Nutrient Management for Cool Season Grasses

By Ray Lamond

Several million acres of introduced cool season grasses, primarily smooth bromegrass and tall fescue, are used for haying and grazing in Kansas and neighboring states. While these cool season grasses have great potential to produce large quantities of high quality forage, many stands are not managed to their full potential. In order to achieve optimum production from these grass pastures, fairly intensive management is required. A nutrient management program including application of nitrogen (N), phosphorus (P), potassium (K), and sulfur (S) should be considered for optimum production.

Cool season grasses can provide high quality forage from the fall into the spring months. Fertility can dramatically affect both forage yield and quality. Thirty-one site years of research in producer fields in Kansas has demonstrated the importance of adequate and balanced fertility on bromegrass yield and quality.

Soil test results from established cool season grass pastures in Kansas often show very low P and sometimes K levels, indicating that many producers employ an N-only management plan. Since these grasses remove 10 to 12 lb P_2O_5/A per ton of production, low soil test P levels are not unexpected where P has not been included in the nutrient management plan. In addition, since these grasses complete growth and development in the spring and fall when soil temperatures are cool, the need for S fertilization may be enhanced due to cooler soil temperatures and reduced mineralization release of S from organic matter. This research was conducted to evaluate N, P, and S fertilization of established smooth bromegrass in eastern Kansas.

All research sites were on producer-cooperator land that had been in bromegrass at least 15 years. Soil samples were taken at all sites at the time studies were established. All sites had organic matter levels in excess of 3 percent. Soil test P levels ranged from as low as 4 parts per million (ppm) Bray P-1 (very low), to as high as 15 ppm (medium). Fertilizer was applied surface broadcast in February. Either ammonium nitrate

TABLE 1. Forage yield and quality in bromegrass, 31 site-year average, 1994-2001.

Nutrient treatment N-P_2O_5-S, lb/A	Forage yield, lb/A	Yield increase due to fertilizer, lb/A	Forage[1] Protein %	Forage[1] P %	Forage[1] S %
0-0-0	2,530	—	7.2	0.17	0.15
40-0-0	4,720	87	7.9	0.15	0.13
80-0-0	5,360	112	8.9	0.14	0.14
120-0-0	6,100	141	10.0	0.14	0.14
40-30-0	5,320	110	7.6	0.18	0.13
80-30-0	6,310	149	8.5	0.18	0.13
120-30-0	6,930	174	9.7	0.17	0.14
80-30-20	6,710	165	8.8	0.17	0.17

[1]Forage protein values are 15 site-year averages; P and S values are 11 site-year averages.

or urea was used as the N source, P was supplied as triple superphosphate, and S was supplied as ammonium sulfate. The studies were harvested in late May to early June.

Thirty-one site years of forage yield data are summarized in **Table 1** and **Figure 1**. The work was conducted from 1994 through 2001. Yields varied considerably from year to year and among sites due to environmental conditions. However, significant responses to N, P, and S fertilization were noted regardless of yield level.

This research clearly shows the importance of N fertilization in producing high yields of high quality forage. Nitrogen fertilization alone resulted in as much as a 141 percent increase in yield. It also resulted in an average 22 percent increase in forage protein. The data also illustrate the importance of including P in the overall nutrient management program for cool season grasses. Within each N treatment, P fertilizer increased yield. Increases due to P ranged from 13 to 18 percent. This demonstrates the importance of balanced fertilization in producing yield and maximizing N use efficiency.

The inclusion of 30 lb P_2O_5/A increased forage yields by 800 lb/A, or 15 percent, when averaged across 31 site years and all N rates. Assuming a P fertilizer price of $0.26 per pound of P_2O_5 and $70/ton hay price, the forage yield increase would generate an additional $28/A for a $7.80 investment. The addition of P also reduced competition from undesirable species (bromesedge, redtop, bluegrass) in the cool season grass stands.

Another interesting facet of this work was the response to S fertilizer. The addition of 20 lb S/A increased forage yields by 400 lb/A, verifying earlier work in Kansas showing cool season grasses consistently respond to S fertilization. Our current recommendation is to apply 10 to 15 lb S/A on brome that is managed for optimum production, in spite of the fact that established stands often have organic matter levels in excess of 3 percent.

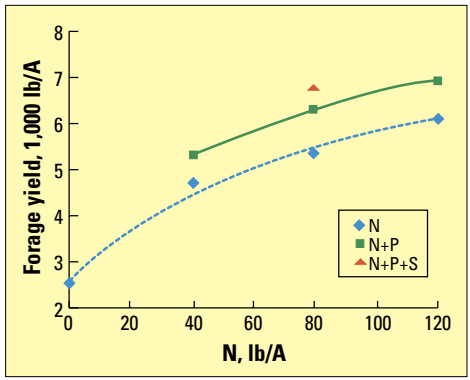

Figure 1. Effect of N, P, and S on bromegrass forage yield, 31 site-year average. Phosphorus applied at 30 lb P_2O_5/A and S at 20 lb/A.

In summary, cool season grasses require intensive management for optimum production of high quality forage. This long-term research shows that adequate P and S should be included with N in the nutrient management program.

Dr. Lamond is Professor/Extension Specialist with the Department of Agronomy, Kansas State University, Manhattan, KS 66506; e-mail: rlamond@bear.agron.ksu.edu. *Kansas County Agricultural Extension Agents Herschel George, Garry Keeler, Bill Wood, and Jody Holthaus were instrumental in completing this research.*

Bromegrass makes high quality pasture for beef cattle.

Bromegrass response to S is shown at left in this photo. The plot at right side received no S.