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## Sunflowers in South Dakota

H. A. Geise

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# Sunflowers in South Dakota



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# Sunflowers in South Dakota

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Domestic sunflower culture was established in the United States after 1880 following introduction of improved varieties that had been developed in Europe before 1600. The Indians in Virginia were using native variety sunflowers for food in 1586, and in New England sunflower oil was being used as a hair dressing in 1615.<sup>1</sup>

During the early 1900's sunflowers were grown in the Northern Great Plains states and prairie provinces of Canada as a silage crop. Sunflowers as an oilseed crop have been grown commercially in Canada since 1943 and in Minnesota since 1947. Commercial birdfeed production in Minnesota began in 1952.<sup>2</sup> Since then, 70% of the harvest has been utilized as bird feed, while 30% has been used for human consumption.<sup>3</sup> Production for oil gained new interest in 1966 when varieties from Russia were introduced which ranged from 40% to 50% oil in their small, black, thin-hulled seed.

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\*Prepared in cooperation with Earl P. Adams, Extension soils specialist; Benjamin H. Kantack, Extension entomologist; Arthur B. Sogn, Extension economist; Leon S. Wood, Extension plant pathologist; and Leon J. Wrage, Extension weed specialist.

<sup>1</sup>Martin and Leonard, Principles of Field Crop Production, textbook.

<sup>2</sup>The Sunflower Crop in Minnesota. Minn. Agr. Ext. Sr. Bul. 299, 1973.

<sup>3</sup>Taylor, R. W., Proceedings of 3rd International Sunflower Conference, 1968.

Although sunflowers are adapted to most of the climates and cultivated soils of the United States and Canada, the risk of sunflower moth damage has limited the sunflower growing area to the Red River Valley and adjacent counties. However, the development of insecticides now permit the growing area to be expanded.

#### ECONOMIC ADAPTATION

Sunflowers are not a "get rich quick" crop because they require additional care which increases cost of production. However, a grower who has his land in a good fertile condition with a low weed population will not need to perform extra operations that add to the production costs.

For sunflowers to be competitive with other crops, growers need to practice all management techniques available. Proper seedbed preparation, planting date, fertilization, weed and insect control, and harvesting need special attention. Any one of the above operations improperly timed or performed means the loss of the profit portion of the seed yield.

The figures presented in Table 1 show the relative yields of various crops to obtain a certain level of gross income per acre. The table does not show costs of production such as harrowing for weed control and spraying for insect control.

The figures presented in Table 2 are the average yields of crops by planning area (Fig. 1). By comparing Tables 1 and 2 and Figure 1, a potential grower can determine if sunflowers would be a profitable crop.

Table 1. Yields of sunflowers and other crops needed to give a gross income of \$30-\$120 per acre

Gross Income per Acre	Crop and Price Received per Unit by Grower*						
	Sunflowers	Soybeans	Flax	Barley	HRS Wheat	Oats	Corn
	7.5¢	\$5.45	\$7.71	\$1.84	\$3.95	\$1.03	\$1.97
	lbs/acre	bushel per acre					
\$30	400	5.5	3.9	16.3	7.6	29.1	15.2
\$40	533	7.3	5.2	21.7	10.1	38.8	20.3
\$50	667	9.2	6.5	27.2	12.7	48.5	25.4
\$60	800	11.0	7.8	32.6	15.2	58.2	30.5
\$70	933	12.8	9.1	38.0	17.7	68.0	35.5
\$80	1067	14.7	10.4	43.5	20.2	77.7	40.6
\$90	1200	16.5	11.7	48.9	22.8	87.4	45.7
\$100	1333	18.4	13.0	54.3	25.3	97.1	50.8
\$110	1467	20.2	14.3	59.8	27.8	106.8	55.8
\$120	1600	22.0	15.6	65.2	30.4	116.5	60.9

\* South Dakota Crop & Livestock Reporter, November 9, 1973.

Table 2. Average yields of principal crops in bushel/acre grown in respective planning areas.\* (1971-1972)

Planning Area	Crop					
	Corn	HRS Wheat	Oats	Barley	Flax	Soybeans
1	52	25	51	37	13	22
2	70	23	54	39	12	27
3	49	22	50	36	11	23
4	49	27	54	41	13	18
5	38	26	54	38	10	18
6	72	26	48	36	8	--

\* South Dakota Crop & Livestock Annual Report, 1972.

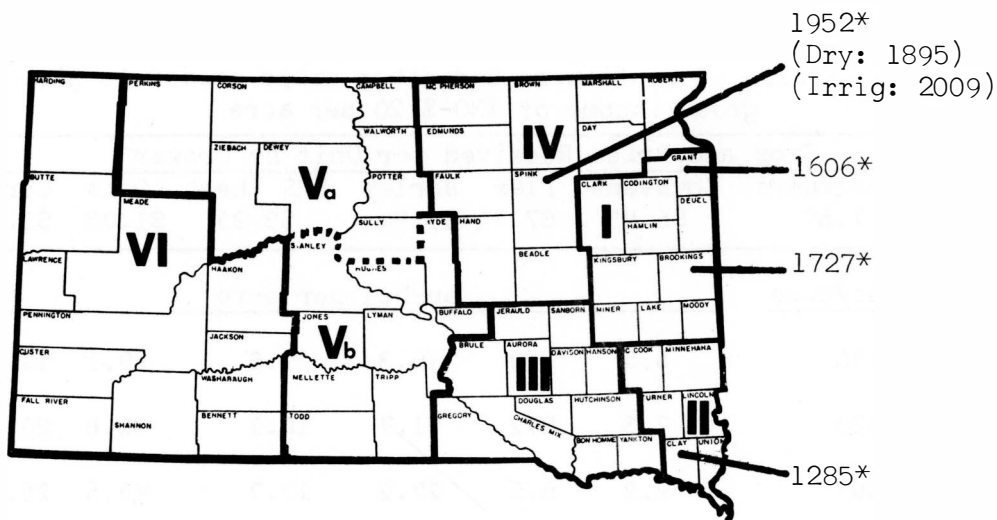


Figure 1. Planning areas in South Dakota. Figures are average yield of sunflowers, lbs/acre, SDSU Agr Exp Sta trials, 1973

### VARIETIES AND MARKETS

Varietal recommendations change as new or improved varieties become available. At present only those varieties desired by a processor will be available through the contracting company to growers. For that reason, varieties and markets must be considered together.

#### Human Food Market

This market usually pays the highest price but also requires the highest quality seed. Large seed without visible insect damage, discoloration, or other unsightly factors are desired. Mingren is the largest seeded variety, followed by Commander, Sundak, and Mennonite. Seed held on a 24/64 or 26/64 round hole screen is used for the roasted whole seed trade; medium large seed is dehulled and used for the nutmeat trade. Seed passing through a 20/64 screen and surplus large seed are sold for bird-feed.

#### Birdfeed Market

Arrowhead and surplus human food varieties are used for

birdfeed. The medium sized, striped seed and high bushel weight are popular with buyers. The small, black, high oil varieties are not acceptable.

#### Oilseed Market

Varieties acceptable in this class must contain at least 40% oil.

### VARIETAL DESCRIPTIONS

#### Mingren

A large seeded variety, high in hull and low in oil content (27%) and bushel weight. It is of medium maturity and height. It is an open-pollinated, rust susceptible variety selected from Mennonite.

#### Commander

A variety similar to Mingren in maturity, height, and use. The seed which is slightly smaller than Mingren has broad black and narrow white stripes. It is an open-pollinated variety selected from Mennonite, is susceptible to rust and moderately susceptible to downy mildew and verticillium wilt. It has a low oil content (28%).

#### Sundak

A large seeded, open-pollinated variety resistant to most races of leaf rust but susceptible to sclerotinia stalk rot, verticillium wilt, and downy mildew. It is low in oil content (26%).

#### Arrowhead

An early maturing variety of medium height. Stands well but shatters easily. Seed is medium in size and hull. Arrowhead is low in oil content (31%), high in protein, and low in bushel



weight. It has good seedling vigor. It is an open-pollinated variety which is excellent for birdfeed production.

Peredovik 66

A medium seeded, thin hulled, oil type variety. It is medium in maturity and quite tall. The seeds are black with dark gray stripes and have high bushel weight. Peredovik has some tolerance to verticillium wilt or leaf mottle, but is susceptible to rust. It is an open-pollinated Russian variety containing 45% oil.

Krasnodarets

A very early maturing variety. The plants are short and produce a small, black seed which is high in oil (44%), and has a medium bushel weight. It is an open-pollinated Russian variety.

VNIIMK 8931-66

This open-pollinated Russian variety is a tall, medium maturing oilseed (44%) type. The seeds are small, black, and thin-hulled. It has high bushel weight.

P21ms x HA60

A rust resistant hybrid which was released by Texas A&M and USDA-ARS. It has a medium sized, striped seed which is intermediate in oil content, but the plant produces a large amount of seed.

Table 3. Yield of sunflowers in South Dakota

Variety	Location and Yield in Pounds/Acre			
	Brookings (1968,70-71)	Milbank Area (1968-69,71)	Garden City (1968-71)	Presho (1968-69,71)
<b>Oilseed types</b>				
P21ms x HA60	1372	1575	1566	778
Peredovik 66	822	1194	1142	612
VNIIMK 8931-66	969	1045	1211	674
Krasnodarets	850	1004	1100	673
<b>Birdfeed types</b>				
Mingren	671	1047	1076	625
Commander	846	1040	1385	806
Arrowhead	834	1230	1118	594

## QUALITY FACTORS AND MARKET GRADES

Bushel weight is an important grading factor within a variety or type, as it indicates whether or not the seed is well filled. Because of differing seed size and hull thickness among human food, birdfeed, and oilseed types, bushel weight should not be used to compare the three types. However, within a type, it is an excellent measure of quality.

Buyers of Mingren and other large seed varieties often pay a premium of about 1 cent per pound for seed held on a 20/64 round hole screen, and sometimes for seed held on a 24/64 screen. Usually bushel weight is not considered when large seeded varieties are bought on a size premium basis. There are no USDA grading standards for sunflower seed.

However, industry and the North Dakota and Minnesota grain inspection departments use a market grade system based on bushel weight, moisture content, and percentage of damaged seed.

### SEED GRADE STANDARDS<sup>4</sup>

Sunflower seed shall be any grain which before the removal of dockage consists of 50% or more of tame sunflower seeds and not more than 10% of other grains for which standards have been established.

Classes shall consist of:

- Class I - Edible and birdfeed varieties
- Class II- Oilseed varieties
- Class III- Mixed class. Seed that contains more than 2% of both Class I and II.

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<sup>4</sup>The Sunflower Crop in Minnesota. Minn. Agr. Ext. Sr. Bul. 299, 1973

	Minimum Test Weight per Bushel			Maximum Limits of			
	Class I		Class II	Moisture	Total Damaged	Heat 0.5%	Dehulled Seed
	Large Seed*	Small Seed					
Grade No.1	24#	27#	29#	10%	5%	0.5%	2%
Grade No.2	22#	25#	27#	14%**	8%	1.0%	3%
Grade No.3	20#	24#	25#	14%**	10%	1.5%	5%

\* 30% or more held over 20/64 round hole screen

\*\* Tough - shall be sunflower seed in Grade No. 2 and No. 3 containing more than 12 percent but not more than 14 percent moisture.

### Sample Grade

This is seed that does not come within the requirements of the Grades No. 1, No. 2, or No. 3 of Class I, Class II, or Class III; or which contains fire damaged sunflower seed; or which contains more than 14% moisture; or which is musty, or sour, or heating, or hot; or which has any commercially objectionable foreign odor; or which is otherwise of distinctly low quality; or which shows evidence of chemicals not approved.

### Dockage

Includes weed seeds, parts of stems, leaves, heads, chaff, straw, dirt, stones and any other material which can be removed readily from sunflower seed by use of prescribed sieves and aspiration; plus any other material or seeds including empty hulls or parts thereof removed by hand picking. The quantity of dockage shall be calculated in terms of percentage based on total weight of sunflower seed including dockage. The percentage of dockage so calculated, when equal to one (1) percent or more, shall be stated in terms of whole percent, and when less than one (1) percent, shall not be stated. A fraction of a percent shall be disregarded. The word "dockage" together with percentage thereof shall be added to grade designation.

## Definitions

- A. Class Determination: shall be made after removal of dockage.
- B. Grade Determination: damaged seed shall be determined after removal of dockage; test weight shall be determined on the mechanically cleaned sample. All other determinations shall be upon basis of sunflower seed as a whole.
- C. Percentages: except in the case of moisture, shall be percentages as ascertained by weight.
- D. Percentage of Moisture: shall be ascertained before removal of dockage by any federally approved moisture device.
- E. Prescribed Sieves for Dockage Determination: the sieve shall be of suitable size for the Class being graded. The bottom sieve used shall be a size number 8 (0.089 diameter).
- F. Test Weight Per Bushel: shall be the weight per Winchester bushel as determined by the testing apparatus and the approved method of use or as determined by any device or method which gives results in the determination of test weight per bushel.
- G. Damaged Sunflower Seed: shall be seed and pieces of seed which are heat damaged, badly weather damaged, sprouted, frosted, insect damaged, immature, moldy, or otherwise materially damaged seed. Dehulled seeds are included in total damage.
- H. Heat Damaged Sunflower Seed: shall be seed and pieces of seed which, when sliced open, show evidence of meats that have been materially discolored and damaged by heat.
- I. Weevily Sunflower Seed: shall be sunflower seed which is infested with live weevils or other insects injurious to stored grain.
- J. Size of Sample: dockage and grade determinations shall be based on 500 grams (1 1/8 quarts). Class determination shall be based on 30 grams.

## SUNFLOWER CULTURE

### Crop Rotation

Grow sunflowers as part of a rotation. They should not be grown on the same field in successive years, nor should they follow potatoes or field beans, which are very susceptible to verticillium wilt. All volunteer and wild sunflowers should be destroyed early in the spring because they act as hosts for sunflower leaf rust.

### Seed Selection

Plant only certified seed. It will not only be pure for variety, but will be treated against seed-borne diseases. Marketing grades permit only 2% seed mixture. Companies desire pure seed and will discount mixed lots because it requires extra processing to remove the undesirable types, especially from those for human consumption.

### Planting Date

Plant sunflowers as early as possible to permit maturation prior to the first frost in the fall. The minimum temperature for germination is 41<sup>o</sup>F which is midway between temperatures required small grain and corn.

Seedlings can withstand temperatures in the mid-20's. Plants with over five leaves are quite susceptible to light frost. If the terminal bud is damaged, many small heads develop from axillary buds, resulting in a very low yield of poor quality seed. The 45<sup>o</sup> F point is used as a base to determine growing-degree-days or heat units required for maturation.

### Seedbed Preparation

A firm, well prepared seedbed is needed to ensure contact between the seed and the soil. This will result in rapid germination and even emergence.

### Planting Depth

Sunflower seed requires a good supply of moisture for germination. It is essential to place the seed in moist soil because of the slow penetration of water through the thick seed coat. Conditions existing at the time of planting will determine the depth at which the seed is placed. Seeds can be placed down to a depth of 3 to 4 inches, but seedling emergence will be much

slower. If seeds are planted too shallow, a severe reduction in stand can occur when mice, gophers, or pheasants are present.

#### Row Width and Plant Populations

Sunflowers are unique in their ability to adjust for changes in growing conditions. They will increase head size in thin stands if moisture is available; or if moisture is short, the number of flowers at heading time may be decreased as a result of stalk breakage.

Row widths are important, as the canopy can properly shade the soil and discourage weed growth. If the canopy is too dense it can limit light penetration, resulting in tall, spindly plants. The optimum row space is 20-36 inches. However, the final selection of the row space will be determined by the equipment available for harvesting.

Plant spacing within the row is the major factor which affects head size, seed size, seed quality, maturity, and population. Research studies with varying populations show that as plant numbers increase within the row, head diameters decrease. The small heads produce small seeds of low quality, but they mature early. If, on the other hand, space between plants is increased, the competition between plants will be less, heads will grow larger, seeds will be larger, but maturity will be

Table 4. Spacing between plants in inches for various populations in rows spaced 20, 24, 30, 36, and 42 inches apart

Plants/Acre	Row Width in Inches				
	20	24	30	36	42
15,000	20.9	17.4	13.9	11.6	10.0
20,000	15.7	13.1	10.5	8.7	7.5
25,000	12.5	10.4	8.4	7.0	6.0
30,000	10.4	8.7	7.0	5.8	5.0
35,000	9.0	7.5	6.0	5.0	4.3

delayed. The larger heads contain more tissue and require longer to dry.

Lower plant populations are more desirable for confectionery or birdfeed type sunflowers than for oilseed types because a grower wants maximum percentage of large seeds. Plant spacings which produce the highest quality heads are 12-18 inches for confectionery varieties and 6-8 inches for oilseed type varieties.

### Fertilizing Sunflowers

Research shows adequate soil fertility to be an important management practice for optimum sunflower seed production. A 2000-lb yield will require approximately 100 lbs of nitrogen, 25 lbs of phosphate ( $P_2O_5$ ), and 75 lbs of potash ( $K_2O$ ).

Nitrogen fertilizer requirements of sunflowers exceed that of phosphate and potash, nevertheless, proper ratio of nutrient availability is important. Regional research shows that optimum nitrogen fertilizer application rates may vary from 20 to over 100 lbs of actual nitrogen per acre per year. This variation results from the supply of soil nitrates which affect the most profitable nitrogen fertilizer application rate. Research work with rates of nitrogen conducted in Spink and Brown counties in 1973 showed yield response to applied nitrogen was small when nitrates in the upper 2 feet of soil were greater than 60 lbs of nitrogen per acre.

Growers planning to apply large quantities of nitrogen and potash fertilizers should apply the major portion broadcast prior to planting and use a moderate amount at seeding time. Additional nitrogen may also be applied as a sidedressing application.

The following fertilizer recommendations are made for South Dakota areas, assuming a population large enough to take advantage of added fertility.

Table 5. Application rates of nitrogen fertilizer recommended for sunflowers\*

Yield Desired lbs/A	Organic Matter Soil Test - Percent			
	less than 2-0	2.1 - 3.0	3.1 - 4.0	4.1+
3000	125	100	80	60
2500	100	80	60	40
2000	80	60	40	30
1500	60	40	30	0
1000	40	30	0	0

\*These N rates will be adjusted upward or downward when nitrate soil tests are available.

Table 6. Recommended application rates of phosphorus for sunflowers

P Soil Test lbs P/A	Recommendations lbs P <sub>2</sub> O <sub>5</sub> /A
0 - 5	45
6 -15	35
16+	0

Table 7. Recommended application rates of potassium for sunflowers

K Soil Test lbs K/A	Recommendations lbs K <sub>2</sub> O/A
0 - 115	60
116 - 220	45
221 - 365	30
366+	0

#### WEED CONTROL

Weed competition in the early part of the growing season has a severe effect on seed production. Weeds reduce yield, test weight, percent oil, and iodine value of the oil. Crop rotation, good tillage practices, and cultivation are useful weed control practices. Herbicides can aid in controlling



annual weeds, but avoid planting sunflowers in fields with serious infestations of perennial weeds like Canada thistle or quackgrass.

### Tillage and Cultivation

Destroy weeds with tillage before planting, and plant soon after the last tillage operation so weeds don't start ahead of the crop. Weeds emerging before the crop can be controlled by cross harrowing one week after planting with a flextime harrow or by using a rotary hoe.

Sunflowers may be harrowed in the direction of the rows after the plants reach the 4- to 6-leaf stage. Do this in the afternoon of a clear, warm day when sunflowers are less rigid. Sunflowers are strongly rooted, and the field may be harrowed 2 to 4 times if necessary. A firm seedbed minimizes stand reduction, but planting 10% additional seed will compensate for those plants lost while harrowing.

Row cultivation must be relied upon to give weed control for the remainder of the season. Avoid excessive root damage during later cultivations by cultivating no closer to the row than the leaf spread. The rows may be hilled using disc type hillers only in the final cultivation.

### Herbicides

Several herbicides have given satisfactory annual weed control in field tests. The following herbicides are approved by the Environmental Protection Agency (EPA) and are recommended for use on sunflowers:

Chloramben (Amiben - 2#/gal, 10% gran) when applied pre-emergence will control most annual grasses and several annual broadleaf weeds. Wild mustard control is usually not satisfactory

and wildoats is not controlled. The herbicide may be applied in a band or broadcast using liquid or granular formulation. Use  $2\frac{1}{2}$  to 3 pounds active chemical ( $1\frac{1}{4}$  -  $1\frac{1}{2}$  gal or 25-30 lbs gran) per acre for most soils. Rainfall is required. Shallow incorporation with a harrow may improve control.

EPTC (Eptam - 6#/gal) is applied before planting and must be incorporated immediately with a tandem disc (set to cut 4-6 inches deep) and a harrow. EPTC gives good short-term control of annual grasses and several annual broadleaf weeds. Wild oat control has been satisfactory in some tests. Wild mustard and smartweed are not controlled. Use 3 pounds active ( $\frac{1}{2}$  gal) chemical per acre.

Trifluralin (Treflan - 4#/gal) is applied before planting and must be incorporated by two tandem diskings set to cut 4-6 inches deep. Incorporation may be delayed up to 8 hours if the soil is dry and wind velocity low. Trifluralin gives season-long control of common annual grasses and several annual broadleaf weeds. Wild mustard and wild oats are not controlled. Use  $\frac{1}{2}$  to 1 lb active ingredient ( $\frac{1}{2}$  - 1 qt) per acre. Carryover may damage oats or sorghum planted the following year.

Barban (Carbyne - 1#/gal) is applied post-emergence to control wild oats. Apply  $\frac{1}{4}$  to  $\frac{3}{8}$  lb active ingredient (2-3 pints) per acre when the majority of the wild oat plants are in the 2-leaf stage and not later than 14 days after crop emergence. Use 45 psi pressure and 5 gallons of water per acre.

READ AND FOLLOW LABEL DIRECTIONS AND PRECAUTIONS. Use of tradenames does not imply endorsement of any particular brand.

Carryover. Sunflowers are sensitive to atrazine carryover. Do not plant the crop on fields where atrazine was used the previous year.

Herbicide drift. Small quantities of chemical in droplet or vapor drift from herbicides like 2,4-D, MCPA, or dicamba to emerged sunflowers can cause serious damage. Use precautions when applying these herbicides in areas near the crop.

Desiccants. Pre-harvest desiccants aid in drying plants, facilitating earlier harvest, and would also help reduce bird feeding losses. However, there are no desiccants approved by EPA for use at the present time. Products may be available in the future.

## INSECTS

### Destructive Insects

Sunflower Moth. The larvae of the sunflower moth can cause severe losses in sunflower production. Larvae feed and tunnel in the seeds and fleshy receptacle portions of the plant. The adult moth is brown to buff in color. The larvae have five alternate dark and light colored longitudinal stripes; the body is yellow to brown. The life cycle of this insect in South Dakota is not known. Peak larval activity in 1972 and 1973 occurred during July and early August with some fields 100% infested. Severely infested heads are easily recognized, with larval damage and webbing very apparent.

Control of this insect is very difficult because of lack of knowledge of the insect's biology. Experiments in Texas and California showed that three insecticide sprays were necessary to obtain satisfactory control, with the first spray applied at

the onset of bloom and two subsequent sprays applied at 5 to 7 day intervals.

Sunflower Beetle. The sunflower beetle overwinters as an adult. It is a striped beetle resembling the Colorado potato beetle to which it is related. Mating and egg laying occur in late May and early June. Larvae usually can be observed about mid-June under the calyx (outer whorl of the flower) of the developing head.

The sunflower beetle can usually be found in most sunflower fields by midsummer. Damage by this insect in South Dakota has not been severe enough to warrant control measures. Where climatic conditions prevent normal growth of the sunflower plant, this beetle will feed and damage the terminal growth, resulting in deformed heads.

Sunflower Maggot. There are a number of "picture winged" flies known to infest sunflowers. Three of these species are considered important. One of these species of maggots develops and feeds in the sunflower stalk. The tunneling by this insect weakens the stalk, making the plant susceptible to wind breakage.

The other two fly species are head-infesting insects. The larvae of one species feed on seeds in the head and the larvae of the other species feed in the fleshy receptacle of the head. There are no known control measures for these maggot infestations.

Sunflower Curculio. This weevil is black and about  $\frac{1}{4}$  inch long. There is only one generation a year with the overwintering stage being the partially grown larva. Larval development and pupation

occur in the spring up until mid-July when the adults first appear. In addition to sunflowers, this insect will feed on wild rose.

Damage by the sunflower curculio is caused by feeding punctures in the stalk just below the head. This weakens the stalk so that the weight of the developing head causes the stalk to break, and the head falls to the ground. Rotation of crops and not planting sunflowers adjacent to fields that were in sunflowers the previous year should help prevent damage from this insect.

Sunflower Olethreutid Moth. The adult moth is grayish brown in color, about  $\frac{1}{2}$  inch long. The light brown larva feeds in sunflower stalks. Early infestation and feeding may involve the plant terminals, and normal heads will not be produced. A second generation may attack late planted or late maturing sunflowers.

Cutworms. There are several species of cutworms that attack sunflowers. The young plants are cut off at or slightly below ground level. Species like the army cutworms feed on the plant above ground.

Most cutworms are dirty gray to grayish brown in color. They can be found in the soil around the base of the plant during the day usually in the upper 2 to 3 inches of soil. Cutworms feed only at night and often go undetected until the crop is severely damaged.

Painted Lady Butterfly or Thistle Caterpillar. Adult butterflies are brownish yellow with a rosy tint and black markings. Larvae are pink with yellow lateral stripes between segments. The larvae have seven rows of tubercles with spines. The head is black and is covered with hair.

Among the normal hosts for this insect are Canada thistle, but the larvae of this species can feed on sunflowers. Populations of this insect fluctuate widely from year to year.

### Beneficial Insects

Sunflowers will normally begin blooming about 60 days after emergence. They are a cross-pollinated crop and depend upon insects to transfer pollen. Every seed is the result of an insect visit, therefore, in areas where there are low numbers of native pollinating insects, it is desirable to place hives of honeybees near the fields.

Researchers in North Dakota found that yields could be increased by 20% if sufficient honeybees were present. Bee visitation rates (number of bees in a given area for a specified time) were influenced by distances from hives and appeared to be influenced by the amount of general insect activity. The average yields were estimated to have been 25% higher near the hives than at a distance of 200 feet. Yields near the hives might be 40% greater than the average for areas further than 400 feet.<sup>5</sup>

### INSECT CONTROL

Growers should be careful when using pesticides to control destructive insects because the chemicals will also kill beneficial insects. The most desirable time to apply a pesticide is when the pollinators are least active. This period is during the hours of darkness which fortunately is the same period that the most destructive insect (sunflower head moth) is the most active. The best control is obtained if application can be accomplished at the time that eggs are hatching.

<sup>5</sup> Helianthus Herald, March 1969.

Insecticides which are approved for use on a sunflower crop are endosulfan (Thiodan) and Methyl Parathion. The maximum limit is three applications of not more than one pound each. Application of methyl parathion should not be within 30 days of harvest. Caution must be taken when using these highly toxic insecticides. They should be applied according to label instructions and only by a competent aerial applicator.

#### SUNFLOWER DISEASES

Sunflowers are attacked by four major fungal diseases: rust, downy mildew, stem rot, and verticillium wilt. All presently grown commercial varieties are susceptible to one or more of these diseases. Because the value of the sunflower crop depends on yield and quality, disease control is important. Damage due to disease can be reduced by crop management practices involving a 4- to 5-year rotation, using good quality disease free seed, and eliminating wild sunflowers and volunteers. Use resistant varieties if available.

##### Rust

This disease is present to some extent during most years, and severe losses can occur on susceptible varieties. Rusted volunteer and wild sunflowers are sources of the disease for commercial fields. Spores produced on wild or on residues of volunteer sunflower plant parts are blown to newly emerged volunteers. The rust that grows on these volunteers spreads to commercial fields. The summer spore (red) stage of rust repeats itself every 10 days. Winter spores (black) germinate in spring on sunflower debris and infect the volunteer and wild sunflower plants. The summer (red) stage develops in 6-8 days after infection. Spores generally develop at about 64° F.

Most oil type varieties have field resistance to rust. All other types are susceptible. Sundak, a new rust resistant confectionery type, has recently been released. For additional control measures, destroy volunteer and wild sunflowers before planting domestic sunflowers.

#### Downy Mildew

Symptoms of downy mildew vary, depending on the age of the sunflower plant when infected. The most obvious symptom is dwarfed plants which fail to head fully. This type of damage occurs when the seedling is infected very early and the fungus develops a systemic type of infection. The leaves of these plants show an "oak leaf" pattern near the midrib and a white cottony growth on the underside of the leaves. Some plants resist this dwarfing effect and grow to full height but they have very erect "bird platform" heads with mostly sterile seeds. Secondary infection results in yellow spots on leaves.

The fungus overwinters in infected plant debris as resistant winter spores. The winter spores germinate in spring and produce secondary swimming spores when free water is sufficient. The swimming spores infect seedlings (systemic infection). The fungus develops in the stem and leaves and produces a white, cottony growth of spores on the underside of the leaves. Secondary infection of leaves occurs from these spores.

Control wild sunflowers and follow a long rotation practice to avoid this disease. Avoid planting fields lying lower than, and adjacent to, previously cropped fields. Use resistant varieties when available. The fungus is both externally and internally seed borne.



### Sclerotinia Rot

This fungus attacks field beans, sugarbeets, soybeans, safflower, flax, potatoes, rape, mustard, and sunflowers. It survives the winter and non-crop years as sclerotia in soil and plant debris. Sclerotia are small grayish black bodies of fungal mycelium which can withstand severe weather conditions.

In spring and summer, sclerotia produce mushroom like growths that contain numerous spores. These spores (seeds) are blown to plants where infection occurs. Early symptoms of the rot are soft, water spots affecting stems, leaves, or heads. Later the plant tissues dry out, becoming pinkish. A white, cottony mold forms on or in the plants. The sclerotia develop in this cottony mass.

Sclerotia of the fungus contaminate seed lots, and fungus spores may be seed borne. Chemical seed treatment does not prevent this disease. Alternating cereal grains with sunflowers gives some control. Avoid planting susceptible sunflower varieties in rotations with field beans. Use herbicides or cultural methods to eliminate undesirable host plants such as pigweed, lambsquarters, volunteer sunflowers, etc. Plowing sclerotia into the soil prevents their germination.

### Verticillium Wilt (Leaf Mottle)

Symptoms of this fungus disease are chlorotic yellowed areas which develop along the veins of lower leaves and become brown necrotic areas as infection gets older. This mottling spreads toward the base of the infected leaf and from lower to upper leaves. On severely infected plants, lower leaves may be dead and dry. The middle leaves show brown areas with green along the veins, and upper leaves often appear healthy.

Infection may result in wilting, stunting, and the death of a plant without the characteristic mottle symptoms.

Associated with this disease is a condition known as premature ripening in which heads lack firmness. Typically verticillium wilt is found in scattered plants throughout the field. The fungus is soil and seed borne and has a wide host range. Potato is especially susceptible.

Disease free seed and a 4-year or longer crop rotation with a cereal crop helps control this disease. Avoid planting susceptible sunflower varieties in any rotation with potatoes or red clover. Use resistant varieties when available.

#### GOPHERS, BIRDS, AND OTHER PESTS

Striped gophers can be very destructive to sunflower stands prior to germination. If seeds are planted too shallow or if the soil does not pack around the seeds, gophers may dig up and destroy the embryo. They may be controlled by placing poisoned grain at the entrance of their burrows. Your county Extension agent can recommend what kind, how much, and where to get the material.

There are a number of bird species that reduce sunflower yield. The most destructive are blackbirds and sparrows. They will destroy large quantities of seed prior to harvest. The only control is to constantly harrass them during the period between flowering and harvest.

Goldfinches will do some damage but their numbers are low compared to blackbirds or sparrows. Doves, pheasants, and grouse will be seen entering and leaving the fields but they are ground feeders and only pick up the seed knocked down by blackbirds, sparrows, finches, and normal shattering.

Rabbits can cause a stand loss by eating the terminal buds of seedlings immediately after emergence as the cotyledons unfold. Once the terminal bud is removed the plant will die. Entire fields are seldom destroyed but stands are reduced in small areas.

#### HARVEST

Sunflowers seeded in early May will be ready to harvest by late September to mid-October. The seed crop is mature when the back of the head turns yellow, but the fleshy disc must be sufficiently dry for combining. It is essential to harvest as soon as the seed can be satisfactorily removed without adding high-moisture foreign matter to the seed.

Seed can be threshed when it contains over 15% moisture but it cannot be stored if it contains over 12% moisture. The preferred moisture level for long time storage is 9.5 percent.

The combine is the only practical method of harvesting sunflower seed. A rasp-bar, or rub-bar type of cylinder causes less damage to the seed than the spike tooth type and does not break up the heads. The broken heads leave excessive debris on the sieves, resulting in unclean seed.

Cylinder speed and concave spacing require careful adjustments: (1) reduce cylinder speed to one-half or less of that required for cereal crops, or (2) a peripheral speed of 3200 feet per minute. The concaves should be opened as wide as possible. Good quality seed is easily threshed while blind or empty seed in the center of the head is removed with difficulty. If the machine is properly adjusted, dockage will be relatively low.

The addition of a sunflower header attachment to the combine may reduce field losses to less than 5%. They are sometimes as

high as 50% when a conventional combine header and reel are used.<sup>6</sup>  
A number of different designs are available. All have long pans ahead of the cutterbar to break over the stalks so that only the head is cut off and fed into the cylinder.

#### SEED DRYING

Sunflower seed can be dried in any type of dryer as long as strict controls on heating are observed. The seedcoats have a layer of tiny hairs which break off and accumulate in corners of the dryer. This material is very flammable and fire danger is reduced in the drying process if these accumulations can be prevented.

Seed which contains little dockage is easier to dry uniformly. Drying can be accomplished at a lower temperature if a continuous flow dryer is used. This reduces the chance of overdrying.

Several precautions can be taken to prevent fires. First, place the air inlet upwind or above the dryer to prevent dust or trash from being sucked into the burner. If possible, increase the distance between the plenum and burner to permit the fuzz and dust to be burned out before it comes in contact with other materials in the plenum chamber. Do not leave a dryer unattended for a long period of time, and do not let trash accumulate in or around the dryer.

Sunflower seed is relatively light in comparison to other seeds, therefore it dries rather easily. For this reason the temperatures should be kept below 120° F.

#### STORAGE

Sunflower seeds can be harvested when they contain relatively high moisture content. However, for storage the moisture content

<sup>6</sup>Production of Sunflowers in Tennessee, Ag. Exp. Sta. Bul 494, April 1972.

must be rather low. Seed to be stored only temporarily must not contain more than 12% moisture or spoilage will occur. Seed to be held for more than a few weeks must be below 9.5% moisture. Fungi which attack sunflower seed become active at about 10% moisture.

Insects which live in stored grain do not bother sunflowers unless the seeds are dehulled, broken, or crushed.

## USES OF SUNFLOWERS<sup>7</sup>

### Whole Seed for Human Food

Whole seed can be dehulled with the teeth or fingernails and eaten raw, or they can be roasted with or without the hulls removed to provide a tasty snack. The seeds are prepared for toasting by soaking for a few hours or overnight in a brine solution (1/5 cup of salt to a quart of water). Drain, place in a flat pan, and toast in a moderate oven (375°) about 45 minutes until dry and crisp. The seeds can be over-toasted very easily so they should be tasted after a half hour in the oven. Toasting and tasting is continued until the proper taste is reached.

### Dehulled Seed for Human Food

After sunflower seeds have been dehulled, the meats are either roasted in a vegetable oil, or are roasted dry, and salted. They can be eaten as nutmeats in candy, cookies, salads, or cereals.

### Seed for Recreational Feeding

The sunflower seed best suited for this use is the thick hulled striped seed. This is one of the major uses of the large striped seed type. Bird species which are attracted by the seeds

<sup>7</sup>The Sunflower Crop in Minnesota. Minn. Agr. Ext. Sr. Bul. 299, 1973.

are bluejays, cardinals, chickadees, nuthatches, and wild canaries. Hamsters and squirrels also consume large amounts of sunflower seed.

#### Seed for Oil Extraction

The small, black, thin hulled seeds are best suited for oil extraction, since they contain over 40% oil. The oil is of very high quality and is used for cooking and salad oils. It is unusually good for frying food, popping corn, and other processes where a high smoke point is desired. It does not develop undesirable tastes and odors when stored.

Sunflower oil has become the world's second most important vegetable oil because it has an unusual combination of high nutritional and keeping qualities and low production costs.

#### Meal for Livestock Feed

After the oil has been extracted, the meal remaining is most commonly used as a protein supplement for livestock feeds. This feed contains from 38% to 46% protein and 8% to 12% fiber. The fiber comes from the hulls which were not removed during processing. Sunflower meal is low in amino acid lysine, so care should be taken when formulating for nonruminant rations. The meal is unusually high in thiamin and niacin.

#### Hulls

The hulls can be used to replace part of the alfalfa hay fed to livestock. They contain about 3% oil and 3-4% protein, but need to be pelleted to reduce the bulk in shipping. The pellets can also be fed to sheep. Unpelleted hulls can be used as a chicken litter.

## CONTRACTS

Nearly all sunflowers presently grown are produced under a contract with a company interested in sunflowers. This type of production is important when growing a new crop in a developing area because it ensures the producer of a market. It also ensures the contracting company of a volume of seed large enough to operate his processing plant and that the seed will be of a nearly constant quality.

Prospective growers should be aware of the conditions which a good contract should include. The contract used to record and verify an advance sale of grain should be a written instrument known to be legal in the state in which the sale is made. Such legal forms are usually available through commission companies or office supply companies. The contract should specify (1) the date the contract is made, (2) the selling price, (3) the number of pounds, (4) the type of grain, (5) the quality the contract price calls for, (6) place and time of delivery, (7) and any penalties for over or under delivery or early or late delivery. In addition, a contract for advance sale of grain should specify grade discounts and/or premiums, and also whether any payment is possible in advance of delivery, if payment is to be made in full on completion of delivery, or if payment is to be deferred.

Once a contract has been agreed upon, the producer should inform the buyer if, for some reason, he cannot fulfill all the conditions of the contract. By doing this as soon as possible, the cost of altering the contract should be less. The buyer will often cooperate with the producer, but producers must understand that buyers have no obligation to make any changes in the original contract.

Even though the conditions of a written contract are assumed to be legal and binding, care should be taken to contract only with reputable firms and reputable people. The cost and embarrassment of litigation to enforce a contract is often thought to be too great to pursue enforced compliance.