



# My Sunflower Project

*Compiled by*

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# Welcome to the North Dakota 4-H Sunflower Project

*Your project can be made to fit your situation. Hopefully you will be able to grow two different sunflower hybrids and make comparisons as they grow and develop through the season.*

*You will have opportunity to learn about the sunflower plant as well as factors that affect the growth and development of this crop. You will gain the most from the project by studying resources about sunflowers and asking questions of your project leader, seed dealer, and others.*

*Set goals for yourself, work to achieve them, and enjoy the project.*

## References:

- Extension Bulletin 25 – Sunflower Production  
Edited and compiled by Duane Berglund, Extension Agronomist  
North Dakota State University (1994) *There is a charge for this publication.*
- Extension Bulletin 28 - Insect Pest Management for Sunflowers  
Prepared and edited by Dean McBride, Dennis Kopp, Christian Oseto  
North Dakota State University (1990, reprinted 1994)

## For more information on sunflower you can:

- Contact your Extension Agent to see the above Extension publications and Circular A-652 – North Dakota Sunflower Performance Trials

## You can also gather information by:

- contacting your seed dealer
- doing research at your local library
- visiting with sunflower growers in your community

# Sunflower Production

Sunflower originated in North America. It has had a variety of uses throughout history. Sunflower has been used for food, as a medicinal crop, a source of dye, as a garden flower, and as an oilseed crop.

Wild sunflower is the state flower of Kansas. North Dakota ranks first in sunflower production within the United States. Both oilseed and confectionery (nonoil seed) type sunflower are grown in North Dakota.

The cultivated sunflower is *Helianthus annuus L.* It is one of many species in the genus *Helianthus*. A few relatives are grown as ornamental or for food or livestock feed. But many are weeds found in pastures, fields, or undisturbed areas. Plant breeders have been able to transfer useful characteristics from wild species for high oil percentage, disease and insect resistance to hybrids grown today.

Producing a good crop involves many factors including:

- Weather
- Soil
- Seed
- Farm management (timelines)

The farmer is, in a sense, the most important factor. The farmer has control over the selection of the soil and the seed. Skill in soil management, knowledge of soil preparation, selection of seed, and technique in planting, cultivating, controlling pests, and harvesting will have a great bearing on final results.

# Planting

Sunflower should be planted only after soil temperature at the 4-inch depth reaches at least 45 degrees Fahrenheit. A temperature of near 50 degrees F. is needed for germination. Seeding at deeper depths and cooler temperatures will delay germination and emergence and reduce stands. The ideal planting depth is 1.5 to 2.5 inches. The seed should be placed into moisture but not deeper than 3 inches.

Check the seed tag to determine planter plate size for the hybrid. Be sure to use correct plates or adjust plateless planters according to directions.

# Recommended Plant Populations

Oilseed sunflower	15,000 to 25,000 plants/acre
Nonoilseed sunflower	14,000 to 20,000 plants/acre

Lower populations are recommended for soils with lower water holding capacity and areas where rainfall is inconsistent or low annual precipitation.

Sunflower is grown at several row spacings. Performance has been best with row spacing between 20 and 30 inches. Plant populations should remain the same regardless of row spacing. Sunflower compensates for differences in plant populations by changes in seed and head size. Smaller plant populations result in larger seeds and heads. Oilseed hybrids are generally planted at higher populations than nonoilseed hybrids because the size of harvested seed is less important.

The following table shows plant population at various seed spacing and row widths.

**Table 1. Plant population per acre at various row widths based on kernel or plant spacings within the row.**

Plant Spacing Within the Row (inches)	Row Width (inches)			
	20	30	36	38
5	—	41,800	34,800	33,000
6	52,200	34,800	29,000	27,600
7	44,800	29,800	25,000	23,600
8	39,200	26,100	21,800	20,600
9	34,800	23,200	19,400	18,300
10	31,400	20,900	17,400	16,500
11	28,500	19,000	15,800	15,000
12	26,100	17,400	14,500	13,800
13	24,100	16,000	13,400	12,700
14	22,400	14,900	12,500	11,800
15	20,900	13,900	11,600	11,000
16	19,600	13,000	10,900	10,300

## Hybrid Selection

Consult with your local seed dealer. Select a hybrid of the correct maturity for your area based on expected planting date and days for maturity as suggested by your seed dealer or county agent. Refer to Circular A-652, Sunflower Hybrid Performance Trials. Check hybrid sunflower performance trials conducted by university research station or seed company yield trials.

## Fertilization

Sunflower requires about the same amount of nitrogen, phosphorous, and potassium for a 2000 pound per acre yield as is required for a 40 bushel per acre wheat yield. Soil testing should be done to learn the correct amount of fertilizer to apply. The chart below shows the amount of nitrogen, phosphate, and potash needed for various yield goals. The amount of a nutrient that should be applied is the difference between the number shown for your yield goal less the amount in the soil according to soil test results.

**Table 2. Nitrogen (N), Phosphate (P<sub>2</sub>O<sub>5</sub>), and Potash (K<sub>2</sub>O) recommended for sunflower in North Dakota.**

Yield Goal	Soil N plus Fertilizer N Required	Soil Test Phosphorus, ppm					Soil Test Potassium, ppm				
		VL 0-5	L 6-10	M 11-15	H 16-20	VH 21+	VL 0-40	L 41-80	M 81-120	H 121-160	VH 160+
1000	50	20	15	10	0	0	35	25	15	0	0
1500	75	30	20	15	0	0	55	40	25	10	0
2000	100	40	30	20	10	0	70	50	30	10	0
2500	125	50	35	25	10	0	90	65	40	15	0

VL = very low    M = medium    L = low    H = high    VH = very high

## Description of Sunflower Growth Stages

The total time required for development of a sunflower plant and the time between the various stages of development depends on the genetic background of the plant and growing season environment. When determining the growth stage of a sunflower field, the average development of a large number of plants should be considered. This staging method can also be used for

individual plants. The same system can be used for classifying either a single head or branched sunflower. In the case of branched sunflower, make determinations using only the main branch or head. In stages R-7 through R-9, use healthy, disease-free heads to determine plant development if possible, because some diseases can cause head discoloration.

Stage	Plant Description
VE Vegetative Emergence	Seedling has emerged and the first leaf beyond the cotyledons is less than 4 cm long.
V (number) Vegetative Stages (i.e. V-1, V-2, V-3, etc.)	These are determined by counting the number of true leaves at least 4 cm in length beginning as V-1, V-2, V-3, V-4, etc. If senescence of the lower leaves has occurred count leaf scars (excluding those where the cotyledons were attached) to determine the proper stage.
R-1 (Reproductive Stages)	The terminal bud forms a miniature floral head rather than a cluster of leaves. When viewed from directly above the immature bracts form a many-pointed star-like appearance.
R-2	The immature bud elongates 0.5 to 2.0 cm above the nearest leaf attached to the stem. Disregard leaves attached directly to the back of the bud.
R-3	The immature bud elongates more than 2.0 cm above nearest leaf.
R-4	The inflorescence begins to open. When viewed from directly above immature ray flowers are visible.
R-5 (decimal) (i.e. R-5.1, R-5.2, R-5.3, etc.)	This stage is the beginning of flowering. The state can be divided into substages dependent upon the percent of the head area (disk flowers) that has completed or is in flowering. Ex. R-5.3 (30%), R-5.8 (80%) etc.
R-6	Flowering is complete and the ray flowers are wilting.
R-7	The back of the head has started to turn a pale yellow color. Rag flower pedals are dropping or dried.
R-8	The back of the head is yellow but the bracts remain green.
R-9	The bracts become yellow and brown. This stage is regarded as physiological maturity.

# Pest Control

## Weeds

Weeds compete with sunflower for water, nutrients and light, causing poor growth and yield loss. Yield loss from weed competition depends on weed species, time of infestation, weed density, and climatic conditions.

A comprehensive weed management program consisting of cultural and/or chemical controls is needed to maximize yields. Sunflower is a good competitor with weeds, but this competitive advantage occurs only after plants are well established. The first four weeks after emergence are most critical in determining weed competition damage, so early weed control is essential. Weeds allowed to compete longer than four weeks cause important yield loss even if removed.

Herbicides used to control weeds in sunflower generally fall into three categories: pre-plant, pre-emerge and post-emergence. Some herbicides are persistent in that they carry over in the soil until the following year.

Choice of herbicide will depend on many factors including soil type, weed problem and crop plans for the following year.

Refer to NDSU Extension Service Circular W-253, Agricultural Weed Control Guide (current year) for specific recommendations.

## Diseases

A number of diseases economically affect sunflower. At least 30 diseases have been identified on sunflower. But only a few are economically significant. The most important diseases in the northern Great Plains are sclerotinia wilt (white mold), rust, and downy mildew. Effective control measures for most diseases are:

- Planting of resistant or tolerant hybrids
- A minimum rotation of four years between successive sunflower crops
- Seed treatment with labeled fungicides

## Insects

Sunflower plays host to a number of insect pests. Usually only a few insects will be of economic concern each year. A quick reference to common sunflower insect pests is on the following page. Various insecticides are available for insect pest control. However, we must remember that some insects are beneficial to the sunflower crop. Care must be taken to minimize the effects of an insecticide treatment on honey bees. Beekeeping is an important industry in North Dakota. While they produce honey, bees are equally important as pollinators and aid in the production of crops such as sunflower. Insect problems can best be handled by regular inspection of your crop. Extension Bulletin 28, Insect Pest Management for Sunflower should be consulted for more information.

**Table 3. Quick Reference Guide to Sunflower Insects.** The information presented on this page is designed to be a quick reference for growers, crop consultants, field scouts and others.

Insects	Description	Occurrence, Injury and Economic Thresholds (E.T.)
Cutworms (several species)	Dirty-grey to gray-brown Grub-like larva ¼ - 1½" length.	E.T. - 1 per sq. ft. or 25-30% stand reduction. Appear in early spring when plants are in the seedling stage, chewing them at or slightly above ground.
Sunflower Beetle	Adult: Reddish-brown head, cream-colored back with 3 dark stripes on each wing cover. Body ¼" long. Larva: Yellowish-green, hump-backed in appearance.	E.T. - 1-2/seedling (adults). E.T. 10/15 seedling (larvae). Adults appear in early June, larvae shortly thereafter. Both adults and larvae chew large holes in leaves.
Sunflower Bud Moth	Adult: Wingspread 5/8"-3/4", gray-brown color with 2 dark transverse bands on forewings. Larva: Cream-colored body with a brown head.	First generation adults appear in late May to mid-June. Second generation adults appear in mid-summer. Larvae from 1st generation damage terminals and stalks whereas 2nd generation larvae feed in receptacle area. No E.T. data.
Sunflower Maggots	Adults: about ¼" long, yellow-orange body with dark lace-like wing pattern. Larvae: White, legless maggot up to ¼" in length.	Adults appear in early to late June. Larvae occur in stalks or heads from late June on. No E.T. data.
Sunflower Stem Weevils	Adults: <i>C. adspersus</i> has a (1/8-3/16" long) gray-brown background with white dots on the back. <i>B. strenua</i> is black and rather robust in appearance. <i>A. occidentale</i> is also black but slightly smaller than the above. Larvae: Creamy-white, C-shaped grub-like insects.	E.T. - Adult/3 plants in late June to early July. <i>C. adspersus</i> and <i>B. strenua</i> adults appear in mid to late June with larvae in stalks from early July to late summer. <i>A. occidentale</i> adults appear as soon as sunflower seedlings emerge – 2nd generation adults appear in mid-summer. Larvae co-inhabit lower stem with <i>C. adspersus</i> but cause negligible damage.
Thistle Caterpillar	Adult: Wingspread of 2 inches, upper wing surface brown with red and orange mottling and white and black spots. Larvae: Brown to black, spiny, with pale yellow stripe on each side.	Adults appear in early to mid-June with larvae appearing shortly thereafter. Larvae chew holes in leaves. E.T. – 25% defoliation provided that most of the larvae are still under 1¼ inch in length.
Sunflower Seed Weevils	Adults: <i>S. fulvus</i> is rusty colored, 3/16" in length. <i>S. sordidus</i> is about ¼" long and gray in color. Larvae: Both species are cream-colored, legless and C-shaped.	E.T. - 14 adults per head (oil) and one adult per head (confectionery). Adults appear in late June to early July. Larvae feed in seeds from mid to late summer.
Sunflower Moth	Adult: Body is 3/8" long with a ¾" wingspread. Color is buff to gray. Larva: Brown head capsule with alternate dark and light lines running longitudinally.	E.T. – 1-2 adults/5 plants at onset of bloom. Adults appear in early to mid-July. Larvae tunnel in seeds from late July to late August.
Banded Sunflower Moth	Adult: Small ¼" straw-colored moth with brown triangular area on forewing. Larva: in early growth stage off-white, changing to purplish color at maturity.	Adults appear about mid July to mid August. Larvae present in head from mid July to mid September. E. T. – Research is continuing.
Head-Clipper Weevil	Adult: Metallic black ¼" long body with a long "snout".	Adults appear in mid to late July and create feeding punctures. around stalk just below the heads. Heads drop off. No E.T. data.
Sunflower Midge	Adult: Small 1/8" tan colored gnat-like insect. Larva: Cream or yellowish color 1/8" long, tapered at front and rear.	Adults emerge in about mid-July during years when soil moisture is 40-60%. Larvae feed around head margin and at base of the seeds causing shrinkage and distortion of heads. No E.T. data.
NOTE: The insects discussed are listed in the order that they are likely to occur throughout the growing season; however, the various insects may or may not appear depending on overwintering survival and environmental conditions as the season progresses. The table is intended simply as a guide to when fields should be checked for possible presence of the various insects known to infest sunflowers.		

## Harvesting

The sunflower plant is physiologically mature when the back of the head has turned from green to yellow and the bracts are turning brown. This is stage R-9 and usually occurs 30-50 days after bloom.

Some seed is lost in the field at harvest. This loss may be from one of three sources:

- Loss in the standing crop ahead of the combine (head shattering or lodged stalks)
- Loss as the crop enters the combine
- Threshing and separating loss

If seeds are evenly distributed over a field, 10 seeds on the ground per square foot is equal to approximately 100 pounds yield loss per acre. Making adjustments to reduce loss from these sources will give you an increase in crop yield.

## Drying

Most sunflower seed is dried artificially prior to safe storage. Low temperature drying is required since at high drying temperatures fires can and do occur.

Sanitation around dryers also is important when drying sunflower because chaff and sunflower debris can be highly flammable.

## Storage of Your Sunflower

Seed should be clean for storage. Large pieces of head and stalk should be removed because they are higher in moisture than the seed. Weed seeds and other foreign materials can cause storage problems.

Oil sunflower should be at or less than 10 percent moisture in the winter and 8 percent or less during the summer for safe storage. Non-oil seed sunflower should be kept at or below 11 percent moisture in the winter and 10 percent moisture in the summer.

## U.S. Grades and Standards

The following table lists minimum test weight and maximum damaged and dehulled seeds for U.S. Grades. These grades were established by the Federal Grain and Inspection Service and have been in effect since 1984.

**Table 4. Grade and grade requirements for sunflower. This table lists the U.S. grade requirements for sunflower according to the Federal Grain and Inspection Service. These became effective September 1, 1984. It lists the minimum limit for test weight and maximum for damaged and dehulled seed. Grades for both oilseed and non-oilseed classes are determined with the requirements.**

Grade	Minimum Test Weight per Bushel (pounds)	Maximum limits of		
		---- Damaged Sunflower Seed Heat Damage	Total	---- Dehulled Seed
		----- (percent) -----		
U.S. No. 1	25.0	0.5	5.0	5.0
U.S. No. 2	25.0	1.0	10.0	5.0

U.S. Sample grade shall be sunflower seed which:

- (1) Does not meet the requirement for the grades U.S. nos. 1 or 2; or
- (2) In a 600 gram sample, contains 8 or more stones which have aggregate weight in excess of 0.20 percent of the sample weight, 2 or more pieces of glass, 3 or more crotalaria seeds (*Crotalaria* spp.), 2 or more castor beans (*Ricinus Communis*), 4 or more particles of an unknown substance(s), or 10 or more rodent pellets, bird droppings, or an equivalent quantity of other animal filth; or
- (3) Has a musty, sour, or commercially objectionable foreign odor; or
- (4) is heating or otherwise of distinctly low quality.

# 4-H Sunflower Project Field Notes and Summary

Name \_\_\_\_\_ County \_\_\_\_\_

Address \_\_\_\_\_ State \_\_\_\_\_

## About Your Sunflower Plot:

Length of plot \_\_\_\_\_ ft.      Width of plot \_\_\_\_\_ ft.      Acres \_\_\_\_\_

Length of rows \_\_\_\_\_ ft.      Number of rows \_\_\_\_\_ ft.      Row width \_\_\_\_\_ ft.

Row length ft. x Row width ft. x No. Rows ÷ 43,560 = acreage      Area in acres (i.e. 30-inch row width = 2.5 ft. etc.)

## Soil Type

circle response(s):    Sandy loam    Clay loam    Heavy clay    Peat    Silt

## Soil Topography

circle response(s):    Level    Hilly    Rolling

## Field History

	Previous crops:	Herbicide applied on previous crops:
One year ago	A. _____	A. _____
Two years ago	B. _____	B. _____

## Soil Preparation

Fall plowed? \_\_\_\_\_    Spring plowed? \_\_\_\_\_    Secondary tillage \_\_\_\_\_

## Condition of Seed Bed When Planted circle response(s):

Wet    Dry    Warm    Cold    Loose    Firm    Cloddy    Smooth

## Fertilizer Applications

Yield Goal: \_\_\_\_\_ lbs./A

Soil test recommendations \_\_\_\_\_

Pre-plant \_\_\_\_\_ # N    \_\_\_\_\_ # P    \_\_\_\_\_ # K

Micronutrients \_\_\_\_\_ # Manure    Date of application \_\_\_\_/\_\_\_\_/\_\_\_\_

Post Plant \_\_\_\_\_ # N    \_\_\_\_\_ # P    \_\_\_\_\_ # K

Micronutrients \_\_\_\_\_    Date of application \_\_\_\_/\_\_\_\_/\_\_\_\_

**Weed Control**

Times cultivated \_\_\_\_\_

Herbicides used: Pre-plant \_\_\_\_\_ Post plant \_\_\_\_\_

Date of application: Pre-plant \_\_\_\_\_ Post plant \_\_\_\_\_

**Insect Control**

Insect problem \_\_\_\_\_

Insecticides used \_\_\_\_\_ Date of application \_\_\_\_/\_\_\_\_/\_\_\_\_

Insect problem \_\_\_\_\_

Insecticides used \_\_\_\_\_ Date of application \_\_\_\_/\_\_\_\_/\_\_\_\_

<b>Planting</b>		
Date Planted		
Rate of Planting (no. seeds/A)		
Depth of Planting (inches)		
Retail cost of seed per acre		
Average distance between seeds		
Hybrid Names/Numbers		
Hybrid Maturity (rating)		
Date of Emergence		
Date when 10% emerged		
Date when 100% emerged		
Seed Vigor		
Strong/Weak		

### **Stages of Development and Date Reached**

*Indicate the stages of development of sunflower in your plot for the following dates.*

June 15		
July 1		
July 15		
August 1		
August 15		
September 1		
September 15		
September 30		

<b>General Observations</b>	<b>Hybrid Name/Number</b>	<b>Hybrid Name/Number</b>
<b>Weeds</b>		
Weed Control		
Times Cultivated		
Main Weed Problems (kind)		
Herbicides Weed Preplant		
Herbicides Weed Postplant		
<b>Resistance or Tolerance</b>		
Wind (1-3)*		
Disease (1-3)*		
List Diseases		
Treatment		
Drought (1-3)*		
Insect (1-3)*		
Insect Problem (kind) (date of problem)		
Insecticides Used		
<b>At Maturity</b>		
Average Plant Height		
Average Head Size		
Natural Dry Down		
Stalk Quality		
Date of Harvest		
Moisture % at Harvest		
% of Oil Content		
Yield (pounds per acre)		

\* 1-Good    2-Fair    3-Poor

<b>Weather Conditions</b>					
	<b>May</b>	<b>June</b>	<b>July</b>	<b>August</b>	<b>September</b>
Rainfall (amount)					
Temperature (above average, normal, below normal)					
<b>Other Conditions</b> Hail, Strong Winds, Early Frost, etc.					

## **Interpretation Of Scorecard**

The following score card may be used during an interview and evaluation of the sunflower project. The notes here can help you prepare for an interview.

### **I. Record book completed**

Has the record book been kept up to date? Score based on degree of completion.

### **II. General Plot Appearance**

Does plot show good crop production practice; has sunflower made reasonably good growth; is plot clean; is it labeled properly; and is it accessible to public. Is the plot in show condition?

### **III. Member's Knowledge of Production Practices and Field Scoring**

- A. General Information – does member know the previous cropping history, seed bed preparation used, and date of planting?
- B. Fertilizer Practices – does member know if there has been a soil test within the past few years, and if fertilizer recommendations were followed? If not, was fertilization used based on previous cropping experience?
- C. Stand – does member know distance between rows and plant population per acre?  
Was recommended stand achieved? Was seed company's seeding recommendations followed?
- D. Pest Control – does member know if pests (weeds, disease, insects) were a problem?  
Does member know which pests were a problem and what was done to correct the problem.
- E. Stages of Plant Growth – does member know the stages of plant growth. Were field observations made during the growing season?

### **IV. Member Participation**

This is an effort to determine member's interest, participation and enthusiasm for the project.

- V. Judges question on knowledge of sunflower production and production techniques.

