Soybeans: survey of the abstract literature, January 1935 to April 1936

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SOYBEANS

SURVEY OF THE ABSTRACT LITERATURE

JANUARY 1935 TO APRIL 1936

BY

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C O N T E N T S

SOYBEANS

A Survey of the Abstract Literature

1935 - 1936 (April)

Scope of Report

This report presents a review of the abstract literature for the year 1935 and the first few months of 1936. It comprises material from Chemical Abstracts (American), British Chemical Abstracts A and B, Chemisches Zentralblatt, Engineering Index, Experiment Station Record, all for 1935, Industrial Arts Index and Agricultural Index to April 1936, Chimie et Industrie, January to June 1935. The original articles were not consulted but information that seemed of interest, so far as such was available in the abstracts, has been incorporated.

Summary

It is evident that interest in soybeans and their development continues to advance at an ever increasing rate. No sensational developments are recorded. Two industrial fields which seem to have been the most promisingly active are the use of soybean oil in paint manufacture and the development of uses for soybean lecithin. In Japan it is asserted that the use of soybean lecithin in the preparation of rubber will give a product with superior characteristics. The use of soybean casein must also be mentioned, though the literature on this subject is meagre. Some work on the hydrogenation of soybean oil has been published in Japan; and in Germany a patent has been issued for the production of octadecyl stearate (a waxy compound) by this means.

Several methods have been published for deodorizing, deflavoring and decolorizing soybeans for use in making bread and other food products.

Explosions in soybean extraction plants have shown the process to be a hazardous one.

Considerable quantities of soybean oil are stated to have been used in paint manufacture in the United States. The direction of research has been towards improving its drying properties by suitable blending and the development of special driers.

Soy sauce and similar fermented products have received experimental attention in the Far East.

Canadian imports of soybean products fell in 1935 as compared with 1934, the single exception being soybean oil for manufacturing soap, which increased over five times. There were no exports.

A great deal of work was carried out on animal nutrition, but with no definite conclusions. In the United States much work was done on variety testing, breeding, and other cultural factors. Storage of soybean seed and the production of certified seed have received attention.

The composition of soybeans was given considerable study, in respect to oil and protein content and amino acids, and the isolation of particular chemical constituents.

The subject of soybeans was discussed at the Dearborn Conferences of Agriculture, Industry and Science held in 1935 and 1936. At the first meeting a paper was read describing Mr. Henry Ford's' activities in the development of soybeans. At the second a whole session was devoted to soybeans and covered their agricultural development and their use in the automobile, paint, and other industries. The American Soybean Association also held a meeting in 1935.

Industry

Food Industry

Much of the literature in this field is devoted to methods of making soybeans more palatable, as by removing the bitter taste and, if necessary, the color, and to deodorization and removal of saponins to conform to food regulations. Claims cover treatment with SO_2 (226, 245) and ethylene dioxide (103), subjection to high temperature (57), e.g., by the Goessel process (116), or in hot oil (154), or by steam (146), and other methods (86, 132, 223).

Two papers were published dealing with the quantitative estimation of staleness in bread (148, 230).

An antidiabetic bread containing 68% of water was reported to have given good results (207, 208), and a soybean diet has been used in the treatment of purulent urinary infections and eczema (56).

Experiments were made on the determination of soybean flour in various breads and meat products (150, 189, 261). The action of soybean flour as a bread improver was studied by means of the Chopin extensimeter (65). The manufacture of flour and its use for bread, beverages, sausages, and ice cream was described (118).

Experiments were made on determining the fineness of the grains in soy flour by the pipette method, diethyl phthalate and isobutyl alcohol being used as suspension media (137).

A refractometric method of fat determination in German soybeans was worked out (152).

A new apparatus for extracting soybean flour was designed and tested with a number of solvents. Different extraction apparatuses for microanalytical purposes were also described and illustrated (147).

An improved method of determining the acidity of soybeans by titrating against phenolphthalein was devised (136), and a method was described for determining the acid content of colored soybean extracts by photometric titrations (106).

A paper entitled "The composition and characteristics of soybeans, soybean flour and soybean bread", published by the United States Department of Agriculture (53), requires special mention. It contains tables showing acreage, production, and unit price in the entire United States and in six separate states for 1932 and 1933; production in the six chief countries from 1929 to 1934; chemical composition of soybeans; fat and protein content of soybeans grown in different localities; mineral content of soybeans, other legumes and grains; composition of the component parts of soybeans; composition of the component parts of soybeans; composition of soybean flours; composition of the principal protein (glycinin); comparison of cost of various foods by different units, such as weight, energy value, ash, fat, etc.; correlation of loaf volume and urease content of soybean flour used in bread making. A bibliography of some 65 references is included, as well as a review of the patent literature on removing the beany flavor from soybeans, statistical figures, information on vitamins, lecithin, etc., formulas for making soybean bread, and information on enzymes and digestibility (53).

A patent was granted for the treatment of soybean milk with B. acidophilus for the production of acidophilus milk (138).

The action of air, light, enzymes and oxidants on soybean oil was investigated (114) and biochemical investigations were made on soybean milk which was found to have a similar protein content to cow's milk but lower nutritional value (104).

The United States Department of Agriculture and the Pennsylvania Experiment Station both published information on quality and varieties of edible soybeans (28, 34). Soybean press cake was found to be an economical raw material for the preparation of glutamic acid (75).

Lecithin

It has been stated that the term "lecithin" is incorrectly used to represent constituents of the soybean which in reality are a mixture of at least two phosphatides, lecithin and cephalin (119). It has been found that beans grown in Virginia (east) contained less phosphatide than those from North Carolina (west) (130). Investigations in Moscow showed the best solvent for the simultaneous extraction of lecithin and fat to be benzene-alcohol or benzene-methylene chloride (200). A German patent appeared for obtaining pure lecithin by washing the aqueous phosphatide emulsion from soybeans with alcohol and evaporating (99). Another German patent describes the stabilizing of soybean sludge by the addition of a little alkali (59). Others describe the dehydration of the sludge by mixing with glycerol or similar substances and centrifuging (180, 181). In another it is freed from water by treatment with dibenzoyl peroxide (100). In still another it is mixed with casein and then dried (167). There were also other patents and papers on the preparation and stabilization of soybean lecithin (43, 49, 59, 60, 243).

A Japanese publication states that the stability of fatty-oil-water emulsions is increased by the addition of soy lecithin and the purer the lecithin the greater the stability (126). The addition of lecithin to sodium soaps was studied with respect to the drop number, foam number, foam value, turbidity and transparency, temperatures, and gold numbers (126).

It was found that the addition of small amounts of soybean flour, or a concentrate therefrom, to fats greatly retards the onset of rancidity due to its antioxygenic powers. The storage life of animal or vegetable fats may thus be greatly extended (92, 127, 143, 174).

Two publications appeared describing work on the formation of ketones in soybean oil by light of different wave-lengths (210, 250) and one on aldehyde formation by heat (211).

The emulsifying properties of soybean lecithin were found to be improved by hydrogenation under pressure (220).

With soybean lecithin, crude rubber can be converted into powder form. In vulcanization, its action is similar to that of lipin in latex. After vulcanization this powder rubber had physical properties superior to those of normal rubber (171, 172).

The use of soybean lecithin in the chocolate industry has been described (108) and a patent for its use in the manufacture of frying fat was granted (46).

The addition of 1% or less of soya lecithin to European wheats was found to give them a baking quality that could otherwise be obtained only by mixing them with American wheat (54).

Other publications on soybean lecithin were entitled "Phosphatides from the soybean" (98), "Coagulation of lecithin sols by electrolytes" (123), "Fat water emulsions" (129), and "Emulsifiability of edible fats" (165).

The use of a very small quantity of a preparation of soybean meal was found satisfactory for the emulsification of mineral oils for spraying apple trees (91), and a contact insecticide made from soya lecithin with an emulsifying agent such as glucamine, sulphonated fish oil, n-butyl alcohol, or soap, has been patented (95).

Two publications appeared on the detection of soybean lecithin as substitutes for egg in food pastes (80, 142).

Casein and Products Therefrom

The factory methods and equipment used for producing soybean casein in the Saratov oil mills in Russia have been described (238). Soybean milk coagulated with HCl yielded 22% casein from which satisfactory adhesive and plastics were made (74). The properties of casein glues from soybean, sunflower, safflower and hemp seeds were compared with reference to their use in veneering (151). Soybean casein, when extracted with limewater and precipitated with acetic acid, was found to have the same chemical composition and physical chemical constants as milk casein (186, 239). The ash content of soybean casein is only 0.5% (239). A review of the work of Mashino and collaborators from 1926 to 1933 on soybean proteins was published in English (160). A United States patent describes the preparation of a dry soluble casein by extracting soybean meal with an alkali, precipitating with an acid and spray drying (70). There is also a Japanese patent on powdered casein (164). A method for preparing plywood glue was patented, in which to an aqueous alkaline soybean flour dispersion formaldehyde is added as a jellying agent and potassium permanganate or wood flour as a stabilizing agent (84). A review of methods for removing oil from soybeans in the manufacture of vegetable casein was published (88). There were also articles on the manufacture, properties and utilization of defatted soybean casein (14) and on the characteristics of soybean casein obtained with different acids (89).

Five articles on soybean products as used by Henry Ford have appeared (3, 6, 29, 161, 240).

There were also articles on the physical characteristics of casein precipitated with different acids (89) and on soybeans and plastics (159).

Hydrogenation and Other Processings of Soybean Oil

A series of four papers was published on the high pressure hydrogenation of soybean oil. Copper carbonate was used as a catalyst. The iodine number, saponification number, acid number and acetyl number of the product were plotted against the temperature at which hydrogenation was carried out. Experimental data on the sodium salts of the product were given. At one temperature an almost entirely esterified wax-like substance was found. Its characteristics were given. Using a copper-chromium catalyst it was possible to decompose this substance, thereby producing a 70% yield of a light gasolene-like oil as well as octadecane (217, 218, 219).

The application of high tension electric discharges to the catalytic hydrogenation process (215) and the inhibiting effect of dyestuffs at low temperature were described (248).

A series of four papers was published on the autoclave splitting of soybean oil. A number of catalysts were tested for activity; the saponification numbers and acid numbers of the products were determined; and conclusions were drawn as to the mechanism of the hydrolysis (175).

Two papers were published on the treatment of soybean oil with Twitchell reagent and the deepening of the color of the fatty acids (178, 179).

The above papers were all pub ished in the Journal of the Society of Chemical Industry of Japan.

The Chinese Chemical Society published an article on the heating of soybean oil with a small quantity of aluminium trichloride. Some 23-32% of light oil was obtained (192).

In Germany the I.G. patented the production of a waxy compound (practically pure octadecyl stearate) by hydrogenating soybean oil at high temperature and pressure (122).

Extraction of Soybean Oil

At the Edison Institute of Technology a new extractor was developed with a throughput of 100 bu. per day, the gases from a 4-cylinder gasolene engine being utilized in place of steam, and its cooling system to supply heat for the evaporator (135). A brief discussion, with diagrams, of the Bollman, Boehm and Ford extraction systems was published (120, 240). A comparison was made between various solvents, the best being considered to be a benzine-alcohol mixture. With this, 91% of the total oil content could be removed but the oil requires refining (153). The Boehm continuous extraction system is said to retain vitamins A, D, and E and give a pleasant flavor, with less susceptibility to oxidative changes.(117).

A description was published with illustrations of the process for extracting soybeans as used at the Hansa Mills in Hamburg, Germany (201).

A U.S. patent was issued for a method of removing foots from soybean oil by filtering and squeezing (197), and another for purifying soybean oil from slimy compounds, fatty acids, phosphatides, and such like by warming first with magnesium sulphate and then with caustic soda (166).

The production of oil by biochemical methods was not successful (115).

Rapidity, convenience and reliability are claimed for a method devised for measuring the color of soybean oil. The oil is matched against a column of iodine in potassium iodide (97).

Explosion Hazards

Explosions may have occurred in soybean plants owing to dust, solvents and such causes. Six publications appeared on this subject (7, 12, 24, 37, 195, 196).

Paint and Allied Industries

Investigations on the drying qualities of soybean oil showed that the time of drying varied widely and had no relation to the iodine value. Various substances destroy its antioxidants. Untreated soybean oil dried in 150-160 hours; treated with potassium chromate it dried in 23 hours (33). Experiments were conducted on the blowing of soybean oil to give a product suitable for use in making printing ink. Specific gravity, viscosity, acid value and color increased, while iodine number decreased (73). A table showing the effect of refining on these characteristics was published. The literature on oil refining was reviewed in the same paper (173).

Studies were made of the atmospheric oxidation of soy and other oils. It was calculated that the number of oxygen atoms absorbed by soy oil per double bond is 3.93 (40).

It was found that the drying power of soybean oil can be raised by removing the saturated components by fractional extraction at low temperatures (treatment with acetone at -20°C. and decantation).

Experiments were made on the specific heat of soybean oil, and its behavior on drying (158) and on the effect of heat and ultra-violet light on extracted soybean oil (221).

Professor Burlison of Urbana stated that 30% and more of the oil used in paint can be made up of soybean oil when properly treated and when special driers are used. In 1934 10,450,000 lbs. of soybean oil was used in the manufacture of paint in the United States. It appears to be non-yellowing and to increase the lustre, gloss retention and flexibility of the film (68).

Other publications are:- "Unfinished paint problems" (107), "Increasing the use of agricultural products in the automotive industry" (161), and "Paint company erects new soy oil plant" (4).

Soy Sauce and Fermented Products

The manufacture of soy sauce has been described (78, 228). Standards were suggested and analytical results of 21 brands given (41). The esters of phenethyl alcohol were investigated for use as antiseptics and found superior to salicylic acid (234). Seventy-seven kinds of steel were examined to determine their corrosion qualities in soy (212). The physical characteristics of Tamari soyoil, a by-product in Tamari brewing and made largely from soybeans, were determined (237). Similar determinations were made on soy oil, a waste product in the brewing of soy, which is made from steamed soybeans and wheat (236, 237, 247). Micro-biological methods were worked out for the treatment of soy and soy milk (18), and the effect of temperature was studied on the maturing of miso, fermented soybean paste (128).

General Utilization of Soybeans

A number of general articles on this subject may be mentioned:-

Utilization of the soybean: The commercial importance of the soybean, oil, cake and lecithin were discussed (190).

Processing the soybean (233).

The possibilities of technical utilization of Czechoslovakian soybeans: Oil extraction and pressing, the manufacture of casein, lecithin, meal, soups, coffee substitutes, milk and sauces were discussed (111).

Reworking of soybeans (61, 62).

Utilization of soya beans; A series of papers read before the American Chemical Society (5).

Soybean oil, its properties and utilization (227).

The soya bean: Its history, cultivation (in England) and uses (60).

Canadian Imports, Calendar Years 1934 and 1935

Soy sauce -

Imports		1934	1935
	Gals.	81,751	73,751
	$	34,526	29,724

Soybean cake and soybean meal for use exclusively in the manufacture of cattle food and fertilizers -

Imports			
	Cwt.	37,997	119,300[X]
	$	51,972	142,231

Tot l oilcake and meal (cotton, linseed, palmnut and soybean) -

Imports			
	Cwt.	87,590	181,284
	$	112,343	218,284

Soybean oil,nop,edible -

Imports			
	Gals.	169,538	148,420
	$	64,704	78,936

Total oils, vegetable, for food (cocoanut, cotton seed, olive, peanut and soybean) -

Imports	$	603,762	760,442

Soybean oil for manufacturing soap -

Imports			
	Gals	20,596	103,053
	$	7,567	48,466

[X]Jan. - Apr. 1934 "soybeans" were included with cake and meal.

Soybeans -	1934	1935
Lbs.	112,460[x]	861,318
$	3,859	17,003

No exports of soybeans, soybean oil or cake were recorded.

Firms Engaged in the Soybean Industry in Canada

Canadian Soybeans Ltd., Milton, Ont., and Soybean Oil and Meal Cooperative of Canada Ltd., Chatham, Ont., were operating in 1934, but not in 1935.

The Dominion Linseed Oil Co., Baden, Ont., Soy Bean Products, Toronto, Ont., Soya Mills Ltd., Stratford, Ont., the Vitone Company, Hamilton, Ont., and Dominion Soya Industries, Montreal,Que., were believed to be operating in 1935.

A company employing a process of exploding soybeans and making a product similar to popcorn is reported to have been in operation.

Agriculture

Animal Nutrition

Soybean press cake contains 43% protein with a digestibility of 80% and shows a growth promoting value comparable with that of casein or meat. It is deficient in vitamin A (157). Soybeans are deficient in vitamins A and D and in mineral salts (155). More than 60% of the iron in soybeans (as in beef and pork liver and cardiac muscle) was found to be available for hemoglobin regeneration in anemic rats (216). A soybean-egg powder showed a somewhat greater growth response thandried whole milk and was satisfactory in hemoglobin and bone production (199). Horses fed on soybeans showed increased nitrogen metabolism and nitrogen excretion with storage of protein in the organism (156). Fresh soybeans grown near Leipzig, Germany, contained practically no vitamin A but about 1.5 international units of B_1 per gm. and significant quantities of B_2 (209). A group of rats (a) were fed on a diet the fat content of which was margarine, in a second group (b) it was soybean oil and in a third (c) it was butter. (b) and (c) showed the same weight increase; (a) grew more slowly. When subjected to starvation (b) lived longest. The high nutritive properties of soybean oil and margarine, which in some respects excel those of butter, were ascribed to the high content in unsaturated fat acids (191). When dogs were fed soybeans it was found that the process of gastric secretion resembled that for a meat diet more closely than that for bread (231). Liberal

[x]Jan. - Apr. 1934 "soybeans" were included with cake and meal.

allowances of whole soybeans, corn oil, menhaden oil and coconut oil in the rations of steer calves during a period of 260 days had no perceptible effect on the color, firmness and degree of unsaturation of the rendered body fats (242). Rats fed on a diet of soybean meal, butter fat, dextrin and salt mixture showed a satisfactory weight gain as compared with a control group in which the soybean meal was replaced by casein. The weight gain varied with the variety of beans. Roasting the bean meal increased its nutritive value slightly and raised it to substantially the value of the control diet (182). Cod-liver oil, in which vitamins A and D had been destroyed by oxygenation produced characteristic lesions when fed to rats, dogs and other animals. Similar lesions appeared after feeding soybean oil and other oils. Investigations were undertaken to determine which constituent was responsible (42). Moldy soybean cakes fed to rats were found to be non-toxic and rather good as a protein source. Eight varieties of aspergillus were isolated from them (185). Soybeans may be used for fattening pigs without any danger to their general condition, though soybeans were found (Germany) more expensive than fish meal and barley (112). A dark colored meal obtained by discontinuous extraction and a light colored meal from a continuous process were found to be were of like chemical composition, digestible protein content, starch value and feeding value for live stock (109). Machine drying as compared with field curing gave a soybean hay that was more palatable to steers and produced increased weight gains of 10 - 11%. Wastage was reduced 40% (225). As a source of protein for pigs, meals prepared by the expeller process (maximum temperature 130 - 150°C.) and the hydraulic process (cooking temperature 105 - 121°C.) were equally efficient. Meals prepared by the solvent process (extracted at 45° C. and dried at 98°C.) and by the hydraulic process (cooking temperature 82°C.) were somewhat less efficient (101). A 66-page book was published entitled "The influence of soybean cake upon milk production and the quality of butter (235). Opinions still seem to differ as to whether the feeding of soybeans to hogs causes soft pork (2, 20, 36, 71, 93, 202, 249, 260).

Experiments and information were also recorded on the following subjects:- Combination of corn and soybeans for silage (30, 253), Deficiencies in soybean silage for dairy cows (11), Preparation of soybean silage, its carotin and vitamin A content (188), Machine dired soybean hay for fattening cattle (225), Comparison of soybean hay and alfalfa for steer feeding (21), Soybean oil meal as a source of protein in laying rations (39, 139), Ground soybeans as a protein supplement for laying birds (244), Nutritive value of green immature soybeans (170), Soybean flour as a substitute for cow's milk in feeding dairy calves (222), Effect of soybeans in the rations of dairy cows upon the vitamine A value of butter (254), Influence of soybean cake on milk production and quality of butter (235), Soybeans for forage and soil improvement (50), Recommendations on how to use soybean oil meal for maximum results (102), Feeding soybeans (213).

Soybean meal was used as control in experiments on the feeding value for dairy cows of wood sugar yeast (67).

Experiments carried out over several years on fowls showed proteins to have the following relative values:- egg white 130.6, egg yolk 100.9, casein 100, fish meal 85.3, egg yolk dried 80.5, wheat germ 68, yeast dried 62, soybeans 55.6, peas 45, bean meal 36.3, alfalfa 25.6, grass 22, lentils 19 (193).

Variety Tests

Variety tests on soybeans have been carried out and reported by various experiment stations throughout the United States, e.g., Hawaii (15), S. Carolina (30), Nebraska (25), Iowa (19), Georgia (13), Arkansas (1), Missouri (22), Idaho (17), Florida (10), Indiana (198), Purdue (83), and the United States Department of Agriculture.(31, 35).

Breeding Work

Breeding work on soybeans was reported from the Cornell (8), Iowa (19), Missouri (22), and West Virginia (38) Stations.

Farming Aspects

Cultural and harvest practices were studied and reported by the Arkansas (1), Georgia (13), California (79), Louisiana (55, 63) and West Virginia Stations (87) and others (85, 229, 252, 255, 256). Practical information was given on methods and mechanical equipment used in corn and soybean production, including seed-bed preparation, planting, cultivation, harvesting, and use of the pulverator. A labor and power summary was also included (Louisiana, 55).

The irrigation of soybeans was studied at the Arkansas Station (1). Soybeans in a drought year broke all crop records (27). Papers were published in the United States and Japan on diseases and pests of the soybean (64, 124, 133).

In Australia experiments were carried out on the vernalization of soybeans but with no significant results (163).

A portable apparatus for drying soybeans and other products while preserving vitamins, etc., was patented (48).

The storage of soybean seeds has been the subject of study (35).

A set of rules and requirements for the production of certified seed was published (26) as well as a revised edition of the Official United States Standards for soybeans (32).

A method was devised for differentiating strains by the luminescence of germinated seeds (76).

Composition

The growing of soybeans in South Africa has been reported on (94). Yellow 1 variety showed the following composition:-

H_2O	7.8 - 8.7
Crude protein	36.5 - 40.0
Oil	17.0 - 18.3
Crude fibre	4.8 - 5.1
Carbohydrates	24.5 - 26.6
Ash	4.8 - 4.9

Some varieties of Manchurian oil seeds showed an oil content of(125):-

Green	16.7%	
Black	18.27	
Red	18.58	
Yellow	19.79	(Low iodine No.)

Analyses of 19 varieties of Oklahoma grown soybeans showed that the oil content is low and the protein content is high compared with soybeans grown in other states. The iodine numbers were especially low (249a).

Chemical analyses of soybeans harvested in Bessarabia and Bukowina in 1932 were reported (82).

The average composition of Cayuga soybeans in New York state was (251):-

Crude protein	35.04%
Fat	16.50
Fibre	5.23
Ash	5.16
Moisture	5.54

Analyses made in Russia on a number of varieties of soybeans grown in the same geographic region showed little or no variation in protein content and quality, ash content and constituents, catalase and lipase. Peroxidase varies with the variety from 7.56 to 88.02. Urease activity varies with region and variety from 26.86 to 60.76. Oil content and iodine value varies, early varieties having less oil with lower iodine value (224).

Soybeans analyzed by the Sind Agricultural Station (241) showed the following composition:-

	Pusa Yellow	Punjab	Pusa Chocolate	Lorido
Oil	16.80%	17.32%	19.71%	17.86%
Free fat acids	0.75	1.05	1.14	1.11
Albuminoids	38.22	34.58	31.79	22.72
H_2O	10.38	10.10	10.21	11.80

An analysis of soybean oil and Tamari soy oil, a by-product of Tamari soy brewing, showed (237):-

	Soybean oil	Tamari soy oil
Acid value	41.9	105.9
Saponofication value	186.3	185.6
I value	102.1	149.4
n^{20}	1.4630	1.4749
d^{15}_{15}	0.8926	0.9172
Flash point	76.5°	218°
Redwood (50 cc. at 20°)	1' 17.6"	5' 57"

Experimental cultivation of soybeans in Czechoslovakia, 1931-34, was reported on (77). Analyses showed:-

Moisture	8-10%
Oil	16-22
Crude protein	31.8-38.6

The relative activities of cathepsin, polypeptidase and dipeptidase of Soja hispida have been tabulated (58).

Detailed analytical data are given on the composition of soybeans and also on the young and matured plants (145).

An acid saponin was isolated from soybeans and sapinogen prepared from it. The physical and chemical properties of both are described (69).

Extensive information on the composition of soybeans, soybean flour and bread was published by the United States Department of Agriculture (53) and others (194).

The developmental work on soybeans at Giessen, Germany, was described. The average oil content of all sorts rose over a five-year period from 16.5 to 21%. The protein content fell from 41.8 to 35.1% (214).

The United States Department of Agriculture published work on the oil content of soybeans (33).

Kuromamin, the dyestuff of Kuromame soybeans, was shown to be identical with chrysanthemin (149).

The presence of fat oxidase in soybean was reported (47).

The following monoamino acids were found in soybean protein (206):-

Glycine (calc. from picrate)	0.23%
Alanine	4.12
Valine	2.56
Leucine	10.02
Isoleucien (calc. from Cu salt)	2.38
Tyrosine	3.82
Phenyl alanine (calc. from HCl salt)	5.21
Proline (calc. from picrate)	3.94
Serine	0
Proline	0

Other work on the amino acids of the soybean has been published (33, 53, 81, 105, 134, 144, 205, 206).

An unsaturated hydrocarbon $C_{18}H_{38}$ was isolated from soybean oil, and named gadusene. Its absorption spectrum was measured, and it was hydrogenated (177).

A glucosidic sterin was isolated in crystalline form and is present in crude soybean oil to the extent of approximately 0.04% (131).

The occurrence of vitamin E in soybean oil was studied (232), as were the composition and vitamin content of green soybeans (16).

Various methods of determining oil in soybeans were tried with the object of establishing a standard procedure. The only reliable method was found to be a double extraction with petroleum ether of an undried ground sample (162).

A method was worked out for estimating small amounts of aluminum (0.01 - 0.20 mg.) in plant tissues. Soybeans were found to contain 7.5 mg. per kg. dry substance (169).

Physiology

A number of papers have been published dealing with the life processes of the soybean. The titles of these papers are:-

Effects of exfloration on plant metabolism.(52).

The nature of the photoperiodic after-effect (induction) and the effect of the length of day on the activity of the oxidizing enzymes (72).

The distribution of pigments in the testa of some varieties of soybeans, Glycine hispida Maxim. (45).

The effect of nitrate nitrogen on the carbohydrate metabolism of inoculated soybeans (184).

The effect of long and short day and shading on nodule development and compositionof the soybean (110).

Catabolism of fats and phosphatides in germinating soybeans (262).

Influence of sulfur deficiency on the metabolism of the soybean (90).

Potassium as an essential nutrient for the soybean (145).

Moisture changes in some agricultural products due to atmospheric conditions (121).

Nitrogen fixation in soybeans as influenced by exchangeable calcium (44).

Light intensity as an inhibiting factor in the fixation of atmospheric nitrogen by Manchu soybeans (183).

The effect of magnesium deficiency on the phosphate absorption of soybeans (257).

Studies on seed germination. Organic bases of seeds and seedlings of soybeans grown in the dark (203).

Studies on seed germination. Carbohydrate changes during soybean germination (204).

Vegetation and reproduction in the soy-bean (51).

Relation of the degree of base saturation of a colloidal clay by calcium to the growth, nodulation and composition of soybeans (113).

It was found that potash fertilization caused a considerable increase in the resistance of soybeans to frost (145).

Three papers deal with the effects of short and long days on the growth of soybeans (52, 72, 110).

Miscellaneous

A conference was held at Dearborn, Mich., on May 7-8, 1935, and May 12-14, 1936, on industrial uses of agricultural products, at which soybeans were one of the subjects of discussion (9). The American Soybean Association held a meeting in 1935 (140). A paper was published on a soybean project for 4-H clubs (141).

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