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SUNFLOWERS
as a Seed and Oil Crop FOR ILLINOIS

Circular 681

UNIVERSITY OF ILLINOIS · AGRICULTURAL EXPERIMENT STATION

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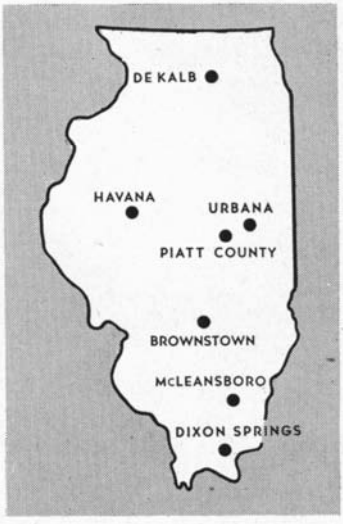


Where variety tests were made. See page 10.

Urbana, Illinois May, 1951

(Experiment Station and Extension circulars are numbered consecutively in the same series.)

SUNFLOWERS

As a Seed and Oil Crop for Illinois

By R. O. Weibel, Assistant Professor of Crop Production and Plant Genetics

SUNFLOWERS have been grown as a commercial seed crop in Illinois for many years, but not for their oil. As an oil crop they show definite promise of a larger place in Illinois agriculture. It is safe to say that more will be planted as farmers get acquainted with this crop, better varieties are developed, and certain problems of harvesting are solved.

The oil and meal from sunflower seed are sources of high-quality human food and livestock feed. With increased production, markets for the seed should become available in Illinois, as they are now in areas where production warrants. Increased production should also encourage a price based on the real value of the product, and this should mean a higher comparative price for sunflower seed. Prices are now set for other oilseeds on a pound-for-pound basis.

Sunflowers Are Widely Adapted

Capable of growing well under a wide range of soil and climate, sunflowers can be expected to produce a seed crop wherever corn is successful. This statement applies especially to the northern two-thirds of the United States. Young plants, up to the 4- to 6-leaf stage, withstand near-freezing temperatures. Also, when the ripening seeds are near maturity, even heavy frosts do not damage them. The crop is more drouth-resistant than corn.

Heavy, poorly drained soils should not be used for sunflowers, especially if there is danger of water standing on the land for long periods.

As more sunflowers come to be grown, the threat of damage from insects and diseases can be expected to increase, but it can also be expected that more study will be directed to determining economic methods of control.

Seed Has Many Uses

Unhulled sunflower seed as it comes from the threshing machine or combine contains from 25 to 35 percent of oil. Hulled seed, or "meats," contain 50 to 60 percent of oil.

Sunflower-seed oil is pale yellow and has only a slight odor. It is a fine-flavored, high-quality oil and is used in the manufacture of shortening, oleomargarine, salad dressing, and cooking oil. It can also be used in the manufacture of paper, plastics, glues, soap, and certain pharmaceutical products. Classified as a semi-drying oil, it rates between linseed and olive oil and can be used to some extent in paints and varnishes. Processors of sunflower seed report a low refining loss. The crude oil can sometimes be used without further refining.

Sunflower-seed meal is high in protein of a high biological value. Meal processed from whole seed will average about 35 percent protein; from hulled seed, as much as 50 percent or more. Sunflower-seed meal competes directly with cottonseed, linseed, peanut, and soybean meals and is interchangeable with them in livestock feeds.

Because of the high digestibility of the protein, the high calcium content, and certain vitamins (especially carotene, thiamin, and niacin), sunflower-seed meal offers possibilities as human food. Tests made at the Illinois Agricultural Experiment Station (reported in Circular 608) show that the meal can be combined with bread and pastry flours with excellent results.

Some people relish sunflower seeds as a confection, and eat them either roasted or raw. A considerable amount of seed is used in mixed poultry and bird feeds.

Growing Sunflowers

Place in the rotation. As a cultivated crop, sunflowers can be included in the rotation as a substitute for such crops as corn or soybeans. Because of disease and insect hazards, sunflowers should not be grown in the rotation oftener than once in four years. A good 4-year rotation would be corn, sunflowers, small grain, and legume sod.

There may be some volunteering of plants when sunflowers are followed by an uncultivated crop like oats. However, if the field is not fall-plowed, birds and rodents will eat most of the shattered seed during the winter. Sunflower plants are easily destroyed by 2,4-D, but it is better to prevent their growth, if possible, than to have to control them later.

Sunflowers are apparently no more harmful to the soil than any other crop; at least, there has been no indication of reduced yields of crops following them.

Seedbed. A firm seedbed similar to that prepared for corn is important, as it results in more uniform emergence and in a better stand of plants.

Time of planting. Sunflowers should be planted earlier than corn. There is quite a range of acceptable planting dates, as the figures in Table 1 indicate, but late April or early May seems best. Later plantings have been more severely damaged by insects, especially the seed weevil.

Table 1. — Seed Yields of Sunflowers Planted at Different Dates in Central Illinois

1945 Sunrise (Cerro Gordo)		1947 Advance (Urbana)		1949 Illinois Common (Urbana)	
Date planted	Yield per acre	Date planted	Yield per acre	Date planted	Yield per acre
	lb.		*lb.*		*lb.*
.....	...	April 19.....	1 642	April 20.....	1 617
May 2.....	878	.....	.....	April 30.....	2 574
May 12.....	903	.....	.....	May 9.....	1 551
May 22.....	877	May 23.....	1 656	May 28.....	1 617
June 4.....	838	.....	.....	June 10.....	1 749

Method of planting. Sunflowers should be planted in rows, so that they can be cultivated. The corn planter, a grain drill, or a soybean drill can be used. Special seed-plates are available for most makes of corn planters and should be used in order to assure uniform planting. Grain drills are satisfactory for the small-seeded types if the proper number of spouts are plugged

Table 2. — Seed Yields of Sunflowers in Plant-Spacing Trials in Piatt county in Central Illinois

(Pounds per acre)

Spacing of plants within 40-inch rows	Five varieties[a]	Seven varieties[b]
3 inches apart	1 886	.....
6 inches apart	2 101	1 879
12 inches apart	2 103	1 867
18 inches apart	1 762	1 616
24 inches apart	1 600	.....

[a] Advance and Jupiter grown at Bement in 1947; Advance and Illinois Common grown at Urbana in 1947; Sunrise grown at Cerro Gordo in 1945. Advance is counted twice, having been grown two seasons.

[b] Average of the varieties listed above plus Sunrise and Arrowhead grown at Monticello in 1946.

to obtain the desired width between rows. Soybean drills are satisfactory provided they can be adjusted for the desired row width.

Growers have used rows varying from 21 to 40 inches apart, with little apparent difference in total yields. If the narrower row spacings are used, there should be fewer plants in the row. In 40-inch rows, spacing the plants 6 to 12 inches apart has produced higher yields than 3-, 18-, or 24-inch spacings (see Table 2).

Because sunflower heads face the east and the upper part of the stalks, as the plants mature, tends to bend in that direction, rows should run east and west to facilitate harvesting. When planted north and south, the heads may bend over into the adjoining row and make it difficult to separate the plants mechanically.

Rate of planting. The amount of seed to plant per acre will vary with the method used and the variety. When planting a small-seeded variety such as Advance, the best rate will vary from about 4 pounds for 40-inch rows to 6 pounds for 28-inch rows. These rates should result in plants spaced approximately 6 inches apart in the row. For larger seeded varieties like Grey Stripe, the rate is about 6 to 8 pounds an acre.

Seed treatment. Seed treatment is a good practice with most crops and will probably prove beneficial with sunflowers, though there are no tests to prove this. Use of New Improved Ceresan or Arasan at the rate of ½ ounce for each 10 pounds of seed is suggested.

Fertilizers. Limited tests in Piatt county, in central Illinois, show that sunflowers respond definitely to potash, either alone or in a complete fertilizer, but they respond only slightly to phosphorus or nitrogen when either is applied alone. A heavy application of nitrogen (more than 60 pounds) reduced yields. This was on soil of good fertility.

On the less fertile soils of the Enfield experiment field in White county, there was a definite response to treatment, as shown by the following four-year average yields:

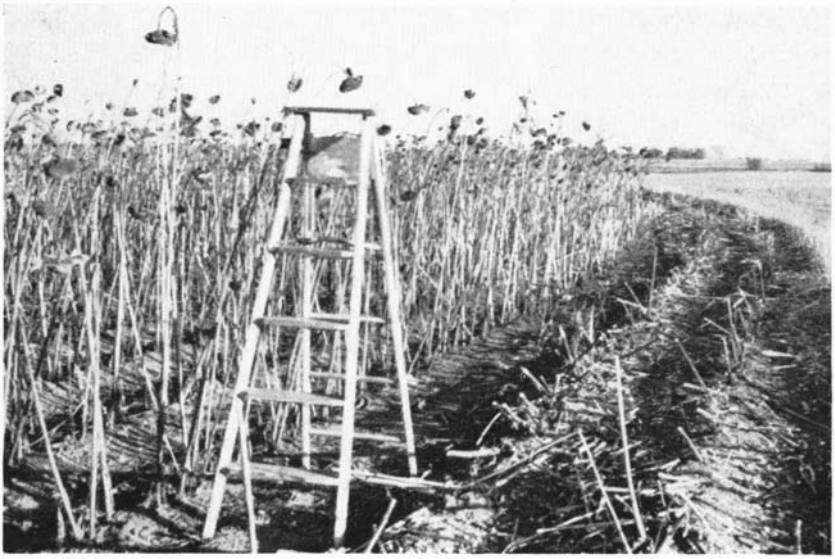
Treatment	*Seed yields, 1946-1949, pounds per acre*
None	50
Residues returned	119
Residues and lime	468
Residues, lime, and phosphate	415
Residues, lime, phosphate, and potash	1 176
Difference between yields necessary for significance	199

Cultivation. Because young sunflower plants are very leafy it is more difficult to control weeds in the row than in rows of young corn. However, once sunflower plants are 6 to 8 inches tall their rapid growth and heavy foliage, which soon shades the ground, make weed control less difficult. Regular equipment used for cultivating corn or soybeans is effective also with sunflowers. Sunflowers should not be cultivated too deep.

2,4-D cannot be used for weed control as sunflower plants are easily damaged by this material.

Harvesting Time and Methods

Sunflowers should be harvested as soon as seed and plants are dry enough. The heads should mature in the field. When mature, the back of the head is brown and dry. Moisture content of the seed should be not more than 12 percent. Any delay in harvesting may mean loss of seed because of shattering, stem breakage, or feeding by birds and rodents. If the season is dry



These sunflowers are ready to harvest — the backs of the heads are brown and dry. This semi-dwarf variety, Illinois Common, is irregular in height and difficult to harvest with machinery. Note that these rows, 40 inches apart, are planted on the contour. Thomas James farm, Mansfield, Illinois. (Fig. 1)

Here is a modified, small-grain combine doing a fair job of harvesting sunflowers. Plants are less than 5 feet tall, very uniform, and standing well. Reel blades are made solid with ½-inch hardwood cloth. Sometimes other material, such as sheet metal or plywood, is used. (Fig. 2)

for a while after the plants are thoroughly mature, they become very brittle and present added difficulties for machine harvesting.

For the most part, harvesting of sunflowers has been a hand operation. The heads are cut off with a knife or clippers, thrown into a wagon, and hauled to the thresher. The ordinary threshing machine, the combine, and even the corn sheller have been used for threshing. With the thresher or the combine, the adjustments necessary are reduced cylinder speed and proper screen and air settings. The time and labor required for harvesting and threshing have been partly responsible for the small acreage of sunflowers.

Some attempt has been made to use the small-grain combine for harvesting direct from the field. If the plants are standing well, are uniform, and not more than 5 feet tall, the combine with a special reel is fairly satisfactory. The reel diameter is increased and the blades made solid with light sheet metal or hardware cloth. Taller plants (and most of the available varieties do grow taller than 5 feet under Illinois conditions) cannot be successfully harvested in this manner. Special equipment will have to be developed if the crop is to be fully mechanized. Some progress has been made and more effort is being directed toward solving the harvesting problem.

Varieties for Illinois

Many varieties of sunflowers have been tested for seed production by the Illinois Agricultural Experiment Station. Of these, seven that seem best under Illinois conditions are described here. All seven have striped seed, except Jupiter, which is a black-seeded variety. Tables 3 and 4 give further facts concerning these varieties, including their yields in test plantings.

Dwarf

Sunrise. A uniform, small-seeded dwarf type. Seed is high in oil and does not shatter easily. However, the yield of seed is low compared with that of certain other varieties. This variety is a selection from an introduction from Russia that came to the United States by way of Canada.

The advantage of Sunrise is its uniformity of growth.

Table 3. — Some Characteristics of Seven Sunflower Varieties Grown at Urbana, Illinois, 1945-1949

Variety	Number of days to—		Plant height	Stem diameter	Head diameter	Percent oil[a]
	Flower	Harvest				
			inches	*inches*	*inches*	
Dwarf						
Sunrise	71	131	56	.96	5.69	29.2
Advance	68	129	55	1.19	6.64	30.8
Arrowhead	62	126	56	.86	5.62	27.3
Semi-dwarf						
Jupiter	67	131	65	.99	6.28	28.7
Illinois Common	73	131	74	1.08	6.90	27.5
Tall						
Manchurian	83	134	87	1.15	7.58	24.2
Grey Stripe	91	139	122	1.20	7.07	25.0

[a] Four-year average 1945-1948. Determinations were made by Northern Regional Research Laboratory, Peoria, Illinois.

Table 4. — Seed Yields of Seven Sunflower Varieties Grown at Several Locations in Illinois, 1945-1950

(Pounds per acre)

Variety	Northern Illinois, DeKalb 1949-1950	Central Illinois			Southern Illinois		Extreme southern Illinois, Dixon Springs 1945, 1947-1950
		Havana 1945-1947	Piatt county 1945-1947	Urbana 1945-1950	Browns-town 1945-1950	McLeans-boro 1947-1949	
Dwarf							
Sunrise	...	.....	.....	1 095	.....	.....	...
Advance	950	1 156	1 922	1 931	1 506	1 014	558
Arrowhead	812	1 023	1 670	1 733	1 269	945	588
Semi-dwarf							
Jupiter	...	1 086	1 544	1 597	.....	.....	...
Illinois Common	1 485	1 067	2 015	2 092	1 470	1 102	838
Tall							
Manchurian	...	.....	.....	1 906	.....	.....	789
Grey Stripe	...	.....	.....	1 539	.....	.....	890

At three of the above locations, the following people cooperated in these tests: at *Havana*, Trevor Jones, manager of Cimco Farm; in *Piatt county*, Lynn Clarkson, Cerro Gordo (1945), Burt Downey, Monticello (1946), and Lester Brandenburg, Bement (1947); at *McLeansboro*, Richard Pickens (1947 and 1948), and F. W. Kittinger (1949).

DeKalb is in DeKalb county, Havana in Mason county, Urbana in Champaign county, Brownstown in Fayette county, McLeansboro in Hamilton county, and Dixon Springs in Pope county.

Advance. Also a dwarf type (see Figs. 3 and 4). It is a few days earlier than Sunrise and produces higher yields of seed. The seed (see Fig. 5, page 16) is a little larger than that of Sunrise and the oil content slightly higher. This is a top-cross hybrid developed in Canada.

Because of its yield, oil content, and dwarf character, Advance is first choice as an oilseed type. Since, however, it is a hybrid, first-generation seed should be planted each year. One reason this variety has not been grown more widely is that the seed has not been readily available.

Arrowhead. An early dwarf type which came to Illinois from Minnesota. The seed is larger and lower in oil than either Sunrise or Advance. Heads bend down badly if the stand is thin, making harvesting very difficult. Seed shatters from the head more readily than that of Sunrise or Advance.

The main advantage of Arrowhead is its earliness and larger seed, which is preferred by some seedsmen.

Short and tall varieties on the Agronomy south farm, Urbana. In the foreground is Advance (4½ feet high); in the rear is Grey Stripe (9½ feet high). Note uniformity and earliness of Advance. Rows are 40 inches apart and plants are spaced 1 foot apart in the rows. When Advance is planted thicker, the plants grow taller and the heads nod less. (Fig. 3)

This excellent stand of dwarf-type sunflowers is in full bloom. The uniformity of the blooms is typical of Advance. The rows, 40 inches apart, are planted east and west to facilitate harvesting. Lynn Clarkson farm, Cerro Gordo, Illinois. (Fig. 4)

Semi-Dwarf

Jupiter. A medium or semi-dwarf type, but too tall for successful combining, especially if grown on highly fertile soil. Its black seed is plump and has a high oil content. It shatters somewhat in the field. This variety came to Illinois from Canada.

Illinois Common. A medium or semi-dwarf type (Fig. 1). It is a selection from a commercial variety obtained from North Dakota. It is not uniform in height and maturity and like Jupiter grows too tall on good land for combining. Yield of seed has been good and the oil content is about the same as that of Arrowhead.

Tall

Manchurian. A late, tall, large-seeded type. It is more leafy than Grey Stripe. Normally it grows too tall for combining, and because of its height is more subject to stem breakage by wind than the shorter varieties. Seed is low in oil, but yields of seed are good when the plants can take advantage of the full season and lodging does not occur.

Grey Stripe. Also a late, tall, large-seeded type (see Fig. 3, page 11, and Fig. 6, page 16). The seed is similar to that of Manchurian in size

and oil content, but it is lighter in color (more white than black in the striping). This is the tallest variety grown in Illinois and the most frequently damaged by wind. Despite these handicaps, the average yields of seed are good and it has been the most commonly grown type.

Disease Hazards

In Illinois, diseases have not been a serious threat to sunflower growing, but the plant is subject to attack by several diseases that may become more severe as the acreage of the crop is increased.

Rust causes small brownish spots, or pustules, on sunflower leaves. Some rust is present every year but has not been severe enough to reduce yields. All stages of this disease are passed on the sunflower plant. The winter spores lie dormant on stalks and leaves or in the soil. Clean plowing, early planting, and rotation of crops are recommended as aids in controlling this disease.

Mildew and Septoria leaf spot also attack sunflowers, but so far they have not caused any significant damage. Mildew produces a grayish-white mold on the upper side of the leaves; Septoria leaf spot causes irregular brown spots from which the tissue sometimes drops.

Stem rots have caused more damage than leaf diseases. There appear to be at least two of these diseases: one is Sclerotinia, a fungus disease, and the other is a bacterial disease. The damage caused by these two diseases is very similar: the stems are weakened, causing the plants to break over. Since the organisms causing these diseases may live in the soil for a year or more, rotation of crops (sunflowers not more than once in four years) is recommended. Also, since Sclerotinia rot attacks many fleshy rooted plants, including alfalfa, sweet clover, and other clovers, sunflowers should not immediately follow these crops in the rotation.

Insect Hazards

Many insects feed on the sunflower at various stages of growth and may do considerable damage when their numbers are high. Included in the list are: *cutworms, wireworms, webworms, white grubs, grasshoppers, aphids, thrips, sunflower beetles, seed weevils, moths,* and *budworms.* The damage from

these insects in Illinois varies from year to year but, with the exception of the seed weevil, has not been very serious.

Among late-maturing sunflower plants injury from the seed weevil has been especially serious. The adult, a small grayish-brown snout beetle, lays her eggs on the head of the sunflower in early bloom stage, and as the larvae hatch they go into the developing seeds. They eat away part or all of the "meat" in completing the larva stage. Then they emerge through holes which they have drilled in the seed coat and drop to the ground for the winter. The damage done by this insect may not be noticed until harvest time. Plants that mature early because they were planted early or are from early-maturing varieties have not been damaged as badly as late-maturing plants.

Rotation of crops, along with early planting and the use of early-maturing varieties, may help to control this insect, but no assured control is known.

Storing Sunflower Seed

If sunflower seed contains not more than 12 percent moisture at harvest time, there is little danger of its heating or spoiling in storage. Dry, cool storage conditions are ideal.

Insects common to other stored grains will also attack stored sunflower seed. Clean bins should therefore be used.

Rodents like sunflower seed, and it must be protected from them.

Markets and Prices

Because sunflower seed has not been produced in Illinois in large enough volume, definite markets for seed for processing have not been established in the state. In other areas where production is larger, markets are being established.

The price paid growers for seed has ranged from 4 to 6 cents a pound, and has been based for the most part on prices for other oilseeds — in some cases soybeans and in others flax. The market price for large-type seed to be used for purposes other than oil has fluctuated greatly, depending upon the supply, and has ranged from 2 to 15 cents a pound.

A Native Plant

Native to the Americas, sunflowers can be found growing wild in many parts of the United States, especially in the Great Plains states. Most people are acquainted with the plant, having seen it growing as a weed or, in its cultivated forms, as ornamentals or for poultry shade or feed.

Early settlers in this country found Indians cultivating sunflowers and using the seed as food and as a source of oil. About the middle of the 16th century, seed was introduced into Europe, and the crop spread from there to many other areas. Toward the latter part of the 18th century sunflowers were reintroduced into America as a commercial crop. Today we find a substantial acreage of sunflowers grown for seed in California, Illinois, Missouri, North Dakota, and Minnesota, and smaller plantings in other states. Even as far north as southern Manitoba, Canada, sunflowers are an important oilseed crop. Some farmers grow the crop for silage.

Varieties that will be more uniform in height and will produce higher yields of seed than those now grown will doubtless be developed through breeding and selection. The hybrid Advance, developed by plant breeders in Canada, is an example of what is being done to develop more satisfactory varieties.

Seeds of two varieties are shown in natural size on the next page.

ADVANCE (dwarf). High oil content. Seed is of medium size, plump, and completely filled with meat, an indication of high oil content. (Fig. 5)

GREY STRIPE (tall). Oil content lower than in Advance. Seed is large but flat and not filled with meat. More commonly produced, and still generally preferred by buyers of bird seed. (Fig. 6)

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