EVALUATION OF AN INJECTABLE TRACE MINERAL SUPPLEMENTS FOR BEEF CATTLE - EVIDENCE FROM WESTERN CANADA

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Introduction

Trace mineral supplementation is essential for metabolic function, growth, and reproduction in beef cattle (NASEM, 2016). Requirements vary by age and production stage, while forage mineral content depends on environmental factors. In western Canada, deficiencies are common, with inadequate copper (Cu) and selenium (Se) reported in 64% and 34% of cows, respectively (Waldner et al., 2023). These deficiencies are linked to reduced pregnancy rates and increased calf health issues (NASEM, 2016). Although free-choice supplementation is widely used, intake varies greatly among animals, leading to inconsistent mineral status. Injectable trace minerals (**ITM**) may provide a consistent and targeted supplement strategy.

This study aims to determine the effects of ITM on trace mineral status, reproductive performance, and calf growth under western Canadian conditions.

Study Site and Animal Management

Data were collected over three years (2021-2023) from a single cohort managed at the Forage & Cow-Calf Research & Teaching Unit and Termuende Ranch at University of Saskatchewan. Each year, multiparous and primiparous British cross-bred cows were stratified by age and body weight and assigned to injectable trace minerals (**ITM**; n≈100/yr) or control (**CON**; n≈100/yr) treatment groups (Wilcox et al., 2026). The ITM cows received MultiMin®90 (Axiota Animal Health, Fort Collins, CO, USA) at 1 mL per 90 kg 4wk pre-calving and 4wk pre-breeding plus inorganic granular 2:1 trace mineral, while CON cows received inorganic granular 2:1 mineral only. All cows had access to cobalt iodized salt. Breeding was by natural service, and standard health protocols were applied. Calves were processed at birth and vaccinated before turnout.

Cow and Calf Performance and Diets

Body condition score (BCS) was recorded, and blood samples were collected at pre-calving, pre-breeding, and pregnancy testing to determine serum mineral concentrations. Pregnancy was diagnosed 35 d after breeding. Calving date, sex, and birth weight (yr 2-3), as well as weaning weight and average daily gain were recorded. During summer, cows grazed rotationally managed mixed pastures, and treatments were commingled. In fall and winter, cows were managed as one group and fed according to National Academies of Sciences, Engineering, and Medicine (2016) guidelines, including crop residues, greenfeed, straw, and barley grain supplementation adjusted for production stage.

Results and Discussion

Mean serum mineral concentrations

Mean serum mineral concentrations were generally within normal reference ranges; however, copper (Cu) was frequently below adequacy in both ITM and CON cows (**Table 1**). Across treatments, cows were more frequently classified as Cu-deficient than for manganese (Mn), selenium (Se), or zinc (Zn). The ITM administration increased serum Cu at pregnancy testing compared with CON cows, but differences at pre-calving and pre-breeding were minimal. Serum mineral concentration varied over time, with Cu increasing from pre-calving to pre-breeding, while Se declined. Significant year effects were observed for all minerals.

Table 1. Effect of an injectable trace mineral supplementation on cow blood serum mineral concentrations

	Supplement[1]		
Minerals	CON (ppm)	ITM (ppm)	Difference[4]
Cu (≥ 0.6 ppm[2])			
Pre-calving	0.55	0.50	0.05
Pre-breeding	0.61	0.64	-0.03
Pregnancy testing	0.43	0.49	-0.06
% less than adequate[3]	62%	63%	1.03
Mn (≥ 0.006 ppm[2])			
Pre-calving	0.011	0.011	0.0005
Pre-breeding	0.011	0.013	-0.002
Pregnancy testing	0.008	0.008	-0.0001
% less than adequate[3]	14%	15%	OR: 0.86
Se (≥ 0.07 ppm[2])			
Pre-calving	0.126	0.137	-0.011
Pre-breeding	0.097	0.098	-0.001
Pregnancy testing	0.109	0.107	0.001
% less than adequate[3]	7%	7%	OR: 0.99
Zn (≥ 0.8 ppm[2])			
Pre-calving	1.21	1.16	0.05
Pre-breeding	1.35	1.27	0.08
Pregnancy testing	1.29	1.26	0.04
% less than adequate[3]	13%	13%	OR: 0.92

[1]Cows assigned for experiment CON = supplemented with granular 2:1 trace mineral; ITM = cows supplemented with granular 2:1 trace mineral and then trace mineral (MultiMin®90) was injected at 1 mL per 90 kg 4wk pre-calving and 4wk pre-breeding.
[2](Minimum adequate concentration).
[3]Classified using the minimum adequate values reported by Puls (1994).

Body weight, BCS and pregnancy rate did not differ between treatments (**Table 2**). Similarly, calf outcomes including birth weight, calving distribution, average daily gain, weaning weight, and mortality were not affected by ITM (**Table 3**).

Overall, ITM did not affect cow performance or calf growth outcomes compared with CON cows. Although the dataset included 565 cows and 369 calves, the ability to detect treatment effects was constrained by high baseline reproductive performance and generally adequate trace mineral status across both groups.

Trace mineral status at critical physiological stages likely explains the lack of response. While Cu deficiency was relatively common overall, mean serum Cu concentrations prior to breeding were adequate in both ITM and CON cows, representing the most important period for conception. In contrast, Mn, Zn, and Se concentrations were largely adequate throughout the study, with fewer than 15% of cows classified as deficient.

Consequently, the biological opportunity for ITM to enhance reproductive efficiency or calf growth was limited.

Table 2. Effect of an injectable trace mineral supplementation on cow performance and pregnancy rate

	Supplement[1]		
Item[2]	CON	ITM	Difference
Body weight, lb			
Pre-calving	1420	1424	-4.6
Pre-breeding	1373	1380	-6.4
Pregnancy testing	1351	1362	-11.2
Body condition score[3]			
Pre-calving	3.06	3.10	-0.04
Pre-breeding	2.99	3.03	-0.04
Pregnancy testing	2.82	2.83	-0.003
Pregnancy rate, %[4]	90.6	92.1	OR: 0.83

[1]Cows assigned for experiment CON = supplemented with granular 2:1 trace mineral; ITM = cows supplemented with granular 2:1 trace mineral and then trace mineral (MultiMin®90) was injected at 1 mL per 90 kg 4 wk pre-calving and 4 wk pre-breeding.
[2]The parameters that were collected at 4 wk pre-calving, 4 wk pre-breeding, and pregnancy testing.
[3]Body condition score (1 = emaciated; 5 = obese).
[4]OR – odds ratio.

Copper was of particular interest given its established role in fertility. Although ITM increased serum Cu at pregnancy testing, this was the only sampling point with a detectable treatment effect. Importantly, Cu concentrations remained below adequacy thresholds at both pregnancy testing and pre-calving in both groups. However, because Cu status was adequate during the pre-breeding period when conception occurs, subsequent differences were unlikely to influence reproductive outcomes.

Temporal variation in mineral concentrations was evident across the production cycle. Serum Cu increased from pre-calving to pre-breeding and declined by pregnancy testing, whereas Se showed the opposite pattern. These changes likely reflect variability in intake from free-choice supplementation combined with physiological adaptations during gestation. Year-to-year variation in Mn, Zn, and Se further suggests environmental or dietary influences (see Wilcox et al., 2026). However, no evidence was observed for a cumulative benefit of repeated ITM administration on overall mineral status.

Cow body condition and reproductive outcomes were consistent across treatments. Cows maintained moderate BCS throughout the study, and pregnancy rates were 92.1 and 90.6% for ITM and CON cows, respectively but did not differ. Similarly, calf performance, including growth rate and mortality, was unaffected by ITM. These findings indicate that when baseline herd productivity and mineral status are adequate, additional injectable supplementation provides limited measurable benefit.

Serum mineral concentrations were used as the primary diagnostic indicator due to their practicality in field conditions. However, serum reflects short-term homeostatic regulation and may underestimate marginal deficiencies, particularly for Cu and Zn. Liver mineral concentrations provide a more accurate estimate of body reserves but are less practical for large-scale field studies. Despite these limitations, the absence of production responses supports the conclusion that trace mineral status was not sufficiently limiting to elicit a biological response to ITM under the conditions of this study.

Table 3. Effect of an injectable trace mineral supplementation to gestating beef cows on calf performance

	Supplement[1]		
Item	CON	ITM	Difference[3]
Calf birth date, Julian date	117	119	-2.8
Calf birth weight, lb	79	80	-0.6
Calving distribution, % of total calves			
1 to 42 d	79.9	73.6	OR: 1.5
1 to 63 d	91.2	92.5	OR: 0.89
Average daily gain, lb/d[2]	2.31	2.31	0.0
Calf weaning weight, lb	443	439	5.3

[1]Cows assigned for experiment CON = supplemented with granular 2:1 trace mineral; ITM = cows supplemented with granular 2:1 trace mineral and then trace mineral (MultiMin®90) was injected at 1 mL per 90 kg 4 wk pre-calving and 4 wk pre-breeding.
[2]During birth to weaning (160 ± 20 d) period.
[3]OR = odds ratio.

Implications

Injectable trace mineral supplementation had no effect on cow reproductive performance or calf growth in herds with adequate trace mineral status and high baseline productivity. Benefits are more likely in herds with confirmed deficiencies or poor reproductive performance.

Future research should target at-risk herds and use more precise selection criteria. Overall, a double injection of trace mineral dose showed no measurable production advantage in this study.

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