

# Preventing Ruminal Acidosis in Lactating Animals with Cation-Based Mineral Supplement

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## Abstract

The nutrition of dairy animals, especially during the prepartum and postpartum periods significantly affects their health, production and reproduction. Proper nutrition is essential to minimize negative energy balance, particularly during late lactation. Dairy animals with high genetic potential require high concentrate diets, but sudden changes from fodder to concentrates can lead to ruminal acidosis. This leads rumen pH drop and disrupts digestion and can cause significant weight loss and health issues. Sub-acute ruminal acidosis (SARA) is a milder but economically impactful form of acidosis, reducing milk production and leading to substantial financial losses. Cation-based mineral supplement (C-bMS) is particularly effective in maintaining rumen health and enhancing milk production, fat composition and overall animal health. Field studies demonstrated that the total average dairy milk yield rose by 13.02%, with crossbred cows' yield increasing by 13.47% and buffaloes by 12.91%. Additionally, the milk fat percentage in the treatment group increased by 0.52% (10.20%) and the body condition score of the animals improved by 0.25 post-intervention. Consequently, farmers' net profits rose by 28.65% with net profits from feeding C-bMS being higher for buffalo rearing farmers (₹16447) compared to crossbred rearing farmers (₹12629).

**Keywords:** Ruminal Acidosis; C-bMS; SARA

## Abbreviations

SARA: Sub-Acute Ruminal Acidosis; C-bMS: Cation-Based Mineral Supplement; DCAD: Dietary Cation and Anion Difference; NDRI: National Dairy Research Institute

## Introduction

Milk production per cow/buffalo continues to extend 2-3 per cent annually. Genetic improvements account for 33-40 per cent of the increase, whereas feeding and management

contributes the remaining 60 to 67 per cent of the milk production. Prepartum and postpartum period of dairy animals is very critical with point of view of milk yield. Therefore, nutrition is an important factor which have profound effects on all aspects of health, production and reproduction of dairy animals. Negative energy balance must be minimized by controlling proper nutrition in late lactation and optimum nutrition at each stage of the lactation cycle which significantly improves health and fertility. Generally, dairy animals with high genetic potentials are required to be fed on maintained and high concentrate diets to fulfil

their nutritional requirements. But after suddenly changing the feed from fodder to concentrates and feeding more concentrates to pregnant dairy animals lead ruminal acidosis.

### Ruminal Acidosis

In high-yielding dairy animals, the rate of milk let-down is so high in the first six weeks of lactation that nutrient secretion into the milk surpasses nutrient uptake from the digestive tract. To compensate for the nutrient deficit, the animal mobilizes body reserves, such as fat and protein leading to weight loss. Excessive weight loss can be detrimental and economically unfeasible. During early lactation, the animal's appetite is reduced by 2 to 3 kg per day making it challenging to meet its nutrient needs within this appetite limit. High-energy diets and challenge feeding strategies are necessary, but care must be taken to provide adequate fiber (36% NDF) to maintain normal milk fat levels. Typically, these animals will experience a negative energy balance for the first five months of lactation. A sudden dietary change and high concentrate feeding can also increase the risk of rumen acidosis.

### Sub-Acute Ruminal Acidosis (SARA)

The sub-acute acidosis (SARA), a type of mild acidosis has a greater economic impact due to much more prevalent and commonly occurring in dairy animals. The sub-acute ruminal acidosis cause reduction in milk production by 3 kg per cow per day, milk-fat production by 3g/kg of milk and milk protein production by 1.2g/kg of milk. This will account to almost 900 L per year per animal and cause a loss of more than INR 20000.00 at the present milk prices Bipin KC, et al. [1]. Economic losses due to reduced production alone due to sub-acute ruminal acidosis have been estimated to 400 US \$ (₹ 30911.40) per cow per lactation Danscher AM, et al. [2].

### Symptoms of Ruminal Acidosis

In ruminal acidosis, the pH of the rumen drops from a normal range of 6.5 to 7 down to 5.2, which impairs effective feed digestion. This low pH level kills the rumen bacteria that are crucial for digestion. As a result, weight gain is significantly reduced and in severe cases, it can be fatal. Symptoms of sub-acute ruminal acidosis include:

- A marked decrease in dry matter intake,
- The animal's dung becoming slightly black and firm,
- The presence of undigested feed and fodder in the dung,
- The animal appearing lethargic and
- The left side of the animal's stomach appearing distended and drooping due to acidity.

### Dietary Cation and Anion Difference (DCAD)

Dietary cation and anion difference (DCAD) based ration feeding is the best way to balance the acid-base chemistry

of the dairy animals which can be altered by manipulating major anion and cation inclusion in diet. The difference between certain anions (Cl<sup>-</sup>, S<sup>-</sup>) and cations (Na<sup>+</sup>, K<sup>+</sup>) may be more important for individual effects and their animal productivity Tucker WB, et al. [3]. Dietary cation and anion difference (DCAD) is a way to balance the electrical charges of the anion and cations in the diet was coined by Hu W, et al. [4]. Hu W, et al. [5] reported that Dietary cation and anion difference (DCAD) supplementation to the dairy animals helps to eliminate the physiologic acidosis by increasing buffering capacity of the blood reflected by increase blood pH and blood bicarbonate (HCO<sup>-3</sup>) concentration. DCAD has a significant positive effect on the productive performance of dairy cows via changing the rumen environment and improving acid-base homeostatic in dairy cows Iwanik ME, et al. [6].

### Cation-based Mineral Supplement

This is necessary to maintain the stable ruminant environment which reduces the risk of rumen acidosis and allow dairy animals to achieve their full milk production potential. Supplementation of cation mineral based ration is an approach by which the acid-base balance of the dairy animals can be altered by maintaining the major cation and anion inclusion in the diet of dairy animals. The cation-based mineral supplement contains feed additives (Na<sup>+</sup> and K<sup>+</sup>) can be fed to dairy animals which increases the basicity in ruminant to alleviate rumen acidosis. Because of easy availability of this through endogenous production through saliva and these are added in their diet of which sodium bicarbonate is the compound most commonly used in the feed industry Chalupa W, et al. [7]. C-bMS is developed by ICAR - National Dairy Research Institute (NDRI). It is said that cation-based mineral supplement feeding in animal's diet leads 10 to 15 per cent increase in milk production, slight increase in fat composition and it helps to reduce the service period Goyal S, et al. [8]. Supplementation of cation-based mineral supplement in diet of the animals lead to increase in total dry matter intake, rumen of animal becomes healthy which improves digestibility and it also helps to control acidity of rumen which increases the digestibility of fibrous feed Mani V, et al. [9]. It helps to avoid problems related to feed digestibility and increase the absorption capacity of rumen to absorb sufficient amount of nutrient elements because feeding cation-based mineral supplement needs to maintain more granules diet for animals. Problem of laminitis is found due to more acidity in high yielding animals, so feeding cation-based mineral supplement helps to reduce laminitis. It increases the disease resistance capacity and helps to save the animals from the foot inflammation problems. Supplementation of cation-based mineral helps to reduce heat stress in summer season, which is a major problematic issue in case of buffaloes Goyal S, et al. [8].

## Benefits of Cation-Based Mineral Supplement Fortified with Certain Trace Minerals for Lactating Animals

Feeding cation-based mineral supplement improves acid base balance and increase rumen pH which results in improved rumen fermentation, increased nutrient digestibility and enhanced feed intake contribute to greater production efficiency in dairy animals. This efficiency is often measured by milk yield per kilogram of dry matter intake or 6% Fat Corrected Milk per kilogram of dry matter intake, particularly when animals are fed high fermentable grains or silage-based rations [10]. The inclusion of antioxidants and ultra-trace minerals can boost immune status, reflected in better immunity parameters and reduced somatic cell counts, which indicates lower mastitis incidence. Chromium and vanadium play a significant role in modulating glucose metabolism, leading to higher milk yields [11]. Dietary manipulation through adjusting the cation-anion difference by +300 and +400 mEq DCAD per kilogram of dry matter has shown a 4.4% increase in milk yield per kilogram of dry matter intake and an 11-12% rise in 6% Fat Corrected Milk per kilogram of dry matter intake. Additionally, cation-based mineral supplements at these levels increase blood pH, bicarbonate, base excess and urine pH.

### Effect of Feeding C-bMS to Lactating Dairy Animals: A Field Study

A field study was conducted in Gurhi Gujran, Churni Jangir, Kamalpur Rodan, Nagla Rodan, Samora, Chand Samand and Dabkoli Khurd villages in Karnal district of Haryana. A 200 of dairy farmers with one cow or buffalo were selected for study. Pregnant and lactating animals with more than 10 litre/day were selected for the study [12]. Required information was collected from the farmers who owned animals with high risk of ruminal acidosis incidence (animals with peak milk yield of more than 10 kg/day), which are not fed any type of Cation diets and had at least 1 month before parturition or recent parturition (up to 15 days of calving). The C-bMS has to be fed 15 days after parturition at a rate of 150 grams per day. The C-bMS was distributed free of cost to all the sampled dairy farmers. Follow-up survey was undertaken after 60 days of parturition of animals. Regular monitoring of treatment was done through continuous field visits and telephonic conversations to make sure that C-bMS is supplemented to animals properly and in-time. It was found that cation-based mineral supplement was highly effective in preventing Sub-acute ruminal acidosis as after feeding C-bMS, cases of sub-acute ruminal acidosis were not found in treatment group. The overall cost of production per lactation was come down by ₹1460 and an increment of ₹14538 in average total net profit was found. ₹ 1749 and ₹1171 cost of production was reduced in case of cows and buffalo, respectively. A jump in

the total average dairy milk yield by 13.02 percent was also observed in overall treatment group of cow and buffaloes. The total milk yield was increased in crossbred up to 13.47 and in buffalo was 12.91 percent. Fat percentage of the milk in overall treatment group was increased by 0.52 percent (10.20%) and the Body condition score value of the animals was improved by 0.25 in the post intervention. It was found that the net profits realised by farmers were up by 28.65 percent. The net profit of feeding C-bMS for buffalo rearing dairy farmers was higher (₹16447) than crossbred rearing dairy farmers (₹12629).

### Conclusion

Loss incurred by ruminal acidosis in early days of lactation is not much observed by dairy farmers but it gives huge loss in long term. The C-bMS is an effective way to control ruminal acidosis in lactating dairy animals. In this study we evaluated the impact of feeding C-bMS on productive and reproductive performance of dairy animals in 200 lactating dairy animals. C-bMS was highly effective in preventing Sub-acute ruminal acidosis as after feeding C-bMS, cases of sub-acute ruminal acidosis were not found in animals. The benefits of the preventive health product are two folded. First, it decreases the losses and improves animal health (by preventing Sub-acute ruminal acidosis incident) and second is, it increases animal productivity and farmer's income.

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