Influence of Copper on Coastal Bermudagrass Forage Yield and Quality

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Copper (Cu) is essential to the growth of plants, with the normal range of concentrations in plant tissue being 5 to 20 parts per million (ppm). Copper concentrations in plants normally do not increase appreciably before becoming toxic to normal plant growth. Even under conditions of Cu toxicity, most of the excess Cu accumulates in the roots, and very little is translocated to the aerial portion of the plant.

COPPER has been identified for many years as an essential nutrient for cattle. Nutritional requirements for beef cattle (NRC-1980) suggest dietary Cu levels of 8 ppm and a maximum tolerable level at 115 ppm. Copper deficiencies in animals are characterized by:

- Depressed growth . . . calves on pastures show poor response in weight gain and may appear wormy.
- Bone disorders — bone fractures can occur in rapidly growing young animals.
- De-pigmentation of hair . . . all hair may be affected, but usually hair around eyes and ears shows loss of color first. Angus may show a reddish-brown color, whereas Herefords may show a yellowish coloring.
- Diarrhea or scours.
- Greater disease susceptibility.

Many other symptoms may occur as Cu deficiency intensifies.

Research on Cu fertilization of Coastal bermudagrass in Texas has been conducted in an effort to meet dietary needs for Cu in grazing beef cattle. The following table shows the effects of Cu rates on Coastal bermudagrass yields at two different cuttings. Copper rates up to 4 lb/A (liquid banded on surface) did not have a significant effect on forage yield levels during this initial work on Cu fertilization (**Table 1**).

Table 1. Influence of Cu fertilization on Coastal bermuda yield.

Copper rate, lb/A	Yield per cutting, lb/A Cutting 1	Cutting 2	Total yield, lb/A
0	3,674	7,112	10,786
1	3,603	7,150	10,753
2	3,342	7,321	10,663
4	3,612	7,116	10,728

Lee County, C. Marek Farm (1992)
Liquid Cu banded on surface

Editor's Note: **Dr. Willis B. Gass**, senior author of this article, died in an automobile accident near Bryan, TX, on October 8, 1993. The staff of the Potash & Phosphate Institute express our condolences to Dr. Gass' family and colleagues. His contributions to agricultural research and education in Texas and surrounding states will be sorely missed.

Dr. Gass (deceased) was Extension Soil Fertility Specialist, Dr. Pratt is Extension Forage Specialist Emeritus, Dr. Herd is Extension Beef Cattle Specialist-Nutrition, and Dr. Pennington is Extension Soil Chemist, Texas Agricultural Extension Service, College Station, TX. Dr. Sanders is Great Plains/Southwest Director, Potash & Phosphate Institute, Stanley, KS.

Table 2. Influence of Cu fertilization on Cu levels in Coastal bermuda forage.

Copper rate, lb/A	Forage Cu concentrations, ppm	
	Cutting 1	Cutting 2
0	6.1	5.7
1	17.3	23.9
2	23.6	8.4
4	47.1	15.2

Lee County, C. Marek Farm (1992)

Although the Cu levels reported in **Table 2** do not exceed the maximum tolerable Cu level suggested for beef cattle, the banded liquid Cu resulted in levels much higher than the normal ranges considered adequate in ruminant diets. There is a fine line between Cu deficiency and toxicity in both plants and animals. The 1 lb/A Cu rate increased Cu levels in the plant at the first and second cutting, and levels appear to be sufficient (but not toxic) for both Coastal bermudagrass and cattle under most conditions.

Summary

Copper is an important nutrient for both livestock and forage production. Although forage production may not be noticeably affected at a certain Cu level, the same level may be deficient for cattle production. Utilization of Cu in forages by the animal can also be negatively influenced by high levels of molybdenum (Mo), sulfur (S) and Iron (Fe). Further research is needed in order to investigate these interactions and their effects on forage and cattle production. ■

COPPER deficiency in cattle may include several symptoms, such as scouring and dull, dry hair. Black animals may show a reddish-brown color.

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P. Where P was added over many years, but plant growth was limited by deficiencies of N or K, soil levels of P were very high. When a balanced N-P-K fertilizer program was used, the amount of P is moderate, reflecting a build-up of plant-available P, but not an excess, due to high plant yields and P removal by the crop. All of these effects are clearly shown by resin capsule data. This type of sensitivity to fertilizer management has been demonstrated for other elements as well.

Summary

Laboratory soil testing of K (and several other nutrients) will likely never be extremely well correlated to crop response in the field. Variables that influence diffusion (especially soil water content and temperature) are not accounted for in results obtained in the laboratory, regardless of the method. However, it is clear that the resin capsule methodology provides a new, improved approach to soil testing. ■