Forage News
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Strategic Points to Better Manage Pasture Fertilization

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Increasing fertilizer prices and the need for strategies that will maintain productivity is a major issue among livestock producers throughout the state. Fertilizing pastures is different from fertilizing hay because most of the nutrients can be recycled into the system. Pasture fertilization should be carefully controlled by considering the individual goals of the producer. I Necessity dictates the following questions in the determination of a fertility program: 1) How much production is needed for the animals; 2) What time of the year is the forage needed most?; 3) What species are present?; and 4) What are my management strategies?. These questions will allow a producer to increase fertilizer efficiency and reduce cost.

Soil Testing

Fertilizer is one of the major annual maintenance costs associated with the productivity of an established pasture. Soil testing is one of the most valuable tools for understanding pasture fertilization and recommendations are tailored to the type of forage being grown. However, less than 10% of the pastures in Mississippi are soil tested. Nitrogen, phosphorous, potassium, and lime constitute a real cash cost for forage producers. Therefore, many producers do not test soil and fertilize their soils regularly to avoid this expense. Soil testing should be considered an investment instead of an expense with today's fertilizer prices. Pasture land should be soil tested every 2 – 3 years. Before any nutrient application, it is necessary to know what soil pH is desirable for the species that are present. At the same time, soil pH has a large effect in nutrient availability (**Fig. 1**) and nutrient uptake (**Table 1**).

Timing of Fertilization

The time of the year and the time during the growing season that fertilizer is applied can make a difference on the amount of growth that occurs. To increase forage production, fertilizer has been traditionally applied in the spring, but this application should reconsidered based on the amount of livestock present and how efficient those animals will utilize the productivity without compromising quality. A common question that needs to be addressed to minimize input and cost is: How can we use fertilizer applications to more efficiently utilize forage production? Fertilizer should be applied in the spring only based on soil test recommendations and assuming that increased forage production is needed to sustain livestock production. One strategy is to fertilize only those areas that have had high productivity throughout the years. In periods of limited soil moisture, delaying fertilizer application until moisture is

present or is imminent can also increase efficiency. Forage plants only utilize 35-40% of nutrients provided through fertilization, which means that split applications might be more beneficial and subsequent applications are made only if needed. Need to jump-start a pasture for early grazing? Consider using 30-40 lbs. of nitrogen on a third of your pastures so the extra early grass will let you get cattle off hay a couple of weeks earlier.

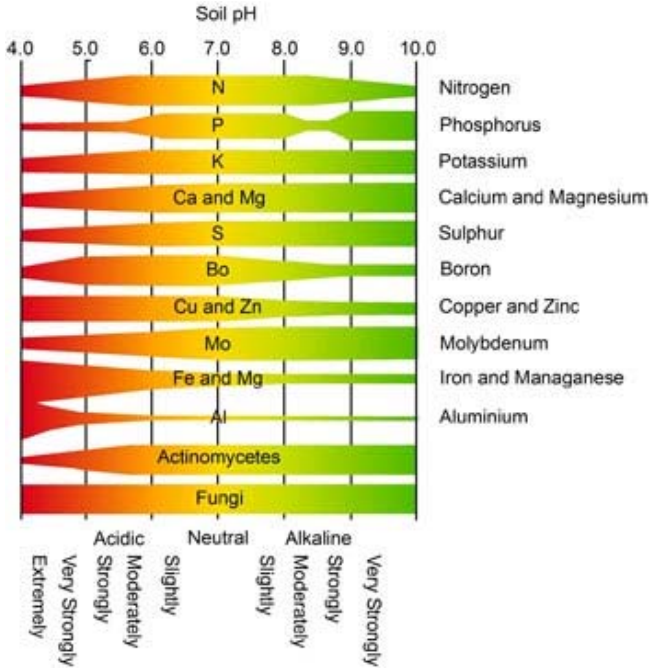

Figure 1. Effect of pH on nutrient availability

Table 1. Effect of soil pH on relative efficiency of nutrient uptake.

Soil pH	Nitrogen	Phosphorous	Potassium
	---------- Percent (%) ----------		
4.5	21	8	21
5.0	38	10	30
5.5	52	15	45
6.0	63	15	60
7.0	70	30	60

Source: Tony Provin, Soil Chemist, Texas A&M University.

Alternative Fertilizer Options

Poultry Litter – Producers have expressed great interest in using poultry litter. Not all of the nutrients in poultry litter are immediately available for plants to use. Most of the nitrogen in poultry litter is in an organic form (about 89%), but poultry litter also contains ammonium (about 9%) and a small amount of nitrate (about 2%). The inorganic nitrogen (ammonium and nitrate) can be immediately used by plants. Organic nitrogen is not available to plants until it is converted to ammonium or nitrate by microorganisms in the soil. Because this is a biological process, the rate of conversion depends on soil moisture and temperature. The conversion takes place over time with the largest release of nitrogen shortly after application if the soil conditions are favorable [moist and warm conditions (>50 ^{o}F)]. One advantage of poultry litter for pastures is that the slow conversion of organic to inorganic nitrogen distributes available nitrogen more evenly over the growing season.

Legumes – Increased incorporation of forage legumes becomes increasingly attractive as the expense of nitrogen fertilizer increases. While soil pH, phosphorus, and potassium requirements are higher for legumes; the combined cost of the increased requirement for these soil amendments is lower than the cost of nitrogen fertilizer. Another incentive for using clovers and other legumes is that they reduce the need for nitrogen fertilizers, improve seasonal distribution of forage dry matter by boosting summer production from the legumes, and improve forage quality by increasing protein levels and overall digestibility of the forage. The primary pathways for nitrogen transfer from the legumes to the soil are through grazing livestock and decomposition of dead legume plant material. If pastures contain at least 30 to 40% legumes, the addition of commercial nitrogen fertilizer can usually be avoided since most legumes could provide enough N to sustain productivity (**Table 2**). The amount of N legumes fix varies among species due to soil conditions, amount of water available, and other seasonal factors during growth (assume a 30 – 40% legume composition) (**Table 3**). It can range from as little as 20 lbs N/acre/year to more than 250 lbs N/acre/year. With N at 0.651 cents/lb, this would be equivalent to from $13 to $163/acre.

Table 2. Estimated potential of N input by legumes (Source: Williams and Watson, MSU)

Legumes	Seasonality	N (lb/ac)
White Clover	Perennial	200
Red Clover	Perennial	110
Crimson Clover	Annual	100
Arrowleaf Clover	Annual	100
Vetch	Annual	60

Table 3. Compatibility of legumes and grasses for forage production.

Legume	Bahiagrass or bermudagrass	Dallisgrass	Johnsongrass	Tall Fescue or orchard grass	Small grain and/or annual ryegrass
Perennial peanut	X				X
Alfalfa				X	
Red clover		X	X	X	X
White/ladino clover		X		X	
Arrowleaf clover*	X				X
Berseem clover*	X	X	X		X
Crimson clover*	X				X
Hairy vetch*	X				X
Rose clover*	X				X
Subterranean clover*	X				X
Caley pea*		X	X		

*Annual legumes such as arrowleaf clover, crimson clover, subterranean clover, and hairy vetch may be grown with tall fescue, but are less desirable than perennial clovers.
Source: Ball et al., 2002

Costs for Nitrogen Fertilization vs. Interseeding Legumes – Based on a cost of $0.651 per pound of nitrogen ($ 443 per ton for ammonium nitrate), the cost per acre for applying 50, 100, and 150 pounds of nitrogen per acre would be $32.55, $65.10, and $97.65 per acre, respectively. The costs for interseeding legumes into the grazed pasture are less than applying nitrogen fertilizers. Red clover and white clover are the legumes most-often interseeded in MS pastures. Let's use red clover in the following example. The cost for a custom no-till drill is $20 per acre. The cost for red clover seed is $3.60 per acre at a seeding rate of 3 pounds per acre (cost averaged over 2 years). The total costs are $23.60 per acre. **Table 4** compares the costs of applying nitrogen fertilizer versus interseeding red clover. It is more important than ever to get those legumes in your pastures. A good legume stand can provide about $75 worth of **nitrogen fertilizer at today's prices.**

Table 4. Economic value of interseeding legumes over N fertilization

N rate (lb/ac)	Difference in Cost per acre for Interseeding Legumes ($)
50	-8.95
100	-41.50
150	-74.05

Grazing Management and Nutrient Cycling

Rotational grazing usually benefits nutrient cycling and distribution in pastures by high stocking rate in smaller areas. With continuous grazing at low stocking rates, much of the animal excreta are concentrated around the water source and under shade trees. When livestock consumes the available forage, 80 to 90% of the nitrogen in that forage passes through the animal and is excreted in the urine and feces. Unfortunately about 50% of the nitrogen in the urine is lost through volatilization. A rotational

grazing management practice that leaves more of the soil covered with green plant residual (stop grazing at 3 -4 inches height) or dead litter keeps the soil cooler and enhances the urine infiltration rate while reducing ammonia loss. Producers can reduce recommended nitrogen rates 20% for the same yield goal on intensively managed pastures than in a continuously grazed pasture. Some studies have suggested that in a rotational grazing system as much as 50% of the pasture surface area may be affected by urine in a single year. In a continuous grazing system, approximately 2 to 5% of the pasture may be affected by cattle urine in a single grazing season. The effective N application rate from cattle urine is also affected by the type of grazing system. In a continuous grazing system, the effective N application is less than 1 lb N/acre/year, in a rotational system, it is about 30 – 50 lbs N/acre/year, and a twice-weekly rotation could contribute approximately 20 lb/acre/week of readily available urinary N to the pasture.

Summary

Fertilizing with nitrogen is a short-term management tool since its effect is usually immediate and does not last more than one grazing cycle. On the other hand, legume establishments are a long-term investments that improve soil and water quality as well as productivity. Additions of N fertilizer may cause a shift to more grass content in the year of application, and under poor management, fertilization is a driving force for increased weed competition. It is important that producers fertilize wisely and only the pastures most likely to be grazed at the start of the season. With the high cost of N, use it as a specific management tool, not a blanket treatment.