Sunflower

Crop Highlights
• Target pH: 6.0 • Split nitrogen (N) application to increase N use efficiency in in sunflower. Apply a small amount at or just prior to planting and the bulk of the N requirement in one or two applications during the growing season. • Monitor crop for manganese (Mn) deficiency, **especially** when soil test Mn is less than 3.4 lb/ac.

Yield Goal

Grain yield of sunflower is influenced by many factors, including the cultivars selected, planting date, winter weather, soil type and water-holding capacity, nutrient and water availability, weed, insect and disease pressure, and crop management practices. **Few yield measurements are available for sunflowers grown on Delaware soils. However, based on data from nearby states with similar soils and climates, 80 bu/ac is a realistic yield goal for sunflower production in a good to average year**.

Delaware growers should use field history to determine the yield goal for each field and use that information to adjust management decisions and fertility programs accordingly. Delaware nutrient management law requires the use of optimal rolling average for determining the yield goal for a specific field when field history is available. To calculate the optimal rolling average yield, see University of Delaware Extension Fact Sheet ***Estimating Yield Goal for Crops***.

Soil pH and Liming

Target pH: 6.0 for most soils

Soils that are high in organic matter (e.g., "black" soils; soil organic matter >6.0%) have a lower target pH (5.6) because organic matter moderates some of the negative effects of excessive soil acidity (e.g., aluminum toxicity).

The lime recommendation for a specific field is calculated from the soil pH and Adam-Evans buffer pH measurements using the steps outlined in University of Delaware Extension Fact Sheet ***Calculating the Lime Requirement Using the Adams-Evans Soil Buffer***. Avoid over-liming to prevent deficiency of micronutrients such as manganese (Mn).

The recommended liming source is dependent upon Mehlich-3 (M3) soil test calcium (Ca) and magnesium (Mg) reported in University of Delaware fertility index value (FIV) and can be determined using Table 1.

Table 1. Recommended type of lime as a function of Mehlich-3 soil test calcium and magnesium concentrations.

Soil Test Levels	Recommended Lime Type
M3-Mg is less than 50 FIV	Dolomitic
M3-Mg between 50 and 100 FIV AND M3-Mg is less than M3-Ca	Dolomitic
M3-Mg greater than 100 FIV	Calcitic
M3-Mg is greater than 50 FIV AND M3-Mg is greater than M3-Ca	Calcitic

Nitrogen

Nitrogen (N) is recommended at a rate of 1 lb/ac per bushel of expected grain yield for sunflower. An expected yield of 80 bu/ac would, therefore, require a total N application of 80 lb/ac per growing season. Split applications of N have been shown to increase N use efficiency by the crop, thus requiring less total N to achieve the same grain yield.

When a single application is planned, N should be applied as close to planting as possible to reduce the potential loss of N by leaching prior to crop uptake. When a split application is utilized, apply a small portion (20 to 25%) of the total N requirement at or just prior to planting. Apply the remaining N (75 to 80%) in one or more applications during the growing season.

Phosphorus

Table 2. Broadcast phosphorus application rates for sunflower.

	M3-P (FIV)										
	0	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
lb P_2O_5/ac	130	110	90	70	50	40	30	20	20	0	0

1. If M3 soil test phosphorus (M3-P) is “Low” (e.g., 25 FIV or less), broadcast and plow down the recommended rate of phosphate prior to planting.
2. If M3 soil test P is “Medium or “Optimum” (e.g., 26 to 100 FIV), phosphate can topdressed in the fall or the spring.
3. If M3 soil test P is “Excessive” (e.g., greater than 100 FIV), the application of phosphorus in fertilizers or manures is NOT RECOMMENDED.
4. If P fertilizers are banded, reduce the rates in Table 2 by one-half.

Potassium

Table 3. Recommended potassium application rates for sunflower.

	M3-K (FIV)										
	0	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
lb K_2O/ac	120	100	80	60	40	30	30	20	20	0	0

1. Broadcast and incorporate or band potash prior to planting.
2. For banded applications, reduce the rates in Table 3 by one-half.
3. To avoid salt injury to seedlings, do not band more than 75 lb K_2O/ac at planting. When N and K_2O are banded together, the sum of the N rate and the K_2O rate should not exceed 75 lb/ac.

Magnesium

Table 4. Recommended application rates of soluble magnesium as a function of soil test magnesium.

Soluble Mg	M3-Mg (FIV)								
	0	5	10	15	20	25	30	35	40
lb soluble Mg/ac	80	70	60	50	40	30	20	10	0

1. Magnesium (Mg) is recommended when M3 soil test Mg is less than 40 FIV.
2. If M3 soil test Mg is less than 40 FIV and lime is recommended, use dolomitic limestone.
3. If M3 soil test Mg is less than 40 FIV and lime is not needed, apply soluble Mg according to the rates in Table 4.

Sulfur

Sulfur (S) deficiency is occasionally observed in sunflower grown on sandy soils in this region. The use of ammonium sulfate as the N source or the addition of a small amount of ammonium sulfate to liquid UAN can prevent S deficiency from occurring.

Manganese

Manganese (Mn) needs are predicted by an availability index that includes M3 soil test Mn and soil pH. Interpretation is crop specific.

$$MnAI = 101.7 – (15.2 \times \text{soil pH}) + (2.11 \times \text{M3-Mn})$$

Where:

MnAI = Mn availability index
Soil pH = Soil pH measured in water (1:1 V:V)
M3-Mn = Mehlich 3 soil test Mn in lb/ac

Table 5. Interpretation of manganese availability index.

Mn Availability Index	Interpretation
Less than 25	Mn deficiency is likely at this soil pH and soil test Mn concentration
25 to 35	Mn deficiency is possible at this soil pH and soil test Mn concentration. Monitor the crop for symptoms, especially if liming has been recommended.
Greater than 35	Mn deficiency is unlikely.

1. If Mn deficiency is predicted or was observed in the previous growing season, broadcast 20 to 30 lb/ac elemental Mn.
2. In some cases, broadcast applications of acid forming fertilizers may correct Mn deficiency without the application of Mn; however, acid-forming fertilizers may be less effective than Mn fertilizers.
3. If Mn deficiency symptoms appear during the growing season or after an application of lime, a foliar application of Mn sulfate or Mn oxide at a rate of 1.0 to 2.0 lb/ac elemental Mn or chelated Mn (Mn-EDTA) at a rate of 0.5 to 1.0 lb/ac elemental Mn can alleviate the symptoms and restore yield potential. **Apply only when adequate growth is present to aid absorption of foliar Mn.**