



International Journal of Agriculture Extension and Social Development

ISSN Print: 2618-0723
ISSN Online: 2618-0731
NAAS Rating (2026): 5.04
IJAESD 2026; SP-9(9): 108-110
www.extensionjournal.com
Received: 20-07-2026
Accepted: 25-08-2026
Published: 29-09-2026

Sachin Pant
SMS-Veterinary Animal
Sciences, KVK, Champawat
(GBPUAT, Pantnagar),
Uttarakhand, India

Effect of chelated mineral mixture supplementation on productive and reproductive performance of crossbred cows

Sachin Pant¹

DOI: <https://www.doi.org/10.33545/26180723.2026.v9.i9Sb.4314>

ABSTRACT

The present study evaluated the effect of chelated mineral mixture supplementation on the productive and reproductive performance of crossbred cows under field conditions in Champawat district of Uttarakhand. Fifty crossbred cows aged 4–6 years were selected under the Front-Line Demonstration programme of Krishi Vigyan Kendra, Champawat, and divided into treatment and control groups comprising 25 animals each. The treatment group received chelated mineral mixture at 50 g/cow/day for 90 days, whereas the control group was maintained according to farmers' existing practices without mineral mixture supplementation. Daily milk yield was recorded, and peak milk yield, onset of first postpartum estrus, total lactation milk yield and benefit cost ratio were assessed. Data were analysed using Welch's independent-samples *t*-test. The mean daily milk yield was 5.628 ± 0.107 L in the treatment group compared with 4.069 ± 0.100 L in the control group. Peak milk yield was 5.830 ± 0.085 L in the treatment group and 4.740 ± 0.121 L in the control group. The onset of first postpartum oestrus occurred earlier in supplemented cows (76.240 ± 2.311 days) than in control cows (93.880 ± 4.179 days). Total lactation milk yield was also higher in the treatment group (1716.540 ± 32.732 L) than in the control group (1240.984 ± 30.556 L). All measured parameters differed significantly between groups ($P < 0.001$). The benefit–cost ratio was 2.80 in the treatment group compared with 2.30 in the control group. Under the field conditions of the present study, supplementation with chelated mineral mixture at 50 g/cow/day was associated with improved milk production, earlier onset of postpartum oestrus and higher economic returns in crossbred cows.

Keywords: Chelated mineral mixture, Crossbred cows, Milk yield, Peak milk yield, Postpartum oestrus, Lactation yield, Benefit–cost ratio, Uttarakhand

1. Introduction

India has a large livestock population, and dairy production is an important component of the rural economy. Dairy farming contributes substantially to agricultural livelihoods and provides an important source of income and food security for rural households (BAHS, 2021; Economic Survey, 2020–21) [1, 2].

Minerals are essential nutrients involved in a wide range of physiological and metabolic processes in dairy cattle. Adequate supplies of macro minerals and microminerals are required for maintenance, productive performance, reproductive function and overall animal health. The mineral content of soil, water and forage varies among geographical regions; consequently, dietary mineral supplementation may be necessary where basal diets do not provide sufficient quantities of essential minerals.

Mineral supplementation has been associated with improved milk production and reproductive performance in dairy cattle (Islam *et al.*, 2023; Sahoo *et al.*, 2017; Muwel *et al.*, 2020; Deka *et al.*, 2024) [3, 4, 5, 6]. Organic or chelated forms of minerals have also been investigated because binding minerals to organic compounds may influence their bioavailability. Previous studies have reported variable effects on milk production and milk composition, indicating the need for field-based evaluation under different production environments (Rabiee *et al.*, 2010; Singh *et al.*, 2016) [7, 8].

The present investigation was conducted as part of the Front-Line Demonstration programme of Krishi Vigyan Kendra, Champawat, to evaluate the effect of chelated mineral mixture supplementation on productive and reproductive performance and the economic outcome of crossbred cows under field conditions. The specific objective was to assess the effects of supplementation at 50 g/cow/day on daily milk yield, peak milk yield, onset of first postpartum oestrus, total lactation milk yield and benefit–cost ratio.

Corresponding Author:

Sachin Pant
SMS-Veterinary Animal
Sciences, KVK, Champawat
(GBPUAT, Pantnagar),
Uttarakhand, India

2. Materials and methods

2.1 Study population and management

A total of 50 crossbred cows aged 4–6 years were selected from different villages of Champawat district, Uttarakhand, under the Front-Line Demonstration programme of Krishi Vigyan Kendra, Champawat. The animals were maintained under a semi-intensive management system. Before commencement of the trial, all animals were dewormed with albendazole at 10 mg/kg body weight, 15 days before the start of the study.

The animals were divided into two groups of 25 cows each. The control group (C_1 – C_{25}) was managed according to farmers' existing practices without additional mineral supplementation. The treatment group (T_1 – T_{25}) received chelated mineral mixture at 50 g/cow/day for 90 days. The composition of the mineral mixture is presented in Table 1.

2.2 Measurements and observations

Daily milk yield was recorded for 90 days. The study includes recording average daily milk yield, peak milk yield, onset of first postpartum oestrus and total lactation milk yield. Economic performance was assessed using the benefit–cost ratio by estimating gross income divided by cost incurred.

2.3 Statistical analysis

Data were analysed using Welch's independent-samples *t*-test. Results are presented as mean $\pm$ standard error (SE). Mean differences were calculated as treatment minus control. All tests were two-sided, and $P < 0.05$ was considered statistically significant.

Table 1. Composition of Standard chelated mineral mixture per kg

S. No.	Ingredient	Quantity
1	Zinc	9,600 mg
2	Magnesium	6,000 mg
3	Iron	1,500 mg
4	Manganese	1,500 mg
5	Iodine	325 mg
6	Cobalt	150 mg
7	Potassium	100 mg
8	Sodium	5.9 mg
9	Calcium	25.50%
10	Phosphorus	12.75%
11	Nicotinamide	1,000 mg
12	Vitamin A	700,000 IU
13	Vitamin D3	70,000 IU

Table 2. Effect of chelated mineral mixture supplementation on productive and reproductive performance of crossbred cows

Parameter	Treatment ($n = 25$)	Control ($n = 25$)	Mean difference	<i>P</i> -value
Average daily milk yield (L/day)	5.628 $\pm$ 0.107	4.069 $\pm$ 0.100	1.559	< 0.001
Peak milk yield (L)	5.830 $\pm$ 0.085	4.740 $\pm$ 0.121	1.090	< 0.001
Onset of postpartum estrus (days)	76.240 $\pm$ 2.311	93.880 $\pm$ 4.179	–17.640	< 0.001
Total lactation yield (L)	1716.540 $\pm$ 32.732	1240.984 $\pm$ 30.556	475.556	< 0.001

3.5 Economic performance

The benefit–cost ratio was 2.80 in the treatment group compared with 2.30 in the control group. Previous studies have also reported favourable economic outcomes following mineral supplementation. Deka *et al.* (2024) [3] reported benefit–cost ratios of 2.32 and 1.71 in treatment and control groups, respectively, while Islam *et al.* (2023) [4] reported ratios of 2.01 and 1.87. Sivara and Bhuvaneswari (2019) [10] reported benefit–cost ratios of 2.76 and 3.36 in control and treat-

3. Results and discussion

The effects of chelated mineral mixture supplementation on daily milk yield, peak milk yield, onset of first postpartum oestrus and total lactation milk yield are presented in Table 2.

3.1 Daily milk yield

The mean daily milk yield was 5.628 $\pm$ 0.107 L in the treatment group and 4.069 $\pm$ 0.100 L in the control group. Thus, the supplemented group produced 1.559 L/day more milk than the control group, corresponding to a 38.32% higher mean daily yield. The difference was statistically significant ($P < 0.001$). The present finding is consistent with earlier reports of increased milk production following mineral supplementation in dairy cattle (Sahoo *et al.*, 2017; Muwel *et al.*, 2020; Deka *et al.*, 2024) [3, 5, 6]. Minerals such as calcium and phosphorus are important components of milk and are involved in physiological processes associated with milk secretion.

3.2 Peak milk yield

Mean peak milk yield was 5.830 $\pm$ 0.085 L in the treatment group compared with 4.740 $\pm$ 0.121 L in the control group. The mean difference was 1.090 L and was statistically significant ($P < 0.001$). The higher peak yield observed in supplemented cows is consistent with previous reports describing improved productive performance following mineral supplementation.

3.3 Onset of first postpartum oestrus

The mean interval from calving to first postpartum oestrus was 76.240 $\pm$ 2.311 days in the treatment group and 93.880 $\pm$ 4.179 days in the control group. The treatment group therefore showed an earlier onset of postpartum oestrus by 17.640 days, with a statistically significant difference ($P < 0.001$). Similar effects of mineral supplementation on reproductive traits in crossbred cattle have been reported by Gupta *et al.* (2017) [9], Sivara *et al.* (2019) [10], Singh *et al.* (2020) [11], Lalhruaipui *et al.* (2023) [12] and Deka *et al.* (2024) [3]. The earlier onset of postpartum oestrus may indicate improved reproductive efficiency; however, inter-calving interval was not directly measured in the present study.

3.4 Total lactation milk yield

Total lactation milk yield was 1716.540 $\pm$ 32.732 L in the treatment group and 1240.984 $\pm$ 30.556 L in the control group, giving a mean difference of 475.556 L ($P < 0.001$). The higher lactation yield observed in supplemented cows is in agreement with findings reported by Singh *et al.* (2023) [13] and Deka *et al.* (2024) [3]. Values are presented as mean $\pm$ standard error (SE). Mean difference = treatment – control. *P*-values were obtained using Welch's independent-samples *t*-test (two-sided). $P < 0.05$ was considered statistically significant. Abbreviations: SE, standard error; n, number of cows.

ment groups, respectively. The present results indicate that mineral supplementation may provide an economically favourable intervention under the field conditions evaluated in this study.

4. Conclusion

Under the field conditions of Champawat district, supplementation with chelated mineral mixture at 50 g/cow/day for 90 days was associated with higher daily milk yield, higher peak milk yield, earlier onset of first postpartum oestrus and higher total lactation milk yield in

crossbred cows compared with cows managed according to farmers' existing practices. The treatment group also showed a higher benefit–cost ratio. These findings indicate the potential value of chelated mineral mixture supplementation as a field-level nutritional intervention for improving productive and reproductive performance of crossbred dairy cows. Further studies with larger sample sizes, detailed dietary characterization and standardized economic calculations are warranted to confirm these effects across different production systems.

References

1. Department of Animal Husbandry and Dairying, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India. Basic Animal Husbandry Statistics. New Delhi; 2021.
2. Ministry of Finance, Government of India. Economic Survey (2020–21). New Delhi; 2021.
3. Deka D, Dutta LJ, Ali A, Deka I, Islam M, Saikia AK, Neog M, Saud RK, Sarma UJ. Effect of area specific mineral mixture on milk yield and reproductive performances in crossbred cows. *Indian Journal of Hill Farming*. 2024;37(1):88–92.
4. Islam MRU, Shafi M, Naikoo M, Yatoo MA. Effect of dietary supplementation of mineral mixture on milk yield in crossbred dairy cows. *Indian Journal of Veterinary Science and Biotechnology*. 2023;19(2):99–100.
5. Muwel N, Mondal M, Choudhar S, Karunakaran M, Ghosh MK. Effect of area specific mineral mixture feeding on reproductive performance and milk yield in crossbred cattle reared under intensive farm condition. *Journal of Animal Research*. 2020;10(5):771–775.
6. Sahoo B, Kumar R, Garg AK, Mohanta RK, Agarwal A, Sharma AK. Effect of supplementing area specific mineral mixture on productive performance of crossbred cows. *Indian Journal of Animal Nutrition*. 2017;34(4):414–419.
7. Rabiee AR, Lean IJ, Stevenson MA, Socha MT. Effects of feeding organic trace minerals on milk production and reproductive performance in lactating dairy cows: a meta-analysis. *Journal of Dairy Science*. 2010;93:4239–4251.
8. Singh S, Chhabra S, Singh C, Randhawa SS, Gupta DK. Effect of area specific mineral mixture feeding on milk yield and composition of dairy animals of central zone of Punjab. *International Journal of Livestock Research*. 2016;6(3):62–65.
9. Gupta R, Singh K, Kumar M, Sharma M. Effect of supplementation of minerals on the productive and reproductive performance of crossbred cattle. *International Journal of Livestock Research*. 2017;7:231–236.
10. Sivara S, Bhuvaneswari B. Assessment of area specific mineral mixture supplementation. *International Journal of Research and Analytical Reviews*. 2019;6(2):546–549.
11. Singh NM, Tripathi AK, Saikia R, Medhi K, Gogoi SK, Gogoi P. Effect of area specific mineral mixture supplementation on milk yield and reproductive traits of crossbred dairy cattle under sub-tropical region of North Eastern India. *International Journal of Chemical Studies*. 2020;8(6):2239–2243.
12. Lalhruiipuii, Singh NM, Leitanthem VK, Shakuntala I. Effect of dietary supplementation of mineral mixture on production and economic performance for small holder dairy farming in Kolasib district of Mizoram. *The Pharma Innovation Journal*. 2023;12(3):2309–2312.
13. Singh D, Gupta L, Singh G, Chundawat DS, Kumar D, Kumar D. Impact assessment of mineral mixture feeding on the productive and reproductive performance of dairy animals. *The Pharma Innovation Journal*. 2023;12(11):255–261.
14. Somvanshi SPS, Gupta R. Effect of supplementation feeding probiotics and mineral mixture in crossbred dairy cows. *Bulletin of Environment, Pharmacology and Life Sciences*. 2018;7:11–13.

How to cite this article: Pant S. Effect of chelated mineral mixture supplementation on productive and reproductive performance of crossbred cows. *International Journal of Agriculture Extension and Social Development*. 2026;SP-9(9):108-110. doi: <https://www.doi.org/10.33545/26180723.2026.v9.i9Sb.4314>