MISSOURI

Soil Phosphorus May Be Important to Beef Herd Health and Performance

By Ryan Lock, Robert Kallenbach, Dale Blevins, Tim Reinbott, Greg Bishop-Hurley, Richard Crawford, Jr., and Matt Massie

Grass tetany is a nutritional disease of ruminants and has been associated with low levels of Mg in forage. This disorder most often affects lactating cows grazing lush, cool-season grass pastures. It is most common during early spring when the grass has a seasonally low Mg concentration and when spring-calving cows have a three-fold greater demand for Mg as a result of milk production.

Although the disease can prove fatal, it rarely progresses to clinical symptoms. More often, a cow suffers from hypomagnesemia, or sub-clinical grass tetany. Hypomagnesemia is a precursor to grass tetany, with symptoms that are difficult to detect, including decreased feed intake, lowered milk production, and loss of body condition. It affects cow performance and health and decreases gains of suckling calves. Thus, it is important that cows consume adequate Mg to ensure the performance of the herd is not compromised.

Typically, producers offer cattle a mineral supplement rich in Mg during the grass tetany season. However, there are problems associated with mineral supplementation. These include the cost, palatability, reliability, and potency of the supplements. Given the fact that supplements can be expensive and do not always work, interest has grown to increase the Mg in cool-season grasses. With this method, a cow would receive her daily requirement of Mg while grazing.

Recent work at the University of Missouri indicates that maintaining soil test P at greater than 30 lb/A can increase the Mg concentration of cool season grasses during spring. Reinbott and Blevins in Missouri published reports in 1991, 1994 and 1997, consistently showing that plants fertilized with P in spring have greater Mg concentrations compared to those grown on low P soils.

Recent research results in Missouri agree with earlier findings that soil phosphorus (P) is important in boosting magnesium (Mg) uptake by tall fescue. Phosphorus fertilization of pastures is a good alternative to Mg supplements for protecting against grass tetany and can help increase calf gains.

Materials and Methods

In a continuation of the work by Reinbott and Blevins, a grazing experiment was conducted at the Southwest Research and

Missouri research indicates that P fertilization of tall fescue pastures can increase forage Mg levels and help protect against grass tetany. Pasture on right in photo, fertilized with P, had a soil test of 30 lb/A Bray P-1. Unfertilized pasture at left had a soil test of only 5 lb/A.

Education Center near Mt. Vernon during the spring of 2000 and 2001. The first objective was to determine if P fertilization of tall fescue would increase the Mg levels in the grass as well as in the animals grazing the grass. Another objective was to compare the Mg status of cows grazing P-fertilized tall fescue to those receiving Mg supplement. The experimental design was a randomized complete block with three treatments and three replications. There were nine pastures, and three cows grazed in each pasture for 56 days beginning February 15, 2000 and again March 6, 2001. The treatments were:

1) Cows grazed tall fescue grown on soil with 34 lb/A available P;
2) Cows grazed tall fescue grown on soil with 6 lb/A available P while supplemented with 12 percent Mg mineral blocks free choice;
3) Cows grazed tall fescue grown on soil with 6 lb/A available P with no supplementation.

For simplicity, the treatments will be referred to as P fertilized, Mg supplement, and control, respectively.

Blood samples were taken from the cows, and forage samples were harvested on the first day of the trial and at 14-day intervals. The Mg concentration of the samples was analyzed. Cows and calves were weighed at these times. Forage availability was kept equal among pastures using electric fencing to control grazing. This method ensured that the Mg status of the animals was a function of forage quality rather than quantity consumed.

Results and Discussion

Forage Mg levels. Preliminary results from this grazing experiment indicate that P fertilization of tall fescue pasture increased the forage Mg levels nearly 20 percent compared to pastures not fertilized with P. This was the case in both years and agrees with previous work suggesting that soil P regulates Mg uptake by tall fescue.

Blood serum Mg levels. Except for March 20, 2001, cows grazing P fertilized pastures and cows receiving Mg supplement showed equal blood serum Mg levels on all sampling dates. On the mentioned date, cows in the P fertilized pastures showed nearly 33 percent less Mg in blood serum than cows receiving Mg supplement. Cold temperatures and snowfall during the three days before this sampling likely reduced the forage intake of these animals because control animals also showed decreased Mg levels at this time, although not as severe. These data suggest that the two groups depending on forage as the only source for Mg could not consume enough dry matter due to the weather conditions at that time. As a result of their decreased forage intake, the cows were unable to consume their daily Mg requirement, and blood serum Mg levels dropped. Cows supplemented with Mg were able to consume the supplement, and their blood serum levels did not drop. As the weather became milder, the cows' Mg status in the P fertilized and control groups returned to previous levels.

The decrease in blood serum Mg of cows grazing P fertilized pasture compared to cows in the control or Mg supplement groups may have also been due to greater milk production coupled with the weather conditions. During cold weather, average daily gains (ADG) of suckling calves were 30 percent higher when their mothers grazed P fertilized tall fescue compared to cows grazing pastures not fertilized with P. This higher rate of gain in calves is perhaps a result of greater milk production by the cows. Since Mg is important for milk production, cows in P fertilized tall fescue may have had more demand for Mg to produce the larger volume of milk needed for the increased calf gains. Therefore, harsh

(continued on page 8)

TABLE 1. Average daily gain of suckling calves for 56 days during the spring seasons of 2000 and 2001.

Mother cow management			Suckling calf
	Pasture		
Treatment	Bray P-1, lb/A	Mg supplement	ADG, lb
P fertilized	34	Yes	2.44
Mg supplement	6	Yes	2.23
Control	6	No	2.16
LSD (0.05)			0.18

and K levels have changed considerably over the last 34 years (**Table 1**). Soil test P has decreased in the check, and P levels of the P only treatment are higher than other treatments because N has been limiting, thus reducing yields and P removal.

The data collected from 110 years of monoculture winter wheat on the Magruder Plots have been invaluable. Identifying that in the 1980s soil K was depleted to levels where yield was adversely affected emphasizes the need for soil testing and proper nutrient management. The lack of a considerable response to inorganic N fertilization prior to the 1960s also illustrates that the original source of N in the soil is organic matter. Its contribution of N via mineralization was and continues to be quite significant. On these prairie soils, first tilled in 1892 and in continuous winter wheat since, it took 70 and 90 years to observe N and K responses, respectively. BC

TABLE 1. Soil P and K levels measured in 1967 and 1997.

Treatment	P	K
	parts per million (ppm)	
	1967[1]	
Check	17.7	316
Manure	27.3	371
P only	50.6	259
NP	35.2	311
NPK	37.5	383
NPKL	30.6	350
	1997[1]	
Check	6.7	231
Manure	41.3	230
P only	55.7	219
NP	46.3	257
NPK	43.2	282
NPKL	38.3	262

[1]In 1967, Bray-Kurtz P-1 for P and ammonium acetate for K; in 1997, both P and K by Mehlich 3.

The authors are researchers at Oklahoma State University, Stillwater.

Beef Herd Health... *(continued from page 5)*

weather conditions and a greater demand for Mg may be the cause for the decrease in blood serum Mg observed on March 20, 2001.

Calf performance. Calves had higher rates of gain in both years when their mothers grazed tall fescue fertilized with P (**Table 1**). We thought that milk quality might have been affected by P fertilization. However, when milk samples were analyzed for protein, no differences were found among treatments. Therefore, it seems that the volume of milk produced may have been greater for the P fertilized group compared to the Mg supplement and control animals. As a result, the calves grew faster. If forage availability is greater, cows can produce more milk for their calves. However, we attempted to keep the amount of available forage equal among pastures. Therefore, the greater milk production may have been the result of increased forage quality, although we do not have those data at this time.

Summary

These results agree with previous research indicating the importance of soil P in increasing Mg uptake by tall fescue. Fertilizing pastures with P compares favorably to use of Mg supplements to protect against grass tetany. Further, P fertilization provides additional benefits to cattlemen, including greater calf gains. BC

Mr. Lock is Graduate Research Assistant, Dr. Kallenbach is Assistant Professor and Extension Forage Crops Specialist, Dr. Blevins is Professor, Mr. Reinbott is Research Associate, and Dr. Bishop-Hurley is Post-Doctoral Fellow, all with Department of Agronomy, University of Missouri, Columbia. Dr. Crawford is Research Assistant Professor and Mr. Massie is Senior Research Specialist, both at Southwest Missouri Research and Education Center, Mt. Vernon.