

Barley

Management Highlights

- Target pH: **6.0**
- Split N applications to increase N-use efficiency in barley. Apply a small amount at planting or in late winter and the bulk of the N requirement (65-80%) when growth resumes in spring.
- Soil test more frequently when straw is removed from the field since soil P and K may decrease more rapidly than when straw is left on site.
- Monitor the crop for Mn deficiency, **especially** when soil test Mn is 3.4 lbs/ac or less and when spring growth accelerates following spring N application.

Yield Goals

Barley grain yield 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 barley grown on Delaware soils in a good to average year.

Table 1. Barley yield goals as a function of soil type.

Soil Type	Yield
	-- bu / ac --
Sands, loamy sands	60 - 90
Sandy loams, loams, black soils	70 - 110
Silt loams	80 - 120

When field history supports the use of a different yield goal, growers should use that information to adjust management decisions and fertility programs accordingly.

Soil pH and Liming

The target pH for barley on most Delaware soils is **6.0**. Soils that are higher in organic matter ("black" soils) 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 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 micro-nutrients 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 **60-90 lbs N/ac** per growing season for barley. For greatest response, N should be split into two or more applications. A small amount (**20-30 lbs N/ac**) should be applied in the fall at planting or in late winter. The remainder (**40-60 lbs N/ac**) should be applied in the spring when growth resumes (i.e., "green up").

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.

Agronomic Crops

Recommended rates of fertilizer N should be reduced under certain conditions. When barley follows a crop with a high fertility management program (e.g., potatoes), N rates should be decreased significantly since even an application of 60 lbs N/ac can result in considerable lodging. Fall applications of N may be eliminated entirely in this scenario.

Fertilizer N rates should also be reduced when planting into fields where manure has been applied or a legume cover crop has been produced. 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 for a specific field, conduct a routine soil test. University of Delaware P recommendations for barley 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 barley.

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

Soil test P may decline more rapidly when straw is removed from the field than when left behind as stubble since P removal from the site is greater. Growers may wish to soil test more frequently when straw is removed to monitor changes in soil test P.

Potassium Management

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

Table 3. Broadcast application rates of K for barley.

K Index Value						
0	10	20	30	40	50	60
----- lbs K ₂ O / ac -----						
110	95	80	60	45	25	0

Soil test K may decline more rapidly when straw is removed from the field than when left behind as stubble since K removal from the site is greater. Growers may wish to soil test more frequently when straw is removed to monitor changes in soil test K.

Magnesium Management

Mg application to barley 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 barley 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 barley are given below in Table 5.

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

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 (see Appendix Table 12-4 for comparative rates of Mn fertilizers). Foliar sprays can be used before fall dormancy or after growth resumes in the spring as long as there is adequate foliage to intercept the spray.

If deficiency is predicted by the Mn availability index or was observed during the previous growing season, it can be prevented by an application of 20-40 lbs/ac of actual Mn in the fertilizer blend.

Applications of acid-forming fertilizer, which lower soil pH in the area of plant roots, may correct Mn deficiency without the addition of Mn fertilizer.

Other Nutrients

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

Additional Information

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