

Wheat

Management Highlights

- Target pH: 6.0
- Split N applications to increase N-use efficiency in wheat. Apply a small amount at planting or in late winter and the bulk of the N requirement (75-80%) in two equal applications in the spring: the first when growth resumes in spring and the second at the Feekes 5 growth stage.
- Monitor crop for Mn deficiency, especially when soil test Mn is 3.4 lbs/ac or less.

Yield Goals

Grain yield of wheat is influenced by many factors, including the cultivar selected, planting date, soil type and water-holding capacity, nutrient and water availability, weed, insect and disease pressure and crop management practices. Table 1 shows typical yield goals for wheat grown on Delaware soils in a good to average year. When field history supports the use of a different yield goal, growers should use that information to adjust management decisions accordingly.

Table 1. Yield goals of wheat as a function of soil type.

Soil Type	Yield
	-- bu / ac --
Sands, loamy sands	50 - 60
Sandy loams, loams, black soils	70 - 80
Silt loams,	90 - 110

Soil pH and Liming

The target pH for wheat on most Delaware soils is 6.0. A lower target pH (5.6) is used for soils that are high in organic matter ("black" soils) 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 buffer pH

measurements using the steps outlined in *Calculating the Lime Requirement -- Chapter 3, Section 3.4*. Avoid overliming in order to prevent deficiency of micronutrients such as manganese.

In most cases, the lime requirement can be met by either calcitic or dolomitic limestone.

Dolomitic limestone is recommended if:

- soil test Mg is less than 50 FIVs, or
- soil test Mg is between 50 and 100 FIVs *and less than soil test Ca*.

Calcitic limestone is recommended if:

- soil test Mg is greater than 100 FIVs, or
- soil test Mg is between 50 and 100 FIVs *and greater than soil test Ca*.

Nitrogen Management

The University of Delaware recommends a total nitrogen (N) application of **80 - 120 lbs N/ac** per growing season for wheat. For greatest response, N should be split into three applications. A small amount (**20-30 lbs N/ac**) should be applied in the fall at planting or in late winter. The remainder (**60-90 lbs N/ac**) should be applied in the spring in two equal applications, the first when growth resumes (e.g., "green up") and the second at the Feekes 5 growth stage.

The higher N rates are recommended for sandier soils and for management systems utilizing a single application to compensate for greater leaching losses. Split applications of N have been shown to increase N-use efficiency, thus requiring less total N to achieve the same grain yield. In general, increasing N rate may increase grain production but can also increase lodging, reducing *harvestable*, and thus *economic*, yield.

When planting into fields where manure has been

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applied or a legume precedes the wheat crop, fertilizer N rates should be reduced. To calculate the adjustment, see *Nitrogen Rate Adjustments -- Chapter 3, Section 3.5.1.2.*

Phosphorus Management

Yield-limiting phosphorus (P) deficiency is rarely a concern on Delaware soils. Long-term applications of fertilizers and manures have resulted in P accumulations in many soils that are capable of supplying crop needs for several years with no further additions.

To determine whether P fertilization is necessary, conduct a routine soil test. University of Delaware P recommendations for wheat are dependent upon the soil test P value. A summary of those P recommendations are given in Table 2 below. When the soil test P index is *Low* (25 FIVs or less), broadcast and incorporate P in the fall. When the soil test P index is *Medium or Optimum* (greater than 25 FIVs), P can be topdressed in the spring or fall.

Table 2. Broadcast application rates of P for wheat.

P Index Value						
0	10	20	30	40	50	60
----- lbs P ₂ O ₅ / ac -----						
140	120	100	90	80	40	0

Potassium Management

The need for potassium (K) fertilization of wheat is best determined by a routine soil test. Potassium recommendations are based on the the soil test K value and the K requirement of the crop. A summary of K rates for wheat are given in Table 3. Potassium can be broadcast prior to or shortly after planting.

Table 3. Broadcast application rates of K for wheat.

K Index Value						
0	10	20	30	40	50	60
----- lbs K ₂ O / ac -----						
110	95	80	60	40	20	0

Since most wheat is followed by a double crop (e.g., soybeans or sorghum), sufficient potassium can be applied to the wheat to meet the needs of both crops. This will reduce application costs plus allow the grower to purchase K fertilizer at a time of year when fertilizer prices are generally at their yearly low.

Magnesium Management

Mg application to wheat is recommended if the soil test Mg value is less than 38 FIVs. If liming is also recommended, use dolomitic limestone to raise soil pH and increase soil Mg. If, however, liming is not necessary but Mg fertilization is still indicated, apply Mg as Mg sulfate or Mg chloride to increase soil Mg. Application rates are summarized below in Table 4.

Table 4. Application rates for soluble Mg as a function of Mg fertility index value.

Mg Index Value									
0	5	10	15	20	25	30	35	40	
----- lbs soluble Mg / ac -----									
80	70	60	50	40	30	20	10	0	

Manganese Management

Manganese (Mn) deficiency may occur in wheat grown on Delaware soils, most often as a result of overliming soils that are naturally low in Mn. The University of Delaware Soil Testing Program uses an availability index based on the soil test Mn value and soil pH to predict the likelihood of Mn deficiency. That availability index is calculated using the equation:

$$MnAI = 101.7 - (15.2 \times pH) + (2.11 \times ST-Mn)$$

where:

MnAI = Mn availability index
 pH = water pH of the soil
 ST-Mn = Mehlich 3 soil test Mn in lbs/ac.

Table 3-14 in *Chapter 3, Section 3.5.5.2 (Manganese Management)* gives a summary of MnAI values for various soil pH-soil test Mn combinations. Interpretations of the Mn availability index for wheat are given below in Table 5.

Table 5. Interpretation of the Mn availability index for wheat.

MnAI Value	Interpretation
Less than 17	Mn deficiency is likely at this soil pH and Mn concentration.
17 to 25	Mn deficiency is possible at this soil pH and Mn concentration. Monitor crop for deficiency symptoms if liming has been recommended.
Greater than 25	Mn deficiency is unlikely.

Suspected Mn deficiency can be confirmed by tissue analysis. Confirmed deficiency situations can be corrected in season by foliar applications of Mn of 1-2 lbs/ac of actual Mn as Mn sulfate, Mn oxide or Mn chelate. Foliar sprays can be used before fall dormancy or after growth resumes in the spring as long as there is sufficient foliage to intercept the spray.

If deficiency is predicted by the availability index or was observed during the previous growing season, it can be prevented by a broadcast application of 20-30 lbs/ac of actual Mn. Broadcast applications of acid-forming fertilizer may correct Mn deficiency without the addition of Mn fertilizer but are not as effective as foliar or broadcast applications of Mn.

Other Nutrients

Sulfur (S) deficiency is occasionally observed in wheat grown on Delaware soils. Symptoms include reduced growth and a general yellowing of the plant. If deficiency is suspected, contact your county Extension agent for diagnosis and corrective action.

No other nutrients are known to be limiting to wheat production in Delaware.

Additional Information

See Soil Test Notes 1, 2, 4 and 5 (Appendix APP-7) for additional information concerning fertilization of wheat.