High Plains Sunflower Production Handbook

Colorado State University • Kansas State University • University of Nebraska • University of Wyoming
USDA–ARS–Central Great Plains Research Station, Akron, Colorado

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devices include guns with "cracker" loads and recorded amplified sound.

Starlicide ™ (an avicide) is currently registered for control of blackbirds in sunflowers. It is a cracked corn bait, which four out of every 100 particles is treated with the active ingredient, 3-aminopyridine. The bait is applied by broadcasting along access lanes placed in the fields, at the rate of 1 pound per acre. When a blackbird eats one or more treated particles, it flies erratically and emits distress calls. This abnormal behavior often causes the remaining birds in the flock to leave the field. It usually kills the bird that eats the bait. Careful consideration must be given to the timing of initial and repeat baiting. The first baiting should be when the birds first initiate damage, and repeat baiting should occur as necessary, about 5 to 7 days apart. Weeds that hide bait, ground insects (e.g., crickets) that eat bait, and excessive rainfall can contribute toward making the product less effective. Instructions on the label, especially the avoidance of baiting field edges, should be carefully followed to avoid contacting nontarget birds. Contact your local county agent, state department of agriculture, or the National Sunflower Association for current registration status and always read and follow label instructions.

Birdshield ™ is another product that may work for blackbird control. It is a biodegradable taste aversion product made from a grape extract and early results look promising for deterring blackbird feeding in sunflowers. Birds are not killed from this product. They stop feeding in treated sunflower fields as a result of unpleasant tastes when feeding.

Some companies now offer a new generation of electronic sound devices using digital technology to produce distress calls of specific birds. They are only effective against bird species whose distress calls are encoded on the microchip. Following are some companies on the Internet that market bird harassment products. The National Sunflower Association has not evaluated any of the products and cannot verify the success of their use.

www.reedposeph.com
www.wildlifecontrolsupplies.com
www.birddamage.com
www.birdbarrier.com
www.bioniet.com

More Web Page Listings

National Sunflower Association

www.sunflowernsa.com

CSU Golden Plains Area

www.colostate.edu/Depts/CoopExt/GPA

Sunflower variety test results

www.extsoilcrop.colostate.edu/CropVar/
www.varietytest.unl.edu
http://ksuoptests.agron.ksu.edu/
http://uwadmnuceb.uwyo.edu/UWPLANT/key.htm

Nutrient Management

Fertile, well-managed soils capable of producing good yields of other crops also can produce good yields of quality sunflowers. Nutrient uptake by sunflowers is influenced by many factors including stage of development, hybrid, and soil fertility. Sunflowers need an adequate supply of nutrients at each developmental stage for optimum growth. High-yielding sunflowers remove considerable amounts of nutrients from the soil. This should be taken into account when developing a nutrient management program. Table 2 summarizes typical nutrient content of sunflowers.

Sunflowers are considered to be efficient in using both nutrients and water from the soil because of a deep, expansive taproot system; however, profitable responses to fertilization can be expected on many High Plains soils.

Fertilizer and lime needs are best assessed by soil testing, field history, and grower experience. Fertilizer rates are suggested for optimum yields, assuming yield potential is not restricted by other factors.

Nitrogen

Nitrogen (N) is the nutrient of greatest accumulation in the aboveground portion of the sunflower crop. Nitrogen recommendations vary with yield expectations associated with soil, climate, soil moisture, cropping sequence, and residual nitrogen in the soil. The results of a 7-year study conducted at the USDA-ARS Central Great Plains Research Station, Akron, Colo., indicated that sunflowers require 6 to 7 pounds of nitrogen for every 100 pounds of production. This has lead to an increase from a previous recommendation of 50 pounds of nitrogen for every 1,000 pounds of potential grain production, to 65 pounds of nitrogen for every 1,000 pounds of expected yield.

Table 2. *Nutrient content in a sunflower crop producing 1,000 lbs. seed/acre*

Element	Nutrient Removal lbs/acre		
	Seed	Stover	Total
Nitrogen (N)	30	18	48
Phosphorus (P_2O_5)	12	3	15
Potassium (K_2O)	8	28	36
Sulfur (S)	2	4	6
Magnesium (Mg)	2	5	7
Calcium (Ca)	1.2	18.5	19.7
Zinc (Zn)	0.05	0.04	0.09

Table 3. *Nitrogen credit for legumes used in crop rotations*

Previous Legume	Nitrogen Credit
	pounds per acre
Alfalfa > 80% stand	100–140
60–80% stand	60–100
< 60% stand	0–60
Second year after alfalfa	½ first year credit
Red Clover	40–80
Sweet Clover	80–120
Soybeans	30–60

Fertilizer nitrogen rates should be lowered if legumes are grown in rotation before sunflowers. Table 3 summarizes nitrogen credits for various legumes.

Since sunflowers are efficient in recovery of residual nitrogen, a soil test for available nitrogen in the profile is strongly encouraged. Profile nitrogen samples should be taken to a depth of at least 2 feet. On deep, well-drained soils, sampling may be justified to 4 feet.

Nitrogen recommendations can be calculated by using the following equation:

N Rec = {[YG × 0.065 pounds nitrogen per pound of yield] × STA} - PCA - PYM - PSNT - (Nmin)

N Rec Fertilizer nitrogen recommended in pounds per acre

YG A realistic yield goal in pounds per acre

STA Soil texture adjustment (1.1 for sandy soils less than 1.0 percent organic matter, 1.0 for other soils)

PCA Previous crop adjustment [use Table 2 for previous legumes, 20 pounds for fallow (if no profile N test) and 0 for all other previous crops]

PYM Previous years manure (50 pounds for last year, 20 pounds for 2 years ago and 0 for no manure history)

PSNT Profile nitrogen soil test results where:

Surface:

ppm nitrogen × 0.3 × depth, inches = pounds per acre

Subsoil:

ppm nitrogen × 0.3 × depth, inches = pounds per acre

Total Profile nitrogen = pounds per acre

Note: If profile nitrogen test is not run, use 30 pounds per acre as a default value for PSNT.

Nmin Estimate of nitrogen mineralized from soil organic matter. Credit 30 pounds of nitrogen for every 1 percent of soil organic matter in the top 6 inches of soil.

Example:

Yield Goal = 1,800 pounds per acre

Soil Texture = Silty clay loam

Previous Crop = Wheat

Previous Manure = None

Soil Test Results:

0 - 6 inches = 8 ppm nitrogen, 6 - 24 inches = 6 ppm nitrogen, 1 percent soil organic matter

N Rec = (1,800 pounds per acre × 0.065 pounds per pound) × 1.0 - 0 - 0 - 47* - 30 = 40

*(8 ppm × 0.3 × 6 inches) + (6 ppm × 0.3 × 18 inches) = 47

Under these conditions, 40 pounds of fertilizer N is recommended.

A soil with 1 percent organic matter and a residual nitrate level of 30 pounds in 2 feet would produce the following N recommendations:

Yield Goal	1,000 lbs./a	1,500 lbs./a	2,000 lbs./a	2,500 lbs./a	3,000 lbs./a
Total Nitrogen Need	5 lbs N/a	40 lbs N/a	70 lbs N/a	90 lbs N/a	125 lbs N/a

The use of excessive nitrogen rates is not advisable. Research in North Dakota, Colorado, and Nebraska indicates that excessive nitrogen can result in decreased oil content and increased lodging. At low yield levels, nitrogen often does not increase yields. At higher yield levels, excess nitrogen can decrease both yield and oil. Research on dryland sunflowers in western Nebraska show nitrogen effects on yield (Figure 4) and on oil content (Figure 5).

If fertilizer is placed in contact with the seed, the starter material should contain no more than 10 pounds of actual nitrogen plus potash per acre. The nitrogen and potash can cause germination damage because of their high salt index when placed with the seed. Much higher amounts can be applied in a 2 by 2 band (2 inches deep and 2 inches away from the seed), or broadcast applied without seedling damage. These fertilizer placement statements hold true regardless of the crop.

Field comparisons of nitrogen sources conducted by K-State researchers indicate little agronomic difference between alternative nitrogen materials, when properly applied. Nitrogen source should be based on applied cost, availability, adaptability to your management system, and dealer services.

Nitrogen application for sunflowers can be made preplant, sidedress, or a combination of these methods with equal results. Applications should be timed so nitrogen is available for rapid plant growth and development.

Figure 4. *Nitrogen rate effects on sunflower seed yield*

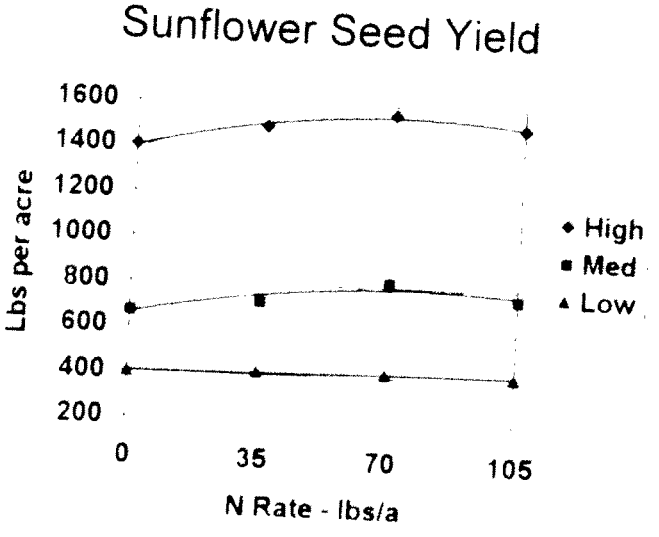
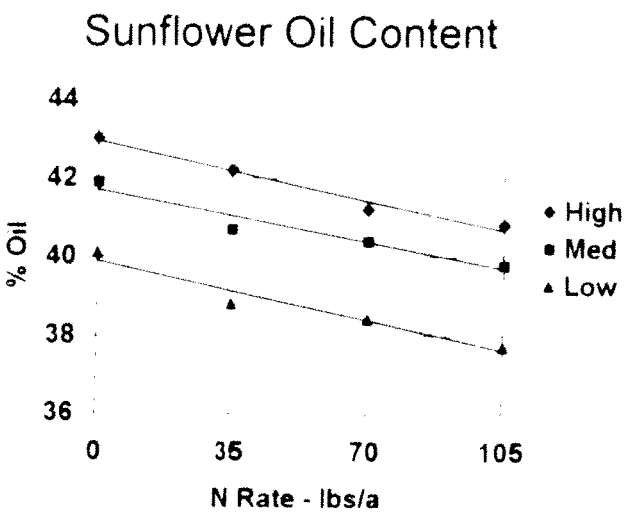


Figure 5. *Nitrogen rate effects on sunflower oil content*



Phosphorus

Phosphorus (P) application should be based on a soil test. Consistent sunflower response to phosphorus fertilization has generally occurred on soils testing very low or low in available phosphorus where yield potential is not restricted by lack of moisture or other environmental factors. With medium-testing soils, yield responses have been erratic and normally quite small. Phosphorus applications are recommended with medium and low soil tests for potential yield response and to maintain the soil in a highly productive condition. Table 4 shows phosphorus recommendations.

Phosphorus should be applied preplant-broadcast, preplant-knifed, or banded at seeding. Starter applications are most efficient, particularly when small amounts are applied on soils low in available phosphorus. Phosphorus can be placed in direct contact with the seed or to the side or below the seed with no restrictions in economical rates. If placed in contact with the seed, the starter material should contain no more than 10 pounds of actual nitrogen plus potash per acre. The nitrogen and potash can cause germination damage because of their high salt index when placed with the seed.

Preplant applications can be made in the fall or spring and should be thoroughly incorporated because phosphorus does not move much in the soil.

Liquid and solid fertilizers, as well as varying chemical forms of phosphorus (ortho- and poly phosphates), are available. Research conducted in several states indicates that, in general, all are agronomically equivalent. Selection of a phosphorus source should be made on the basis of cost, availability, and adaptability to the operation.

Potassium

Like phosphorus, a soil test is the best guide to potassium (K) need (Table 5). Potassium removal is much greater with silage than with grain production. Potassium deficiencies are not likely unless soil tests levels are low, which normally occur in sandy soils.

Potassium should be applied preplant-broadcast or as a starter. Remember, sunflowers are sensitive to fertilizer salts (nitrogen and potassium). When applying starter applications with the seed, limit application to no more than 10 pounds actual nitrogen plus potash per acre. Preferred fertilizer placement is 2 inches deep and 2 inches away from seed. Broadcast applications should be thoroughly incorporated to place the potassium in the root zone. The most common potassium source is muriate of potash (potassium chloride); however, potassium sulfate, potassium nitrate, potassium-magnesium sulfate, and mixed fertilizers are other sources. Little difference in potassium availability exists among these materials. Selection should be based on cost, availability, and adaptability to the farm operation.

Lodging of sunflowers at maturity has been a problem in some areas resulting in considerable harvest loss. Research has shown that many factors such as weather stress, insect and disease damage, hybrids, date and rate of planting, and nutrient imbalance can cause lodging. Adequate potassium is essential for sturdy stalks and may help reduce lodging on medium- to low-potassium test soils.

Table 4. *Phosphorus recommendations for sunflower*

		Soil Test Phosphorus, ppm			
		L	M	H	VH
	Bray-1 P	0-5	6-15	16-25	>25
	Olsen P	0-3	4-10	11-15	>15
Yield Goal	Mehlich 3	0-11	12-22	23-31	>31
lbs/a		lbs P_2O_5 per acre to apply broadcast*			
1,000	30	20	15	0	0
1,500	40	30	20	0	0
2,000	50	40	25	10	0
2,500	60	50	30	15	0
3,000	70	60	35	20	0

*For banded P, apply half this amount

Table 5. *Potassium recommendations for sunflowers*

Yield Goal	Soil Test Potassium (ppm)				
	VL	L	M	H	VH
lbs/a	<40	41-80	81-120	121-160	>161
	lbs K_2O per acre to apply broadcast				
1,000	50	40	15	0	0
1,500	60	50	25	10	0
2,000	70	60	35	15	0
2,500	80	70	45	20	0
3,000	90	75	55	25	0

*When sunflowers are used for sludge, add 60 lb K_2O acre to the recommendation for low testing soils

Liming

Acid soils are not common in the High Plains, but soil pHs less than 5.5 have been reported in northwest Kansas.

Lime recommendations are intended to maintain soils in a productive condition. Sunflowers are not the most responsive crop to lime, but liming of acid soils should not be ignored. Although yearly yield increases may be small, liming is a sound farming practice. Lime is recommended for sunflowers on all soils with a pH of 6.0 or less. If sunflowers are grown in a cropping system that includes legumes, liming to obtain a higher pH (6.2 to 6.5) should be maintained. However, most High Plains soils test quite high in pH and therefore, liming is not common.

Other Elements

Perhaps because of the extensive root system, reports of secondary and micronutrient deficiencies in field-grown sunflowers are rare. In most states in the region for example, sulfur, iron, and/or zinc deficiencies have been reported on other row crops, small grains, and forage crops. However, there have been no reported deficiencies of any of these nutrients in sunflowers. In fact, sunflowers are often suggested as an alternative crop on severely iron deficient soils. Likewise, there should be no problems with boron, copper, or manganese nutrition in sunflowers.

Soil Fertility and Micronutrients

Iron availability decreases with increasing soil pH. However sunflowers are tolerant of low iron availability. Sunflower production is usually successful in soils that cause deficiencies on sensitive crops such as corn, sorghum, or potatoes. Severe iron deficiency of sunflowers in the seedling stage shows interveinal chlorosis on the youngest leaves with stunted plants.

Zinc deficient plants are stunted with distorted upper leaves. As the deficiency intensifies, leaves tend to wilt. Zinc deficiencies, or responses to added zinc, are not likely in the region.

When setting yield goals, considerations must include individual management skills, soils, and average weather conditions. Adequate fertilizer nutrients must be provided as required for selected yield goals. The most limiting factor however for yield on dryland sites is often stored soil water and effective summer precipitation. Decisions for choosing yield goals therefore should be based on yield histories and future expectations.

Recent research with micronutrients applied foliarly two times during the season in a 2-year study at USDA-ARS Akron, Colo. did not provide a return on investment that was great enough to pay for the micronutrient application (Vigil et al 2001.). Although in one of the years, a significant increase in seed oil content was measured with micronutrient application. Similar results were found by researchers at Colorado State University where no yield advantages were found by adding micronutrients. In that study neither soil-applied granules or foliar applications provided any yield advantage regardless of soil moisture conditions.

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