Establishing a Forage Fertility Program

Soil fertility is important to perennial forages because it affects the quality of the forage that the animal eats. Many forage producers in Mississippi do not consistently pay attention to soil fertility. Managing soil fertility for forage production depends on three phases of planning: (1) pre-establishment, (2) establishment, and (3) maintenance (Figure 1). A soil test is the foundation of a good forage fertility program.

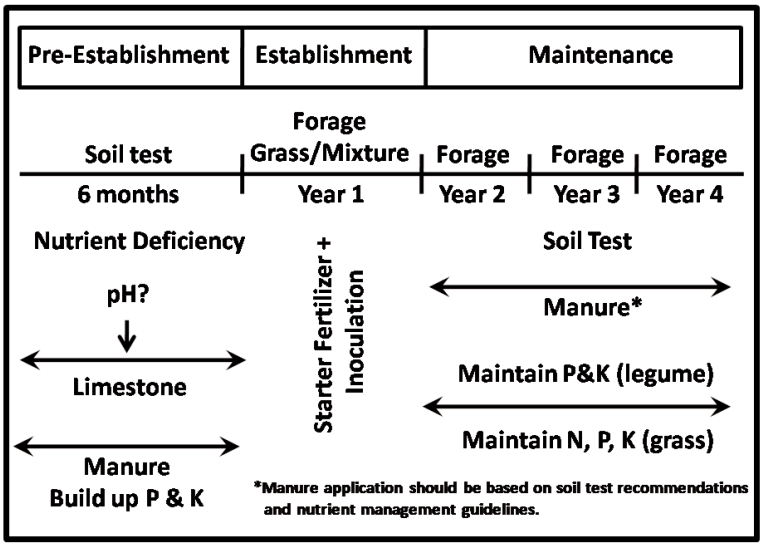

Figure 1. Soil fertility management timeline for forage production.

Pre-establishment

The pre-establishment phase is the most critical part of a fertility management program. Soil samples are collected to determine soil conditions, to fine-tune the soil pH or nutrient levels, and to assure optimum conditions for seed germination and establishment. The best time to collect samples is in the fall. To obtain a representative sample, collect soil cores that are 6 inches deep from 15 to 20 random spots in the field. Each sample should represent no more than 10 to 20 acres. When sampling, avoid old fence rows, wet areas, shaded areas, feeding areas, and other spots that are not representative of the whole field.

Adjusting the soil pH may increase the availability of nutrients important to plant growth and development. Forages vary in their sensitivity to soil pH, and legumes are more sensitive than grasses are. The optimum pH for legumes ranges from 6.5 to 7.0; for grasses, it is 6.0 to 6.5. Low pH levels inhibit bacterial nitrogen fixation in legumes, which reduces yields. To increase pH and improve fertility, apply lime to legumes. Lime application is a more economical way to increase pH and improve fertility than applying nitrogen (N) to legumes is.

The amount of lime needed to make an adjustment in soil pH depends on the level of acidity. Lime applications of 1 to 2 tons per acre can be surface applied in established pastures or incorporated into the soil surface at least 6 months before planting. Lime applications of more than 2 tons per acre should be split. Mix half the application at least 6 inches into the soil with the primary tillage. Apply the other half after the primary tillage, but incorporate it into the soil surface. This split application will allow a more uniform neutralization process, especially where seedlings will be developing.

Forage crops, especially legumes, have a high demand for phosphorous (P) and potassium (K). If soil test results show low P and K, apply before establishment

to help build up the necessary levels. Potassium and phosphorous are relatively immobile in the soil, and losses due to leaching are minimal. These applications will increase root development and establishment. A good establishment of forages requires optimum to high levels of phosphate (P_2O_5) and potash (K_2O).

Establishment

The fertility program is a continuous process that should be carried out into the establishment phase. At this point, pH should be at an optimum range, requiring only minor adjustments. At establishment, starter fertilizers are applied (banded) one inch below the seed to ensure proper germination. A starter fertilizer should be high in P, and N-P-K fertilizers such as 10-20-10, 10-20-20, and 8-32-16 are commonly used. Nitrogen application for establishing grass should be 25 to 40 pounds per acre. If the pasture is being renovated, do not apply N at time of seeding; it will stimulate the growth of the existing sod and increase competition for the new seedlings.

If you incorporate legumes into the forage system, be sure those legumes are properly inoculated. Most legumes require a specific rhizobia bacteria strain to fix nitrogen properly. Legumes are usually preinoculated. If the legumes are not preinoculated, make sure that the inoculant you add is appropriate for that legume. Always check the expiration date. A list of legumes and their inoculants is at http://msucares.com/crops/forages/index.html. Inoculants can be mixed directly with the seed, applied directly to soil in a granular form with an insecticide or fertilizer box in the seeder, or sprayed in a liquid form directly between the seed rows.

Maintenance

Maintaining fertility levels for forage production is also an important part of a good management program. Test soil routinely to monitor changes in pH and nutrient levels, especially if biomass is removed. You can use manure, such as poultry litter, to maintain nutrient levels, especially P and K. It is important to know the nutrient levels of the manure. Make applications according to soil test recommendations and nutrient management guidelines.

During the maintenance phase, pastures are either grazed or harvested for hay. Grazing usually acts as a recycling process, as most nutrients are returned through urine and feces. Distribute manure evenly at least once a year. When fields are harvested for hay, it is important to know which nutrients were depleted in order to replenish them in the soil. See Table 1, below.

Table 1. Approximate nutrient uptake by forage crops.

	Nutrient (lb/ton DM forage)				
Forage Crop	Nitrogen (N)	Phosphate (P2O5)	Potash (K2O)	Magnesium (Mg)	Sulfur (S)
Alfalfa[1]	56	15	60	5	5
Annual Ryegrass	68	16	67	–	–
Bahiagrass	43	12	35	–	–
Bermudagrass	46	12	50	3	5
Clover[1]-grass	50	15	60	–	
Orchardgrass	50	17	62	–	–
Sorghum-Sudan	40	15	58	6	–
Tall Fescue	39	19	55	4	4
Vetch[1]	56	15	46	–	–
Grass Hay	40	60	13	–	5

[1]Legumes obtain most of their N from the air though N fixation by Rhizobia.

Sources: Johnston, A. and R. Mikkelsen, *PPi*, 2006; C.S. Snyder, *Better Crops*, 2003; Clemson University, 2002.

A soil test is the best way to develop an effective nutrient management program. Sample pastures every 3 years as part of the nutrient management program for forages. The test results will indicate how much fertilizer needs to be applied for optimum forage production. If you apply too much fertilizer because you do not know what is present in the soil, the cost per ton of forage will increase dramatically. The forage can only use a certain amount of nutrients. Overfertilization can also cause problems such as nitrate accumulation in plant tissues or luxury consumption of potassium, which increases health risks for livestock. Use soil sampling as a management tool to reduce excessive fertilizer applications, which will help prevent these problems and save money.

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