Iowa State University
Digital Press
Animal Industry Report

AS 658 ASL R2693

2012

Investigation of the Impact of Mineral Status and Use of an Injectable Mineral on Beef Cattle Performance

Olivia Genther
Iowa State University

Stephanie L. Hansen
Iowa State University

Investigation of the Impact of Mineral Status and Use of an Injectable Mineral on Beef Cattle Performance

A.S. Leaflet R2693

Olivia Genther, graduate student;
Stephanie Hansen, assistant professor in animal science

Summary and Implications

Adequate trace mineral status of feedlot cattle decreases losses during shipping and improves marbling score (**MS**). Utilizing an injectable trace mineral, at the start of the finishing period, improved average daily gain (**ADG**), body weight (**BW**) and hot carcass weight (**HCW**). Trace mineral supplementation is important to beef cattle performance, and improves response to stress. Injectable minerals improve recovery after a stressful event, and enhance performance.

Introduction

Trace minerals are vital to the health and growth of livestock and are necessary for many biochemical processes including skeletal development, immune response, reproductive performance, and antioxidant capacity. Trace minerals can be found in common feedstuffs, but often not in adequate concentrations. Stressful events such as shipping also can increase trace mineral requirements of cattle. Trace minerals are frequently supplemented; however, supplementation programs can be inconsistent and dietary antagonists may be present in the diet and decrease the absorption of trace minerals. Use of an injectable mineral could improve trace mineral status rapidly, as injected minerals bypass digestion in the gastrointestinal tract and absorption coefficients will be higher than dietary minerals. Multimin®90 is an injectable mineral manufactured by Multimin USA, Inc. that contains 15 mg copper (**Cu**)/mL (as Cu disodium EDTA), 60 mg zinc (**Zn**)/mL (as Zn disodium EDTA), 10 mg manganese (**Mn**)/mL (as Mn disodium EDTA), and 5 mg selenium (**Se**)/mL (as sodium selenite). Previous research data suggest that Multimin®90 injection improves the Cu and Se status of trace mineral-adequate steers through at least 15 d post-injection. The objective of this study was to examine the effects of Multimin®90 injection on performance in steers with adequate or moderately deficient trace mineral status after a stressful shipping event.

Materials and Methods

Depletion period. Forty steers (mean BW = 712 lbs) were stratified by weight and assigned randomly to one of two treatments: 1) a corn silage-based diet supplemented with NRC recommended concentrations of Cu, Mn, Se and Zn (**CON**), or 2) a corn silage-based diet not including supplemental Cu, Mn, Se or Zn, and supplemented with iron and molybdenum as dietary trace mineral antagonists (**DEF**). Steers were weighed every 28 d throughout the depletion period, and two-day consecutive weights were taken on d 83 and 84 of the depletion period.

Shipping period. Steers were loaded onto a tractor-trailer on d 88, and shipped for 20 h. Steers were received back at the Beef Nutrition Research Center on d 89, and two-day consecutive weights were taken on d 90 and 91. These weights were compared with weights from days 83 and 84 to calculate shipping ADG.

Repletion period. On d 91 an equal number of steers from both the CON and the DEF steers were injected with sterilized saline (**SAL**) or Multimin®90 (**MM**) at a dose of 1 mL/150 lb BW. Steers were all fed a common finishing diet (50% ground corn, 20% DDGS, 15% corn silage, 10% soyhull pellets) supplemented with Cu, Mn, Se and Zn at NRC recommended concentrations for the 90 d repletion period. Steers were weighed on days 181 and 182, harvested at Tyson Fresh Meats (Denison, IA) and carcass data were collected.

ADG was calculated from 2 d consecutive weights at the beginning and end of each period. ADG and carcass data were analyzed using the MIXED procedure of SAS including the random effect of steer and the fixed effects of diet for the depletion and shipping periods, and the fixed effects of both diet and injection for the repletion period (SAS Institute Inc., Cary, NC). Body weights were analyzed as repeated measures, also using the MIXED procedure of SAS.

Results and Discussion

Depletion period. During the depletion period there was no difference between cattle fed the CON or the DEF diet in BW ($P = 0.86$) or ADG ($P = 0.74$; Figure 1). These results indicate that the moderate mineral deficiencies (mineral data not shown in this report) induced in DEF cattle were not enough to decrease performance during the 90 d depletion period.

Shipping period. Steers on the DEF diet lost significantly more weight during the shipping period than steers on the CON diet ($P = 0.02$; Figure 1), suggesting that trace minerals may have a protective effect during a stressful event such as shipping. Trace minerals are needed for a proper immune response and are excreted in higher amounts during stress.

Repletion period. Steers on the DEF diet that received the SAL injection had the smallest ADG, and gains were significantly lower than steers on the same diet that received the MM injection ($P < 0.05$; Figure 2). Steers on the DEF diet during the depletion period that received MM had the same ADG as steers on the CON diet ($P > 0.40$). There was a slight tendency for MM to improve ADG regardless of depletion period diet (*P* = 0.11; Table 1). These data indicate that a trace mineral deficient diet prior to the finishing period negatively impacts performance during the finishing period. However, treatment with an injectable mineral can alleviate these negative effects so that steers with trace mineral deficiencies perform as well as steers with adequate mineral status.

This trend was mirrored in the bodyweights taken every 28 d. Cattle on the DEF diet treated with SAL had significantly lower weights than the other treatment combinations ($P < 0.05$) and weighed 43 lb less than DEF steers treated with MM ($P < 0.01$) over the course of the 90 d period. There was a significant effect of MM on BW (*P* = 0.02; Figure 4) as steers injected with MM, regardless of previous diet, were an average of 25 lb heavier compared with those receiving SAL throughout the 90 d period.

Overall, MM improved steer performance of steers, and steers on the DEF diet that received MM performed as well as steers that were supplemented with trace minerals throughout the entire study.

Carcass Characteristics. Trace minerals are required for growth and have been shown to have variable effects on carcass characteristics. Previous research data demonstrated that supplemental Cu and Zn have the potential to increase yield grade (**YG**), rib eye area (**REA**), and MS.

Cattle that received the MM injection, regardless of depletion diet, had numerically greater HCW than cattle that received SAL (*P* = 0.13; Table 1). Supplemental Cu has been previously shown to have a positive effect on HCW, although other supplemental minerals have shown no effect.

There was a significant diet by injection interaction on backfat thickness and YG, as steers on the CON diet during the depletion period that received SAL

had a greater backfat thickness and YG than cattle on the same depletion period diet that received MM, while backfat thickness and YG of cattle on the DEF diet did

not differ, regardless of receiving MM or SAL. Given the small number of animals used in this study it is unclear why CON + SAL cattle achieved a greater degree of finish compared to others in this study.

There was a slight tendency for MM to increase REA in steers, regardless of depletion phase diet. Greater animal numbers will be needed to further elucidate the potential impact of injectable trace minerals on REA.

Interestingly, steers receiving the DEF diet prior to repletion had significantly lower MS than CON steers, suggesting that trace minerals are important in the development of intramuscular fat. Injection had no effect on marbling.

In conclusion, steers with moderate trace mineral deficiencies had increased BW losses during shipping, and also had lower MS when compared with steers that received a trace mineral adequate diet during the depletion period. Multimin®90 injection improved ADG and HCW of moderately trace mineral deficient steers during the repletion period. Overall, injectable minerals improved steer performance, and improved carcass characteristics in moderately trace mineral deficient animals.

Acknowledgements

The authors wish to thank Multimin USA, Inc. for the funding of this project, and the farm staff at the Iowa State University Beef Nutrition Research Farm for their help.

Table 1. Effect of trace mineral adequate or deficient diet and injectable mineral on growth and carcass characteristics.

Diet	CON		DEF		SEM	*P*-value		
Injection	SAL	MM	SAL	MM		Diet	Injection	D*I
HCW, lb	747.4	760.0	739.0	774.5	15.41	0.84	0.13	0.46
DP, %	62.2	62.8	63.3	63.1	0.65	0.32	0.76	0.56
YG	3.28	2.91	2.98	3.11	0.11	0.64	0.29	0.03
REA, in	12.12	12.34	12.13	12.58	0.23	0.59	0.16	0.62
KPH	2.55	2.15	2.3	2.35	0.13	0.85	0.20	0.10
Backfat, in	0.53	0.42	0.44	0.49	0.033	0.82	0.40	0.02
MS	602	588	509	550	21.4	<0.01	0.53	0.21

Figure 1. Average daily gain during the depletion and shipping periods; asterisks denote differences between injection (*P* < 0.05).

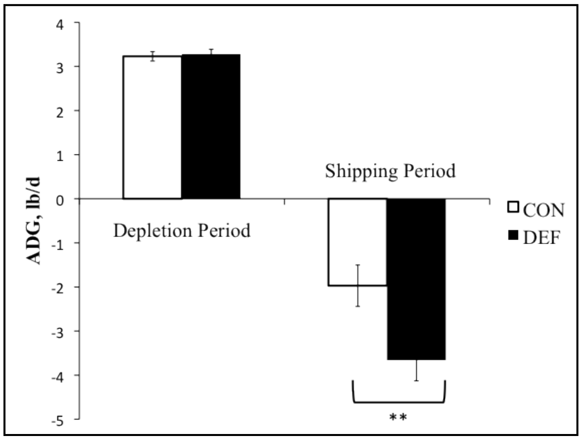

Figure 2. Average daily gain during the repletion period; asterisks denote differences between injection within the DEF diet (*P* < 0.05).

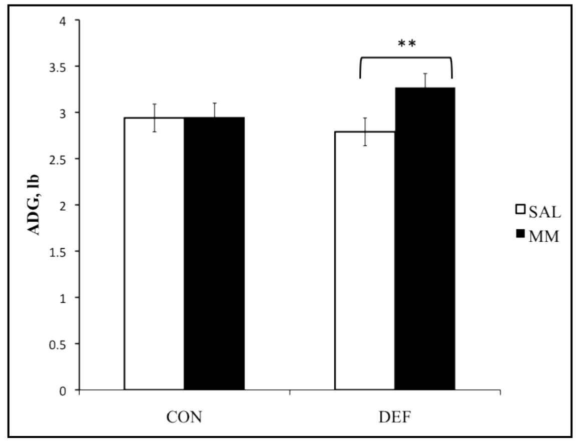

Figure 3. Body weights during the repletion period; injection (P < 0.05), diet x injection (P < 0.10).