria [Capodistria], who says that this plant has been cultivated for a very long time in Istria where its seed is employed as an equivalent to coffee, and which does not present any difference from the latter." Note 1. See Paillieux (Sept. 1880) in *Bulletin de la Societe d'Acclimatation* 27:456.

Note 2. The Istrian Peninsula, on the northeast coast of the Adriatic Sea, is about 60 miles long from Trieste at its base to its southern point. Part of Austria from 1815-1919, it became part of Yugoslavia in 1946, and since June 1991 the northern area has been part of Slovenia and the southern area part of Croatia.

(2) Page 423-24: *"Le Soja employé comme succédané du Café* (The soybean used as a substitute for coffee)." "The exciting and stimulating properties attributed to the soybean *(Soja hispida)* are confirmed by experience and its use as a coffee substitute currently seems almost beyond doubt. On this subject, M. L. [Léon] de Lunaret writes us the following letter" from Montpellier, dated 20 Oct. 1880. "An article which I read in the last issue of this periodical reminded me that during my trip to Hungary, I drank soya coffee *(café de Soja).* Compared to coffee made from chick-peas or chicory root, soya coffee comes out slightly ahead. At Montpellier there is a company which only exists here, at least under similar conditions. It sells low-priced coffee (1 *sou* per cup, with milk and sugar)... I gave the owner soybeans from my last year's harvest and asked him to roast and grind them, then to prepare them as coffee and serve this new coffee to his regular customers and ask for their impressions." Well, the soya coffee was accepted so enthusiastically that the next day the owner came to give me an account of how his coffee was welcomed by his customers, and asked me if I could sell him a large quantity of my soybean seeds for 30 centimes per half kilo, which is higher than the typical price of chicory and chick-peas that he ordinarily uses. I answered that I did not have any seeds to sell because I was keeping them to plant next year. He then agreed to buy all my harvest next year and assured me that his competitors would not be able to compete with his soya coffee.

"To support what I have said, I will send you some roasted and ground soybeans, so that you can judge for yourselves, but for the moment forget the inimitable aroma of mocha coffee, yet remember the lower price and the industrial opportunities that are offered by this new legume, which is now, for good reasons, attracting so much attention."

Page 441-42: *"Le café de Soja* (Soy coffee)." "We published an interesting note from Mr. de Lunaret, on the subject of soy coffee, in our previous issue. He has sent us some of this powdered coffee, we have sampled it, and now we can express our opinion on the subject. It is certainly not mocha, but neither is it inferior to coffee made from chicory, chick peas, acorns, etc.; it is soy coffee, a unique product, rather difficult to define and one to which we will return. But when prepared like regular coffee, it gives a rather thick liquid, very dark in color, with a weak flavor / savor, which reminds one a little of chicory coffee... We believe that, when mixed with real coffee, the two would harmonize perfectly. This should be tried. The last word on Soya is far from having been said."

Note: This is the earliest French-language document seen (March 2001) that refers to soy coffee as *café de Soja.* Address: France.

71. Paillieux, Auguste. 1880. Le soya, sa composition chimique, ses variétés, sa culture et ses usages [The soybean, its chemical composition, varieties, culture, and uses]. *Bulletin de la Societe d'Acclimatation* 27:414-71. Sept.; 27:538-96. Oct. 28 cm. [73 ref. Fre]
• ***Summary:*** One of the most important and original of the early publications on soya in Europe. Its in-text bibliography on soya was the largest of any published up to that time.

Contents: Part I: Introduction and extracts on soybeans and soyfoods from 30 articles published previously in the *Bulletin of the Society for Acclimatization* from 1855 to 1880 (pages 414-430). 1. Soybean botany (p. 430-31). 2. The soybean in Japan (p. 431-42): Engelbert Kaempfer and his writings on miso and shoyu, information on soya from a document titled *Japan at the World Exposition of 1878 (Le Japon á l'Exposition universelle de 1878,* written in French by a Japanese, p. 29-33), recipe for making shoyu in France, tofu. 3. Soya in Cochinchine (French Indochina, p. 442-46): Black soybeans. 4. Soya in China (p. 446-51): Soy oil *(Huile de Soya),* tofu *(le fromage de soya, teou-fou),* soy sauce *(tsiang-yeou;* In London, England, it is sold under the name of "India Soy" at Cross & Blackwell, Soho-Square {p. 451}). 5. Soya in Austria-Hungary (p. 452-71): Starting with soybeans at the World Exposition of Vienna in 1873, includes a long, in-depth

discussion (with many excerpts) of Prof. F. Haberlandt's book *Le Soja*, published in Vienna in 1878.

Tables in Part I show: (1) The chemical composition (in both their normal and dry states) of Chinese soybeans *(pois de Chine)*, tofu *(fromage de pois)*, and tofu curds (p. 427). (2) The yield of tofu. 120 gm of soybeans yields 184 gm of tofu (p. 427). (3) The weight and nitrogen content of the different components when tofu is made from soybeans (p. 428). (4) The Japanese names of 23 soybean *(mame)* varieties and a very brief description of their characteristics (p. 435-36; e.g., 1. *Go-guwatsu no mame* {5th month bean}. 2. *Use mame [sic, Wase mame]* {early}. 3. *Nakate mame* {half season}. 3a. *Okute mame* {late}. 4. *Maru mame* {round}. 5. *Shiro teppo mame* {white, like a pistol bullet} 6. *Kuro mame* {black}. 7. *Kuro teppo mame* {black, like a pistol bullet} 8. *Koishi mame* {small stone}. 9. *Awo mame {Ao*, green}. 10. *Kage mame* {shade, shadow}. 11-15. *Aka mame* {red; 1 of same species, two of different species}. 16-18. *Tsya mame {Cha*, tea colored}. 19. *Kuro Kura Kake mame* {black saddled}. 20. *Aka Kura Kake mame* {red saddled}. 21-23. *Fu iri mame* {striped, variegated, mottled; see Uzura mame = speckled like quail eggs}). This nomenclature was taken from a Japanese work titled: "Explanation, with figures, of trees and plants recently determined / identified."

(5) The romanized Chinese names of six types of soybeans and a French translation of each (e.g., *Houang-teou = Soya jaune)* (p. 447). (6) Two analyses of soybean seeds, reprinted from *Chemischer Ackersmann*, 1872 (p. 458). (7) The chemical composition of three soybean varieties, including Yellow of Mongolia, Yellow of China, and Reddish-Brown of China; the composition of the original seeds and the first generation seed is given for each type (p. 460-61). (8) The chemical composition of reddish-brown, yellow, and black varieties of soybeans (p. 469-70; data from M. Schroeder, Mach, and Caplan, published by F. Haberlandt). (9) Weight of 1,000 seeds for four generations grown out in Vienna. Original seeds: 81.5 to 105 gm. First generation: 110.5 to 154.5 gm. Second generation: 141.8 to 163.6 gm. Third generation: 116.0 to 151.0 gm.

Contents (continued), Part II. 6. The Soybean, by Count Heinrich Attems (p. 538-60): Soybean culture and harvest, uses, and preparation of whole soybeans. Practical soybean culture trials on a grand scale, in the domain of the archduke Albert, an extract from a booklet by Edmond de Blaskovics titled "The Soybean, Its Culture, Use, and Value as Forage" (Vienna, 1880). Excerpts of six articles on soya from the *Wiener Landwirthschaftliche Zeitung (Viennese Agricultural Journal)* (Jan. 1879 to June 1880) (p. 548-54). Excerpts of ten articles on soya from the *Oesterreichisches Landwirtschaftliches Wochenblatt (Austrian Agricultural Weekly)* (March 1879 to Feb. 1880) (p. 554-59).

7. The soybean in France (p. 561-76): History (starting with Buffon, who became director of the *Jardin des Plantes* [Royal Garden, also called Jardin du Roi] in 1739), varieties grown, cultivation, utilization (mainly as forage plant for livestock and as an oilseed for oil and meal), accessory uses (miso, Japanese-style soy sauce *{shoyu}*, Chinese-style soy sauce *{tsiang-yeou}*, Japanese-style tofu *{tô-fu}*, Chinese-style tofu *{téou-fou}*, soy nuggets *{téou-che}*, and soy coffee *{café de Soja}*, white fermented tofu *{fromage blanc}*, red fermented tofu *{fromage rouge}*, green vegetable soybeans *{des graines fraîches, écossées encores vertes, comme le Haricot flageolet}*, whole dry soybeans *{les graines sèches comme le Haricot blanc ordinare})*.

8. Conclusion and tables showing French analyses of soybeans (p. 576-78). Appendixes (p. 579-96): Summaries of letters to the Society describing 27 cultural experiments with soybeans conducted during late 1880 at various locations in France, Switzerland and Algeria. (Note: Though the publication date of this appendix is given as Oct. 1880, some of the letters are dated as late as 21 Nov. 1880). Reprint of a 2-page letter from Eugene Simon, former French consul in China, on soybean farming in China (p. 591-93). Reprint of a description by Eugene Simon, based on the description of a Chinese, of how tofu is made in China (p. 593-94). A French translation of a 1781 article by Isaac Titsing on preparation of soy sauce in Indonesia (p. 594-95). And some information about soybeans from the ancient Chinese herbal *Pên Ts'ao Kang Mu* (p. 595). Reprints of 2 letters from Eugene Simon in China, on soya and tofu in China. French translation of a 1781 article by Isaac Titsing on preparation of soy sauce.

Note 1. We find it surprising that this superb work contains no illustrations of a soybean plant, or of any part of the plant, or of any foods made from soybeans; the only illustration (p. 569) is a cross section of an empty pit into which one could put a mixed silage that contained 20% soybean plants.

Note 2. This is the earliest French-language document seen (Dec. 1999) that uses the term *Huile de Soya* to refer to soybean oil.

Note 3. This is the earliest document seen (March 2001) that has a bibliography of more than 50 references concerning soybeans.

Note 4. This is the earliest European-language document seen (Sept. 2004) that mentions the Japanese soybean types *Nakata-mame* or *Okute mame.* Address: France.

72. Paillieux, Auguste. 1880. Le soya, sa composition chimique, ses variétés, sa culture et ses usages: Le soja comme un succédané de café [The soybean, its chemical composition, varieties, culture, and uses: The soybean as a coffee substitute (Document part)]. *Bulletin de la Societe d'Acclimatation* 27:456. Sept. [Fre]

• ***Summary:*** In 1878 Haberlandt reported that the soybean was already being used as a coffee substitute in southern Europe. "The soybean is already grown here and there in southern Austria, although it is not widely known. Last summer, Dr. E. Mach, director of the agricultural Institute in southern Tirol [since 1919 in Italy, just south of Brenner pass], sent me a sample of a plant which is said to have been long known there, and it was none other than the soybean. In that area it is known as the coffee bean *(fève du café)* and the seeds are used for the manufacture of a coffee substitute *(d'un équivalent de café).*

"Mr. Josef Kristan, a headmaster on the Istrian Peninsula [Capodistria, on the Adriatic sea, since 1991 split between Croatia and, at its base, Slovenia] told me that he had discovered that the soybean existed in Istria, and that its seed is used there as a coffee substitute *(un succédané du café).* A friend assured him that there was no difference between the soybean seed and real coffee."

Note: This is the earliest French-language document seen (March 2001) that mentions soy coffee, which it calls *un succédané du café* ("a coffee substitute"). Address: France.

73. Paillieux, Auguste. 1880. Le soya, sa composition chimique, ses variétés, sa culture et ses usages: Le soja en France [The soybean, its chemical composition, varieties, culture, and uses: Soya in France (Document part)]. *Bulletin de la Societe d'Acclimatation* 27:561-76. Oct. [Fre]

• ***Summary:*** "Historical.–Buffon [Comte Georges-Louis Leclerc de Buffon, lived 1707-1778] became director of the *Jardin des Plantes* [Royal Garden, also called *Jardin du Roi]* in 1739. Shortly thereafter French [Catholic] missionaries in China sent him specimens and seeds of most of the important plants of that country. Soybeans or their seeds were almost certainly among their shipments, and without being able to prove it, we have no doubt on this subject. Be that as it may, we have recovered from the Museum [of Natural History] a sachet which, in 1779, contained soybean seeds. It bears the following dates of harvest: 1834, 1836 to 1841, 1843, 1844, 1846, 1847, 1849, and 1850 to 1855 inclusive. Then 1857 to 1859, 1862, 1865 to 1867, 1870, 1871, 1873, 1874, 1877.

"In fact, soybeans have been cultivated at the Museum very probably since 1740, certainly in 1779, and more recently from 1834 to 1880 without interruption. The plant has always germinated and borne fruit as desired, cultivated like haricot beans (French green beans), without any particular problems. It has proved its hardiness and the small influence which changes in atmospheric conditions have on it.

"Since 1855, the abundant distribution of soybean seeds ceaselessly by the Society for Acclimatization, has allowed soybean agronomic trials to be conducted throughout France. But it is difficult, if not impossible, to obtain information about trials made before 1855.

Mr. Blavet, president of the Horticultural Society of Etampes, has uncovered an interesting document in a brochure titled *Seance publique de la Societe d'Agriculture de l'arrondissement d'Etampes* (Public session of the Agricultural Society of Etampes), for the year 1832, page 84. One chapter bears the title "Report by Mr. C. Brun of Beaumes, member of the Agricultural Society of Etampes, chevalier of Saint-Louis, doctor on the faculty of sciences of France, of some agronomic trials conducted by him in 1821, on various species of cereal grains, on his property of Champ-Rond, near Etampes [Seine-et-Oise], France." A final note says: The heat of the summer of 1821 was so favorable to exotic plants that I saw the following plants bear fruit abundantly in my outdoor garden at Champ-Rond, near Etampes: the Dolichos of China *(le Dolichos de la Chine;* perhaps wistaria), the soybean *(Dolichos Soja),* and Dolichos Lablab (also called hyacinth bean). The Niouelle (?) of Senegal showed here for the first time its long pods *(épis),* etc." Note: This is the earliest document seen (April 2000) that describes the 1821 soybean experiment by Mr. C. Brun of Beaumes.

"The duty of the Museum, as a public-interest organization is to distribute seeds, either as a pure gift or as part of an exchange, to persons who request them. Undoubtedly, therefore, trials have been made at various early dates, but we have no record of them.

"Starting in 1855 a large number of participants received seeds from the *Société d'Acclimatation* and experimented with them. Most of these people did not report the results of their trials, as they were obliged to. Others, however, did, including Messrs. Vilmorin, Delisse, Lachaume, etc. But their cultivation did not lead to any progress, so the soybean was not established a permanent crop in France.

"In 1868 Mr. Chauvin, vice-president of the Society of Horticulture at Côte-d'Or [a department in eastern France], cultivated several soybean varieties there, and the culture has continued there to this day.

"In 1874 the Society of horticulture of Etampes received soybean seeds from the Society for Acclimatization, and began experiments that continued until 1880. One can find them mentioned in the Introduction to the Etampes livestock reports. Their cultivation is direct with great seal by Mr. Blavet, president of the horticultural society of that area.

During the same period, one Dr. H... brought the best soybean varieties from Japan and cultivated them. He failed in this trial because his soybeans were late-maturing types. He then restricted himself to cultivating yellow soybeans from China. He encountered no more difficulties and he made *Sho* [perhaps shoyu, or Japanese-style soy sauce] by himself for use in his home.

"In 1878 we received seeds of two soybean varieties. One, from Japan, had white flowers and very pale yellow seeds with a greenish hue. The other, from China, was yellow and belonged to the *Houang-téou* ["yellow soybean"] series; they were among the seeds received from Mr. Montigny and other donors, and have been cultivated at the Museum, at Etampes, at Marseilles, and a little bit all over. (Footnote: These varieties look a little different on the outside, but their chemical composition, usage, and cultivation are the same).

"The seeds from Japan give us nice green foliage, but the plants do not mature their seeds. The Chinese variety succeeds in France as it does anywhere else."

In 1879 a yellow variety received directly from China matured well and was harvested at Marseilles. In 1880 Vilmorin-Andrieux & Company introduced into France one of the varieties tested by Haberlandt in Austria, which variety has proven well adapted to French conditions.

On pages 564-65 the author attempts a sober appraisal as to why a plant with such obvious merits, that has been known in France for over 140 years, is still virtually unknown. Established institutions such as the Museum of Natural History and the government had taken exasperatingly little interest in aiding the private efforts of the Society to introduce new plants. Chemical analyses, demonstrating the nutritional superiority of the soybean, had been lacking until about 1855, when Frémy [Fremy] confirmed that the soybean contained oil. Messrs. Champion and Lhôte have given an incomplete analysis [published in 1869]. But the classical books on agricultural chemistry, the works of our professors, which make known the chemical composition of the seeds of our typical legumes, omit information on the soybean. There was a general resistance, especially on the part of the establishment, to growing new crops and using new foods. And finally the basic approach of the Society in introducing soya first and foremost as a human food was questioned.

"Our point of departure has not been successful. Soya has been presented simply as a new legume. But it is more difficult to cook than other legumes, The flavor is good, but not superior. Fresh, it takes lots of time to shell. Dry, it requires pre-soaking for 24 hours in water that is not hard. If one is ignorant of its nutritive properties, there would be little incentive to grow it, and one would keep growing the traditional legumes instead.

"The people of Austria-Hungary have been wiser. Having already acquired incontestable proof of the value of soya for livestock fodder, they have no other objectives. They seem at the very least to have considered as secondary the utilization of soya for human nutrition. Therefore as soon as they had enough seed, they cultivated large areas, while we were still cultivating the furrows between the rows in the kitchen garden for use as food.

"The seeds will soon be found in all the good markets of southern Germany. The small farmer will then find them (soybeans) all around him at low prices. In eating them, he will find himself strengthened. Then he, in turn, will plant them himself."

Page 567 continues: "We tried to introduce soya as a food plant for the garden rather than as a fodder and oilseed. We started where we should have finished. If we persist in this direction we shall fail. Soya will fall back into oblivion, while in southern Germany, the Danube provinces, central Russia, and Italy, it will soon be widely grown and serve as a source of riches."

Note: This document contains the earliest date seen for soybeans in France, or the cultivation of soybeans in France (very probably in 1740, certainly in 1779). The source of these soybeans was French missionaries in China. Address: France.

74. Podoba, Ivan Grigor'evich. 1880. Opyt vozdelyvaniia maslichnago gorokha (Soja hispida), v Tabricheskoi gubernii [Experiments concerning the growth of an oil-bearing pea (Soja hispida) in the Tavricheskaia region {of Ukraine}]. *Zapiski Imperatorskago Obschestva Sel'skago Khoziaistva Uzhnoi Roccii (Odessa)*. Oct. Part 4. Unpaginated. [Rus]

• ***Summary:*** Contents: Description of soil suited to soybeans. Conditions of light vs. shade suited to soybeans. Protection of soybeans from drought and predators. Methods of harvesting soybeans. Composition of the soybean plant: number of pods and seeds. Acquisition of soybeans in 1877 from Haberlandt. Benefits and advantages of soybeans.

"In 1877 I received 25 yellow soybean seeds from Prof. Haberlandt. I have multiplied this until now I have more than 15 lb of seed; I would have more than 600 lb, if rabbits had not attacked the soybeans. Thankfully, I had more seeds left from that batch; I planted only one-fourth of the seeds I had, in fear of my late-spring sowing."

During the time before summer experiments with soybean cultivation, Mr. Podoba did not notice any signs of soybean regrowth [which shows it is an annual plant]. "I can surely state that this is the best / most worthy member of the bean family, and that it can be cultivated here and wherever, for example common beans *(Phaseolus)*, sorghum, and maize are grown. The soybean needs the same number of heat units (2,500 to 3,000) as the above-mentioned plants need." Address: Tavricheskaia [Ukraine as of 2002].

75. Anderegg, F. 1880. Verschiedene Mittheilungen: Soja-Bohne [Various communications: The soybean]. *Schweizerische Landwirthschaftliche Zeitschrift ("Die Gruene")* 8(1):100-01. [1 ref. Ger]

• ***Summary:*** "The undersigned received in the year 1877 from Prof. Haberlandt in Vienna the pleasant assignment, to establish in our local canton's experimental nursery, the first cultivation station in Switzerland for the soybean, which Prof. Haberlandt had acclimatized from Japan and China. Subsequently, in the first year, the yields exceeded all expectations, and the results of other experiment stations in Austria, Hungary, Steiermark, etc. showed themselves to be equally favorable. In 1878, in the interest of this new crop plant and its dissemination, he [Haberlandt] gave some private individuals and various canton governments [in Switzerland] small quantities of seeds for experimental planting in 1879, in places such as: Zurich, Bern, Lucerne, Glarus, Solothurn, St. Gallen, Thurgau, Aargau, Basel-Land (Baselland), Vaud (Waadt), Tessin (Ticino, canton in Switzerland), and Genf (Geneva).

"In order to establish very definite guiding principles in the cultivation and profitability, the undersigned [Prof. Anderegg] would be very grateful if you would send him of the results of your cultivation for a report [that he intends to write].

"The plant seems increasingly to be gaining ground, and is already planted to good advantage in large quantities in other countries for use as a food- and fodder plant. Thus it is all the more necessary, based on these local results, to recommend the general introduction of this plant to our farmers.

Thur, 16 Jan. 1880, Prof. F. Anderegg. Address: Thur [Chur], Switzerland.

76. Hansel, Julius. 1880. VIII. Anbauversuche mit der Sojabohne im Jahre 1878 [VIII. Agronomic trials with the soybean in the year 1878]. *Bericht der steiermaerkischen Landes- Obst und Weinbauschule bei Marburg a/d Drau* p. 14-22. [1 ref. Ger]

• ***Summary:*** Note 1. The title page of this volume continues: "*... über die ersten 8 Schuljahre vom 1 März 1872 to 1 März 1880, zugleich als Jahresbericht für das achte Schuljahr. (Aus Anlass der Grazer Landes-Ausstellung im September 1880). Mit 6 lithographierten Plänen.*" Translation: "... about the first 8 school years from 1 March 1872 to 1 March 1880. The same as the Yearly Report for the 8 school years. (On the occasion of the Graz agricultural exhibition in 1880). With 8 lithographic diagrams.

Note 2. Maribor is a city in northeastern Slovenia, on the Drava River near the Austrian border about 65 miles (105 km) northeast of Ljubljana. Address: Marburg an der Drau [Slovenia].

77. Wein, Ernst. 1881. Die Sojabohne als Feldfrucht [The soybean as a crop]. *Journal fuer Landwirtschaft* 29:563-613. Supplement *(Ergänzungsheft).* A 50-page supplement at the end of volume 29. Apparently also published as a monograph in 1887 in Berlin. [7 ref. Ger]

• ***Summary:*** This work, which draws heavily on the research of Prof. Friedrich Haberlandt, contains practical instructions for the farmer who wants to grow soybeans and offers a compilation of current research findings.

Contents: 1. Characteristics of the soybean *(Soja)* and its varieties (p. 3-5). 2. General suggestions for the cultivation, growth, care, harvest etc. of the soybeans *(Sojabohnen)* (p. 5-9). Tables show (for yellow soybeans): Emergence of 100 soybeans at various dates in May and June based on depth of planting (p. 7). Depth of planting, weight of the seeds of 100 plants, weight of the straw of 100 plants, and weight of 100 seeds (p. 7).

3. Chemical composition of the soybean plant. Tables give the composition, including maximum and minimum values, of the following varieties, based in part on earlier published sources: (1) Soja hispida tumida, Var. pallida, yellow soybean (16 sources). (2) Soja hispida tumida, Var. castanea, brown soybean (8 sources). (3) Soja hispida tumida, Var. atrosperma, black round soybean (2 sources). (4) Soja hispida platycarpa, Var. melanosperma, black oblong soybean (2 sources). Also: (5) Composition of five legumes: peas, beans, lupine, yellow soybean, brown soybean. (6) Composition of straw (5 sources, incl. Schwachöfer of Vienna, Caplan of Vienna, Weiske of Proskau). (7) Composition of soybean hulls *(Hülsen)* (4 sources). (8) Comparison of the composition of soybean hulls and straw with the composition of wheat hay, pea straw, bean straw, and lupine straw based on data from E. Wolff's tables. (9) Composition of the ash of soybean straw based on data from Schwachöfer of Vienna.

4. What yields can be expected from the soybean and which varieties (yellow, brown, or black) are suited to cultivation? Weight of 100 seeds (those planted and those harvested): Soja pallida (15.37 gm / 16.39 gm). Soja castanea (13.81 gm / 13.78 gm). Soja atrosperma (12.26 gm / 11.44 gm). Soja melanosperma (9.19 gm / 7.93 gm). 5. How do soybean yields compare with those of other legumes? 6. What fixed position or rank does the soybean claim in the achievement of maximum yield, and how does one obtain the best seedstock (as for next year's planting). 7. Soil and manuring *(Düngung*, including fertilizer trials with Chili saltpetre / saltpeter [nitrate of soda or sodium nitrate from Chile] *{Chilisalpeter}* and sulphate of ammonia / ammonium sulfate *{schwefelsaures Ammoniak}).* 8. Animals and parasites that harm the soybean. Note: Regular saltpeter is potassium nitrate. 9. Is the cultivation of soybeans in Germany to be recommended? 10. Utilization of soya. 11. Summary of the main results and closing words.

Soya is a superior fodder material. Haberlandt organized field trials in all parts of the Austro-Hungarian empire and many surrounding countries. It should be noted that the introduction of this fodder plant to Germany, primarily in Bavaria, was undertaken by Professors Braungart in Weihenstephan and Lehmann in Munich.

Unfortunately, there was bad weather during the early years of attempted introduction.

Concerning harvesting: If you can pull out the plants easily by hand, which is possible when the soil is soft, this is the best way to harvest them. If that is not possible, you can take them out with instruments / tools *(Instrumenten)*, which enable you to cut the plants close to the ground, since soybeans have very low pods *(Früchte)*– 7-9 cm above the ground. For this reason you should not use mowing machines *(Mähmaschinen)*, based on the experience they have had in Hungarian-Altenburg with large-scale cultivation.

The author gives original analyses of the nutritional composition of various soybeans, including oblong black soybeans grown in Munich, Germany, and at the Agronomic Institute in Paris, France.

Section headings include: Is the soybean recommended for cultivation in Germany? Use of the soybean. Miso paste and a brew, the sooju. Preparation of shoyu taken from Haberlandt.

Professor Hecke of Vienna gave the following recipe for the preparation of a puree: Take 1 part soy meal [probably whole soy flour] or soyaschrot and 2 parts fresh potatoes. Cook each separately, then mix to form stiff paste. Add salt and braised *(geschmorte)* onions. The addition of fat and milk is unnecessary since the soybeans contain lots of fat and protein. This dish tastes excellent, like Hecke said (Wein 1881). Franz Mark of Budapest proposed the use of soybean as a coffee substitute. Blaskovics was a soy bean pioneer in Europe (Wein 1888).

Note 1. This material was also published as a book in 1881 by Verlag Paul Parey in Berlin. Ted Hymowitz got a copy from Prof. Dietrich Werner, a German interested in soybean history.

Note 2. The author uses two words, *Soja* and *Sojabohne,* to refer to the soybean. Address: Munich, Germany.

78. Organov, N. 1881. Soia ili maslichnyi gorokh (Soja hispida *) [Soybean or oil-bearing plant (Soja hispida *)]. *Trudy Imperatorskago Vol'nago Ekonomicheskago Obshchestva, St. Petersburg (Transactions of the Imperial Free Economic Society)* 1(2):184-198. Feb. [3 ref. Rus]
• ***Summary:*** The asterisk in the title refers to a footnote (p. 184) which states: Some call this plant "Chinese beans"; in Austria they call them "Haberlandt's beans." Haberlandt is responsible for the successful cultivation of such useful soybeans in Germany. Thanks to Haberlandt, soybeans also became known in Russia. In 1877, Haberlandt sent about 50 soybeans to I.G. Podoba; from these soybeans we have already (1881) obtained 15 pounds of soybeans. This article is based on a brochure by Haberlandt [his superb book, *Die Sojabohne,* 1878], plus the scarce information from the Russian agricultural literature.

The origin of the soybean is in Asia (India, China, Japan, Mongolia). Large quantities of numerous varieties are cultivated there. Soybeans are also grown in the Caucasus, Tunisia, and Algeria, as well as in southern and central Europe. Many attempts have been made to cultivate soybeans in Europe, but more were unsuccessful. Attempts were made in: Hohenheim [Germany]–unsuccessful. Bamberg [southern Germany], by Dr. A. Rauch, who obtained the seeds from their native country–unsuccessful. Germany, by Carl Berndt, using seeds from Shanghai–unsuccessful. France, where soybeans are more commonly known as *pois oleagineux.* 1872–During the Franco-Prussian War [1870-1872, France lost], Sergeant Otto Wehrman found soybeans in the botanical garden of Montigny near Metz and brought them to Germany, where in 1875 attempts to cultivate them were again made.

In 1877 Prof. Haberlandt (Austria) cultivated soybeans received from Capodistria in Istrien [Istria or Istrian Peninsula; as of 2003 divided between Croatia and, at its base, Slovenia]. In Istria, soybeans were used to make coffee. They were also cultivated in Dalmatia [as of 2003 largely in Croatia] and southern Italy.

Such methods of cultivation resembled experimental gardening of horticultural and hothouse plants rather than scientific research on the acclimatization and growing capabilities of soybean plants.

The soybean plant has been well known and well documented by botanists and travelers since the last [18th] century. Kaempfer called the soybean *Daidzu* or *Mame.* Linnaeus called it *Glycine soja.* Jacquin–*Dolichos soja.* Dr. von Siebold and Zuccarini *Soja Japonica,* Sav. and *Soja hispida,* Mönch. Each name represents a different variety of soybeans [sic].

A footnote (p. 181) states: The famous essay by Kaempfer, titled *Amoenitatum exoticarum politico-physico-medicarum,* describes his travels in Persia and Central Asia in 1712. The essay includes descriptions and uses of soybeans in Japan, China, India, and other places.

Knowledge of and interest in soybeans in Europe expanded during and after the 1873 Vienna World Exhibition. Twenty varieties of soybeans were obtained by Haberlandt, who planted them in 1875 in the Vienna Botanical Garden.

A description of Haberlandt's studies (p. 186) includes favorable growing conditions, a description of planting, and identification of different soybean varieties. In 1876, there were only 7 interested people or organizations who wanted to continue Haberlandt's research on soybean cultivation. However by 1877 Haberlandt's successful results interested more people (up to 160). These people received samples of soybeans from Haberlandt and reported their results back to him. Footnote (p. 187): The results of Haberlandt's experiments and those of the colleagues to

whom he sent samples were published in the 1878 brochure [sic, book] *Die Sojabohne: Ergebnisse der...*

Describes the physical appearance of soybeans.

Page 188 proposes uses for the soybean in Europe, as food for people, feed for livestock, soybean oil, coffee, and soy sauce. Quotations from Oken (p. 189-90) discuss various uses of soybeans, including a description Miso (a substitute for butter) and Shoyu (a sauce added to fried meat), and how each is made. In China, soybeans are used to prepare a soft cheese or cottage cheese (tofu). A footnote (p. 188) is a reference to a book: Oken. 1841. *Allgemeine Naturgeschichte für aller Staende.* Vol. 3, p. 1661. Page 190 continues with comments on the great nutritional value of soybeans when used as food. A quotation from Dr. F. Leithner [of Krems, lower Austria, on the Danube River, 38 miles west-northwest of Vienna] describes his positive experiences in preparing soybeans as dinner for his guests. Prof. W. Hecke recommended that soybeans be combined with potatoes to make a kind of porridge. A quotation from Dr. Eduard Mach [of St. Michele, South Tirol] describes the taste of soybeans. Other food uses of soybeans proposed by Haberlandt: a substitute for peas in pea sausages, chocolate substitute.

Three tables (p. 191) show the nutritional value / chemical composition of soybeans. (1) The first analysis of the composition of soybeans (soybean seeds) in Germany was conducted by Senff, who obtained the seeds from Japan [from Mr. Berndt]. Their average chemical composition is given. (2) Mr. A. Tomaszek / Tomasek [in Napagedl in Mähren / Moravia, a region in today's Czech Republic] gives the following composition percentages for two types of soybeans from China, grown by him in 1876: yellow (column 1) and dark red (col. 2). (3) Further analysis by Tomaszek / Tomasek shows extremely high concentrations of fat and nitrogen [protein] for the two types of soybeans shown in table (2).

Three more tables (p. 192) give a more detailed analysis, by the Technical Laboratory in Vienna, of three soybean varieties: yellow (from Mongolia), yellow (from China), and dark red (from China). There are three columns: Original soybean sample, soybeans grown the first year, and soybeans grown the second year. For each variety, data are given for water, protein, fat, nitrogen-free extract, crude fiber, and ash.

A table (top of p. 193) shows the chemical composition of seven types of legumes: Peas, lentils, wild beans, yellow lupins, haricot beans, broad beans [Vicia faba], Chinese beans (soya), and soya beans. For each legume, data are given for water, protein, fat, nitrogen-free extract, crude fiber, and ash. The data for the first five legumes come from Emil T. Wolff. The data for the broad beans and Chinese beans (soya) come from J. Kuehn / Kühn. The data for the soya beans come from Zulkowski.

A quotation from Carl Berdt includes details on soybean composition, and discussion of the uses of soybean oil (including in bread). A table (p. 193-94), based on the research of Prof. Völker [Voelcker, of London] gives the percentage composition of dried soybean oil-cake (Chinese oilbean cake). A table (2 columns) by Caplan (p. 194) gives the chemical composition of soybean pods, and of the leaves and stems. Another table (p. 194-95) gives an analysis by Zulkowski of the composition soybean straw and chaff dried at two temperatures: air-dried, and dried at 100ºC. A table (p. 196) shows the mineral composition of soybeans.

Pages 197-98 summarize: (1) Cultural trials and harvest information by Attems with Mongolian yellow and Chinese brownish-red soybeans. He was satisfied with the results and sees a future for soybeans. (2) Harvest results of Tomaszek. (3) Harvest results of Prof. Kulisz. Continued.

Note 1. This is the second earliest Russian-language document seen (Nov. 2002) concerning the soybean.

Note 2. This is the earliest Russian-language document seen (Sept. 2006) that mentions soy oil.

Alternate Journal Name entry: Trudy Vol'nogo-Ekonomicheskogo Obshchestva (Scholarly Works of the Free Economical Society).

79. Organov, N. 1881. Soia ili maslichnyi gorokh (Soja hispida *): Okonchaie [Soybean or oil-bearing plant (Soja hispida *): Conclusion]. *Trudy Imperatorskago Vol'nago Ekonomicheskago Obshchestva, St. Petersburg (Transactions of the Imperial Free Economic Society)* 1(3):304-325. March. [Rus]

• ***Summary:*** Contents: 1. Haberlandt's 1876 experiments with soybeans: Table showing analysis (p. 305). 2. Haberlandt distributes seeds to interested colleagues for further experimentation: Overall success rate (first year not successful due to poor weather), results of harvests in various countries. 3. Analysis of experimental results of the following [scientists]: Goethe / Göthe (of Marburg; table p. 309). Josef Mosdosy (of Croatia; table p. 310). Thausing (of Mödling). Josef Kristan (of Capodistria; tables p. 311-12 on his three types of soybeans: yellow, dark-red, or black). Eduard Mach (of St. Michele in southern Tyrol; table p. 313). Unknown (of Grodenskaya region, Russia; data / results also unknown). I.G. Podoba (2 footnotes) (of Novorossiisk), Tomaszek / Tomasek, Schnorrenpfeil (of Proskau).

4. Generalization of the soybean's capabilities of acclimatization, and nutrition (in Europe). 5. Tables (p. 314): Comparison of fat and protein values–original sample, grown in 1875, grown in 1876.

6. Soybean's requirements for growth: water, warmth, and light (table, p. 319, summarizing the total heat units {ºC} during certain growing seasons). 7. Table (p.

323): Data collected while trying to predict the best season for growing soybeans. The column heads are as follows: 1. Plot number (11 plots). 2. Time of planting. 3. Time of emergence (first sighting of sprouts / shoots). 4. Start of flowering. 5. Harvest time. 6. Number of plants. 7-8. Number of pods. 7. Full pods. 8. Empty pods. 9-11. Weight in units of zolotnik (1 zolotnik = 4.26 gm). 9. Seeds. 10. Pods. 11. Stems and leaves. 12-13. Number of pods. 12. Minimum. 13. Maximum.

80. Cook, George H. 1881. Soja beans. *Rutgers Scientific School, Annual Report* 17:54-57.
• ***Summary:*** "We made another trial of these beans this year, planting them very thick in two rows 128 feet long, upon very good ground. They grew well all season, and ripened evenly, not being much affected by the extreme dry weather. The crop of beans from the rows was twenty-two pounds. They can be easily planted and properly tended in rows two feet apart. This appears to be a good way of growing them. Last year we tried to grow them by sowing the seed, but they were soon overrun and choked by weeds, and the crop was worthless. This year success is very encouraging. An acre of ground, at the rate these rows produced, would yield thirty-one bushels.

"The seed was obtained, part in Munich and part in Vienna, in 1878, and has now been planted three times without showing any signs of deterioration from our climate or soil. It has some most valuable properties as a farm crop. To quote from the paper sent out by the Bavarian Experiment Station:" Note: this same translation appeared in Cook 1879.

"The following is the composition of the beans grown on the College Farm this year, which is the third year's growth with us:" A table (p. 56) shows: "Albuminoids 35.39%, fat 19.01%, carbohydrates 26.17%, fibre 4.96%, ash 4.88%, water 9.64%."

"The superior value of these beans will be better appreciated after an examination of the composition of some of our best-known feeding substances, and a comparison of the results." The same table and subsequent analysis of it that appeared in Cook's 1879 annual report is reproduced again here. The article concludes: "We hope in another year to be able to make some feeding experiments with soja beans."

Note: Largely through the influence of George Hammell Cook, "the New Jersey legislature, by an act of April 4, 1864, designated Rutgers Scientific School as the State College of Agriculture and Mechanic Arts and made it the beneficiary of the Federal Land Grant Act of 1862... That year a farm of 100 acres was purchased, and field experiments with fertilizers were begun in 1865... Professor Cook became vice president of Rutgers College in 1864" (True 1937, p. 75-76). Address: New Jersey.

81. Paillieux, Auguste. 1881. Le soya, sa composition chimique, sa culture et ses usages [The soybean, its chemical composition, culture, and uses]. Paris: Librairie Agricole de la Maison Rustique (26 Rue Jacob). 126 p. 28 cm. [42 ref. Fre]
• ***Summary:*** This is largely a reprint in book form of Paillieux's excellent article by the same title published in the September and October 1880 issues of the *Bulletin de la Societe d'Acclimatation.* The arrangement of text on the pages is somewhat different from (and clearer than) the earlier publication, and it contains small amounts of new information–as on p. 87-88.

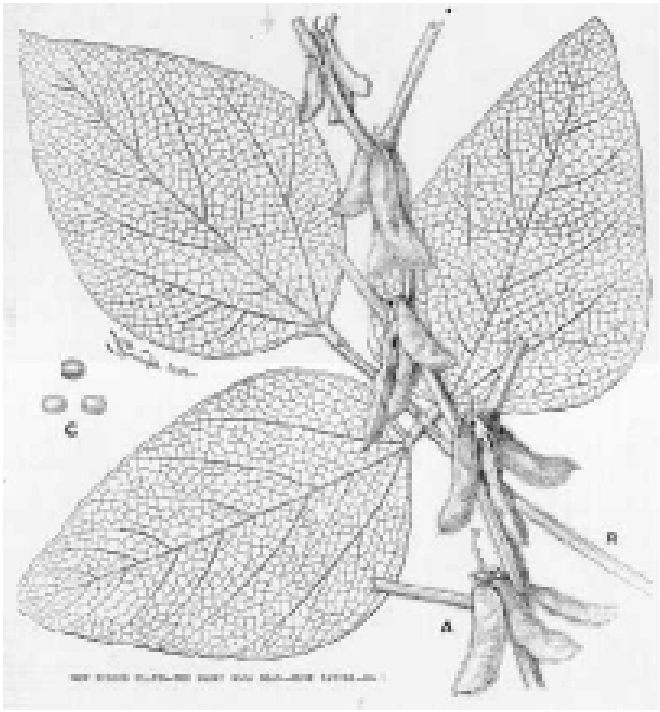
Note: This is the second book on the soybean published in the western world; the first was by Haberlandt in 1878. This book contains only one unimportant illustration, the same one found in the preceding articles. Address: Membre de la Societe d'Acclimatation, France.

82. Voss, A. 1881. Die Soja- oder Haberlandtbohne *(Soja hispida* Moench) [The soya- or Haberlandt bean *(Soja hispida* Moench)]. *Hamburger Garten- und Blumenzeitung* 37:32-36. [2 ref. Ger]
Address: School Gardener at the Agricultural School of Hildesheim (Schulgaertner an der Landwirthschaftsschule zu Hildesheim).

83. Wein, Ernst. 1881. Die Sojabohne als Feldfrucht: Zusammenstullung der vorliegenden Cultur- und Duengungsversuche fuer den praktischen Landwirth [The soybean as a crop: Compilation of the existing cultivation and fertilizer trials for the practical farmer]. Berlin: Verlag von Paul Parey. 50 p. [7 ref. Ger]
• ***Summary:*** This book is identical in content to a 50-page article also published in 1881 in *Journal für Landwirthschaft* (29:563-613)–which see for table for contents and details. However a dedication page states that the book is dedicated to the director of the Bavarian agricultural research station, Dr. Julius Lehmann. A forward notes that it was written in Munich, i.e., South Germany. Address: Munich, Germany.

84. *Rural New-Yorker.*1882. Notes from the experimental grounds of the Rural New-Yorker [The Hairy Soja Bean]. 41:9-10. Jan. 7.
• ***Summary:*** A large, excellent illustration (line drawing, by W. Scranton of the *Rural New Yorker)* shows three leaves,

several clumps of pods, 3 seeds, and the upper stems of soja bean plant.



"The Hairy Soja Bean ["Hairy" is based on the German term "rauhaarigen"], of which an original sketch is now presented,... was first brought to our notice by Professor Geo. H. Cook of the Rutgers Scientific School of New Brunswick, New Jersey... he says that when in Munich in 1878, he saw the Soja Bean in cultivation as a new crop, and probably a desirable addition to our forage products. It was seen in the grounds of the Bavarian Agricultural Experiment Station, and was in very vigorous growth. The gentleman in charge gave him a few seeds; and seeds of several other varieties of the same plant were procured at Vienna by Mr. James Neilson. Both planted them and gathered crops of the different kinds in 1879. The following is a translation of a part of a paper sent out from the Bavarian Experiment Station to those who were growing and testing the capabilities of the new plant: "Two years ago Professor Haberland [Haberlandt], of Vienna, an untiring botanical experimenter, introduced to us a plant whose pleasant-tasting seeds are rich in albumen and fat in very digestible forms. This plant is the Hairy Soja Bean (Soja hispida, Moench). Professor Haberland found samples of the seed at the Vienna Exposition among the agricultural products of China, Japan, Mongolia, Transcaucasia and India... Its seeds, boiled or roasted, have a pleasant taste, and form an almost daily part of the food in India, China and Japan."

Experiments were made in various parts of Bohemia, Moravia [both in the Czech Republic as of Jan. 1993], Southern Austria, Styria [the capital of Graf in today's Austria], Hungary and Upper Silesia in 1876. The next year 135 trials were made under various climatic influences from the well-ripened seeds from these crops. Professor Schwackerhofer, of Vienna, has analyzed the original and the harvested seed, and the Soja straw.

The article then summarizes two articles on soybeans, one from *La Nature* in France (July 1881) and another from *Gardener's Chronicle* in London (18 Sept. 1880).

"Seeds of the Soja Bean were sent to us by Mr. James H. Gregory [seedsman] of Marblehead, Massachusetts, at our request, last winter." The Rural New-Yorker grew them, and concluded: "While the leaves and stems were quite green our cattle eat them with evident relish but the relish was less apparent as they ripened–and they were refused entirely after being cut and dried. From the above test we should never raise the Soja Bean as a fodder plant. Many kinds of the cow-pea, as may be seen from our reports in these columns during 1880, will yield five times the amount of vine and leaves."

85. Kraevskii, -. ed. 1882. Peterburskago sobranii sel'skikh khoziaev: 16-go fevralia 1882 goda [St. Petersburg meeting of agriculturists: 16 Feb. 1882]. *Golos ("Voice") (St. Petersburg, Russia; Newspaper)* No. 72. March 18. p. 5. [Rus]

• ***Summary:*** This full-page article begins: Head of the meeting: "Our colleague, K.A. Skachkov, who is well acquainted with China and its agriculture, will present his report about the soybean and its use in Chinese agriculture."

K.A. Skachkov: He notes the previous mention of soybeans by A.V. Sovetov. Soybeans are considered "new" only in Europe; they have existed for centuries in China and Japan, where they are well documented in monographs on soybeans. He discusses soybeans in northern China (methods of cultivation, climate, yield) and uses of soybeans in China and Japan such as soy sauce *(tsiap yu),* jiang (after processing soybeans to make jiang, which is fermented, the jiang is used to pickle the roots of vegetables which, being well salted, are eaten between meals and called *jiang-tsai),* soybean prices in Russia, and various types of tofu *(age-dofu, yaki-dofu,* etc.). He notes that in China soybeans are not sold in raw form (?), but can be obtained from factories.

After the talk, the head of the meeting asks if there are any questions or comments; various Russian participants (not only Skachkov) answer the questions. First, K.A. Skachkov comments on the preparation of tofu; the "60-day" soybean is best planted during the latter half of June in Russia.

E.I. Ragozin, asks: "What are the practical uses of the soybean for us [in Russia]? How can it be used in our agriculture? Can it be used only as feed for livestock or can

it play a more important role? It is very interesting to discuss the theoretical possibilities of soybeans, but in my opinion it would be better to put them to use." A.V. Sovetov replies that, as he has discussed in a previous report, the soybean can be used as both livestock feed and human food. "It is of high nutritional value and contains twice as much nitrogen as meat, but only 18% fat. The answer to the question of how soybeans can be assimilated into Russian agriculture (and how successfully it can be bred here) lies in numerous experiments and trials of actually growing this plant here. Podoba has already proven that it can be grown in the far southern region of Russia (Tavricheskaia), as has Chernoglazov in the Poltavskaia region and Levanda in the Kiev region. However, I do not known how far north soybeans can be grown, although I have heard of trials in the Voronezhkaia region."

A.S. Ermolov: "My cultivation of soybeans in the Voronezhkaia region was not successful. I know that they are not acclimatized to withstand frost." Again A.V. Sovetov replies that soybeans can handle a light spring frost, but an early fall frost kills soybean plants just as it does pea plants. As Podoba reports, it can survive temperatures 2-3ºC below zero. Discusses successful times and temperatures for soybean cultivation.

A.S. Ermolov: "Nevertheless, the soybean plant is fairly easily acclimatized. I talked about this matter with Friedrich Haberlandt, who agrees with me. It is just a matter of obtaining the right varieties."

Head of the meeting: "I would like to add that with time and patience, plants can be gradually acclimatized to almost any environment." A.V. Sovetov, in agreement, adds: Cucumbers and pumpkins, which are warm-weather plants, have been acclimatized to the colder climates of northern Russia. Likewise with beans. E.I. Ragozin adds that he cultivates beans here in the St. Petersburg region.

A.S. Ermolov concludes that soybeans can be cultivated perfectly well in at least *southern* Russia. However, he still questions how soybeans can be used in Russia. None of the other agriculturists at this meeting have told the society how they use the soybeans they grow, so Ermolov suggests listening to the ideas Sovetov has and will present.

A.V. Sovetov: Soybeans can be used to make: Soybean broth, a substitute for beans or peas, soybean potato cakes, a mixture with rice or corn. Soybeans have a very high nutritional value. They can also be used as a feed for livestock, or as food for the army or navy.

Head of the meeting: Difficulties in cultivating this plant should not prevent us from trying.

E.I. Ragozin: Would it be possible for me to obtain and attempt to cultivate the 60-day bean plant? A.V. Sovetov: Of course, but this 60-day bean plant is not a soybean plant, so the previous statements may not apply to it. Head of meeting: Closing remarks.

86. Giliaranskii, V.P. 1882. Monografiya Kitaiskago maslichnago gorokha "Soja hispida" [Monograph on Chinese oil-bearing pea plant *Soja hispida]. Trudy Imperatorskago Vol'nago Ekonomicheskago Obshchestva, St. Petersburg (Transactions of the Imperial Free Economic Society)* 3(3):269-71. Nov.; 3(4):435-50. Dec. [10 ref. Rus] • ***Summary:*** Part I (Nov.): Soybeans were introduced to Russia to increase the country's food production. Discusses the nutritional value of soybeans. Haberlandt introduced the cultivation of soybeans to Europe, and his trials proved that soybeans could be successfully grown in various European countries. However Podoba was the first who practically / experimentally proved the success of soybean in Europe. Podoba also installed a laboratory partner named Fein in southern Russia. The first popularizer was A.V. Sovetov, who initiated further projects and data collection.

Giliaranskii began his work in 1881 when he received 5 soybean seeds from his director, Nikolai Pavlovich Ill'inu, who also allowed Giliaranskii to use his equipment and laboratory. In 1880 the Asian Department of Foreign Ministry (of Russia) obtained soybean samples by demand. In the same year, crop information about soybeans was received from the Consulate.

In the text, Giliaranskii then cites five documents that were helpful to him in compiling this article: (1) Organov, N. 1881. *Soia ili maslichnyi gorokh (Soja hispida *)* [Soybean or oil-bearing plant (Soja hispida *)]. *Trudy Imperatorskago Vol'nago Ekonomicheskago Obshchestva, St. Petersburg* (Scholarly Works of the Imperial Free Economical Society 1(2):184-198. Feb.; 1(3):304-325. March). (2) The publications of Dr. Bretschneider, who was on a mission to Peking. (3) La Planta Soja hispida, by Geerts, a report from a mission to Japan. Chapters 3 and 4 from Part 1; Chapters 4 and 5 from Part 2 (translation from French), including much information about soy sauce and miso. (4) The famous book: Haberlandt, Friedrich. 1878. *Die Sojabohne: Ergebnisse der Studien und Versuche ueber die Anbauwuerdigkeit dieser neu einzufuehrenden Culturpflanze* [The soybean: Results of studies and trials on the potential for growing this newly introduced crop plant]. Vienna, Austria-Hungary: Carl Gerold's Sohn. ii + 119 p. (5) *Oesterreichische Monatsschrift für den Orient* (Vienna). 1881. *Die japanische Sojabohne als Nahrungsmittel* [The Japanese soybean as a source of food]. 7(12):204-05. Dec. 15.

Part II (Dec.): Chapter 1. Oil of soybean seeds *(Maslo semian soi).* Bretschneider discusses the taste and use of soybeans in Russia. Karl Brendt is mentioned again. Giliaranskii states: "My yield included 40 *zolotnik* (1 *zolotnik* = 4.26 gm) of oil, produced from the variety of seeds received from Mr. Podoba. The oil was extracted using sulfuric ether. I had about 4 lb of soybeans, which I ground in a coffee mill. Then I immersed the flour in ether

in a test tube for 4-5 days. Almost all of the oil was extracted. I also extracted the oil using carbon bisulphide, but the yield was 1.5% less than with sulfuric ether.

"I also tried to extract the oil using petroleum ether, but again the yield was unsatisfactory. In addition, the petroleum ether dissociates from the soybean oil, thus changing the latter's smell and taste. The product known as *rigolen,* which has a boiling point of 35ºC, would be the best solvent of all, it is impossible to obtain in St. Petersburg.

"The oil I extracted using sulfuric ether had a clear, heavy yellow color, similar to olive oil in color and viscosity... however as time passes, under certain conditions, it becomes black in color." Through his experiments, Giliaranskii proved that soybean oil contains nitrogen. Sato and his experiments are mentioned (p. 436-37).

A table (p. 437-38) gives the percentage composition of soybean cake (water, protein, fat, nitrogen-free extract, cellulose, ash), with two columns based on the research of Völcker (1872) and J. Küehn (see Pott 1889, p. 490). Soybean oil cakes, known in English as "bean-cakes," are an important export from the port of Newchwang to southern China, especially to Syamou (?). Discusses the price of soybeans.

Chapter 2. Uses of soy sauce (in China, as well as Europe). Methods of preparing soy sauce are described in numerous Chinese and Japanese publications, but also in European publications such as: (1) *Etude pratique du commerce d'exportation de la Chine,* by N. Rondot (1848, Renard, p. 188). (2) *Chinese Commercial Guide,* by W. Williams (1863, Hong Kong, p. 139). (3) Newspaper article by K.A. Skachkov in *Golos* [Voice] (No. 72, 1882). The main ingredients used in making soy sauce are yellow soybeans *(Soja hispida,* Shiro-daizu or Teppo-mamé or Shoyu-mamé), wheat koji, salt, and water. A detailed description of the process is given. Amazake is sometimes added to soy sauce to give variation in the flavor. Kinch's analysis of Geerts' data (p. 443) gives the relative density of soy sauce as 1.199. The density of soy sauce solids is 359.88 gm/liter. A table (p. 443) gives the density (in gm/liter) of soy sauce constituents as follows: Ash 195.16. Sugars 31.03. Albumen 41.00. Acids 6.20.

Chapter 3. Sauce *miso* or *dai-dzu-ko.* Describes seven different types of Japanese miso and how each is made: 1. Original miso or *shiro miso*–white with little salt. 2. *Chu-miso*–very salty. 3. *Aka-miso*–red, prepared with koji. 4. *Nagoya-miso.* 5. *Kinzanji-miso*–made with soybeans, eggplant and gingerroot. 6. *Mugi-miso*–made with barley and soybeans. 7. *Kogane-miso*–a type of *aka-miso.* A table (p. 445) compares the nutritional composition of *shiro-miso* and *aka-miso.*

Chapter 4. Tofu. Chinese name: doufu. English name: bean-curd. Japanese name: tofu. Yellow soybean varieties *(Gogwatsu-mamé, Wase-mamé,* and *Natsu-mamé)* are widely used in Japan to make tofu. A table (p. 447-48) gives the percentage composition of tofu, with two columns based on the research of Kinch (1880) and Geerts (1876). Tofu is seen as an excellent alternative for dairy cheeses.

Chapter 5. Preparation and composition of dried-frozen tofu (kori-tofu) and other types of tofu (dried cheeses). A table gives the nutritional composition of kori-tofu (based on Kinch 1880). Also discusses *agé-tofu, abura-tofu,* and yuba. Describes the method for preparing yuba, which is eaten in soups in Japan. Several tables were summarized by Nikitin in Russian (1900) and German (1901). Address: USSR.

87. Paillieux, Auguste. 1882. Le café soya [Soy coffee]. *Bulletin de la Societe d'Acclimatation* 29:636-37. Nov. [1 ref. Fre]

• ***Summary:*** Mr. Paillieux, vice-president of the Society, is presiding at the meeting on 6 June 1882. He offers the members present the seeds of various edible plants, about which he gives the following information: "If any of you read the report that I published last year, you will perhaps remember the surprise of Professor Haberlandt when he learned, in response to his shipment of seeds of soya, that the plant had been cultivated for a very long time in certain parts of southern provinces of the Austro-Hungarian empire and used as a coffee substitute.

"The same is possibly true in some parts of our territory. More than 10 years ago, the abbot Father Crétin, arriving, it is thought, from Brazil, brought brown soybean seeds to Allerey, a village *(commune)* in the department of Saône-et-Loire, where he was then the parish priest; he presented them as a substitute for coffee. Since that time soya has been cultivated without interruption either at Allerey or in the neighboring villages. Mr. Faivre, from whom I received this information, has had the kindness to send me some seeds which seemed to me to be identical to the brown soya of Hungary sold by the House of Vilmorin.

"It is very doubtful that the abbot Father Crétin brought from Brazil the seeds which have been cultivated for a long time on a small scale in some villages of Saône-et-Loire and at Côte-d'Or. In order to clarify this point, I wrote him at Dettey, in the division *(arrondissement)* of Autun, of which he is the parish priest today, but he has not responded.

"Very recently, Mr. Roman, chief engineer at Périgueux, wrote me: 'I introduced soya culture at Orange [a city in southeastern France, in the department of Vaucluse] last year following your brochure which interested me very much, and we use this seed daily with great success as coffee with milk *(café au lait);* we prefer it to ordinary coffee.

"'If you use or have others use soya as coffee, recommend that it be roasted very little. The seed will have

already turned black while the outside seed coat is still blond.' This observation applies evidently to the yellow soybean.

"I am presenting you today with some bottles which contain the product made by roasting and grinding the brown soybean of Hungary. The aroma is very agreeable but weaker than that of coffee. It is customary in villages to add to chicory a little mocha [real coffee] in order to give it the aroma that it lacks. I believe that one can dispense with adding coffee beans to the roasted soya in this way when making soya coffee. It has enough of its own aroma.

"I encourage my colleagues to praise and propagate soya coffee *(le café Soya).* It is surely very good with milk and those cultivating the plant can make from it each year, without appreciable expense, a sufficient provision for the consumption of their family. This year, I had some soybeans given to the inhabitants of my village for them to try."

Note: If the soybeans that the abbot Father Crétin brought to France did, in fact, come from Brazil, this document would contain the earliest date seen for soybeans in Brazil (1872 or before). Address: France.

88. Koenig, Franz Joseph. ed. 1882. Chemie der menschlichen Nahrungs- und Genussmittel. Vol 1. Chemische Zusammensetzung... Ed. 2 [The chemistry of human foods and food adjuncts (stimulants / enjoyables). Vol. 1. Chemical composition... 2nd ed.]. Berlin: Verlag von Julius Springer. 351 p. See p. 103-04. [13 ref. Ger]
• ***Summary:*** Summarizes early studies on the chemical composition of soybeans, including 21 analyses of yellow soybeans, 8 analyses of brown, 2 analyses of round black, and 2 analyses of oblong black soybeans. Cites studies by Senff, Caplan, Wildt, Haberlandt, Schwackhöfer, Zulkowski, Schröder, Portele, Wein, Blaskovics, Pellet, and Carriere. Address: Head, Agricultural-Chemical Experiment Station, Muenster in Westphalia, Germany (Vorsteher der Agric.-Chem. Versuchsstation Muenster in Westphalia).

89. Renouard, Alfred. 1882. Sur l'acclimatation du "Soja hispida" [On the acclimatization of the soybean]. *Annales Agronomiques* 8:377-80. [11 ref. Fre]
• ***Summary:*** This article is fairly similar to, though more detailed than, that written by the author and published in April 1881 in the *Association Francaise pour l'Avancement des Sciences, Comptes Rendu* (10:945-51).

After discussing the early work with soybeans in Europe by Haberlandt in Vienna (Austria) and Blavet in Etampes (France), he notes that the variety cultivated in Etampes was named *Soja de Étampes* by the house of Vilmorin, "to which we owe the propagation of so many good species of seeds. But none of the particular trials which these diverse shipments engendered showed clearly that large-scale cultivation of soybeans could have some chance of success in our countries.

"There was nothing to retract from what had been said: the agricultural value of this soybean *(pois oléagineux)* [is] among the richest in protein, and [is] capable of being easily and advantageously distributed, if not as food for humans, by reason of its quite special and not very agreeable taste, at least as a forage plant for livestock. The Tramway Company of Roubaix sent for some last year from Hungary in large quantities for the feed of its horses and had only to congratulate itself on this innovation.

"Also, when near the end of 1879 Mr. Julius Robert, great farmer of French origin and maker of sugar in Seelowitz (Moravia, *Moravie* [a region in today's Czech republic]), proposed to the Society of Farmers of the Department of Nord *(Société des Agriculteurs du Nord).* in Lille and to the Agricultural Board *(Comité)* of the city, to send several hectoliters of soybeans to Nord to do some serious trials of acclimatization with them, several members of these societies, who knew the high agricultural value of this bean, eagerly accepted. These are the results of large-scale cultural trials conducted by various members of the societies, and by some other farmers of this department, on parcels ranging from 35 to 50 ares [1 *are* = 100 square meters], which we are going to make known.

"In 1880 only nine farmers accepted soybeans. The seeds were planted during the first days of April. The plants broke ground after nine or ten days, remaining puny while the weather was wet and rainy, but at the first heat they developed very rapidly. Flowering took place only at the beginning of June. The flowers passed very quickly; they did not bloom together but succeeded each other every three or four days. The soybeans were harvested from Oct. 1-15 according the village. There were from 40-150 pods per plant, and 3-4 beans per pod. These beans were mature, and one could consider this result as relatively fruitful. Only two farms did not succeed, but one had planted the seeds too close together, forgetting that for a plant like the soybean, which develops much in width, the seeds should be placed 50 cm apart. The other had sown its seeds in a cold and clayish soil, and it is common knowledge that all seeds with pods spoil there [in such soil].

"The next year, 32 farmers, encouraged by these first trials, planted soybeans. One of our friends, Mr. de Swarte, treasurer-general of Jura, wanted to engage several farmers from his area around Lons-le-Saulnier to do the same. He later published the results of their tests that agreed with ours. In 1881 the soybeans were planted over a wide range of time: from April 15 to June 20. Germination required on average 170 hours, flowering 38-40 days. But instead of having, as in 1880, a hot late autumn, we had a rainy one, as happens only too often in Nord. The soybeans which were harvested very late did not ripen. (Footnote: A serious test of soybean agriculture was tried at Grignon in

1881. The plant developed very well, and one could have hoped for a good harvest when it was destroyed by an early frost at the beginning of October. The plant had been judged too delicate to renew the test.) One could observe, however, that the terrain lent itself perfectly to its agriculture. On some plants up to 182 pods were counted, while in the surveys conducted in 1879 in Hungary upon the order of the minister of agriculture of that country, only 119 were reported as a maximum, but these pods [harvested in Nord] remained green [and thus did not mature]. In a few villages, a frost that arrived in the first days of October forced immediate harvest. In others, they were able to wait until Oct. 31 but without result. Some farmers used green soybeans as soon as harvested and observed that the cows devoured them greedily. Most ensiled them in pulp form for winter. But these, in a very large number, perceived rapidly that they obtained much less advantageous results than with corn forage *(maïs-fourrage)*, usually ensiled in the same way, easily cultivated in our regions. Although much less rich in protein than soybeans (4-5% against 2.5-2.9%), corn yields a harvest otherwise quite considerable in weight.

"This year, five farmers wanted to begin tests again, but as we go to press, the plant is green, the pods hardly formed, and it is certain that the soybean cannot produce seed suitably. In addition, there will soon be early frosts to fear that always necessitate an immediate uprooting.

"We have intended to publish these results in order to inform farmers of the possibility or better the ease of acclimatization of these agricultural plants of exotic origin, that, like the soybean, are recommended from all points of view, but whose success is less than certain and that, in the green state, cannot take the place of other well acclimatized crops.

"Perhaps the agriculture of soybeans could succeed in the warmer countries of the south of France. In any case, the test for the regions of Nord is done: in our opinion this crop can neither pay for itself nor be profitable." Address: [The Younger *(fils)*, Civil engineer, manufacturer at Lille, secretary general of the Industrial Society of Nord {a department in northern France}.

90. Dabney, Charles W., Jr. 1883. The soja bean–*Soja hispida*. *North Carolina Agric. Exp. Station, Annual Report* 5:116-27. For the year 1882.

• ***Summary:*** Contents: Introduction. Description of the *Soja hispida* and its varieties. Cultivation of the soja bean. Chemical composition of the Soja. Yield of the soja bean. Soils and fertilizers. Uses of the soja bean.

The introduction begins: "This plant has been tried by a number of persons in different sections of the State and is favorably considered by them. It appears to be well adapted to our climate and soils, and yields very well. It produces more bushels per acre of beans than can be obtained of cow peas or any other kind of bean known to us. In feeding value, the soja bean is also superior to the highly esteemed cow pea. The plant has made a great reputation for itself in Europe in spite of decided disadvantages as to climate. Our climate is exactly suited to it, and it promises to have a useful career here.

"The soja bean was first brought to the attention of the agricultural world through the efforts of Prof. Friedrich Haberlandt, of Vienna, who found it among the products exhibited from China, India and the East generally, at the Exposition of 1873. Haberlandt's investigations showed that this new legume not only contained a large amount of proteins or flesh-producers, as was to have been expected in an article of its class, but also a remarkably large amount of fat, which is so unusual and which qualified it at once to be an excellent article of food for animals. His labors to introduce the plant have succeeded so well, against a climate which did not afford a long enough growing season, that the Soja bean is now extensively cultivated and highly valued throughout all central Europe.

"The following description of the Soja bean and its varieties is condensed from Wein's [1881] *Die Sojabohne als Feldfrucht:"* This description includes extensive information based on seed shape and color published by Prof. Harz in the Journal of the Agricultural Association of Bavaria. "The yellow bean has been the most popular, however, and is said to be a little heavier than the other varieties. This is the variety which we have tried in North Carolina."

Concerning cultivation: "A single plant will bear 30 to 100 pods; an average of 100 is easily reached with good cultivation, a fair season, and tolerably rich soil. The pods contain 1 to 2 seeds most often, not infrequently 3, seldom 4 or 5. We find a bushel yellow beans, variety *pallida*, grown near Raleigh, to weigh 58 pounds to the bushel. A fortunate property of the Soja bean is, that it can withstand cold, damp, or generally unfavorable weather, very well. It is not liable to be injured easily thus by a late spring or an early frost. It requires a sharp cold to kill it."

Concerning chemical composition. A table (p. 120) contains two columns. "Under One is given the analysis of a specimen of the yellow Soja bean, variety *pallida*, grown in North Carolina. Under Two, the average of 16 analyses of the same variety by German chemists." All values are given as percentages. Water 10.12 / 9.49. Proteins 34.63 / 34.30. Fat 17.98 / 17.67. Nitrogen-free [extract] or carbohydrates 30.50 / 28.44. Cellulose 3.69 / 4.79. Ash 3.07 / 5.31. The "North Carolina grown specimen 1 has a nutritive ratio of 1 to 1.5.

A second table (p. 121) compares the chemical composition Soja bean seeds with the seeds of the yellow cowpea, white beans, green peas, and cotton seed kernels. "According to these figures the Soja surpasses the other legumes in proteins considerably, in fat very far. These are

the costly ingredients of feeding stuffs... The cotton seed kernels alone surpass the Soja in combined content of proteins and fat [cotton seed contains more than twice as much fat, but only 84.5% as much protein]... the Soja far surpasses the cotton seed in yield of protein and fat per acre."

Concerning yield of the Soja bean: In North Carolina they give 31-53 bu/acre plus 4,500 to 9,000 pounds of straw per acre.

Concerning soils and fertilizers: "The Soja bean is adapted to almost all soils. It will grow upon purely sandy soils, on loams or clay soils. It has done particularly well, however, upon sandy limestone or marled soils and upon well drained marshes and peaty soils. It does best of all upon such swamp soils as have been heavily marled. Prof. Wollny who has made experiments upon this subject, says: 'The Soja bean is especially adapted for cultivation upon drained bogs or swamps rich in lime (marl).' We have vast areas of such soils in North Carolina. The eastern part of the state is underlaid with marls..."

"As for fertilizers to be used upon the Soja, we find that sulphate of potash and kainite are as important manures here as we found they were with peas. The sulphate did much better than the muriate. Among nitrogenous manures nitrate of soda and animal nitrogen did much better than sulphate of ammonia. The precipitated phosphates, the phosphates of iron, alumina, &c., gave better results than the soluble phosphates. We have gathered these hints from Wein's [1881] compilation on this subject."

"Uses of the Soja bean: In its native lands this bean is an important article of food for man. In the East the crushed or ground bean is made into a kind of mush or soup and eaten with broiled or roasted meat.

"Owing to its peculiar composition, containing so much proteins and fat and no starch, it is best prepared with other things to supply the starch, such as potatoes or rice. Prof. Hecke of Vienna highly commends a dish prepared by boiling these beans and potatoes separately, mashing them, mixing one part of the beans with two of the potatoes and seasoning to taste. He thinks that the beans contain so much fat, that no milk or butter needs to be added to this dish.

"The chief interest of this bean is, however, as a feeding stuff for stock."

Other tables show: (3) Composition of the Soja bean plant at four different stages, based on recent research at the North Carolina station (p. 122). (4) Composition of Soja straw and hulls (p. 123; empty pods, based on Wein 1881, p. 13). (3) Composition of the Soja compared with other fodders: Whole plant, Sept. 1, matured whole straw, hulls, cow pea hay, meadow hay, English pea hay (p. 124; "The other analyses are from [Emil] Wolff's tables")

Note 1. This is the earliest document seen (June 2007) that clearly refers to the cultivation of soybeans in North Carolina. This document contains the earliest clear date seen for the cultivation of soybeans in North Carolina (1882). It is also the earliest publication seen on soybeans from a North Carolina Agricultural Experiment Station.

Note 2. This is the earliest agricultural experiment station publication seen (Aug. 1998) whose sole subject is the soy bean (soja bean). It is also the earliest agricultural experiment station publication seen with the term "soja bean" in the title.

Note 3. According to I.O. Schaub's "North Carolina Experiment Station: The First 60 Years, 1877-1937," Dr. Charles William Dabney, Jr., was director of the station from 1880 to 1887. A photo (p. 60-61) shows Dabney with other past directors on the 50th anniversary of the station on 17 April 1927. Dabney left his position as Director of the North Carolina Experiment Station in 1887 to become president of the University of Tennessee. He left that position to become Assistant Secretary of Agriculture under president Grover Cleveland. For a detailed biography of Dr. Dabney, see R.Y. Winters (1965).

Note 4. The author of this article interested Dr. John Harvey Kellogg in meat substitutes and soybeans in about 1893-97. See: Richard W. Schwarz. 1970. *John Harvey Kellogg, M.D.*, p. 121-22.

Note 5. This is the earliest document seen that mentions kainite in connection with soybeans. *Merriam-Webster's Collegiate Dictionary* (1998) defines kainite (pronounced KAI-nait, formerly sometimes spelled kainit, derived from the Greek *kainit* or *kainos* = new or recent), a word first used in 1868, as "a natural salt [the chemical formula is given] consisting of a hydrous sulfate and a chloride of magnesium and potassium that is used as a fertilizer and as a source of potassium and magnesium compounds."

Note 6. This is the earliest English-language document seen (April 2002) that mentions the use of "sulphate of ammonia" or "nitrate of soda" as a fertilizer, or in connection with soybeans.

Note 7. This is the earliest English-language document seen (April 2003) that uses the term "cotton seed kernels" to refer cotton seeds.

Note 8 This is the earliest English-language document seen (Oct. 2006) that contains the word "cowpea" (or "cowpea"), spelled as one word. Address: Ph.D. (Goettingen), Chemist and Director of the Station, Raleigh, [Wake County], North Carolina (Ph. D. Goettigen).

91. Koenig, Franz Joseph. ed. 1883. Chemie der menschlichen Nahrungs- und Genussmittel. Vol. 2. Zweite sehr vermehrte und verbesserte Auflage [The chemistry of human foods and food adjuncts (stimulants / enjoyables). Vol. 2. 2nd ed.]. Berlin: Verlag von Julius Springer. xviii + 816 p. See p. 371-72, 387. Illust. Index. 25 cm. [5 ref. Ger] • ***Summary:*** In the section on "Legumes" is a subsection titled "Soybeans" *(Sojabohne)* (p. 371-72) which begins

with short summaries of Haberlandt (1878) and Wein (1881). The first table, based on calculations by Wein, shows that, on a per hectare basis, soybeans yield about 1/3 more protein and about ten times as much vegetable oil as common beans or peas. The second table gives the average chemical composition of 43 soybean varieties analyzed by König, and first published in detail in Vol. 1, p. 103-04. The range: Protein 26.5 to 40.0%. Oil 14 to 19%. The third table gives the average analysis of the ash found by Edward Kinch in 1882. The soybean is unique among legumes in its combination of a high oil content with an even higher protein content. Moreover, its straw makes a nutritious fodder for cattle. "The soybean is therefore highly recommended for cultivation in Germany, and efforts should be made to find ways of producing good-tasting foods from it."

In China and Japan, soybeans have long been used to make human foods such as miso *(Misobrei),* shoyu *(Soohu),* and tofu *(Tofu).* The fourth table gives the nutritional composition of five soy products as determined by Edward Kinch: White miso, red miso, fresh tofu, frozen tofu, and soybean cake. While some of these products may not be suited to German tastes, E. Wein has used soybeans to prepare a tasty German dishes, including a soup like that made from beans and peas, a salad like that made from garden beans, or by cooking soybeans with potatoes or rice, a purée, which resembles Italian "Polenta" and has been called "Sojenta" by Haberlandt (1878). The taste of dishes made from soybeans reminds one of somewhat of almonds or chestnuts, but even more of garden beans. A soybean flour *(Mehl),* similar to the flour made from beans and peas, has already been made for kitchen use from soybeans (see p. 387).

The section titled "Legume flours" *(Leguminosenmehle)* (p. 387) contains a table that gives the nutritional composition of such commercial flours: Bean flour *(Bohnenmehl),* pea flour *(Erbsenmehl),* lentil flour *(Linsenmehl),* and soybean flour *(Sojabohnenmehl).* The latter contains: Water 10.23%, protein 25.69%, oil / fat 18.83%, carbohydrate 38.12%, cellulose *(Holzfaser)* 2.75%, ash 4.36%. On a moisture-free basis: Nitrogen 4.58%, carbohydrate 42.45%.

Also discusses: Lecithin in egg yolks (not in soy, p. 223, 233). Composition of vegetable oils, incl. olive, linseed, poppyseed, hempseed, rapeseed, white sesame, black sesame, cottonseed, peanut, palm kernel, coconut (p. 325). Lupins (yellow or blue, p. 373-75). Almonds (p. 495, 497). Agar-Agar (p. 496-97). Peanuts (p. 495, 497). Coffee substitutes (not incl. soy, p. 607). Address: Head, Agricultural-Chemical Experiment Station, Muenster in Westphalia, Germany (Vorsteher der Agric.-Chem. Versuchsstation Muenster in Westphalia).

92. Pogson, Frederick. 1883. Manual of agriculture for India. Calcutta, British India: Thacker, Spink and Co. 296 p. See p. 280-81. Index. [1 ref]

• ***Summary:*** Chapter 14, "Field pea crops, including the Japan pea" states (p. 184): "The Japan pea assumes the form of a bush from two to three feet in height. In the plains it should be sown after the rains cease. Drills should be made three feet apart, and a single seed should be sown at every three feet; the spot where the seed is sown being manured as for beans. The botanical name of the Japan pea is *Soya Hispida.* It is half pea and half bean in appearance, with singular leaves, and pods somewhat like the pods of the *Cajanus sativa* or *Urhur Dall [Dahl]* of the next chapter."

In the Appendix (p. 267+) is a section titled "Japan pea" which states (p. 280-81): "A small supply of this pea-bean was received by the writer in the spring of 1882. It was freely distributed in Dehra, but failed entirely as a hot-weather crop. A few seeds sown at Mussoorie grew to the height of two feet, and bore pods very much resembling those of the *Urhur Dall (Cajanus sativa).* At the writer's request a supply of the seed was sent to Simla, and the result is given beneath.

"'The Government of India has decided on the cultivation of the Japan pea being extended in this country, and with this view it has suggested that further experiments should be made in suitable places. This bean or pea has its natural habitat in China and Japan, it also grows in Mongolia, and in India in the Himalayas, and within the last few years it has been cultivated experimentally in several European countries, under the name of the Soy bean. It is a vegetable, which approaches most nearly in its proximate chemical composition to animal food. The Soy bean first attracted attention in Europe in the year 1873, when specimens from Japan, from China, and from India were shown at the Vienna International Exhibition. Dr. Forbes Watson, reporter on the products of India, called attention to it in the catalogue of the exhibits of the India Museum. Since then numerous experiments have been made on the European continent on its growth, and also feeding experiments with the bean and its straw on different kinds of animals have been prosecuted. Such experiments have been carried on by Woolling and Wein at Munich; by Haberlandt, Lehman, Harz, Stahel, Zimmerman, Siewert, Wieske, and others at various stations in Germany, Austria, and Hungary; and experiments have also been made in France and in Italy.

"'In Japan it is known by names signifying THE bean, and from it are made not only soy [sauce] but a paste, known as *miso,* which is in constant request at nearly every meal, *tofu* or bean cheese, and other foods used to a less extent. This bean cheese is also well known in China, and is obtained by extracting the legumin from the beans with water and precipitating it with brine. These foods are most valuable additions to the dietary of the Oriental nations, and

especially the Japanese, who use so little animal food. They tend to supply the deficiencies of the staple food, rice, in nitrogenous matter [protein], fat, and also in mineral constituents. The Buddhist priests, who are strictly forbidden the use of animal food, consume considerable quantities of these beans, principally in the form of *miso.'– Vide 'Simla Argus,' 18th November, 1882."*

Note: Simla was a hill station in British India. The *Argus* was a periodical published at Simla, a hill station in British India in the 1880s. The Simla Argus Press published a few books at the same place and time. Address: Lieutenant, Her Majesty's Bengal Army, Dehra Doon; Honorary Member Agri-Horticultural Society of India.

93. Podoba, Ivan Grigor'evich. 1884. Soya i lallemantsiya: Novye ves'ma poleznye rasteniya, ikh svoistva i kul'tura [Soya and *Lallemantia iberica* (dragon's head): New useful plants, their composition and cultivation]. St. Petersburg, Russia: Printing House of I.P. Voschinskii. 24 p. 20 cm. [8 ref. Rus]

• ***Summary:*** Discusses: The soybean plant is attracting interest in agriculture, as being a prominent plant in the future, competing with the domestic potatoes and corn. Introduction of soybeans to Europe from Asia (Austria, Germany, France). The yellow soybean found best suited for acclimatization. Botanical indications of a useful / healthy soybean plant. Professor Garts divided soybeans into two varieties according to their shape and color: Soja platycarpa and Soja tumida. Cultivation of soybeans. Uses of soybeans: Dairy cattle–Podoba says it is already known that soybeans can be used to feed dairy cattle and recommends it to be used likewise in the Southern agriculture to enhance the quality and quantity of the milk. Table comparing the chemical composition of soybeans to that of other plants. Preparation of soybeans for food: soybean flour, "bean" cheese [tofu], uses in the army, "bean" sausages, substitutes for coffee and chocolate. Cultivation of soybean in Tavricheskoi region (Crimean region of today's Ukraine [2002]).

A full-page table (p. 14) gives the chemical/ nutritional composition of soybean seeds, straw, and pods, and compares that of yellow soybeans with the composition of a similar part of other legumes. Values are given for the following: Water, protein, fat, nitrogen-free extract, fiber, and ash (minerals). Under seeds, for example, six types of yellow soybeans are used individually for comparison: (1) Pallida. (2) Those grown in Vienna, Austria, in year 1. (3) Those grown by Podoba in Ukraine in year 3. (4) Castanea [brown]. (5) Atrosperma. (6) Melanosperma. These are compared with nine other legumes. Average figures are given, but no individual investigations.

Introduction of soybeans into various regions of Russia (p. 15): 1. Khersonskaia and Tavricheskaia (Taurida) regions. In 1877, fifty seeds were acquired from Haberlandt. Podoba released his soybean experiments in his yearly report, and later published them in the sixth volume of *Zemledel'cheskaya Gazeta.* Note: Khersonskaia (Kherson) is a region in southern Ukraine extending north of Crimea from the Sea of Azov to the Black Sea.

2. Grodnenskaia region. Experiments not known and not published. 3. Poltavskaia (Poltava) region [part of Ukraine as of 2005]. Positive results of acclimatization by L.A. Chernoglazov. 4. Penza region. A frost in May did not damage soybeans, however many other crops died. 5. Bessarab region [part of Moldova as of 2005]. K. Morkarov successfully produced 5 lb of soybeans. 6. Samara region. Unsuccessful results due to late harvest which was damaged by frost and hail.

A half-page table (p. 16) gives information about people, from different regions in today's (2002) Ukraine, who presented each year from 1879 to 1883 at the Annual Exhibition of the Independent Economic Society *(Vol'no Economicheskim Obschestvom)* held on Oct. 31 each year. In 1879 I.G. Podoba presented from Tavricheskaia. In 1881 Grigorii Ivanov Yaschenko and L.A. Chernoglazov presented from Poltavskaia, and N. Zhelekhovskii presented from Kievskaia. In 1882 Gr. Iv. Yaschenko presented from Poltavskaia and L.V. Illyashevich from Khar'kovskaia. In 1883 Gr. Iv. Yaschenko and L.A. Chernoglazov presented from Poltavskaia.

A half-page table (p. 17) gives the prices (in rubles) for which soybeans were sold in 1883. 2.50 per pood (36 lb) by Gr. Iv. Yaschenko in the Khar'kovskaia region (today's Ukraine). 2.50 per pood by the agricultural store of K.V. Laskari in Kishinev (Chisinau), Bessarabia (today's Moldova). 3.00 per pood by L.V. Illyashevich in the Khar'kovskaia region (today's Ukraine). 8.00 per pood by seed-seller Grachev in St. Petersburg (today's Russia). 0.60 per lb by seed-seller Gol'dring in Warsaw (today's Poland).

History of *Lallemantia iberica* (dragon's head). It is a plant native to Georgia, introduced to Europe from Persia in 1873 at the World Exposition in Vienna. Description and cultivation. History of the spread of Lallemantia throughout Russia.

Note 1. This is the earliest document seen (July 2002) concerning the feeding of soybeans to dairy cattle.

Note 2. *Lallemantia iberica* (dragon's head) is an annual plant with a short vegetative cycle adapted to dry climates, cultivated for its seeds, from which a drying oil is extracted. The oilcake is used as a feed for horses, ruminants, and rabbits. A cow can be fed up to 2 kg/day. Address: Candidate/Applicant of Natural Sciences, St. Petersburg, Russia.

94. Lipskii, A.A. 1885. Kitaiskii bob soya *(Soja hispida)* i ego pishchevoe znachenie [The soja bean (Soja hispida) and

its nutritional value, or effect on digestion]. *Vrach (Doctor) (St. Petersburg, Russia)* 6(40):657-59. Oct. 3. [5 ref. Rus]
• ***Summary:*** Extensive literature has been published about the agricultural science of soybeans (by Haberlandt, Sovetov, Skachkov, Organov, Giliarianskii, Podoba, Chernoglazov, Iankovskii, etc.). In Russia, Podoba was the first person to work with soybeans; he received the seeds from Haberlandt of Vienna.

A.V. Sovetov, professor of agriculture at the University of St. Petersburg, wrote extensively about the economic and nutritional importance of soybeans, including in the journal *Vol'no Ekonomicheskaogo Obschestva.* He also sent out samples of soybean seeds. In 1883 V.P. Giliaranskii, influenced by Il'in, wrote a monograph [48 pages] on the soybean. It seems that P.A. [L.A.?] Chernoglazov was the first person in Russia to prepare bread and sauces from soybeans, then to feed them to his co-workers. Theoretical yield measurements by Podoba agree with those of Haberlandt. Podoba states that soybean plants, when used as green forage for livestock, exceed the nutritional value of other plants, including clover and alfalfa.

In the laboratory of A.P. Dobroslavin, Lipskii formulated experiments to test the nutritional value of soybeans. In 1881 Lipskii received soybeans for analysis from I.G. Podoba. Lipskii then gives background information on the soybean plant (mostly structure, varieties, etc.–no history) and methods of preparing foods from soybeans. Chernoglazov then outlines the preparation of miso.

A table (p. 659) shows that two people (a doctor and a lab worker) were fed various foods and liquids. In the upper half, the left column shows the foods or nutrients consumed (soy flour, dry flour, nitrogen, fats, ash, water, tea or broth of bilberries / whortleberries); the right column shows the amount of each consumed. The lower half of the table the "output" of the two people (urine, specific gravity of urine, nitrogen in urine, sulfur in excrement, dry mass of excrement, nitrogen in excrement, percentage of nitrogen in dry excrement, fat in excrement, percentage of ash in dry excrement). The last two lines are contents that were not digested: Nitrogen, fat.

Footnote 5 (p. 658) mentions exhibitions of dried plants, including soybeans and other beans, at a museum in St. Petersburg, Russia.

Footnote 7 (p. 658) states that the label on a container of coffee, made in Russia, fails to reveal that this coffee is actually made from soybeans.

Nikitin (1900) states that Lipskii found, in his investigations on the digestibility of soybeans, that in a diet consisting exclusively of mashed soybeans, 19.5% of the nitrogen and 19.2% of the fat remained undigested.

Horvath (1927) says that "Lipsky" mentioned use of baking soda for cooking whole dry soybeans. Address: USSR.

95. 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).*

Note 1. This is the earliest document seen concerning soybeans in Malaysia, or the cultivation of soybeans in Malaysia. This document contains the earliest date seen for soybeans in Malaysia, or the cultivation of

soybeans in Malaysia (1885). The source of these soybeans is unknown.

Note 2. This is the earliest document seen concerning soybeans in the Philippines, or the cultivation of soybeans in the Philippines. This document contains the earliest date seen for soybeans in the Philippines, or the cultivation of soybeans in the Philippines (1885). The source of these soybeans is unknown.

Note 3. This is the earliest document seen concerning soybeans in Siam (renamed Thailand in 1938), or the cultivation of soybeans in Siam. This document contains the earliest date seen for soybeans in Siam, or the cultivation of soybeans in Siam (1885). The source of these soybeans is unknown.

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 4. 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 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 soy nuggets *(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 hypogœa, 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].

96. Welch, Adonijah Strong. 1885. Report on the organization and management of seven agricultural schools in Germany, Belgium, and England. Washington, DC: Government Printing Office. 107 p. See p. 73-77. Made to Hon. George B. Loring, U.S. Commissioner of Agriculture.
• ***Summary:*** The last section is titled "The Royal Agricultural College at Cirencester, England," where the author visited on 8 Feb. 1884. The subsection titled "Work of the laboratory" (p. 73) describes seven types of current original research. including: "7. On the soy bean (Soja hispida), its chemical composition and value as a food.

"The following is a detailed account of Prof. Edward Kinch's description and analyses of the soy bean of China. I append his entire report of the results of this interesting investigation, because it not only shows the character of the work done in his laboratory, but indicates that this bean may be profitably grown in some parts of the Western States. Indeed, the same bean was grown on the experimental grounds of the Iowa Agricultural College last year, and showed a very large yield."

Prof. Kinch's report, titled "The Soy bean," states: "This bean, sometimes known as the Japan pea and China bean, is the seed of the *Soja hispida*, Miquel *(Glycine hispida*, Moench; *Dolichos Soja*, Linné; *Glycine Soja*, Jaquin), a plant of the natural order Leguminosae,..." suborder Papilionaceae, and tribe Phaseolæ. Its natural habitat appears to be China and Japan; it also grows in Mongolia and in India, in the Himalayas, and within the last few years it has been cultivated experimentally in several European countries. This bean is worth more than a passing notice, as it is the vegetable which approaches most nearly in its proximate chemical composition to animal food. This will be seen later on. There are a great number of varieties of the soy bean known, which differ to some extent in the shape, size, and especially in the color of the seed, and in a few minor particulars, but which seem to vary comparatively little in chemical composition. Dr. C.O. Harz has classified the principal varieties as follows:

"Group I.–*S. hispida platycarpa. 1. olivaeea. 2. punctata. 3. melanosperma (a. vulgans. b. nigra. c. renisperma. d. rubro-cincta). 4. platysperma. 5. parvula.*

"Group II.–*S. hispida tumida. 6. pallida (Roxburgh). 7. castanea. 8. atrosperma.*

"These names sufficiently indicate the nature of the variety as far as the seed is concerned. The soy bean is extensively cultivated in the north of China, whence it is exported, to the southern provinces; it is here pressed for the sake of its oil and the residual cake largely used as a food for man and beast, and also as a manure.

"In Japan it is known by names signifying the bean, and from it are made not only soy [sauce] but a paste known as *miso*, which is in constant request at nearly every meal, *tofu*, or bean cheese, and other foods used to a less extent. This bean cheese is also well known in China, and is obtained by extracting the legumin from the beans with water and precipitating it with brine. An analysis of it is given below.

"These foods are most valuable additions to the dietary of the Oriental nations, and especially of the Japanese, who use so little animal food; they tend to supply the deficiencies of the staple food, rice, in nitrogenous matter, fat, and also in mineral constituents.

"The Buddhist priests, who are strictly forbidden to use animal food, consume considerable quantities of these beans, principally in the form of *miso*. The soy bean first attracted attention in Europe in 1873, when specimens from Japan, from China, and from India were shown at the Vienna International Exhibition. Dr. Forbes Watson, reporter on the products of India, called attention to it in the Catalogue of the Exhibits of the Indian Museum. Since then numerous experiments have been made on the European Continent on its growth, and also feeding experiments with the bean and its straw on different kinds of domestic animals have been prosecuted. Such experiments have been carried on by Wolling and Wein, at Munich; by Haberlandt, Lehman, Harz, Stahel, Zimmerman, Siewert, Wieski, and others, at various stations in Germany, Austria, and Hungary, and experiments have also been made in France and in Italy.

"The proximate chemical composition of some of the different varieties, grown in different places, is now given and compared with some other foods of vegetable and animal origin."

Table 1, titled "Percentage composition of the soy bean," gives the percentage of six constituents (water, nitrogenous matter [protein], fat, carbohydrates, fiber, and ash) in seven different types of soy beans: Pale yellow (from Japan, China, Germany &c., India), brown, round black, and long black.

"It has been shown by Levallois *(Comptes-Rendus)* that the soybean contains a special variety of sugar, many of its properties resembling mellitose; this constitutes about 10 per cent, of the soluble carbohydrates. Of the nitrogenous matters nearly all is in the form of albumenoids; a small quantity, about 1 per cent., appears as a peptone-like body, and about one-tenth to two-tenths per cent. is non-albuminoid."

Table 2, titled "Percentage composition," compares the percentage content of the six constituents listed above for six foodstuffs: Peas, [common] beans, lupins, lentils. lean beef, and fat mutton.

"These analyses show the greater richness of the soy beans in nitrogenous matter and in fat than the common bean and pea, and that, when the water is equalized, it more nearly approaches meat in proximate composition. The only leguminous seed of common occurrence, which contains more oil than this bean, is the earth-nut or ground-nut,

Arachis hypogæa, which is now so largely cultivated abroad for its oil and its cake. In order to compare the soy bean straw with hay and with other straws of like nature, the following average analyses are given:

Table 3 (untitled) compares the percentage content of the six constituents listed above for six feeds: Meadow hay, bean straw, pea straw, lentil straw, soy bean straw, soy bean hulls.

"A special variety of *Soja hispida* is cultivated in some parts of Japan as a fodder crop and cut just as the pods are fully formed. The hay made from this is much relished by horses, cattle, and sheep. A sample of a crop grown on the Imperial College of Agriculture Farm, Komaba, Tokiyo, gave on analysis: Water 15.0%, nitrogenous matter 19.8%, fiber 35.9%, ash 6.8%, carbohydrates and fat 22.5%. Total 100.0%.

"It will be seen that this hay exceeds even lentil straw in the amount of nitrogenous matter it contains." Continued. Address: LL.D., Ames, Iowa.

97. Rein, Johann Justus. 1886. Japan: Nach Reisen und Studien, im Auftrage der Koeniglich Preussischen Regierung dargestellt [Japan: Travels and researches undertaken at the cost of the Prussian government. Vol. II.]. Leipzig, Germany: Verlag von Wilhelm Engelmann. 679 p. See p. 5, 65-70, 123-27, 185, 649. Illust. Indexes (1 German and Latin, 1 Japanese). 2nd ed. 1905. [9 ref. Ger]

• ***Summary:*** A superb book, showing the high German art of studying other cultures. The many illustrations are either beautiful wood engravings *(Holzschnitte)*, real photographs, or actual samples of paper or textiles (glued in). In the chapter on "Food plants" *(Nährpflanzen)*, the following is a partial contents of the section on "Pulse or leguminous plants" *(Hülsenfrüchte oder Leguminosen*, p. 65-71): Introduction to crops cultivated in Japan. 1. The ground-nut and ground-nut oil. 2. The soybean: "Among the pulse of Japan (and not the less of China), the soy-bean ranks first in extent, variety of use, and value; and chemical analyses prove the empirical judgment is well founded. In point of nutriment, the soy-bean is of all vegetables the nearest to meat. It contains nearly two-fifths of its weight in legumin rich in nitrogen, and nearly one-sixth in fat. The soy-bean is to the inhabitants of Japan what their *garbanzos* (chick-peas) are to the Spanish, and their *feijao preto* (black beans) to the Brazilians. The author then describes the characteristics of the soy-bean, the work of Haberlandt with soy-beans in Austria, and the yields that he and his co-workers obtained.

"In Japan the varieties of soy-bean are distinguished–according to colour, as white (more properly yellowish), black, brownish red, green, and spotted; according to duration of growth [maturity] as early-ripening, middle-ripening, and late-ripening; according to form, as spherical, ellipsoidal, kidney-shaped, and compressed laterally; and according to use, as to those which serve primarily in making Shôyu (soy), Tôfu (bean-cheese), and Miso (a sort of sauce), and those eaten in any plain shape."

Soy-bean varieties in Japan include: 1. "White (pea-yellow) soy-beans, Japanese Shiro-mame or Haku-daidzu. To this division belongs an early-ripening sort with very small seeds, called Goguwatsu-mame [Go-gatsu], or 'five-months-kind,' because it ripens in the fifth month of the old Japanese calendar, our July; also another small-seeded, early-ripening variety, the Wase-mame or Natsu-mame, that is, early and summer-bean. These two are also called Tôfu-mame, because they are used chiefly in making Tôfu. Another sort serves to produce Miso. It is called Nakate-mame, 'middle-late bean,' its time of maturity occurring half-way between that of the early and late kinds. Its seeds are round and somewhat larger. The late ripening varieties, Okute-mame (late-bean), Maru-mame (bullet-bean), and Teppô-mame (gun-bean), or Aki-mame (autumn-bean) have, as their names indicate, mostly bullet-shaped seeds, which become harder and larger than the early ones. The variety last named is used in making Shôyu, while Maru-mame is valuable as horse-feed.

2. Black soy-beans, Japanese Kuro-mame or Koku-daidzu. These are eaten boiled with sugar, as an entrée, or as a relish to rice. There is a middle-late sub-species, with round, elliptical seeds, Kuro-mame, in short, and another like it with big, bullet-shaped beans is called Kuro-teppô-mame. And again there is a late-ripening sort with flat, elliptical seeds under several names.

3. Brown soy-beans, Japanese Katsu-daizu (thirsty soy-bean) are much less grown than the white and black sub-species, and are used like the latter. They are distinguished as Aka-mame, red soy-beans, round, reddish-brown in colour, in different varieties, and Cha-mame, tea beans, three light-brown sorts of small extent and significance.

4. Greenish or bluish green soy-beans, Japanese Ao-mame or Sei-daizu, are eaten mostly boiled and with sugar, like the black and brown-red varieties. And, with the brownish sorts, they are much less widely grown than the black and yellowish. The Japanese distinguish the following sub-species of Aö-mame [sic, Ao-mame]:–(a) Sei-hito,–epidermis green, inside a whitish yellow. (b) Nikuri-sei,–greenish throughout. Both sub-varieties run from roundish-ellipsoidal to a bullet roundness, are of medium size, and remind one of green peas. (c) Kage-mame, with pale green, round beans. 5. Speckled soy-beans, Japanese Fuiri-mame or Han-daidzu. This group is not important. Its cultivation is confined to a small area, in a few provinces. Its sub-varieties are known as:–(a) Kuro-kura-kake-mame, with a black spot on the saddle (eye), otherwise greenish; flat and with the outline of an egg. (b) Aka-kura-kake-mame, with a brown spot on the saddle (eye), otherwise yellowish-green,

flat and drawn out long. (c) Fuiri-mame or Udzura-mame, speckled or spotted soy-bean, yellowish-green with many dark flecks. A rare variety, grown only in a few places, especially in Harima.

"Early-ripening soy-beans are sown as early as April in Southern Japan, in Central Japan during May. Those that ripen in autumn need much more warmth, and are sown, as a rule, one month later... Late-ripening Daidzu is also a favourite for planting along the edge of fields and on the new-built dykes of rice-fields."

"At the end of his above-mentioned treatise, Haberlandt summed up in five noteworthy propositions, the results of his experiments with the soy-bean and of its chemical analysis. His conclusions are as follows:

"(a) The acclimatization of the early-ripening sorts, particularly those with yellow and reddish brown seeds, appeared to have fully succeeded in Central Europe.

"(b) The seeds obtained were larger, heavier, and handsomer than those from Eastern Asia, the chemical composition, however, remaining unchanged.

"(c) The soy-plant resists light spring frosts better than our young beans, and endures greater dryness in summer than most leguminous plants, though otherwise much like other kinds of beans.

"(d) It is distinguished by heavy crops, besides furnishing, in its stems and leaves, either green or dried, a nourishing feed, of which cattle are very fond.

"(e) In their high percentage of protein and fat, they far excel all other pulse in nutritive quality; and when properly prepared are second to none in flavour.

"After such favourable judgments, it might have been expected that the soy-bean, at least in the warmer regions of the Austro-Hungarian monarchy, would soon become popular and generally cultivated. The result, however, was quite otherwise. The hopes which he had aroused in behalf of this plant seem to have disappeared with Haberlandt, who died in 1878.

3. Azuki beans (many varieties are named and described).

Two tables (p. 73-74) show the following: (1) Analysis of 10 different numbered samples of soybeans, empty pods, and straw and leaves. Eight are from Haberlandt's book *Die Sojabohne* [The Soybean] (1878), two are from Caplan, and one each from Mach, Senff, Levallois, and Kinch. (2) Comparative composition of 9 different legumes, including soybeans, azuki beans, common peas, broad beans / faba beans, lentils, yellow lupins, and peanuts. The soybean has by far the most crude protein, is second in fat (after peanuts), and is average in (minerals).

Foods made from soybeans (p. 123-27): Shoyu *(Shôyû, die japanische Bohnensauce, auch Soja).* Miso (made with rice koji). Tofu *(Tôfu, Bohnenkäse),* incl. dried-frozen tofu *(Kori-tôfu, gefrorener oder Eis-Tôfu).*

"Kori-tôfu, frozen or ice-Tôfu, is the spongy, horn-like substance that remains when common Tôfu is allowed to freeze and then thawed and dried in the sun, thus getting rid of most of its water. By Yuba is meant a third preparation, consisting of brownish, tough skins, made by boiling the dissolved legumine of the Tôfu-process, with the addition of some wood-ashes, and then taking away in succession the scums that rise" (p. 126-27; see Rein 1889).

The section on "Oil plants and their products" (p. 176-89) gives details on 13 plants and the oil obtained from them, including: 1. Rapeseed oil. 2. Mustard oil. 3. Camellia oil. 4. Cottonseed oil. 5. Peanut oil. 6. Sesame oil. 7. Perilla oil *(Perilla ocymoides).* 11. Hempseed oil. Soybean oil is not one of these. However a table (p. 185) gives the average composition of various Japanese oilseeds (Source: E. Wolff et al.; Ollech 1884): Rapeseed, peanuts, cottonseed, sesame (brown and white), hemp seeds, shelled beech-nuts, and soybeans.

Note 1. Volume 1 was published in 1881. The title of volume 2 is Land-und Forstwirtschaft, Industrie und Handel. Johann Justus Rein lived 1835-1918.

Note 2. This is the earliest German-language document seen (Feb. 2004) that uses the term "kori-tôfu," or "gefrorener Tôfu," or "Eis Tôfu" to refer to dried-frozen tofu.

Note 3. Also discusses: Ame, midzu-ame, and barley malt syrup (p. 121-22). Fu, or baked wheat gluten cakes. Hemp, hempseed, and hempseed oil (p. 88, 177, 184-85). Kudzu (p. 75, 199, 217). Peanuts and peanut oil (p. 176-81, 185). Sea-weeds–especially marine algae (p. 93-96). Sesame seeds and oil (p. 88, 176-78, 181-82, 185). Address: Prof. of Geography, Univ. of Bonn, Germany.

98. 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.* 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: 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 firm tofu or 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, 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).* Continued.

99. Egasse, M. 1888. Le soja et ses applications économiques et thérapeutiques: Matière médicale et therapeutique [Soja and its economic and therapeutic applications: Medical and therapeutic subject-matter]. *Bulletin General de Therapeutique Medicale, Chirurgicale, Obstetricale et Pharmaceutique* 115:433-48. [28 ref. Fre]
• ***Summary:*** This is a review of the literature, especially the use of soy in diabetic diets. The author was one of the first Westerners to suggest the therapeutic use of soybeans in diabetic diets. Illustrations show: (1) A soy bean plant (from Vilmorin 1883, p. 434). (2) Two views of a soy bean and a cross section of soy bean seed (both from Blondel, p. 435). Discusses (with 11 tables) the work of Haberlandt in

Austria-Hungary, Steuff in Germany, Schroeder (a chemist) in Napagedl [in Mähren / Moravia, a region in today's central Czech Republic], Capan [sic, Caplan] in Vienna, Pellet in France, P. Muntz, A. Levallois, Stingl and Morawski, E. Kaempfer, Eug. Simon, Champion, L'hôte and Champion, Mr. Lecerf, Mr. Dujardin-Beaumetz and Mr. Bourdin at Reims (soy bread), and Mr. Lailleux in Algeria.

Blondel (1888) reports the absence of starch in all parts of the soybean seed (p. 435).

"Soybeans are used above all to prepare foods: in Japan, miso and shoyu *(le sooju)*, in China an imitation of milk *(une imitation du lait* [soymilk]) and a cheese *(un fromage* [tofu]) greatly appreciated by the common people" (p. 441).

"Throughout China, soybeans *(les graines du soja)* are also used to prepare a milklike / lacteal emulsion *(une émulsion leiteuse)* which replaces milk and which is obtained by crushing the seeds, soaking them in water, and simply passing the liquid through a fine sieve. The [soy] milk, this liquor *(liqueur)*, only looks like [dairy] milk, but since [dairy] milk is extremely rare, this liquor supplements the milk [i.e., soymilk supplements dairy milk] from the alimentary point of view" (p. 443). Note: This is the earliest French-language document seen (Oct. 2003) that uses the term *une imitation du lait* or *une émulsion leiteuse* to refer to soymilk.

"The applications of soybean seeds for the feeding of diabetics is not numerous. Yet we know, via an oral communication from Mr. Lailleux, former intern at the hospital in Algiers, that a certain number of diabetic Arabs under treatment at the hospital of Dey, in Algiers, have seen, under the influence of a dietary regimen based on soybean pap, that not only did the content of sugar in their urine diminish by a considerable proportion, but also the condition of their sores was improved, a condition which like all of its type had resisted other treatments employed. If this fact can be verified again, either with soy pap or soy bread, the therapy would have found in soybeans an aid of great utility in the ordinary treatment of diabetes mellitus, which is so difficult for most patients to stand, especially because they must abstain from starches for which they generally show such a strong appetite" (p. 447). Address: France.

100. 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. 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)*, 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 in 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.

101. Vigoureux, Carlos E. 1889. La Soya hispida [The soybean]. *Anales de la Sociedad Rural Argentina* 23(22):614-23. Nov. 30. [Spa]

• ***Summary:*** A summary, in Spanish, of early developments in Europe with growing soybeans, especially by F. Haberlandt and the Society for Acclimatization in France.

Note: This is the earliest document seen concerning soya in connection with (but not yet in) Argentina. Address: Consul Argentino y Director de la Oficina de Informacion en Ninza, Argentina.

102. Gorkom, K.W. van. 1890. Supplement op De Oost-Indische Cultures, in betrekking tot handel en nijverheid [Supplement to East-Indian crops: In relation to commerce and industry]. Amsterdam, Netherlands: J.H. de Bussy. vii + 303 p. See p. 283-87. Supplement to the 1884 publication of the same title. 25 cm. [2 ref. Dut]

• ***Summary:*** The section titled "Kadelé" (Soybeans) discusses the cultivation of soybeans (also called *katjang djepoen* [Japan beans], Soya, *Glycine hispida,* or *kadelé boontjes)* on Java and the experimental culture in Europe. Interest is shown in the cultivation of soybeans as a food for diabetics.

Soya is cultivated in Java both for its seed and for its green leaves which are used as animal feed. The small soy beans are roasted by the indigenous people or, in the form of cakes / patties *(tetempé* [tempeh]), eaten like bean-cheese *(boonen-kaas* [tofu]). *("De kadele boontjes worden door de inlanders geroosterd of, in den vorm van koeken (tetempé), als boonen-kaas gegeten").*

The author considers that Indonesian soy sauce *(kétjap)* is inferior to Japanese soy sauce. Nutritionally, soya is rich in proteins *(proteïnestoffen)* (± 38%) and fat (± 21%), and low in starch and sugar.

In Germany and Austria, many years have been spent in developing and cultivating varieties of soybeans adapted to the European climate. Dr. Haberlandt, professor at the University of Vienna, distinguished himself for this work, even to the extent that a variety was named after him. In the experimental gardens at the National Agricultural in Wageningen [Netherlands], a field of soya is cultivated, but the results are not yet satisfactory. Yields are low, especially during the dry and warm summers, when the plant flowers abundantly, but the seeds don't have time to develop properly. The author hopes that through continued experiments, a suitable variety will be developed.

The soya bean has received attention from the medical profession because of its composition. Dr. Le Cerf of Paris was one of the first to try using soya with diabetic patients. He introduced soya bread instead of an almond bread and was successful with it. Dr. Stokvis, a professor in Amsterdam, recommended soy bread (see *Nederlandsch Tijdschrift voor Geneeskunde* No. 10), and the chemical analyses published by Mr. L.C.W. Cox in the same journal (issue No. 19) supported the recommendation. Patients were content with the bread, although they did not find it very appetizing. The author states that if rye or wheat flour could be used together with soy flour, they would yield a very digestible and nutritious food. For this reason also he recommended experiments aimed at acclimatizing soya to Europe.

Dr. Sollewijn Gelpke has published a work titled "The Yield and Cultivation of Dryland Crops," in which he writes that the cultivation of soya is quite easy and in Java takes place on sawahs (wet rice fields) and clay, in contrast to peanuts *(katjang-tanah),* which is grown on tegals and sand. [Note: A tegal is a dry (not irrigated) field, near the rice fields, but used for vegetables and other secondary crops.] Soya beans are sun-dried, soaked in water for 24 hours, then sown on land that has first been flooded with water. Otherwise they are sown by poking holes in the ground and dropping in the seeds. Gelpke says that soya is so appealing to the indigenous people that, if the soil is hard, he just opens the surface with a crowbar and sows his seeds. This way of cultivation is seen especially on the heavy clay soils of Java.

In the Netherlands it is not well known that soya is cultivated in Java, because it could be imported for less money than is currently the case. The author has samples of the beans and has noticed that the seeds from European experiments are smaller in size than those grown in Java.

Various laboratory analyses are given. It is noted that a soya flour coming from Hungary is used for the production of soy bread, baked by Mr. Koehler of Amsterdam. Mr. Cox studied this bread. The author believes that the sugar content of this bread is high enough to make it unsuitable for diabetic patients, and notes the presence of starch and dextrin. Morawski and Harz have confirmed that ripe soya beans don't contain starch, whereas unripe beans do.

Note 1. Kempski (1923) says: "see van Gorkom's Oost-Indische Cultures, neu herausgeg. von Prinsen-Geerligs, Verlag de Bussy, Amsterdam, 1913, Vol. III, p. 283/86."

Note 2. This is the earliest Dutch-language document seen (Aug. 2003) that uses the word *proteïnestoffen* (or *proteïnestoff)* to refer to proteins in connection with soybeans. Address: Dr., Former Head Inspector of Crops, Dutch East Indies (Oud-Hoofd-Inspecteur der Cultures in Nederlandsch Oost-Indië).

103. Williams, Thomas A. 1897. The soy bean as a forage crop. *USDA Farmers' Bulletin* No. 58. p. 1-19. March. Revised (very slightly) in 1899. [7 ref]

• ***Summary:*** Contents: General characteristics and origin. Varieties. Conditions of growth. Methods of culture. Harvesting. Yield. Chemical composition. Digestibility. Value and uses: As a soiling crop, as a silage crop, as a hay crop, as a pasture plant, as a soil renewer, value of the bean for feed. Summary. Appendix–Soy beans as food for man.

In the letter of transmittal printed at the front of this bulletin, F. Lamson-Scribner (USDA Agrostologist) says: "For reasons set forth in the body of this bulletin [see

p. 4], the name 'soy' has been adopted to 'soja,' by which it has been generally known.

"In 1875 Professor Haberlandt began an extensive series of experiments with this plant in Austro-Hungary, and in a work published in 1878 he gave the results of his studies and strongly urged the cultivation of the soy bean as a food plant for both man and beast. Although he succeeded in exciting a great deal of interest in its cultivation while making his experiments, and distributed a considerable amount of seed, very little seems to have come of it; for at his death, which occurred in 1878, the interest flagged, and the soy bean has failed to obtain the place as a staple crop which he prophesied for it."

"It is only within the last 15 years that it [the soy bean] has received much attention as a forage crop." Robert C. Morris of Illinois grew soy beans in 1896.

"The term 'soy' applied to this bean is derived from a Japanese word 'shoyu,' denoting a certain preparation from the seeds which is a favorite article of diet in that country. The term 'soja' is often used in connection with this plant, but Professor Georgeson, who spent some time in Japan, and who, since his return to this country, has experimented extensively with this plant, says [1892, "Test of some Japanese beans"]: 'The term *soja,* often applied to this bean, is misleading, inasmuch as the species named by Siebold and Zuccarini *Glycine soja* is not cultivated there (Japan), or at least rarely cultivated, though wild in the south...'" (p. 3-4). Note 1. Prof. Georgeson played an important role in changing the name of this plant to soy bean from soja bean.

"Varieties (p. 5-7): The different varieties of soy bean are distinguished largely according to the color, size, and shape of the seed, and the time required for the plants to reach maturity. They also differ more or less in the habit of growth and in the character and degree of the hairiness of the various parts of the plant. The names applied to the varieties here in the United States usually refer to the time of reaching maturity and the color of the seed; as, for example, 'Early White,' 'Medium Late Green,' 'Medium Black,' etc. The early varieties generally fruit heavier in proportion to the size of the plant than the later ones, and hence are better to grow for seed, while the medium or late varieties are better for forage on account of the larger yield of fodder that may be obtained.

"The 'Early White' soy bean is an excellent variety to grow when a crop of seed is desired, particularly in the North, where the growing season is likely to be short... 'Medium Early Green' is one of the best varieties to plant for hay, as it yields heavily and retains its leaves well. For soiling or for ensilage 'Medium Early Green,' 'Medium Early Black,' or the 'Late' green or black varieties may be used, according to the length of the season and the time at which the crop is to be used. In the New England States the 'Medium Early Green' variety is generally preferred, while in the Central States 'Medium Early Black' seems to be the favorite... For green manuring the large medium or late varieties are best; 'Medium Late Black' being excellent for this purpose."

Harvesting: The "best forage will be obtained by cutting just as the pods are forming... In harvesting a crop for the seed, the plants may be pulled by hand or cut with a scythe or mower and gathered into small piles, which should be relatively high and of a small diameter, so that the plants may dry out readily. Thrashing can be done with a flail or with the thrashing machine. Very good results can be had with common grain thrashers by taking out a portion or all of the concaves and substituting blanks."

The subsection titled "As a pasture plant" (p. 16) states: "In some parts of the country, particularly in the South, the soy bean crop is often pastured. Although hogs are perhaps most frequently used, all kinds of stock can be pastured on it. The crop can often be fed in this manner to great advantage. The labor and expense of harvesting is saved and the droppings from the animals are of great value to the land. Young stock, particularly sheep and hogs, can be very profitably pastured on this crop. Many farmers maintain that by this method of feeding the land is benefited as much as if the crop had been plowed under, and they obtain the pasturage in addition."

The subsection titled "As a soil renewer" (p. 16-17) states: "Leguminous plants, through the aid of the root tubercle organisms, are able to add to the available nitrogen of the soil... When the soy bean was first introduced into the United States it did not form root tubercles, owing to the absence of the tubercle organism from the soil, and it has been grown for several years in some localities without the appearance of any tubercles. In other cases the tubercles have developed in great abundance after a short time. At the Massachusetts (Hatch) Station the medium green soy bean produces great numbers of the tubercles. (See fig. 5.) At the same station it was found that a liberal application of nitrates interfered with the development of the tubercles."

"Value of the bean for feed: There is no crop so easily grown that is so rich and can be used to such good advantage in compounding feeding rations as the soy beans. Excepting the peanut, there is no other raw vegetable product known which contains such high percentages of protein and fat in such a highly digestible form.

"For feeding to animals the beans should be ground and the meal used with some less concentrated feeding stuffs. Comparatively few experiments have as yet been made in the United States to test the feeding value of soy-bean meal. Professor Brooks, in Massachusetts, found that it compared very favorably with cotton-seed meal. Cows fed on soy-bean meal gave richer milk and produced a better quality of butter than when fed on cotton-seed meal, but on the latter the cream was richer. Professor Georgeson obtained excellent results in feeding hogs on a ration of

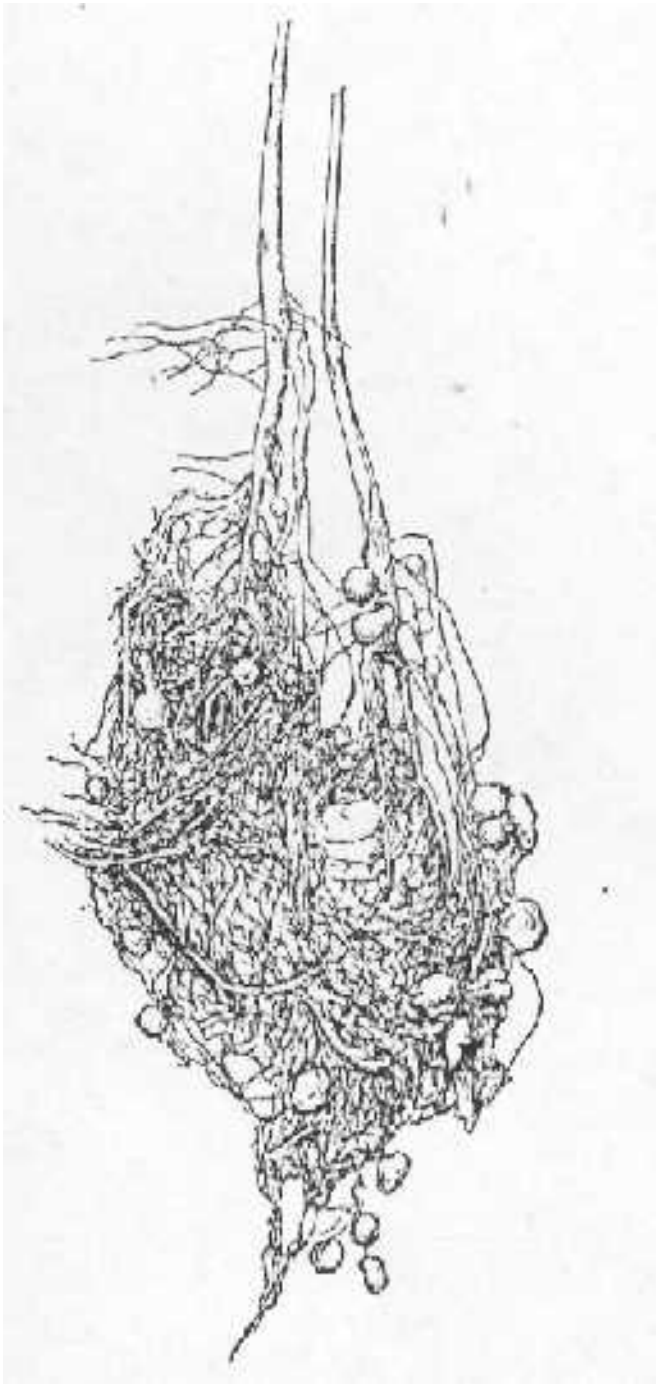
which soy-bean meal was a prominent constituent" (See Bulletin No. 61 of the Kansas Station).

Excellent illustrations (line drawings, some made from photos, p. 4-7, 17) show: (1) A young seedling soy

bean (½ size).

(2) (a) flowering branch of a soy bean plant (reduced 2/3). (b) one of the flowers (enlarged), (c) pods of a soy bean plant (reduced 2/3).

(3) Extra early soy bean, leaves and roots at age 7 days (¼ size). (4) Medium black soy bean, leaves and roots at age 7 days (¼ size).



(5) Roots of a soy bean plant, showing tubercles.

Tables show: (1) Composition of soy bean at four different stages of growth. (2) Chemical composition of the various kinds of forage made from the soy bean (incl. hay and ensilage). (3) Total amounts in pounds of food constituents produced on an acre of land by soy bean and fodder corn (proteins are flesh formers; fat, fiber, and

extract matter are fat and heat producers). (4) Digestibility of soy-bean forage.

An appendix to this article is titled "Soy Beans as Food for Man," by C.F. Langworthy (which see).

Note 2. This is the earliest document seen (Jan. 2003) that uses the word "mower" or the word "concaves" in connection with soybean production.

Note 3. This is the earliest English-language document seen (Jan. 2003) that uses the word "machine" (thrashing machine) in connection with a specific machine for soybean production.

Note 4. This is the earliest document seen (Aug. 2004) that mentions the soybean varieties Medium Early Black, Medium Early Green, or Medium Late Black.

Note 5. This is the earliest document seen (Oct. 2004) which gives details on use of soy bean as a good "pasture plant" or a pasture plant well suited for use in fattening hogs.

Note 6. This is the earliest English-language document seen (Oct. 2004) that uses the words "pasturage," "pasture," or "pastured," or the term "pasture plant," in connection with soybeans. Address: Asst. Agrostologist, Div. of Agrostology, USDA.

104. Krafft, Guido. 1897. Die Pflanzenbaulehre. Sechste, neuarbeitete Auflage [Instruction in plant cultivation. 6th ed.]. Berlin: Verlagsbuchhandlung Paul Parey. viii + 279 p. Illust. (incl. many color). Index. 23 cm. Series: Lehrbuch der Landwirtschaft auf wissenschaftlicher und praktischer Grundlage. 2nd Bd. [2 ref. Ger]

• ***Summary:*** In Chapter 2, "Legumes (Cultivation of protein-rich seeds)," section 7 (p. 80-81) is about the soybean *(Die Sojabohne)* also called the hirsute Soya *(rauhhaarige Soja)* or the "Haberlandts bean" *(Haberlandt's-Bohne) (Soja hispida* Mönch). Discusses: Botanical description, color of seeds, two important German-language publications about soybeans (Wein 1881 and Haberlandt 1878), widely cultivated in China and Japan, bears seeds in Europe only in areas which in 20-25 weeks accumulate 2500 to 3000ºC heat units *(Wärmeansprüchen),* description and chemical composition of yellow soybean seeds, used as food to make [soy] sauce and cheese [tofu] in China and Japan, a source of oil in Europe, and a feed for cattle, imported also as soya cake and meal *(Sojakuchen, Sojaschrot, Sojamehl),* best soil for cultivation, planting time, care, flowering, typical yields of seeds (62-72-75 kg/ha) and straw. A non-original illustration (line drawing) shows a soybean plant with many pods growing thickly on the stem, plus an enlarged view of a cluster of about 7 pods to the upper left of the plant. The soybean is also mentioned on p. 64. Also discusses Lupines (p. 80-85).

Chapter 3, Oilseeds *(Ölfrüchte;* the cultivation of oil-containing seeds, p. 81+) mentions: Peanuts, almonds, white sesame, brown sesame. It discusses: rapeseed (p. 82-83). Address: PhD, Professor der Land- und Forstwirtschaft an der k.k. technischen Hochschule in Wien (o. ö. Professor der Land- und Fortswirtschaft and der k.k. technischen Hochschule in Wien).

105. Fruwirth, Carl. 1898. Anbau der Huelsenfruechte [Cultivation of legumes]. Berlin: Verlagsbuchhandlung Paul Parey. xii + 274 p. See p. 11-13, 19, 47, 214-19 (Die Sojabohne), 264, 272-73. Illust. No index. 19 cm. [5 ref. Ger]

• ***Summary:*** Contents: Vernacular names in other countries. Botanical characteristics. Varieties, types *(Varietäten, Sorten).* Natural history. Uses and significance. Demands placed on the soil and climate *(Wärmesumme* or "heat units"). Use of fertilizers. Preparing the soil. Planting and seed. Harvest and yields. Animal pests. An illustration (p. 215) shows the leaves and buds of a soybean plant *(Glycine hispida).*

Concerning varieties and types: In addition to the yellow-seeded form, soybeans *(Sojas)* with brown and with black seeds are also cultivated in Europe, and both likewise belong to the Soja tumida group. However the distribution of these latter two is insignificant. Haage and Schmidt, the seedsmen in Erfurt, sell a green-seeded form named Bluish-green Soybean *(Blaugrüne Soja).* 100 seeds weigh 8-13 gm. One liter of seeds weighs 712-717 gm. Individual seeds are 7-8.2 mm long, 5-5.5 mm wide, and 3.2-4 mm high.

Yield: The yield obtained in Hungarian Altenburg was 1,600 to 2,100 liters of seed and 1,300 to 1,600 kg of straw per hectare. The yield in Bavaria *(Bayern),* based on many trials, averaged 2,400 kg/ha of seed. Haberlandt calculated the yield, based on trial plots with small areas, at 1,685 kg/ha. The range in yield is considered to be 700 to 3,000 kg/ha of seeds and 1,200 to 3,000 kg/ha of straw.

A table (p. 266-73) gives the composition on an as-is and moisture-free basis of all legumes discussed in this book.

Note: Karl Fruwirth was born in 1862. Address: Professor at the Royal Agricultural Academy (an der Koenigliche Landwirtschaftlichen Akademie), Hohenheim [Württemberg, Germany].

106. *Proceedings of the American Pharmaceutical Assoc.*1898. Report on the progress of pharmacy. 46:582-1120. See p. 857-60.

• ***Summary:*** In the section titled "Materia medica," under "Vegetable drugs," we read: *"Soy Bean-Food Value, etc.–* Referring to his paper on the soja bean (see Proceedings 1896, 634), in which he gave a summary of the literature on this valuable food product, Prof. Henry Trimble reproduces in the abstract a recent paper entitled "The Soy Bean as a Forage Crop," by Thomas A. Williams, with an appendix on "Soy Beans as Food for Man," by C. F. Langworthy,

published in *Farmer's Bulletin*, No. 58, issued by the U. S. Department of Agriculture. While not adding anything new to the knowledge of the digestive ferment, which was prominently discussed in the summary above referred to, there is much valuable information that is of interest to the pharmacist.

Discusses *Glycine hispida*, soy bean, Prof. Haberlandt, yuba, shoyu, tofu, frozen tofu, natto, and miso.

See: Trimble, Henry. 1897. "The soy bean." *American J. of Pharmacy* 69:584-93. Nov.

107. Sempolowski, A. 1900. Ueber den Anbau der Sojabohne [On soybean culture]. *Fuehling's Landwirthschaftliche Zeitung* 49(5):193-96. March 1. [Ger]
• ***Summary:*** "The soybean first aroused great interest in Europe after the Vienna World Exposition in 1873, where a large collection of soybean varieties from China, Japan, India, etc. were exhibited. Professor Haberlandt in Vienna and others subsequently conducted a large series of agronomic trials with the soybean in various locations from Austria and Germany. These, however, showed that the cultivation of this fodder plant in the districts concerned is not worth recommending since the soybean matured either very late or not at all. At that time I also conducted soybean agronomic trials in the province of Posen and in Russian Poland; these, too, gave negative results in those vegetation areas. The farmers were discouraged from cultivating the soybeans and pretty soon the once-popular fodder plant was indeed forgotten.

"However, in more recent years, there arose a new, eager apostle of the soybean, the farmer J. Owsinski [Owinsky, Ovinski] from the province of Podolia. He had been working for a long time in East Asia, allegedly, and there he learned about new, earlier-ripening varieties of this fodder plant. For cultivation, he recommends two varieties above all: one black- and one brown-seeded. Since the soybean still continues to have a great reputation, publicity, especially in Russia, as an excellent fodder plant, I decided to conduct another agronomic trial with these two new varieties at agricultural research station at Sobieszyn (in Russian Poland). I wanted to answer two questions: First the time required for the soybean to mature in our climate, and second the value of the entire plant as fodder.

According to Owsinski, the soybean took 100 days to come to vegetative maturity in southwest Russia and 110 days in western Russia, corresponding to late varieties of oats or blue lupins. The brown-seeded soybean is said to ripen in 100 days in southwest Russia and 108-110 days in western Russia, however the yield is low and the seeds shatter easily.

In East Asia soybeans are used to make soy sauce ("Shoya, Soohu, or Soy"), miso, and natto–the last two being fermented foods. A table shows the nutritional composition of soybean cake on a dry weight basis (41.73% protein, and 7.18% fat).

On 14 May 1898 the author planted his trial field with soybeans. On Sept. 22 he harvested 30 plants of brown-seeded soybeans, including 200 gm of seeds; 100 seeds weighed 22.07 gm. The plants were 26-36 cm high and on each stem were 13-17 pods. The time to maturity was 140 days. On Oct. 5 he harvested 23 plants of black-seeded soybeans, including 208 gm of seeds; 100 seeds weighed 16.01 gm. The plants attained a height of 30-55 cm, and on each stem were 12-56 pods. The time to maturity was 173 days.

On 17 May 1899 the author planted a larger quantity of brown-seeded soybeans at the rate of 643 kg/ha in rows 40 cm apart. The time to maturity was 130 days. At the same time on another test plot he planted black-seeded soybeans in rows 50 cm apart. The harvest took place on Oct. 7 and the time to maturity was 170 days, but the seeds were not completely ripe and had to be dried for another week. A table shows the nutritional composition of these two varieties. Brown: 39.03% crude protein and 18.55% fat. Black: 37.62% crude protein and 20.87% fat.

"When we consider the protein and fat content of the seeds, we must acknowledge that the soybean, compared with other crops, has a very high nutritional value. However, farmers must be urgently advised to treat the new, allegedly early-ripening varieties with great caution, since they have not yet been sufficiently tested to be recklessly praised and their cultivation widely expanded."

Note: This document contains the earliest clear date seen for soybeans in Russia, or the cultivation of soybeans in Russia (14 May 1898). This is also the earliest document seen that describes soybean breeding in Russia. The source of these soybeans was Owinski, who apparently obtained them from East Asia. Address: Dr., Sobieszyn [Russian Poland?].

108. Ito San: New U.S. domestic soybean variety. Synonyms: Medium Early Yellow (Towar 1902). Early White, Early Yellow, Kiyusuke Daizu, Kaiyuski Daizu, Kiyusuki Daidzu, Kysuki, Yellow Eda Mame (Ball 1907). Dwarf Early Yellow (1908). Coffee Berry, Dwarf Yellow, Japan Pea, Medium Yellow, Yellow (Morse 1918). Early, Eda Mame, Etampes, German Coffee Berry (Morse 1948). Eda-Mame. 1902. Seed color: Yellow (straw), hilum pale.
• ***Summary:*** Sources: Towar, J.D. 1902. "Cowpeas, soy beans and winter vetch." *Michigan Agric. Exp. Station, Bulletin* No. 199. p. 165-74. April. See p. 173 (table). This table shows the nutritional composition of the following varieties: Extra Early Black, Medium Early Green, Medium Early Black, Ito San or Medium Early Yellow, Medium Early Yellow. Note: Towar probably got these Ito San soybeans from Mr. E.E. Evans of West Branch, Michigan.

Thorburn, James M., & Co. 1902. One hundred & first annual catalogue of high-class seeds. New York, NY. The seed company is offering Ito San, Yellow at $0.25/ quart, $6/bushel.

Evans Seed Co., Inc. 1904. *1904 retail price list: Northern grown legume, forage plant, grain and grass seeds.* West Branch, Michigan. 24 p. See p. 6. "Varieties: Ito San. (Pronounce all vowels short.) Named by Mr. Evans in honor of Marquis Ito, the Japanese statesman. This variety matures in 75 to 95 days, varying with the soil and season. Height 2½ to 3½ feet, stalks long and fine, leaves small, foliage compact: beans small, yellow, eye marked with brown. Excellent for soiling and hay. For balancing rations we prefer this sort to any other, as analysis of beans grown in three states have shown an average of 40 per cent. protein. It is also one of the best yielders–of seed. Yield at Wisconsin Experiment Station 33 bushels per acre. Yield at Illinois Station 38 bushels."

Ball, Carleton R. 1907. "Soy bean varieties." *USDA Bureau of Plant Industry, Bulletin* No 98. 28 p. May 27. See p. 12-13, 23-24. "Classification–Key to the varieties (p. 11): VI. Yellow seeded: 1A. Much-branched plants, branches as long as the main stem; pods small to medium, 1 to 1¼ inches long, often 3 seeded, seeds medium. 5½ to 8 mm. long, round or broadly elliptical, flattened, mostly deep yellow. Early, about 95 days, 18 to 24 inches tall = Ito San." "Ito San is probably the best known variety of soy bean on the market. The original source of the variety is not known, but it was very probably one of the early importations made by the Kansas and Massachusetts agricultural experiment stations; perhaps by others also. It has long and widely sold under the names, 'Yellow,' 'Early Yellow,' 'Early White,' etc. It is said that the name 'Ito San' was given it by Mr. E.E. Evans, of West Branch, Michigan. The greatest value of the Ito San lies in its earliness and fairly large yield of seeds. It is too small to yield heavily for hay, silage, etc. It remains, however, one of the most popular varieties on the northern market... Ito San commonly matures in from 90 to 100 days, with the average between 90 and 95 days. Occasionally it ripens in less than 90 days... The Kentucky Agricultural Experiment Station reports 5 3/10 tons of green fodder per acre, curing 1½ tons. In Ontario, Canada, the average height for four years was 27 inches and average yield of green hay 8½ tons. In 1903 the Kansas Agricultural Experiment Station secured yields of 14½ to 15 7/10 bushels of seed from four different plats. All showed a high percentage of nondehiscence of the pods–88 to 96 per cent. At the Massachusetts Agricultural Experiment Station the seed yields have varied between 18 and 20 bushels in favorable years. Numbers and sources of lots grown: Agrost. No. 658, 'Kaiyuski [probably Kiyusuke] Daizu;' Agrost. No.1183, 'Adzuki,' Rhode Island Expt. Station; Agrost No. 1186, 'Yellow;' Agrost. No. 1187, 'Early White,' Rhode Island Expt. Station; Agrost No. 1189, 'Yellow Eda Mame,' Rhode Island Expt. Station; Agrost. No. 1192, 'Kiyusuke Daidzu,' Rhode Island Expt. Station; Agrost. No. 1294, 'Rokugatsu,' S.P.I. No. 6326; Agrost. No.1313, 'Ito San,' J.M. Thorburn & Co.; Agrost. No. 1316, 'Early,' F. Barteldes & Co.; Agrost. No. 1468, 'Ito San,' J.M. Thorburn & Co.; Agrost. No. 1475, 'Ito San,' Hammond Seed Co.; Agrost. No. 1478, 'Early Yellow,' Currie Bros.; Agrost. No. 1765, 'Early Yellow,' Kansas Agric. Expt. Station; Agrost. No. 1973, union of Agrost. Nos. 1183, 1186, 1187, 1294; Agrost. No. 1974, union of Agrost Nos. 1189, 1192, 13161478, 1540; Agrost. No. 1975, union of Agrost. Nos. 1316, 1468, 1475; S.P.I. No. 6326, 'Rokugatsu,' Japan; S.P.I. No. 17268, grown from Agrost. Nos. 1765, 1973, 1974, 1975." Note: The meaning of the name/word "Kiyusuke" is unclear; it could refer to a person's surname.

Piper, C.V.; Nielsen, H.T. 1909. "Soy beans." *USDA Farmers' Bulletin* No. 372. 26 p. Oct. 7. See p. 9. "Ito San (Yellow)."

Piper, Charles V.; Morse, W.J. 1910. "The soy bean: History, varieties, and field studies." *USDA Bureau of Plant Industry, Bulletin* No. 187. 84 p. Dec. 31. See p. 28. "Ito San was among the varieties introduced in 1899 by Prof. W.P. Brooks, of Amherst, Massachusetts, and by him called Early Yellow. Later, Mr. E.E. Evans secured seed of it and in 1902 called it Ito San. Mr. Evans writes that he subsequently secured it 'from half a dozen sources in the United States and Japan.' The same variety was also among those introduced by Prof. C.C. Georgeson, of the Kansas Agricultural Experiment Station, and grown in 1890 (see Kansas Agric. Exp. Station, Bulletin 19) and subsequent years. This conclusion is based on the identity of nine varieties obtained from the Rhode Island Agricultural Experiment Station in 1903. This station had previously obtained several varieties from the Kansas Agricultural Experiment Station in 1892. Three of the varieties from Rhode Island had exactly the same names as those published in Bulletins 19 and 32 of the Kansas Agricultural Experiment Station, namely, Eda Mame, Yellow Soy Bean, and Kiyusuke Daidzu. All three of these are Ito San.

"Ball (1907) gives a list of numerous American sources through which this variety was secured under such names as Yellow, Early Yellow, and Early White. It was also grown at the Virginia Agricultural Experiment Station in 1905 as Japanese pea, as shown by later cultures at the Arlington Experimental Farm of seed from this experiment station.

"Among the introductions of the Office of Foreign Seed and Plant Introduction it is represented by No. 6326, received in 1901 from Tokyo, Japan, and No. 21818, obtained from Vilmorin-Andrieux & Co., Paris, France, as 'Yellow Etampes.' It is quite probable that this is one of the varieties grown by Professor Haberlandt in his experiments, as all of his varieties were grown at Etampes and other places in France (see Roman. 1881. *La Nature*, pt. 2, p.

115). We suspect that this is also the variety that was distributed by the United States Patent Office in 1853, as most of the early documents point to this or a closely similar variety. These accounts refer to it as Japan pea, Japanese pea, Japan bean, and also coffee berry (see especially the T.E.W. 1854. *Rural New Yorker,* Jan. 21. p. 22).

Piper, Charles V. 1914. *Forage Plants and Their Culture.* New York, NY: The Macmillan Co. xxi + 618 p. See p. 520-21. "Ito San.–This variety is also known as Japanese pea, Early White and Early Yellow. It was introduced from Japan by C.C. Georgeson in 1890, but apparently the same or a very similar variety was distributed by the United States Patent Office in 1853. It is a bushy variety growing 2 to 2½ feet high, with rather slender stems, and on this account, excellent for hay. It becomes fully mature in about 100 days after planting. The pubescence is tawny, and the flowers purple. The seeds are rather small, straw yellow with a pale hilum, but with a brown speck near the micropyle, by which this variety may be certainly known. One pound contains about 2300 seeds. This variety has been much grown in the Northern States."

Morse, W.J. 1918. "The soy bean: Its culture and uses." *USDA Farmers' Bulletin* No. 973. 32 p. July. See p. 14. "Ito San.–This variety is one of the earliest commercial sorts and has been known under the names of Japan Pea, Yellow, Medium Yellow, Dwarf Yellow, Early Yellow, Early White, and Coffee Berry."

Piper, Charles V.; Morse, William J. 1923. *The soybean.* New York, NY: McGraw-Hill Book Co. xv + 329 p. March. See p. 41-42, 46, 166, 167. Page 41 states: "The early introduced varieties.–Previous to the numerous introductions by the United States Department of Agriculture beginning in 1898, there were not more than eight varieties of soybeans grown in the United States." One of these was Ito San (with yellow seeds). "Introduced from Japan, 1890." "Medium Early Yellow.–The same as Ito San." Pages 45-46 state: "In 1880 Vilmorin-Andrieux & Company introduced into France one of the varieties tested by Haberlandt in Austria, which variety has proven well adapted to French conditions. This variety is presumably that now known in France as 'Yellow Etampes' which is the same as that known in the United States as 'Ito San.'"

Morse, W.J.; Cartter, J.L. 1939. "Soybeans: Culture and varieties." *USDA Farmers' Bulletin* No. 1520 (Revised ed.) 39 p. Nov. See p. 11. "Ito San–Introduced by the Kansas Agricultural Experiment Station, from Japan in 1890. Maturity, about 105 days; pubescence, tawny; flowers, purple, appearing in 40 to 45 days; pods, two- to three-seeded; seeds, straw yellow with pale hilum and a brown speck at one end of hilum, about 3,325 to the pound; germ, yellow; oil, 18.14 percent; protein, 41.46 percent."

Talk with Dr. Richard Bernard, Univ. of Illinois. 1998. May 29. He has always heard the name of this soybean pronounced AI-toe-san, where the "san" rhymes with "man" or "can." In Japanese the name, pronounced EE-toe-sahn, means "Mr. Ito." San rhymes with "Don" or "fawn." Address: USA.

109. Pinolini, D. 1905. Della soia [On soybeans]. *Italia Agricola (L'): Giornale di Agricoltura* 42(12):276-78. June 30. [7 ref. Ita]

• ***Summary:*** Contents: Botanical characteristics. Origin and early history in Europe. Varieties.

Concerning history: The soybean first made its appearance in Italy in 1840, and was first grown successfully near Verona, on the Lombard Coast of Lake Maggiore, near Mantova, and near Lucchese. It was cultivated more as an ornamental and curiosity than as an agricultural plant. In about 1850 Prof. Inzenga made some experiments on soybean cultivation, publishing his results in the *Annali dell'Agricoltura Siciliana* in 1857. He concluded that "The soybean *(la soia)* is disgusting and has absolutely no use as a bean [to eat], nor is it of any worth as an oilseed." Prof. Berti-Pichat in his *Treatise on Agriculture* referred to the soybean as a coffee bean *(fagiole de café).* In 1860 the Hungarian Ministry of Agriculture published instructions on soybean cultivation and distributed these for free. From 1880 the Italian Ministry of Agriculture, Industry and Commerce worked to encourage soybean cultivation in various regions of Italy. They distributed seeds and information but little came of their efforts. Since 1885, the Society for Acclimatization in Paris distributed a large quantity of free seeds. This article laments that the soybean did not catch on in Italy, noting that it was becoming popular in France.

Illustrations (line drawings; facing p. 276) show three different full-size views of the Soja plant, including: (1) Plant with roots. (2) Stem, leaves and pods. (3) Stem and pods.

Note 1. This document apparently contains the earliest date seen for soybeans in Hungary, or the cultivation of soybeans in Hungary (1860). The source of these soybeans is unknown.

Note 2. This is the earliest Italian-language document seen (March 2001) that refers to soy coffee. It calls the soybean a coffee bean *(fagiole de café).* Address: Italy.

110. Haberlandt: New U.S. domestic soybean variety. Dry edible variety. Synonym: White (Morse 1948). 1907. Seed color: Yellow (straw), hilum dusky brown.

• ***Summary:*** Sources: Ball, Carleton R. 1907. "Soy bean varieties." *USDA Bureau of Plant Industry, Bulletin* No 98. 28 p. May 27. See p. 12-13, 22. "Classification–Key to the varieties (p. 11): V. Greenish yellow seeded: 2. Medium late, about 120 days, 25 to 30 inches high, branches long, pods about 1¼ inches long, seeds medium large, roundish or broadly elliptical, hilum dark brown = Haberlandt." "A plot

grown in 1905 at Baton Rouge, Louisiana, had foliage of a very light glaucous green, much resembling a plot of rape in color. The same appearance was also reported for this variety by the Virginia Agricultural Experiment Station... The time required for this variety to reach maturity varies from 110 to 130 days, the average time being somewhere near 118 to 120 days. Two seed yields secured were 12 9/10 and 13 3/10 bushels to the acre, respectively. The Haberlandt is one of the most promising varieties for hay, silage or green manuring, and for a cover crop. From the Tokyo it can be distinguished only by its earlier maturity, rather deeper greenish yellow seed and distinctly brown hilum. This variety was named in honor of Prof. A. Haberlandt, who first brought the soy bean to agricultural notice in Europe. His work was published in 1878 at Vienna. Numbers and sources of lots grown: Agrost. No. 1194, 'White,' S.P.I. No. 6396; Agrost. No. 1539, S.P.I. No. 8495; Agrost. No. 1540, S.P.I. No. 8493; S.P.I. No. 6396, 'White,' Ping-yang [Pyongyang / P'yongyang], Korea; S.P.I. No. 6397, Ping-yang, Korea; S.P.I. No. 8493, grown from S.P.I. No. 6396; S.P.I. No. 8495, grown from S.P.I. No. 6397; S.P.I. No. 9415, grown from S.P.I. No. 6397; S.P.I. No. 17263, grown from Agrost. No. 1539-1; S.P.I. No. 17271, grown from Agrost. No. 1194-1."

Piper, C.V.; Nielsen, H.T. 1909. "Soy beans." *USDA Farmers' Bulletin* No. 372. 26 p. Oct. 7. See p. 11. Haberlandt (Yellow) is one of the best out of more than one hundred sorts tested in the last three years. It is not yet on the market, but will probably be available by 1910.

Piper, Charles V.; Morse, W.J. 1910. "The soy bean: History, varieties, and field studies." *USDA Bureau of Plant Industry, Bulletin* No. 187. 84 p. Dec. 31. See p. 47, 75. Seed color: Straw yellow. S.P.I. No. 17271. "From Pingyang, Korea, 1901... Grown nine seasons." "The best varieties of soy beans (p. 75): Medium late–Haberlandt, 17271."

Morse, W.J. 1918. "The soy bean: Its culture and uses." *USDA Farmers' Bulletin* No. 973. 32 p. July. See p. 14.

Piper, Charles V.; Morse, William J. 1923. *The soybean.* New York, NY: McGraw-Hill Book Co. xv + 329 p. March. See p. 165. "Introduced from Pingyang [Pyongyang], Korea, 1901."

Morse, W.J.; Cartter, J.L. 1937. "Improvement in soybeans." *Yearbook of Agriculture* (USDA). p. 1154-89. For the year 1937. See p. 1187. Origin: Introduction, Chosen [Korea]. Year: 1901. Days to mature: 130. Flower color: Purple, white. Pubescence color: Tawny. Seed coat color: Straw yellow. Germ color: Yellow. Hilum color: Brown. Seeds per pod: 2-3. Seeds per pound: 2,400. Use: Grain, or dry edible beans. Note: This is the first of many documents in which Morse classified the Haberlandt as a "dry edible" soybean, one of a limited number of "edible varieties of soybeans."

Bernard, R.L.; Juvik, G.A.; Nelson, R.L. 1987. "USDA soybean germplasm collection inventory." Vol. 1. INTSOY Series No. 30. p. 10-11. Haberlandt is in the USDA Germplasm Collection. Maturity group: VI. Year named or released: 1907. Developer or sponsor: USDA. Literature: 01, 03. Source and other information: From Pyongyang, North Korea, in 1901. Prior designation: PI 6.396 (also PI 17.271). Address: USA.

111. Tokyo: New U.S. domestic soybean variety. Dry edible variety. Also spelled Tokio. Synonyms: Austrian Green, Ita Mame, Late Ita Mame, Southern Medium Green (Morse 1948). 1907. Seed color: Yellow (olive), hilum pale. • ***Summary:*** Sources: Ball, Carleton R. 1907. "Soy bean varieties." *USDA Bureau of Plant Industry, Bulletin* No 98. 28 p. May 27. See p. 12-13, 22-23. "Classification–Key to the varieties (p. 11): V. Greenish yellow seeded: 3. Late, 130 days or over, 35 inches or over in height, very long branched, pods 1½ inches long, seeds larger, round or elliptical, hilum scarcely tinted = Tokyo." The Tokyo differs from the medium greenish yellow (Haberlandt) variety mostly in a somewhat more vigorous growth and in later ripening... The Tokyo is one of the very best varieties for all-around use. It will give heavy hay and silage crops, is equally good for pasture and cover-crop purposes, and where it matures it gives very good seed yields. Eight plots grown at Washington [DC] in two different years averaged 8 1/3 bushels of seed per acre, in which the lowest yield was 4 bushels and the highest 14½ bushels. The Kentucky Agricultural Experiment Station reports a very much higher seed yield, with the weight of green forage to the acre 11.84 and 14.08 tons from two plots, curing to 5.44 and 6.16 tons, respectively. It is too late for the best results in most Northern States, but it may be replaced there by the Haberlandt variety. This variety was named for the Japanese capital, where some of the importations were secured. Numbers and sources of lots grown: Agrost. No. 468, grown from S.P.I. No. 4914; Agrost. No. 696, grown from Potomac Flats; Agrost. No. 1171, 'Best Green,' S.P.I. No. 9409; Agrost. No. 1198, 'Late Ita Name,' S.P.I. No. 8424, Japan; Agrost. No. 1200, 'Medium Ita Name,' S.P.I. No. 8423, Japan; Agrost. No. 1298, 'Medium Green,' S.P.I. No. 6335, Japan; S.P.I. No. 4914, 'Best Green,' Japan; S.P.I. No. 5766, grown from No. 4914; S.P.I. No. 6335, 'Medium Green,' Japan; S.P.I. No. 8423, 'Medium Ita Name,' Japan; S.P.I. No. 8424, 'Late Ita Name,' Japan; S.P.I. No. 9409, grown from S.P.I. No. 5766; S.P.I. No.17264, grown from Agrost. No. 1198-1; S.P.I. No. 17265, grown from Agrost. No. 1200-1; S.P.I. No.17266. grown from Agrost No. 1171-1; S.P.I. No. 17267, grown from Agrost No. 1298-2." Note: The words/name "Ita Name" make no sense in Japanese. Perhaps "Eda Mamé" was intended.

Piper, Charles V.; Morse, W.J. 1910. "The soy bean: History, varieties, and field studies." *USDA Bureau of*

Plant Industry, Bulletin No. 187. 84 p. Dec. 31. See p. 18, 45, 75. Variety name: Tokyo. Seed color: Olive yellow. S.P.I. No. 17264. "From Tokyo, Japan, 1901... Grown nine seasons. This variety was also obtained from Kobe, Japan, No. 20893." "The best varieties of soy beans (p. 75): Late–Tokyo, 17264."

Tracy, S.M. 1912. "Forage crops for the cotton region." *USDA Farmers' Bulletin* No. 509. 47 p. Oct. 11. See p. 29. The soybean variety Tokyo has recently become popular in the cotton region of the USA (the southern states).

Country Gentleman. 1915. "Soy beans for all climates." May 22. See p. 11. Note: This is the earliest document seen (Dec. 1998) which uses the spelling "Tokio" rather than "Tokyo" for this variety. In about 52% of all documents where this variety is mentioned, its name is spelled "Tokyo," while in the remaining 48% it is spelled "Tokio." The "Tokio" spelling was more common from 1919 to 1925, however it was not used after 1947, when "Tokyo" became the standard spelling.

Morse, W.J. 1918. "The soy bean: Its culture and uses." *USDA Farmers' Bulletin* No. 973. 32 p. July. See p. 16.

Piper, Charles V.; Morse, William J. 1923. *The soybean.* New York, NY: McGraw-Hill Book Co. xv + 329 p. March. See p. 68, 87, 89, 96, 100, 111, 152, 154, 158, 169, 171, 192-193. "Tokio–Introduced from Tokio, Japan, 1901." Seed olive yellow, hilum pale, germ yellow, oil 18.4 per cent., about 134,400 to the bushel.

Morse, W.J.; Cartter, J.L. 1937. "Improvement in soybeans." *Yearbook of Agriculture* (USDA). p. 1154-89. For the year 1937. See p. 1187. Origin: Introduction, Japan. Year: 1901. Days to mature: 140. Flower color: Purple. Pubescence color: Gray. Seed coat color: Olive yellow. Germ color: Yellow. Hilum color: Pale. Seeds per pod: 2-3. Seeds per pound: 2,260. Use: Grain, or dry edible beans. Note: This is the first of many documents in which Morse classified the Tokyo as a "dry edible" soybean, one of a limited number of "edible varieties of soybeans."

Bernard, R.L.; Juvik, G.A.; Nelson, R.L. 1987. "USDA soybean germplasm collection inventory." Vol. 1. INTSOY Series No. 30. p. 18-19. Tokyo is in the USDA Germplasm Collection. Maturity group: VII. Year named or released: 1907. Developer or sponsor: USDA. Literature: 01, 03. Source and other information: 'Ita Name' from Yokohama, Japan, in 1902. Prior designation: PI 8.424. Address: USA.

112. Ruata, Guido; Testoni, Giuseppe. 1907. La soia nell'alimentazione italiana [Soy in the Italian diet]. *Ministero d'Agricoltura, Industria e Commercio. Bollettino Ufficiale* 6(6):698-718. Dec. 18. (Chem. Abst. 2:864). [35 ref. Ita]

• ***Summary:*** Contents: Introduction. Description of the soybean. Cultivation and its history in Europe. Harvest and yield. Nutritional value of the soybean: Tables show analyses according to König (10 tables), to Balland (1 table analyzing 3 varieties, from Cambodia {Exposition of 1900}, from Cochin China, and from Tonkin), to Gautier (1 table), to Maurel (1 table), and to Lechartier and Joulie (from Grandeau 1903, analyzing 3 varieties, from Etampes, black soybean, and yellow soybean–all grown in France; each either as is or dry). Tables of nutritional analyses by Ruata & Testoni (includes the weight of 1,000 seeds for each variety): I. Black soybean, from Vilmorin-Andrieux of Paris, France; from Dammann & Co. [seedsmen] of Naples (Italy); and from the Inst. of Hygiene of Bologna, Italy. II. Giant Yellow, from Etampes (Pinolini), from Naples (Dammann), from Bohemia *(Boemia*–Ingegnoli); III. Small yellow soybean (from Dammann in Naples). IV. Green soybean (from Dammann). V. Brown soybean (from Dammann). The authors believe the Giant Yellow soybean is best adapted to Italian conditions. The analysis of the variety from Naples is as follows: Weight of 1,000 seeds: 205 gm. Water 9.80%. Albuminoids 37.13% *(albuminoidi,* protein) Carbohydrates 24.40%. Fat 18.36%. Lecithin 1.62%. Crude fiber 4.47%. Ash: 4.30%.

Preparation of soybeans (detailed descriptions and nutritional analyses): The whole seeds, miso *(Il miso),* tofu *(To-Fu* or *to-fu),* shoyu (made with koji), soy flour and bread *(farina e pane di soia,* incl. experiments by Brugia, and Rimini), soy polenta. Conclusions.

Three non-original illustrations (line drawings; between p. 700 and 701) show three different full-size views of the Soja plant, including: (1) Plant with roots. (2) Stem, leaves and pods. (3) Stem and pods (Original from Pinolini 1905).

Several bar graphs (following p. 712) give nutritional composition comparisons of 12 staple foods, mainly legumes, cereal grains, dairy products, and meat: Fig. 2–Albuminoids (protein content); soya is the highest with 37.13%. Fig. 3–Carbohydrate content. Fig. 4–Fat content; soya is highest with 18.36%. Fig. 5–Salt *(Sali).*

Other tables show: (1–p. 701): For four soybean varieties, weight of 100 liters in kg and number of seeds per kg. Soia d'Etampes yellow 72 / 7,400. Black soybean from Podolia 74.5 / 7,400. Yellow soybean 72.5 / 8,550. Black soybean 73 / 12,200. Note that the black soybean has by far the smallest seeds.

Selected translations of the text: The first part of the article discusses dietary problems in Italy, especially pellagra, a skin disease caused by deficiencies in protein and niacin. One of the causes seems to be the consumption of corn, especially spoiled corn *(maiz guasto)* (p. 699-700). The authors are interested in studying the soybean as a potential new food for Italy, based on the examples from other countries where it has been consumed for a long time

and where corn is unknown or almost unknown. They want to take the initiative in getting the best possible advantage from the introduction of soybeans as an Italian food (p. 700). In Italy the varieties which grow well are the early black, the yellow, the brown, the green, and the giant yellow; the latter is similar to the variety Soya Etampes, which has been acclimatized in France (p. 701). History in Italy: According to Pinolini, the soybean made its appearance around 1840, and has been cultivated with success around Verona, along the Lombard coast of Lake Maggiore, and near Mantua and Lucca (Mantova and Lucchese). As far as we know, it either was cultivated or is still cultivated in Liguria, Friuli, the Marches, and Emilia. Around Naples, it is especially cultivated in San Giovanni a Teduccio, under the care of Dammann & Co., a seed company (p. 702).

In the year 1906 in a field annexed to the Institute of Hygiene, we conducted experimental cultivation of soybeans, sowing the black variety from Podolia, sent to us by the Vilmorin-Andrieux, a seed company in Paris. A similar experiment was carried out on a larger expanse of land, at the same time as ours and with the same seeds, by Dr. Ignazio Buldrini at his farm near Bologna. The land at the Institute of Hygiene, being rather rich in humus, was fertilized with phosphate fertilizer at the rate of 500 kg/ha and potassium sulfate at the rate of 100 kg/ha. Dr. Buldrini's land, well supplied with potassium and phosphoric anhydride,... was fertilized with plenty of manure. The seed was planted on both fields in early May. The vegetation developed regularly and in August we obtained a harvest that yielded 1,500 kg/ha of seeds reaching perfect maturation (p. 703).

Brugia (1902) has conducted numerous experiments in baking with soy flour, and here is what he writes about it: "It is necessary to find an inexpensive food with great nutritional value for the poor farmers and rural people. It would be ideal to be able to make bread from soybean flour, thus creating a food that would be physiologically balanced and complete." He first tried mixing soy flour with wheat flour in the proportions 50/50 and 30/60, but the results were unfavorable. Then they tried using brewer's yeast in the process and had very good results, except that the price was a little high. It was then necessary to substitute a mixture of bicarbonate of soda and cream of tartar (½ gm per 3 g of flour) for the brewer's yeast. This worked very well. He then gives a table showing the nutritional analysis of the best bread (p. 716). In the conclusions of his work, Brugia says: "Soy flour cannot be used by itself in baking. But mixed with wheat it gives an optimum bread, soft textured, complete and balanced nutritionally, economical, and convenient. A second table shows an analysis of soy bread published by Rimini (1902) (p. 716).

Soy polenta, a mixture of soy and corn, was named Soyenta by Haberlandt who first prepared it. It could be of nutritional benefit to the people in those parts of Italy who get almost all of their nutrients from polenta. We have conducted numerous tests to find a type of Soyenta (to adopt Haberlandt's name) which, because of taste and ease of preparation, could enter into the diet of our rural population without difficulty. Here are the results of our experiments with various types of Soyenta: (1) With whole yellow soy flour: The resulting product does not have a soft consistency; it is coarse and crumbles rather easily, but the taste is nice. (2) With sifted soy flour: This product is not as good as the previous one, because it is too sticky. The taste reminds us of infant cereal made of wheat flour. (3) Soy flour mixed with wheat flour in varying proportions: Not advisable because it presents in various degrees the difficulties of the former. (4) (p. 717). Soy flour mixed with corn flour: Best results were obtained with a mixture of 1 part soy flour to 4 parts corn meal (coarsely ground, Veronese style). The consistency of this product is not unlike that of regular polenta, and the flavor is also very close. Hot or cold it slices very well, and overall it can be used just like regular polenta, but it has more nutritional value (p. 717).

Note 1. This is the earliest Italian-language document seen that mentions tofu, which it calls *To-fu.* It is the second earliest Italian-language document seen (July 2000) that mentions miso, which it calls *Il miso.*

Note 2. This is the earliest Italian-language document seen (Aug. 2003) that uses the term *albuminoidi* to refer to protein in connection with soybeans. Address: 1. Direttore dell'Istituto d'Igiene della Regia Universita di Bologna (Director of the Inst. of Hygiene at the Univ. of Bologna); 2. Insegnante nella Regia Scuola Media Commerciale, Direttore del Laboratorio chimico Compartimentale delle Gabelle di Bologna, Italy.

113. Senft, Emanuel. 1907. Ueber einige in Japan verwendete vegetabilische Nahrungsmittel, mit besonderer Beruecksichtigung der japanischen Militaerkonserven [On some vegetable foods used in Japan, with special attention to Japanese military canned foods]. *Pharmazeutische Praxis* 6(3):81-89; 6(4):122-24, 131-32; 6(6):211-12, 219. [19 ref. Ger]

• ***Summary:*** These three sections contain a good review of the literature (especially the Japanese literature) in German. Issue No. 3 begins with "Phanerogams. Chapter 5. Legumes. Soybeans and soybean preparations" (p. 81-89). Contents: Introduction. Varieties: Group I. Soja platycarpa-Harz (5 forms–olivacea-Harz and punctata-Harz, melanosperma, platysperma, parvula Martens). Soja tumida-Harz (3 forms–pallida Roseb. [sic, Roxb = Roxburgh], castanea-Harz [brown], atrosperma-Harz). Anatomy and cell structure of different parts of the plant and seeds. A non-

original illustration (line drawing; p. 83) shows a soy bean, full-size and at cellular levels. Haberlandt and the Vienna World Exposition of 1873. Foods made from soybeans in China and Japan described by Charles Bryant (1785): Miso, soy sauce *(sooju-sauce* or soy), Roos, Koji. Tofu, sake. Shoju or Soja-Sauce. Miso (vegetable cheese; "Recently the firm Jul. Maggi & Comp. in Kempthal makes a type of miso and sells it commercially").

Issue No. 4 begins with "Natto and tofu" *(Bohnenkäese)* (p. 122-24) and includes fresh tofu and frozen tofu *(gefrorener tofu).* Yuba. A separate section on miso pickles *(Misozuke;* p. 131-32) describes the different types, especially those made with daikon *(Rettiche).*

Issue No. 6 discusses shoyu (called *Extrakt-Sauce Japonica,* or Shoju-Sauce) (p. 211). A table (p. 212) lists the main food plants of Japan, including five different "varieties" *("var.")* of soybeans: *Kuro-mame, Shiro-mame, Ao-mame, Goishi-mame, Gankui-mame.* A photo (p. 219) shows various Japanese preserved foods, including a metal box containing "Fukujinsuke" *[fukujinzuke]* consisting of sliced vegetables (cucumbers, bamboo shoots, onions) preserved in soy sauce. Address: Military medicine official, Germany.

114. Strakosch, Siegfried. 1907. Das Problem der ungleichen Arbeitsleistung unserer Kulturpflanzen [The problem of the unequal production efficiencies of our crop plants]. Berlin: Verlagsbuchhandlung Paul Parey. 110 p. No index. 23 cm. [Ger]

• ***Summary:*** This book, dedicated to Julius Wiesner, "the master of plant physiology," looks at national food supplies from the viewpoint of plant physiology. In the section on "Calculation of assimilative effects," a table (p. 44-45) compares rye, wheat, corn, rice, soybeans, and potatoes in their production per hectare of starch, digestible protein, value of product in German marks, value of nutritive elements consumed, assimilative effect (defined as the ration of the value of the usable substance produced per unit area to the value of the nutritive elements borrowed from the soil by producing this substance), assimilative effect compared with rye, and difference between the production and consumption in German Marks. Soybean produces much more protein per given area of land than the other crops, has the highest assimilative ratio, 6.68 times larger than that of rye. Thus the culture of soybeans should be the most remunerative.

In the same section, a bar graph (p. 48) shows the value (in marks) of physiologically useful substance resulting from withdrawal of one mark worth of soil nutrients. The soybean gives the greatest returns of the 22 plants listed.

In the section on "Consideration of plant production efficiency in crop rotations" (p. 66+), the legumes are praised and soybeans are mentioned on pages 71 (the most productive of all legumes with an enormous number of 668) and 73. In this context, the work of Friedrich Haberlandt with soybeans and his book, *Die Sojabohne* (The Soybean, Vienna, 1878) are described in detail (p. 74-76). Haberlandt died shortly after the publication of this book, and Hecke, his friend, carried on his work.

In the last chapter, "Goals and consequences," a table (p. 102) shows the productivity in the northern U.S. states of nine crops, including wheat, barley, corn, sugar beets, peas, Jerusalem artichokes, and soybeans. In value of crop per hectare, soybeans are third after Jerusalem artichokes (German: Topinambur; French: Topinambour) and sugar beets. Two long footnotes (No. 122 and 123, p. 109-10) discuss the importance in Japan of soybeans and the various foods made from them including shoyu (Shoju, Shoyu), miso, tofu, and yuba. Address: Dr., Wien-Hohenau.

115. Choles, H.J. 1908. The soy bean. A valuable fodder plant and its cultivation. *Natal Agricultural Journal* 11:1411-23. Nov.

• ***Summary:*** Contents: Introduction. Botany and habitat (incl. the work of Prof. Haberlandt from 1875 in Austro-Hungary). Varieties. Cultivation: Conditions of growth, methods of culture. Harvesting: When to harvest, curing [allow the plants to lie in a swath or wind-row until well wilted], harvesting for seed, yield of forage [up to 12-13 tons/acre of fresh fodder], yield of seed. Chemistry: Composition, digestibility. Value and uses of the crop: As a soiling crop (for green forage), as a silage crop (it is best mixed with hay for making mixed ensilage; it is more profitably ensiled than cured for hay), as a hay crop, as a pasture plant (hogs are most widely pastured on it), as a soil renewer (when a crop of soy bean is turned under for green manure it should be well limed), value of the bean for feed.

"A crop which I think has not received the attention in Natal that it deserves is the soy bean. The soy bean is considered by many authorities to be an extremely valuable fodder plant...

"Since the plant would in all probability suit conditions in many parts of the Colony, I have collected... a considerable amount of information regarding its cultivation which should prove useful to farmers who may be disposed to give the plant a trial. The plant stands drought well and is not easily injured by excess of moisture. Little cultivation is needed when grown for forage. The soy bean may be used for soiling, pasturage, hay and ensilage, or the beans themselves may be harvested and fed as grain."

"In harvesting a crop [of soybeans] for seed, the plants may be pulled by hand or cut with a scythe or mower and gathered into small piles, which should be relatively high and of a small diameter, so that the plants may dry out readily. Thrashing can be done with a flail or with the thrashing machine. Very good results can be had with

common grain thrashers by taking out a portion or all of the canvas and substituting blanks."

116. *USDA Bureau of Plant Industry, Inventory.*1909. Seeds and plants imported during the period from January 1 to March 31, 1908. Nos. 21732 to 22510. No. 14. 64 p. Jan. 9. Also titled USDA Bureau of Plant Industry, Bulletin No. 137.

• ***Summary:*** Soy bean introductions: Glycine hispida (Moench) Maxim. [Note the first use of this terminology in this publication.]

21754-21757. "From Paris, France. Purchased from Vilmorin-Andrieux & Co. Received January 3, 1908.

"21754. Yellow seeded.

"21755. *Ogemaw.* Extra early, brown seeded.

"21756. Black seeded.

"21757. Extra early, black seeded."

21818. "From Paris, France. Purchased from Vilmorin-Andrieux & Co. Received January 17, 1908. *Ito San.* Called by the French, *Yellow Etampes.*

21825. "From Hokkaido, Japan. Presented by Mr. K. Hashimoto, Kuchchau Agricultural Society, Abutagun. Received January 14, 1908. *Amherst* (?). 'Used in the manufacture of "soy," "miso," "tifu" [tofu], etc.' *(Hashimoto.)"*

21830/21831. "From Hokkaido, Japan. Presented by the Yokohama Nursery Company, Yokohama, Japan. Received January 24, 1908.

"21830. *Butterball.* Japanese name *Akita.*

"21831. Japanese name *Rumoi."*

21946. "From Buitenzorg, Java. Presented by Dr. M. Treub, director of the Department of Agriculture. Received February 11, 1908. *'Zwarte kadelee'"* [black soybeans].

21999. "Received through Mr. F.N. Meyer, agricultural explorer for this Department at the Plant Introduction Garden, Chico, Cal., February 12, 1908. From Boshan, Shantung, China. '(No. 799a, Sept. 18, 1907.) A rare variety of soy bean, sparsely grown near Boshan. Chinese name *Ta ha tau.* Used by the higher classes as a vegetable in soups.' *(Meyer.)"*

22311/22312. "From Shanghai, Kiangsu, China. Presented by Rev. J.M.W. Farnham, Chinese Tract Society. Received March 11, 1908.

"22311. Black. 'Similar to *Nuttall* but larger.' *(Neilsen.)*

"22312. Yellow."

22317-22322. "From Erfurt, Germany. Purchased from Haage & Schmidt [seedsmen]. Received March 16, 1908.

"22317. Probably *Butterball.*

"22318. *'Giant Yellow.'* Probably *Amherst.*

"22319. Brown.

"22320. *Samarow.* Like No. 17260.

"22321. Probably *Cloud.*

"22322. *'Early Black* from Podolia [Ukraine].' Probably *Buckshot."*

22333-22337. "Grown at Arlington Experimental Farm, Virginia, season of 1907. Received March 19, 1908.

"22333. *Baird.* 'This variety was mixed with *Brownie* when received from Pingyang [Pyongyang / P'yongyang], Korea. This mixture was given S.P.I. No. 6414. The two varieties were grown together under these numbers, 9417, 17256, and Agrost. No. 1542, respectively. The two varieties were separated in the 1907 seed from Arlington Farm, and *Baird* given the above new number, *Brownie* remaining as No. 17256.' *(Nielsen).*

"22334. Flat black. 'Received from Mr. H.B. Derr, Agricultural Experiment Station, Champaign, Illinois. The original source of the seed is not known. It is quite similar in growth to *Nuttall,* but the seed is not the same shape, being flatter and larger.' *(Nielsen.)*

"22335. Yellow. 'Received from Mr. H.B. Derr, Agricultural Experiment Station, Champaign, Illinois, where it was grown as *Illinois Medium Yellow.* It is very similar to *Hollybrook,* and perhaps is the same, but appears different on account of having been grown farther north.' *(Nielsen.)*

"22336. *Guelph.* 'Received from Mr. H.B. Derr, Agricultural Experiment Station, Champaign, Illinois. Original seed was procured from the Agricultural Experiment Station, Wooster, Ohio.' *(Nielsen.)*

"22337. *Guelph.* 'Received from Mr. H.B. Derr, Agricultural Experiment Station, Champaign, Illinois. Original seed was procured from the Agricultural Experiment Station, Fayetteville, Arkansas' *(Nielsen.)."*

22379-22381. "From Canton, Kwangtung [province], China. Presented by Dr. J.M. Swan, Cooks Hospital. Received March 20, 1908.

"22379. Yellow.

"22380. Black.

"22381. Green mixed with yellow and a few brown."

22406/22407. "From Hongkong, China. Presented by Mr. S.T. Dunn, Botanical and Forestry Department. Received March 26, 1908. [Note: It is not clear whether or not they were ever cultivated in Hongkong. These two soybeans (#22406 and #22407, both black seeded) were later given the names "Hongkong" and "Nigra" respectively, and introduced to the USA in about 1910].

"22406. Yellow.

"22407. Black."

22411-22415. "From Naples, Italy. Purchased from Dammann & Co. Received March 25, 1908.

"22411. *Samarow.*

"22412. Black. 'Similar to *Cloud.' (Nielsen.)*

"22413. Brown.

"22414. Yellow. 'Similar to *Acme.' (Nielsen.)*

"22415. Giant yellow."

"Glycine soja Sieb. & Zucc." [Note the first mention of this species.] 22428. "Grown at Arlington Farm, Virginia, season of 1907, under C.V.P. No. 0474. Received March, 1908. 'Original seed presented by the Botanic Gardens, Tokyo, Japan. A near relative to the soy bean, but a spreading or decumbent plant, abundantly provided with large root nodules. Has considerable promise as a cover or green manure crop.' *(Piper.)"*

22498-22501. "From Hangchow, Chehkiang, China. Presented by Dr. D. Duncan Main, through Mr. J.M.W. Farnham, Shanghai, China. Received March 26, 1908.

"22498. Yellow. Similar to No. 18619.

"22499. Yellow.

"22500. Green. Similar to No. 17857.

"22501. Black."

22503-22507. "From Yokohama, Japan. Purchased from L. Boehmer & Co. Received March 31, 1908. The following seeds with Japanese names quoted; varietal descriptions by Mr. H.T. Nielsen:

"22503. *'Teppo Mame.'* Yellow, similar in appearance to *Amherst*, No. 17275.

"22504. *'Kaze Mame.'* Green.

"22505. *'Gogwatsu Mame.'* Yellow, similar to *Haberlandt*, No. 17271.

"22506. *'Maru Mame.'* Yellow.

"22507. *'Vieuri Lei.'* Green, similar to *Yosho*, No. 17262." Address: Washington, DC.

117. *USDA Bureau of Plant Industry, Inventory.*1909. Seeds and plants imported during the period from April 1 to June 30, 1908. Nos. 22511 to 23322. No. 15. 81 p. Feb. 25. Also titled USDA Bureau of Plant Industry, Bulletin No. 142.
• ***Summary:*** Soy bean introductions: Glycine hispida (Moench) Maxim.

22534/22535. "From Weihsien, China. Presented by Mrs. C.W. Mateer. Received April 4, 1908.

"22534. Yellow. 'This bean is used for making lamp and cooking oil and for flour to make cakes; also for bean curd (a mush curdled by caustic soda and eaten fried). All these are nourishing, but more esteemed by Chinese than foreigners. The refuse after expressing the oil forms a cake (round) 2 feet in diameter and 3 inches thick. This is exported for feeding animals (pounded fine) and enriching land.' *(Mateer.)*

"22535. Black. Similar in appearance to *Cloud."*

22536-22538. "From Chefoo [Yantai], Shantung, China. Presented by Mr. Hunter Corbett, through Rev. J.M.W. Farnham, of Shanghai, China. Received April 4, 1908. The following seeds, varietal descriptions by Mr. H.T. Nielsen:

"22536. Green. Similar to No. 17857.

"22537. Green. Similar to No. 17262, *Yosho.* 'Chinese names (S.P.I. No. 22536) *Ching teo* and *Luh teo;* (S.P.I. No. 22537) *Whong teo.* These beans are used extensively for the manufacture of oil; the bean cake which remains after the oil has been pressed out is shipped south and extensively used as a fertilizer in vegetable gardens. Will grow well on level or high and hilly land. Is used by the people largely for food, being ground and made into a curd, also put in water and soaked until well sprouted and used as a vegetable. It is also boiled and eaten in the same manner as rice.' *(Corbett.)*

"22538. Black. Similar in appearance to *Cloud.* 'Chinese name *Shao hih teo.* Used chiefly for feeding animals.' *(Corbett.)"*

22633/22634. "From Sheklung, Kwongtung [Kwangtung / Guangdong], China. Presented by Mr. A.J. Fisher, American Presbyterian Mission. Received April 3, 1908.

"22633. Yellow. Similar in appearance to *Acme,* No. 14954, but seed is a trifle larger.

"22634. Black. Seed flatter than any other of the same size received from China."

22644-22646. "From Hangchow, Chehkiang, China. Presented by Mr. John L. Stuart. Received April 18, 1908. The following seeds, varietal descriptions by Mr. H.T. Nielsen:

"22644. Smoky yellow. Looks like it might possibly be a mixture.

"22645. Greenish yellow. Similar in appearance to *Haberlandt*, No. 17263.

"22646. Yellow. Practically identical with No. 18619."

22714. "From Saigon, Cochin China. Presented by Mr. Jacob E. Conner, American consul. Received April 21, 1908. Yellow."

22874-22885. "From Tokyo, Japan. Purchased from the Tokyo Plant, Seed, and Implement Company. Received May 14, 1908. The following seeds, varietal identifications and descriptions made by Mr. H.T. Nielsen:

"22874. Green.

"22875. *Flat King.* Same as Nos. 19982 and 17252.

"22876. Yellow. Similar in appearance to *Hollybrook*, No. 17269.

"22877. *Okute.* Apparently identical with No. 19986.

"22878. *Butterball.* Apparently identical with Nos. 19981 and 17273.

"22879. Yellow. Evidently two varieties; most of the seed very similar in appearance to *Acme,* No. 14954.

"22880. Yellow. Quite closely resembling *Hollybrook.*

"22881. Green.

"22882. Yellow. Apparently identical with No. 20892.

"22883. *Buckshot.* Apparently identical with No. 19987.

"22884. Yellow, with a slight purple marking on many of the seeds.

"22885. *Amherst.* Apparently identical with Nos. 19983 and 17275."

22886. "From Swatow [Shantou], Kwangtung [province], China. Presented by Mr. William Ashmore, Jr., through Rev. J.M.W. Farnham, Chinese Tract Society, Shanghai, China. Received May 14, 1908. Black."

22897-22901. "From Paotingfu, Chihli [later Baoding, Hebei], China. Presented by Rev. J.W. Lowrie, D.D., through Rev. J.M.W. Farnham, Chinese Tract Society, Shanghai, China. Received April 22, 1908. The following seeds. Chinese names in italic as given by Mr. Lowrie. Descriptions of varieties by Mr. H.T. Nielsen.

"22897. *Da ching don.* Green. Similar to No. 17857.

"22898. *Hwang don.* Yellow.

"22899. '*Hei don.* Boiled as a fodder for mules and horses. Oil expressed from it, and refuse used as manure.' *(Lowrie.)*

"22900. '*Da wu don.* Tends to vary after successive plantings.' *(Lowrie.)* Black. Similar in appearance to *Nuttall*, Nos. 17253 and 19183, but has green cotyledons.

"22901. *Hsiao bai hei don.* Smoky yellow."

22919-22922. "From Ingchung, via Fuchau, China. Presented by Mr. J. Willis Hawley. Received May 22, 1908. The following seeds. Varietal descriptions by Mr. H.T. Nielsen:

"22919. Black. Very similar to No. 22886.

"22920. Yellowish green.

"22921. Yellow. Very similar to No. 22714.

"22922. Yellow. Seed resembles *Mammoth* very closely, but slightly smaller."

22927. "From Shanghai, Kiangsu, China. Presented by Rev. J.M.W. Farnham, Chinese Tract Society. Received May 27, 1908. Black. 'Identical with *Shanghai*, No. 14592; cotyledons are green.' *(Nielsen.)"*

23205. "From Shanghai, Kiangsu, China. Presented by Dr. S.P. Barchet, interpreter, American consulate. Received June 30, 1908. 'Similar in appearance to *Ebony*, No. 17254.' *(Nielsen.)* An important bean for dry rice land. Chinese name *Pu chi.' (Barchet.)"*

23207-23209/23211-23213/23229/23232. "From China. Received through Mr. Frank N. Meyer, agricultural explorer, and brought by him to the Plant Introduction Garden, Chico, Cal., June, 1908. Forwarded to Washington, D.C., and received July 6, 1908. The following seeds:

"23207. From Soochow, Kiangsu, China. '(No. 960a, April 27, 1907.) A large, greenish soy bean, grown around Soochow on the rather low-lying lands. Used when slightly sprouted as a vegetable. Chinese name *Tsin tou.' (Meyer.)*

"23208. From Tangsi, Chehkiang, China. '(No. 961a, April 20, 1908.) A large, yellow soy bean, often purplish colored on one side. Considered locally a very good variety. Chinese name *Sian chu tou.* Grows on the ridges around inundated rice fields.' (Meyer.)

"23209. From Tangsi, Chehkiang, China. '(No. 962a, April 20, 1908.) The ordinary variety of yellow soy bean as grown around Tangsi on the ridges and strips of land around and between inundated rice fields. Chinese name *Huang tou.' (Meyer.)*

"23211. From Tangsi, Chehkiang, China. '(No. 964a, April 20, 1908.) A very dark brown colored soy bean, grown near Tangsi; said to be very productive. Chinese name *Tsze pi tou.' (Meyer.)*

"23212. From Hangchow, Chehkiang, China. '(No. 965a, April 24, 1908.) An early-ripening, yellow soy bean, called the sixth month's bean, meaning ripening in the Chinese sixth month (our July). Chinese name *Lu ya pai mou tou.' (Meyer.)*

"23213. From Hangchow, Chehkiang, China. '(No. 966a, April 24, 1908.) A yellow soy bean called the seventh month's bean, meaning ripening in the Chinese seventh month (our August). Called in Chinese *Chi ya pai mou tou.' (Meyer.)*

"23229. From Tientsin, Chihli, China. '(No. 982a, April 4, 1908.) A dark brown colored soy bean; rare. Said to grow near Tientsin. Used for human food; boiled in soups or as a vegetable when slightly sprouted. Chinese name *Tse doh.' (Meyer.)*

"23232. From Shanghai, Kiangsu, China. '(No. 985a, May 11, 1908.) The *Barchet* soy bean, growing on wet rice lands. Chinese name *Ma liao tou.* Obtained through Dr. S.P. Barchet, of Shanghai, who procured these soy beans from Chinhuafu, in the Chehkiang Province, central China.' (Meyer.)"

23291/23292/23296/23297/23299/ 23303/23305/ 23306/23311/23312. "From China. Received through Mr. Frank N. Meyer, agricultural explorer, and brought by him to the Plant Introduction Garden, Chico, Cal., June, 1908; forwarded to Washington, D.C., and received July 6, 1908. The following seeds:

"23291. From Wutaishan, Shansi, China. '(No. 922a, Feb. 26, 1908.) Black soy bean, growing at 5,000 to 6,000 feet elevation. Are considered by the Chinese the best food for their hard-working mules and horses; they must always be boiled before being fed to the animals; otherwise they may cause colic; the Chinese also mix a liberal quantity of sorghum seed and chopped straw with these beans. Chinese name *Ghae doh.' (Meyer.)*

"23292. From Wutaishan, Shansi, China. '(No. 923a, Feb. 26, 1908.) Yellow soy bean. Growing at 5,000 to 6,000 feet elevation. They are used all through northern China for making bean curd and bean vermicelli. Chinese name *Huang doh.' (Meyer.)*

"23296. From Taichou, Shansi, China. '(No. 929a, March 2, 1908.) Yellow soy beans, found growing on

strongly alkaline lands. Chinese name *Huang doh.'* For further remarks see No. 923a (S.P.I. No. 23292).' (Meyer.)

"23297. From Taichou, Shansi, China. '(No. 930a, March 2, 1908.) Black soy bean. Grows on strongly alkaline lands. Chinese name *Ghae doh.'* For further remarks concerning their uses see No. 922a (S.P.I. No. 23291).' (Meyer.)

23299. "From Tsintse, Shansi, south of Taiyuanfu, China. '(No. 933a, March 12, 1908.) Black and yellow. A rare local variety of a strange soy bean used as a vegetable when slightly sprouted, and after having been scalded for a few minutes in boiling water is eaten with a salt sauce; the skin must be removed before scalding. Chinese name *Yang yen doh*, meaning sheep's eye bean.' (Meyer.)

"23303. From Shiling, Chihli, China. '(No. 949a, Jan. 25, 1908.) Yellow soy bean. Chinese name *Ta huang doh.* For further remarks see No. 923a (S.P.I. No. 23292).' (Meyer.)

"23305. From Peking, Chihli, China. '(No. 951a, Feb.8, 1908.) Large, light yellow soy bean. Used mostly as a vegetable when slightly germinated, and eaten with a salt sauce. Chinese name *Ta huang doh.' (Meyer.)*

"23306. From Peking, Chihli, China. '(No. 952a, Feb. 8, 1908.) Large, black soy bean, green inside. Comes from Manchuria and is used mostly like the preceding number (S.P.I. No. 23305.) Chinese name *Ta ghae doh.' (Meyer.)*

"23311. From Shiling, Chihli, China. '(No. 957a, Jan. 25, 1908.) Large, green soy bean. Used as a vegetable when slightly sprouted, after having been scalded in boiling water. Chinese name *Ta ching doh.' (Meyer.)*

"23312. From Pautingfu, Chihli, China. '(No. 958a, Jan. 28, 1908.) A rare, local variety of soy bean, being small and of greenish yellow color. Chinese name *Shau ching doh.' (Meyer.)"*

Note: This is the earliest English-language document seen (Oct. 2004) that uses the term "dark brown" to describe the color of soybean seeds. Address: Washington, DC.

118. *USDA Bureau of Plant Industry, Inventory.*1909. Seeds and plants imported during the period from October 1 to December 31, 1908. Nos. 23745 to 24429. No. 17. 58 p. June 30. Also titled USDA Bureau of Plant Industry, Bulletin No. 153.

• ***Summary:*** Soy bean introductions: Glycine hispida (Moench) Maxim.

24180-24184. "From Soochow, Kiangsu, China. Presented by Rev. R.A. Haden, B.D. Received November 14, 1908. The following seeds. Quoted descriptions by Mr. Haden; description of varieties by Mr. H.T. Nielsen.

"24180. 'Plant bunchy.' Looks like *Nuttall*, No. 17253, also like No. 19183.

"24181. 'Large yellow soy bean, early.'

"24182. 'Green soy bean, early.' Seed looks like *Okute*, No. 19986.

"24183. 'Small light green variety, early.' Seed similar to *Haberlandt*, Nos. 17263 and 19985, but is a little smaller.

"24184. 'Large yellow variety, medium early.' Seed looks like *Haberlandt*, No. 17271." Address: Washington, DC.

119. Ruhräh, John. 1909. The soy bean in infant feeding; Preliminary report. *Archives of Pediatrics* 26:496-501. July.

• ***Summary:*** This pioneering paper was read before the Twenty-first Annual Meeting of the American Pediatric Society, Lenox, Massachusetts, May 28, 1909. "The soy bean (glycine hispida), sometimes incorrectly called the soja bean, is an annual leguminous plant which originally grew in a wild state from Cochin China to the south of Japan and Java."

There follows a brief but accurate history of the soy bean. "In 1875 Professor Haberlandt began a series of investigations with this plant in Austro-Hungary, and in his work published in 1878 he urges the importance of the soy bean as a food both for man and animals. After his death, which occurred in 1878, very little notice was taken of the soy bean in Hungary and the prophecy that he made for its future failed."

"As early as 1829 Thomas Nuttall wrote an article in the *New England Farmer* concerning the bean as a valuable crop for this country. The Perry expedition to Japan also brought back soy beans, but until the last fifteen or twenty years the plant was known only as a curiosity."

"The plant is grown in America, but is used chiefly for the purpose of a forage crop and comparatively little reference has been made to its use as food for man." The plants "bear a remarkable number of beans and the flowers are self-pollinated, making the yield independent of insects. The bean may be easily grown in Maryland. I am indebted to three friends for experimenting with this plant in their gardens and obtaining good crops... At the present time there are seven varieties handled by seedsmen, and some twenty-two distinct varieties are known." The varieties Mammoth Yellow, Hollybrook, and Ito San have been used in infant feeding experiments. "The other varieties are the Guelph (green), the Samarow (green), the Ogemaw (brown), and the Buckshot (black). All of these latter may be grown in the north."

"I am indebted to Mr. Frank N. Meyer, agricultural explorer for the Department [U.S. Department of Agriculture], for information concerning the use of the beans in the East... The light-colored beans are eaten in soups and the pods are sometimes picked green, boiled, and served cold with a sprinkling of soy sauce. The green varieties are often pickled in brine and eaten moist or dried with meals as promoters of appetite." Also discusses soy

sprouts, oil, natto, soy bean milk (which "has a composition nearly the same as that of cow's milk" as shown in a table), tofu, miso, yuba, shoyu, and roasted soybeans used as a substitute for coffee.

"The fact that the soy beans contain little or no starch suggested to Dujardin-Beaumetz that they be used as a food for diabetics. The soy bean flour has been placed on the American market, but was withdrawn owing to the fact that according to the manufacturers it contained 8 per cent. carbohydrate. It contains much less carbohydrate, however, than any of the other diabetic foods."

"As regards the use of the beans in infant feeding it seemed to me that soy bean gruel or milk, either alone or with cow's milk, might be of value in feeding several classes of cases, viz., of marasmus and malnutrition, as a substitute for milk in diarrhea, and in intestinal and stomach disorders, and in diabetes mellitus." Note 1. This is the earliest English-language document seen (Nov. 2002) that uses the word "malnutrition."

The writer had hoped to conduct experiments and make a more complete clinical report but several misfortunes attended his efforts to secure the beans. "My first crop was eaten by rats, my second moulded in the pods owing to some unusually damp weather, and insects ate about two-thirds of my last crop. Fortunately, the beans may now be obtained from Messrs. T.W. Wood & Son, Richmond, Virginia.

"So far the gruel has been prepared by soaking the beans over night, stirring to remove the envelope surrounding the bean. Three times the amount of water is added to the beans and they are boiled until a smooth gruel results. This is strained if necessary [to make real soymilk]. This has the odor and taste of malt, but with the addition of a little salt is well taken, especially after the first bottle or two. The gruel is retained unusually well and seems to be easily digested. The stools are not more frequent than with other foods. The stools are light brown in color like those from malted milk. This soy bean gruel has nearly the same food value as milk and for certain children may need further dilution. About the same size feedings should be used as if milk were being given. Five percent sugar may be added to increase the fuel value.

"I have not used the beans in a sufficiently large number of cases nor over sufficient periods of time to justify any further statements at this time, but I do feel that properly used they will be a most valuable addition to the dietary of the sick infant. Grinding them to a bean meal would simplify matters very much, and, if success attends their use, a soy bean meal could easily be prepared.

"I hope to be able to make a second report at the next meeting and have called your attention to the bean in hope that other members may try them and report at the same time."

Note 2. This is the earliest document seen (Aug. 2003) concerning the feeding of soymilk to infants or children, or concerning a soy-based infant formula. The author was the world's first pediatrician to use soybeans in infant feeding, and did the first U.S. studies with soyfoods and human nutrition.

Note 3. Pediatrician Herman F. Meyer (1960, p. x) published a long poem by Dr. John Ruhräh titled "A Simple Saga of Infant Feeding," which described the history and present status of infant feeding. Meyer described Ruhräh as a "philosopher, teacher, poet, pediatrist and able historian."

Note 4. This is the earliest English-language document seen (Oct. 2001) that uses the term "soy bean flour."

Note 5. This is the earliest English-language document seen (Oct. 2003) that uses the term "substitute for milk" to refer to soymilk. Address: M.D., Baltimore, Maryland.

120. Williams, Thomas A. 1910. La "soya." La haba soya como forraje [The soy bean as a forage crop]. *Boletin de la Sociedad Agricola Mexicana* 34(15):292-95. April 17; 34(16):307-11. April 25; 34(17):331-33. May 1; 34(18):348-50. May 9. Translation of USDA Farmers' Bulletin No. 58 (1897, revised 1899). [7 ref. Spa]

• ***Summary:*** Contents: Part 1. Origin and general characteristics. Varieties. Growth. Illustrations show: Soy bean seedling with roots (p. 292, 294-95). A flowering soy bean plant, with close-ups of pods and one flower (p. 293).

Part 2. Cultivation. Harvest. Production and yield. Chemical composition. Part 3. Digestibility. Value and uses: As pasture *(como pasto)*, as ensilage, as hay. Part 4. As pasture *(como pastura)*, as a plant for soil improvement, value of the seeds as feed. An illustration shows soy bean roots with nodules (p. 349). Summary.

Note: This is the earliest Spanish-language document seen that uses the term "la haba soya" to refer to the soy bean. Address: Asst. Agrostologist, Div. of Agrostology, USDA (agrologista auxiliar).

121. Piper, Charles V.; Morse, W.J. 1910. The soy bean: History, varieties, and field studies: Early agricultural history in the United States (Document part). *USDA Bureau of Plant Industry, Bulletin* No. 197. p. 26-27. Dec. 31. [14 ref]

• ***Summary:*** "The first mention of the soy bean in American literature is by Thomas Nuttall, in the New England Farmer, October 23, 1829. Nuttall grew a variety with red flowers and chocolate-brown seeds in the botanic garden at Cambridge, Massachusetts.

"In the same journal two years later, November 23, 1831, is an account of the successful culture of the plant at Milton, Massachusetts, the seed having been obtained from Nuttall. No further mention of the plant in American

literature appears until 1853, when a brief account appeared under the name 'Japan pea,' by A.H. Ernst, Cincinnati, Ohio...

"In the following year, 1854, the Perry expedition brought back two varieties of 'soja bean' from Japan, one 'white' seeded, the other 'red' seeded. These, together with the Japan pea, were distributed by the Commissioner of Patents in 1854, and, thereafter, frequent references to the plant occur in agricultural literature under such names as Japan pea, Japan bean, and Japanese fodder plant. Most of these articles speak of the plant as the Japan pea, none of them as the soy or soja bean. It is apparent from the early accounts that there were at least two Japan peas, one early enough to mature in Connecticut (Patent Office Report, 1854, p. 194), the other very late (American Agriculturist, 1857, vol. 16, p. 10). Judging from all the accounts, we suspect that the early Japan pea may be the Ito San variety, which, however, has red flowers, while the late variety may be the Mammoth. The Ito San is still occasionally called the Japan pea, while the introduction and source of the Mammoth has never been definitely determined. From these early accounts the Mammoth may well be the 'white-seeded' soja bean obtained by the Perry expedition. The 'red-seeded soja bean' was perhaps, the Adsuki [azuki] bean *(Phaseolus angularis)*, as no red-seeded soy bean is known.

"Prof. G.H. Cook, of New Brunswick, New Jersey, obtained seed of the soy bean at the Bavarian Agricultural Station in 1878. In the same year Mr. James Neilson obtained seeds of several varieties at Vienna, Austria. Both of these gentlemen planted the seeds and gathered crops of the different varieties in 1879. These varieties were without doubt those grown and distributed through Europe by Professor Haberlandt, of Vienna.

"A yellow-seeded soy bean was grown at the North Carolina Agricultural Experiment Station in 1882 and reported on in some detail. The source of the variety is not given, but by implication it is the same as the variety stated to be grown by a number of persons in the State, and is probably the Mammoth.

"Two varieties, one black seeded, the other with white seeds, were grown at the Massachusetts Agricultural Experiment Station in 1888. In 1890 Prof. C.C. Georgeson secured three lots of soy beans from Japan which were grown at the Kansas Agricultural Experiment Station in 1890 and subsequently. Prof. W.P. Brooks, of Amherst, Massachusetts, brought with him from Japan in 1889 a number of soy-bean varieties, including the Medium Green or Guelph, and the Ito San. It is quite certain that other importations of soy beans from Asia were made by others, but no definite records have been found. [Note: The Guelph variety was NOT developed in Canada.]

"Since 1890 most of the agricultural experiment stations have experimented with soy beans and many bulletins have been published dealing wholly or partly with the crop." Address: 1. Agrostologist; 2. Scientific Asst., Forage-Crop Investigations, Bureau of Plant Industry, USDA, Washington, DC.

122. Piper, Charles V.; Morse, W.J. 1910. The soy bean: History, varieties, and field studies: Varieties introduced into the United States independently of the Department of Agriculture or previous to 1898 (Document part). *USDA Bureau of Plant Industry, Bulletin* No. 197. p. 27-31. Dec. 31. [14 ref]

• ***Summary:*** "Enumeration: Previous to the numerous introductions by the United States Department of Agriculture beginning in 1898, there were not more than eight varieties of soy beans grown in the United States, namely, Ito San, Mammoth, and Butterball, with yellow seeds; Buckshot and Kingston, with black seeds; Guelph or Medium Green, with green seeds; and Eda and Ogemaw, with brown seeds." The history of and information about each of these eight soybean varieties is given in great detail.

U.S. seedsmen or seed companies which have carried these soybeans include: Mr. E.E. Evans, West Branch, Michigan (1901); J.M. Thorburn & Co. (1901); W.A. Burpee (1902); Hammond Seed Co. (1903); Johnson & Stokes (1902); W.T. Wood & Sons, Richmond, Virginia (1889).

Foreign seedsmen include: Vilmorin-Andrieux & Co., Paris, France (1901); Haage & Schmidt, Erfurt, Germany (1908); Dammann & Co., Naples, Italy (1908).

Note: This is the earliest document seen (June 2003) stating that soybeans were being sold by W.A. Burpee (1902). Address: 1. Agrostologist; 2. Scientific Asst., Forage-Crop Investigations, Bureau of Plant Industry, USDA, Washington, DC.

123. Honcamp, Fr. 1910. Die Sojabohne und ihre Abfallprodukte [The soybean and its by-products]. *Landwirtschaftlichen Versuchs-Stationen* 73:241-84. Dec. (Chem. Abst. 4:3099). [18 ref. Ger]

• ***Summary:*** Largely a good review of the literature. Contents: Introduction and history. Botanical and microscopic characteristics. The best varieties for production of seeds / beans (incl. Soja platycarpa, Soja tumida, etc.). Soybean cultivation (incl. Fesca, Haberlandt). Chemical composition. Utilization of the soybean and its products: Use as food and food adjuncts (stimulants / enjoyables) *(Genussmittel)* (incl. boiled or roasted soybeans, shoyu or soy sauce *{Shoyu oder Bohnensauce}* made with rice- or wheat koji *{Reis- oder Gerstenkoji}*, miso, tofu *{Bohnenkäse}*, dried-frozen tofu *{Kori-Tofu oder Eisbohnenkäse}*, soybean meal *{Sojabohnenmehl}*, soybean oil *{Sojabohnenöl})*, industrial and technical uses of soybean oil (illuminant, soaps, table of constants), use as a livestock feed (Sheep were fed soybean oil meal and meal *{Sojakuchen, Sojamehl}*, pressed residue *{Pressrückstand}*,

or solvent processed *{Extractionsrückständen, Sojamehle, Sojakuchenmehl};* soybean hay *{Sojabohnenheu}* and straw also make good feeds).

Illustrations show: (1) A soy bean plant with pods (non-original, p. 245; from an original in Fesca 1898). (2) Soy bean pods, seeds, and cells (non-original, p. 246; from an original in C.O. Harz 1885).

Note: This is the earliest German-language document seen (Feb. 2004) that uses the term "Eisbohnenkäse" to refer to dried-frozen tofu. Address: Rostok, Germany.

124. Neumann, Hermann. 1912. Die Sojabohne, ihre Bedeutung fuer den gesunden und kranken Menschen und ihre Verwertungsform [The soybean, its significance for people in good and poor health, and the forms in which it is used]. *Zeitschrift fuer Physikalische und Diaetetische Therapie (Leipzig)* 16:129-51. [26 ref. Ger]

• ***Summary:*** "In my own medical practice, since 1908, I have served soybeans in various forms (as soup, vegetables, or bread) to many dozens of people, of all ages and degrees of ill health. In almost every case they have praised them and been helped by them." The author reported splendid results in treating diabetics with soybean bread and a patented preparation named "Soyap." Tables show the composition of various beans, including the soybean. Address: Potsdam.

125. Krafft, Guido. 1913. Die Pflanzenbaulehre. 9 Auflage neubearbeitet von Dr. Dr. C. Fruwirth [Instruction in plant cultivation. 9th ed. Revised by G. Fruwirth]. Berlin: Verlag Paul Parey. viii + 300 p. Plus 7 unnumbered pages of color plates at end. Illust. Index. 23 cm. Series: Lehrbuch der Landwirtschaft auf wissenschaftlicher und praktischer Grundlage. 2nd Bd. [2 ref. Ger]

• ***Summary:*** In Chapter 2, "Legumes (Cultivation of protein-rich seeds)," section 7 (p. 79-80) is about the soybean *(Die Sojabohne)* also called the "Haberlandt bean" *(Haberlandt's-Bohne)* or the hirsute Soya *(rauhhaarige Soja) (Soja hispida* Mönch). This section is almost identical to that in the 1897 edition, but slightly expanded.

Chapter 3, "Oilseeds" *(Ölfrüchte;* the cultivation of oil-containing seeds, p. 84+) mentions: Peanuts, almonds, white sesame, brown sesame. It discusses: rapeseed (p. 85+).

Note: Fruwirth wrote the preface to this edition in Dec. 1912 from Waldhof, Amstettin [in Austria-Hungary; as of 1995 in north central Austria]. He had previously been professor at the Imperial Württembergischen Agricultural College; now he is professor at the k.k. technischen Hochschule in Vienna. Address: PhD, weil. Professor der Land- und Forstwirtschaft an der k.k. technischen Hochschule in Wien.

126. Piper, C.V.; Morse, W.J. 1916. The soy bean, with special reference to its utilization for oil, cake, and other products: Soy beans in Japan, in Europe, and in the United States (Document part). *USDA Bulletin* No. 439. 20 p. Dec. 22. [2 ref]

• ***Summary:*** "Soy beans in Japan (p. 4):... In many districts it is cultivated not in fields by itself, but in rows along the edges of rice and wheat fields. Although not grown to any considerable extent as a main crop by the Japanese farmer, the average annual production is about 18,000,000 bushels. In quality the beans raised in Japan are said to be superior to those of Manchuria and Chosen [Korea] and are used exclusively in the manufacture of food products. The imported beans, of which very large quantities are obtained from Manchuria and other Asiatic countries, are used principally in the manufacture of bean cake and oil."

"The soy bean forms one of the most important articles of food in Japan. It is one of the principal ingredients in the manufacture of shoyu (soy sauce), miso (bean cheese), tofu (bean curd), and natto (steamed beans). The beans are also eaten as a vegetable and in soups; sometimes they are picked green, boiled, and served cold with soy sauce, and sometimes as a salad. A 'vegetable milk' is also produced from the soy bean, forming the basis for the manufacture of the different kinds of vegetable cheese. This milk is used fresh and a form of condensed milk is manufactured from it. All of these foodstuffs are used daily in Japanese homes and for the poorer classes are the principal source of protein. To a limited extent, soy beans are used as a horse or cattle feed, being sometimes boiled and mixed with straw, barley, and bran."

"Soy beans in Europe (p. 6): The soy bean was first introduced into Europe about 1790 and was grown for a great number of years without attracting any attention as a plant of much economic importance. In 1875 Professor Haberlandt, of Vienna, begun an extensive series of experiments with this crop and strongly urged its use as a food plant for man and animals. Although interest was increased in its cultivation during the experiments, the soy bean failed to become of any great importance in Europe. At the present time it is cultivated only to a limited extent in Germany, southern Russia, France, and Italy."

"Soy beans in the United States (p. 7): Although the soy bean was mentioned as early as 1804 (Footnote: Willich, A.F.M. American Encyclopedia, 1st Amer ed., v. 5, p. 13. Philadelphia, 1804), it is only within recent years that it has become a crop of importance in the U.S. At the present time the soy bean is most largely grown for forage. In a few sections, such as eastern North Carolina, however, a very profitable industry has developed from the growing of seed... The yields of seed to the acre in various sections of the United States range from about 15 bushels in the Northern States to about 40 bushels in the northern half of the cotton belt. The average yield in eastern North Carolina

is about 25 bushels, although many fields produce 35 bushels or more to the acre...” Note: This is the earliest U.S. document seen (June 2003) that cites the 1804 publication by Willich [and James Mease] concerning the soybean in Philadelphia. Note that this article appeared 112 years after 1804.

“The first extensive work in the U.S. with the soy bean as an oil seed was entered upon about 1910 by an oil mill on the Pacific coast. The beans, containing from 15-19% of oil, were imported from Manchuria, and the importations, most of which are used in the manufacture of oil and cake, have gradually increased, as shown in Table V. The oil was extracted with hydraulic presses, using the same methods employed with cottonseed and linseed. It found a ready market, as a good demand had been created for this product by soap and paint manufacturers, which up to this time had been supplied by importation from Asiatic countries and England. The soy cake, ground into meal, was placed on the market under a trade name and was soon recognized as a valuable feed by dairymen and poultrymen. The use of the cake has been confined almost wholly to the Western States, owing principally to the high cost of transportation.”

“An industry which promises to be of importance in a further utilization of the soy bean is the manufacture of ‘vegetable milk.’ At the present time a factory in New York State is being equipped for this purpose.” Address: 1. Agrostologist in Charge; 2. Scientific Asst. Forage-Crop Investigations, USDA, Washington, DC.

127. Fuerstenberg, Maurice. 1916. Die Einfuehrung der Soja, eine Umwaelzung der Volksernaehrung [The introduction of soya, a revolution in the food of the people]. Berlin: Paul Parey. 30 p. Foreword by Dr. Gottlieb Haberlandt, Director of the Plant Physiology Institute, Univ. of Berlin. [5 ref. Ger]
Address: Germany.

128. Fuerstenberg, Maurice. 1917. Die Soja, eine Kulturpflanze der Zukunft und ihre Verwertungsmoeglichkeiten [The soybean, a cultivated plant of the future, and possibilities for its utilization]. Berlin: Paul Parey. 40 p. [59 ref. Ger]
• ***Summary:*** Dedicated to the Prof. Friedrich Haberlandt, who introduced the soybean to Central Europe. Contents: Foreword. Introduction: The soybean. Ways of using the soybean in its homeland (East Asia, especially Japan and China). Shoyu or soy-sauce. Miso (vegetable cheese). Natto. Tofu of the Japanese or Tao-hu of the Chinese (bean cheese). The soybean as an oilseed. Soybean meal (and flour). Soya as a coffee substitute or extender. Soybean milk. Soya meat substitutes. Soybeans as a chocolate substitute. Soya rubber substitute. The utilization of soya in agriculture: As cow fodder. Summary. Bibliography. Photos show: (1) A field of soybeans (p. 6). (2) A soybean plant with the leaves removed to show the pods (p. 12). (3) Soy beans and pods (p. 13). Contains numerous tables, mostly from other sources: pages 11, 16-17, 19, 25, 27, 30, 35-37. Contains one of the best early European bibliographies on the soybean.

The author wrote this book during World War I. In his first book, published one year earlier in 1916 and titled “The Introduction of Soya, a Revolution in the Food of the People,” he discussed what he believed to be the great agricultural and nutritional value of the soybean. He uses two terms, *Die Soja* and *Die Sojabohnen* to refer to soybeans.

Chapter 1 (p. 5-7): In 1908 England started to import large quantities of soy beans; in 1909 these increased to 400,000 tonnes and in 1910 to 800,000 tons. Also in Germany, in the years just before World War I, imports of soybeans climbed in an unexpected way, reaching 43,500 tonnes in 1910, 90,600 tonnes in 1911 and 125,200 tonnes in 1912. Note: These units are given in dz. One dz *(doppelzentner)* = 100 kg.

The first manufacture of soyfoods in Europe took place in France, at Valees near Asnieres, where they made flour, bread, cakes, cheese, and soymilk–though only in small quantities and, above all, for diabetics. In England, soy flour has been used for a long time in the preparation of cakes.

However it was in Germany that the utilization of soybeans for food took place on a large scale; this began shortly before the war. The supply of foods to Germany was almost completely cut off during the war, so general attention soon turned to the new foods prepared from soybeans and people quickly became aware of their great nutritional value. Thus, in the middle of the war, a soybean industry was built in Germany. Unfortunately this youngest twig of the food industry was left crippled due to lack of raw materials. However one can predict that this industry has a bright future because of the great encouragement given to these products in so short a time. For example, in October 1914 the *Agumawerke* (Aguma Works) located in Harburg (near Hamburg) on the Elbe, first began mass production of a soy flour according to its own process. During the next few years it made many thousands of tonnes of this meal, until the production had to be stopped for lack of raw materials (p. 6).

Equally gigantic sales of soy products were made by the *Soyamawerke* (Soyama Works) in Frankfurt am Main; this company made only soy food products. In addition to a meal (flour), it also produced a meat substitute *(Fleischersatz)*, and, largely from soybeans, fresh and dried milk *(Frisch- und Trockenmilch)* as well as a fresh and dried cream preparation *(ein Frisch- und Trockenrahm-Präparat)*. Likewise, this firm had to cease production of most of its soy products because of difficulties in soybean

procurement, and concentrate only on the production of meat substitutes *(Fleischersatz).* These articles likewise entered all classes of the population splendidly as is seen from the large demand for them. Within 3-4 weeks this firm had orders for more than 1½ million pound cans, of which unfortunately it was able to satisfy only a small part. In addition to these two well-known firms, there are in Germany still a number others that are occupied with the production of foods from the soybean.

In Austria [the Austro-Hungarian empire], there exists a unique firm, the food factory Santosa in Prague [in the Czech Republic as of Sept. 2002], which is still processing soybeans. They introduced soy coffee into commerce. I understand that in Austria a large-scale soy processing venture is now being planned.

Certainly the soy processing industry finds itself in a beginning state and, like all young industries, in need of improvement. Remember the sugar-beet industry was also once young but it made improvements and went on to great success, as will be expected of this new twig on the food industry. In any case, the beginning of utilization of the soybean as food for the people has been made, and in the foreseeable future the soybean may, as in China and Japan, become an indispensable part of our people's food.

It is different with the introduction of the soybean as a cultivated plant in Central Europe. Forty years ago Friedrich Haberlandt showed (and after him countless others have shown) that the soybean grows well in Central Europe. Although additional new tests verify this, there are still those who object to soybean culture. One objection is the long time required by the soybean to come to maturity; the answer is the development of new varieties. Another is the relatively low yield compared with other beans; the answer lies in the use of inoculation. The author then discusses nutrient yield per acre and per unit of money, showing both to be high for soybeans.

Pages 10-11: It is well know that legumes possess the ability to transform and fix free nitrogen from the air. In 1886 Prof. Hellriegel discovered that this capability is due to certain bacteria that live in the soil and move through the root hairs into the root, where they cause nodule formation. The nitrogen-fixing bacteria living in the nodules nourish the plant. The author then talks about inoculation using either soil from a previous planting or "Nitragin," a pure culture of root bacteria, which is well known and has recently been improved. Dr. Kuehn of Berlin-Grunewald showed that soil inoculated with Nitragin gave a 3 to 4-fold increase in yield, plus an increase in protein in the roots and leaves. He then discusses improved cultural practices. Winkler says that transplanting improves yields. Continued. Address: Steiermark, Germany.

129. Fuerstenberg, Maurice. 1917. Die Soja, eine Kulturpflanze der Zukunft und ihre Verwertungsmoeglichkeiten [The soybean, a cultivated plant of the future, and possibilities for its utilization. Part II (Document part)]. Berlin: Paul Parey. 40 p. 28 cm. [59 ref. Ger]

• ***Summary:*** Continued on p. 14. Ways of using the soybean in its homeland (East Asia, especially Japan and China): Note: In this section, starting on p. 15, the author repeatedly uses the word *Sojaspeisen* meaning "soyfoods." The soybean probably originated in India. The Chinese and Japanese used it to fortify their rice-based, protein-poor diet. The practice came before the theory. The author says (incorrectly, p. 15) that all the basic soyfoods are fermented. He then gives a long description of koji and how it is made.

Shoyu or soy sauce *(Shoju oder Soja-Sauce)* (p. 15-17)" In Japan, 540-720 million liters are manufactured each year so each Japanese uses 60-100 ml/year. The fermentation time is 8 months to 5 years. The best soy sauce is fermented for 3 to 5 years. He explains how as soy sauce is fermented, the protein is broken down into amino acids such as leucine, tyrosine, and members of the "Xanthin" group.

Miso (vegetable cheese, p. 17-18): Miso is widely used in soups. More than half of the yearly Japanese soybean harvest is used for making miso. This is 30 million kg per year. Types of miso include *shiro miso* and Sendai miso. Winkler, in his small work titled "The Soybean of Manchuria," mentions two other types of miso: Aka or red miso and nuka miso. Kellner investigated five types of miso; a table shows their composition. Loew reports that this vegetable cheese (miso) is consumed either raw or in soups. Kellner, Nagasaka and Kurashima report that, based on their investigations, the amount of amino-nitrogen increases 3-fold and the quantity of carbohydrates is significantly diminished through lactic acid and alcoholic fermentation. The carbonic acid created thereby rises significantly during fermentation (Loew).

Natto (p. 18): Discusses the findings of Yabe.

Japanese tofu or Chinese Tao-hu (p. 18-20): This is the so-called "bean cheese" *(Bohnenkäese).* A table (p. 19, from König) shows the nutritional value of fresh tofu (84.8% moisture) and frozen tofu (17.0% moisture). E. Senft studied frozen tofu, a Japanese military preserved food *(Militärkonserve)* that is not canned; he found it had a beige color and a unique, slightly sour aroma which was at times reminiscent of dextrin. It has a uniform texture throughout, with many tiny pores. Winkler refers to five other types of soy cheese. Concerning the military preserved foods, they were highly regarded during the Russo-Japanese War and (according to Senft) played a key role in the war. (Footnote: The descriptions of the various preparations made from soya make E. Senft's treatises (1906 and 1907) valuable; in them he published his investigations of a number of Japanese vegetable foods and military preserved foods or conserves). The well-known

food manufacturer Maggi in Kempttal, Switzerland, has tried for many years to introduce a commercial miso-like product, but was not successful.

The soybean as an oil plant (p. 20-26): Winkler, in his brochure, discusses the uses of soybeans in Manchuria. After 1908, soybeans were sold in Europe at incredibly low prices which resulted in the expansion of imports and production. Then tariffs were levied on soybeans. There were some major problems in the Austrian oil industry.

Soybean flour *(Sojabohnenmehl;* p. 26-28): In recent years, various processes have been patented. One manufacturer is Soyamewerke in Frankfurt am Main, which makes *Soyama Kraftmehl.* Yellow soybeans are mechanically cleaned, washed, dried, and dehulled according to the process of Dr. Fritz Goessel. Agumawerke in Harburg also makes soy flour.

The soybean as a coffee substitute and extender (p. 28-31): Coffee is known to be detrimental to good health and void of nutrients. Rye, for example, has been used since the 17th century as a coffee substitute. Barley also plays a major role, especially as malt. A table (p. 30) shows the nutritional composition of ten coffee substitutes, including chicory, figs, lupin, and carob. Soy coffee tastes remarkably similar to real coffee. In Istria *(Istrien),* in the Austrian alps, in Switzerland as well as in Alsace *(Elsass),* the soybean has been used since its introduction as a coffee substitute. Haberlandt reported in his work that a teacher from Capo d'Istria told him that the soybean was used as a coffee substitute in Istria, and a friend told him that there was no difference between the flavor of the two. The Thunschen is used to make good soy coffee. The soybeans are mechanically cleaned, put into a trommel, agitated with water at 65-70ºC, brushed and thereby freed of a large number of impurities which can leave a burned smell. The aroma of soy coffee can be improved by impregnation with an extract of largely decaffeinated coffee. It has roughly twice the nutrients of regular coffee and no harmful constituents.

Soybean milk *(Sojabohnen-Milch,* p. 32-33): The most popular vegetable milk is Dr. Lahmann's Vegetable Milk *(Lahmannsche Vegetabile Milch),* an emulsion made from almonds and nuts. In Japan, they make milk from soybeans; he describes the process, inaccurately, based on information from Winkler. This milk is also used to make cheese [tofu]. Also in Europe there have been successful attempts to make a soymilk adapted to European tastes, as in France by the Caseo-Sojaine at Valées near Asnieres, and in England by the Synthetic Milk Syndicate. Using the process of Dr. Fritz Goessel, the latter company has a factory in Liverpool; it makes 100 liters of soymilk from: 10 kg ground soybeans plus 5 gm sodium phosphate, 2.4 kg lactose, 2 kg sesame oil, 6 gm common salt, and 60 gm sodium carbonate. Also the Soyamawerke in Frankfurt makes a soybean milk, named Soyama, as mentioned above (fresh and dried milk and cream). Recently Prof. Melhuish developed a new method using soybean, peanuts, and added coconut milk fat.

Soy meat substitutes *(Soja-Fleischersatz;* p. 33): Soyamawerke makes a product named *Soyama-Fleisch-Ersatz.*

Soybean as a chocolate substitute (p. 34): Haberlandt reports such a product.

Soya rubber substitute (p. 34): Goessel and Sauer have developed a rubber substitute made from soybean oil.

The utilization of soya in agriculture (p. 34-38): Use as fodder for cows. In 1880 Blascowicz [Blaskovics], Assistant at the Royal Hungarian Academy in Hungarian Altenburg, conducted fodder tests, whose results are given in various tables.

Conclusions (p. 38).

Note: This is the earliest document seen that uses the word *Ersatz* or the word *Fleischersatz.* They mean "artificial or inferior substitute" and "meat substitute" respectively. Though often associated with World War I, the word "ersatz" (which means simply "substitute" in German) was actually adopted into English as early as 1875, in reference to the German army's "Ersatz reserve," or second-string force, made up a men unqualified for the regular army and drawn upon only as needed to replace missing soldiers. Hence the meaning "inferior substitute." Address: Steiermark, Germany.

130. Trabut, Louis. 1918. Le Soja: Soja Max (L.) Soja hispida *Savi* [The soybean]. *Algerie, Service Botanique, Informations Agricoles. Bulletin* No. 55. 16 p. April. [7 ref. Fre]

• ***Summary:*** One cannot say that the soybean has been introduced to the Western world only relatively recently; it has been cultivated at the Jardin des Plantes since 1779. There the soybean has always produced seeds, which have been distributed to botanical gardens and amateurs interested in plants. It would be unjust to say that for 138 years no one has been involved in the utilization of soya in Europe. In fact, there have been a number of fervent popularizers and propagators of the plant. A history of this work is given, including the Vienna Exposition of 1873, the work of Prof. Haberlandt in Austria disseminating and testing soybeans and his remarkable book on the soybean published in 1878, the work of the Society for Acclimatization in France from 1855 (they made the vegetable cheese, tofu [To-fou]), and exports from Manchuria to Europe.

Since 1898, Manchuria, which can no longer cultivate the opium poppy, has greatly expanded its cultivation of soybeans and has looked for outlets in European markets. In 1909 Manchuria exported 410,000 tonnes of soya, a figure which rose to 650,000 tonnes in 1912.

A that time, according to Mr. Brenier, Director General of the Chamber of Commerce at Marseilles, the industry of Marseilles, confronted with a influx of new oilseeds, tried to obtain soya but ran into customs problems. It wasn't clear whether soya should be classified as a legume (because it is a bean) or as an oilseed *(graine oléagineuse).* While the matter was being debated, all the available beans had been purchased by Hull, England, and Hamburg, Germany *(Académie d'Agriculture de France,* 1917, p. 189).

"As the Director of the Chamber of Commerce of Marseilles informs us, in England, Germany, and the Netherlands, the industrial use of the soybean has been growing in importance for several years. In Germany there even existed an important manufacture of soymilk.

"A Chinese factory [run by Li Yu-ying] was installed a few years ago near Paris to enable the soybean to realize its full potential and to introduce various commercial food products made from this seed. In 1912 Messrs. Li Yu-ying and Grandvoinnet published a work on the soybean, recommending its cultivation in France.

"In 1917 Mr. Balland notified the Academy of Sciences of the utilization of soya in war bread, biscuits, etc. All these products, said the knowledgeable chemist, can contribute to a good diet because of their rich nutrient content.

"The Swiss, who consume many coffee substitutes, roast the soybean seeds to make a coffee.

In Algeria, starting in 1894, soybean agronomic trials were started at the botanical station of Rouïba. The results were communicated to the other French colonies in 1898 [by Louis Trabut] in Bulletin No. 16 of the Botanical Service." The results of these and subsequent trials in 1896 and 1897 in Algeria are summarized.

In 1896 a soybean with a green seed coat yielded 2,980 kg/ha of soybeans.

Pages 7-11 include discussions of the nutritional value of soybeans, their use in diabetic diets, the fact that soybeans are rarely consumed as such but are almost always processed into more sophisticated foods (including fermented foods). Following these trials, that were focused on a very important collection (80 soybeans in number) received [in France] from a missionary in China through the intermediary of Mr. H. de Vilmorin, the seeds were distributed and the results of their cultivation were generally good. There follows a letter from a person in Bou-Medfa [Bou Medfaa, Algeria]. Also discusses the availability, benefits, and method of producing soybean milk which the Chinese prefer to animal milks, and which is free of bacteria that can cause tuberculosis. In Algeria, soybean yields range from 12 to 30 quintals per hectare. Note: 1 quintal = 100 kg. The Arabs consume soybeans boiled in salted water. In England a Soya Flour is sold which contains 75% wheat flour and 25% soy flour. This flour is used commercially to make a soy bread. A Soja Biscuit is made in the Netherlands.

Pages 12-14 list 26 soybean varieties in order of their earliness. Synonyms and characteristics are also given: *Soja très hatif à grain noir* (Extra Early Black; Vilmorin or Ogema [Ogemaw] of Michigan. Matures in 80-90 days). *Brun précoce* (Early Brown from Indiana). Vireo (Tokyo). Chernie (Khabarovsk, Siberia; black seed). Auburn (American selection). Merko (Mekoechofka of Siberia; brown seed). Elton (Khabarovsk, Siberia; yellow seed). Chestnut (American selection 1907; brown seeds). *Jaune d'Etampes* (Yellow Etampes, or Ito San in America; One of the earliest varieties introduced to Europe and America). *Vert de Samarow* (Green Samarow, or Guelph in America; green seeds, matures in 120 days). Butterball (or *Jaune géant* {Yellow Giant} from Dammann, from Tokyo; yellow seeds. Matures in 110 days). *Soja noir de Podolie* (Black Podolia, or Buckshot in America; black seeds). Wilson Black (Manchuria). Meyer. Austin. Haberlandt. *Huang-Tou* (Yellow Bean, from Ningouta {Ninguta, see Ning'an}). Bhetmas (from India; seed chocolate and yellow). Medium Yellow. Shingto (From Tieling {T'ieh-ling or Tiehling, Liaoning prov.}, Manchuria). Swan (from Canton). *Soja tigré* (Striped, spotted, or speckled soybean from Peking; seeds are grilled and eaten like peanuts). Brooks (Manchuria and China). *Maculata gigantea* (Large spotted, sold under this name by Dammann; probably the same as the American variety Meyer). Mammoth (American selection). Riceland (From China).

The importance of inoculation with bacteria is emphasized. Soybeans can be cultivated with cowpeas for forage. An illustration (line drawing) on the cover shows the soy bean plant, with a close-up of the pods.

Note: This is the earliest document seen (Oct. 2004) that mentions the soybean variety Wilson Black. Address: Director of the Botanical Service for the Government of Algeria.

131. Fruwirth, C. 1918. Die Sojabohne [The soybean]. *Oesterreichische Garten-Zeitung (Zeitschrift fuer Garten und Obstbau, Vienna)* 13(3):81-86. [Ger]
Address: Prof.

132. Morse, W.J. 1918. The soy-bean industry in the United States. *Yearbook of the U.S. Department of Agriculture* p. 101-11. For the year 1917. See p. 101-06. Contains many photographs by Frank N. Meyer.
• ***Summary:*** Contents: Early history of the soy-bean industry. Soy beans in the United States. Cultural requirements. Varieties. Soy beans as forage. Soy beans for oil. Soy-bean meal. Soy beans for human food: Dried beans, green beans, soy-bean milk, soy-bean cheese, soy sauce, soy-bean sprouts. Possibilities of the soy-bean industry in the United States.

"The annals of Old China set forth the fact that the soy bean was an important food fully 5,000 years ago. When the ports of China were first opened to foreign commerce, the trade in [soy] beans and bean products was found to have been a long-established and flourishing institution. In value and in extent and in variety of uses the soy bean is the most important legume grown in Asiatic countries." Note: This is the earliest document seen (May 2003) which gives the age of the soybean as "5,000 years."

"Near the close of the eighteenth century the soy bean found its way its way to Europe, its cultivation being recorded in England in 1790. It is mentioned in the United States as early as 1804. For several decades, however, it was regarded more as a botanical curiosity than as a plant of much economic importance. In 1875, Prof. Haberlandt began an extensive series of experiments in Austria with the soy bean and strongly urged its use as a food for both man and beast. Although considerable interest was aroused during the experiments, the soy bean failed to attend the success hoped for by the experimenter.

"Previous to the Russian-Japanese war [1904-05] China and Japan were not only the greatest producers but also the greatest consumers of the soy bean and its products. During the war the production of the crop was greatly increased throughout Manchuria. After the war, however, it became necessary to find new markets for the surplus beans, and trial shipments were made to Europe. The first attempts to introduce the soy bean and its products into European markets were generally unsuccessful because of the unsatisfactory condition in which the beans and cake were received, owing to poor shipping facilities. About 1908 a large trial shipment made to the English oil mills was received in much better condition than previous shipments, and the results obtained were so satisfactory that larger imports were made."

"Soy beans in the United States. As previously stated, the soy bean was introduced as early as 1804, but it is only within recent years that it has become a crop of much importance in the United States. Until the present season it has been grown primarily as a forage crop, though a constantly increasing demand for seed for food and planting has led to the development of a very profitable soy-bean seed industry in many sections of the South and the corn belt. The large yield of seed, the ease of growing and handling the crop, the value of the beans for both human and animal food, and the value of the oil and meal all tend to make this crop one of great potential importance and to assure its greater agricultural development in America."

"Varieties:... At the present time about 20 varieties are handled commercially by growers and seedsmen, although more than 500 distinct varieties are known and have been grown by the Department of Agriculture on its testing grounds. The yellow-seeded sorts are preferred for food and the production of oil and metal and include the following: Mammoth (late), Tokyo (late), Hollybrook (medium late), Haberlandt (medium late), Medium Yellow (medium), Mikado (medium), Ito San (early), Manchu (early), and Elton (early). For forage, the black and brown seeded varieties are most suitable and include Barchet (late), Biloxi (late), Peking (medium), Wilson-Five (medium [black seeded]), Virginia (medium late), Early Brown (early), and Black Eyebrow (early).

"Soy-bean meal:... The meal or flour produced from American-grown yellow varieties is bright yellow in color when fresh and has a sweet, nutty flavor. Samples of meal from different sources range from 46 to 52 per cent protein and from 5 to 8 per cent oil. As a human food, soy-bean flour has been used in the United States principally as a special article of diet and sold by companies manufacturing special foods of low starch content. The flour or meal can be successfully used as a constituent of bread, muffins, biscuits, or pastry. Extensive tests have been conducted by the United States Department of Agriculture with soy-bean flour in the making of bread and pastry. In these various food products about one-fourth soy flour and three-fourths wheat flour has been found to be the proper proportion. In some of the pastry products, however, as much as one-half soy flour can be used. During the past year the use of soy-bean meal has gained in popularity on account of the many palatable products that may be made from it." Photos are described in Part II. Continued.
Address: Scientific Asst. in Forage-Crop Investigations, Bureau of Plant Industry, USDA, Washington, DC.

133. Reichsauschuss fuer Oele und Fette. 1919. Zur Frage des Anbaues und Akklimatisation der Soja in Deutschland [On the question of the cultivation and acclimatization of the soybean in Germany]. *Chemische Umschau auf dem Gebiete der Fette, Oele, Wachse und Harze (Germany)* 26(9):113-15. Aug. 10. [Ger]
Address: Wissenschaftliche Abteilung, Unter den Linden 68 a, Berlin N.W. 7, Germany.

134. North, J.L. 1921. To solve the cost-of-living problem? A magic bean. *Illustrated London News (The).* Oct. 8. p. 476-77. [1 ref]
• ***Summary:*** "The leading article and letter in the *Times* of Sept. 28 from its Vienna correspondent about Manna flour, manna bread, and milk substances made from the Soya bean, are likely to do good if they help us to realise how much we are losing by our neglect of this, the most valuable–for the uses to which it can be put–of all legumes.

"In the letter giving the details of the researches of Dr. László Berczeller of Vienna, there is no reference to the fact that these 'Manna' or Soya bean products were first made in England before the war. Samples of the flour and biscuits are to be seen in the cases of the London Institute of Hygiene, and Manna milk has been for years–and, no doubt,

still is–sold here under the name of 'Solac' at a price considerably lower than that charged for milk by dairymen. The appearance and rapid rise into importance of the Soya bean is one of the most remarkable commercial events of modern times."

"In 1790 the [soy] bean was brought to Europe when its cultivation was first attempted by Young [Arthur Young, lived 1741-1820 in England], the father of British Agriculture, though without success. In 1878 an Austrian professor, Haberlandt, tried it, but failed [Note 1. Haberlandt did not fail; he successfully cultivated soybeans in Austria as early as 1875, and many times thereafter.] When the bean came here in 1908 there was an immediate rush to grow it both in Europe and America. Experiments were started by our Board of Agriculture, the Royal Agricultural Society, and many semi-public bodies. The early experiments failed completely, for the reason that they were made with seed whose climatic origin was unknown, as well as the orthodox Chinese methods of growing it. Later, this was remedied..."

By 1918 Europeans were aware of 500 different soybean varieties that were growing experimentally at Arlington, Virginia.

"My interest in the Soya bean began in 1913 with a visit from an agent of a German cultivator at the office of the Royal Botanical Society at Regent's Park. He was, he said, trying to form a syndicate to grow what he called an acclimatised Soya bean, brought from China in 1910, and already in cultivation in Germany. He refused seeds for testing, but sent from Hamburg a plant which had been carefully cleared of the seed, though the *empty* pods, nearly sixty in number, were left. The syndicate never materialised, and I thought no more of the matter, until later on, whilst examining the dried plant, I noticed a tiny pod, scarcely half an inch long, which contained a seed no bigger than a pin's head. Going over the plant I found other pods which evidently had been thought too insignificant to be of use, and from these I obtained thirteen seeds. These were sown in 1914 and resulted in thirteen plants, which produced four hundred and forty seeds. From thirty-three plants in 1915 one thousand seeds resulted, and in 1916 no less than twelve thousand. Many experiments as to the value of different methods of growing them were made in several countries, and with no less than twenty-one different foreign varieties. One thing came clear throughout the tests, and that was that the original variety started with was by far the best. It says a good deal for German astuteness that they should have gone to Manchuria and, from hundreds of varieties, chosen the one best for them and for us."

The future of the Soya bean in England is uncertain. "Natural selection helps the plants that mature earliest produce most seed; those that mature late die out. It is noticeable that the plants experimented with in England fruit earlier now than they did at first, and this is a very hopeful sign. Another satisfactory fact is that there is no lessening in the number of pods produced, but rather a gain. This year there are plants with three times the number of pods shown in a photograph of the best German-grown specimen of 1912."

In China and Japan the Soya bean "enters into the composition of most dishes, and in one form or another, as Soy sauce, bean paste, bean cheese, bean curd, bean milk, bean wafers, bean cakes and confectionery, is used everywhere. For a hundred years Soy sauce has been imported–the principal ingredient in the well-known Worcester [Worcestershire] sauce."

Apart from its value as a food, it is used in the manufacture of glycerine, explosives, enamels, varnish, varnish, waterproofs, linoleum, paints, soaps, celluloid, printing inks, and as a lubricant."

Photos (all but #1 by Frank N. Meyer of the USDA) show: (1) A typical pod from a soya bean plant grown by Mr. J.L. North at Chiswick in 1921. (2) Blocks of tofu (also called soya bean cheese, bean curd, or soya bean curd) ready to be cut up into squares for sale. (3) Varieties of soya bean cheese on a bamboo tray. (4) A pile of wooden trays full of bean curd in a dark room. (5) A basketful of sprouted soya beans. (6) Soy bean plant with leaves, many pods and roots.

Note 2. This is the earliest document seen written by Mr. J.L. North, the pioneer in cultivating soybeans in England.

Note 3. This is the earliest English-language document seen (Feb. 2004) that uses the term "soya bean cheese" or "soya bean curd" to refer to tofu.

Note 4. This is the earliest English-language document seen (July 2000) that uses the term "bean paste" (not preceded by the word "soy" or "soya") to refer to miso.

Note 5. This is the earliest English-language document seen (July 2007) that uses the term "magic bean" or that uses the word "magic" as an adjective to refer to the soybean.

Note 6. Concerning Arthur Young. He was the author of many books on agriculture, which were very influential in their day. He was an important advocate for the progressive agricultural practices of his time, advocating such innovations as the seed drill, improved crop rotations, the use of marl as fertilizer, and the enclosure of open fields. In 1767 he undertook the management of a farm in Essex. He conducted various experiments and published the results in *A Course of Experimental Agriculture* (1770). In 1784 he began the publication of the *Annals of Agriculture*, a periodical which was continued for 45 volumes and had many contributors. Young traveled to France during 1787-89 and in 1792 published an important book about his travels and observations there. The soybean was first grown in Paris, France, perhaps as early as 1740, definitely by 1779. So he may have learned about soybean from fellow

agriculturalists in Paris while on this trip. Address: Curator of the Royal Botanic Society of London.

135. Rouest, Leon. 1921. Le soja et son lait végétal: Applications agricoles et industrielles [The soybean and its vegetable milk. Agricultural and industrial applications]. Carcassone (Aude), France: Lucie-Grazaille. 157 p. Illust. No index. 25 cm. [42 ref. Fre]

• ***Summary:*** Contents: Introduction–What is soya? 1. History of the dissemination of soya: In 1712 the naturalist Kaempfer introduced soya, introduction of soya to France and Europe, soya is cultivated in Austria in 1875 by Prof. Haberlandt, soya is the object of many trials in France from 1876 to 1881, the study and acclimatization of soya becomes widespread, the causes of setbacks in the cultivation of soya.

2. Cultivation of soya: Botanical characteristics of soya, the varieties of soya, Chinese varieties and soya in China, Japanese varieties and soya in Japan, American varieties and soya in America (varieties: Mammoth, Hollybrook, Ito San, Guelph, Haberlandt, Medium Yellow, Wilson, Peking, Tokio, Mandchu [Manchu], Black Eyebrow, Barchet), soya in Europe–France and Italy, seven varieties of soya tested in France, soya in the experimental farms for new crops *(les Fermes Expérimentales de Néoculture;* Many varieties from the USA were tested, including Manchu, Wilson Five, Haberlandt, Tokio, Virginia, Hato [Hahto], Early Medium Green), the cultural and geographical appearance of soya, its production worldwide, planting soybeans, heat units *(degré thermique)* and the germination of soya, the importance of spacing between plants, number of seeds per hectare, soya during its vegetative stage, the vegetation of soya compared with that of the haricot at high altitudes, rolling the seeds and types of crop maintenance, growth of the plant, acclimatization, the enemies of soya.

3. Composition of the soybean plant. 4. Soya forage: Green soya forage, soya hay, soya as a plant for soil improvement. 5. Harvesting soybean seeds: Maturity of the seed, harvesting soya, the food value and composition of soya seeds. 6. Soya as an oil plant: Richness in oil, defatted soybean cake, imports and exports of soya cake from 1915 to 1919 (Imports to: Sweden, Canada, Korea, Japan, Formosa. Exports from: England, China, Korea), production of soya cake from 1915 to 1919 (Denmark, Great Britain and Ireland, Netherlands, Sweden, USA, Japan, Formosa, Korea, Java and Madura).

7. Soymilk: Its manufacture (in 1910-1913 Li Yu-ying installed a factory named "La Caséo-Sojaïne" at Valées {Asnière-Seine} near Paris. Rouest visited this factory and saw them make soymilk, which was filtered using a filter-press resembling those used in sugar refineries), its properties and composition, composition compared to other types of milk, powdered soymilk, soymilk in the nursing and feeding of animals, soymilk related to tuberculosis in animals and in humans, soymilk would allow the milk and butter from animals to be reserved exclusively for human foods and could be used for raising many piglets, manufacture of non-dairy milk in Canada (a factory is now under construction). 8. Soya in Industry: Soymilk and soy casein, Sojalithe (like Galalithe).

9. Soya in human nutrition: Soy flour and its applications (incl. Li Yu-ying's usine de la Caséo-Sojaïne, and bread made of soya and wheat), soya compared to dry legumes (such as lentils, haricots, peas, beans), soya used as a legume (whole soybeans), the food value of soy sprouts, preserves and confections made from soya, soya chocolate and coffee, the amount of nutrients produced by soya and other crops from a unit of land, a meal of soya served in France (prepared and served some years ago by Li Yu-ying's soyfoods plant La Caséo-Sojaïne for the major print media, the medical press, the National Society for Acclimatization, etc.; it consisted of 2 soups {one with 'soya meat' and one with soymilk}, 2 entrees {an omelet with smoked soya ham, and fritters stuffed with soy meat}, soy [actually mung bean, *lüdou]* sprouts in a salad and sauteed, 3 desserts {soya cake, biscuits, and confection}, and soy coffee; a recipe for each is given; soya meat is smoked tofu).

10. Use of soya in East Asia: Tofu *(fromage végétal),* soy-based condiments (such as natto {Ping ming Natto and Tokio-Natto}, miso, Chinese miso or tao-tjiung [dou-jiang], and shoyu {Soyou or Schozou}), making soy sauce in Kwantung, China (from Groff).

11. The opinions of several authors concerning soya (from the French medical and hygienic press): Introduction–E. Maurel. Soya and soy bread in diabetic diets–Dr. Dujardin-Beaumetz, Dr. Bloch, Dr. J. Le Goff, L. Beille, M. Gautier. Soya used as a bean–M. Gautier. Soy sauce used in place of meat extracts. The state of cheese. The popularization of soya in Europe–A. Paillieux.

Conclusions: The influence of cultural technology on variation. Appendix: Advice to experimenters on the acclimatization of soya in France. Other methods of obtaining early-maturing soybeans.

The author concludes (p. 140): We must make every effort to acclimatize soya in France. We must develop the will and learn from past mistakes. Most soybean varieties now available in France are too late. We must get varieties from Manchuria, whose climate is similar to that of southeastern France, and from the northeastern USA. It is urgent that, in the near future, we start a Soybean Experiment Station to take responsibility for this work. The setbacks since 1830 can be overcome by present science and genetics. The first step is to introduce better varieties.

On the last page is a full-page advertisement for various seeds sold by Mr. Rouest, including 30 varieties of

soybeans *(Soja hispida);* the names of the individual varieties are not given.

Illustrations show: (1) A soy bean plant with many pods (title page). (2) Flowers and pods of the soy bean plant (p. 29). (3) Soy pods and beans (p. 30). (4) A soy bean plant drawn by a Chinese artist (p. 32, from Li Yu-ying). (5) Pods of the Hato [Hahto] variety of soy bean (p. 51). (6) Germinating soy bean seeds (p. 54, from Li Yu-ying). (7) Soy bean roots with nodules (from a photo by Dr. Le Goff; p. 73). (8) Soy bean pods, opened to show 3 beans in each (p. 82).

Tables show: (1) Production of soybeans by color in China in 1916 and 1917 (p. 35, in quintals, from the International Yearbook of Rome, Vol. 1, 1919): In 1917: Yellow 4,069,822. Other 953,012. Green 181,190. White 71,234. Black 40,066. Total: 5,315,324.

(2) Percentage composition of various oilseed cakes (p. 95, from Kellner). (3) Imports and exports of soybean cake, by country, from 1915 to 1919 (in quintals, p. 96). Imports are given for Sweden, Canada, Korea (from 1916), Japan, and Formosa [Taiwan]. Exports are given for England (6 quintals in 1915), China (including Manchuria, by far the biggest exporter, from 1916), and Korea (from 1916).

(4) Production of soybean cakes, by country, from 1915 to 1919 (p. 97, in quintals, based on statistics from the International Bureau of Agriculture, Rome, 1919). In descending order of production in 1915 (in quintals): Japan 5,439,337. Korea 3,209,238. Great Britain and Ireland: 1,513,059. Denmark 921,782. Java and Madura 503,025. Note that China is not listed. Netherlands 144,523. Formosa [Taiwan] 62,131. Sweden 1,733. USA 0, but 501,822 in 1916. Address: Directeur des Fermes Expérimentales de Néoculture, Carcassonne (Aude), France.

136. Rouest, Leon. 1921. Le soja et son lait végétal: Applications agricoles et industrielles [The soybean and its vegetable milk. Agricultural and industrial applications]. Carcassone (Aude), France: Lucie-Grazaille. 157 p. Illust. No index. 25 cm. [42 ref. Fre]

• ***Summary:*** This is a summary of interesting points throughout this book. The main early use of soy in Europe was more therapeutic than nutritional (p. 3); it was used mainly in diabetic diets.

Nothing remains of the early trials conducted 20 years ago in France and Austria. The reasons for the crop's failure were lack of understanding of the laws of acclimatization and genetics, and the fact that soya *(soja)* was introduced as a new food legume, when actually it can only be utilized as a forage plant and industrially (for oil, cakes, and casein). Later, when the plant has been adapted, when it is understood that soya is not being propagated to competed with other dry legumes, that it is not being cultivated to extract from the seeds a vegetable milk for people, but simply as a forage plant–and the most remarkable one that exists (p. 3).

The English are trying to acclimatize soya to their colonies, especially those in southern Africa. In 1908 some 200,000 tonnes (metric tons) of soybeans were exported from China [including Manchuria] to Europe, followed by 500,000 tonnes in 1909. One can extract from soybean seeds a vegetable milk *(lait végétal)* which has the same value as animal milk for use in raising young animals. Its seeds and forage are also fine for raising farm animals and for industrial products. The author thanks all those who have helped him to acclimatize the soybean to France and to create new varieties of soya in France (p. 4).

Introduction of the soybean to France and to Europe (p. 6-7): A good but brief review of the literature on this subject. In 1739 Buffon was made director of the Jardin des Plants in Paris. Shortly thereafter, Christian missionaries in China sent him specimens of seeds and plants. The soybean must have been among them. The soybean has very probably been cultivated at the Museum since 1779, certainly in 1779 and later from 1834 to 1880. In 1855 Baron de Montigny was charged by the Society for Acclimatization to distribute five varieties of soya sent from China by Mr. Montigny; these were from northern China. The plants first bore seeds in France in 1854; their acclimatization is assured. In 1857 Mr. Lachaume transmitted to the Society for Acclimatization details of the success he obtained at Vitry-sur-Seine with soy culture. The seeds were planted in 1856. In 1858 a report to the Society for Acclimatization indicated that the acclimatization of the soybean was complete. In 1859 Mr. de Vilmorin reported on cultural trials sent from China by Mr. Perny. The varieties matured to late. The same year Dr. Turrel harvested soybeans at Toulon. In 1862 the Society for Acclimatization received seeds from Mr. Guillemin; the yellow soybean was said to be used for making tofu. Following the events of 1870, the cultivation of the soybean in France was apparently. Note: The brief war of 1870 between France and Bismark's Germany ended in France's defeat and the ceding to Germany of Alsace- Lorraine.

In the long section on Prof. Haberlandt's work with soya, starting with his cultivation of it there in 1875, is a quotation from him: "I don't know, in this history of cultivation, any example of a plant which has, in so few years and to such a high degree, excited such general interest" (p. 8).

From 1876 to 1881, the soybean was the object of numerous trials in France by the Society of Horticulture at Etampes (Seine-et-Oise). During this same period, one Dr. H. failed with varieties sent from Japan but succeeded in cultivating a yellow soybean sent from China, and used the latter to make his own tofu *(fromage végétal)* for use at home. In 1880 Messrs. Vilmorin-Andrieux introduced in

their catalog a species cultivated in Austria-Hungary (p. 17-18).

In 1878, Japan, China, and India presented all the varieties of Soya at the Universal Exposition, and their seeds filled more than 20 boxes. In 1880 the National Society for Acclimatization was able to distribute soy in France and tests were conducted in 24 regions; they were largely successful, especially in central and southern France (p. 19-22).

Tests were then abandoned from this time until about 1888, when the soybean started to grow in the southern states of the USA. That same year Messrs. Lecerf and Dujardin-Beaumetz first had the idea of using soy bread in diabetic diets (p. 22).

Causes of setbacks in soybean culture (p. 24-27): First, the varieties used matured too late and were not acclimatized in a progressive manner. We must choose varieties from northern China and adapt them to the south of France *(le Midi)* [which is on the same latitude as Toronto, central Wisconsin, or southern Minnesota]. From these, we must develop hybrids, and gradually move them northward.

The soybean has been ostracized in France. Major commercial, financial, and social interests have viewed with terror the production of an inexpensive food and have retreated into the egotistical "Malthusian agriculture. This is the truth!

Soy cheese is even feared by the cheese industry in France. They ask if they should abandon their excellent cheeses in order to adopt a vegetal cheese *(fromage végétal)*.

A long quotation from the *Chinese Imperial Encyclopedia of Agriculture* gives the various colors of soybeans, including black, white, grey, and even some speckled / mottled with blue. The black ones can be used for medicine. And they are used as an ingredient in the condiment called soy nuggets *(Chi [douchi])*, made of soybeans, ginger, and salt.

In 1910-1913 a factory named "La Caséo-Sojaïne" was installed near Paris. I (Rouest) visited this factory in which were installed all the modern comforts, and presented the best guarantees of hygiene. The milk was filtered using a filter press similar to those used in sugar factories (p. 99).

Note: Rouest has borrowed a great deal of material from earlier publications by Li Yu-ying, usually without acknowledgment and often arriving at very different conclusions, especially on the question of using soya to make human foods (Li) vs. foods and milk for animals (Rouest).

Rouest strongly recommends the use of soymilk to feed young domesticated animals. For us, soy will not replace green beans, milk or cheese. During World War I, the Germans were actively involved with the study of soymilk. A translation of an article from the *Schweizerische Milchzeitung* (Nov. 1918) tells how to make soymilk and tofu (p. 102). By using soymilk, there is no fear of transmitting tuberculosis. Address: Directeur des Fermes Expérimentales de Néoculture, Carcassonne (Aude), France.

137. Piper, Charles V.; Morse, William J. 1923. The soybean. New York, NY: McGraw-Hill Book Company, Inc. xv + 329 p. Feb. Illust. Index. 24 cm. Reprinted unrevised in 1943 by Peter Smith Publishers, New York. [563 ref]
• ***Summary:*** This is the first comprehensive book about the soybean written in English, and the most important book on soybeans and soyfoods written in its time. Contains an excellent review of the world literature on soybeans and soyfoods with a bibliography on soy that is larger than any published prior to that time (563 references), a good description of the present status of the soybean worldwide based on the authors' extensive contacts, and a great deal of original information. It quickly became a key source for people and organizations working with soybeans and soyfoods in all countries, and a major factor in the expansion of the soybean in the western world. Because of its scope and influence, Soyfoods Center considers the year of its publication to mark the end of the "Early Years" of the soybean worldwide. It remained in print until about 1986.

Contents: Preface. 1. Introduction: Name of the plant, origin, literature, use by the Chinese and Japanese, present importance, future prospects in the U.S., recognition of the possibilities. 2. The commercial status of the soybean: Manchuria and China, Japan, Europe, U.S., other countries, summary of imports and exports of soybeans and soybean oil. 3. Botanical history of the soybean: History prior to Linnaeus' "Species Plantarum" 1753, Linnaeus' misunderstandings of the soybean, Prain's elucidation, other and the correct botanical name.

4. Agricultural history of the soybean: Vernacular names of the soybean, China, Korea, and Japan, India and neighboring regions, Cochin China, Malayan region, early introduction into the United States, later U.S. introductions, the early introduced varieties (grown in the USA by 1898– Ito San, Mammoth, Buckshot, Guelph or Medium Green, Butterball, Kingston, Samarow, Eda, Ogemaw or Ogema), soybean in Europe, varieties grown in Europe and identification, Hawaiian Islands, Australia, Africa, Argentina (p. 50), Canada, Philippines, Egypt, Cuba (p. 52), British Guiana, Mauritius (p. 53), present culture distribution. 5. Culture of the soybean: Climatic adaptations, soil preferences, water requirement, preparation of seed bed, time of planting, methods and rate of seeding, seeding for pasturage, depth of seeding, inoculation, fertilizer reactions, cultivation, soybeans in mixtures (with cowpeas, sorghums, Sudan grass, Johnson grass, millet, corn, or sunflowers and corn).

6. Harvesting and storage of soybeans: harvesting soybeans for hay, silage, for the seed, seed yields, proportion of straw to seed, storing seed, separation of

cracked from whole soybean seed, viability of soybean seed, pedigreed, inspected, registered, and certified seed. 7. Composition of the soybean: Proportions of stems, leaves and pods, composition of plant and seed, nutritive and mineral constituents, forms of nitrogen in soybean nodules, factors affecting oil content of seed. 8. Utilization of the soybean: Diversity of uses (a chart, p. 129, shows 59 products that can be made from soybean seeds, and 6 more that can be made from soybean plants), soybeans for green manure, pasturage, soiling, ensilage, hay, straw.

9. Varieties: Japanese, Manchurian, botanical classifications, vital characteristics, descriptions of important varieties, key for identification, breeding and improvement, genetic behavior, oil content.

10. Structure of soybean seeds. 11. Soybean oil: Methods of extraction [Manchurian, and solvent], American oil mills, methods of shipping and marketing, prices, utilization in soap manufacture, food, paint manufacture, miscellaneous. 12. Soybean cake or meal: Feeding value, composition, use for feeding for dairy cows, cattle, swine, sheep, poultry, digestibility, injurious effects, fertilizer.

13. Soybean products for human food: Food value of the soybean, digestibility of the soybean and its products, mature or dry soybeans, immature or green soybeans [a nutritious green vegetable], soybean flour, digestibility of soybean flour, soybean bran (p. 225-26), soybean sprouts, soybean coffee, soybean or vegetable milk [soymilk] (preparation, composition, residue from the manufacture of vegetable milk [okara], utilization of soybean milk, condensed vegetable milk, vegetable milk powder, fermented vegetable milk), vegetable casein, tofu or soybean curd (names and brief history, method of manufacture, coagulating agents, manufacturing yields, digestibility, utilization of bean curd and manufactured products, bean curd brains or *tofu nao,* dry bean curd or *tofu khan,* thousand folds *{chien chang tofu},* fried bean curd *{tza tofu},* Fragrant dry bean curd *{hsiang khan},* frozen tofu *{kori tofu},* Chinese preparation, various dishes), natto, hamananatto [hamanatto], yuba, miso, shoyu [soy sauce], confections. 14. Table dishes of soybeans and soybean products: mature or dry beans, flour, tofu, sprouts (86 recipes). 15. Enemies of the soybean: bacterial, mosaic, fungous [fungus], and nematode diseases, insects, rodents. This last chapter is a comprehensive review of the literature on soybean diseases and insects published before 1922.

The Preface begins: “The soybean, also known as soya or soja bean, has assumed great importance in recent years and offers far-reaching possibilities of the future, particularly in the United States. It is, therefore, desirable to bring together in a single volume the accumulated information concerning this crop...

“The aim has been to present the information so as to make it useful from both agricultural and commercial standpoints, not omitting, however, much that is mainly of historical or botanical interest...”

The introduction begins: “There is a wide and growing belief that the soybean is destined to become one of the leading farm crops in the United States.”

Note 1. C.V. Piper lived 1867-1926. Note 2. This is the earliest English-language document seen that uses the term “soybean bran” to refer to soy bran.

Note 3. This is the earliest document seen in which Piper or Morse describe natto, Hamananatto [Hamanatto], yuba, or miso.

Note 4. This book was published by March 1923 (See *Ohio Farmer,* 10 March 1923, p. 313). Address: 1. Agrostologist; 2. Agronomist. Both: United States Dep. of Agriculture, Washington, DC.

138. Piper, Charles V.; Morse, William J. 1923. Introduction of the soybean to Europe (Document part). In: Piper and Morse. 1923. The Soybean. New York: McGraw-Hill. xv + 329 p. See p. 45-47.

• ***Summary:*** “The soybean has been grown experimentally at least in most of the European countries but in general the climatic conditions are not well suited to its culture. Some measure of success has been had however in south Europe, but the crop has never become of much importance.

“France: Paillieux (1880) has traced in detail the records of early attempts to introduce the culture of the soybean into France. Packets of soybean seeds from missionaries in China were received at the Jardin des Plantes, Paris, in 1739 and at frequent later dates beginning with 1834. The plants were very probably grown at the botanical garden since 1740, certainly so in 1779, and from 1834 to 1880 without interruption. In 1821, an unusually warm season, a Chinese variety had matured seed at Champ-Rond near Etampes. Beginning with 1855 the *Société d’Acclimatation* distributed numerous packets of seed, but did not succeed in establishing a permanent culture of the plant. In 1868 M. Chauvin cultivated several varieties at Cote d’Or, and the culture there has since continued. In 1874 the Society of horticulture of Etampes began experiments that continued until 1880. In 1879 a Chinese variety matured well at Marseilles. In 1880 Vilmorin-Andrieux & Company introduced into France one of the varieties tested by Haberlandt in Austria, which variety has proven well adapted to French conditions. This variety is presumably that now known in France as ‘Yellow Etampes’ which is the same as that known in the United States as ‘Ito San.’

“The soybean is now rather widely grown in France but apparently is not an important crop. No definite statistics of its culture seem to have been published. Presumably it is grown more as a garden vegetable than as a field crop. Apparently only four varieties were cultivated in France before 1910 namely: Yellow Etampes (= Ito San);

Early Black from Podolia (= Chernie); Brown (= Ogemaw); and Extra Early Black (= Wisconsin Black). All of these are short season varieties, indicating that the later sorts will not mature in France.

"Italy: The cultivation of the soybean in Italy dates from about 1840. [Question: What is the source of this date?] At the present time it is grown sparingly in the compartments of Liguria, Emilia, Marches, and near Naples. In no part of Italy does it seem to be a crop of prime importance.

"Austria and Germany: A great impetus was given to the culture of the soybean in Europe by the experiments of Prof. Friedrich Haberlandt (1878) of Vienna, in 1875 and subsequent years. Haberlandt obtained seed of nineteen varieties at the Vienna exposition in 1873. These were as follows:" Five yellow-seeded, three black-seeded, three green-seeded, and two brown-red-seeded varieties from China. One yellow-seeded and three black-seeded varieties from Japan. One black-seeded variety from Trans-Caucasia. One green-seeded variety from Tunis.

"Of these only four varieties matured at Vienna in 1875, namely, two yellow-seeded, one black-seeded and one brown-red-seeded, all from China. The black-seed sort was so late that it matured but few seeds. Of the other varieties some did not even come into bloom, while the remainder produced blossoms or young pods too late in the fall to mature.

"In 1876 the two yellow and the brown varieties were tested by cooperators in Hungary, Bohemia, Steirmark [Steiermark, Austria], Bukowina [an area divided between Romania and the USSR after 1945], Moravia, and Silesia, favorable results being secured in each case.

"In 1877 seeds of all four varieties were distributed to 148 cooperators, mostly in Austria-Hungary, but some in Germany and Russian Poland, and one each in Switzerland and Holland. Most of the tests gave promising results.

"Haberlandt (1878) published the results of his investigations in much detail, and his results had great influence in stimulating further investigations. All of the varieties that Haberlandt was able to mature were short season varieties, which in general are far less productive than later sorts.

"England: According to Aiton (1812) the soybean was grown as early as 1790 at the Royal Botanic Gardens, Kew, but merely as a botanical curiosity. The soybean has apparently never been grown as a crop in England, where indeed only the earliest varieties would be expected to mature.

"Investigations on the adaptability of the soybean have been carried on by Dr. J.L. North of the Royal Botanic Gardens during recent years. Early varieties were introduced from numerous sources. With careful selections two or three quite promising early strains have been obtained which mature fully and give good yields of seed under English conditions."

139. Piper, Charles V.; Morse, William J. 1923. Soybean varieties grown in Europe and the identifications of those grown by Haberlandt (Document part). In: Piper and Morse. 1923. The Soybean. New York: McGraw-Hill. xv + 329 p. See p. 47-49.

• ***Summary:*** "Seeds of soybeans were secured by the U.S. Department of Agriculture from various European sources, including five packets from Dr. E. Von Tschermak of Vienna, said to be the progeny of those used by Haberlandt in his experiments. These were tested one or more years at Arlington Farm, Virginia, and their identities established as follows:

"Samarow: Seed obtained from Dammann & Co., Naples, Italy, No. 224411, and identical with No. 17260, which last was introduced by Thorburn & Co. [of New York] from Italy. Also No. 01597 from Von Tschermak, Vienna, said to be one of Haberlandt's varieties, but this is probably an error as Haberlandt mentions no green-seeded sort that matured in his experiments.

"Etampes: Seed from Vilmorin-Andrieux & Co., Paris, France, No. 21818, proved identical with Ito-San. Also advertised by other Europeans, usually as Yellow Etampes.

"Wisconsin Black: Seed was received from Vilmorin-Andrieux & Co. as 'Early Black from Podolia,' No. 21757 and No. 21756; from Haage & Schmidt, Erfurt, Germany, as No. 22321; from Dammann & Co., as 'Black,' of Haberlandt's experiments; and No. 5039 from Vilmorin-Andrieux as 'Extra Early Black Seeded.' This last is the original importation of the variety later named Wisconsin Black, S.P.I. No. 25468, which is now commercially handled by a few seedsmen.

"'Yellow Riesen': Seed obtained from Haage & Schmidt, No. 22318. The variety is very similar to Mammoth, but somewhat later. No. 22317, 'Yellow,' from the same source, has indistinguishable seeds, but did not germinate.

"Buckshot: No. 22322, obtained from Haage & Schmidt, is indistinguishable from the Buckshot variety, S.P.I. No. 17251. It was received as 'Early Black from Podolia,' but is not the same as the variety received under the name from another source. Seeds of this variety were also mixed in the brown seed from the Botanical Garden of Bremen, Germany, and grown as No. 25212A.

"'Yellow': This variety was received from Dammann & Co., No. 22414, and Vilmorin-Andrieux & Co., No. 21754, the two being identical and different from any others yet received. It is a small, early variety, maturing at Arlington in ninety days. No. 17276, without name, from Havre, France, is a very similar but distinct variety, matched exactly by No. 01594 from Von Tschermak, Vienna, said to

be the progeny of one of the yellows used in Haberlandt's experiments.

"'Brown': Seed under this name was obtained from Dammann & Co., No. 22413, Haage & Schmidt, No. 22319, and Vilmorin-Andrieux & Co., No. 21755. These seeds are indistinguishable, but only No. 21755 grew. The original seed of this is much smaller than Ogemaw, but in 1909 both the seeds and plants could not be distinguished from Ogemaw from Michigan. No. 25212, from the Botanical Garden, Bremen, Germany, also with brown seeds, was likewise indistinguishable from Ogemaw in 1909, though the original seeds were different both from No. 21755 and from Ogemaw. Finally two lots of seed, Nos. 01595 and 01598, from Von Tschermak, Vienna, said to be the brown of Haberlandt's experiments, also proved to be Ogemaw.

"Butterball: The variety secured from Dammann & Co., No. 22415, as 'Giant Yellow,' could not be distinguished from S.P.I. No. 17274, Butterball.

"There are no authentic records of a few of the earliest S.P.I. importations from Europe, so that nothing definite can be said as to their identity. Among these are No. 1492 (brown-seeded), No. 1493 (black seeded), and No. 2156, Yellow Etampes, all from France. From these data it would appear that in 1909 at least ten varieties of soybeans were more or less grown in Europe.

"The four varieties used by Haberlandt in his trials include with scarcely a doubt Wisconsin Black, Ogemaw, and No. 17276, 'Yellow.' What the other yellow seeded sort may have been is doubtful. It could scarcely have been Etampes or Ito San, as that variety could hardly be expected to mature in Vienna."

Note: Prof. Haberlandt's work is also discussed in this book on pages 157 (heat units) and 218 (use of the soybean as a food for humans and animals).

140. Piper, Charles V.; Morse, William J. 1923. Early introduction of the soybean into the United States (Document part). In: Piper and Morse. 1923. The Soybean. New York: McGraw-Hill. xv + 329 p. See p. 39-41.

• ***Summary:*** "There are fortunately fairly complete records for the early history of the soybean in the United States. The facts emphasize the difficulties with which a new crop wins its way to recognition.

"The earliest records.–The first mention of the soybean in American literature is by Mease (1804), who writes 'The soybean bears the climate of Pennsylvania very well. The bean ought therefore to be cultivated.'

"Thomas Nuttall (1829) grew a variety with red flowers and chocolate brown seeds in the botanic garden at Cambridge, Massachusetts, and from his observations wrote a brief account concerning it. He writes:

"'Its principal recommendation at present is only as a luxury, affording the well-known sauce, soy, which at this time is only prepared in China and Japan.'

"In the same journal two years later, November 23, 1831, is an account of the successful culture of the plant at Milton, Massachusetts, the seed having been obtained from Nuttall.

"No further mention of the plant in America literature appears until 1853, when a brief account appeared under the name 'Japan pea' by Ernst [of Ohio] (1853), as follows:

"'The Japan pea, in which so much interest has been manifested in this country for a year or two past, from its hardihood to resist drought and frost, together with its enormous yield, appears to be highly worthy of the attention of agriculturists.'"

"The Perry Expedition to Japan.–The Perry expedition in the year 1854 brought back two varieties of 'soja bean' from Japan, one 'white' seeded, the other 'red' seeded. These, together with the Japan pea, were distributed by the Commissioner of Patents in 1854, (Browne 1854) and, thereafter frequent references to the plant occur in agricultural literature under such names as Japan pea, Japan bean, and Japanese fodder plant. Most of these articles speak of the plant as the Japan pea, none of them as the soy or soja bean. It is apparent from the early accounts that there were at least two Japan peas, one early enough to mature in Connecticut (Patent Office Report, 1854, p. 194), the other very late (American Agriculturist, 1857, vol. 16, p. 10). Judging from all the accounts, we suspect that the early Japan pea may be the Ito San variety, which, however, has red flowers, while the late variety may be the Mammoth. The Ito San is still occasionally called the Japan pea, while the introduction and source of the Mammoth has never been definitely determined. From these early accounts the Mammoth may well be the 'white-seeded' soja bean obtained by the Perry expedition. The 'red-seeded soja bean' was, probably, the adsuki bean *(Phaseolus angularis)*, as no red-seeded soybean is known.

Later Introductions.–Prof. G. H. Cook, of New Brunswick, New Jersey, obtained seed of the soybean at the Bavarian Agricultural Station [in Germany] in 1878. In the same year Mr. James Neilson obtained seeds of several varieties at Vienna, Austria. Both of these gentlemen planted the seeds and gathered crops of the different varieties in 1879. These varieties were without doubt some of those grown and distributed through Europe by Professor Haberlandt of Vienna.

"A yellow-seeded soybean was grown at the North Carolina Agricultural Experiment Station in 1882 and reported on in some detail. The source of the variety is not given, but by implication it is the same as the variety stated to be grown by a number of persons in the State, and is probably the Mammoth.

"Two varieties, one black seeded, the other with white seeds, were grown at the Massachusetts Agricultural Experiment Station in 1888.

"In 1890 Prof. C. C. Georgeson (1890) secured three lots of soybeans from Japan which were grown at the Kansas Agricultural Experiment Station in 1890 and subsequently.

"Prof. W. P. Brooks, (1890) of Amherst, Massachusetts, brought with him from Japan in 1889 a number of soybean varieties, including the Medium Green or Guelph, and the Ito San. It is quite certain that other importations of soybeans from Asia were made by others, but no definite records have been found.

"Since 1890 most of the agricultural experiment stations have experimented with soybeans and many bulletins have been published dealing wholly or partly with the crop."

141. Wastl, Helene. 1926. Das Sojamehl als Nahrungsmittel [Soy flour as a foodstuff]. *Wiener Medizinische Wochenschrift* 76(41):1209-10, 1213-14. Oct. 9. Reprinted in: L. Berczeller. 1928. Publications on Berczeller's Soy Flour. Vol. I. [4 ref. Ger]

• ***Summary:*** In 1870 a large migration of Chinese into Manchuria began, and from this time the soybean started to become the main crop of Manchuria, which is today the most important place for growing soybeans in the world.

The soybean became known in Europe largely through the efforts of Prof. Haberlandt following the Vienna World Exposition of 1873. Large agronomic trials were undertaken, not only in Austria-Hungary but also in Russia. Trials were conducted successfully in most areas where corn/maize thrives. Nevertheless, the crop did not expand, since there were no suitable conditions for the utilization of soya or even market opportunities for the new crop. But with the development of improved extraction processes for obtaining vegetable oils, since 1908 the soybean has become widely used in Europe (and especially in England) as an oilseed, and imports have grown very rapidly. This growth was so sudden that in the trade report of Gehe & Co. for 1911 it was described as "something that has happened only once in the history of world trade. The imports of this heretofore neglected commodity rose to fabulous heights, and in a very short time it conquered the world market."

The author then discusses the nutritional composition of the soybean and briefly reviews the history of research on its nutritional value, including the work of Osborne and Mendel–which was confirmed by L. Berczeller. "The high biological value of soya protein is also shown by the fact that in East Asia, soya largely replaces animal protein in human diets. The use of the soybean for human nutrition depends (despite its outstanding chemical composition) on how it its technically processed. For centuries, ongoing experiments have been conducted on how best to make soybeans into tasty, nutritious foods." The soybean was used as a vegetable, made into milk, subjected to fermentation processes, used to make a type of cheese [tofu], and even a coffee substitute. Above all, people tried to mill it into a flour or to cook it like European legumes, and these recommendations were repeated uncritically in book after book until the advent of World War I, when they were examined on a large scale over a long time. In 1915 Lüthje [Luethje] wrote that the soybean could not be cooked and used like typical European legumes. People who tried to make soy flour during the war found that, because of the oil in the soybean, the flour quickly became rancid, causing consumers to complain about its bitter taste. So processors tried to make soy flour from defatted soybeans, but this caused a loss in nutritional value. However L. Berczeller, using a process of fractional distillation, succeeded in making whole soy flour which, despite its high fat content, did not become rancid. On a dry-weight basis this soy flour contains 45.50% crude protein and 2.38% fat. A table (p. 1213) shows that it is a less expensive source of calories than any other food. Using prices from June 1926 1,000 calories from whole soy flour cost only 0.19 shillings compared with 0.78 shillings for milk, 0.80 for butter, 1.07 for pork, 1.75 for an egg, and 2.64 for lean beef. The great practical significance of this lies in the use of soy flour in bread in place of all or part of the milk, eggs, and fat.

"Through the use of soya flour it is therefore possible, even for people with a low income, to secure a similar consumption of protein and fat, as is otherwise accessible to only a very small part of the population. Soya makes this possible in East Asia already today for hundreds of millions of people." Address: Physiologischen Institut der Wiener Universtaet (Vienna), Austria.

142. *Good Health (Battle Creek, Michigan).*1927. The dietary value of the soy bean. 62(4):36. April.

• ***Summary:*** "A recent issue of the *Lancet* calls attention to the special nutritional value of the soy bean...

"Now, however, a new phase in the use of the soy bean has been entered upon, owing to the discovery of Doctor Berczeller of Vienna [Austria] that the obnoxious constituents can be eliminated by a special milling process and fractional distillation, without interfering with the high nutritional value of the meal. This nutritional value is so great that Professor Haberlandt, years ago, prophesied that the carbohydrate stores of the potato would come to be supplemented, at least in the diet of the poorer classes, by the proteins and fats provided in such abundance in the soy bean.

"The proteins of the soy bean are, according to McCollum, distinctly more valuable from the point of view of nutrition than are those of the other legumes."

143. Brillmayer, Franz A.; Drahorad, Fritz. 1929. Die Sojabohne, ihre Bedeutung, Kultur und Verwendung [The

soybean, its significance, culture, and utilization]. Vienna, Austria: Published by the authors. 62 p. Illust. 21 cm. [Ger]
• ***Summary:*** Contents: Foreword. 1. History of the soybean in its homeland and its introduction to Europe and America. 2. Current area where soybeans are grown worldwide and world production. 3. Soybean botany. 4. Use of the soybean: As a food (in East Asia, in Europe and America [in the form of flour, for making soymilk, as a coffee substitute, a meat substitute, and for making chocolate]), as an oilseed, as a source of fodder. 5. Soybean cultivation: Climate and the northern limit of growth, soil, crop rotation, seedbed *[Saatbeet],* manuring or fertilizing the soil, the seeds, care of the plants, diseases and enemies, harvest, cultivation for hay, green manure or silage, soybean varieties, agronomic trials with 22 varieties, summary of results, root bacteria and inoculation. 6. Significance of the soybean: For agriculture, as a food for the people, economic effects of the use of soybeans in agriculture and as food.

According to Brillmayer (1947, p. 14), the first edition of this work was self-published as a "brochure" in 1928, but it is not mentioned in this 1929 edition. Describes the last intensive research on soybean variety improvement in Austria until 1970. Address: 1. Seed breeder in Platt, Austria; 2. Commissioner, Federal Institute for Agronomy and Seed Testing, Vienna.

144. Dittes, Frances L. 1931. The soybean as human food. *Madison Survey (Madison, Tennessee).* Dec. 9. p. 189-90; Dec. 16. p. 193-94. [3 ref]
• ***Summary:*** This paper was presented by Miss Dittes at the 20th annual meeting of the Tennessee Academy of Science, held 27-28 Nov. 1931 at George Peabody College for Teachers, Nashville, Tennessee. It summarizes scientific research on the subject. "In 1917 during the World War, a special committee appointed by the Department of Agriculture, while searching for a cheaper source of protein for human consumption, discovered the soybean."

"At present there is a great interest in soybean preparations throughout the world. In this country the leading forces are the Bureau of Home Economics, and W.J. Morse, of the United States Department of Agriculture. The famous Austrian, Professor Haberlandt, wrote about fifty years ago that the time would come when soybeans would play an important role in human dietary."

"An important step being studied at the present time is the establishment of a soya foundation in order to promote the creation of a National Soya Food Research Institute." Address: Madison Sanitarium Dietitian and Prof. of Home Economics, Madison College, -.

145. Rewald, Bruno. 1931. Ergebnisse von Anbauversuchen amerikanischer Sojabohnen in Deutschland [Results of culture trials with American soybeans in Germany]. *Landwirtschaftlichen Versuchs-Stationen* 113(1-2):93-101. (Chem. Abst. 26:4110). [Ger]
• ***Summary:*** American varieties of soy beans produced crops in Germany having less fat and protein, but similar phosphatide contents, in comparison with American-grown crops. Differences are not of the same order in all varieties. Address: Hamburg.

146. Drahorad, Fritz. 1932. Sojabohnenanbau in Oesterreich [The cultivation of soybeans in Austria]. *Wiener Landwirtschaftliche Zeitung* 82(15):113-14, April 9; 82(16):122-23. April 16. [Ger]
• ***Summary:*** Part I concerns soybean culture *(Die Kultur der Sojabohne),* starting with a brief history of soybean investigations in Austria from the Vienna Exposition of 1873, through which Prof. Haberlandt obtained seeds, and including Brillmayer.

Part II concerns the utilization of the soybean *(Die Verwertung der Sojabohne),* including green fodder, soybean meal, and oil. Address: Oberkommissaer der Bundesanstalt fuer Pflanzenbau und Samenpruefung.

147. Edwards, Thomas I. 1932. Temperature relations of seed germination. *Quarterly Review of Biology* 7(4):428-43. Dec. [55* ref]
• ***Summary:*** Gives a history of research on the subject, and discusses relations of germinating soybeans to temperature and length of incubation time. Address: Dep. of Biology, The Johns Hopkins Univ., Baltimore, Maryland.

148. Pollak, J. 1933. Soy bean is a source of food and milk for diabetics. *Industrial and Engineering Chemistry, News Edition* 11(23):347. Dec. 10. Translated by W.L. Hill.
• ***Summary:*** "The process worked out by L. Berczeller in Vienna for purifying the soy bean, which is known to be especially rich in protein and fat, has made possible the production of a soy bean meal [whole soy flour] that still shows the total fat and lecithin content of the bean and yet does not become rancid. Later, E. Kupelweiser [sic, Kupelwieser] in Vienna utilized and perfected this process on a technical scale." By the addition of the necessary technical baking supplements to edible soy meal, a soybean bread has been produced in Austria. It contains only "one-fourth as much sugar-forming substance as normal bread. In taste and appearance this bread comes so near to ordinary whole-grain bread that it can scarcely be distinguished from it. Moreover, there is the practical advantage that this new bread, now being manufactured for diabetics on a factory scale, is markedly cheaper than most of the baked products hitherto used by diabetics.

"Another old problem of the production of soy milk has also been worked out recently in Austria. By suitable preliminary treatment of soy beans, M. Adler has been able to produce a soy milk which is completely neutral

to the taste and can scarcely be distinguished from cow's milk. Moreover, in chemical composition and physical properties it appears to be quite equal to animal milk. On account of its low cost this product could assume importance in the food-processing industries. The process is also probably suitable for the production of milk for diabetics." Address: Vienna, Austria.

149. Kaltenbach, D.; Legros, J. 1936. Soya: Selection, classification of varieties, varieties cultivated in various countries: Western Europe (Document part). *Monthly Bulletin of Science and Practical Agriculture (International Institute of Agriculture, Rome)* 27(6):216T-28T. June.
• ***Summary:*** "1. Germany. In spite of numerous attempts extending over a long period of time, and particularly since 1920, soya cultivation in Germany has remained in the experimental stage. From a practical standpoint it cannot be said that economic cultivation of soya exists...

"All the varieties introduced for trial have failed as they were not adaptable to the climatic conditions of the country. Certain growers, however, (Schurig at Stedten; Brandt at Gierdorf; Heinemann; Winkler, etc.) and several professors of State Institutions (Professor Riede of the Bonn University; Professor Sessous of the Giessen University; Professor Berkner of the Breslau University; Dr. Heinze of the Chamber of Agriculture of Halle) have carried out breeding work and have obtained lines superior to the varieties which were used as the point of departure. These lines are at present being tested in various regions in Germany.

"Several varieties have been obtained by the botanical station of the Higher School of Agriculture of Bonn-Poppelsdorf:

"Yield per hectare of Bonn 373 is 20.9, and yield per hectare of Bonn 456 is 19.1.

"2. Austria. Soya cultivation was introduced in 1870 by F. Haberlandt. Since that time breeding work and tests in acclimatisation have been carried out at various times. The most important work of this kind was started in 1923 by Dr. Fritz Drahorad and his assistant M.F. Brillmayr [Brillmayer]. Trials were made with 28 varieties in various parts of the country and the results centralized at Platt (Lower Austria) at the Leguminous Plant Breeding Station dependent from the Federal Station of Plant Cultivation and Seed Selection. In this way early varieties were bred at Platt with a growth period of 110-125 days.

"The principal varieties bred are: Platter Schwarze Soja, Platter Kleine Gelbe Soja, Platter Gelbe Riesen.

"In Austria the only varieties that may be cultivated with success are those selected in the country which have a growth period of from 130 to 145 days at the most.

"3. France. Soya was introduced into the Botanical Garden at Versailles in 1740. Several trials in cultivation have been made since 1855. L. Rouest in Aude and Charles de Carbonnières, in Tarn, carried out test of some importance from 1918 to 1925. But it was not until 1932 that the first scientific investigations were made on the possibilities of acclimatising soya in France. These researches were carried out chiefly by M.H. de Guerpel, in Basse-Normandie. The results obtained in the first year were so encouraging that it was decided to sow 5 hectares of soya in ten communes in Normandy, the principal being: Cagny, Saint-André-sur-Orne, Vieux-Fumé, Percy-en-Auge, Villons-le-Buissons, Saint-Contest, Beny-sur-Mer. The seed was taken both from the harvest of the previous year and also from seed from Poland... Yields varied from 1400 to 1800 kg per hectare.

"Another trial was made with a variety with yellow seed from Manchuria.

"In 1934 trials were made in the Department of Eure with the variety Tokio with black seeds.

"4. Great Britain (and Colonies). One of the first tests in acclimatisation of soya in Great Britain took place at the Royal Botanical Garden, Regents Park, in 1914. During these tests Mr. North found that certain varieties were sufficiently early to mature at the end of September. By careful selection with these varieties for several years lines were obtained which were particularly early. In 1928, a hybrid was introduced from Canada which proved to be earlier than any of the 60 varieties tested up to that time. By sowing the seed the first week in May it was possible to harvest the beginning of September. Good results were obtained in Middlesex, Essex, Berkshire, Oxfordshire and Hampshire.

"The most important researches were made at Boreham in Essex in 1933 where 47 varieties were grown originating from North America, Canada, Manchuria and Japan. Trials were also made with the varieties already bred by Mr. North. Interesting results were obtained.

"The investigations were continued in 1934 with the 4 best varieties acclimatised, known as Jap, 'C,' 'O,' and 'J.'

"6. Italy. Sporadic trials in soya growing were made in Italy from 1740 to 1880, but it was chiefly at the beginning of this century that an attempt was made to introduce this crop into the national economy. Soya has been the object of patient and continuous research at the Bonafous Institute in Turin, where two varieties were selected, well adapted to the region, one with yellow and the other with green seeds, large and spherical in shape. In the district of Spoleto, the Marquis G. Marignoli obtained good results, in 1926, with this plant and is of the opinion that soya cultivation for seed production would be completely successful in Puglia and the South. He found that the American variety Mammoth Yellow is easily acclimatised in Central Italy and he has undertaken mass selection of this variety which is of great importance on account of its precocity and yields. In respect of forage production, he has

successfully experimented with a variety with green seeds which, owing to its great development, is doubtless the same as the variety that gave good results in Piedmont. According to information received from the Director of the Travelling Chair of Agriculture of Cagliari, similar trials have been made in the Sanluri farm and certain other private farms. In 1928, a Yellow Japanese variety gave 3.3 quintals of seed per hectare at Sanluri. This same variety, grown at Santa Margherita di Pula, only gave 2.3 quintals. At Simacis, in 1919, a light coloured variety of soya yielded 3 quintals per hectare. In the experimental plots of the Faculty of Agriculture of the Perugia University, small trials have been made with 4 varieties of soya which had already been tried and selected before the war by Professor Bottari at the Bonafous Agricultural Institute. Note: 1 quintal = 100 kg.

"Soya was grown for the first time at the Agricultural Station of Bari in 1921. Seeds obtained from Professor Borzi were used. This variety proved to be very productive, but rather late. In the following years Professor Pantanelli, Director of the Station, procured 45 varieties from the United States and India.

"7. Netherlands. Soya growing is not widespread in the Netherlands and only small trials in acclimatisation are carried out. It is not yet known whether soya can be grown on a remunerative basis in the humid climatic conditions of this country.

"10. Switzerland. The first trials in soya growing in Switzerland date back to the time of the Universal Exhibition of Vienna in 1873, in fact, a great quantity of soya seeds belonging to different Manchu varieties were shown. In 1878, Professor Haberlandt, who had carried out cultivation trials in various countries in Europe, made a few tests in the town of Coire [Chur]. A little later, Professor Kraemer made a few trials in Zurich for three years and published a pamphlet in 1880 giving the results obtained. In practice, soya growing had not developed and it is only recently that further efforts in soya cultivation have been made.

"At present trials are carried out solely by the Establishment of Agricultural Research of Oerlikon-Zurich, foreign varieties being the principal object of study. There are no native Swiss varieties. The first varieties tried were those obtained by the German breeder Dieckmann at Hamburg. Late an Austrian variety was introduced: Platter Gelbe Riesen, and a whole series of American varieties obtained from Professor Wiggans of the Cornell University, Ithaca. Finally, 3 Polish varieties from Vilna were introduced which, it appears, came from the Botanical Garden of Basle [Basel, Switzerland]...

"*Soya grown for seed:* There are also wide variations in seed yields. With the 22 varieties tested in 1935, they varied from 1.5 to 16.5 quintals per hectare.

"In Switzerland, forage production is the principal object of soya growing. There are, however, factories which are interested in soya for the production of foods for persons suffering from diabetes. Local production of soya cannot compete with the present imports from abroad." Address: Rome, Italy.

150. Morse, W.J. 1936. Soybeans in the United States: In relation to world production and trade. *Proceedings of the American Soybean Assoc.* p. 55-64. 16th annual meeting. Held 14-16 Sept. in Iowa. [2 ref]

• ***Summary:*** The slow advance of soybean "cultivation in Western Countries was undoubtedly due to the lack of adapted varieties for various soil and climatic conditions. Increase of acreage and production in the United States is closely correlated with the introduction of varieties from the Orient. In less than thirty years the acreage of soybeans in the United States has increased a hundred fold–from about 50,000 acres in 1907 to nearly 5½ million acres in 1935. During this period the United States Department of Agriculture has brought about 10,000 introductions of soybeans from the soybean regions of the Far East and the culture of the crop has spread from a few states in the early days to twenty-seven states at the present time.

"In Manchuria, often called 'the land of beans,' the soybean is grown to a greater extent than in any other country. It occupies about 25 per cent of the cultivated area and is relied on by the Manchurian farmer as a cash crop. With its rise as an international trade commodity, it is truly the 'Wealth of Manchuria.' Chosen [Korea] and Japan are large producers and southward from China the soybean is cultivated to some extent in India, Siam [later renamed Thailand], the Philippines, Cochin China, and during the past decade the production has nearly doubled in the Dutch East Indies. In Siberia extensive experiments have been under way to extend the cultivation of the crop but progress has been slow and Siberian beans have not yet been a factor in international trade.

"The production of soybeans in the Western World is concentrated largely in the Corn Belt States of the United States. Beginning with the experiments of Haberlandt in Austria in 1877, the soybean has been grown experimentally in most of the European countries but in general the climatic conditions are not well suited to its culture with the possible exception of certain regions, such as the Ukraine in the U.S.S.R. Varying degrees of success have been obtained in different regions of Africa, especially South Africa where yields of 25 to 35 bushels per acre have been obtained. Experiments in nearly all South American countries and Mexico have shown some successful results in Argentina and Cuba but acreage is not extensive. In Canada, considerable interest had been shown in the crop but its culture–about 15,000 acres–is confined chiefly at present to the Province of Ontario. The future trend of the crop for commercial purposes undoubtedly will be

concentrated largely in the United States, Canada, and certain regions of the U.S.S.R."

A table (p. 56) shows the increase in production of soybeans (in million bushels) during the 10-year period from 1925 to 1935 in the world's top five producing countries: Manchuria 92.67 -> 140.4. United States 5.190 -> 39.64. Chosen (Korea) 18.72 -> 21.96. Japan 18.31 -> 13.31 (1933). Netherland India [later Indonesia] 3.536 -> 6.676 (1934).

"Bean trade was an ancient and flourishing institution when the ports of China were first opened to the commerce of the Western World. In 1835, Newchwang (Yingkow, Yingkou), in South Manchuria, was an important port of shipment for the great coastal trade in beans, bean cake, and bean oil to the ports of southern Chinese provinces and other oriental regions. Manchuria is still the chief source of world trade in soybeans and from here the beans and bean products oil and cake move principally to other provinces of China, Japan, the Philippines, the East Indies, and to other countries of Northwest Europe. In 1908, about 7,000,000 bushels of beans were shipped out through the port of Dairen, chiefly to Chinese and Japanese ports. For the period 1925-1929, the average annual shipments to China, Japan, and European countries were 62,353,566 bushels. The first successful shipment from Manchuria to Europe was made to an English oil mill in 1907, and as an important source of vegetable oil and animal feed the beans soon found a market not only in English oil mills but in other European countries and America. Since 1931, when American-grown soybeans were first exported to European markets, chiefly to the oil mills of Germany, there has been an open European market to the American farmer. With economical methods of production and high quality beans, America is in a position to compete for the 50,000,000-bushel trade in European markets."

Two tables (p. 58) show international imports and exports of soybeans by major trading countries for an average 5-year period (1925-29) and for 1934. The leading importers in 1934 (preliminary, with imports in million bushels) are: Germany 33.57. Japan 20.29. Denmark 9.910. United Kingdom 6.615. Netherlands 4.695. Sweden 3.426. Italy 0.739. United States 0.006. The leading exporters in 1934 are: Manchuria 44.21 (down from 62.35 in 1925-29). Japan 0.025. Netherlands 0.0009.

"In recent years, the oil milling industry of Manchuria has declined quite markedly. During the height of processing beans for oil and cake, more than 90 mills were in operation, while late in 1930 not more than 25 mills were crushing beans. The decline in this industry has been due chiefly to a decreased demand for bean cake as fertilizer, the low price of silver, and almost the entire suspension of bean oil export due to the development of the oil extraction industry in Europe. In European countries it has become more profitable to import soybeans than to import bean oil."

Two tables (p. 59) show international imports and exports of soybean oil by major trading countries for an average 5-year period (1925-29) and for 1934. The leading importers in 1934 (preliminary, with imports in million lb) are: Netherlands 44.00. Belgium 27.60. United Kingdom 24.13. Austria 22.07. Morocco 20.28. Sweden 12.55. Also listed are: Norway 8.701. Algeria 0.004. The leading exporters of soybeans in 1934 (preliminary, with imports in million lb) are: Manchuria 122.6. Denmark 41.80. Netherlands 26.05. Germany 24.99. Sweden 8.98. Japan 7.95 United States 2.040.

"Practically all exports of soybean cake and meal have originated in Manchuria and average about 1,375,000 tons for the five-year period 1926-31. About 70 per cent of this exportation went mainly to Japan, Chosen, and China. Cake and meal shipments to European countries went chiefly to Germany, although considerable quantities were exported to Denmark, Sweden, the Netherlands, and Finland. The average importation of soybean meal and cake into the United States for the five-year period 1930-1935 was 31,726 tons."

"The rise of the soybean to a crop of special importance in the world's commerce and in the industry of the United States is one of the most remarkable agricultural developments of recent times." Address: Bureau of Plant Industry, USDA, Washington, DC.

151. Malis, Oskar. 1939. Soja vytlaci z Kamerunu kukurici [Will soy replace corn in Cameroon?]. *Cesky Zemedelec (Czech Farmer)* 21(43-44):268. Nov. 3. [Cze]
• ***Summary:*** The author's name is listed below this short article as "Ms." Address: Dr. V. Praze, Czechoslovakia.

152. Haberlandt, Gottleib F. 1940. Die Sojabohne [The soybean]. *Natur und Volk* 70:183-88 (April). [Ger] Address: University of Berlin.

153. Brillmayer, Franz A. 1947. Die Kultur der Soja in Oesterreich [The cultivation of soybeans in Austria]. Vienna, Austria: Scholle-Verlag. 97 p. Scholle-Buecherei, Bd. 80. With 33 illust. and 16 tables. 22 cm. [Ger]
• ***Summary:*** Contents: Foreword (written in May 1947 at Braunsdorf-Wien). 1. The origin of the soybean and how it spread throughout the world. 2. The history of its introduction into Europe: Into Austria, into Germany, into France, into Poland, Hungary, and the Balkans. 3. Botanical information about the soybean: Its morphology, physiology, Austrian varieties, European varieties, diseases and pests, nodule bacteria and hormones. 4. Breeding, the goals of breeding, and conduct of investigations (Versuchswesen). 5. Climate and suitable varieties. 6. Culture: Soil, preceding and subsequent crops in rotations, preparation of the soil,

fertilizing the soil, time of seeding, inoculation, seeds, scarification *(Beizung)* of the seeds [to "wound" or scratch the seed coat so that the seeds imbibe water and thus germinate better], plant spacing and density of planting, amount of seeds and depth of planting, damage done by wild animals (game), care of the crop, harvest, threshing, storage.

The many interesting photos at the back of the book include: 3. The first soya field in 1924 growing the variety Platter SS 14. 5 and 6. A breeding plot in southern France (Lamagistere). In April 1937 the best Austrian soybean varieties were planted at St. Sylvain d'Anjou. 7. Threshing of Platter gelbe Riesen varieties harvested in Casablanca, Morocco. 8. A field of Austrian soybean varieties in Marrakech (Marakesh), French Morocco. 10. Marcel Blanchard with a breeding plot of Austrian soybeans at Agen (Garonne), France. 11. Soybean nodules inoculated with Radicin. 11-12. The Radicin factory. 26. The soybean breeding plots at Platt. Address: Braunsdorf, Post Roseldorf, Niederoesterreich (Lower Austria), Austria.

154. Brillmayer, Franz A. 1947. Geschichte der Einfuehrung der Soja in Oesterreich [History of the introduction of the soybean to Austria. I. (Document part)]. In: F.A. Brillmayer. 1947. Die Kultur der Soja in Oesterreich. Vienna: Scholle-Verlag. 97 p. See p. 11-14. [Ger]

• ***Summary:*** In the section titled "History of the introduction of soya to Europe," page 11 states: "Starting in 1920 again, for the second time, Austria promoted the production and utilization of soybeans, and with this the impulse for a new "soya wave," which now went all over Europe, was unleashed. Here in Vienna a soya industry also began with the production of Edelsoja. Assistant Professor Kupelwieser used it to demonstrate the outstanding significance of soya as a protein source, going against the then current opinion that soya was primarily an oilseed. From my soybean breeding location at Platt in Lower Austria, Austrian cultivars spread all over Europe and even overseas.

"Why should it not be widely known that valuable pioneering work was performed in Austria? The line of soybeans bred in Platt went to Poland, the Balkans, to Hungary, Belgium, Holland, and Greece, to Turkey, to Persia, Canada, England, Germany, Dutch Guiana [later renamed Suriname], the Indian Peninsula [Vorderindien, incl. India, Sri Lanka, and parts of Pakistan and Burma], China, Java, Tanganyika, to French Morocco, and Bessarabia [now part of the Moldavian S.S.R. in the USSR]. It was not only new breeds of soybeans that spread out from Austria but a rekindling of the "soya idea" that had its origin here. This led to a change of opinion and the soybean came to be seen as a world power factor *(Weltmachtfaktor)*, as is already well known today.

"According to Dr. [E.C.] Winkler's patented process for debittering soya, a very modern factory was erected in Vienna XX. In it, a part of the oil was expressed, leaving a meal with only half its original fat content. Dr. Winkler achieved, through prior debittering of the soybeans, an excellent food and salad oil that did not need to be further refined. Also, the production of unrefined salad oil from Edelsoja originated in Austria.

"History of the introduction of soya to Austria (p. 11): On the occasion of the Vienna World Exhibition of 1873, Japan exhibited soybeans and awakened a great interest for this Asian plant throughout Central Europe. This was mainly because of the fact that in the Exhibition attention was called to the value of the soybean. The Viennese university professor Friedrich Haberlandt took the matter into his own hands. Through the agency of the imperial embassy / legation he had the Ministry of Agriculture acquire 20 soybean samples from Japan and China. The tests were done in the warmer provinces of the Monarchy. There were 148 agronomic trials introduced in Hungary, Dalmatia [a former region on the Adriatic coast of what is now Croatia; formerly an Austrian crownland], Kärnten [Carinthia, today a state in southern Austria bordering on Italy and Yugoslavia], Steiermark [Styria, a state in the mountainous part of central and southeast Austria], Istrien [Istria, in Slovenia since June 1991], and Mähren [Moravia, a region in central Czechoslovakia]. In 1877 Haberlandt had already gathered so much experience that exact guidance for cultivating soybeans could be given. At this time the first composition analyses were undertaken, so exact knowledge of the value of soybean seeds was obtained. Likewise, through Steuf and Wolker, experience was gained in pressing oil from the seeds, and selections were undertaken in the Botanical Garden at Vienna. The highest yielding types were called "Haberlandt" and these first appeared in the seed catalog of the great seed company Vilmorin Andrieux & Co. in 1880.

"Haberlandt pointed out the value of the soybean as food and recommended a diet of soybeans and potatoes, which contained all nutrients necessary for human life. It was also recommended that the soybean be incorporated into the commissary provisions of the army, and in this process that peas in the popular pea sausage 'Erbswurst' be partially replaced by soybeans.

"At that time, the soybean could not stand on its own. It remained strong for a long time in the peasant agriculture of Krain [Carniola; now in Slovenia] and Istrien, and served as a 'coffee bean' *(Kaffeebohne)* in the preparation of a breakfast drink. There were two conditions which stood in the way of the spread of soybeans. First, the soybean is a foreign food to us. When cooked, it remains hard and has an after-taste, an off flavor that is bitter. The very thin layer under the seed coat of the bean is the source of this after-taste. In addition, it was said that Asian

soyfoods have no taste. What is more, there was plenty of food in the Monarchy, so there was no need for a new, foreign food.

"The soybean completely disappeared from memory in Austria. It was only kept in a few botanical gardens as a curiosity.

"In 1920 I began breeding soybean lines with the goal of getting ones that would ripen in our climate and give reasonable yields. Conditions for soybean culture became ripe after World War I due to the general lack of food. My starting material was a matchbox full of soybeans that a prisoner of war had brought with him from Siberia. After a long delay, the solution to the soybean problem was begun in Platt in lower Austria, near Zellerndorf in the district of Hollabrun. Some of the seeds ripened and in the next year those that ripened earliest were selected. In 1924 I was able to announce to Dr. Markus Brandl (the top agricultural official in the area) that I had a field of soybeans that matured in mid-September. Immediately Dr. Fritz Drahorad was sent to Platt to inspect and report on the soybean plant. Drahorad was the current top ranking agronomic official in Vienna in charge of plant cultivation and seed testing *(Oberkommissär der Bundesanstalt für Pflanzenbau und Samenprüfung)* and the assistant to Privy Councillor *(Hofrat)* Professor Dr. Tschermak von Seysenegg, who had been involved with soya at Royal College of Agriculture *(Hochschule für Bodenkultur)* in Vienna. He wrote a confirming report, that a good yielding, early maturing variety was now at hand. This first domestic variety was small seeded and black. It was called Platter SS (Black Seeded) 14.

"Using only newspaper articles and a small price list, I propagated soybean culture. I pointed out its significance as human and animal food, established connections with central authorities in China, and exchanged experiences and breeding material with research stations in Manchuria. The Chinese Eastern Railway soybean station in Harbin, which then employed a staff of 20 scientists, published annually a hefty volume with research results dealing with all questions of culture, breeding and utilization. In this way, Austria received new breeding material from Manchuria–over 80 soybean varieties. But in Platt they failed to perform up to our expectations because of the longer vegetation period.

"Meanwhile, from the small-seeded SS 14 a very large seeded strain was selected. In the price list of 1929, eight lines appeared, with maturity times ranging from 114 to 128 days. One thousand seeds weighed 158 to 170 gm. Yields steadily improved throughout 1929. In the same year, the new varieties of Platt Yellow and Platt Yellow Giant were made available in small quantities for research. A table (p. 14) shows that 100-gm packets of mixed types were sold, including many black types and Professor Früwirth's Black Eyebrow, all prefaced by the word 'Platter.'

Note: This is the 2nd earliest document seen concerning the cultivation of soybeans in Persia [renamed Iran in 1935]. Address: Braunsdorf–Vienna, Austria.

155. Brillmayer, Franz A. 1947. Geschichte der Einfuehrung der Soja in Oesterreich [History of the introduction of the soybean to Austria. II. (Document part)]. In: F.A. Brillmayer. 1947. Die Kultur der Soja in Oesterreich. Vienna: Scholle-Verlag. 97 p. See p. 14-18. [Ger]

• ***Summary:*** In 1928 a breeding station was opened for the CSR by Dr. Georg Hanreich at Wositz in south Mähren [Moravia] and on the existing steam mill *(Dampfmuehle)* a soya factory (Soja-san) was constructed.

Also in 1928 the experiences with soybean culture in Austria were self-published in a brochure by Brillmayer-Drahorad entitled *Die Sojabohne, ihre Bedeutung, Kultur, und Verwendung.* J. Helmus translated this brochure into Dutch under the title *Soja-Cultur, een National Belang.* It was published by Ten Hagen's Drukkeriy en Uitgevers Mij, den Haag.

In 1931 Dr. Drahorad was asked by the Turkish government to take charge of growing the first Austrian-bred soybean seeds they had purchased. He received a leave of absence and traveled via Constantinople to Samsun on the Black Sea. The growing went smoothly, despite floods which the soybeans survived miraculously. The growing area was steadily expanded.

"Two or three years later [in about 1933 or 1934] a man was sent to visit me by the Shah of Persia to buy Austrian-bred soybeans. Astonished, I asked him how the Shah came to know about Platt in Lower Austria. He answered that the director of the sugar factory in Alpullu, Turkey, while visiting the Shah, spoke so enthusiastically of the success of the soybeans bred in Platt, that the Shah decided to send a buyer to Austria for soybeans and to Germany for fodder turnipseeds *(Futterruebensamen; Brassica rapa).* According to reports of the Director of the Agricultural Academy in Tehran, Dr. E. Gauba, the soybean cultures are growing nicely there."

In the early 1930s, because of the propaganda in Austria, there was much interest in growing soybeans, especially among the small farmers of the Alpine districts who did it on a trial basis. Some got good results; some were disappointed. Here and there large operations started. Enthusiastic letters arrived; most wanted to sell the harvest at a high price as seeds, which hurt expansion of the crop as it was too expensive for industry to buy. In those days, Austria was flooded with low-cost soybean meal *(Sojaschrot)* for fodder use, so there was little stimulus for home production of soybeans. They could not sell for more than the cost of production. The production of soybeans for seed in Austria was only about 1,000 kg/year.

"Meanwhile in Germany agronomic trials were conducted, especially in Lower Silesia *(Niederschlesien),*

where the Platt Yellow Giant ripened. There were also good results in Schleswig, and in Westfallen the crop became established. On the average in these days, we delivered seeds for trials to about 100 operations each year.

"In 1932, because of a tax on the license for the multiplication and selling of seeds inside Germany, the way was paved for dealings with Delitzsch Rapeseed Breeders, Inc. in Delitzsch [near Leipzig]. But it was broken off at a discussion in Berlin. The next year brought unification, and then in Delitzsch I started the first breeding nurseries *(Zuchtgärten)* and helped with many operations in the area to build seed multiplication fields.

"In 1934 the Soja Cultur en Handelmaatschappij Nederland NV was founded in Voorburg, Holland. It bought soybeans from Austria but the climate was not very favorable and the organization had little drive.

"In 1935 Mr. A. Dieckmann from Heimburg am Harz came to Platt to see the soybean breeding operation and fields, and for negotiations on selling breeding material in Germany. Dieckmann had already, years ago, conducted soybean trials. The negotiations came to no conclusion and he ended up acquiring breeding material for Heimburg from Professor Dr. G. Riede in Bonn, Director of the Institute of Plant Culture and Breeding *(Pflanzenbau und Pflanzenzuechtung).* I was invited to Heimburg and helped with the establishment of the first breeding nurseries.

"At the same time [in 1935] the Department of Agriculture of the Greek government purchased a large amount of soybean seeds. Despite enquiries, no news could be obtained concerning their success.

"In 1936 a finance group in Paris took an interest in soybeans from Platt. A delegation consisting of Messrs. Leplanquais, van der Weyde, and Rousseau came to Vienna to inspect the breeding and seed multiplication operations, as well as Dr. Winkler's processing factory *(Veredlungsfabrik).* On the best of terms–which still exist today–a corporation was founded named SAIS *(Société Agricole et Industrielle du Soja, S.A.),* with capital of 1 million francs. The headquarters were in Casablanca, French Morocco, with a central bureau in Paris.

"At St. Sylvain d'Anjou near Angers in the Loire valley they bought land and planted Austrian soybean seeds. I traveled to Germany four times a year for the establishment of the breeding nurseries, observation of the vegetative stage, harvest, and working up of the material. The successes were encouraging.

"At the same time (1936) a large planting of soybeans in Morocco was planned. According to climatological data obtained from several weather station in Morocco, Dr. Drahorad and Dr. Kopetz in Vienna came to the opinion that the weeks between Christmas and New Year would be a good time for planting." But there were delays. In 1936 or 1937 the director in Morocco ordered 15,000 kg of Platt Yellow Giant and inoculum, via Casablanca. All went well with the shipment–but then there was no rain. The seeds sprouted, then withered under the Moroccan sun. Not a single seed was harvested.

Thereby SAIS lost half its capital. They planted smaller plots the next year. Brillmayer was supposed to supervise it and fly to Casablanca, but the Spanish Civil War prevented him from getting a visa at the French embassy in Vienna. So he guided the crop by remote control from Austria in an exchange of airmail letters and photos. The crop succeeded in Austria.

During the German occupation of France, Brillmayer was called to France to continue the breeding work done earlier. How was he, assigned as a military commander for France, to do large scale propaganda encouraging French farmers to grow soybeans. The breeding nurseries were established in the south of France at Lamagistere on the banks of the Garonne. Colonel Fauché was in charge. The original SAIS was rebuilt during the war; the group Beauvois Freres entered. General Médecin Saurel was its president. The soybeans prospered, and acreage was expanded into the provinces near the French-Spanish border: in Basses Pyrennées, in the valley of the Adur, in Tarn et Garonne, and in Lot et Garonne. By the time of the American invasion (June 1944), several thousand hectares were planted with Austrian soybean varieties.

In 1937, a Sojaring, consisting of Austrian soybean growers, was founded in Vienna to represent their interests. (In 1947 its headquarters were at Schauslergasse 6, Wien I, Austria). In 1939 two new soybean varieties were introduced, Angerner and Wolfsthaler. Much good work was done and the area planted in soybeans expanded from 68 hectares (ha) in 1937 to 654 in 1938, to 1,527 in 1940, to 2,461 in 1944. Likewise, the number of participating farm operations grew, from 16 in 1937 to 868 in 1944. From small beginnings–from a matchbox of seeds–a considerable soybean growing movement had arisen in Austria. The main producing area was Lower Austria *(Niederösterreich),* which produced a peak of 803 tonnes in 1940. Next was Vienna, then Kärnten, and Steiermark was far behind with 76 tonnes. The peak yield in Steiermark was 3,300 kg/ha in 1939. The best yields in the area ranged from 2,100 to 3,300 kg/ha during the period from 1937 to 1943. Detailed statistics for hectarage, production, and yield are given for each area from 1937 to 1944.

Note 1. This document contains the earliest date seen (June 2007) for soybeans in Greece, or probably for the cultivation of soybeans in Greece (1935). Yet we cannot be sure that these soybeans were actually cultivated in Greece.

Note 2. This is the 2nd earliest document seen (Dec. 2007) that clearly refers to soybeans in Persia, or the cultivation of soybeans in Persia [renamed Iran in 1935]. This document contains the earliest date seen (Dec. 2007)

for soybeans in Persia, or the cultivation of soybeans in Persia (1933-34). The source of these soybeans was Brillmayer in Austria.

Note 3. This document contains the earliest date seen (Dec. 2007) for soybeans in Turkey, or the cultivation of soybeans in Turkey or the Middle East (1931). The source of all these soybeans was F.A. Brillmayer in Platt, Lower Austria. Address: Braunsdorf–Vienna, Austria.

156. Brillmayer, Franz A. 1947. Geschichte der Einfuehrung der Soja in Frankreich [History of the introduction of the soybean to France (Document part)]. In: F.A. Brillmayer. 1947. Die Kultur der Soja in Oesterreich. Vienna: Scholle-Verlag. 97 p. See p. 20-23. [Ger]

• ***Summary:*** The first soybeans in France were grown at the *Jardin des Plantes* in Paris in 1779, and served mainly scientific interest. In 1857-58 the National Society for Acclimatization did culture trials in Vitry sur Seine and got good results. The seeds were planted May 10-12, they set flowers July 25, were harvested at the end of October, and yielded an average of 183 seeds per plant. In 1859 the House of Vilmorin-Andrieux had a bad harvest with late varieties from China. After the 1873 Vienna Exposition, the work of Prof. Haberlandt and his writings had their effects in France.

On page 21 the author refers to the soybean as *die Sojarrucht.* Address: Braunsdorf–Vienna, Austria.

157. Brillmayer, Franz A. 1947. Die Bedeutung der Soja fuer die Ernaehrung Oesterreichs [The significance of soya in the nutrition of Austria]. Vienna, Austria: Wilhelm Frick Verlag. 103 p. Illust. 21 cm. [Ger]

• ***Summary:*** 1. Austria's food situation: The country cannot feed itself. 2. The human organism as a motor (with certain fuel/nutritional/food needs). 3. How do we feed ourselves? How to grow enough food when the percentage of agricultural land is constantly shrinking. 4. The soybean *(Die Soja)* as a nutritional factor: The soybean is the most concentrated foodstuff, and is also called "meatless meat." Comparison of the nutritional value of soybeans with animal products. Protein and fat. 5. Soya in our kitchen: 20 years ago the use of soya in Austria was promoted in the form of Edelsojamehl, made largely from foreign-grown soybeans. Products now made from soya (dry egg substitute, soybean paste, nuts, almonds, cocoa, coffee). Debittering of soybeans *(Sojaentbitterung).* How does one cook with soya? Green vegetable soybeans *(Gruene Sojakoerner;* similar to green peas in the pods), soy sprouts, soya tea. Soybean recipes for 6 people by Frau Friedl Brillmayer (17 pages of Austrian-style recipes). 6. Soybean production in Austria and the possibilities for its expansion: Statistics on increase in planted hectares and number of growers from 1937-1944. 7. Possibilities for industrial uses of soybeans. 8. Soya as a fodder plant: Green fodder, hay, silage, ground soybeans *(Sojapflanzenmehl),* straw and chaff, soybean cake and extracted meal, industrial waste. 9. The effect on agriculture, the nutrition of the people, and maintenance of their good health: Measures needed for gaining acceptance and success in Austria.

Page 68 notes: "The soybean pioneer in Austria was Prof. Friedrich Haberlandt of Vienna, starting in 1878. His interest in the significance and relevance of soya for Austria was aroused by the Chinese booth at the Vienna World Exhibition *(Wiener Weltausstellung).* In the following years he worked successfully to introduce the plant and make it better known. On the basis of extensive variety trials, he confirmed his hypothesis, that the soybean would do well wherever maize (corn) would ripen. In those days, however, the varieties used did not ripen as early as those available today, and because of this the main areas where trials were conducted lay in south Hungary, Croatia [before 1991 a republic of Yugoslavia; the capital is Zagreb], and Dalmatia [a region on the Adriatic coast of Yugoslavia, and a former Austrian crownland]. Haberlandt's varieties ripened too late to be grown in the area that is today Austria. And since the Monarchy had enough food, the soybean soon disappeared and came to be forgotten.

In 1920 in Austria, after a long pause, the first soya acclimatized in Austria was planted. Once again soybean production began in this country.

"Starting in 1921 Prof. Dr. Drahorad and I began cooperative work at Platt in lower Austria (Niederoesterreich). The varieties we used were adapted over a number of years using strict selection processes. Then in the following years we initiated preliminary trials in all the Austrian provinces (Bundeslaendern).

In 1929 the first soybean exposition was held in the banquet hall of the country villa at Linz (Landhaus in Linz), sponsored by the Austrian Department of Agriculture (Landwirtschaftskammer), and there were already more than 100 samples exhibited, all from upper Austria (Oberoesterreich).

"Up until 1937 about 1,400 farmers in Austria were registered, part of them grew soybeans experimentally and part of them expanded their production area year after year.

"But there was no ready market. Soya was so cheap on the world market, that its production in Austria was not profitable. The world market price dropped to its lowest level in 1933, £6.07 sterling per tonne! The unassuming and easily satisfied Chinese peasant could produce soybeans so cheaply that the nutritional value of a kg of meat cost 5 times as that from a kilogram of soya...

"The Viennese soybean industry that existed at the time using primarily imported soybeans, decided to support and buy Austrian-grown soybeans and voluntarily paid the higher price. Nevertheless, because of the low world market price, the possibilities for sale were at hand, but the price offered no incentive to expand soybean acreage.

"Contrary to this was the promotion I did for soya as being excellent fodder, and defatted soybean meal soon came to be widely used in this way.

"Thus did the soybean breeding work, with financial support, start again. We then succeeded in moving our Platt breeding operation partially to foreign countries, to Voorburg in Holland, to St. Sylvain d'Anjou in France, and to Casablanca in Morocco. On a modest scale, soybeans grown in Austria could also be exported. Also several large batches were dispatched. So to Turkey and Greece, to Dobruja [a region now in southeast Romania and northeast Bulgaria], to Persia, Holland, and France, and a shipment of 15,000 kg of "Platter gelben Riesen" to Morocco.

"In 1937 the Austrian soybean growers formed a "Soya Ring," in order to better represent their position as a solid organization. Soon new soybean breeding places developed, and from them came new varieties: the Angerner and the Wolfsthaler. The Soya Ring continues to expand.

"During World War II, I.G. Farben had large areas planted to soya in Romania, Bulgaria, and Yugoslavia. This total area reached a peak of about 150,000 hectares in 1942.

In 1937 in Austria, only 16 farmers *(Betriebe)* grew 68.14 hectares yielding 83,521 kg of soybeans (1,226 kg/ha). In 1940 this increased to 315 farmers growing 1,526.99 ha yielding 957,809 kg of soybeans (627 kg/ha). In 1944 868 farmers grew a record 2,461.17 ha of soybeans (production not given). The four main growing areas, in descending order of number of hectares grown in 1944, are: Lower Austria and Burgenland 1,311.67, Kaernten and Steiermark 71.54, Vienna 46.27, and Upper Austria 1.24. The climate in Austria varies widely from region to region. Production is measured in units of Doppelzentner (dz); 1 Doppelzentner = 100 kg. In 1943 the best yield in one region was 28.00 dz/ha (2800 kg/ha or 41.6 bu/acre) in Lower Austria. The best yields per region rose from 2,100 kg/ha in 1937 to 2,800 kg/ha in 1943, both in Lower Austria. Address: Austria.

158. Morse, W.J. 1950. History of soybean production. In: K.S. Markley, ed. 1950. Soybeans and Soybean Products. Vol. I. New York: Interscience Publishers or John Wiley & Sons. xvi + 1145 p. See p. 3-59. [59 ref]

• ***Summary:*** Contents: 1. Origin. 2. Ancient history. 3. Modern history. 4. Description of soybean plant. 5. World distribution. 6. Climatic adaptations. 7. Soil preferences. 8. Soil erosion and practices. 9. Varieties and variety improvement. 10. Fertilizer and lime requirements. 11. Inoculation. 12. Cultural methods: Preparation of seedbed, methods of seeding, time of seeding, rate of seeding, depth of seeding, cultivation. 13. Rotations. 14. Mixture with other crops. 15. Hay production. 16. Seed production. 17. Soil improvement. 18. Diseases. 19. Insect enemies. 20. Other enemies (rabbits, pigeons, pheasants).

"Varieties now grown in the United States may be divided into three general groups, namely commercial (grain), vegetable, and forage. Varieties for commercial seed production are preferably yellow-seeded and are used largely for processing for oil, meal, and soybean flour, but these varieties may also be used for forage purposes if heavier rates of seeding are used. The varieties used principally for forage and green manure are the black- and brown-seeded varieties, which for the most part are low in oil but yield a finer and heavier forage than the commercial and vegetable varieties.

"The term 'vegetable varieties' has been applied to varieties introduced from oriental countries where they are used solely as green vegetable or dry, edible soybeans. In extensive tests of the quality of the green and dry beans made by the Bureau of Human Nutrition and Home Economics, Department of Agriculture, and by departments of home economics of various agricultural colleges, the vegetable varieties have proved much superior to the field or commercial varieties in flavor, texture, and ease of cooking. Many of these vegetable types have been found through experiments to be superior to commercial types for soybean milk, soybean flour, soybean curd, salted roasted soybeans, and other food products. (See Chapter XXV). The varieties used for processing and forage purposes usually do not cook easily and have a raw 'beany' flavor. Nearly all vegetable varieties cook easily and have a sweet or bland nutty flavor. The most suitable vegetable varieties are those with straw-yellow, greenish-yellow, or green seed, although a few black, brown, and bicolored varieties do have superior qualities as green shelled beans. Vegetable varieties, ranging in maturity from 75 to 175 days, have been developed for all soybean-producing areas in the United States.

"Several commercial companies have canned large packs of the green shelled beans of the vegetable varieties. Quick-frozen green shelled beans alone and in succotash have been placed on the market by several companies, the frozen product being highly satisfactory in color, texture, and flavor. For canning or quick freezing in the green stage, the yellow- and green-seeded varieties make a more attractive product than the black-, brown-, or bicolor-seeded varieties. Vegetable varieties have also become quite popular with the home gardeners and many seedsmen in various sections handle two or more varieties" (p. 22).

Listed from very early to very late, vegetable varieties include: Agate, Sac, Bansei, Kanro, Mendota, Hokkaido, Jogun, Aoda, Funk Delicious, and Seminole.

This chapter contains many interesting photos and a map. 1. Wild soybeans, cultivated soybeans, and *Glycine gracilis.* 2. Unloading soybeans from farm carts and storing the seed in osier bins in a Chinese merchant's storage yard–Manchuria. 3. Map of the principal soybean seed producing areas and countries of the world. 4. A soybean grain market in Korea. 5. "Fertilizer used for soybeans by Manchurian

farmers is compost placed in piles in the field and scattered between rows of previous year's crop just before planting soybeans." 6. Roots of soybean plant showing abundant development of nodules. 7. Ordinary grain drill (pulled by a tractor) may be used in sowing soybeans in rows or close drills. 8. Soybeans sown by hand on ridges in rows about 21 inches apart in Manchuria. Two horses pull a wooden plow. 9. Korean woman planting soybeans along ridged rows. 10. Soybeans planted along edges of rice paddies in Japan, China, and Korea are used for home consumption. 11. Cultivating soybeans in rows, using a tractor-pulled rotary hoe, weeder, or harrow, in the Corn Belt. 12. Hand-cultivation of soybeans in Manchuria. 13. The Korean farmer grows many other crops with soybeans: millet, mung beans, buckwheat, sesame, susu, or castor beans. 14. A field of soybeans and Kaoliang in China planted in alternate hills. 15. The combine has been one of the most important factors in the economic production of soybeans in the United States. 16. Harvesting soybeans by hand methods in Manchuria. 17. Threshing soybeans in Manchuria using a stone roller pulled over the plants by horse or donkey. 18. Primitive wind method of separating soybean seed from threshed plant material in Manchuria. 19. Korean farmers threshing soybeans with bamboo flails on the home threshing ground. 20. Japanese farmers turning under soybeans in a rice paddy for soil improvement. Address: 6809 Fifth St. N.W., Washington, DC; formerly Principal Agronomist, Div. of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, USDA, Beltsville, Maryland.

159. Morse, W.J. 1950. History of soybean production: 3A. Modern history in Asia and Europe (Document part). In: K.S. Markley, ed. 1950. Soybeans and Soybean Products. Vol. I. New York: Interscience Publishers or John Wiley & Sons. xvi + 1145 p. See p. 6-9.

• ***Summary:*** "The origin of soybean culture in Manchuria is not definitely known, but it is supposed to have been brought from central China many centuries ago. At first soybeans were grown only for food but when they became a source of oil, production gradually increased. No mention has been found of soybean oil in ancient Chinese literature, so it is concluded that the crushing of soybeans for oil occurred in comparatively recent times. The production of soybeans, however, was more or less localized until after the Chinese-Japanese War (1894-1895), when Japan began to import the soybean oil cake for fertilizing purposes, resulting in a sudden expansion of demand for this product. Soybean cake became the chief end product of the oil mill industry. The Russo-Japanese War brought about a wider interest in the soybean and its products; shipments were made to Europe about 1908 and the soybean assumed worldwide attention. Acreage and production increased rapidly and the soybean became one of the most staple crops and exports of Manchuria.

"The soybean was first brought to the attention of Europeans in 1712 by Engelbert Kaempfer, a German botanist, who spent two years, 1691-1692, in Japan. Although Kaempfer discussed in detail the various food products prepared from the soybean by the Japanese, little interest was taken in the crop. According to Dale's *Pharmacologiae*, it is evident that European pharmacologists were familiar with the Japanese soybean and its medicinal uses in 1751. Soybean seed sent from China by missionaries was planted as early as 1740 in the Jardin des Plantes, Paris. The plant was experimented with at various times after this date and in 1855 the *Société d'Acclimatation* distributed seed but did not succeed in establishing a permanent culture of the plant. The soybean was grown in 1790 in the Royal Botanical Gardens, Kew, England, but apparently no effort was made toward its culture as a crop. The greatest impetus given soybean cultivation in Europe was the work in 1875 and subsequent years of Friedrich Haberlandt of Vienna, who published the results of his work in much detail. Haberlandt obtained seed of nineteen varieties–Chinese and Japanese–at the Vienna Exposition in 1873. Only four of these varieties matured and in 1877 seed was distributed to various co-operators throughout Europe. Although most of the tests gave fairly promising results, and Haberlandt strongly urged the use of the soybean as a food plant for both man and beast, the soybean failed to obtain any great importance until about 1909. Previous to this time efforts had been made to introduce the soybean and its products–oil and oil meal–from the Far East into European markets in competition with similar products manufactured from other oleaginous seeds, but they were generally unsuccessful, chiefly because of the inferior quality of the meal and oil, and unfavorable shipping conditions for the seed. Although attempts to grow soybeans in European countries have extended over many years, in general, the climatic conditions are not well suited to the successful culture of the crop. At present, production is largely confined to parts of European U.S.S.R., Austria, Bulgaria, Yugoslavia, Czechoslovakia, and Rumania." Address: 6809 Fifth St. N.W., Washington, DC; formerly Principal Agronomist, Div. of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, USDA, Beltsville, Maryland.

160. Bening, W. 1953. Soy flour and milk powder in Europe. I. *Soybean Digest.* Feb. p. 18-19. See also Part II. March, p. 20-21. Part III. April, p. 20.

• ***Summary:*** Discusses the pioneering work with soya done by six Europeans: 1. A. Urbeanu, a medical doctor in Bucharest, Romania, published his first Romanian booklet on soya in 1905. It recommended the bean for systematic fortification of the national diet. Urbeanu's publication was

the first suggestion of a complete soya project in Europe that included growing and processing. Little attention was paid to it. Its ideas were too strange. Thirty years later the Rumanian government successfully developed a large-scale soybean-growing program, for export. A subsequent book titled *Soia,* by Iona Mavrodi Cornea and Mihai Gr. Romanscanu contained Urbeanu's earlier report.

2. Friedrich Haberlandt, an Austrian botanist, first noticed soybeans at the Vienna World Exposition of 1873. He procured 19 soybean seed varieties there for planting in test plots at the High School for Soil Cultivation in Vienna. These were successful and by 1877 there were 144 soybean test plots using seed obtained from Haberlandt scattered throughout Europe. Haberlandt cooperated with the physiologist Heck to develop food uses of soybeans. They developed a potato-soya dish that their families and professor-friends ate with relish. Haberlandt died in 1878 and with him his work–except for his book *Die Sojabohne.*

3. Laszlo Berczeller was a doctor in Budapest, Hungary. He was interested in providing sufficient low-cost protein for all people. 4. Li You Ying, the famous Chinese soya specialist and Dr. L. Grandvoinnet built a factory in Paris, France, to make foods from soybeans and wrote an excellent monograph on the soybean.

161. Santifaller, L. 1959. Oesterreichisches biographisches lexicon [Austrian biographical lexicon, 1850-1950: Friedrich Haberlandt]. Graz-Koeln, W. Germany: Verlag Hermann Boehlaus Nachf. See vol. 2, p. 124. [7 ref. Ger]
• ***Summary:*** Gottlieb Friedrich Johann Haberlandt was born on 22 February 1826 at Bratislava (called Pressburg in German), a city on the Danube in Slovakia, Czechoslovakia. He studied at the agricultural college in Hungarian Altenburg, where he was active from 1851 to 1853 as assistant professor and from 1853 to 1869 as professor. In 1860 he published his first important work, *The Most Important Plants and Weeds Classified by Where They Grow.*

On the basis of his work with silkworm diseases, he was invited in 1869 to be director of the newly established sericulture research station at Goerz. In 1871 he published *Mulberry Silkworms: Their Rearing and Diseases.* In 1872 he was invited to be professor of agronomy and applied botany at the newly established Royal College of Agriculture *(Hochschule für Bodencultur)* in Vienna. From 1873 to 1874, as Chancellor, Haberlandt was one of the most distinguished followers of the school of Justus Liebig, who established the close association of theory and practice as the basis of agronomy. Haberlandt's areas of specialization included research on seed germination and transpiration in cultivated plants, the promotion of agricultural seed exchanges, and studies in soil science. In 1875 and 1877 he published "Scientific and Practical Research on Plant Cultivation."

The last years of his life were devoted to soybean cultivation in Austria, Germany, and Central Europe. Haberlandt died on 1 May 1878 at the rather young age of 52 years and 2 months. He was the father of Gottlieb Haberlandt (1854-1945), a professor of Botany in Berlin, and of folklorist Michael H. Haberlandt. He was grandfather of Edith Haberlandt and of physiologist Ludwig H. Haberlandt, all of whom became famous in their respective fields.

162. Shurtleff, William; Aoyagi, Akiko. 1981. Friedrich J. Haberlandt: History of work with soyfoods. Soyfoods Center, P.O. Box 234, Lafayette, CA 94549. 10 p. Sept. 22. Unpublished typescript.
• ***Summary:*** A comprehensive history of the subject. Contents: Introduction: Summary, sources of information. Biographical sketch: Born 1826, early education. Early work with soy: first encounter 1873 at Vienna Exposition, first experiments (1875), earliest publication seen (1876), "Der Anbau der Rauhaarigen Sojabohne" (1877). *Die Sojabohne* 1878: Summary of the book, information about soyfoods. Subsequent influence on soy: Death in 1878, posthumous publications, other Viennese soyfoods pioneers (son Gottleib), loss of momentum in European work with soy after his death, Morse's observations in 1950, size of crop today in Eastern Europe, influence in America. Address: Lafayette, California. Phone: 415-283-2991.

163. Wolf, Anton. 1983. Re: More publications about soybeans from Austria. Letter to William Shurtleff at Soyfoods Center, May 3–in reply to inquiry. 1 p. Typed, with signature. [3 ref. Eng]
• ***Summary:*** Thank you very much for your letter; I had no difficulty in understanding it. I am sending you the publications you requested, *Die Deutsche Sojabohne* and also *Die Soja,* by Fürstenberg (1917), as well as an article from *Trend* (Austria) (May 1983). This article is an answer to the letter by Dr. Fangauf!

May I call to your attention an error in your documentation. The area that Haberlandt called *Istrien* lies not in Tirol, but rather was a Crownland in Austria-Hungary at that time, and has been in the possession of Yugoslavia since 1945.

I will try to find the publications by Dr. Winkler in our national library. If you want anything else, I will make my best effort to help you. Address: Dipl.-Ing. Zentralanstalt fuer Meteorologie u. Geodynamik, A-1190 Wien [Vienna], Hohe Warte 38, Austria.

164. Cittadino, Eugene. 1990. Nature as the laboratory: Darwinian plant ecology in the German Empire, 1880-1900. Cambridge and New York: Cambridge University Press. xi + 199 p. Illust. 24 cm. *

• ***Summary:*** The young Darwinian plant ecologists were a new breed at this time. The old guard resisted them and made it difficult for them to find established positions. So they went out to the colonies to study.

165. *Giornale della Soia (Il) (Italy).*1992. La soia nell'Impero Austro-Ungarico [The soybean in the Austro-Hungarian empire]. 8(1):31-33. Jan. [1 ref. Ita]
• ***Summary:*** This is a reprint from the section on the history of the soybean in Europe from the book *La Soja* by Fulvio Bottari (p. 39-45), published in 1923. Contains a long discussion of the work of Friedrich Haberlandt and a photo of Francesco Giuseppe.

166. Kolak, Ivan; Henneberg, R.; Milas, S.; Radosevic, J.; Satovic, Z. 1992. Soybean breeding and seed production in Croatia–Current status and perspectives. *Eurosoya* No. 9. p. 76-84. Dec. [31 ref]
• ***Summary:*** "Soybean seed was introduced from China by sailors from Dubrovnik for the first time in 1800 and, the same year it was planted in Dubrovnik, Konavle, Slano and Ston under the name 'Chinese yellow beans' (p. A. Buconjic 1804 cit. according to fra. I. Simic, 1826). Soybean was spread from Dubrovnik to the Neretva Valley (Opuzen, Metkovic, Caplijna, Mostar) and the seeds were used for human consumption and as poultry feed. The Franciscans from Dubrovnik selected the best plants from crops and the seed was sold on markets. As early as 1804 the seed selected within soybean population was sold under the name "Dubrovnik yellow beans" and since then individual selection of soybean population began. During the 19th century, by constant selection of the best and healthiest plants, soybean production began to be based upon domesticated and well adapted indigenous populations and selected lines. Soybean was grown mainly in gardens and rarely as a major crop. It was used for human consumption and as feed for livestock.

"A planned introduction of soybean to Croatia was initiated by the Austrian biochemist Friedrich Haberlandt (lived 1826-1878) after the seed exhibition in Vienna in 1873. He introduced about 20 cultivars from China, Japan, Korea, Tunisia and Transcaucasia and carried out several multicultivar adaptation trials from Bohemia to Dubrovnik. Unfortunately his intentions were misunderstood and that was the main reason why soybean did not spread significantly in Croatia at that time.

"More comprehensive work on the introduction of soybean in Croatia was carried out by Stjepan Cmelik in Korija near Virovitica. The lack of cattle feed in 1921 stimulated him to import several cultivars from China and Manchuria. He tested them and selected only those plants which reacted favourably to agroecological conditions. In this way he started soybean selection in Croatia and after several years the so-called 'Cmelik's soybean' was developed and largely extended over the regions of Posavina and Slavonija region (maturity group 1). Friedrich Reiner continued to grow 'Cmelik's soybean' on his farm near Osijek selecting the best plants and he created his own improved cultivar named 'Osjecka'. Between 1931 and 1934 seed yield of the cultivar 'Osjecka' varied from 1.6 to 2.2 tons/hectare and that was the reason why it was extended over Podunavlje, Posavlje, Romania and Bulgaria.

"Academician Alois Tavcar brought Manchurian soybean populations from Prague [Czechoslovakia] in 1918 and began his research work at the Faculty of Agriculture and Forestry in Zagreb. By individual selection of the best plants from introduced populations he released the first domestic soybean cultivars M 7, M 14 and M 60 (M stands for Maksimir, experimental field near the Faculty of Agriculture in Zagreb). These cultivars had shorter vegetation than Cmelik's and Osjecka and were spread in the production of the northwest region of Croatia, as well as in Slavonia and Srijem.

"During the second world war the old genotypes were saved. After the war more intensive soybean introduction and breeding started in Croatia. The new young generation of plant breeders–Tavcar's successors–continued to work on soybean breeding and seed production: V. Milinlkovic (1946-1950) and Ruzica Henneberg (1952-1953 and 1958-1992)–Tavcar's assistants at the Faculty of Agriculture in Zagreb; D. Palaversic (1946-1950) at the Institute for Plant Breeding and Crop Production in Botinec near Zagreb; M. Budisic (1945-1970), Marija Vrataric (1970-1992) and M. Krizmanic (1973-1978) at the Institute of Agriculture in Osijek; I. Vicic (1960-1980), F. Satovic (1960-1980) and I. Kolak (1973-1987) in the Croatian Agricultural Centre in Zagreb–Sesvete. During this period a considerable number of cultivars and lines were released...

"The world-wide gene-collections were established at the Faculty of Agriculture in Zagreb–Maksimir (Milinkovic, Henneberg), Zagreb–Botinec (Palaversic), Zagreb–Sesvete (Satovic) and Osijek (Vrataric). In the 1950s D. Palaversic started to work on maize breeding and the soybean gene-collection from Botinec was transferred to the Faculty of Agriculture, Zagreb–Maksimir. The same thing happened in 1987 with the gene-collection of the Croatian Agricultural Centre when I. Kolak came to work at the Faculty of Agriculture from the Centre. In 1982 Jasna Radosevic started to work on the soybean breeding programme at the Faculty of Agriculture.

"From 1950 to 1980 many introduced and domestic cultivars were examined in a network of small-plot multicultivar trials at various locations arranged in conjunction with the Agricultural Extension Service. From 1979 to 1989 the Faculty of Agriculture in Zagreb and Institute of Agriculture in Osijek joined the European network on soybean."

Graph 1 shows soybean area and yield from 1947 to 1990. Prior to 1981 soybean area was less than 5,000 ha; it reached about 5,000 ha in 1949, 1950, and 1973. During the 1980s soybean area grew rapidly from about 2,000 ha in 1980 to 27,000 ha in 1990. Yield rose steadily from about 600 kg/ha in 1947 to 2,000 kg/ha in 1959 to 2,750 kg/ha in 1989. Table 1 shows cultivars released in Croatia from 1804-1991, including the breeder's name, cultivar name, maturity group, year of release, production region, and range of yields. Table 3 shows minimal and maximal yields of Croatian soybean cultivars in small plot trials from 1980 to 1990. The record yield of 4.5 tonnes/ha was attained by the cultivar named Tisa at Darda in 1988.

Note: This document contains the earliest date seen for soybeans in Croatia, or the cultivation of soybeans in Croatia (1800). The source of these soybeans was China. Address: Faculty of Agriculture, Univ. of Zagreb, Svetosimunska 25, 41000 Zagreb, Croatia.

167. Kubová, Anna; Vavrac, Ján. 1993. Re: Soybeans and soyfoods in Slovakia. Letter to William Shurtleff at Soyfoods Center, Oct. 5. 3 p. Typed, with signature. [1 ref]

• ***Summary:*** Before Czechoslovakia was founded in 1918, Slovakia had been geo-politically a part of the Austro-Hungarian Monarchy, and in some sources you can recognize Slovakia as so-called "Upper-Hungary" as well. Besides, many former (mostly Hungarian or German) names of Slovak towns have been changed over the years.

The earliest references seen to soybeans within the boundaries of present-day Slovakia are found in Prof. Haberlandt's 1878 monograph titled *Die Sojabohne* (The Soybean). This book describes the first field trials with soybeans in 144 localities throughout western and central Europe. The information on the soybean trials in today's Slovakia appears in Part 3, titled "Culture trials in the year 1877," in the section on "Culture trials in Hungary and Croatia." Pages 68-71 list the results of 8 field trials made in the region that became Slovakia or the Slovak Republic after 1 Jan. 1993. Note that the names of some villages have been changed, as follows: #93 Pápa. #94 Kövesd or Kövesdö is a small village presently named Kamenicná (near Komárna). #99 Császtkócz is now Cásta (near Bratislava). #100 and #101 Szucsany is now Sucany (in Slovak transcription). #102 Poltár is near Lucenec. #104. Bálványos is now Balvany (near Levice). And #105 Kápolnás-Nyék is now Kaplná (near Bratislava).

"After the first unsuccessful attempts to introduce the soybean to our country, the crop somehow became forgotten, or was grown only in botanical gardens as a decorative plant. But some area of soybeans was being constantly maintained to a certain extent in southern Slovakia. The data show that in 1934 the area cropped with soybeans exceeded 1,000 hectares, which was quite a large area considering that we currently grow here approximately 3,000 hectares of soybeans.

"Promotion of soybean cultivation and support for its utilization have always been given little attention. The soybean market was already established in 1915. Except for this, soybean became interesting as an oil-seed crop as well as a source of high-quality protein apparently consumed by vegetarians.

"As far as we know, no history of soybean cultivation in Slovakia has ever been published. We were provided with a bibliography on soybeans by the Regional Agricultural Library located at the Agricultural Museum in Nitra.

"We are enclosing the names of two companies that make soyfoods in Slovakia and the Czech Republic. The first one makes tofu." (1) Alfa Bio s.r.o., Horná 37, Banská Bystrica, Slovakia. Phone: 088/242 35. Fax: 088/539 38. (2) Pragosoja spol. s.r.o., Vestinska 36, 153 00 Praha (Prague) 5, Czech Republic. Phone and fax: 59 43 16. Address: 1. Dep. of Plant Physiology; 2. Dep. of Plant Protection. Both: Univ. of Agriculture KFR, Tr. A. Hlinku C.2, SK-949 76 Nitra, Slovakia. Phone: +42-87-411 560.

168. Vollmann, Johann. 2002. Interest in soybeans and Englebert Kaempfer (Interview). *SoyaScan Notes.* Oct. 31. Conducted by Meagan Calogeras in Vienna, Austria. [2 ref. Eng]

• ***Summary:*** Prof. Vollmann, who is writing a book on the history of the soybean, is very interested in the works of Engelbert Kaempfer [1651-1716, German physician and traveler] which can be found in *Economic Botany.* He also knows Blomeyer (Leipzig), who said it was not possible to grow soybeans in Europe. He is also interested in the works of Prof. T. Hymowitz. He mentioned F. Anderegg, from Thur [Chur], Switzerland, who concluded that the soybean was perfect for cultivation in Switzerland. He has Franz A. Brillmayer's 1947 work *Die Kultur der Soja in Oesterreich.*

Prof. Vollmann's future project is to go around to those places where Prof. Haberlandt cultivated soybeans in Hungary and along the Austro-Hungarian border.

He talked about the popularity of soyfoods and the names of some restaurants where one can eat them. Address: Univ. of Agricultural Sciences, Plant Breeding Department, Gregor Mendel Str. 33, A-1180 Vienna, Austria; IPP (Inst. fuer Pflanzenbau und Pflanzenzuechtung), Vienna, Austria.

169. *SoyaScan Notes.*2008. Historical research on the dissemination of the soybeans worldwide: Wish list (Overview). Compiled by William Shurtleff of Soyinfo Center.

• ***Summary:*** In the record titled "Countries, overseas dependencies, and Canadian provinces in which we have no record of soya ever having been cultivated (Overview)," try

to find when and where soybeans were first cultivated in each of these geographical areas.

Africa: In 1873 Prof. F. Haberlandt obtained soybeans from Tunisia. What was his source? When, how and from where were these soybeans first introduced to Tunisia?

Asia–Central: In 1873 Prof. F. Haberlandt obtained soybeans from Transcaucasia. What was his source?– Perhaps the Republic of Georgia. When, how and from where were these soybeans first introduced to Transcaucasia. Clarify when and where soybeans were first cultivated in the Republic of Georgia (before 1911, maybe before 1873), and in Kazakhstan (before 1940), and in general in Transcaucasia. Learn more about the work of G. Sturua with soybeans.

Canada–The story of the arrival of the soybean in Canada between 1855 and 1894 needs to be researched. There must be some early records, similar to those from the Commissioner of Patents.

Europe–Western: Make a good translation of F. Haberlandt's 1878 classic *Die Sojabohne*, accompanied by 2 maps of the places in Europe where Haberlandt and his cooperators grew soybeans (one of the area in 1878 and one now; travel in Eastern Europe to get these) and a database for making a good overview: What kind of people tested the soybeans? (Gutsbesitzer, Freiherr, Schloss-gaertner, agricultural institutions, etc.). Who got the best yields and where? In Aug. 1878 Prof. Friedrich Haberlandt wrote: "In Tirol [Tyrol, Austria] the soybean is called the Coffee Bean *(Kaffebohne)* and used to prepare a coffee substitute." When and how were these soybeans introduced to Tirol?

Europe–Eastern: Write a biography of Mr. Ovsinskii (Also spelled Ovsinski, Owinsky, Ovinsky) of Podolia, Ukraine (See Sempolowsky 1900) who traveled to Asia, introduced soybeans to Russia, was the first man in Russia to grow and test them extensively, then publicize their many virtues.

USA: Write a good history (with a good bibliography) of Chinese growing and processing soybeans in California. They must have grown them between 1849 and 1899! Likewise with Japanese growing soybeans in California.

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