AN112

UF UNIVERSITY of FLORIDA
IFAS Extension

Effect of Sulfur-Containing Fertilizer on Bahiagrass Quality and Grazing Cow Mineral Status[1]

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Introduction

Bahiagrass is the most predominant forage for grazing cattle in Florida. It is resistant to overgrazing and most pasture pests. Also, bahiagrass is adapted to grow in multiple Florida soil environments. In recent years, concerns have arisen about sulfur deficiency in Florida bahiagrass. In the past, fertilizer impurities provided pasture forages with supplemental sulfur, but the refinement of modern fertilizer manufacturing processes has made sulfur contamination uncommon. Therefore, the effect of sulfur fertilization on bahiagrass yield and quality and the effect of increased forage sulfur on grazing cow mineral status are important issues, deserving investigation.

Florida Research

Dr. Rechcigl (UF-IFAS) reported on a three-year study investigating the effect of ammonium sulfate fertilization on bahiagrass yield and quality at a site in south central Florida. His results showed a 25% increase in bahiagrass yield when pastures were provided with 77 pounds of sulfur per acre. In this study, bahiagrass fertilized with ammonium nitrate contained approximately 0.10% sulfur. The application of sulfur via ammonium sulfate increased forage sulfur concentrations to 0.23 and 0.30% for applications of 77 and 155 pounds of sulfur per acre, respectively.

More recently the effect of ammonium sulfate versus ammonium nitrate at common nitrogen rates (60 pounds per acre) was investigated over three consecutive growing seasons on bahiagrass pastures near LaBelle, Florida. In this study, the application of sulfur increased bahiagrass yield only in 1999 but produced a substantial increase in plant sulfur concentration each year. The increase averaged 0.50% over the three-year study.

A similar three-year study has been conducted at the Range Cattle Research and Education Center, Ona, Florida. In this study, there were no differences in yield when bahiagrass was fertilized with ammonium sulfate versus ammonium nitrate. The absence of a response to sulfur fertilization was attributed to the higher initial forage sulfur concentrations found at this location during the study (greater than 0.20%). In the LaBelle study, average forage sulfur concentrations in ammonium-nitrate-fertilized pastures were 0.22% in

1. This document is AN112, one of a series of the Animal Science Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Published November 2001. Revised May 2002, reviewed August 2008. Please visit the EDIS Web Site at http://edis.ifas.ufl.edu.

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2000 (no yield response), compared to 0.17% in 1999 (improved yield). Collectively, these studies suggest a minimum critical plant sulfur concentration for obtaining a bahiagrass yield response to additional sulfur application. An initial sulfur concentration less than 0.20% may be essential before a yield response to additional sulfur is realized.

Forage molybdenum is the primary contributor to secondary copper (Cu) deficiencies in grazing cattle. Although molybdenum is an essential component in this antagonism, it will seldom affect tissue Cu stores when sulfur levels are limiting. When dietary sulfur is adequate, molybdenum combines with Cu to form an insoluble complex in the rumen, rendering Cu unavailable for absorption. We have found that a dietary concentration of sulfur of 0.35% (total sulfur) is sufficient for this antagonism to become a concern. The current beef cattle NRC (1996) suggests a maximum tolerable concentration of dietary sulfur of 0.40 %.

Cows from the LaBelle, Florida pastures fertilized with ammonium sulfate had lower liver Cu concentrations at the end of the grazing season compared to cows from pastures fertilized with ammonium nitrate and cows from unfertilized pastures (71.8, 137.0, and 203.8 ppm Cu for ammonium sulfate, ammonium nitrate, and no fertilizer, respectively). Liver Cu concentrations greater than 125 ppm are considered adequate, 75 to 125 ppm are marginal, and less than 75 ppm are deficient. A random collection of 12 liver samples at the start of the study revealed an initial Cu concentration of 68.0 ppm. These results suggest that the cows were Cu deficient when they initially entered the study. Cows in each pasture were provided with free-choice access to a balanced, salt-based trace mineral supplement containing 0.25% Cu from Cu sulfate. The most likely explanation for the low liver Cu concentrations in cows grazing ammonium-sulfate-fertilized pastures is high forage sulfur concentrations. The three-year average sulfur concentration for forage samples collected on ammonium-sulfate-treated pastures was 0.50%. Even though the maximum dietary sulfur threshold was exceeded in cattle grazing ammonium sulfate pastures, no reduction in cow gain or signs of clinical distress were noted. The only indicator of sulfur toxicity in this study was the failure of cows on ammonium-sulfate-fertilized pastures to respond to Cu supplementation.

A concurrent cattle study was conducted using pregnant heifers grazing ammonium-sulfate-fertilized pastures from the same LaBelle, Florida ranch location. Heifers were transported to the Range Cattle REC, Ona, and housed in dry lot pens. Heifers were initially Cu deficient (54 ppm liver Cu). Over 83 days of Cu repletion, heifers experienced a marked linear increase (1.91 ppm per day) in liver Cu concentration when removed from their pastures and offered a controlled diet that provided 123 mg of Cu per day (Figure 1). These data suggest that the cattle were able to rapidly respond to Cu supplementation once the dietary antagonism of sulfur was removed.

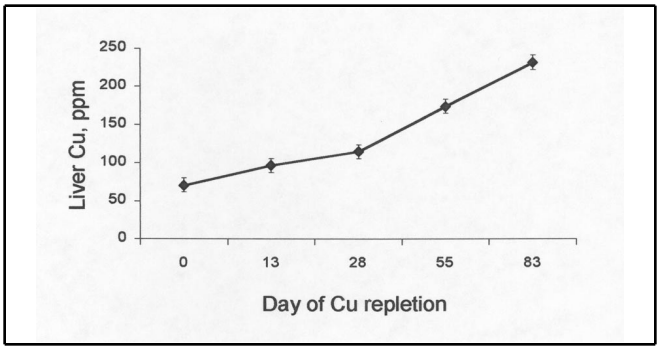

Figure 1. Increase in liver Cu concentrations in post-partum Brangus heifers following supplementation with 123 mg of Cu / d. Linear response; Y = 68.2 + 1.94(x), (r^2= 0.66), P<0.01.

Implications

The decision to apply ammonium sulfate to bahiagrass pasture should be based on plant sulfur need and cost compared to other nitrogen sources. Although the data have been variable, ammonium sulfate fertilizer may improve bahiagrass yield when initial plant sulfur concentrations are below 0.20%. Application of ammonium sulfate will increase forage sulfur concentration. If this increase in forage sulfur causes the total diet to exceed 0.35% sulfur, there may be a decrease in cow response to copper supplementation. We are currently unaware of any situations where declines in grazing cow production were linked to the use of ammonium sulfate fertilizer in Florida.