





Extension Office to determine the soil types in a specific area and proper soil sampling documentation.

Adjusting the soil pH usually increases the availability of essential nutrients for plant growth and development. Forages vary on their sensitivity to soil pH, and legumes are more sensitive than grasses. The optimum pH for legumes ranges from 6.5 to 7.0 and 6.0 to 6.5 for grasses. At low pH levels, bacterial nitrogen fixation in legumes is inhibited causing a reduction in yields. Lime application will be the most economical way to increase pH and improve fertility versus applying nitrogen (N) to legumes. The amount of lime needed to make an adjustment in soil pH varies with the level of acidity. Small lime applications (1 to 2 tons/ac) should be applied after tillage and incorporated into the soil surface at least six months before planting. Large lime applications (>2 tons/ac) should be split and half should be mixed deep into the soil (at least six inches) with the primary tillage and the other half applied after the primary tillage, but incorporated into the soil surface. This split application will allow a more uniform neutralization process, especially where seedlings will be developing.

Forage crops have a high demand for phosphorous (P) and potassium (K), especially legumes. If soil test results show low P and K, applications prior to establishment are recommended to 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. To obtain a good establishment of forages, optimum to high levels of phosphate ( $P_2O_5$ ) and potash ( $K_2O$ ) are necessary. These levels should range from 140 to 350 lb  $P_2O_5$ /acre and 200 to 500 lb  $K_2O$ /acre.

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 and only minor adjustments should be needed. 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 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 lb/ac. In the case of pasture renovation, do not apply N at time of seeding since it will stimulate the growth of the existing sod and increase competition for the new seedlings. If legumes are incorporated into the forage system, ensure that those legumes are properly inoculated. Most legumes are related to specific rhizobia bacteria strain to properly fix nitrogen. Most legumes are usually pre-inoculated. In case the legumes are not pre-inoculated, make sure that the inoculant is specific to the legume being planted, and always



check the expiration date. A list of legumes and their inoculants could be found at <http://msucares.com/crops/forages/index.html>. The inoculants can be mixed directly with the seed, applied directly to soil in a granular form through an insecticide or fertilizer box in the seeder, or sprayed directly between the seed row using a liquid preparation.

Maintaining fertility levels for forage production is also an important part of a good management program. In this case, routine soil testing should be used to monitor changes in pH and nutrient levels, especially if biomass is being removed. Producers may choose to utilize manure (commonly poultry litter) to maintain nutrient levels (especially P and K). It is important to know the nutrient levels of the manure being applied and applications should be done according to soil test recommendations and nutrient management guidelines. During the maintenance phase, pastures will be either grazed or harvested for hay. Grazing usually acts as a recycling process since most nutrients are returned through urination or fecal deposition. Uniform distribution of manure should be done at least once a year. When fields are harvested for hay, it is important to determine the extent of nutrient depletion in order to replenish them in the soil (Table 1).

**Table 1. Approximate nutrient uptake by forage crops.**

Forage Crop	Nutrient (lb/ton DM forage)				
	Nitrogen (N)	Phosphate (P <sub>2</sub> O <sub>5</sub> )	Potash (K <sub>2</sub> O)	Magnesium (Mg)	Sulfur (S)
Alfalfa <sup>1</sup>	56	15	60	5	5
Annual Ryegrass	68	16	67	--	--
Bahiagrass	43	12	35	--	--
Bermudagrass	46	12	50	3	5
Clover <sup>1</sup> -grass	50	15	60	--	--
Orchardgrass	50	17	62	--	--
Sorghum-Sudan	40	15	58	6	--
Tall Fescue	39	19	55	4	4
Vetch <sup>1</sup>	56	15	46	--	--
Grass Hay	40	60	13	--	5

<sup>1</sup>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. A good soil testing and nutrient management program for forages recommends that pastures be sampled every three years. The test results will indicate how much fertilizer needs to be applied to obtain optimum forage production. If too much fertilizer is applied without knowing what is present in the soil, the cash cost per



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ton of forage will increase dramatically since the forage can only use a limited amount of nutrients. This, in most cases, causes negative effects such as nitrate accumulation in plant tissues or luxury consumption of potassium and increasing health risks for livestock. Soil sampling should be used as a good nutrient management tool to prevent these future problems and will also reduce excessive fertilizer applications, especially with increasing market prices.

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