

Fertilizing Sunflower

SF-713 (Revised), October 1992

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Sunflower responds best to fertilizer when soil nutrient levels are low, appropriate plant populations are used and weeds are controlled. Optimum production of high-yielding, high-quality sunflower requires fertilization based on an evaluation of the current soil fertility level. Excessive nitrogen can contribute to decreased oil content in the seed.

Yield Goals:

Total plant nutrient requirement for a crop depends on the total production of that crop. Establish realistic yield goals. When estimating yield goals, consider the highest yield that has been produced on a particular field and then make adjustments from that point. Usually the yield goal should be within 200 pounds of the highest yield of sunflower ever produced on the field in question. In addition to previous yields on a particular field, also consider changes in management (new varieties, better weed control, more timely operations) when estimating your yield goal (see Circular SF-822). Excessive fertilizer use, especially nitrogen and phosphorus, has potential to degrade ground and surface water quality.

Excessive fertilizer use is also costly. Establishing realistic yield goals, carefully soil sampling fields and fertilizing crops according to soil tests will help preserve water quality.

Nitrogen:

Table 1 gives the amount of soil NO₃-N plus fertilizer nitrogen that is needed in the top 2 feet of the soil to achieve specified yield goals. Table 1 is based on soil nitrate-nitrogen levels of soil samples taken from about September 15 to April 1. If soil samples are taken between July 1 and September 15, subtract 0.5 pound of nitrogen from the recommendation for each day that the soil was sampled prior to September 15. These adjustments are automatically included in recommendations received from the North Dakota State University Soil Testing Laboratory.

To determine fertilizer nitrogen rates needed, subtract the amount of nitrate-nitrogen (NO₃-N) in the soil, as determined by the soil test, from the total amount of soil plus fertilizer nitrogen needed (Table 1) for your particular yield goal. For example, if your NDSU soil test shows that there are 40 pounds of NO₃-N present in the top 2 feet of soil and your yield goal is 2000 pounds per acre, the amount of fertilizer nitrogen that should be applied would be 60 pounds actual nitrogen (N) per acre. (This is the difference between the 100 pounds soil N plus fertilizer N needed for a yield goal of 2000 pounds taken from Table 1 and 40 pounds found in the soil).

Adjusting Nitrogen Recommendations When Sampling Below 2 Feet:

Recently there has been concern about accumulations of available nitrogen below the 2-foot depth. The original data gathered for calibration of the nitrogen test took into consideration available nitrogen to a depth of 5 feet. At that time sampling beyond 2 feet improved the recommendations somewhat, but it was decided that the extra effort and expense to sample to a depth of 3 or 4 feet was not justifiable. Excessive applications of nitrogen can result in a buildup of available

nitrogen in the soil profile. When fields are tested for nitrogen each year and reasonable yield goals are used, an accumulation of nitrogen below 2 feet is unlikely.

If you suspect an accumulation of available nitrogen below 2 feet, have the 2- to 4-foot depth tested in addition to the top 2 feet. The following guidelines are used to adjust nitrogen recommendations:

1. If the amount of NO₃-N in the 2- to 4-foot depth is less than 30 pounds NO₃-N per acre, no adjustment is made. This is the normal amount found in most soils in North Dakota.
2. If the amount of NO₃-N in the 2- to 4-foot depth is more than 30 pounds NO₃-N per acre, the nitrogen recommendation is reduced by 4 pounds for each 5-pound increment above 30 pounds found in the 2- to 4-foot depth. In other words, if there were 50 pounds of NO₃-N in the 2- to 4-foot depth, the nitrogen recommendation would be reduced by 16 pounds (80% of 20 pounds).

Phosphate and Potash:

Because of the nature of phosphate and potash soil chemistry the simple method of subtracting the soil test level from the amount needed for the proposed crop does not work. The amount of broadcast phosphate (P₂O₅) and potash (K₂O) recommended for specified yield goals are given in Table 1.

As an example:

If the yield goal for sunflower is 1500 pounds per acre and the phosphorus fertility level is low (L) and the potassium fertility level is high (H), the fertilizer recommendation would be 20 pounds per acre of P₂O₅ and 0 pounds per acre of K₂O (see Table 1).

Micronutrients:

To date, using micronutrients on sunflower has not resulted in a yield response. If for some reason a micronutrient problem is suspected, it is suggested that a micronutrient soil test be obtained and that micronutrient use be limited to a trial basis.

Fertilizer Application:

Sunflower seedlings are sensitive to fertilizer salts. No more than 10 pounds per acre of nitrogen (N) plus potash (K₂O) should be put down in contact with the seed. Although some interest in "pop-up" fertilization (placement of some nutrient in direct contact with the seed) has developed in recent years, extreme care must be used to avoid germination damage. The recommended placement of the fertilizer band is 2 inches to the side and 2 inches below the seed. This planter attachment application can benefit sunflower in many growing seasons. The type of germination conditions (cool, wet or very dry conditions cut availability and uptake of nutrients) and distribution of nutrients in the soil influence the possible need for starter fertilizer.

Fall applications of nitrogen are not recommended on coarse textured soils or on soils with a high water table. On these soils, apply nitrogen as near to planting time as possible. A portion of the recommended rate may also be side-dressed before sunflower plants are 1 foot high.

Phosphorus and potassium may be fall or spring applied on most soils in the area. All phosphate and potash recommendations given are for **broadcast applications**. If all phosphorus material is to be banded, reduce the broadcast rate by one third on **very low testing** soil. Broadcast phosphate should be applied before a deep tillage operation. A deep band application may be used to prevent a buildup of nutrients at the soil surface when using minimum tillage.

Since phosphorus and potassium move very little in the soil it is possible to "build up" or increase the available level of these nutrients in the soil. The application of approximately 20 pounds of P₂O₅ per acre will increase the phosphorus soil test level by 1. In other words, if your phosphorus soil test is 5 and you prefer to operate at a test level of 12, the application of 140 pounds of P₂O₅ (285 pounds of 18-46-0) per acre thoroughly mixed in the top 6 inches of soil will raise the soil test by 7. Likewise, the application of 10 pounds of K₂O per acre will increase the potassium soil test by 1. Nitrogen requirements should be applied each year as needed.

Nutrient recommendations for sunflower.

		Soil Test Phosphorus, ppm					
Yield goal	Soil N plus fertilizer N required	Bray-I Olsen	VL	L	M	H	VH
			0-5	6-10	11-15	16-20	21+
			0-3	4-7	8-11	12-15	16+
lb/a	lb/acre-2'		lb P2O5/acre				
1000	50		20	15	10	0	0
1500	75		30	20	15	0	0
2000	100		40	30	20	10	0
2500	125		50	35	25	10	0

		Soil Test Potassium, ppm					
Yield goal	Soil N plus fertilizer N required	Bray-I Olsen	VL	L	M	H	VH
			0-40	41-80	81-120	121-160	161+
lb/a	lb/acre-2'		lb K2O/acre				
1000	50		35	25	15	0	0
1500	75		55	40	25	10	0
2000	100		70	50	30	10	0
2500	125		90	65	40	15	0

Nitrogen recommendation = $0.05 \text{ YG} - \text{STN} + \text{SDA} - \text{PCC}$

Bray-I P recommendation = $(0.0225 - 0.0011 \text{ STP})\text{YG}$

Olsen P recommendation = $(0.0225 - 0.0014 \text{ STP})\text{YG}$

Potassium recommendation = $(0.04100 - 0.00027 \text{ STK})\text{YG}$

The abbreviations used in the equations are as follows:

YG = yield goal STK = soil test potassium

STN = soil test nitrogen SDA = sampling date adjustment

STP = soil test phosphorus PCC = previous crop credit

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