



EXTENSION
BEEF CATTLE RESEARCH UPDATE
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Effect of Zinc Supplementation on Feedlot Performance and Carcass Characteristics of Non-implanted and Implanted Feedlot Cattle

Zinc functions as an essential component of a number important enzymes and proteins in the body and has a vital role in protein synthesis.¹ In spite of substantial improvements in beef cattle growth due to genetic selection and the development of growth promoting technologies such as growth promoting implants and beta agonists, zinc recommendations have remained steady for over 40 years.^{1,2,3,4} The requirement for zinc in finishing cattle diets has been established at 30 ppm. However, a 2016 survey of consulting feedlot nutritionists showed that these nutritionists recommend added zinc levels (rather than total zinc) ranging from 34 to 130 ppm with a mean recommendation of approximately 87 ppm (mode of 100 ppm).⁵ This survey showed that supplementation of trace minerals observed across the beef industry are commonly 2 to 3 times the recommendations.^{1,5}

A 2018 Iowa State University study determined the effects of trace mineral supplementation and hormone implant strategy on growth and carcass characteristics of feedlot cattle.⁶ In this study, steers received growth-stimulating implants (implanted on day 0 with Component TE-IS and reimplanted day 56 with Component TE-200, Elanco, Greenfield, IN), or no implant. Trace mineral treatments (zinc, copper, manganese, selenium, and cobalt) included no additional trace mineral supplementation, supplementation at the national recommendations¹ from inorganic sources, and supplementation at 2 to 3 times recommendations (used values from feedlot consulting nutritionist survey).⁵ In this study, regardless of implant status, trace mineral supplementation at 2 to 3 times recommendations improved gain and hot carcass weight over non-supplemented trace mineral cattle and cattle supplemented at recommend levels. Due to feeding elevated concentrations of multiple trace minerals simultaneously, it is difficult to determine the growth performance enhancing effects of individual trace minerals from this study. However, due to the role zinc plays in growth, and numerous other physiological and biochemical pathways, Iowa State University researchers conducted follow up studies to specifically look at zinc supplementation.

In a 169-day study, 208 Angus-cross heifers (642 lb) were used to examine the effects of implant strategy and zinc supplementation on growth and mineral status of heifers.⁷ The study included two implant strategies (Merck Animal Health, Madison, NJ): extended-release Revalor-XH on day 0 or Revalor-200 on days 0 and 91 and two supplemental zinc (zinc sulfate) strategies: 30 ppm (national recommendations) or 100 ppm (industry recommendations). A corn silage-based diet was fed during a 56-day growing period followed by transition to a corn-based finishing diet.

These researchers reported that heifers implanted with Revalor-200 had greater average daily gain (ADG) from days 0-28 and 91-120, while Revalor-XH heifers gains peaked during days 56-91 (implant x time; $P = 0.02$), corresponding to likely periods of greatest hormone payout from each implant. Hot carcass weight, dry matter intake, carcass-adjusted ADG, and feed efficiency were not different between implant strategies ($P \geq 0.18$). Steers fed 100 ppm zinc tended to be heavier on day 91 ($P = 0.06$) and were heavier on day 120 ($P = 0.05$) than steers fed 30 ppm zinc. However, final body weight did not differ due to zinc ($P = 0.37$). These authors concluded that the similar performance between implant strategies and superior performance during peak hormone payout by heifers supplemented with 100 vs. 30 ppm zinc suggested that increased zinc may support rapid growth.

Another study determined the effects of increasing supplemental zinc levels within implant strategy on performance, carcass characteristics, and zinc status of feedlot steers.⁸ In this study, 128 Angus-cross steers (1085 lb) were fed one of four supplemental zinc levels (0, 30, 100, or 150 ppm) from

zinc sulfate) and either not implanted or implanted with Component TE-200 on day 0. The cattle were stratified by bodyweight (BW) to GrowSafe (electronic feed bunks that measure individual intakes) equipped pens of 5 or 6 steers and assigned to pen-wide treatments (16 steers/treatment). The steers were weighed on days -1, 0, 18, and 59 with blood collected on days -1, 18, and 40.

These researchers reported that plasma zinc concentrations on days 18 and 40 linearly increased within both implant treatments ($P \leq 0.03$) and were lower for the implanted than the non-implanted steers on day 18 ($P = 0.001$). Zinc linearly increased ($P \leq 0.002$) BW on day 18 BW and ADG during the first 18 days. These results match those observed in a 2016 Iowa State University study in which steers fed a beta agonist (Optaflexx®, Elanco Animal Health) for the last 28 days of the feeding period linearly improved performance during this 28-day period due to increasing zinc supplementation up to 90 ppm (90 ppm added to control diet with 88 ppm zinc) while no performance response to zinc supplementation was observed within cattle not receiving Optaflexx.⁹ These two studies suggest that cattle experiencing high growth rates may respond to additional zinc supplementation indicating a greater demand for zinc.

These researchers also reported that within the implanted steers, zinc increased dressing percentage ($P = 0.01$) and tended to increase hot carcass weight ($P = 0.09$) linearly. In addition, carcass-adjusted final BW and overall ADG tended to increase ($P = 0.10$) linearly within the implanted steers with no zinc effects within the non-implanted cattle ($P \geq 0.18$). As would be expected, implanting increased carcass-adjusted final BW 29 lb over non-implanted steers ($P < 0.0001$). Overall feed efficiency quadratically increased within the non-implanted steers ($P = 0.01$) peaking at 100 ppm zinc with no observed zinc effects within either implant group for overall dry matter intake ($P \geq 0.15$). These authors concluded that these data “suggest implant-induced growth in steers may require dietary zinc above current national recommendations”.

In a recently published review, Iowa State University researchers noted that “although supplementation of zinc to cattle utilizing growth-promoting technologies has been proven advantageous, timing of zinc supplementation may be vital to capturing this growth response.” Peak payout of hormone from steroidal implants occurs within 40 days of implant administration¹⁰, resulting in a period with the greatest growth potential for the implanted animal. These studies suggest strategic supplementation of increased zinc during periods of peak hormonal payout or during other times of high growth rates may improve growth performance.

¹ National Academies of Sciences, Engineering, and Medicine. 2016. Nutrient Requirements of Beef Cattle, Eighth Revised Edition. Washington, DC: The National Academies Press.

² NRC. 1976. Nutrient Requirements of Beef Cattle, 5th ed.; Natl. Acad. Press, Washington, DC.

³ NRC. 1984. Nutrient Requirements of Beef Cattle, 6th ed.; Natl. Acad. Press, Washington, DC.

⁴ NRC 1996. Nutrient Requirements of Beef Cattle. 7th ed. Natl. Acad. Press, Washington, DC.

⁵ 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. *J. Anim. Sci.* 94:2648-2663.

⁶ Niedermayer, E. K., O. N. Genther-Schroeder, D. D. Loy and S. L. Hansen. 2018. Effect of varying trace mineral supplementation of steers with or without hormone implants on growth and carcass characteristics. *J. Anim. Sci.* 96:1159-1170.

⁷ Messersmith, E. M., E. Niedermayer, G. Crawford and S. L. Hansen. 2020. Effect of a single Revalor-XH or Revalor-200/Revalor-200 re-implant program and zinc supplementation on performance, carcass characteristics, and liver mineral of feedlot heifers. *J. Anim. Sci.* 98:133-133.

⁸ Messersmith, E. M. and S. L. Hansen. 2021. Increasing Concentrations of Supplemental Zinc Influence Performance, Carcass Characteristics, and Trace Mineral Status of Non-implanted and Implanted Steers. *J. Anim. Sci.* 99 (Suppl. 1):123 (Abstr.).

⁹ Genther-Schroeder, O. N., M. E. Branine and S. L. Hansen. 2016. The effects of increasing supplementation of zinc-amino acid complex on growth performance, carcass characteristics, and inflammatory response of beef cattle fed ractopamine hydrochloride. *J. Anim. Sci.* 94: 3389-3398.

¹⁰ Johnson, B.J., P.T. Anderson, J.C. Meiske, and W.R. Dayton. 1996. Effect of a combined trenbolone acetate and estradiol implant on feedlot performance, carcass characteristics, and carcass composition of feedlot steers. *J. Anim. Sci.* 74:363-371.