FERTILIZATION STRATEGIES FOR HAY PRODUCTION

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Dennis Hancock, Forage Extension Specialist, University of Georgia

If you have been trying to get a grip on your hay costs, you likely have realized that one of the largest costs is tied to fertilization. Using current prices in the enterprise budgets put together by Dr. Curt Lacy, UGA Extension Livestock Economist, one can quickly find that fertilizer costs in the production of hay in our region are likely to be more than 40% of the total cost of production (Figure 1). I would dare say that the fertilizer costs for hay production in your region would be very similar.

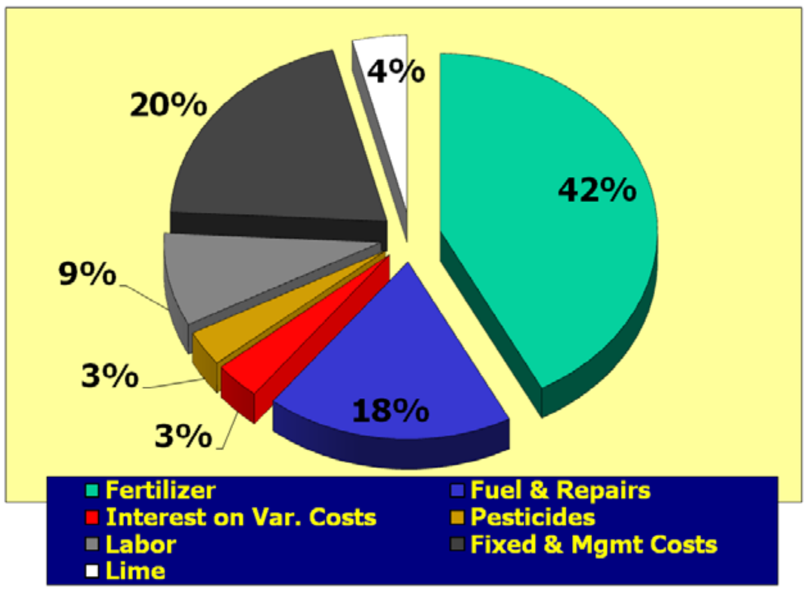

Figure 1. The approximate breakdown of major costs associated with hay production in the Southeast.

At these prices, it is entirely logical to look for ways to reduce fertilizer costs. However, if the reduction in fertilizer costs results in reduced yield (i.e., less fertilizer often equals lower yields), then the cost of the forage per ton (or pound) can actually go up! The reason for this can be seen in the following equation that is used to calculate the unit cost of forage production:

$$\text{Cost of Forage (\$/ton)} = \frac{\text{Total Cost (\$/Acre)}}{\text{Forage Yield (tons/Acre)}}$$

Consider Table 1. Let's assume in this example that the field we are dealing with has a yield potential of 6 tons of hybrid bermudagrass hay per acre. Based on current prices, the average cost of production for hybrid bermudagrass hayfields is approximately $750/acre (or $125/ton). If production costs are reduced and yields remain essentially the same, the unit cost ($/ton) decreases (green cells). However, it is likely that substantial reductions in costs in hay production will have to come from reductions in fertilizer expenditures (because fertilization constitutes such a big part of the total variable costs). Indiscriminant reductions in fertilizer will likely lead to reductions in yield.

This may very well result in an increase in the unit cost ($/ton) of the hay (red cells). **Thus, it is critical to remember that cutting costs in forage production should be done in a way that has a minimal impact on the forage yield.**

Table 1. The unit cost of hay produced under different levels of cost (relative to the current average for hybrid bermudagrass hay) at different levels of hay production.

	Cost of Production Compared to Average					
Yield	60%	75%	90%	100%	110%	125%
(tons/A)	------------- Unit Cost of the Forage ($/ton) -------------					
8	$56	$71	$85	$94	$103	$118
7	$64	$80	$96	$107	$118	$134
6	$75	$94	$113	$125*	$138	$156
5	$90	$113	$135	$150	$165	$188
4	$113	$141	$169	$188	$207	$235
3	$150	$188	$225	$250	$275	$313

* The average cost of production for a hybrid bermudagrass hayfield is approximately $750/acre. If the yield goal is 6 tons/acre, the unit cost of the forage is $125/ton.

Management Tips

So, how does one reduce forage production expenses without compromising yield? The following tips can help reduce fertilizer expenses or at least make the investment in fertilizer more efficient.

1. **Soil Test and Follow Fertility Recommendations.** If one does not soil sample and apply fertilizer and/or lime based on the results of those tests, it is likely that they are either 1) not putting on enough fertilizer/lime and therefore the forage yield is below its potential, or 2) putting on more fertilizer than is required to meet the yield goals and therefore they may be wasting money. Few other practices in the hay production enterprise can improve the profitability more than soil testing and following fertility recommendations from your state's Land Grant University.

2. **Do NOT neglect your soil's pH.** Keeping an optimum soil pH will ensure that soil tilth is maintained, root development is encouraged, and (most importantly) the nutrients in the soil are freely available to the plants. If the soil pH drifts much below 6.0 or much above 7.0, the availability of some nutrients in the soil will decrease and some other nutrients can reach toxic levels (Figure 2). This can translate to a major waste of one's "fertilizer dollar." For example, a pH difference of 5.6 vs. 6.2 can effectively reduce the value of the N fertilizer by as much as 35%, the P fertilizer by as much as 50%, and the K fertilizer by as much as 10%. When totaled, this may mean that one has lost $40-75 worth of the fertilizer's value in just one season because the soil pH prevented adequate nutrient availability. Of course, soil amendments that rectify soil pH problems have benefits far beyond just one year and are very cost-effective on the short- and long-run.

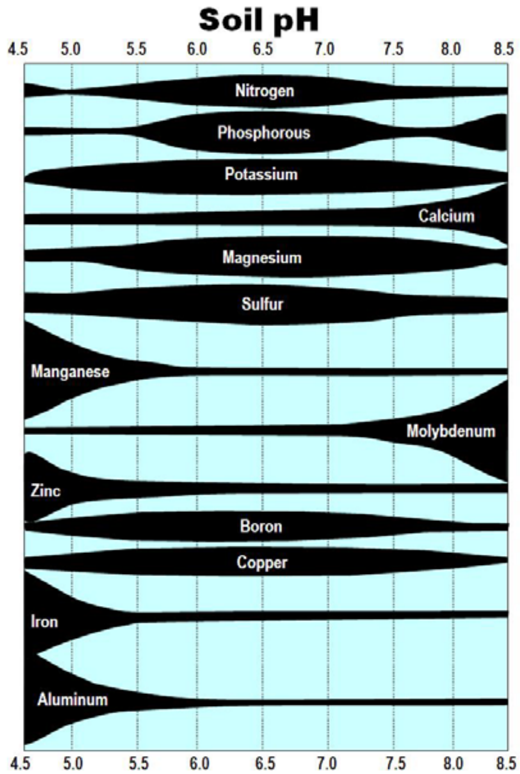

Figure 2. The relation between soil pH and the relative availability of plant nutrients in mineral soils. The wider the bar, the greater the availability.

3. **Focus Your Resources.** Apply fertilizer to hayfields where soil test P and K values indicate an economic response to the addition of the fertilizer <u>AND</u> the soil pH is in the optimum range. If the soil pH is too high or too low, attempts to add P and K will result in a lack of return on the fertilizer investment. Instead, focus first on rectifying the soil pH problem in those fields. If possible, identify other fields or pastures that could be used as hayfields while the pH in that field is being corrected.

4. **Avoid the Use of Standardized Blends.** Standardized blends (e.g., 10-10-10, 17-17-17, etc.) of homogenized (uniform particle size) fertilizer products are commonly sold. Unfortunately, these blends are usually much more expensive than custom mixed fertilizer products, which can be been tailored to meet the needs of the individual field or site's target fertilization rate (Table 2). Using current prices, one can save over $100/acre by fertilizing a bermudagrass hayfield with a custom mixed fertilizer rather than a standardized blend.

5. **Use Animal Manures When Available, but be Strategic.** Continuing the scenario that is posited in Table 2, note that the use of animal waste (and, in this case, supplementing to provide enough K) can reduce fertilizer costs by nearly 50%. Certainly, animal manure can be a cost-effective and beneficial fertilizer source. After many years of animal manure applications, however, nutrients can accumulate to very high levels in these soils. If this is the case, a producer may be better off applying commercial N and utilizing the P and K that has built up in

Table 2. A comparison of three common strategies for fertilizing hybrid bermudagrass hayfields.*

Fertilizer Strategy	Product Used	Amount	Product Price
		(lbs/ac)	($/ac)
Standard Blend	17-17-17	1471	$404.53
		Total:	$404.53
Mixed Fertilizer	Urea (46-0-0)	488	$119.56
	DAP (18-46-0)	141	$36.31
	Potash (0-0-60)	375	$140.63
		Total:	$296.50
Poultry Litter	3-3-2	8000	$120.00
	Potash (0-0-60)	110	$41.25
		Total:	$161.25

* Based on a target fertilizer rate of 250-65-225 (i.e., assumes medium soil test level P & K) and prices from the USDA-AMS's Alabama Weekly Feedstuff/Production Cost Report (http://www.ams.usda.gov/mnreports/mg_gr210.txt).

the "soil bank." Note from Table 2 that if soil test P and K levels are sufficient and only N is needed, then the total cost of fertilization would be much lower (i.e., the cost of urea fertilizer, in this instance).

6. **Split Your Nitrogen Applications.** Fertilizer recommendations are given as totals for the season. For some nutrients, the entire amount can be applied at one time with little economic or environmental risk. However, high rates of N application at the beginning of the growing season can result in unnecessary risk. This can be especially risky when conditions for leaching, volatilization, late frosts, or drought occur. Split applications of N also reduce the risk of nitrate toxicity. Further, long-term research has shown that yields can be increased by 5-10% and N use efficiency can be as much as 25-30% higher when N fertilizer applications are evenly split among 2-4 applications (or more, if your growing season allows) during the season.

7. **Apply Phosphorus when it is Convenient.** Since P applied to the soil is relatively stable and generally available to the plant as it is needed, P fertilizer can be applied to the hayfield virtually any time during the year. This flexibility in application timing allows the producer to purchase P fertilizer in "off-peak" times of the year (i.e., summer and fall) when demand for the product and spreading services are lower. A major exception to this flexibility is that the recommended P rate should always be applied before planting annual crops or new plantings of perennial forages. Further, producers should avoid spreading P fertilizer when the risk of runoff is high. The loss of P in runoff is the primary way in which P is lost from soils and ends up lowering water quality. Some producers mistakenly believe that by using commercial P sources that they need not worry about runoff. This is not true. Runoff can be a problem regardless of the source of P being used. Recent studies have shown that losses from commercial fertilizers can actually be much larger than losses from animal wastes, when they were applied at similar rates.

8. **Split Your Potassium Applications.** In contrast to N and P, the environmental risk posed by K is very low. However, K has become much more expensive than in the past, occasionally being more expensive than N. Therefore, care must be taken to ensure it is used efficiently. The biggest potential for inefficient use of K is a phenomenon called “luxury consumption.” Most plants (especially forage crops) will take up more K than is required for optimum growth, if it is readily available in the soil. Thus, if relatively large rates of K are applied early in the growing season, forage crops will absorb excess K and reduce the amount available for later growth cycles. Because of this potential for luxury consumption, it is recommended that K applications be split across two or more application times (50:50 or 40:60 splits, are common). This will lower the risk of luxury consumption and leaching, allowing K to be used more efficiently and available throughout the growing season.