Effect of Injectable Trace Mineral on Reproductive Performance in Beef Heifers

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Summary with Implications

Trace minerals serve an essential role in regulating reproduction. Free-choice trace mineral supplementation is often provided to grazing beef cattle. An injectable trace-mineral solution used with free-choice trace minerals may be beneficial before breeding to improve mineral status. Therefore, Red Angus-based, May-born heifers were utilized to determine the effects of an injectable trace mineral on reproductive performance. Pregnancy rates did not differ between heifers injected with a trace mineral and heifers that received no injection. Injectable trace mineral at CIDR insertion 33 d before artificial insemination did not influence reproductive performance in heifers with adequate trace mineral status.

Introduction

Trace minerals serve an important role in many biochemical processes, including reproduction. Traditionally, grazing beef cattle are offered trace-mineral supplementation free-choice; however, trace-mineral intake can vary. Furthermore, dietary trace-mineral absorption may be reduced due to negative interactions with other nutrients during digestion. An injectable trace-mineral (ITM) solution used with free-choice trace minerals may be beneficial before breeding to increase mineral status. Heifers given an ITM in conjunction with a free-choice mineral supplement have shown an increase in conception rates to timed embryo transfer. Additionally, conception to fixed-time AI was greater in ITM cows when compared with saline-treated cows. Conversely, a more recent study noted no differences in reproductive performance of feedlot-developed heifers given an ITM 30 d prior to the breeding season when adequate concentrations of trace mineral were provided in the diet. Limited research has been conducted concerning the effects of an injectable trace mineral administered at CIDR insertion on reproductive performance of extensively-developed beef heifers. Heifers developed extensively represent those managed under dormant or scarce forage conditions, low precipitation, undulating terrain, or restricted-gain pen developed. Therefore, the objective of the current study was to determine if an injectable trace mineral at CIDR insertion affected reproductive performance of range-developed beef heifers.

Table 1. Composition and nutrient analysis of diet provided to heifers in the feedlot (DM basis)[1]

Ingredient	% of diet
Distillers grains	47.48
Silage	35.00
Straw	11.71
Grower Supplement	5.81
Nutrient Analysis	
CP, %	19.39
TDN, %	78.78

[1]Diet balanced to meet trace mineral NRC requirements

Table 2. Initial liver mineral concentrations of CON and MULTIMIN beef heifers

Item	Adequate Status	CON	MULTIMIN	SEM	*P*-value
n		13	9		
Initial Mineral					
Cu, ug/g	125–600	163	129	22	0.26
Mn, ug/g[1]	>8	9.09	9.35	0.13	0.80
Se, ug/g	1.25–2.50	1.56	1.52	0.38	0.61
Zn, ug/g	25–200	114	116	11	0.89

[1] Adequate status range not well established (Hansen et al., 2006).

Procedure

Red Angus-based, May-born heifers (n = 799) at 2 locations were utilized to determine the effects of an injectable trace mineral on reproductive performance. Heifers were managed at the Maddux ranch near Wauneta, NE. Following weaning in October, heifers were backgrounded in a feedlot (Table 1) until a body weight (BW) of 650 lb was reached and then moved to graze native range at location 1 (L1, n = 125) or location 2 beginning in early March (L2, n = 286). A subset of heifers (n = 388) grazed corn residue with cows over winter, weaned in April, and backgrounded in a feedlot until target BW of 650 lb was attained and then transported to L1 and L2 finishing in early June. Heifers were offered free-choice mineral at both locations. Initial mineral status was analyzed via liver biopsy prior to mineral treatment (677 lb, n = 22). Initial liver concentrations of copper (146 μg/g), manganese (9.22 μg/g), selenium (1.54 μg/g), and zinc (115 μg/g) were adequate and not different ($P > 0.26$) among heifers managed at the 2 overwinter locations (Table 2). Heifers were synchronized with a 14-d controlled internal drug release (CIDR)-prostaglandin $F_{2\alpha}$ protocol (Figure 1) and either injected with a trace mineral (5 ml, MULTIMIN, n = 399) or received no injection (CON, n = 400) the day of CIDR insertion. Fertile bulls were placed with heifers on range for 60 d following AI (1:17

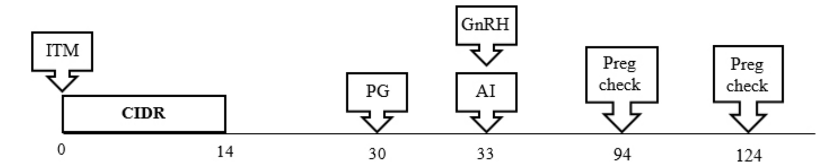

Figure 1. Experimental timeline for heifers. Heifers were administered an injectable trace mineral (ITM) or received no injection at controlled internal drug-releasing device (CIDR) insertion on d 0. On d 14, CIDR was removed, and prostaglandin $F_{2\alpha}$ (PG) was injected d 30. Gonadotropin-releasing hormone (GnRH) was administered concurrently with fixed-time AI on d 33. Pregnancy (Preg) was determined 61 d post-AI and 30 d following first pregnancy diagnosis.

Table 3. CON and MULTIMIN heifer pregnancy rates

Item	CON	MULTIMIN	SEM	*P*-value
n	400	399		
Pregnancy rate, %				
First 21 d	63	69	3	0.32
First 33 d	86	77	2	0.57
Overall	95	93	1	0.38

bull to heifer ratio). Pregnancy diagnosis was determined via transrectal ultrasonography 61 d post-AI and 30 d following first pregnancy diagnosis.

Pregnancy data were analyzed using the GLIMMIX procedure of SAS, while trace-mineral concentrations were evaluated with the MIXED procedure. Least square means and SE of the proportion of pregnant heifers by treatment were obtained using the ILINK function as pregnancy rate represents binomial distribution. Individual heifer was considered the experimental unit. Treatment and location were considered fixed effects. No interactions between treatment and location were observed. A *P*-value ≤ 0.05 was considered significant.

Results

The proportion of heifers pregnant within the first 21 d of the breeding season was not different ($P = 0.32$, Table 1) nor was proportion pregnant within the first 33 d ($P = 0.57$). Bulls remained with heifers at initial ultrasound; therefore, a second pregnancy diagnosis was performed 30 d later. Heifer BW at pregnancy diagnosis was 745 lb. Overall pregnancy rates were also similar ($P = 0.38$) between treatments. Previous research has indicated Cu and Se in the liver to remain elevated through d 30 post-injection. Therefore, if a difference in pregnancy rates transpired, it would most likely occur within the first 21 d of the breeding season. The data described above, however, coincides with a previous study conducted on black Angus heifers administered an ITM 30 d prior to the breeding season. In this particular study, conception rates and overall pregnancy rates did not differ between ITM and control heifers being fed adequate trace minerals in the diet. In summary, injectable trace mineral at CIDR insertion did not influence reproductive performance in heifers with adequate trace mineral status.

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