Alfalfa

Management Highlights

- Target pH: **6.8**
- Monitor soil P and K levels. It is more efficient and economical to maintain soil fertility than to re-establish the stand.
- Watch for Mn deficiency, especially when soil test Mn is less than 3.4 lbs/ac.
- Inoculate all seed with fresh, live inoculum just prior to seeding.

Yield Goals

Forage yield of alfalfa is dependent upon many factors: the cultivar selected, seeding date, age of the stand and degree of establishment, stand composition, 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 alfalfa at different stages grown on Delaware soils.

Table 1. Alfalfa yield goals as a function of stand age.

Stand Age	Forage Yield
	------- tons / ac -------
Year following fall seeding	4.0 - 5.0
Year of spring seeding	2.0 - 3.5
Subsequent years	5.0 - 7.0

Soil pH and Liming

The target pH for alfalfa on most Delaware soils is **6.8**. ***If the soil pH is 5.5 or lower, soil is too acid for good growth of alfalfa***. For soil pH between **5.1** and **5.5**, apply lime at the recommended rate and plow down prior to seeding the field.

When soil pH is 5.0 or less, the soil is too acid for establishment of alfalfa. Apply lime at the recommended rate and incorporate thoroughly. ***Do not seed immediately.*** Instead, plant another crop and re-test the soil in 6 to 12 months to determine if pH has been adequately corrected.

Soil pH problems are best corrected prior to initial seeding for perennial crops such as alfalfa since tillage, which can increase the effectiveness of liming, is limited for several years once the crop is established.

The lime recommendation for a specific alfalfa 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 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

Alfalfa is a leguminous plant and, once established, capable of fixing sufficient nitrogen (N) to meet crop needs. Nitrogen application to alfalfa is, therefore, recommended only at seeding to aid in establishment. ***To ensure that N fixation will be successful, treat the seed with fresh, live inoculum just prior to planting.***

Table 2 gives a summary of recommended N rates for use when seeding alfalfa. Rates are higher for sandier soils to compensate for greater leaching losses.

Table 2. Recommended N rates for seeding alfalfa.

Soil Type	N Rate
	----- lbs / ac -----
Loamy sands, sandy loams	30
All other soil types	20

In subsequent years, the composition of the stand should be evaluated to determine N needs. For stands with more than 25% alfalfa, no N is recommended. When the stand is less than 25% alfalfa, re-seed with alfalfa or interseed a grass crop. If interseeding with grass or if grass is already present, switch to nutrient recommendations for grass-alfalfa mixtures.

Phosphorus Management

Adequate concentrations of soil phosphorus (P) are important for forage production and stand longevity of alfalfa. However, yield-limiting 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 alfalfa are dependent upon stand age and soil test P value. A summary of P recommendations for Delaware alfalfa are given in Table 3

Table 3. Broadcast application rates for P for alfalfa.

Stand Status	P Index Value						
	0	**10**	**20**	**30**	**50**	**70**	**90**
	---------- lbs P_2O_5 / ac ----------						
Seeding	210	190	170	150	100	60	20
Subsequent years	150	125	100	80	60	20	0

Seeding

When soil test P is ***Low*** or ***Medium*** (***50 FIVs or less***), P should be broadcast and plowed down prior to seeding. When soil test P is ***Optimum***, (***51 FIVs or greater***), P can either be broadcast and incorporated or topdressed prior to or at planting.

Topdressing Established Stands

When soil test P is ***40 FIVs or greater***, topdressing the recommended rate of P_2O_5 should be effective in meeting crop needs for P.

If soil test P is ***less than 40 FIVs***, satisfactory growth of alfalfa is unlikely. ***Do not attempt to correct the problem by topdressing P_2O_5 or by broadcasting and incorporating P, followed by immediate re-seeding.*** Instead, correct P deficiency by plowing down the field and then broadcasting and incorporating the recommended rate of P_2O_5. Grow a short-season corn or early-maturity soybean cultivar for one season, and then re-seed alfalfa to obtain optimum yields.

Potassium Management

Potassium (K) is very important for alfalfa growth and stand longevity. The need for K fertilization of alfalfa is best determined by the use of a routine soil test. Potassium recommendations are based on crop status (new seeding or established crop) and the soil test K index value. A summary of University of Delaware K recommendations for alfalfa is given in Table 4.

Table 4. Broadcast application rates for K for alfalfa.

Stand Status	K Index Value						
	0	**10**	**20**	**30**	**50**	**70**	**90**
	---------- lbs K_2O / ac ----------						
Seeding	320	280	240	200	110	25	0
Subsequent years	330	290	255	220	150	75	0

Seeding

When establishing a new field, K should be broadcast before or immediately after planting. Incorporation of K by disking or plowing down will de-

crease potential salt effects from higher application rates.

Topdressing Established Stands

If the recommended K rate is ***90 lbs K_2O/ac or less***, potash can be broadcast in a single application either after the first cutting in the spring or after the last cutting in August. When the recommended rate is ***greater than 90 lbs K_2O/ac***, apply K in two applications -- one after the first or second cutting and one after the last cutting in August

Calcium and Magnesium Management

Calcium (Ca) and magnesium (Mg) needs of alfalfa are usually met through routine liming. ***Magnesium application is recommended if the soil test Mg value is less than 38 FIVs.*** If liming has been recommended, use dolomitic limestone to raise soil pH and increase soil Mg. If, however, liming is not necessary but Mg is still indicated, apply Mg as Mg sulfate or Mg chloride to increase soil Mg. Appropriate application rates are given below in Table 5.

Table 5. 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

Sulfur Management

Alfalfa should receive sulfur (S) at a rate of **20-40 lbs S/ac** per year to ensure that adequate S is available to meet crop needs. Sulfur should be broadcast prior to seeding and topdressed annually during each subsequent year of production.

Manganese Management

Manganese (Mn) deficiency may occur in alfalfa 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:

$$MNAI = 101.7 - (15.2 \times pH) + (2.11 \times ST\text{-}Mn)$$

where:

MNAI = Mn availability index
pH = water pH of the soil
ST-Mn = 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 index for alfalfa are given in Table 6.

Table 6. Interpretation of Mn availability index for alfalfa.

MnAI Value	Interpretation
Less than 12	Mn deficiency is possible.
Greater than or equal to 12	Mn deficiency is unlikely at this soil pH.

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. 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.

Boron Management

Boron (B) deficiency is occasionally observed in alfalfa grown on Delaware soils. To prevent deficiency, apply **2.0 lbs B/ac** each year. Prior to seeding, apply B in a blended, broadcast fertilizer, or as a soil spray, and incorporate into the soil. On established stands, B can be topdressed in a blended, broadcast fertilizer or applied as a foliar spray.

Caution: Although B is required for maximum yield of alfalfa, even slight over-application of B can be toxic to the crop. When applied as a foliar spray, be certain to apply the correct rate.

Other Nutrients

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

Additional Information

See Soil Test Notes 1, 3, and 4 (Appendix 7) for additional information concerning fertilization of alfalfa.