

SULFUR BOOSTS WARM- AND COOL-SEASON GRASSES



The Demise of “Free” Sulfur

For decades, atmospheric S deposition — or “free” S from power plants and industrial facilities — provided much of forage crops’ S needs, according to Dr. Robert Kallenbach, forage extension researcher and assistant dean, University of Missouri. However, in recent years, pollution control measures have dramatically reduced the amount of S discharged through smokestacks. Without that airborne source of S, many soils have become S-deficient and as a result, crops have begun to respond to applications of S in traditionally non-responsive regions.

“We started seeing responses to sulfur in high-protein crops like alfalfa,” Kallenbach said. “We also know our cool-season grasses have a sulfur requirement as well.”

Kallenbach recently presented a 2015 study of tall fescue pastures he conducted at the University’s Forage Systems Research Center near Linneus, Missouri. Among 27 treatment combinations, the only significant yield response came from S-containing products, which increased yields by 600 to 700 pounds of forage per acre. He is currently sorting through palatability data from the trial.

Protein Building Block

Kallenbach noted that it is not surprising that high-protein crops were the first to demonstrate S deficiencies, as S is a crucial building block for amino acids such as cystine and methionine, which in turn are integral to building digestible crude proteins. He said he would like to explore the impact of S on cool-season grass protein levels in future research.

“While we don’t have data that addresses S and protein, it does stand to reason that (such research) would be the next step,” he pointed out.

At University of Georgia, forage extension specialist Dr. Dennis Hancock said research has demonstrated increases in both yield and protein following S applications in warm-season grasses such as bermudagrass.

“We have seen studies show a very positive response to sulfur in terms of nutritional value, particularly in protein,” Hancock said. “Higher protein levels, to a point, can increase rumen function and improve animal nutrition and performance.”

Forage crops, in which sulfur (S) has long been overlooked by many producers, are increasingly showing a response to S applications. Yield increases of 10 to 30 percent have been recorded in both cool-season and warm-season grass crops following S fertilization.

This paper explains some of the data behind sulfur fertilizer recommendations for maximizing forage yield and quality.

S is also critical to the formation of chlorophyll. Hancock noted that S-treated forage can be more attractive to buyers of horse hay, who like to see the bright-green fodder they equate to higher protein content.

Partners with K

While S deficiencies are most often a problem in sandy soils, a Louisiana study demonstrated significant synergies between ammonium sulfate and potash applications in bermudagrass grown in a silty clay loam soil with two percent organic matter.

Compared to untreated checks, plots receiving S alone had a 31 percent yield increase and those getting potassium (K) alone had a seven percent yield increase. Plots that received both S and K yielded 57 percent more forage, showing a synergistic effect between the two nutrients. Ammonium sulfate also boosted crude protein by nearly one-third to 20.5 percent versus 15.8 percent in the no-S plot. The study was also a good example of the role of S in maximizing nitrogen (N) use efficiency, reducing the potential for N loss to the environment (see Table 1, page 2).

Table 1: Effect of Sulfur and Potassium on Bermudagrass Dry Matter Yield Averaged Across 15 Varieties

K rate lb K ₂ O/A	S rate lb S/A	Dry Matter Yield, Ton/A						
		May 8	June 7	July 12	August 9	Sept. 7	Oct. 26	Total
500	170	1.24	2.12	2.27	2.00	1.63	1.00	10.26
500	0	1.04	1.31	1.52	1.20	0.95	0.52	6.54
0	170	0.95	1.95	1.93	1.36	1.19	0.58	7.96
0	0	0.87	1.31	1.50	1.09	0.83	0.49	6.09

Source: *The Synergistic Effect of Sulfur and Potassium on Bermudagrass Hay*. Louisiana Agriculture, Vol. 35, No. 4.

Right Rate, Right Time

Hancock said 10 to 15 pounds of S per acre per year delivers enough to maximize yields where warm-season forages are growing in S-deficient fields. That is especially true in intensively managed stands with high yield potential.

“Often under irrigation, we’ll push those with heavy rates of nitrogen, and often we’ll see sulfur deficiency,” Hancock said.

He also noted that S is especially vital in the southern Coastal Plain, where soils are naturally low in organic matter and do not get the benefit of S-rich chicken manure applications that are more common in northern Georgia which is closer to centers of poultry production.

Kallenbach concurred, adding S should be applied when plants are beginning active growth.

“Sulfur tends to be most deficient in the spring when soils are cool and growth is just starting up,” he said. As a result, crops respond most dramatically to spring S applications.

Right Source, Right Place

One of the most popular sources of S fertilizer on pasture fields is ammonium sulfate, which also contains nitrogen. Throughout the eastern half of the United States, ammonium sulfate is applied over the top of pastures and forage crops without the need for a volatilization inhibitor. Kallenbach noted that the sulfate-S in ammonium sulfate is immediately available to plants, and ammonium nutrition promotes uptake of all anions, including sulfate-S.

In a three-year study Kallenbach conducted with colleagues at Mizzou’s Southwest Research and Extension

Center near Mt. Vernon, Missouri, ammonium sulfate ranked in the top-producing group at nearly all harvests and locations (see Table 2).

Top Producers

Kallenbach said S will increasingly be seen as an important tool as forage growers maximize yield and production efficiency.

“Sulfur is something that often gets overlooked; we get focused on nitrogen or N-P-K,” he explained. “But there are some things top producers must maintain, and one of them will be sulfur.”

Table 2: Effect of Nitrogen Source on Tall Fescue Dry Matter Yield Averaged Across Three Years

Nitrogen Source (75 lbs N/Acre)	Dry Matter Yield – Mt. Vernon, MO (lbs/Acre)
Ammonium Sulfate	5,667
Urea + NBPT	5,319
Ammonium Nitrate	5,233
Urea	4,866
Polymer-coated Urea	4,206
No N Check	2,483

Source: *Alternative Nitrogen Fertilizers to Ammonium Nitrate for Tall Fescue Pastures*. Alliance of Crop, Soil and Environmental Science Societies. Poster 339-1405, 2016.

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