

Volume 8, Issue 6

Rocky Lemus Extension Forage Specialist

June 2015

Visit us at: http://mississippiforages.com

Nutrients can be absorbed or taken up by plants either through roots or leaves. With the steady increase in fertilizer prices in the last decade, hay producers have diverted from using conventional fertilizers such as nitrogen and potash. They are trying to rely more on poultry litter when available and some other products available in the market such as foliar fertilizers. Foliar fertilizers are products that can be absorbed through the leaf surfaces instead of the roots. Although some of these products have been used in the row crop market, there is a lack of replicated testing in warm-season forage crops such as bermudagrass or bahiagrass. One advantage that foliar fertilizers have is that they can be incorporate with herbicides or insecticides to reduce the cost of application. Although soil applied fertilizers might have limited uptake due to nutrient imbalances, pH, soil moisture, soil temperature, and root distribution; foliar fertilizer can also be affected by wind speed, air temperature, humidity, leaf respiration, evapotranspiration, volatilization rates and other factors.

Some of the limitations of using foliar fertilizers in a forage production is that leaves in grasses are structured for photosynthetic processes (light capture) and not for nutrient absorption due to small pores and waxy compounds. Foliar

Table 1. Biomass response to conventional nitrogen applications.

Forage	Biomass Response above the N Critical Level*						
	Early Season	Mid-Season	Late-Season				
	Ib DM/Ib N applied						
Annual ryegrass	5-12	10-20	15-30				
Bermudagrass							
Coastal	30-45	35-45	20-35				
Tifton 85	30-40	45-55	30-40				

*N fertilization that is 25, 40 and 50 lbs N/ac for annual ryegrass, Coastal, and Tifton 85, respectively. Source: Hancock, D., Univ. of Georgia.

absorption is not as easy as portrayed because the fertilizer need to be absorbed through the pores and through the waxy cuticle before it dries out in the leaf surface or volatilizes. It is very unlikely that a forage plant would have the ability to absorb large amounts of any given nutrient under the summer weather conditions of high temperatures and humidity. Therefore, a foliar fertilizer program will be an impractical management practice to correct major deficiencies of macronutrients such as N, P, Ca, Mg, or S. Because foliar fertilizers can create a visual impact that gives the looks of greener leaves, not always translate in yield and quality increase. If too much N is added to the foliar application, tissue burn can occur.

The primary route for nutrients to enter plants is through roots. Nutrient solutions have the ability to supply only a small amount of material with each application. For nutrients such as nitrogen and potassium, foliar application cannot supply a substantial amount to satisfy the crop needs and removal rates. Some studies have indicated that to absorb 50% of nutrient applied as a foliar fertilizer can take time. For example, urea can take up to two hours, phosphorous up to 10 days and potassium up to 24 hours under ideal weather conditions (cool temperatures and low humidity). It is important to keep in mind that under the summer weather conditions in the south (high temperatures and humidity), the opportunity for greater losses can be much higher due to volatilization of the liquid solution and the low absorption rates of warmseason grasses with thicker cell walls in the leaves and waxy cuticle. Foliar application of trace element or micronutrients (nutrients needed in very small quantity such as boron, molybdenum, manganese, iron, zinc and copper) might be a place for this type of management in hay production system; especially when soil pH changes can affect micronutrient solubility or availability.

Recent products such as foliar fertilizers have been marketed as cheaper alternatives for hay production with limited data collected by third-party research entities in replicated trials. A study was conducted by University of Georgia at three locations on bermudagrass using a 42-0-0 fertilizer and conventional N (ammonium nitrate, urea, and urea-ammonium nitrate) applied at 75 lb N/ac per cut of hay from May through August. The initial results indicated that yields were reduced by almost 50% when fertilized with the 42-0-0 foliar fertilizer compared to conventional N applications. Results also indicated that the cost of using 42-0-0 at equivalent university's nitrogen recommendations resulted in a much higher fertilizer cost to producers.



A diluted nitrogen solution on a weight basis is most of the time necessary to reduce leaf burning or desiccation from the application. Due to the dilution effect, these solutions tend to supply only small amounts of nutrients to the foliage. For example, let's assume that a producer is willing to use a foliar fertilizer containing 18% nitrogen, 3% phosphorous and 4% potassium weighing 9.8 lb/gallon. That means that you have 1.764 lb N per gallon of product (**9.8 lb/gal*0.18 N = 1.764 lb N/gal**). If your recommendation calls for 50 lb N/ac per cut of bermudagrass hay, that means that you will need 28 gallons of this product to satisfy the recommended rate. On the other hand, without a soil test, there is the unknown part about what the soil P and K levels are or the pH necessary to optimize plant uptake. If we assume that the cost of the product is \$16/gallon, the price of N is \$9.07/lb N (\$16/1.764 lb N = \$9.07/lb N). The cost per acre to achieve the recommended application of 50 lb N/ac will be **\$453.50 per cut of hay**. If we use urea (46-0-0) and assume that the price is \$0.59 per lb of N (\$540/ton), the nitrogen cost per acre per cut of hay will be **\$29.50** (50 lb N*\$0.59/lb N = \$29.50). The cost of application with this type of foliar fertilizer will be 15 times more expensive that using urea. This

means that to achieve optimum yields, plants needs to efficiently use N to attain good levels of biomass production per pound of N applied (Table 1).

Forage producers should be cautious of nutrient management that recommend foliar products on plant tissue analysis. Nutrient recommendations based on tissue analysis can vary regardless of crop condition or growth stage. Keep in

Forage Crop	Nutrient (lb/ton DM Forage)					
	Nitrogen (N)	Phosphate (P ₂ 0 ₅)	Potash (K ₂ O)	Magnesium (Mg)	Sulfur (S)	
Annual Ryegrass	68	15	60	5	5	
Bahiagrass	43	12	35		6	
Bermudagrass	46	12	50	3	5	
Clover/Grass	50	15	60			
Dallisgrass	45	12	50		6	
Mixed Grass Hay	40	60	13		5	
Sorghum Sudan	40	15	58	6		
Tall Fescue	39	19	55	4	4	

mind that plant tissue analysis is a diagnostic tool to correct a nutrient imbalance and not a tool to develop a nutrient management program. Tissue analysis is used to determine nutrient sufficiency levels at a specific growth stage and not to make a fertilizer recommendation for the growing season. This is just an interpretive tool. To determine a fertilizer recommendation, plant tissue should be collected from a normal area and the area affected by nutrient deficiency along with a soil sample for analysis from the two areas.

There is a wide array of foliar fertilizers in the market that were developed in the turf industry and now they have been marketed for hay production with limited research information. Before developing a foliar fertilizer program for hay production, it will be good to review university research and ask your extension personnel if the concept is sound and economically sustainable for the hay operation. Foliar fertilizers can be used to quickly correct a micronutrient imbalance and stimulate increase in root uptake, but not used as a replacement for N and K, especially in hay production systems. The reason for this is because forage crops remove large quantity of nutrients (Table 2) and foliar uptake can be limited. For foliar application of nutrients to be effective, a dilute solution of the nutrient must be able to supply the amount needed by the plant. It also important to determine the composition of the ingredients in the formulation to make sure that are not highly volatile and can be readily absorb through the cuticle of the leaves (chelated nutrients).

For upcoming forage related events visit: http://forages.pss.msstate.edu/events.html June 30, 2015— Coastal Plain Exp. Station Field Day, Newton, MS July 14, 2015— Simpson County Forage Field Day, Mendenhall, MS July 18, 2015— Goat Boot Camp, Philadelphia, MS November 13, 2015 – Mississippi Forage & Grassland Conference, Newton, MS

Cooperative Extension Service • Mississippi State University

We are an equal opportunity employer, and all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, disability status, protected veteran status, or any other characteristic protected by law.