TRACE MINERAL SUPPLEMENTATION OF CATTLE FED FINISHING RATIONS

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Story in Brief

Sixty one Angus x Hereford crossbred steers and heifers and 36 Holstein steers were used to evaluate trace mineral supplementation during the late finishing period. Trace mineral supplementation during the last 73 days on feed had no effect on the performance or carcass traits of the Angus x Hereford cattle fed from 960 pounds to slaughter. However, marbling score and percentage of cattle grading choice were improved for Holstein steers fed added trace minerals during the last 132 days on feed. Trace mineral supplementation did not affect hematocrit, plasma zinc or plasma copper levels.

(Key Words: Trace Minerals, Feedlot Cattle, Holstein, Marbling.)

Introduction

Feedlot rations usually are supplemented with protein, macrominerals, vitamins and feed additives to optimize animal performance; trace mineral supplementation often is overlooked. Compared to estimated trace mineral needs, typical corn, milo and wheat-based feedlot rations frequently are deficient in cobalt, iodine, copper, iron, manganese, zinc and selenium. Most feedlots rely on either a trace mineral supplement package or trace mineralized salt as their source of supplemental trace minerals. Sometimes an additional but separate selenium premix is added. A survey of trace mineral supplement packages and trace mineral salts commercially available revealed that most supplements do not provide appropriate levels of trace minerals to balance feedlot rations (Hicks and Owens, 1988). In some cases, inadequate levels of trace minerals were being supplemented, and in others excessive amounts were being provided. None of the trace mineral salts provided adequate amounts of all of the trace minerals. Few premixes or salts provided supplemental selenium.

This experiment was designed to test the response of both Holstein and beef cattle during the finishing period to supplemental trace minerals. The trace

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minerals were added to meet the NRC (1984) requirements for growing cattle. Feed intake, gain, carcass characteristics and blood measurements were recorded.

Materials and Methods

Thirty-six Holstein steers from the Oklahoma State University dairy unit, and 61 Angus x Hereford (AxH) cattle from a previous study were started on feed in June or July, 1988. The cattle were adapted to a corn finishing diet by gradually decreasing the roughage level. On July 22, cattle were weighed individually and divided into blocks according to body weight. The Holstein steers were allocated into three blocks of two pens each (six cattle per pen). The 52 AxH steers and 9 AxH heifers were divided into five blocks, four blocks of steers allocated by weight and one block of heifers. Animals within each block were allocated randomly to two pens, one pen receiving the control treatment and one pen receiving the same diet with supplemental trace minerals. All cattle had ad libitum access to feed in self feeders.

The diet composition is shown in Table 1. The supplemental trace mineral package added 20.8 ppm manganese from manganous oxide, 31.2 ppm zinc from zinc oxide, 5.2 ppm iron from ferrous sulfate, 3.12 ppm copper from copper sulfate, .21 ppm iodine from EDDI, .65 ppm cobalt from cobalt sulfate, and .104 ppm selenium from sodium selenite to the diet dry matter.

The AxH cattle were shipped to slaughter in two groups. Forty head of these cattle from six pens of steers of the heaviest weight blocks, and several steers from each of the other two pens, were shipped 75 miles to Booker, TX on September 29. The remaining AxH steers and heifers were shipped to the same plant on November 1. All Holsteins were shipped to Wellington, KS and slaughtered on December 5.

Table 1. Composition of diets on an as-fed basis.

Ingredient	Ration composition, %
Rolled corn	80.87
Alfalfa pellets	3.91
Cottonseed hulls	4.88
Supplement[a]	6.24
Molasses	4.10

[a] Supplement composition: soybean meal 44.88%, cottonseed meal 31.26%, calcium carbonate 11.73%, salt 4.36%, urea 5.76%, Vitamin A, Vitamin E, Rumensin and Tylan.

On October 20, blood samples were obtained from three cattle in each of the ten pens remaining (six pens of Holsteins, four pens of AxH cattle).

The data were analyzed within breed by analysis of variance. Means were compared using the Duncan's multiple range test.

Results and Discussion

Beef Cattle

Average daily gain, feed intake, and feed efficiency were not significantly affected by trace mineral treatment (Table 2). Trace mineral requirements probably are higher for younger, rapidly growing animals than for cattle like ours, which started receiving the supplement at 960 lb near the end of the finishing period. A significant response to trace mineral treatment would not be expected to occur during the last two months on feed unless cattle are deficient.

Carcass characteristics were not significantly altered by trace mineral treatment (Table 3). There was a trend toward an increased marbling score, fat thickness, and yield grade with trace mineral supplementation.

Limited blood data from the AxH cattle indicated that these animals had adequate levels of plasma copper and zinc (Table 4). Treatment did not affect blood measurements. The mean plasma copper level was 1.08 ppm in both groups, with values ranging from .94 to 1.38 ppm for controls, and .94 to 1.30 ppm for trace mineral treated cattle. Plasma or serum copper levels between .80 and 1.50 ppm are considered to reflect adequate copper status (Puls, 1981). Plasma zinc levels ranged from .90 to 1.25 ppm with a mean of 1.15 ppm for controls, and .95 to 1.30 ppm with a mean of 1.09 ppm for trace mineral treated cattle. Normal levels are .7 to 1.4 ppm for plasma zinc. Hematocrit was 38.8% for controls and 41.0% for the trace mineral treatment, indicating iron status was adequate.

Holstein Cattle

Growth, intake and feed efficiency also were not significantly affected by trace mineral treatment (Table 2). However, trace mineral treatment tended to increase feed intake and weight gains, and reduce feed required per lb of gain. As with the AxH cattle, there was a tendency toward increased fat thickness and ribeye area with trace mineral supplementation (Table 3). Marbling score was increased from 11.47 to 12.90 ($P<.05$), and the percentage of cattle grading choice was increased from 41.2 to 68.4%.

Blood measurements were not affected by treatment (Table 4). Hematocrit levels of Holsteins were lower ($P<.05$) than for AxH cattle (32.8 vs 40.0%,

Table 2. Effects of trace mineral supplementation on steer performance.

Breed	Angus x Hereford		Holstein	
Item Treatment[a]	0	+	0	+
No. of pens	5	5	3	3
No. of animals	30	30	17	19
Avg. days fed	73	73	132	132
Weight, lb				
Initial	953	968	764	759
33 days	1052	1073	857	856
64 days	1165	1175	955	967
92 days	1187	1202	1054	1076
110 days			1136	1162
132 days			1188	1213
Gain, lb/day	3.27	3.20	3.20	3.44
Intake, lb/day[b]	20.20	20.59	21.96	23.20
Feed/Gain[b]	6.37	6.73	7.31	6.84

[a] 0 is control diet; + is trace mineral supplemented diet.
[b] As-fed basis.

Table 3. Effects of trace mineral supplementation on carcass characteristics.

Item	Breed	Angus x Hereford		Holstein	
	Treatment[a]	0	+	0	+
Carcass weight, lb		746	758	693	707
Dressing percentage		62.8	63.0	58.3	58.3
Fat thickness, in					
measured		.44	.47	.20	.23
adjusted		.49	.51	.25	.28
KPH[b], %		1.95	1.96	2.13	2.08
Ribeye area, in^2		12.67	12.81	10.89	11.23
Marbling score[c]		14.77	15.48	11.47[d]	12.90[e]
USDA yield grade		2.89	2.94	2.70	2.70
Choice, %				41.2	68.4

[a] 0 is control diet; + is trace mineral supplemented diet.
[b] KPH-Kidney, heart and pelvic fat.
[c] Slight minus=10; small minus=13; modest minus=16.
[d,e] Means in the same row for the same breed with different superscripts differ (P<.05).

Table 4. Effect of trace mineral treatment on plasma copper and zinc and on hematocrit.

Item	Breed	Angus x Hereford		Holstein	
	Treatment[a]	0	+	0	+
No. of animals		6	6	9	9
Plasma copper, ppm					
Mean		1.08	1.08	1.06	.94
Range		.94-1.38	.94-1.30	.76-1.30	.80-1.18
Plasma zinc, ppm					
Mean		1.15	1.09	1.11	1.04
Range		.90-1.25	.95-1.30	.80-1.39	.80-1.35
Hematocrit, %					
Mean		38.8	41.0	31.9	33.7
Range		35.0-47.0	38.0-44.0	27.0-36.0	28.0-38.0

[a] 0 is control diet; + is trace mineral supplemented diet.

respectively). Plasma levels of copper and zinc tended to be lower in Holsteins than in the AxH cattle. Some of the Holsteins in the unsupplemented group had marginal plasma copper levels (.76 to .80 ppm) compared to copper considered indicative of adequate copper status (.8 to 1.5 ppm).

Some of the cattle finished in feedlots are Holstein cattle. Usually marketed with less external fat than other breeds, this often reduces their marbling score and quality grade. Studies with zinc methionine, a chelated zinc source, have shown a marbling response in cattle. This study indicates that supplementation of trace minerals to NRC levels with common trace mineral sources also may improve marbling and fat deposition in cattle. Effects of trace mineral supplementation on performance were not conclusive, but considering the small costs involved and the risks involved with deficiencies, routine supplementation at NRC levels is recommended.

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