Grain Sorghum

Crop Highlights
• Target pH: 6.0 • Base nitrogen (N) application rates on the crop rotation in use. Sorghum has shown only minimal response to N when following an average soybean crop (e.g., 30 to 40 bu/ac yield) or another legume. Increase N rates when sorghum follows a corn or sorghum crop.

Yield Goal

Grain yield of sorghum 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. **On Delaware soils, 80 bu/ac is a realistic yield goal for grain sorghum 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

University of Delaware nitrogen (N) recommendations for sorghum are based upon the crop rotation in use. **A total nitrogen (N) application rate of 50 to 75 lb/ac per growing season is recommended for a grain sorghum crop following corn or sorghum.** When the sorghum crop is following an average soybean crop (e.g., 30 to 40 bu/ac yield) or another legume in the rotation, the N application rate should be reduced to 25 to 50 lb/ac per growing season.

To reduce the potential loss of N by leaching prior to crop uptake, N should be applied as close to planting as possible.

When planting into fields where manure has been applied, determine the plant available N (PAN) for the manure application and reduce fertilizer N rates as appropriate.

Phosphorus

Table 2. Broadcast phosphorus application rates for grain sorghum.

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

1. If M3 soil test phosphorus (M3-P) is “Low” or “Medium” (e.g., 50 FIV or less), broadcast and plow down the recommended rate of phosphate prior to seeding.
2. If M3 soil test P is “Optimum” (e.g., 51 to 100 FIV), broadcast and incorporate phosphate prior to seeding or surface broadcast at or shortly after planting.
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 grain sorghum.

	M3-K (FIV)										
	0	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
lb K_2O/ac	150	120	90	70	50	30	30	20	20	20	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 Mehlich 3 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 early in the season on sorghum grown on sandy Delaware soils. 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.**

Manganese toxicity has also been observed in grain sorghum grown on Delaware soils with low soil pH. Symptoms of Mn toxicity include generally stunted growth, yellowed or chlorotic leaves, or (in severe cases) a series of reddish-purple bands that run parallel to the leaf veins about ½ to ⅓ of the way back from the leaf tip. Suspected Mn toxicity can be confirmed by a tissue or soil pH test. When detected early, the problem may be corrected by broadcasting agricultural-grade lime at a rate of 1 ton/ac. Little can be done to correct Mn toxicity when identified later in the season. Take note of the area where Mn toxicity occurs in the field so that lime can be applied in that location following harvest to raise the pH for future crops.

Zinc

Zinc (Zn) deficiency is predicted by an availability index that includes M3 soil test Zn, soil pH, and M3 soil test P. It is most common on soils with a pH of 6.5 or higher and high soil test P concentrations but may also be induced by environmental conditions such as cold, wet soils that may limit root growth.

Table 6. Interpretation of zinc availability index.

Soil Test Criteria	Interpretation
M3-Zn is less than 1.9 lb/ac	Zn deficiency is predicted
M3-Zn is less than 3.1 lb/ac **AND** soil pH is higher than 7.0	Zn deficiency is predicted
M3-Zn is less than 3.1 lb/ac **AND** soil pH is 6.6 or higher **AND** M3-P is 100 FIV or higher	Zn deficiency is predicted
M3-Zn is 3.2 lb/ac or higher	Zn deficiency is unlikely

If zinc deficiency is predicted by the availability index or was observed the previous year, one of the following treatments can be applied:

1. Broadcast Zn sulfate or Zn oxide at a rate of 10 to 12 lb/ac elemental Zn or Zn chelate (Zn-EDTA) at a rate of 2 to 3 lb/ac elemental Zn. Broadcast applications should correct Zn deficiency for several years.
2. Foliar application of Zn sulfate or Zn oxide at a rate of 1 lb/ac elemental Zn or Zn chelate (Zn-EDTA) at a rate of 0.5 lb/ac elemental Zn in 20 to 50 gallons of water. **Apply only when adequate growth is present to aid in the adsorption of foliar Zn.** Foliar Zn application should be repeated if symptoms reappear.

Boron

Boron (B) deficiency is not usually observed in this crop. If B deficiency symptoms appear, contact your county agent for assistance with diagnosis and corrective recommendations.