

NEWS & VIEWS

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Nitrogen, Phosphorus, Potassium, Sulfur and Magnesium for Bermudagrass Pastures and Hay Meadows

HYBRID bermudagrass fields that were once highly productive have gradually declined in many areas. Annual forage yield reductions have been attributed to weed competition, stand loss as a result of diseases or winter-kill, and/or continued use of outdated fertilization and harvest management practices. If managed properly, hybrid bermudagrass pastures and hay meadows can provide excellent long-term production of forage and hay for dairy and beef cattle. To achieve good yields and good quality, the forage producer needs to pay close attention to the plant nutrient requirements, forage maturity, and nutrient removals. **Table 1** shows nutrient uptake at three yield levels of bermudagrass.

Table 1. Total nutrient uptake by hybrid bermudagrass.

Yield, tons/A	N	P ₂ O ₅	K ₂ O	S	Mg
	----- uptake, lb/A -----				
6	258	60	288	30	18
8	368	96	400	44	26
10	460	120	500	55	32

Fertilization for Hay Production

Research conducted at the Hill Farm Experiment Station in Louisiana since 1952 has shown that for every 2.0 tons/A of hay yield goal per cutting, the following nutrients must be provided...from the soil and/or as fertilizer (**Table 2**):

The application of nitrogen (N), phosphorus (P), potassium (K), sulfur (S), and boron (B) should be made in the spring, at or just before greenup, which is about six weeks prior to the first harvest in May. These same nutrients should also be applied, for each additional cutting desired, after removal of the hay from the field. Calcium (Ca) and magnesium (Mg) can be provided through a sound

liming program, based on soil tests, to maintain the soil pH in the preferred range of pH 5.5 to 6.2. If soil tests indicate a need for aglime, good quality calcitic or dolomitic (high-Mg) limestone can be used to provide the necessary Ca and/or Mg. If dolomitic or high-Mg limestone is not used, and soils test below 75 to 100 lb/A in extractable Mg at 0 to 6 inches, and also in the subsurface 6 to 12 inches, Mg can be applied as K-Mg-sulfate (K-Mag, Sul-Po-Mag) at rates of at least 20 to 50 lb of Mg/A. Other Mg sources can be used but are seldom available to most forage producers. Magnesium fertilization should be balanced with soil Mg levels and the forage uptake demand.

Table 2. Nutrient requirements for each 2.0 tons of hay/A per cutting (lb/A).

N	100	B	0.25
P ₂ O ₅	30	Fe	0.25
K ₂ O	100	Mn	0.75
S	25	Cu	0.03
Ca	10	Zn	0.06
Mg	5		

From: 1996 Agronomy Research Report, edited by M. M. Eichhorn, Jr. LSU Ag Center, Hill Farm Research Station.

Iron, manganese (Mn), copper (Cu) and zinc (Zn) are not thought to be limiting in most southern pastures and hay meadows. To avoid potential limitations of these nutrients, producers may choose to make applications each spring.

Ideally, bermudagrass hay should be cut in the flag-leaf stage and no later than early seed head development, to a 2-inch stubble height. This is usually about six weeks after the first fertilization, and about four to five weeks after N, K, and S fertilizers are applied to harvested fields. If forage growth is limited severely because of drought and harvest is not justified...even though the forage may be at peak



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maturity...harvest can be postponed until forage is more abundant. Harvest decisions should be based on both quantity of the forage, and growth stage. Cutting on a strict four, six, or eight-week cycle can result in failure to achieve hay quantity and quality goals. If harvest is delayed too long, however, the ratio of leaves to stems will decrease, protein will decline, and digestibility will be lowered. Harvested hay should be kept under a roof, if possible, to reduce dry matter losses associated with weathering.

Pasture Fertilization

Bermudagrass pastures should receive 100 to 300 lb of N/A, 0 to 100 lb of P₂O₅/A, and 0 to 120 lb of K₂O/A each year. If brood cows are grazed at one to two head/A, 34 to 68 lb of N/A can be applied on April 1, June 1 and August 1. Phosphate and potash can be applied in March according to soil test results. If stocker cattle (2,500 lb of live weight/A) are grazed, N can be applied at 50 lb/A in mid-April and again every 21 to 28 days during the growing season (April to September, depending on geography) based on the grazing intensity and prevailing weather. Phosphate and potash applications for grazing stockers can be made in March and should be based on soil tests.

Stocking rates for beef cows should generally range from one to two head/A. With stockers, begin with three to four head/A. With lactating dairy cows, begin with seven to 10 head/A. Graze to keep the forage in a vegetative stage. If the forage reaches eight to 10 inches tall, consider mowing the pasture back to a two-inch stubble height. Properly fertilized bermudagrass pastures can result in animal gains of 1,000 lb/A, or an average daily gain of 1.5 lb/A/day. A cow-calf pair/A can be provided sufficient forage from mid-April to mid-November with proper fertilization and grazing management in north Louisiana. Dates will vary in other areas, depending on the frost-free growing season.

Soil and plant tissue tests can be useful in determining the need for any of the plant nutrients and to evaluate the success of the nutrient management program. Nutrient sufficiency ranges for Coastal and other high-yielding bermudagrasses are shown in **Table 3**.

Table 3. Conservative nutrient sufficiency ranges in hybrid bermudagrasses for 90 percent of maximum yield.

Sufficiency range, %				
N	P	K	S	Mg
2.2	0.24	1.5 ¹	0.15	0.10

¹ A K range of 1.8 to 2.2 percent is preferred in more northern bermudagrass producing regions. If the last harvest shows a K level below 1.1 percent, substantial stand loss can occur during the winter.

Nutrient Use Efficiency

Global economic competitiveness and a heightened desire for improved environmental stewardship demand that we do everything possible to maximize the efficient use of applied nutrients, regardless of source (fertilizer, manure, etc.). One way to accomplish these goals is to provide balanced plant nutrition. Research with forages and field crops has shown that deficiencies of P and K can result in increases in residual soil ammonium-N (NH₄-N) and nitrate-N (NO₃-N) levels. Research at the Hill Farm Experiment Station showed that 400 lb of N/A/year produced the maximum economic yield of Coastal bermudagrass hay. At this same N rate, the uptake and N-use efficiency were maximized with 400 lb of K₂O/A. Interestingly, a K₂O rate of about 600 lb/A was required to build soil test K levels. Annual applications of at least 400 lb of K₂O/A were required to rejuvenate thinning bermudagrass stands.

Other research in Louisiana showed that with optimal nutrient balance, residual available N levels in the top four feet of soil were very low after bermudagrass (less than 3.2 ppm), regardless of the N application rate, which ranged from 0 to 800 lb/A in the seven-year study. It demonstrated that bermudagrass can be fertilized with near maximum N rates without seriously affecting residual soil NO₃ levels (that may potentially impact water resources), if other nutrients are kept in balance.

In another study on a Darley gravelly fine sandy loam, forage yield, crude protein yield, digestible dry matter yield, and total digestible nutrient yield increased with increasing P application and were maximized at a Bray P-2 soil test Bray P-2 level of 70 ppm at the 0 to 6-inch depth, or 112 ppm at the 0 to 3-inch depth. With 400 lb of N/A, and an annual optimum P₂O₅ rate of 120 to 180 lb/A, each harvest removed 30 lb of P₂O₅/A. In the absence of P fertilization, forage yields were reduced by about 66 percent, potentially resulting in large residual soil N levels.

The results of decades of research indicate that 100-30-120-25-0.5 lb/A of N-P₂O₅-K₂O-S-B for growing each cutting of hay appears optimal for bermudagrass hay on the Hill Farm Experiment Station. An ideal N-P₂O₅-K₂O-S ratio in fertilizers for bermudagrass would be 4-1-4-1 on many Gulf Coastal Plain soils. ■

Correction: In the March 1998 PPI *News & Views* titled “Precision Agriculture Progress in the Midsouth,” a number was given incorrectly. The second sentence in column two on front page should have said: “Reports indicate there may be more than 17,000 grain yield monitors in the U.S.” The figure was incorrectly shown as 170,000.—*Dr. Cliff Snyder*