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Liming Forages Crops in Florida

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Liming is frequently used to raise soil pH. By raising the soil pH, macronutrient (i.e. N, P, and K) availability is typically increased. However, at high soil pH (> 6.5) micronutrients become less available. Therefore, it is important that adequate amounts of lime material are applied to the soil to bring the pH to a desirable range. Excessive lime application may cause nutrient unbalances and micronutrient deficiency. Caution should be exercised when using repeated applications of biosolids or sludges, especially the calcium-stabilized materials. Repeated application of these materials can excessively increase soil pH and reduce forage yields.

Root development is closely related to soil pH. Optimum soil pH promotes better root growth, which, in turn, results in more efficient fertilizer and water utilization by the plants. For instance, N fertilization efficiency in forage systems can increase 2.5 times by increasing soil pH from 4.5 to 5.5. Similarly, P and K fertilization efficiency is also increased when soil pH is adequate.

Target Soil pH for Forage Crops

Forage crops require different soil fertility conditions and target pH varies according to the forage species (Table 1). In general, warm-season grasses are more tolerant to soil acidity than legumes.

Table 1. Target pH for different forage crops grown on mineral soils (Adapted from Chambliss and Kidder, 2003).

Crop Category	Crops Included	Target pH
Warm-season perennial grasses	Bahiagrass, bermudagrass, stargrass, limpograss, rhodes , suerte, and digitgrass	5.5
Warm-season annual grasses	corn, sorghum, sorghum-sudans, and millets	6.0
Warm-season legumes or legume-grass mixtures	perennial peanut, stylo, desmodiums, aeschynomene, alyceclover, hairy indigo, and other tropical legumes	6.0
Cool-season annual grasses	small grains and ryegrass	6.0
Cool-season legumes or legume-grass mixtures	all true clovers (white, red, arrowleaf, crimson, subterranean), vetches, lupines, and sweet clover	6.5
Alfalfa	Alfalfa	7.0

Liming frequency as well as application rate will depend on the soil's characteristics and management practices. For instance, N fertilization and decomposition of organic materials contribute to soil acidity. It is critical to closely monitor pH and soil fertility status by testing the soil regularly. Routine soil test provides the soil pH levels as well as the recommended lime application rates. Soil test should be repeated at least every 3 years to identify potential soil fertility problems. Maintaining adequate soil pH is an extremely important step in soil fertility programs for forage crops.

Liming Materials

The most common liming materials are dolomitic and calcitic limestone, calcium and magnesium oxide, slag, sludge, and wood ashes. Since the solubility of these materials is typically very limited, it is important that they should be preferably applied 3 to 6 months prior to seeding or fertilization. The reactions that take place in the soil when lime is applied will only occur in presence of water. If soil moisture is not adequate, the positive effects of lime in neutralizing soil acidity will be very limited.

The quality of the lime material is expressed in terms of effective calcium carbonate equivalence (ECCE). The University of Florida recommendations are based on lime material that has 100% ECCE. If a different material is used, the rate should be adjusted by dividing the recommended rate by the actual ECCE of the material. For example, if the recommended rate based on soil test is 1 ton/acre a material has ECCE of 60% will be used, the actual application rate will be 1.67 ton/acre. The ECCE of lime materials is affected by two main factors; 1. Fineness of the material or particle size, and 2. Chemical purity.

The physical composition of liming materials is defined by the percentage of the

materials that pass through 10-, 60-, and 100-mesh sieves. Finely ground materials normally neutralize soil acidity faster than coarse liming materials. Materials that contain a range of particles may be desirable when soil pH is not required to be increased in the short term. Small particles will react rapidly and the coarser particles will neutralize acidity over time.

Besides the fineness of the material, the chemical composition and percentage of impurities will also impact the effectiveness of liming materials. The purity of the liming material is measured by the “Calcium Carbonate Equivalence” or CCE. A material with CCE of 100% is equivalent to pure calcium carbonate. Below are some examples of CCE of various liming materials. The moisture content should be also considered when selecting liming materials. Materials with greater moisture content may difficult field application.

Table 2. Calcium carbonate equivalence of various liming materials.

Material	CCE (%)
Pure calcium carbonate	100
Calcitic lime	75-100
Dolomitic lime	75-109
Hydrated lime	120-136
Burned lime	179
Wood ash	30-70