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Effects of Incorporation of Ruminally Protected Methionine into a Commercial Mineral Supplement on Growth Performance of Grazing Beef Steers in the Kansas Flint Hills

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Abstract

Forage-based diets for grazing cattle are often deficient in methionine, an essential amino acid required for protein synthesis and metabolism. In the Kansas Flint Hills, seasonal declines in forage quality further reduce metabolizable methionine supply to the small intestine, which may restrict animal growth. This study evaluated the effects of incorporating ruminally protected methionine into a commercial mineral supplement on growth performance of beef calves grazing native tallgrass prairie. A total of 360 crossbred steers (initial body weight [BW] = 611 ± 7 lb) were allotted to 18 pastures in a 90-day grazing trial. Pastures were randomly assigned to receive a control mineral (NoMet) or a mineral containing a rumen-protected methionine analog (Met [MetaSmart, Adisseo, Alpharetta, GA]). Mineral was provided *ad libitum* throughout the trial, and growth performance and mineral consumption were recorded. Final BW and average daily gain did not differ ($P \geq 0.67$) between treatments, with steers gaining 2.51 lb/day (No Met) and 2.55 lb/day (Met). Mineral intake was greater ($P < 0.01$) for control steers compared to those receiving methionine. No health differences were observed between treatments. These findings suggest that supplementation with ruminally protected methionine did not enhance growth performance of steers grazing in the Flint Hills but reduced mineral intake without compromising performance.

Introduction

Methionine is an essential amino acid, meaning cattle cannot synthesize it in sufficient quantities; therefore, it must be supplied through the diet. This amino acid plays a vital role in protein synthesis and various metabolic processes. However, methionine provided by the diet is degraded by rumen microbes and is not absorbed by the animal in the small intestine. Supplementing ruminally protected methionine has been shown to improve growth performance in feedlot cattle by increasing metabolizable methionine to the small intestine. However, there has been limited research evaluating the effects in grazing beef cattle. Methionine is commonly noted as the first limiting amino acid in forage-based diets. Its deficiency is particularly relevant in regions such as the Kansas Flint Hills, which is one of the largest areas of tallgrass prairie in the

United States, known for its abundant forage resources. Kansas Flint Hills pastures display seasonal shifts in quality. As grasses mature, the supply of essential amino acids, including methionine, decreases particularly during the mid- to late summer grazing season. Therefore, the objective of this study was to evaluate whether incorporating ruminally protected methionine into a mineral supplement would affect growth performance in grazing beef cattle.

Experimental Procedures

A total of 360 crossbred steers (initial body weight [BW] = 611 ± 7 lb) were shipped to the Kansas State Beef Stocker Unit for a 90-day grazing trial. The Beef Stocker Unit is divided into 18 pastures ranging from 40 to 70 acres. Prior to the start of the trial, two prescribed spring burns were applied April 3 and 6, 2025 on all pastures. Upon arrival steers were housed in 13 head pens and limit-fed a common growing diet at 2.0% of BW (dry matter [DM] basis) for 5 days. On day -1, steers were individually weighed in a hydraulic squeeze chute (Silencer, Moly Manufacturing, LLC, Lorraine, KS), given an visual identification tag, an electronic radio frequency identification tag, and treated for external and internal parasites (Safeguard, Merck Animal Health, Rahway, NJ, and Clean Up II, Elanco Animal Health, Greenfield, IL). On day 0, steers were administered a subcutaneous implant in the ear (Revalor-G, Merck Animal Health, Rahway, NJ) and given a pasture identification tag. Steers were then blocked into two groups by weight and randomly assigned to one of 18 pastures at a targeted stocking rate of 250 lb of live weight/acre.

Pastures were randomly assigned to one of two mineral supplements: a free choice mineral (NoMet; Table 1) or a free choice mineral supplement that contained an isopropyl ester of methionine hydroxy analogue (Met [MetaSmart, Adisseo, Alpharetta, GA]; Table1). Mineral was offered for *ad libitum* consumption throughout the trial. Prior to the start of the trial, mineral feeders (Bull Master, F&B Mann Products, Waterville, KS) were placed near water tanks with flaps up and were not moved for the duration of the grazing period. A 10-day acclimation period was established to ensure adequate mineral consumption for all pastures; during that time all pastures were fed a commercial salt premix. Once steers had acclimated to feeders, flaps were placed down, and treatments were applied to respective pastures. Because mineral consumption was greater than expected, on day-53 a salt block was placed next to the feeders in each pasture in order to slow mineral intake. Mineral feeders were checked daily and refilled as needed per pasture. Steers were checked daily for clinical signs of lameness, pinkeye, and respiratory disease.

Growth performance and mineral consumption data were analyzed using the MIXED procedure of SAS (SAS 9.4 SAS Inst. Inc., Cary, NC). The model for growth performance included treatment as a fixed effect. The model for mineral consumption included fixed effects of treatment, week, and treatment × week. However, no treatment × week interactions were observed ($P = 0.99$) so main effects of treatment are presented.

Results and Discussion

Following the grazing period, final BW and average daily gain did not differ ($P \geq 0.67$; Table 2) between treatments. Steers in the NoMet treatment gained 2.51 lb/day and Met steers gained 2.55 lb/day. Additionally, no steers were treated for bovine respiratory disease and only three were treated for pinkeye.

Mineral consumption was greater ($P < 0.01$, Table 2) in NoMet steers compared to Met steers. Additionally, mineral consumption for both treatments was greater ($P \leq 0.01$; Figure 1) from weeks 3 to 6 compared to weeks 1, 2, 7, 8, 9, 10, and 11. The depression in mineral consumption from weeks 6 to 11 correlated with the placement of salt blocks in the pasture and was by design. The initial lower mineral intakes in weeks 1 and 2 were likely while cattle were adjusting to the new mineral and mineral feeders. Mineral intake was formulated at 4 oz/head/day; however, both treatments exceeded that intake at 7.56 and 5.56 oz/head/day (NoMet and Met, respectively). The overall decrease in mineral consumption in Met steers could reflect palatability differences in the mineral supplements; however, mineral intake was still adequate.

Implications

Feeding a free choice mineral that contained a methionine hydroxy analogue (MetaSmart) did not improve growth performance of steers grazing in the Flint Hills. However, mineral consumption was reduced when methionine was added to the mineral without any negative effects on performance, which could allow producers to reduce mineral consumption without sacrificing weight gains.

Table 1. Composition of mineral treatments

	Treatment	
Ingredient, % as fed	**NoMet**	**Met**
Calcium carbonate	31.03	31.03
Salt	25.13	25.13
Distillers grains	20.52	11.71
Molasses, 5% fat	2.00	17.99
Dicalcium phosphate	17.99	2.00
Beef MFG TM II	1.25	1.25
Mineral oil	0.75	0.75
Selenium 0.4% premix	0.55	0.55
Iron oxide	0.50	0.50
Vitamin A 650,000 IU	0.01	0.01
Beef MFG vitamin premix	0.20	0.20
Flavor, dry dairy AP	0.03	0.03
Magnesium oxide bulk	0.03	0.03
MetaSmart[1]	---	8.81

[1] Methionine hydroxy analogue (Adisseo, Alpharetta, GA).

Table 2. Growth performance and mineral intake of grazing crossbred steers

	Treatment[1]			
Item	**NoMet**	**Met**	**SEM[2]**	***P*-value**
Number of head	180	180		
Number of pastures	9	9		
Initial body weight, lb	612	611	2.387	0.75
Final body weight, lb	837	840	5.805	0.74
Average daily gain, lb/day	2.51	2.55	0.069	0.67
Mineral intake, oz/head/day	7.56[a]	5.56[b]	0.463	< 0.01

[ab] Within row, means with different superscripts differ ($P < 0.05$).
[1] NoMet = no added methionine to commercial, free choice mineral, Met = hydroxyl methionine analog (Adisseo, Alpharetta, GA) added to commercial, free choice mineral.
[2] Largest standard error of the mean.

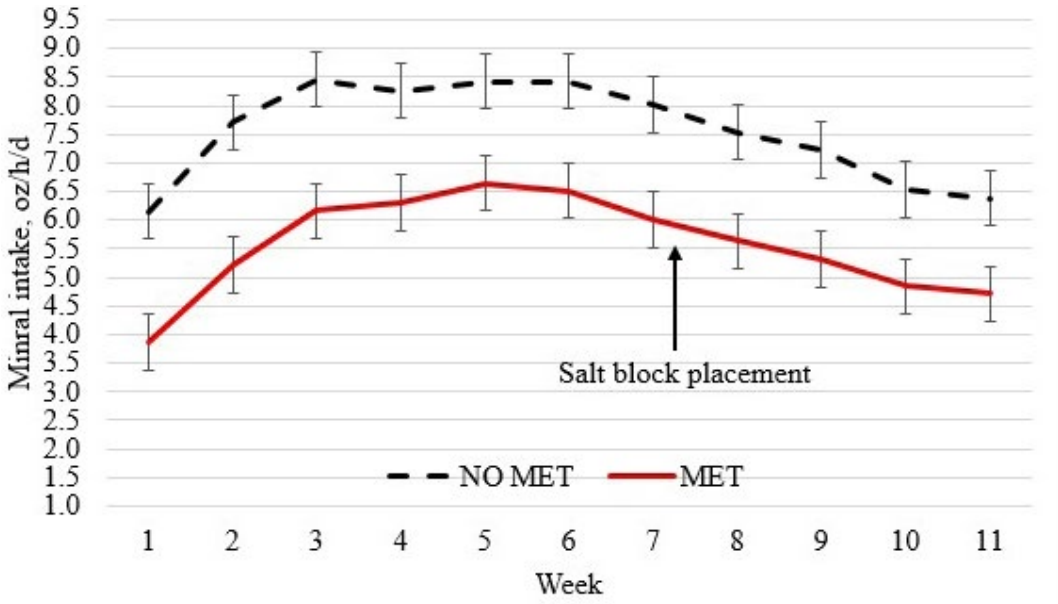

Figure 1. Mineral consumption of grazing crossbred steers over 90 d. No Met = no added methionine to commercial, free choice mineral, MET = hydroxyl methionine analog added to commercial, free choice mineral. Treatment: $P < 0.01$, Week: $P < 0.01$, Treatment × week: $P = 0.99$. SEM = 0.483.