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Timing and Rates of Nitrogen, Phosphorus and Potassium for Top Yields of Quality Bermudagrass

By W.I. Segars and N.R. Usherwood

Excellent studies on bermudagrass nutrition have been conducted by leading scientists throughout the South. Field research findings provide the basic ingredients for bermudagrass production systems needed for this year and beyond.

Nutrient management in a high yield, high quality production system enables bermudagrass producers to grow forage needed for livestock on fewer acres and at lower cost per ton. This article lists key facts based on research with bermudagrass in the South.

Balanced Nutrition is Essential for Optimum Bermudagrass Development

Nutrition is only one of the vital inputs for high yield, quality, stand longevity, and input use efficiency of bermudagrass. Other management practices ... such as soil preparation for stand establishment, soil acidity correction, variety selection, harvest frequency, crop protection management, timeliness of operations, or even the symbiotic relationships between inputs ... improve yield and quality. Nutrient management needed for top quality bermudagrass production then becomes one of balancing nutrients available from the soil and those from fertilizer and other sources.

The Goal ... A Quality, Dependable Low-cost Feed Source for Livestock

The goal in bermudagrass production is to produce a quality feed source with protein, total digestible nutrients (TDN), and other ingredients in tune with livestock requirements. Nutrient availability and balance have a lot to do with meeting such objectives. Nutrient management in a high yield, high quality production system allows growers to produce the tons of quality forage needed for their livestock on fewer acres and at a lower cost per ton.

Total Nutrient Requirements of Bermudagrass Change with Management Practices, Yield Level, and Forage Quality Expectations

Nutrient requirements of bermudagrass change with management. For example, more frequent harvests at an earlier plant growth stage will result in lower yields of dry matter but higher protein, TDN and digestiblity of the harvested forage. Georgia research with 2, 4 and 6 week clipping intervals resulted in dry matter yields of 5.1, 6.9 and 8.9 tons/A, respectively.

Plants harvested at earlier growth stages are higher in nutrients such as nitrogen (N), potassium (K), and sulfur (S) since all three are involved with protein formation. As the crop grows older and dry matter increases, the nutrient content is diluted on a per ton basis. In the Georgia study, each ton of forage contained about 50 lb of N, 12 lb of P_2O_5,

and 47 lb of K_2O. Thus, each acre of bermudagrass harvested at a 4-week interval and yielding about 7 tons/A would remove about 350 lb of N, 85 lb of P_2O_5, and 330 lb of K_2O. Also, about 25 lb of magnesium (Mg) and 40 lb of S would be removed.

Removal of Soil Nutrients without Adequate Replacement Can Be Costly

Annual crop fertilization is essential to maintain a productive stand of quality forage year after year. Nutrient management research shows that annual fertilization is beneficial in a given field for any one of the following reasons:

- To avoid a decline in stand due to severe winter injury or competition from weed species which are more competitive at lower soil nutrient levels. Early stand loss means fewer years to absorb high establishment costs and an increase in the cost per ton of forage. Georgia studies revealed that severe winter temperatures after the third harvest year resulted in stand survival of 76 percent for plants treated with a 2:1 N/K fertilizer. This compared with 35 percent stand survival where N was applied alone at 400 lb/A/year and 46 percent stand survival when 50 lb/A of K_2O was added to the 400 lb/A N application (**Figure 1**).
- To minimize disease problems brought on when crops are under stress from a nutrient shortage of K or from an imbalance among nutrients such as N, K and/or S. Researchers in Texas and Louisiana confirmed that K deficient hybrid bermudagrass is more susceptible to the fungal leaf spot disease, *Helminthosporium*.
- To avoid losing crop stress resistance due to drought, temperature extremes, frequent harvest, or injury from pests and diseases
- To prevent an early decline in both forage yield and especially forage quality. This results in lower feed value of each ton of forage (quality) plus more acres to produce the tonnage requirements.

Why Is the Right Balance of N, P and K So Important for Bermudagrass?

USDA and University of Georgia scientists provided the following answers from years of intensive work with common and Coastal bermudagrass treated with four levels each of N, phosphorus (P), and K, managed for optimum yield and quality forage.

- Both P and K fertilization increased the percentage of N recovered in the harvested crop.
- NPK fertilizer significantly increased the weight of roots to a depth of 3 ft. for Coastal. Root reserves and rooting depth are critical for rapid regrowth after harvest and for improved tolerance to summer drought stress.

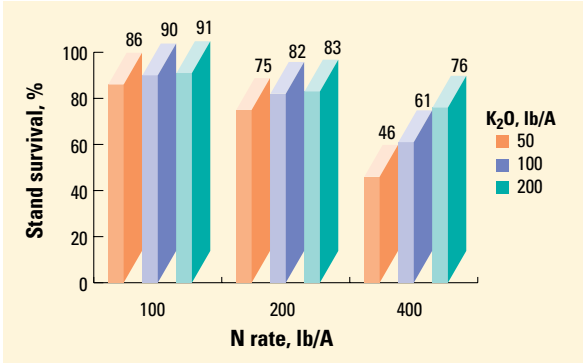

Figure 1. Influence of N and K on stand survival of Coastal bermudagrass. (USDA-ARS, Georgia)

- Total root weight increased from 3,440 lb/A in control plots to 6,858 lb/A due to annual fertilization with 400-200-200 lb/A N-P_2O_5-K_2O, respectively.
- Soil water used per ton of Coastal decreased from 9.8 inches in the control to 2.7 inches per ton of forage produced due to annual fertilization with the 400-200-200 treatment. No water was measured moving below the fertilized root zone.
- Yield of Coastal responded little to applied P when K was inadequate, regardless of the level of N applied. Forage yields increased with K fertilization at all levels of N and P. Coastal fertilized with 400-200-200 lb/A N-P_2O_5-K_2O yielded 7.3 tons/A compared with 5.9 tons with N and K but no P and only 5.7 tons/A when K fertilizer was omitted.
- Stand loss and the need for re-establishment are often the consequences and accumulative effect of inadequate K nutrition or an imbalance among N, P and K.

Fertilizer Scheduling Improves Forage Yield and Quality, Input Use Efficiency, and Stand Longevity

The timely application of the right nutrients in the right amounts is fundamental to nutrient management of any crop. Consider the following guidelines when growing bermudagrass as a high quality feed for livestock.

- Estimate the number of acres needed to produce an adequate supply of high quality livestock feed.
- Select highly productive fields and soil test to determine lime and build-up P and K needs. Incorporate lime and nutrient needs before crop establishment.
- Consider preplant applying up to half of the N and K plus all other remaining first season nutrient needs.
- Split apply the remainder of first year N and K as well as subsequent year annual maintenance fertilizer needs. Options include the resupply of nutrients after each crop harvest, or splitting annual needs with about one-half going on after the first cutting in the Spring and the remainder after the next to last harvest in the Fall. The objective is to stimulate rapid regrowth, provide full-season nutrient needs, attain optimum nutrient use effectiveness and avoid premature loss of stand.
- Nutrients most often needed to maintain quality forage include N, P, K, S, Mg and boron (B). Field studies, in general, show that total nutrient needs for maintenance are quite comparable to the amounts removed in the harvested forage at that site.

Visible nutrient deficiency symptoms are seldom seen on leaves of high yielding bermudagrass plants. Early warning signals might include one or more of the following:

- slow plant regrowth after harvest
- disease problems, such as leafspot
- premature decline in stand
- poor response to applied N, possibly due to a shortage of S or K
- winter injury
- low or declining protein or TDN
- low forage digestibility or palatability for livestock
- weed infestations
- low or unusual nutrient content in the leaves. BC

Dr. Segars is Extension Agronomist and Water Quality Specialist, Department of Crop and Soil Sciences, University of Georgia, Athens, GA 30602. Dr. Usherwood is Southeast Director, PPI, Norcross, GA.