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Sulfur Fertilization of Bahiagrass

Dr. Rob Kalmbacher, Dr. John Arthington, and Dr. Ike Ezenwa
University of Florida/IFAS
Range Cattle Research and Education Center

For questions or comments regarding this publication contact
Dr. Rob Kalmbacher, Dr. John Arthington, or Dr. Ike Ezenwa

Sulfur (S) is an important nutrient for plant growth and second only to N in its requirement for the production of essential amino acids. When S becomes deficient, not only are there adverse affects on plant growth, but also on the productivity of cattle because S affects dry matter intake, fiber digestion, and N and S retention.

A concern has been that Florida's sandy soils are likely to be deficient in S due to low organic matter content and leaching . Prior to the 1970s, low-grade fertilizers contained S as an impurity, and the need for additional S was thought unnecessary. However, with widespread use of high-grade fertilizers that contain little S, deficiencies of S have increased throughout the US. Research on fertilization of bahiagrass with S in Florida has shown mixed results with respect to improving bahiagrass yield. Let's look at examples where S has and has not increased bahiagrass yield.

S increased yield. Dr. Bill Blue, a now-retired UF professor, found that grass yield was improved with S fertilization in north Florida, but the yield response to S (0-40 lb S/acre) did not occur until after 4 years. He felt the reason for this was the large stolon-root system in bahiagrass was capable of accumulating and storing S. This was eventually depleted without S fertilization. After depletion, best yield occurred with S application at about 30 lb S/acre/ year. One of the most interesting results from Dr. Blue's research is that S appears to be very much like phosphorus (P) in that once a critical level is reached in bahiagrass tissue (when S concentration is 0.16 %) yield does not increase even though concentration of S in tissue continues to increase with higher S fertilization rates. However, unlike P, the sulfate form of S does not remain in the soil for long because it is water-soluble and leaches rapidly.

In a second example, Dr. Jack Rechcigl applied ammonium nitrate and sulfate to bahiagrass over 3 years on a ranch in Desoto County and found a statistically greater yield of 3000 lb/acre from 60 lb N/acre from ammonium sulfate compared with a yield of 2700 lb/acre from ammonium nitrate. Ammonium sulfate supplied 77 lb S/acre, and bahiagrass tissue contained 0.22% S with ammonium sulfate compared with 0.10% in grass receiving ammonium nitrate and no S.

S did not increase yield. In the 1960s, Dr. Blue compared several forms of N including ammonium nitrate and ammonium sulfate for bahiagrass production in north Florida. There was no difference in 10-year average yield as a result of using these fertilizers even though ammonium sulfate supplied S each year. The objective of this research was not to evaluate S as a fertilizer, so S concentrations in tissue were not published. However, it is certain that concentrations of S in tissue were not critically low because P (probably containing S) was also applied annually.

Recently at the Range Cattle REC, all possible combinations (16) of four levels of N (0-225 lb/acre) and four levels of S (0-250 lb/acre) were applied annually to an old bahiagrass pasture. Sulfur did not increase bahiagrass yield at any of three sample dates in each of 2 years at any N rate. At 35 days after fertilization, 2-year average S concentration in tissue ranged from 0.23% with no S to 0.38% with 250 lb S/acre.

Should S be applied to bahiagrass? Yes, when S is limiting bahiagrass growth there will be a yield response to S fertilizer, otherwise, no. The amount of S required by bahiagrass is similar to the quantity of P required. Dr. Blue's recommendation of 30 lb S/acre/year when the critical level of < 0.16% of S in tissue is a good one. Without S fertilization, sulfate comes from storage in the bahiagrass stolon/root system, mineralization of organic matter, and from atmospheric deposition. It is estimated that about 7 lb S/acre/year comes from deposition in Florida. If cattle are supplemented with molasses, about 1 to 2 lb S/acre can come from this source. There will be situations where S will limit bahiagrass growth. Ammonium sulfate is a good source of S, and a mixture of 125 lb/acre of ammonium sulfate with 75 lb/acre of ammonium nitrate will supply 50 lb N /acre with 30 lb S/acre. Since this would involve a mixing charge at the fertilizer plant, an alternative would be to use ammonium sulfate in alternate years. Why not apply ammonium sulfate alone to supply N and S every year? Because for every 50 lb N/acre supplied by ammonium sulfate, 260 lb of lime/acre are required to neutralize the acidity caused by the ammonium ion compared with 90 lb/acre lime for ammonium nitrate. At $22/ton for dolomite and $6/ton for spreading, the additional 170 lb/acre of dolomite would add $2.38/acre to the cost of ammonium sulfate. Ammonium sulfate is currently about $96.75/ton in bulk compared with $231.75 for ammonium nitrate, so cost of 50 lb N/acre from ammonium sulfate is currently about $11.51 compared with $17.38 for ammonium nitrate.

Can there be too much S applied? When dietary S is excessive, it combines with molybdenum to form a thiomolybdate complex that binds copper (Cu) and renders it unavailable to cattle. Low Cu status results in impairment of the immune system in cattle. It has been suggested that the maximum concentration of S should not exceed 0.4 % (dry

matter basis) in the diet of cattle.

Cows grazing bahiagrass fertilized annually with 60 lb N/acre from ammonium sulfate on a ranch near Labelle contained 0.48 and 0.51% S in 1999 and 2000, respectively. Prior to grazing these pastures the cows were provided a molasses-based winter supplement containing approximately 0.8% S. Together, these factors resulted in 72 ppm liver Cu in cows grazing ammonium sulfate fertilized pastures compared with 204 ppm liver Cu in cows grazing unfertilized pastures. A level of 25 to 75 pm Cu is considered low for cattle.

Even at S rates of 250 lb S/acre/year, concentrations of S in bahiagrass tissue could not be elevated beyond 0.4% at Ona. Was the elevated tissue S and depressed Cu a phenomenon associated with the Lake region? It is not known, but the fact remains that the cow diet can contain too much S. Common sense and fertilization according to the needs of the plant and the level of forage production needed at any ranch are essential. Tissue testing to determine the concentrations of S in bahiagrass forage is a good way to determine if S fertilizer is needed.