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Liming for Production of Forage Crops in Florida [1]

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The primary reason for liming acidic soil is to increase crop yield and/or quality. Liming changes a number of soil parameters simultaneously as soil acidity is altered. When lime is added, solubility of aluminum decreases and the soil pH is raised. Aluminum is soluble at pH values below 5.5 and toxic levels are frequently encountered in Florida mineral soils with a pH of less than 5.0. Organic soils contain little aluminum; therefore, plants can tolerate low pH levels on these soils without adverse effects.

Lime also affects the solubility of other elements; therefore, some plant nutrients are made more available by liming while toxicities caused by excessive concentrations of other nutrients are reduced. In some cases, lime will also improve the physical properties of the soil. Liming a strongly acid soil to 5.5 or greater improves the environment for most soil microorganisms. Breakdown of plant residues and nodulation of many legumes are improved by addition of lime to an acid soil. In addition to their acid neutralizing action, calcitic limestone supplies the plant nutrient calcium, and dolomitic limestone supplies both calcium and magnesium. While a correct liming program is beneficial for plant growth, excessive liming can be detrimental. Deficiencies and imbalances of certain plant nutrients may result from over liming.

To obtain maximum benefit from liming, soil and plant factors must be taken into account in determining the type and quantity of lime to apply. The first step is to properly collect a soil sample from the area to be limed. Samples are normally taken to a depth of 4-6 inches following the procedures described on the Extension Soil Testing Laboratory Producer Information form (SL135). The soil sample should be sent to a reputable soil testing laboratory for determination of pH and lime requirement.

Liming recommendations made by the University of Florida/IFAS Extension Soil Testing Laboratory are based on interpretations of the Adams-Evans (A-E) Lime Requirement Test for Florida conditions (13). The A-E lime requirement test is designed to measure the buffering capacity of soils with low cation exchange capacities, such as those usually encountered in Florida. The test measures, among other factors, the effect of soil texture and organic matter content on the lime requirement. It assumes that standard agricultural lime (calcite or dolomite ground to specifications)

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will be used. Adjustments in application rates may be necessary if other less commonly used liming materials are used. Liming recommendations made by other laboratories may or may not coincide with those used by the IFAS Extension Soil Testing Laboratory.

The amount of limestone recommended for production of a given forage crop is determined by the soil pH and the A-E buffer pH in concert with the target pH of the crop. The target pH values of various forage crops are given in Table 1. The target pH is the pH above which no increase in yield would be expected from liming. Either calcitic or dolomitic limestone may be used. If lime is recommended and magnesium (Mg) is interpreted as medium or low from soil tests, then dolomitic limestone is recommended.

The nutrient requirements of the forage crop for calcium normally should be satisfied when the soil pH is near the target pH for the crop. Even for exceptionally coarse-textured soils, no data have been found to date which document a forage response to calcium in addition to that produced by liming to the appropriate target pH value of Table 1. The magnesium requirement of all forage crops normally should be satisfied when the value for Mehlich 1 extractable magnesium is at or above 30 ppm Mg.

There may be times when the soil pH (as measured in 1:2 soil:water) is less than the target pH and yet no lime is recommended. This occurs when the soil has little buffering capacity, and thus only a small amount of reserve acidity. In such cases, only a small amount of lime (less than 0.5 ton) would be needed to correct or bring the pH up to target. As an insurance factor for forage crops, at no time will the pH be allowed to fall below 5.0 without recommending at least 0.5 ton of lime even though the lime requirement test might call for zero lime.

Lime should be incorporated into the soil whenever possible since lime reacts with that soil with which it contacts. Surface applied lime neutralizes the soil acidity of the surface soil, but has little immediate effect on the soil pH below the top inch or so.

The frequency of lime application will depend on many factors, but should seldom be more frequent than every 3 years. An example of a possible exception would be a bermudagrass hay field that receives more than 300 lb of nitrogen per acre per year.

All of the recommendations shown in Table 1 are part of the Standardized Fertilization Recommendation System of the UF/IFAS Extension Soil Testing Laboratory and the appropriate ones are automatically recorded as part of the lab's soil test report.

Literature Sources

1. Adams, Fred. 1971. Soil, crop, and economic benefits from lime use. *In* Increasing Lime Use in the Tennessee Valley Region. Bull. Y-20, National Fertilizer Development Center, Tennessee Valley Authority, Muscle Shoals, AL.

2. Adams, Fred and R. W. Pearson. 1967. Crop response to lime in the southern United States and Puerto Rico. pp 161-206. *In* R. W. Pearson and Fred Adams (eds.) Soil Acidity and Liming. American Society of Agronomy, Madison, WI. (See Table 4-9 on page 180).

3. Adams, W. E., R. W. Pearson, W. A. Jackson and R. A. McCreery. 1967. Influence of limestone and nitrogen on soil pH and coastal bermudagrass yield. Agronomy J. 59:450-453.

4. Blue, W. G. and C. L. Dantzman. 1977. Soil chemistry and root development in acid soils. Soil Crop Sci. Soc. Fla. Proc. 36:9-15.

5. Dantzman, C. L. 1983. Effect of lime levels on bigalta limpograss. University of Florida, Ona Agricultural Research Center. Unpublished data.

6. Dantzman, C. L. 1983. Effect of lime levels on white clover-pangola digitgrass. University of Florida, Ona Agricultural Research Center. Unpublished data.

7. Dantzman, C. L. 1983. Effect of lime levels on pangola digitgrass yield and soil analysis. University of Florida, Ona Agricultural Research Center. Unpublished data.

8. Foy, D. D. 1964. Toxic factors in acid soils of the southeastern United States as related to the response of alfalfa to lime. USDA-ARS Production Res. Rept. 80.

9. Gammon, Nathan, Jr. and W. G. Blue. 1968. Rates of calcium loss and production of clover-grass herbage at four lime levels on Leon fine sand. Soil Sci. 106:369-373.

10. Hodges, E. M., A. E. Kretschmer, Jr., P. Mislevy, R. D. Roush, O. C. Ruelke, and G. H. Snyder. 1982. Production and utilization of the tropical legume Aeschynomene (*Aeschynomene americana* L.). Agric. Exp. Sta., IFAS, University of Florida, Circular S-290.

11. Kidder, G., C. G. Chambliss, and R. Mylavarapu. 2000. UF/IFAS Standardized Fertilization Recommendations for Agronomic Crops, SL129, Fla. Cooperative Extension Service, IFAS, Univ. of Fla.

12. Kretschmer, A. E., Jr., N. C. Hayslip and C. T. Ozaki. 1957. Liming experiments and observations with white Dutch clover on Immokalee fine sand. Soil Crop Sci. Soc. Fla. Proc. 17:274-286.

13. Pearson, R. W. and C. S. Hoveland. 1974. Lime needs of forage crops. *In* D. A. Mays (ed.) Forage Fertilization. American Society of Agronomy, Madison, WI.

14. Snyder, G. H. and A. E. Kretschmer, Jr. 1974. Tropical legume response to lime and superphosphate in Oldsmar fine sand. Soil Crop Sci. Soc. Fla. Proc. 34:63-66.

15. Teare, I. D., D. L. Wright, R. L. Stanley, Jr. and B. T. Kidd. 1987. Bahiagrass response to lime and nitrogen under pines. Agronomy J. 79:1-4.

Table 1. Target pH for different forage crops grown on mineral soils.

Crop Category	Crops Included	Target pH	Literature Sources
Bahiagrass	bahiagrass	5.0 - 5.5	2,4,12,15
Other improved perennial grasses	bermudagrass, stargrasses, limpograsses and digitgrasses	5.5	2,3,5,7,12
Warm season annual grasses	corn, sorghum, sorghum-sudans and millets	6.0	1,2,12
Cool season annual grasses	small grains and ryegrass	6.0	2,12
Warm season legumes or legume-grass mixtures	perennial peanut, desmodiums, aeschynomene, alyceclover, hairy indigo, and other tropical legumes	6.0	12,14
Cool season legumes or legume- grass mixtures	all true clovers (white, red, arrowleaf, crimson, subterranean), vetches, lupines, and sweet clover	6.5	2,6,9,10,12
Alfalfa	alfalfa	7.0	2,8,12