



Effect of area specific mineral mixture on milk yield and reproductive performances in crossbred cows

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ABSTRACT

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The present investigation was aimed to study the impact of AAUVETMIN, an area specific mineral mixture supplement, on milk yield of crossbred dairy cattle in Baksa district, Assam. A total of 120 crossbred cows in their 1st to 2nd lactation phases were selected for the experiment in six different villages under Front Line Demonstration programme of Krishi Vigyan Kendra, Baksa. In each village, cows were divided into control group consisting of 10 cows (C₁ to C₁₂), which were managed as farmers' practice d without any mineral mixture and treatment group with 10 cows (T₁ to T₁₂) that received area specific mineral mixture, AAUVETMIN @ 50 g/d/cow for 120 days. The average daily milk yield in treatment groups increased by 0.968 liter (21.53%). The peak yield and days to peak yield were found to increase by 0.972 liter (17.31%) and 11.69 days in treatment groups, respectively. The average onset of first post-partum estrus after calving was 46.083±1.018 days in treatment group compared to 57.183±0.948 days in control group. The average service period (days) was recorded as 58.550±1.052 and 85.467±0.780 in treatment and control groups, respectively. The average total lactation milk yield (litre) was recorded as 1616.833 ±4.100 and 1514.033 ±7.803 litre in treatment and control groups, respectively. The average total lactation length (days) was recorded as 297.283±1.941 and 294.933±1.958 in treatment and control groups, respectively. The benefit-cost (B: C) ratio for treatment and control group was recorded as 2.32 and 1.71, respectively in the present study emphasizing the economic advantage of mineral supplementation. The health condition of the cows was good during the study period. The findings of the present result suggest that inclusion of area specific mineral mixture as feed additive to the cows enhances their productivity and reproductive performances.

1. Introduction

Dietary supplementation of mineral mixture enhances the milk production of dairy animals and help in improving the socio-economic condition of the farmers to some extent (Islam *et al.*, 2023). Macro and micro minerals are vital inorganic compounds, essential for proper functioning of metabolic processes in animals. Mineral mixtures are

formulated blends containing all the necessary minerals in specific proportions and their supplementation is crucial for high-yielding dairy cows. This is especially important because the levels of various minerals in soil, water, and consequently in the fodder and forages, can vary significantly across different geographic regions. Due to these geographical variations, the mineral requirements for dairy

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animals also differ from one area to another. As a result, the supplementation of area-specific mineral mixtures plays a pivotal role in several aspects of animal health and performance, including maintenance, growth in young animals, improved gut health for more efficient nutrient absorption, strengthened immunity and enhanced productivity and reproductive performances. Area-specific mineral mixtures are formulated by carefully compounding and blending all the necessary mineral elements in the correct proportions to address or rectify deficiencies specific to a particular geographical region. When dairy farmers incorporate these area-specific mineral mixtures into their animal feed, they can significantly enhance the performance of their livestock, leading to a sustainable and profitable enterprise. Somvanshi and Gupta (2018) found gross return, net return and B: C ratio superior in improved practices of feeding Probiotics and Mineral Mixture. However, no significant difference was reported in milk lactose, milk protein, milk fat and milk SNF in earlier studies (Wu *et al.*, 2000; Sharma *et al.*, 2002; Rabiee *et al.*, 2010; Singh *et al.*, 2016). AAUVETMIN is an area-specific mineral mixture developed by Assam Agricultural University to address the variations in mineral content found in the state. This formulation is the result of extensive research, involving the mapping of minerals in soil, water, feed, fodder, and biological samples from livestock in different agro-climatic zones of Assam. In the present investigation, conducted as part of the Frontline Demonstration (FLD) program, the focus

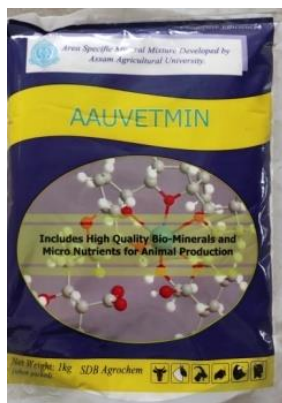
was on studying the impact of AAUVETMIN on various aspects of productive and reproductive performance in crossbred cows.

1. Materials and Methods

A total of 120 crossbred cows of 1st to 2nd lactation stages were selected for this investigation in six different villages of Baksa district, Assam under Front Line Demonstration programme of Krishi Vigyan Kendra, Baksa. The cows were managed under Intensive system of care. Before commencing the experiment, all animals of both treatment and control groups were de-wormed fifteen days prior to the start of the study with fenbendazole @ 10 mg/kg body weight. In each of the six villages, animals were divided into two groups, with 10 cows in each group. The cows of control groups (C₁ to C₁₂) were fed and managed as per farmers' practices without addition of any mineral mixture whereas the Treatment group (T₁ to T₁₂) cows received a supplementary feeding of AAUVETMIN @ 50 g/d/cow for a period of 120 days. The composition of AAUVETMIN mineral mixture is presented in Table 1. The daily milk yield of these animals was recorded in morning and evening for 120 days. Important parameters such as the peak milk yield, days to peak yield and lactation lengths were recorded. Data were analyzed by one way analysis of variance (ANOVA) and post hoc test was carried out for pair wise comparison of means (Snedecor and Cochran, 1989).

Table1. Composition of AAUVETMIN mineral mixture

Sl. No.	Mineral	Quantity (%)
1	Calcium	22.00
2	Phosphorus	12.00
3	Magnesium	3.50
4	Zinc	0.56
5	Copper	0.05
6	Sodium Chloride	20.77



2. Results and Discussion

Effects of feeding area specific mineral mixture on daily milk yield (litre), peak yield (litre), days to reach peak yield (days), onset of first post-partum estrus (days) after calving and service period (days) recorded in the present study have been documented in Table 2 and results of analysis of variance is presented in Table 3.

Effect on daily milk yield: In the study, the average daily milk yield of cows was found to be 5.464 ± 0.065 litres in treatment group and 4.496 ± 0.067 litres in control group. There was an increase of 0.968 litre (21.53%) in treatment group due to supplementation of area specific mineral mixture AAUVETMIN to crossbred cows. The results of the analysis of variance clearly demonstrated that the feeding of the area specific mineral mixture had a substantial and positive impact on daily milk yield. These findings align with previous studies conducted by Saxena *et al.* (2008), Tiwari *et al.* (2013), Singh *et al.* (2016), Sahoo *et al.* (2017) and Muwel *et al.* (2020), all of which reported increased milk production in dairy cattle through the supplementation of area-specific mineral mixtures. This increase can be attributed to the essential role played by mineral mixtures in the synthesis of milk components. Calcium and phosphorus are major constituents of milk, and their presence is crucial for milk secretion and overall dairy production.

Effect on peak yield and days to peak yield: The study revealed that the average peak yield of crossbred cows in the treatment group, which received supplementation of the area-specific mineral mixture AAUVETMIN, was 6.588 ± 0.083 liters, while in the control group, it was 5.616 ± 0.082 liters. This demonstrated a notable increase of 0.972 liters (17.31%) in peak yield among cows in the treatment group compared to those in the control group. Regarding the days to reach peak yield, the mean values were 34.440 ± 0.714 days in the treatment group and 46.133 ± 0.747 days in the control group. This indicates a significant advancement of 11.693 days in achieving peak yield for crossbred cows in the treatment group. This reduction in the time to peak yield resulted in a higher total milk yield. Result of analysis of variance indicated significant difference between treatment group and control group on peak yield and days to peak yield of crossbred cows. These findings highlight the positive impact of AAUVETMIN supplementation on these crucial aspects of milk production.

Effect on onset of first post-partum estrus (days) after calving: The average onset of the first post-partum estrus (in days) for crossbred cows after calving was recorded as 46.083 ± 1.018 days in the treatment group with

supplementation of area specific mineral mixture AAUVETMIN, while it was 57.183 ± 0.948 days in the control group. The analysis of variance clearly demonstrated a significant difference in the onset of the first post-partum estrus (in days) after calving between the crossbred cows in the treatment group and those in the control group under study. These findings are consistent with previous research conducted by Mohapatra *et al.* (2012), Gupta *et al.* (2017), Sahoo *et al.* (2017), Sivara and Bhuvaneshwari (2019), Singh *et al.* (2020) and Lalhruaipuii *et al.* (2023) in crossbred cattle. This difference indicates a shorter inter-calving period for cows in the treatment group, which can have significant implications for reproductive efficiency. The shorter inter-calving period observed may be attributed to the role of minerals in influencing the physiological changes associated with estrus and reproduction. Minerals play a crucial role in maintaining hormonal balance, which in turn affects the timing of post-partum estrus.

Effect on service period: The mean of service period of cows in both treatment group and control group along with result of post hoc test and analysis of variance are presented in Table 2 and Table 3, respectively. The average service period of crossbred cows in treatment group supplemented with area specific mineral mixture AAUVETMIN was recorded as 58.550 ± 1.052 and a service period of 85.467 ± 0.780 days was recorded in control group, which resulted from shorter post partum estrus period. The result of analysis of variance indicated that the service period of cows of treatment group was significantly shorter than the cows of control group. This corroborated with the findings of Singh *et al.* (2020) and Lalhruaipuii *et al.* (2023) in crossbred cows. This reduction in the service period observed in the treatment group can be attributed to the shorter post-partum estrus period, as indicated earlier.

Effect on total lactation milk yield and lactation length : The mean of total lactation yield (litre) and lactation length (days) of cows in both treatment group and control group along with result of post hoc test and analysis of variance are presented in Table 2 and Table 3, respectively. The average total lactation yield of crossbred cows in treatment group supplemented with area specific mineral mixture AAUVETMIN was recorded as 1616.833 ± 4.100 and in control group it was recorded as 1514.033 ± 7.803 litres. The average lactation length were found to be 297.283 ± 1.941 and 294.933 ± 1.958 days respectively of crossbred cows in treatment group supplemented with area specific mineral mixture AAUVETMIN and in control group. The result of analysis of variance indicated that the total lactation yield of cows of treatment group was significantly ($P < 0.01$) higher

than the cows of control group. This finding was also supported by Singh *et al.* (2023) in cattle. The lactation length did not differ significantly between the cows of treatment group and control group.

Benefit Cost ratio: Benefit-Cost ratio (B:C ratio) is a crucial metric for evaluating the economic impact of interventions in agricultural practices. In the present study, the calculated B:C ratio for the treatment group was 2.32, while for the control group, it was 1.71. Islam *et al.* (2023) estimated cost benefit ratio as 2.01 and 1.87, respectively in treatment and control group in an experiment on Effect of Dietary Supplementation of Mineral Mixture on Milk Yield in Crossbred Dairy Cow of Kashmir. Sivara and Bhuvaneshwari (2019) also calculated benefit cost ratio in milch cows as 2.76 and 3.36, respectively in control and treatment group feeding with area specific mineral mixture. The present result of cost benefit ratio

indicates that the supplementation or incorporation of area specific mineral mixture addresses the imbalances stemming out of deficient and disproportionate mineral content in feeds and fodder affecting profitability of the dairy farmers and helps to optimize farm income and sustainability.

3. Conclusion

The findings of the present study strongly support the supplementation of the area-specific mineral mixture AAUVETMIN in crossbred cows. This supplementation has been shown to enhance various aspects of dairy cow performance, including daily milk yield, peak yield, days to peak yield, onset of post-partum estrus period, and service period. These improvements not only result in better productivity but also enhance the profitability and sustainability of dairy farming for the benefit of farmers and the industry as a whole

Table 2. Mean and standard error (SE) and result of post hoc test on daily milk yield (litre), peak yield (litre), days to peak yield (days), onset of first post-partum estrus (days) after calving, Service period (days), total lactation milk yield (litre) and lactation length (days)

Animal groups/ Parameters	Daily milk yield (litre)	Peak yield (litre)	Days to peak yield (days)	Onset of first post-partum estrus (days) after calving	Service period (days)	Total lactational Yield (Litre)	Lactation Length (days)
Treatment	5.464 ^a ±0.065	6.588 ^a ±0.083	34.440 ^a ±0.714	46.083 ^a ±1.018	58.550 ^a ±1.052	1616.833 ^a ±4.100	297.283±1.941
Control	4.496 ^b ±0.068	5.616 ^b ±0.082	46.133 ^b ±0.747	57.183 ^b ±0.948	85.467 ^b ±0.780	1514.033 ^b ±7.803	294.933±1.958

Subclass means in a column with different superscripts differ significantly (P<0.05).

Table 3. Analysis of variance of daily milk yield (litre), peak yield (litre), days to peak yield (days), onset of first post-partum estrus (days) after calving and Service period (days)

Effect	df	Daily milk yield	Peak yield	Days to peak yield	Onset of first post-partum estrus (days) after calving	Service period	Total yield	Lactation length
		MS						
Treatment	1	28.1301**	28.3435**	4960.8736**	3696.30**	21735.208**	317035.2**	165.675
Error	118	0.2667	0.4462	32.2991	58.064	51.4727	2330.4768	227.9823

(**= P<0.01)

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