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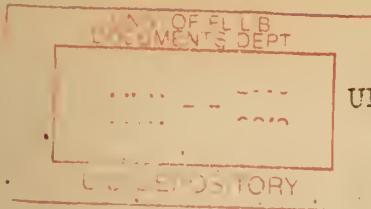
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THE SUNFLOWER, ITS CULTIVATION AND USES

A Selected List of References

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Sources examined in the compilation of this list are the card catalogues of the U. S. Department of Agriculture Library and the Bureau of Agricultural Economics Library; the Botanical Catalogue of the Bureau of Plant Industry Library; Agricultural Economics Literature, 1928-1940; Agricultural Index, 1919-Sept. 1940; Experiment Station Record, 1912-1940; Public Affairs Information Service Bulletin, 1930-Mar. 1941; Industrial Arts Index, 1913-1940; Readers' Guide to Periodical Literature, 1910-Feb. 25, 1941; International Index to Periodicals, 1920-Jan. 1941.

Call numbers following the citations are those of the U. S. Department of Agriculture Library.

Abitia, Luis J. El cultivo del girasol. Mexico. Secretaría de Relaciones Exteriores. Revista del Comercio Exterior 5(4): 35-40. Sept. 1940. 286.8 N575

Describes the sunflower plant, the advantages in growing it, methods of cultivation and uses of the seed, and concludes that sunflower cultivation in Mexico, in addition to being more valuable than corn because of its resistance to drought, frost, insect attack and disease, may be used to overcome the practice of planting the land one year and letting it lie fallow the next, since the sunflower plant restores the necessary elements to the soil.

Alexandrow, Alexandre. Informe preliminar sobre el cultivo del "girasol" en Venezuela. El Agricultor Venezolano 4(49): 18-22. May 1940.
9.95 Ag8

The writer describes the conditions needed for sunflower cultivation and methods of growing it, and discusses the cost of production, the uses of the sunflower and its importance to Venezuela.

Amos, Arthur, and Woodman, Herbert Ernest. Sunflower silage. Jour. Agr. Sci. 13(2): 163-168. Apr. 1923. 1C J822

Gives the results of an experiment in which the sunflower was grown for silage. A comparison is made between the composition of green sunflower and sunflower silage. "The results...indicate that the absolute amount of crude protein underwent little or no change during ensilage... As a source of digestible protein, sunflower is...inferior to oats and tares...the sunflower protein suffered a slight depression of digestibility during storage in the silo..."

"The writers do not, from a consideration of the findings in this preliminary trial, feel prepared as yet to recommend the making of sunflower silage on a large scale for feeding to stock."

The Argentine vegetable oil industry. Impressive increase in sunflower seed oil production. Rev. River Plate 88(2532): 21-23. June 21, 1940. 286.8 R32

"The latest industrial statistical survey carried out by the National Statistical Department and published in the customary form of a report addressed to the Minister of Finance is identified with the production in Argentina of edible oils. The report just published comprises a census of the edible oil industry as at December 31, 1938, with the analogous statistical comparisons corresponding to the years 1937 and 1935." As far as sunflower is concerned, tables give quantities and values of seed consumed by edible oil factories, quantities and values of oil, oilcake, and flour produced in the above mentioned years, and amount of oil produced annually 1924-1925, 1927-1938.

Attention is called to the "enormously increased production of sunflower seed oil in 1938 as compared with the two former years. At 55,752,703 kilos in 1938, sunflower seed oil production represented an increase of 100.6 per cent. over the 1937 period, and no less than 769.9 per cent. over the 1935 result."

Argentine vegetable oil production. 248% increase in ten years: huge supplies from cotton seed and sunflower seed. Rev. River Plate 89(2541): 15, 17. Aug. 23, 1940. 286.8 R32

"Argentina's progress in vegetable oil production in the past decade is impressively revealed in a Ministry of Agriculture statistical report issued during the past week with special reference to production during 1939."

Atkeson, F. W. Sunflower silage for milk production. Idaho. Agr. Expt. Sta. Bul. 315, 8pp. Moscow, 1935.

"On the basis of total digestible nutrients consumed and milk produced the sunflower silage was equal to corn silage... Choice between corn silage and sunflower silage is a problem of more milk per acre rather than more milk per cow."

Atkinson, Alfred, Nelson, J. B., and others. Growing and feeding sunflowers in Montana. Mont. Agr. Expt. Sta. Bul. 131, 29pp. Bozeman, 1919.

A brief survey of the characteristics and history of the cultivation of the sunflower, and an account of the results of investigations made in Montana of the yields and methods of growing and feeding. Silage made from sunflowers 30 to 40 percent in bloom were found to be equal to chopped green corn in the roasting-ear stage as a soiling crop for dairy cows.

Audas, J. W. The sunflower. Its cultivation and utilization. Victoria. Dept. Agr. Jour. 16(10): 620-626. Oct. 1918. 23 V66J

Discusses cultivation and harvesting of the sunflower, its value as a stock food, and as silage for dairy cows, and the uses of the plant and seed. It is said to be a good honey plant.

Bechdel, S. I. Sunflower silage for milk production. Pa. Agr. Expt. Sta. Bul. 172, 16pp. State College, Pa., 1922.

Experiments in feeding cows with sunflower and corn silage indicate "that the use of sunflowers as a silage crop is not advisable on Pennsylvania farms except in a very few localities where corn is not always a sure crop."

Cole, C. L., Donovan, R. L., and Allen, Nat N. The influence of sunflower silage upon milk production. Jour. Dairy Sci. 20(5): 221-230. May 1937. 44.8 J822

"In a group of 13 cows, no advantage in milk production or in health and condition of the cows was found due to inclusion of sunflower silage in the ration containing an abundant supply of legume hay and with water supplied by means of drinking cups."

French, H. E., and Humphrey, H. O. Experiments on sunflower seed oil. Missouri. Univ. Bul. v. 27, no. 7, Engin. Expt. Sta. Ser. no. 25, 27pp. Columbia, Missouri, 1926. 290.9 M69

It is stated in the introduction that the experiments described were undertaken to investigate the possible industrial uses of sunflower seed oil in order to obtain information as to the advisability of encouraging or discouraging increase of production of the seed. "No attempt was made to develop special uses for the oil, nor was any effort made to compare the cost of sunflower seed oil with that of the oil for which it was substituted."

A review of the literature shows conflicting opinion as to the value of sunflower as silage. The suggestion is made that the ash would be a valuable fertilizer for certain soils. A table shows considerable variation in the analyses of sunflower products. The vitamin content of the oil has been found to be low. Investigators have found that the oil dries slowly.

Paragraphs are given on expressing the oil, on clarification, purification and bleaching, on the oil as a salad and frying oil, on its hydrogenation, and its use in paints.

Gaines, W. L., and Nevens, W. B. The sunflower as a silage crop.

Composition and yield at different stages of maturity. Ill. Agr. Expt. Sta. Bul. 268, pp. 405-455. Urbana, 1925.

Investigations of yield and composition of the sunflower crop were made to ascertain "(a) the state of maturity at which it is best to harvest the sunflower crop for silage; (b) the best time and rate of planting for silage; and (c) the amount and kind of fertility removed in the crop."

García Mata, Carlos. Estudio económico de la producción y consumo de aceites comestibles en la Argentina. Ed. 2, 73pp. Buenos Aires, G. Kraft, 1936. (Junta Nacional del Algodón, Pub. 6) 307 G16

Contains information on the production and use of edible oils in Argentina. Tables give production of sunflower seed oil and its percentage of the total oil production 1924, 1925, 1927-1935, the percentage of by-products resulting from industrialization, the cost of industrialization of 100 kilos of sunflower and the export of sunflower seed 1920-1935.

Granato, L. O girasol; sua cultura e exploração industrial. São Paulo, Secretaria da Agricultura, Commercio e Obras Publicas. Boletim de Agricultura 24(2): 47-61. Feb. 1924; (3): 95-113. Mar. 1924.

9.2 Sa63

Discusses the history, cultivation, and uses of the sunflower and its derivatives.

Gutierrez, H. P. El girasol; su importancia en la industria aceitera nacional. Sociedad Rural Argentina. Anales 71(2): 143-145. Feb. 1937. 9 Sol

Gives statistics to show the increase in sunflower oil production in Argentina since 1924 and a price increase from 8.50 pesos per 100 kilos in 1933 to 12.51 pesos in 1936. Brief information is given on the cultivation of the sunflower and on its composition, including its protein content.

Helm, C. A. Production of sunflower seed in Missouri. Missouri. Univ. Col. Agr. Agr. Ext. Serv. Cir. 241, 4pp. Columbia, Feb. 1930. 275.29 M69C

"In the United States, the seed is used chiefly for chicken feed.

The present market outlet is a limited one and may easily be glutted." Information is given on growing, harvesting and threshing the crop, on insect pests, and on storage and marketing.

"Providing the seed is dry when threshed, it will keep indefinitely when warehoused... Since the market outlet is limited the price received per pound often fluctuates violently. The price to the grower within the past 10 years has ranged between 1 1/2 and 10 cents per pound. During this period, the grower probably has received an average of 3 cents per pound. Following the disastrous season of 1920 the growers of sunflower seed in Southeast Missouri, through their commodity organization, secured a tariff of 2 cents per pound on foreign seed. Since this became effective, the market has risen about 2 cents per pound."

Henderson, H. O., and Gifford, Warren. Sunflower silage vs. corn silage for milk production. W. Va. Agr. Expt. Sta. Bul. 210, 15pp. Morgantown, 1927.

"In West Virginia, where sufficient good silage corn can be grown, there is no advantage in growing sunflowers for silage. In sections where sufficient corn cannot be grown...the sunflowers will make a satisfactory substitute."

Hensley, Harry C. Production of sunflower seed in Missouri. Missouri. Univ. Col. Agr. Agr. Ext. Serv. Cir. 140, 7pp. Columbia, 1924. 275.29 M69C

A brief account of production, chemical analysis and uses of sunflower seed. A graph shows the average minimum price of sunflower seed at all seasons of the year from 1912 to 1921, Merchants Exchange, St. Louis. The main accomplishments of the Southeast Missouri Sunflower Growers' Association are enumerated.

Holden, E. D., and Delwiche, E. J. Sunflowers for silage. Wis. Univ. Col. Agr. Ext. Serv. Cir. 220, 16pp. Madison, 1914. 275.29 W75C

Gives reasons for recommending sunflowers for silage in certain parts of Wisconsin. Tables give yield and labor cost for rutabagas, corn silage, and sunflower silage at Ashland Station, 1919-1927. Many illustrations are given.

Hopper, W. C. Sunflowers as a silage crop. Jour. Agr. and Hort. (Quebec) 33(12): 178. June 1930. 7 J82J

Indicates that, in spite of drawbacks, sunflowers may be grown with profit on farms in eastern Canada.

Hulbert, H. W., and Christ, J. H. Growing sunflowers for silage in Idaho. Idaho. Agr. Expt. Sta. Bul. 141, 12pp. Moscow, 1926.

Sunflowers are said to be a valuable silage crop in many sections of Idaho. "At Moscow sunflowers have yielded 72 per cent more silage than corn. Under Sandpoint conditions sunflowers have out-yielded corn by 303 per cent... Analyses of sunflowers and corn show that they are nearly equal in feeding value... Sunflowers are

slightly higher than corn in ash, protein and fat. Corn has a higher crude fiber content and is substantially higher in nitrogen-free extract."

La industria aceitera en nuestro país. Gaceta Algodonera 17(199): 6.

Aug. 31, 1940. 72.8 GI1

A brief summary of trends in vegetable oil production in Argentina, showing particularly large increases in cottonseed and sunflower oil. Production of vegetable oils in 1939 was 248% of production in 1929.

International institute of agriculture. Hungary. General situation of agriculture. Internat'l. Inst. Agr. Monthly Bul. Agr. Econ. and Sociol. [reprint from Internat'l. Rev. Agr.] 30(2): 71E-77E. Feb. 1939. 280.29 In83

"The Ministry of Industry and Trade [of Hungary] authorized the Futura A. G....to buy and work up sunflower seed and to sell sunflower oil. The prices of seed and oil were fixed for the whole year."

International institute of agriculture. International chronicle of agriculture, Bulgaria. Internat'l. Inst. Agr. Monthly Bul. Agr. Econ. and Sociol. [reprint from Internat'l. Rev. Agr.] 29(12): 580E-587E. Dec. 1938. 280.29 In83

"By the law of July 18, 1936 the Cereals Purchase and Export Administration [of Bulgaria] was required to purchase sunflower seed of the 1936 crop at the price of 3 leva per kg... Later in 1937, following an appreciable improvement in the prices of sunflower seed, the law of 1936 was annulled, and trade in this product was freed from restrictions."

Jamieson, George S., and Baughman, Walter F. The chemical composition of sunflower-seed oil. Amer. Chem. Soc. Jour. 44(12): 2952-2953. Dec. 1922. 381 Am33J

Notes the long continued commercial importance of sunflower-seed oil in Russia, Hungary, India and China. "In Russia it is used for culinary purposes, as a salad oil, and in making butter substitutes, soaps and Russian varnishes. It is stated that in 1911 more than 500 mills in the Caucasus were engaged in pressing sunflower seed and that some of the oil was exported to English refineries. It is reported that this oil is used in the manufacture of the excellent Holland enamels."

Decline in production in the United States is noted due to unsatisfactory prices for the oil.

"Sunflower seed contains from 27 to 30% of oil. The hulls constitute from 46 to 49% of the seeds, so that by removing the hulls prior to pressing, a material very rich in oil is obtained. The press cake is a valuable stock feed, and has been used for many years in Europe." Tables give the chemical composition of sunflower-seed oil.

Janieson, George S. Vegetable fats and oils. The chemistry, production and utilization of vegetable fats and oils for edible, medicinal and technical purposes. 444pp. New York, Chemical catalog co., inc., 1932. (American chemical society. Monograph series) 307 J24

Pages 215-217 contain information on sunflower seed oil and give a brief bibliography.

Jumelle, Henri. Les huiles végétales; origines, procédés de préparation, caractères et emplois. 496pp. Paris, J. B. Bailliere et fils, 1921. 307 J95

Discusses briefly the composition and uses of sunflower seed, oil, and cake. It is said that the oil may be used for lighting purposes.

Kerle, W. D. Sunflowers a possible sideline. Agr. Gaz. N. S. Wales 51(9): 479-481. Sept. 1940. 23 N472

The author suggests that this is an opportune time to get the sunflower industry established in Australia. He states that "the annual production of the Danubian countries amounts to from 600 to 700 million pounds, Russia producing 228 million pounds and exporting annually 110 million pounds chiefly to Germany, Sweden and Great Britain. In 1935 approximately 5,000,000 acres were sown in Russia.

The uses of the sunflower and its derivatives are enumerated, among them its use as feed for poultry and stock and for ensilage, for the production of edible and technical oils, as a substitute for olive oil, and as a staple diet of the Russian peasant. Sunflower cake is said to contain 45 percent protein and about 10 percent oil, and the meal 35 percent protein and about 2 percent oil.

Knapp, Otto. Sonnenblumenzüchtung in Ungarn. Der Züchter 12(8): 193-199, illus. Aug. 1940. 442.8 Z8

An account of sunflower production in Hungary with a brief reference to its economic importance.

Lozano Villegas, A. El cultivo mecanizado de las oleaginosas en Venezuela. El Agricultor Venezolano 5(55-56): 33-38. Nov.-Dec. 1940. 9.95 Ag8

This article on mechanized cultivation of oilseed crops in Venezuela includes cost of production per hectare for sunflowers.

Lund, Charles E. Fats and oils trade of the United States in 1940.

U. S. Dept. Com. Bur. Foreign and Dom. Com. Indus. Ref. Serv. Pt. 3, Foodstuffs, no. 22, 17pp., processed. Washington, D. C., Feb. 1941.

A table shows imports of sunflower seed oil into the United States for the 5-year period 1934/38, and for 1939 and 1940.

Mainwaring, C. The common sunflower. (*Helianthus annuus*) Rhodesia Agr. Jour. 19(3): 295-301, illus. June 1922. 24 E34

A table gives Rhodesian acreage and yield per acre for the years 1917-1921. Others give the Rhodesian and American composition of sunflower leaves and heads for feeding purposes. The cultivation of the sunflower and its uses are discussed.

Malberti, Félix. El girasol, cultivo y aprovechamiento industrial.

Cuba. Revista de Agricultura, Comercio y Trabajo 13(1): 31-33.

July 1931. 8 Ag88Re

Discusses the importance of developing sunflower seed in Cuba because of the large sums spent to import sunflower seed and other oils.

Markets for Southern Rhodesia sunflower seed. Rhodesia Agr. Jour. 27(3): 283-289. Mar. 1930. 24 R34

Gives the results of the examination of samples of sunflower seed to determine the best types to grow for marketing purposes.

Markley, K. S., and Schreiber, W. T. *Helianthus argophyllus*. Commercial possibilities as indicated by its composition. Indus. and Engin. Chem. 20(6): 636-637. June 1928. 381 J825

An analysis "indicates that, in regard to the content of crude fiber, protein and nitrogen-free extract, *H. argophyllus* has about the same value for roughage as that of the common sunflower... The total cellulose content, amounting...to 46.5 percent, compares favorably with that of cotton stalks..."

"It is not likely that this material could compete with wood in the cellulose-ester, rayon, or paper industries at the present time; but it is conceivable that in the face of the continually diminishing wood supply it could compete with materials such as bagasse, cotton stalks and grain hulls."

Marseille. Institut colonial. La production mondiale du tournesol.

Marseille. Institut Colonial. Bulletin des Matières Grasses 16(8): 225-229. 1932. 77.9 M35

English translation in Oil and Colour Trades Jour. 82(1766): 497-498. Aug. 19, 1932. 306.8 0152

Discusses briefly sunflower production in Russia, Rumania, Bulgaria and Hungary. "International trade in sunflower seed oil or cake is very limited."

Maxim, Marie, and Bers, George. Der vitamingehalt einiger inländischen öle. Klinische Wochenschrift 18(49): 1555-1556. Dec. 9, 1939. 448.8 K68

Lists the vitamin content of certain vegetable oils of Rumania, including sunflower seed oil.

Mell, C. D. The dyeing substance in the sunflower of doubtful utility. Textile Colorist 52(613): 50-51. Jan. 1930. 306.8 T31

Mell, C. D. The sunflower. Sci. Amer. Sup. 85(2217): 411. June 29, 1918. 470 Sci25

Lists a number of uses for the various parts of the sunflower plant. The pith of the stalk is said to be the lightest substance known. One of its chief uses is the making of life-saving appliances. "The pith of the larger sunflower stalks is used extensively as a substitute for other materials formerly employed in making moxas for sunburn, etc."

Mendoza (Province) Argentina. Ministerio de economía, obras públicas y riego. Instituto técnico de investigaciones y orientación económica de la producción. Economía y finanzas de Mendoza, v. 1, no. 1, 125pp. Mendoza, Dec. 1939. 255.1 M523E

Tables of production and value of sunflower by provinces and districts of Argentina are given on pp. 88-89.

Neidig, Ray E., and Snyder, Robt. S. Mineral composition of sunflowers grown for silage. U. S. Dept. Agr. Jour. Agr. Res. 31(12): 1165-1171. Dec. 15, 1925. 1 Ag84J

"The composition of the ash of sunflowers has been determined for different systems of plantings and for different stages of growth. A comparison of the minerals removed by 10-ton crops of sunflowers and corn is given. Sunflowers draw more heavily than corn upon certain soil elements, especially potassium and calcium."

Nevens, W. B. The sunflower as a silage crop. Feeding value for dairy cows; composition and digestibility when ensiled at different stages of maturity. Ill. Agr. Expt. Sta. Bul. 253, pp. 183-229. Urbana, 1924.

Odland, T. E., and Henderson, H. O. Cultural experiments with sunflowers and their relative value as a silage crop. W. Va. Agr. Expt. Sta. Bul. 204, 16pp. Morgantown, 1926.

Comparison is made for silage of sunflowers and corn and the results are given. Differences with corn in protein, ash, fat and fiber contents were found to be relatively small.

Oil and Colour Trades Journal, v. 92, 1940. Published by Scott Green-wood & Son Ltd., 8, Ludgate Broadway, London, E. C. 4, England. 306.8 Oi52

Each weekly issue contains prices of sunflower seed oil, crude, and refined.

Oklahoma. Agricultural experiment station. The tame sunflower as a honey plant. Okla. Agr. Expt. Sta. Ann. Rpt., 1920/21, pp. 22-23. Stillwater, 1921.

"Records are on file to the effect that tons of honey have been made from wild sunflowers." Experiments have been made which indicate that "the tame sunflower can be used to a good advantage as a honey and pollen plant, as well as a silage plant."

Los oleaginosos en la Argentina. Revista de Economía Argentina, año 21, t. 38, no. 254, pp. 224-226. Aug. 1939. 280.8 R325

Tables on p. 226 give statistics of area, and yield of sunflower 1934/35-1937/38, production 1922/23-1937/38, export 1922/23-1937/38 and consumption and stocks 1923/24, 1924/25, 1926/27-1937/38; also area, production, and yield by provinces 1937/38.

P., A. Present importance of sunflower cultivation in the Argentine Republic and its influence on the production of vegetable edible oils. Internat'l. Inst. Agr. Monthly Bul. Agr. Sci. and Pract. [reprint from Internat'l. Rev. Agr.] 31(10): 367T-368T. Oct. 1940. 241 In82

Notes the steady increase of sunflower production since 1920. "The use of sunflower seed in the Argentine oil industry dates from 1924. In that year, 282 tons of seed were milled, producing 52 tons of oil, a yield of 19 per cent. The improvements made in this industry increased this yield to 25 per cent. in 1938. The oil-cake, for cattle feed, is exported to Germany, Denmark and the Scandinavian countries. The Argentine Government encourages the home production of oil-yielding seeds, with a view to entirely eliminating the importation of foreign produced vegetable oils and fats..."

"The market has already benefited by the heavy demand for oil for industrial purposes... The seeds originally used, which were imported by the Russian settlers, have been replaced by an early pure variety of uniform height and good industrial value (25-27 per cent. oil is obtained from the seed)."

Papaicannou, J. H. Le grand soleil et le tourteau du grand soleil. Annales de Gembloux 22(1, 4): 74-104, 209-234. Jan., Apr. 1912. 13 G28

Discusses the cultivation, composition, and uses of the sunflower and sunflower cake.

Pieraerts, J. Le grand soleil ou tournesol, Données générales - Quelques données nouvelles concernant l'huile qui s'en extrait - Son introduction et sa culture au Congo belge. Bulletin Agricole du Congo Belge 16(1, 2): 240-255, 393-406. Mar., June 1925. 24 K83

The sunflower was introduced into the Belgian Congo in 1906, but had not been cultivated to any appreciable extent until shortly before this article was written. The cultivation and composition of the sunflower seed, and its uses and the composition and uses of sunflower seed oil and cake are discussed.

Rhodesia. Dept. of agriculture. Export of sunflower seed. Rhodesia. Agr. Jour. 23(12): 1143-1145. Dec. 1926. 24 R34

Contains regulations governing the export of sunflower seed contained in Government Notice No. 459 of August 6th, 1926.

Rolet, Antonin. Le tournesol oléifère. Les Matières Grasses 16(191): 6716-6718. Mar. 15, 1924. 307.8 M42

A brief description of varieties of sunflower, its characteristics, the places where it is grown, and its uses. The oil is said to be used as a table oil in southern Russia. It is recommended for making soap. The oilcake is used as a fertilizer. Sunflower seeds are used for food in Chile and Peru. They are used also as chicken feed and as a flour for baking. The stalks furnish a fibre that looks

like silk, and the petals of the flowers provide a yellow color for dyeing. The leaves may be used in the treatment of asthma instead of stramonium (thorn apple).

Rolet, Antonin. Le tournesol, ses graines et son huile. La Vie Agricole et Rurale, 13.année, t. 25, no. 35, pp. 140-143. Aug. 30, 1924. 14 V67

Contains the same information as the article by the same author cited above.

Ross, A. M. Some morphological characters of *Helianthus annuus* L., and their relationship to the yield of seed and oil. Sci. Agr. [Canada] 19(6): 372-379. Feb. 1939. 7 Sci2

"Sunflower seed contains an extremely high percentage of vegetable oil which is used extensively in the manufacture of various food products. After the oil has been extracted, the remainder of the seed is utilized as a cattle feed and for this purpose is comparable with linseed cake both in nutritive value and in palatability. Unfortunately, no statistics are available to show the amount of sunflower oil which is annually imported into Canada." Results of an experiment at the Central Experimental Farm, Ottawa, are given, showing the correlation obtained between the percentage of oil in the seed and the yield of seed, and various factors studied. Factors affecting the oil percentage and the yield of seed are discussed.

Sessous, G. Entwicklung und bedeutung des ölfrauchtanbaus in Deutschland. Fette und Seifen 47(1): 10-12. Jan. 1940. 384 C422

Contains a table giving the fat and protein content of a number of oil seeds including sunflower seeds.

Severin, G. Sunflower seed and sunflower oil. In International institute of agriculture. Studies of principal agricultural products of the world market, no. 4. Oils and fats: Production and international trade. Pt. I, pp. 77-89. Rome, 1939. 280.39 In8

Three varieties of sunflower are distinguished, the wild sunflower being native to America and the ornamental sunflower having been discovered in Central America. The seeds were imported into Europe from Central America in the sixteenth century. They were used first in confectionery and as coffee substitutes in the seventeenth century. And towards the middle of the nineteenth century the oil was first extracted in Russia.

The uses of sunflower products are enumerated as follows: "(1) the seeds...are used for the extraction of edible or industrial oil; (2) sunflower oil is largely employed in the manufacture of margarine and compound lard; it is an oil of low drying capacity; (3) the seeds of certain varieties are also consumed baked, especially in the U. S. S. R.; (4) the refuse of oil extraction, cake and meal, rich in protein and fatty matter, are used especially as concentrated feed

for livestock; (5) the stalks, leaves and inflorescences of the fodder varieties make good ensilage for large livestock; (6) the flowers are attractive to bees, which help to pollinate them; (7) the stalks, leaves and inflorescences when threshed are used by the peasants as fuel; the ash is a good fertilizer, rich in potash; (8) finally, the crop plays an important part in the rotation.

Information is given on the production of sunflower in the U. S. S. R., Rumania, Bulgaria where the Office for the Purchase of Cereals regulated the price of the seed in 1934, Czechoslovakia, Yugoslavia, and Argentina.

Tables give world area and production of sunflower by countries average 1909/13 and 1924/28 and annually 1929-1936; and export and import of sunflower seed by countries 1929-1937.

Severin, G. The trade in sunflower seed. Internat. Inst. Agr. Internat. Rev. Agr. 26: 280S-284S. 1935. Rome, 1935. 241 In82

Tables give area, production, and yield of sunflower seed in European countries, 1915, 1930-1934 and exports and imports of sunflower seed 1930-1934.

Shutt, Frank T. Chemistry of the sunflower plant; sunflower seed. Canada. Dept. Agr. Dominion Expt. Farms. Div. Chem. Interim Rpt. 1921/22, pp. 90-102. Ottawa, 1922. 101 Ex68

An account of the chemistry of the sunflower plant "dealing chiefly with composition as related to the stage of growth... The sunflower crop in Canada is grown almost exclusively for the silo; there is no extensive cultivation of it for seed."

Sievers, A. F. The sunflower: its culture and uses. 5pp., processed. Washington, D. C., U. S. Dept. of agriculture, Bur. of plant industry [1940] 1.965 D2Su7

The author discusses briefly the cultivation of sunflower in the United States as a silage crop and as a seed crop. Under the heading of production, chief demand, and prices of sunflower seed he notes that "approximately 95 percent of the sunflower seed produced in the United States is grown in Missouri, Illinois, and California... The largest crops on record (since 1919) were harvested in 1928 and 1929, the production in each of those years amounting to about 16,000,000 pounds... Up to 1927 the domestic production of sunflower seed was usually insufficient to meet the demand, hence much seed was imported. Prior to the First World War Russia contributed the largest imports, but since then Argentina, Manchuria, Rumania, Hungary, Bulgaria and other countries have been the chief sources, although during the past two years the quantity of sunflower seed imported has been small. Imports during the 10-year period, 1930-39, averaged 334,152 pounds. The largest quantity ever imported in any year was 5,677,525 pounds, which occurred in 1923. Since 1922 there has been a duty of 2 cents a pound on sunflower seed.

"The principal demand for sunflower seed in the United States is as an ingredient of scratch feeds for poultry. A small percentage

of this seed is put in many commercial scratch feeds. It not only adds variety to the ration, but also increases both the protein and fat content of the scratch feed and is considered especially desirable for use during the molting period. Although much higher in protein and fat than either corn or wheat, sunflower seed is usually relatively too high in price to make up more than a small percentage of poultry feed...

"The lack of a sustained active demand for sunflower seed has been reflected in prices of this seed during the last 8 years. Growers in Illinois and Missouri have received an average price of 2 1/10 cents a pound during the 10-year period, 1930-39, and growers in California received 2 4/5 cents... There seems to be no disposition on the part of poultry-feed manufacturers to increase the percentage of sunflower seed in their feeds..."

"Sunflower seed weighs from 21 to 26 pounds per bushel and contains from 23 to 32 percent of oil that can be used for food or for technical purposes... In the United States there has been no sustained commercial production of sunflower oil. In 1920 about 100 tons of seed were crushed in a cotton-oil mill in Tennessee, but this operation was not repeated in subsequent years. It is reported that seed could not be obtained at a price that would permit a profit to the mill..."

"During the 5-year period, 1932-36, a total of 120,000,000 pounds of sunflower oil was imported, of which about 75 percent was designated as edible oil. In 1937 only 172,000 pounds of the oil designated as edible were imported. The following year only a few thousand pounds came in, and there was no edible sunflower oil imported during 1939. The largest quantity was imported in 1935 when 37,250,000 pounds were received, less than 1 percent of which was designated as inedible oil."

Simmons, W. H., and Mitchell, C. Ainsworth. Edible fats and oils; their composition, manufacture and analysis. Ed. 2, rev., 189pp. London, Scott, Greenwood & son, 1921. 389 Si4

Contains brief references to sunflower-seed oil on pp. 25 and 112. Its iodine value is said to be "considerably higher than that of cotton-seed oil."

Sunflower oil for paints. Canad. Chem. and Metall. 20(8): 269. Aug. 1936. 381 C16

Notes use of sunflower oil in paint as a substitute for linseed oil.

Sunflower oil industry in Cuba. Soap 7(11): 116. Nov. 1931. 307.8 Sol2

Discusses the project of an "American Company" for the development of the sunflower oil industry in Cuba. The first sowing was of approximately 9,000 acres. The aim is to develop the Cuban market "by selling sunflower oil at a price based upon the market price of prime summer yellow cotton seed oil plus the cost of freight to Cuba and a certain part of the difference due to improved quality." This is expected to benefit the cattle industry as a whole.

Sunflower seed. A flourishing new branch of Argentine agriculture. Rev. River Plate 88(2513): 17. Feb. 6, 1940. 286.8 R32

Points out the importance of and uses for sunflower seed and its possibilities in Argentina.

Timson, S. D. The sunflower (*Helianthus annuus*). Rhodesia Agr. Jour. 25(3): 281-296. Mar. 1928. 24 R34

Discusses the production of the sunflower and its uses. Analyses are given of sunflower head meal, sunflower silage, and the digestible nutrients in sunflower silage as compared with corn silage. "No plant produces finer honey and wax." A table gives area, production and yield in Southern Rhodesia 1921/22-1925/26.

Torres, L. G. El girasol (*Helianthus annuus*). Mexico. Secretaría de Agricultura y Fomento. Boletín Oficial, t. 8, época 6a, nos. 5-12, pp. 635-639. May-Dec. 1923. 8 F732B

A short sketch of cultivation, yield, and composition of the sunflower which is said to be a native of Peru and which is grown in Mexico only as an ornamental plant. Contains a good illustration of the plant.

U. S. Dept. of agriculture. Agricultural statistics 1940. 737pp. Washington, D. C., 1940. 1 Ag84Yas

Table 460, p. 342, gives statistics of production of sunflower seed in California, Illinois, and Missouri, average 1928/37 and annually 1928-1939; also imports for consumption during the same period.

U. S. Dept. of agriculture. Office of foreign agricultural relations. Argentine peanut and sunflower production estimates revised. U. S. Dept. Agr. Off. Foreign Agr. Relations. Foreign Crops and Markets 41(19): 694, processed. Nov. 12, 1940. 1.9 St2F

Revised tables are given for area and production of sunflower seed in Argentina, 1934/35-1939/40.

U. S. Dept. of agriculture. Office of foreign agricultural relations. Argentine vegetable-oil and oilseed production increases. U. S. Dept. Agr. Off. Foreign Agr. Relations. Foreign Crops and Markets 41(9): 270-275, processed. Sept. 3, 1940. 1.9 St2F

Notes increased production of oilseeds in Argentina in recent years most of which are consumed by the domestic oil-milling industry.

"Sunflower-seed production, which was introduced by Russian settlers more than 30 years ago, received little attention until about 5 years ago, when it became difficult to obtain olive-oil supplies from Europe. Its cultivation has expanded rapidly, as it has been recognized that the cost of production is low, and the returns have been sufficient to encourage farmers to increase their acreage. The average yield of seed in the past 5 years has risen from 588 pounds to 828 pounds per acre, due to improved cultural methods."

Statistics are given of sunflower seed crushed, 1935-1938, and of exports of the seed, 1936-1939.

U. S. Dept. of agriculture. Office of foreign agricultural relations. Argentine vegetable-oil production increased in 1939. U. S. Dept. Agr. Off. Foreign Agr. Relations. Foreign Crops and Markets 41(11): 367, processed. Sept. 16, 1940: 1.9 St2F
"Sunflower seed shows the greatest volume, accounting for 64 percent of the total 1939 production."
The amount of seed crushed and oil produced in 1939 is given.

U. S. Dept. of agriculture. Office of foreign agricultural relations. Sunflower cultivation in Rumania to be expanded. U. S. Dept. Agr. Off. Foreign Agr. Relations. Foreign Crops and Markets 41(19): 694, processed. Nov. 12, 1940. 1.9 St2F
"Germany appears to be cooperating closely with Rumania in developing cultivation of sunflower seed in the latter country. German interests are active through their participation in a German-Rumanian oilseed organization called 'Solagra.' It is reported that this company was instrumental in sowing a large area to sunflowers this year, and the expansion is expected to be much greater in 1941. The latest production figures available for all of Rumania are for 1938, when the output was approximately 509 million pounds. Over 70 percent of this amount was produced in Bessarabia and about 8 percent in Transylvania, now ceded to the Soviet Union and Hungary, respectively."

U. S. Dept. of agriculture. Office of foreign agricultural relations. United States foreign trade in agricultural products, 1939-40. U. S. Dept. Agr. Off. Foreign Agr. Relations. Foreign Crops and Markets 41(9): 295-328, processed. Sept. 5, 1940. (Sup. to issue of Sept. 3, 1940) 1.9 St2F
Imports of sunflower oil are given for 1938/39 as 271,000,000 lbs. of a value of \$13,000.

U. S. Dept. of commerce. Bur. of the census. Animal and vegetable fats and oils; production, consumption, imports, exports and stocks. Quarterly for calendar years 1935 to 1939. 29pp. Washington, D.C., 1940. 157.41 An52
Contains tables which give imports of sunflower seed oil for consumption 1935 to 1938 and factory consumption in 1935 and 1936. For earlier years see earlier reports.

Varadachar, K. S. Synthesis of proteins in plants. Part I. Conversion of nitrates into protein in *Helianthus annuus*, Linn. Indian Inst. Sci. Jour. 16A(12): 129-138. 1933. 513 In23
"A direct method of feeding of plants with nutrients is described. This technique has been applied to the study of protein synthesis by feeding nitrogen-starved sunflower plants with potassium nitrate solution and studying the attendant changes.
"There is evidence to suggest that there is continuous conversion of nitrate into other forms of nitrogen. The added nitrogen would appear to pass through the amide stage before being converted into protein."

Vass, A. F. Sunflowers - their culture and use. Wyo. Agr. Expt. Sta. Bul. 129, pp. 77-107. Laramie, 1921.

"The sunflower will yield twice as much silage as will corn on our high altitude farms, and the crop can be handled with approximately the same amount of labor per ton of silage... The use of sunflower silage on our farms and ranches means the saving of hay, and this in turn means the saving of livestock during the drought years that are bound to come."

Vinall, H. N. The sunflower as a silage crop. U. S. Dept. Agr. Bul. 1045, 32pp. Washington, D. C., 1922.

Among the topics discussed are the early history of the sunflower, its present distribution, cultivation in the United States, sunflowers for silage and its feeding value.

Wacker, [Johann] Ölfrüchte und gespinstpflanzen. In Deutsche landwirtschafts-gesellschaft. Neunzehn vorträge gehalten... zu Magdeburg vom 5.-10. Sept. 1919, pp. 102-116. Berlin, P. Parey, 1919. (Arbeiten, Heft 300) 18 D48

On p. 110 there is a paragraph on the unsuccessful cultivation of the sunflower during the war years. Further cultivation of the more profitable varieties is urged.

Wiggans, R. G. Sunflowers as compared with corn as a silage crop for New York. N. Y. (Cornell) Agr. Expt. Sta. Bul. 456, 29pp. Ithaca, 1926.

"As a result of the experimental work with corn and sunflowers for silage purposes, sunflowers cannot be recommended in areas well suited for corn production, but under special conditions they may serve a very useful purpose."

Wiley, Harvey W. The sunflower plant: its cultivation, composition, and uses. U. S. Dept. Agr. Div. Chem. Bul. 60, 31pp. Washington, D. C., 1901. 1 C42B no. 60

Contains information on the composition of the sunflower, the methods of culture, and the manufacture of oil from the seed. When this bulletin was published the oil of the sunflower seed was "not produced commercially in the United States."

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- No. 19. The banana industry in tropical America with special reference to the Caribbean area, 1930-1940; a selected list of references. January 1941.



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No. 20. The sunflower, its cultivation and uses; a selected list of references. April 1941.