

Rye

Management Highlights

- Target pH: 6.0
- Split N applications to increase N-use efficiency in rye. Apply a small amount at planting or in late winter and the bulk of the N requirement (65-75%) when growth resumes in spring.
- Monitor crop for Mn deficiency, especially when soil test Mn is 3.4 lbs/ac or less.

Yield Goals

Grain yield of rye 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 rye grown on Delaware soils in a good to average year.

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

Soil Type	Yield
	-- bu / ac --
Loamy sands	40
Sandy loams, loams	50
Black soils	60
Silt loams, black loams, black silt loams	70

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 rye on most Delaware soils is 6.0. Higher organic matter soils ("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 recom-

mendation 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 **40 - 70 lbs N/ac** per growing season for rye. 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 (**20-40 lbs N/ac**) should be applied in the spring when growth resumes (e.g., "green up").

The higher N rates are recommended for sandier soils and for management systems utilizing a single application in order 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 applied or a legume crop precedes rye, 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 for a specific field, conduct a routine soil test. University of Delaware P recommendations for rye are dependent upon the soil test P value. A summary of those recommendations is 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 rye.

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

Potassium Management

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

Table 3. Broadcast application rates of K for rye.

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

NOTE: When rye is being grown in double-crop rotation with soybeans or sorghum and additional K is needed for the subsequent crop, the combined K can be applied as a single application to the rye crop. This will reduce application costs and often allows the purchase of K fertilizer at a time when prices are near their yearly low.

Magnesium Management

Mg application to rye 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 rye grown on Delaware soils, most often as a result of over-liming 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

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values for various soil pH-soil test Mn combinations. Interpretations of the Mn availability index for rye are given below in Table 5.

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

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 1-2 lbs/ac of actual Mn as Mn sulfate, Mn oxide or Mn chelate.

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 20-40 lbs/ac of actual Mn or by 8-10 lbs of actual Mn in the fertilizer band. Broadcast 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 but are not as effective as foliar or broadcast applications of Mn.

Other Nutrients

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

Additional Information

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