Comparison of Tri-Basic Copper Chloride Versus Copper Sulfate on Measures of Forage Utilization and Copper Status in Beef Heifers

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SUMMARY

The objective of this study was to investigate the effect of supplemental tri-basic copper chloride (TBCC) vs Cu sulfate on the Cu status and voluntary forage intake of growing heifers fed forage-based diets. Twenty-four crossbred heifers were stratified by weight and randomly allotted to individual pens. Heifers were provided free-choice access to ground grass hay (8.0 and 54.0% CP and TDN, respectively) and 4.0 lb/d of a ground corn-cottonseed meal supplement. Three treatments were randomly allocated to pens, providing: 1) 100 mg/d Cu from Cu sulfate, 2) 100 mg/d Cu from TBCC, or 3) 0 mg Cu/d (Control). Forage intake was measured daily. Individual heifer body weight, jugular blood, and liver biopsy samples were collected on d 0, 30, 60, and 90. Heifer ADG was not affected by Cu treatment (average = 0.49 ± 0.15 lb/d). Change in liver Cu and plasma ceruloplasmin (Cp) concentration did not differ among Cu sources (120 vs 77 ppm liver Cu, and -6.0 vs 3.5 mg CP/dL for Cu sulfate and TBCC supplemented heifers, respectively). Heifers fed no supplemental Cu experienced a lesser forage DMI compared to both Cu sulfate and TBCC supplemented heifers (average forage intake = 10.8 and 11.7 lb/d for Control and Cu supplemented heifers, respectively). These data indicate that Cu sulfate and TBCC are of similar availability when offered to growing beef heifers in corn-cottonseed meal supplements. As well, these data indicate that the lack of supplemental Cu may decrease voluntary forage intake in growing beef heifers.

INTRODUCTION

In a previous series of studies, heifers provided molasses-based supplements had lower liver Cu concentrations compared with heifers consuming a similar amount of Cu provided in a corn-based supplement. High S concentrations, naturally found in molasses, were suggested to be the most likely reason for this reduction in Cu availability. Since this time, other studies have been completed with the objective of identifying a source of Cu that may overcome this sulfur antagonism. Two organic and one inorganic source of Cu has been evaluated. In one study, steers consuming treatments containing tri-basic Cu chloride were found to have greater voluntary forage intake. The objective of this study was to investigate the effect of supplemental tri-basic copper chloride (TBCC) vs Cu sulfate on the Cu status and voluntary forage intake of growing heifers fed forage-based diets.

PROCEDURES

Twenty-four, Brahman x British crossbred heifers were randomly allocated into individual covered pens. All heifers received a common ground corn - cottonseed meal supplement formulated to provide, on average, 3.25 lb of TDN and 0.75 lb CP daily. Three Cu treatments were randomly assigned to individual pens (eight pens/treatment), providing 100 mg of Cu/d from TBCC or Cu sulfate. A third treatment acted as the negative control, providing no additional dietary Cu beyond that found in the base diet.

To assess the effect of Cu source on animal performance, liver Cu concentration and individual body weight were measured on d 0, 30, 60, and 90. All heifers were offered free-choice access to ground stargrass hay (Cynodon spp.) To determine the effect of dietary treatment on forage intake, daily forage offered and refusal was determined.

RESULTS

Heifer ADG was not affected by Cu treatment (average = 0.49 ± 0.15 lb/d). Change in liver Cu and plasma ceruloplasmin (Cp) concentration did not differ among Cu sources (120 vs 77 ppm liver Cu, and -6.0 vs 3.5 mg CP/dL for Cu sulfate and TBCC supplemented heifers, respectively). Heifers fed no supplemental Cu experienced a lesser accumulation of liver Cu and a greater decrease in Cp concentration over the 90-d supplementation period (Figure 1) (-34.4 ± 20.6 ppm liver Cu and -4.1± 3.1 mg/dL Cp) compared to both Cu sulfate and TBCC supplemented heifers.

Voluntary forage intake did not differ among Cu sources, however, heifers provided no supplemental Cu had lesser forage DMI compared to both Cu sulfate and TBCC supplemented heifers (Figure 2) (average forage intake = 10.8 and 11.7 lb/d for Control and Cu supplemented heifers, respectively).

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Figure 1. Effect of Cu source on liver Cu accumulation in growing heifers. ab=Means differ; P<0.05.

Figure 2. Effect of Cu source on voluntary forage intake in growing heifers.