BEEF CATTLE RESEARCH UPDATE

Britt Hicks, Ph.D., PAS
Area Extension Livestock Specialist
Oklahoma Panhandle Research & Extension Center

April 2017

Effect of Trace Mineral Supplementation at NRC or Industry Concentrations with or Without Growth Implants on Feedlot Performance

Trace minerals are essential for skeletal growth and muscle accretion. Over the last several years, the beef industry has been genetically selecting for maximum growth (through the use of growth EPDs). As a result, the type of cattle being fed today have more growth potential than cattle fed years ago which might increase trace mineral requirements. However, trace mineral feeding recommendations for cattle have changed little in the past 40 years when comparing suggested requirements from the 1976 vs. the 2016 Beef Cattle NRC.[1,2] Current 2016 NRC recommendations for trace minerals will prevent deficiency, but may not optimize performance. A 2015 survey of consulting feedlot nutritionists found that trace minerals are often fed at concentrations 25-300% greater than NRC recommendations (Table 1).[3] In the survey, the majority of the consulting nutritionists considered only the partial value of the trace mineral concentrations in the basal diet or did not consider trace minerals in the basal diet when formulating diets for feedlot cattle. Thus, the recommended trace mineral concentrations in this survey were expressed as the concentration of added minerals rather than the concentration of total trace minerals provided in the diet.

Table 1. Trace mineral recommendations (ppm) in finishing cattle diets reported by NRC and consulting feedlot nutritionists.

Trace mineral, ppm	NRC[a]	Survey Mean[b]	Survey Mode[b]
Copper	10	17	20
Zinc	30	87.3	100
Manganese	20	47.9	50
Selenium	0.10	0.24	0.30
Cobalt	0.15	0.82	0.20
Iodine	0.50	0.73	0.50

[a]Recommendations from 2016 Beef NRC expressed as concentration of total minerals.
[b]Recommendations from survey expressed as concentration of added minerals.

Growth promoting Implants are routinely used in the finishing phase of beef production to improve animal performance and feed efficiency. Data collected during the USDA's National Animal Health Monitoring System's Feedlot 2011 study showed that about 94% of heifers and steers were implanted at least once in the feedyard.[4] Research has shown that implanting in the feedlot on average increases average daily gain (ADG) by 16 to 20% and improves feed conversion by 6 to 14% compared with non-implanted controls with the greatest improvements in performance seen with combination implants.[5,6]

Due to these changes in cattle growth potential, Iowa State University research evaluated the effects of trace mineral supplementation on the growth and carcass characteristics of feedlot cattle receiving or not receiving implants.[7] This trial used 72 Angus-cross steers (initial weight = 854 lb) blocked by body weight (12 pens with 6 steers per pen) fed 124 days. Steers were either not implanted or were implanted with Component® TE-IS (contains 16 mg of estradiol, 80 mg of trenbolone acetate and 29 mg of tylosin tartrate; Elanco Animal Health) on day 0 and reimplanted on day 56 with Component® TE-200 (contains 20 mg of estradiol, 200 mg of trenbolone acetate and 29 mg of tylosin tartrate; Elanco Animal Health). Within implant treatments, the steers were assigned to one of three trace mineral treatments: 1) No supplemental trace minerals (Control), 2) NRC recommendations, or 3) Feedlot consultant recommendations (used most frequently reported concentration from survey, mode, expressed as concentration of total minerals). All supplemental trace minerals were provided from inorganic sources.

The effects of growth implants and trace mineral supplementation on feedlot performance and carcass characteristics are shown in Tables 2 and 3, respectively. There were no implant x trace mineral supplementation interactions for any of the feedlot performance measures or hot carcass weight. However, there were implant x trace mineral supplementation interactions for ribeye area (P = 0.02) and yield grade (P = 0.01). Since, these interactions did not affect the overall results, I chose to show only the main effect means for the implant and trace mineral treatments in these tables.

As was expected, the use of growth implants increased (P < 0.001) final body weight (BW), ADG, dry matter intake (DMI), and hot carcass weight by 10.4, 35.6, 11.9, and 11.8%, respectively. In addition, feed efficiency was improved (P < 0.001) by 18.0%.

Table 2. Effect of growth implant on performance and carcass characteristics of feedlot steers.

Item	No Implant	Implant	P-value
Feedlot Performance			
Initial BW, lb	854	856	0.70
Final BW, lb	1230	1359	0.001
ADG, lb	2.98	4.04	0.001
DMI, lb/day	20.84	23.33	0.001
Feed/Gain	7.13	5.85	0.001
Carcass Traits			
Hot Carcass Weight, lb	789	882	<0.001
Dressing percent	64.4	64.9	0.35
Fat thickness, in.	0.59	0.54	0.18
Rib-eye area, sq. in.	12.4	13.60	<0.001
Yield Grade	3.51	3.30	0.12
Marbling Score[a]	523	503	0.53

[a]Marbling scores: slight: 300, small: 400, modest: 500, moderate: 600.

DMI was approximately 7 to 8% greater for steers fed supplemental trace minerals (P = 0.004; 21.02, 22.46, and 22.78 lb/day, for controls, NRC, and survey treatments, respectively). As a result, ADG tended (P = 0.07) to be approximately 6 to 9% greater for steers fed supplemental trace minerals. In addition, hot carcass weight was greater (P = 0.03) with trace mineral supplementation where steers fed the survey recommendations yielded heavier carcasses than control steers (822, 830, and 855 lb for controls, NRC, and survey treatments, respectively).

Table 3. Effect of trace mineral supplementation on performance and carcass characteristics of feedlot steers.

Item	Control	NRC	Survey	P-value
Feedlot Performance				
Initial BW, lb	857	856	853	0.84
Final BW, lb	1287	1289	1309	0.56
ADG, lb	3.34	3.55	3.65	0.07
DMI, lb/day	21.02	22.46	22.78	0.004
Feed/Gain	6.58	6.55	6.34	0.62
Carcass Traits				
HCW, lb	822	830	855	0.03
Dressing percent	64.0	64.7	65.4	0.14
Fat thickness, in.	0.53	0.55	0.63	0.14
Rib-eye area, sq. in.	13.15	12.90	12.90	0.57
Yield Grade	3.22	3.34	3.67	0.02
Marbling Score[a]	490	532	517	0.56

[a]Marbling scores: slight: 300, small: 400, modest: 500, moderate: 600.

In conclusion, these researchers concluded that growth implants remain a good return on investment and that a growth response due to trace minerals was observed regardless of implant

administration. Furthermore, the results suggest that current NRC trace mineral recommendations may not be adequate to optimize the performance of feedlot cattle.

---

[1] NRC. 1976. Nutrient requirements of beef cattle, 5th revised edition. National Academy Press, Washington, DC.

[2] National Academies of Sciences, Engineering, and Medicine. 2016. Nutrient Requirements of Beef Cattle, Eighth Revised Edition. Washington, DC: The National Academies Press.

[3] Samuelson, K. L., M. E. Hubbert, M. L. Galyean, and C. A. Löest. 2016. Nutritional recommendations of feedlot consulting nutritionists: The 2015 New Mexico State and Texas Tech University survey. Journal of Animal Science 94: 2648-2663.

[4] USDA-APHIS. 2013. The use of growth-promoting implants in U.S. Feedlots. USDA–APHIS–Veterinary Services, Fort Collins, CO. Available: http://www.aphis.usda.gov/animal_health/nahms/feedlot/downloads/feedlot2011/Feed11_is_Implant.pdf.

[5] Duckett, S. K. and S. L. Pratt. 2014. Meat science and muscle biology symposium—anabolic implants and meat quality. J. Anim. Sci. 92:3-9.

[6] Garmyn, A. J. and M. F. Miller. 2014. Meat science and muscle biology symposium—implant and beta agonist impacts on beef palatability. J. Anim. Sci. 92:10-20.

[7] Niedermayer, E. K., O. N. Genther-Schroeder, D. D. Loy, and S. L. Hansen. 2017. Effect of trace mineral supplementation at NRC or industry concentrations with or without hormone implants on growth and carcass characteristics of steers. In: 2017 Plains Nutrition Council Spring Conference, San Antonio, TX. p. 99-100 (Abstr.).