Effects of tribasic copper chloride versus copper sulfate provided in com- and molasses-based supplements on forage intake and copper status of beef heifers

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ABSTRACT: The objective of this study was to investigate the effect of supplemental tribasic copper chloride (Cu$_2$(OH)$_3$Cl; TBCC) vs. Cu sulfate (CuSO$_4$) on Cu status and voluntary forage DMI in growing heifers. Two 90-d experiments were conducted using 48 non-pregnant, crossbred heifers (24 heifers/experiment; 355±10.7 and 809±9.9 kg for Exp. 1 and 2, respectively). In each experiment, 3 supplemental Cu treatments were randomly allocated to heifers in individual pens consisting of (1) 100 mg of Cu/d from CuSO$_4$, (2) 100 mg of Cu/d from TBCC, or (3) 0 mg of Cu/d. The 2 experiments differed by the form of supplement used to deliver the Cu treatments (corn- vs. molasses-based supplements for Exp. 1 and 2, respectively). Supplements were formulated and fed to provide equivalent amounts of CP and TDN daily but differed in their concentration of the Cu antagonists, Mo (0.70 vs. 144 mg/kg), Fe (113 vs. 189 mg/kg), and S (0.18 vs. 0.37%) for corn- and molasses-based supplements, respectively. All heifers were provided free-choice access to ground stargrass (Cynodon spp.) hay. Jugular blood and liver biopsy samples were collected on d 0, 30, 60, and 90 of each experiment. Heifer BW was collected on d 0 and 90. Heifer ADG was not affected by Cu treatment (average = 0.22±0.11 and 0.44±0.05 kg for Exp. 1 and 2, respectively; P > 0.20). In Exp. 1, heifers provided supplemental Cu, independent of source, had greater (P<0.05) liver Cu concentrations on d 60 and 90 compared with heifers provided no supplemental Cu. In Exp. 2, average liver Cu concentrations were greater (P=0.04) for heifers receiving supplemental Cu compared with heifers receiving no Cu; however, all treatments experienced a decrease in liver Cu concentration over the 90-d treatment period. Plasma ceruloplasmin concentrations did not differ in Exp. 1 (P=0.83) but were greater (P=0.04) in Exp. 2 for heifers receiving supplemental Cu compared with heifers receiving no Cu. In Exp. 1, voluntary forage DMI was greater (P<0.05) for heifers provided supplemental Cu, independent of source, compared with heifers provided no Cu. In contrast, voluntary forage DMI was not affected (P>0.10) by Cu supplementation in Exp. 2. These data imply that CuSO$_4$ and TBCC are of similar availability when offered to growing beef heifers in both corn- and molasses-based supplements. However, corn- and molasses-based supplements appear to affect Cu metabolism differently. These impacts may affect voluntary forage DMI in growing beef heifers.

Key words: copper, heifer, cattle, corn, molasses