EXTENSION

BEEF CATTLE RESEARCH UPDATE
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Effects of Injectable Trace Minerals on Reproductive Performance of Beef Heifers in Adequate Trace Mineral Status

Forage surveys suggest that nearly all forages are deficient in one or more minerals and that there is a widespread occurrence of deficient levels of copper and zinc for beef cattle grazing forages. This is further complicated by the fact that the availability of minerals may be affected by the distribution and form of mineral in the feedstuff, as well as interactions with other minerals or dietary components that inhibit absorption or utilization of a given mineral. However, supplemental trace minerals delivered through injection bypass the gastrointestinal tract and dietary antagonists, making it an advantageous method by which to increase trace mineral status.[1] The use of injectable trace minerals has been shown to be beneficial in some studies and not in others. University of Nebraska research evaluated the use of an injectable trace mineral on the reproductive performance of range-developed beef heifers.[2]

This study used 799 Red Angus–based, May-born heifers at 2 locations. Following October weaning, heifers (426 lb) were backgrounded in a feedlot until reaching a body weight of BW of 650 lb and then moved to location 1 (125 heifers) or location 2 (286 heifers) in early March. An additional 388 heifers grazed corn residue with cows, weaned in April, and were backgrounded until reaching 650 lb and then transported to locations 1 and 2 in early June. Free-choice mineral was available at both locations. Initial mineral status was determined in a subset of heifers via liver biopsy in late June. Initial liver concentrations of copper, manganese, selenium, and zinc were adequate and not different among heifers at the two locations.

The heifers were synchronized in mid-July with a 14-day controlled internal drug-release (CIDR) timed artificial insemination (AI) protocol and either injected with trace minerals (MM, 399 head, 5 mL of Multimin 90; Multimin USA, Fort Collins, CO) or received no injection (Control, 400 head). Multimin 90 is an injectable trace mineral that contains 60 mg/mL of zinc, 10 mg/mL of manganese, 5 mg/mL of selenium, and 15 mg/mL of copper. Removal of CIDR occurred on day 14, and prostaglandin F2α was administered to heifers on day 30. Gonadotropin-releasing hormone was administered concurrently with fixed-time AI on day 33. Five days after AI, bulls were placed with the heifers on range for 60 days. Pregnancy diagnosis was determined via transrectal ultrasonography 61 and 91 days after AI. Bulls were still with heifers at the initial ultrasound.

The effects of an injectable trace mineral pregnancy rate in the heifers are shown in Table 1. The proportion of heifers pregnant within the first 21 days of the breeding season was not different between treatments (69 vs. 62% for CON vs. MM, P = 0.32;). The proportion pregnant within the first 33 days also did not differ (86 vs. 77% for CON vs. MM, P = 0.57). Since the bulls remained with heifers at the initial ultrasound; a second pregnancy diagnosis was performed 30 days later. Overall pregnancy rates did not differ between treatments (P = 0.38; 95 vs. 93 for CON vs. MM, P = 0.38).

Table 1. Effect of an injectable trace mineral on pregnancy rate in beef heifers.

Pregnancy Rate, %	CON	MM	P-value
First 21 days	69	62	0.32
First 33 days	86	77	0.57
Overall	95	93	0.38

Source: Springman et al., 2018.

These researchers concluded that an injectable trace mineral administered at CIDR insertion did not influence reproductive performance in heifers with adequate trace mineral status. They also noted that that "the available peer-reviewed literature suggests that there may be no benefit to using an injectable trace mineral before breeding if cattle have adequate status, but when using an injectable trace mineral to correct a deficiency before breeding, an improved conception rate may be observed".

Effect of Repeated Trace Mineral Injections on Beef Heifer Development and Reproductive Performance

In addition, injectable trace minerals offer an advantage compared to traditional oral supplement methods in that they provide a targeted delivery of a specific amount of trace minerals to individual animals eliminating the variability associated with fluctuation in voluntary intake noted among cattle provided free choice mineral.[3] University of Illinois research evaluated the effects of repeated trace mineral injections on beef heifer growth, mineral status, and reproductive development and performance.[4]

This study utilized 290 commercial Angus heifers (initially averaging 221 days of age and 439 lb). One-half of the heifers were administered an injectable trace mineral (Multimin 90) post-weaning at 221, 319, 401, and 521 average days of age. The remaining heifers (controls) received saline injections at the same ages. Throughout development, all heifers grazed endophyte-infected fescue and red clover pastures and were supplemented with corn distillers grains (6 lb per heifer per day) and given access to free choice inorganic minerals.

Heifer body weight and body condition scores (BCS) were collected at trial initiation and 4- to 7 week intervals thereafter. At 421 days of age, reproductive tract scores (RTS; 1 = immature to 5 = luteal phase) were assigned to all heifers and the heifers were estrous synchronized and bred via artificial insemination (AI) at 430 days of age. Ten days following AI, heifers were placed with cleanup bulls.

Heifer BW and BCS did not differ ($P \geq 0.27$) throughout development. Plasma manganese and zinc concentrations at breeding did not differ ($P \geq 0.54$) between treatments. However, Multimin injected heifers had greater ($P \leq 0.01$) plasma and liver concentrations of copper and selenium compared to Control heifers. Throughout development, the number of heifers cycling was lower ($P < 0.01$) for Multimin than Control heifers. However, there was no difference ($P \geq 0.19$) in reproductive tract scores, AI pregnancy rates (30 vs 37% for Multimin and Control, $P = 0.36$), or overall pregnancy rates (75 vs. 74% for Multimin and Control, $P = 0.78$).

These researchers concluded that repeated supplementation of an injectable trace mineral to developing heifers resulted in an increase in Cu and Se status. They noted "heifers administered the injectable trace mineral did have decreased attainment of cyclicity." However, this ultimately did not affect AI or overall pregnancy rates. These data suggest that additional mineral supplementation in the form of an injectable trace mineral may increase trace mineral status; however, no improvement in developing heifer performance or reproductive success was observed.

[1] Genther, O. N. and S. L. Hansen. 2014. A multielement trace mineral injection improves liver copper and selenium concentrations and manganese superoxide dismutase activity in beef steers. J. Anim. Sci. 92: 695-704.

[2] Springman, S. A., J. G. Maddux, M. E. Drewnoski, and R. N. Funston. 2018. Effects of injectable trace minerals on reproductive performance of beef heifers in adequate trace mineral status. Prof. Anim. Sci. 34: 649-652.

[3] Arthington, J. D., and C. K. Swenson. 2004. Effects of trace mineral source and feeding method on the productivity of grazing Braford cows. Prof. Anim. Sci . 20:155–161.

[4] Stokes, R. S., M. J. Volk, F. A. Ireland, P. J. Gunn, and D. W. Shike. 2018. Effect of repeated trace mineral injections on beef heifer development and reproductive performance. J. Anim. Sci. 96:3943-3954.