FORAGE FERTILIZATION RECOMMENDATIONS FOR FLORIDA

Gerald Kidder

Soil Science Department
University of Florida, Gainesville

INTRODUCTION

Fertilizer recommendations, like other aspects of management, are dynamic. They reflect research findings, professional observations, philosophies, history, and economics. It requires continuing effort for organizations such as IFAS to keep recommendations in tune with current conditions.

As resource managers, ranchers have long used recommendations made by land grant universities as a starting point for making fertilization decisions. How much fertilizer nutrient actually gets applied is influenced by many factors -- current cash flow of the operation, price of cattle, individual field or pasture conditions such as drought susceptibility, and grandma's health, to name a few.

The trend in IFAS recommendations is to present more information than a simple single rate which is generalized for all conditions. This approach allows managers to use recommendations more intelligently in making fertilization decisions. However, it makes our recommendations more complicated and requires that managers take more time to understand what is being recommended.

The purpose of this presentation is to review some aspects of IFAS forage fertilization recommendations. Particular emphasis will be placed on recent changes in bahiagrass pasture recommendations.

HISTORICAL ASSUMPTIONS

The use of fertilizer to supplement plant nutrients is one of the main reasons for the increase in agricultural productivity in the last fifty years. During much of that time, the cost of nutrients was relatively low in comparison with the increase in productivity realized with their use. Thus, the stated (or unstated) assumption in almost all fertilization recommendations is that **the rate of nutrient application recommended will allow production at essentially maximum crop potential**.

Another assumption is that **no other production factor is limiting, including other nutrients**. Thus, the nitrogen (N) rate recommended assumes that water, pests, and other nutrients are not limiting plant performance. Sometimes a production factor is explicitly noted in the recommendation, for example when the fertilization recommendation states that it is for irrigated conditions.

With cash crops it is relatively easy for the manager to determine the economic returns from fertilization since the increase in product yield or quality can be related to fertilization cost. In the case of forages, the relationship of cost and return is complicated by the fact that the return is usually realized in the animal fed the forage rather than the forage itself. Forage fertilization recommendations generally assume that **the producer wants the best performance possible from the forage in question**. The economic implications of such action must be considered independently by the manager.

A WORD ABOUT PHILOSOPHIES

An aspect of fertilization recommendations which is important, but which is seldom carefully analyzed, is the basic philosophy being used by the person or organization making the recommendations. This is never easily explained because it deals a bit with our fundamental understanding of soil and

plant interaction, our individual attitudes towards use of natural resources, and who our teachers were, with some economics thrown in for good measure.

Suffice it to say that two of the three principal philosophies of fertilization recommendation used in the US for the past fifty years or so have been found to have fundamental problems. The cation balance approach which is based on the concept of an "ideal soil" has been shown to be basically invalid (McLean, et al.,1983). The buildup and maintenance approach has resulted in widespread over-fertilization, incidences of harmful buildup of some nutrients, and waste of natural and financial resources.

The **nutrient sufficiency** approach to fertilization recommendations, which uses crop response and calibrated soil tests to predict the need for individual nutrients, has proven to be the best philosophy to date (Olson, et al., 1982). Persons using this approach recommend addition of a nutrient to a particular crop only when there is documented evidence of high probability of positive crop response. Crop yield and quality are thus maximized, resources are utilized with minimum waste, and adverse effects of fertilization avoided.

Various aspects of all these philosophies can be found in many IFAS recommendations even though the nutrient sufficiency concept is the one of choice. It will likely take years for the influence of the other philosophies to become insignificant.

HOW ALL THIS AFFECTS FORAGE FERTILIZATION

Liming Recommendations Several years ago, IFAS faculty concerned with forage crop nutrition reviewed the literature and found our target pHs for grasses and warm season legumes were higher than necessary. The target pH is the anticipated soil pH after liming. The high recommendations were due in part to the influence of the cation balance philosophy which places considerable emphasis on Ca and Mg ratios without regard for crop response.

The recommendations were changed to reflect documented increases in forage productivity (Chambliss, et al., 1984). For bahiagrass, the target pH was changed from 6.5 to 5.5, because no benefit could be documented for having the pH above 5.5.

The Pasture Fertilization Situation Surveys of beef cattle producers in central Florida conducted in 1982 and 1986 showed that the average annual rate of N fertilization of permanent pastures was 53 lbs N, 24 lbs P_2O_5, and 32 lbs K_2O per acre (IFAS, 1990). The survey also confirmed bahiagrass to be by far the most widely grown perennial grass. At that time, the IFAS recommended rate for perennial grass pastures was 120 lbs N plus P and K depending on soil tests (Whitty, et al., 1977). The vast majority of soil samples from permanent pastures tested at the IFAS Extension Soil Testing Laboratory were low in P and K. Thus, the most common recommendation was for 80 lbs P_2O_5 and 80 lbs K_2O/acre/year (Kidder, unpublished data).

The differences between what producers were applying and the recommended rates caused considerable discussion and concern. From all indications it seemed that producers did not feel it was economically feasible to apply the whole IFAS recommendation so they were applying a reduced portion of all three of the recommended nutrients. Unfortunately, given a limited fertilizer budget, that is not the best approach to fertilization. It is well documented that the first increment of added nutrient gives a greater response than each additional increment. Maximization of return on fertilizer requires taking care of the most limiting factor first.

Agronomically, it was known that response to P and K would not be expected at low N rates of 50 to 60 lb/acre/year. Thus, under conditions of limited fertilizer budget, better utilization of the resources would result if the N rate were increased to the 90 to 100 lb/acre

range before P and/or K were applied. As N rate increases to those levels, response to applied P and K would be expected if predicted by soil tests. Recommendations which presented producers more fertilization options, especially under different levels of N fertilization, seemed to be needed.

On-ranch Studies Field demonstrations were set up in grazed bahiagrass pastures of ranches in nine south-central Florida counties to verify proposed recommendations. The trials ran for three years, and results upheld the call for revised recommendations based on the level of N fertilization (Sumner, et al., 1991). New recommendations for bahiagrass pastures went into effect in early 1990 (Kidder, et al., 1990).

Current N, P, and K Recommendations for Bahiagrass It is important to note that the new recommendations require careful reading to avoid misunderstandings. The producer will find that the P and K recommendations depend on the level of N fertilization and the soil test levels of P and K. Tests are continuing to assure against unforeseen adverse effects.

The following is a discussion of the revised recommendations. A section of the recommendation is presented first in italics, followed by some explanation of the reasoning behind each portion with emphasis on crucial points.

"For established stands of bahiagrass, apply all of the fertilizer in the early spring to maximize much-needed spring forage. Bahiagrass is a very efficient forager and recovers nutrients from deeper in the soil profile than other popular forage grasses so danger of leaching losses is low. Three fertilization options are presented below. Choose the option which most closely fits your fertilizer budget, management objectives, and land capability."

Note that we recommend **all** the N be applied in one spring application rather than being split into spring and late summer applications. This approach results in increased quantity and quality of bahiagrass in the spring when forage is needed. Response to N in late summer is less than in the spring, and the increased forage is usually not needed in late summer. Bahiagrass has a deep root system and the ability to capture and store N, so risk of loss from leaching rains is minimal.

*"**Low-Nitrogen Option** (for Grazed Pastures Only) Apply around 50 lb N/A this year, recognizing that N will be the limiting nutrient. Thus, do not apply P or K. If you follow this practice of applying only N to your pasture for more than one year, apply the P and K recommended by soil test every third or fourth year to avoid excessive depletion of those nutrients. Do not use this option if you cut hay since nutrient removal by hay is much greater than by grazing animals."*

It is important to note that we are **not** saying that grazed bahiagrass only needs 50 lb of N. We **are** saying that if you can apply no more than about 50 lb N, you will not get a benefit from P or K. In that situation it is better to use your P and K money to buy more N. Until you have applied 50 lbs of N to all your acreage of grazed bahiagrass, no other fertilizer nutrients should be bought for bahiagrass. This suggestion recognizes that (1) N is the most limiting nutrient in mineral soils and (2) you get greater plant response to the first increments of applied nutrient than to later increments.

The user is cautioned that the low N option is only for **grazed bahiagrass pastures**. It is not recommended if any hay is being made on the pasture. Managing bahiagrass nutrition for hay production is quite different from managing for grazing. Nutrient recycling occurs under grazing so that removal of nutrients from the pasture is much less than under hay production. Also, if the low N option is used for several consecutive years, we recommend P and K be applied every third or fourth year to avoid the potential that P or K would become limiting.

"Medium Nitrogen Option Apply around 100 lb N/A this year. At that level of N

fertilization, P and K may be limiting if your soil tested low in these nutrients. Apply 25 lb P_2O_5 /A if your soil tested low in P and none if it tested medium. Apply 50 lb K_2O /A if your soil tested low in K and none if it tested medium. Re-test your soil every second or third year to verify P and K levels. If you plan to make a late-season cutting of hay, apply around 80 lb N/A between August 1 and 15 (about 6 weeks before the growing season ends)."

When the N fertilization rate is in the 100 lbs/acre/year range, the likelihood of P and K being limiting is greater than when it is in the 50 lb range. At the 100 lb N level, we recommend some P and K if the soil tests low in these nutrients. If the soil tests medium, no P or K are recommended because there should be sufficient P or K to supply the bahiagrass needs at the 100 lb N/acre rate. A high soil test means that the nutrient is not expected to limit growth under even the best growing conditions.

"High-N Option Apply 160 lb N/A and the soil-test-based recommended rates of P_2O_5 and K_2O for each of your pastures. The fertilization rates suggested in this option are high enough to allow bahiagrass pasture to achieve well above average production. Management and environmental factors will determine how much of the potential production is achieved and how much of the forage is utilized."

The high N option recognizes the fact that bahiagrass responds well to N fertilization. The N response can only be realized when the other nutrients and growth factors are not limiting. Thus, the recommendations call for P and K to be applied when the soil tests either low or medium, as was done in the old recommendation when we assumed that the N was being applied at the recommended rate along with the P and K.

FITTING FERTILIZATION DECISIONS INTO THE MANAGEMENT CYCLE

Fertilization and liming decisions are complicated and should be made with the best possible information available. IFAS recommendations are based on crop responses, soil tests, and the nutrient sufficiency philosophy of fertilization. We feel that this approach has proven to be the best means of maximizing the returns from applied nutrients. Other organizations which give producers advice may use different approaches which may favor their objectives more than those of the producer.

The decision to fertilize or lime forage should be supported by soil tests and careful consideration of how each component will benefit the forage produced. Soil samples should be sent off for testing two months ahead of the planned fertilizer application. That will give time to get the results, resolve any questionable analyses or recommendations, and shop for fertilizer to supply the recommended nutrients. For most Florida bahiagrass pastures, that would mean soil sampling in early January, making fertilization plans in January and February, and fertilizing in March.

SUMMARY

Current IFAS liming and fertilization recommendations for forage crops reflect the best understanding of a complicated subject and the needs of a diverse clientele. Recent changes in bahiagrass fertilization recommendations recognize that clients may have very different management objectives, so several options are presented. The new recommendations are somewhat more complicated to read but, if followed, should result in considerably greater return on fertilizer investment.

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