

Cation-based mineral supplement

to prevent acidosis in dairy animals of Karnal district

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Negative energy balance must be minimized to improve health and fertility. Dairy animals with high genetic potentials are required to be fed on maintained and high concentrate diets to fulfil their nutritional requirements. Suddenly changing the feed from fodder to concentrates of pregnant dairy animals leads to rumen acidosis. The rumen pH comes down to 5.2 (normal 6.5 to 7.0) and this is not favorable for proper feed digestion hence called Rumen acidosis. At this pH, all rumen bacteria which helps in digestion die. Dietary cation and anion difference (DCAD) based ration feeding is another way to balance the acid-base chemistry of the dairy animals which can be altered by manipulating major anion and cation inclusion in diet. Study was designed with randomized controlled trial (RCT) design. A total of 300 farmers were selected for study after complete enumeration of seven villages. Out of 300 farmers, 210 most desirable farmers were selected for the study. A 12% increase in milk in case of buffaloes and 14.50% increase in case of cows of treated group was obtained. The net income to variable cost was more in case of buffalo rearing farmers' (₹17025) than cow rearing farmers' (₹13437).

Keywords: C-based mineral supplement, Dairy, Farmer's income, Milk yield, Ruminal acidosis

INDIA is a leading milk producing country in the world. The total livestock population in India is 535.78 million which has increased 4.6% over the previous livestock census; in which total bovine population (buffalo, cattle, mithun and yak) is 302.79 million in 2019 which increased about 1%. The total population of cattle and female cattle population was 192.49 and 145.12 million which increased 0.8% and 18.0%; respectively (Basic Animal Husbandry Statistics 2019). The total number of buffaloes in the country is 109.85 million showing 1.0% increase over the population from last livestock census 2012 (Basic Animal Husbandry Statistics 2019). According to data from Food and Agriculture Organization Corporate Statistical Database (FAOSTAT), milk production was 209.96 million tonnes (MT) during 2020-21 against 198.44 MT in 2019-20.

India accounted for 21% of the global output. The livestock sector has been growing at a compound annual growth rate (CAGR) of 7.93% from 2014-15 to 2020-21. The percentage share of the livestock sector has increased from 24.38% in 2014-15 to 30.87% in 2020-21 in the Gross Value Added (GVA) of the agriculture and allied sector. India today is not only the global leading milk producer, but it has also become the largest consumer of cow milk (<https://worldpopulationreview.com/country-rankings/milk-consumption-by-country>). There is need to draw attention on negative energy balance and health disorders of dairy animal which eventually affect the loss of milk production. Dairy farmers and our field extension functionaries are not much aware about the prevention of the many diseases e.g. milk fever, acidosis, theliriosis and mastitis which are

biggest threat to the dairy industry. Such efforts are being carried out in the Farmer FIRST programme and one of them has been presented in this article for the benefit of the dairy farmers and other end users.

Ruminal acidosis: Milk production per cow/buffalo continues to increase 2.0 to 3.0% annually. Genetic improvements accounts for 33 to 40% of the increase, whereas feeding and management contributes the remaining 60 to 67% of the milk production.



Fat & SNF Mobile testing Van

Parturition and postpartum period of dairy animals is a critical period. Therefore, nutrition is an important factor which has 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 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. Suddenly changing the feed from fodder to concentrates of pregnant dairy animals leads to rumen acidosis. In rumen acidosis, the rumen pH comes down from 5.5 (normal 6.5 to 7.0) and this is not favourable for proper feed digestion (<https://www.thecattlesite.com>). At this pH, almost all rumen bacteria which helps in digestion die. Rumen acidosis can reduce weight gain drastically and severe condition may cause animal's death. 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 (<https://www.thecattlesite.com>).

Symptoms are reduced feed intake, acidity in forestomach, mild diarrhea, undigested feed particle and reduced milk fat.

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^+ and K^+), can be fed to dairy

animals which increase 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.

Intervention: (Cation based mineral supplement): Dietary cation and anion difference (DCAD) based ration feeding is another 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^- , S^-) and cations (Na^+ , K^+) may be more important for individual effects and their animal productivity. 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 Sanchez and Beede.

Dose and time: Cation-based mineral supplement was provided to dairy farmers who had lactating buffalo or cow. Dairy farmers were provided with the information about 150 g of C-bMS to be fed mixed in concentrate. It can be divided into two equal half and fed in morning and evening. C-bMS should be fed after 15 days of calving to up to the peak yield of cow/buffalo. Generally peak yield level comes after 50-60 days of calving.

Effect of cation based mineral supplement

- Improved rumen fermentation.
- Increase in production efficiency expressed as milk yield/kg, dry matter intake or 6% Fat Corrected Milk per kg dry matter intake.
- Inclusion of antioxidant/ultra-traces minerals are effective



Field trial conducted at Farmers' Dairy Unit

in enhancing their immune status as reflected in immunity parameters and reduction in somatic cell counts (mastitis).

- Presence of chromium and vanadium are particularly effective in modulating glucose metabolism which contributes in more milk yield.
- Production efficiency increased by 4.4% and 11-12%, respectively by manipulating dietary cation-anion difference to the extent +300 and +400 mEqDCAD/kg dry matter, showing not much variation with two levels of supplementation.

Extension strategies: Mass campaign were organized in all seven villages to create awareness about ruminal acidosis. Dairy farmers were explained about ruminal acidosis and losses incurred by it through awareness camps, home-to-home and farm-to-farm visit and animal health camps followed by feeding trials.

Research Design: Randomized controlled trial (RCT): A randomized controlled trial (RCT) is a way of doing impact evaluation in which the selected population receiving the programme or policy intervention is chosen randomly from the eligible population, and a counterfactual (control group) also chosen randomly from the same eligible population. It explains the extent to which planned, specific impacts of intervention are being achieved. Randomized Controlled Trial is an experimental form of impact evaluation. In RCT, the programme or policy is considered as an intervention in which a treatment, which may be programme or policy being evaluated is tested for the extent it achieves its objectives, as measured by predetermined set



Acidosis symptoms in cow.



Diarrhoea in acidosis.



Awareness programme at FFP Village

of indicators. The strength of the RCT design is that it provides a very powerful response which tells the change in treatment group is only because of the intervention. To estimate the impact of an intervention or programme under RCT, take the difference between the outcome under treatment (the mean outcome of the randomly assigned treatment group) and estimate of the counterfactual (the mean outcome of the randomly assigned comparison group). The Cation based Mineral supplement developed by ICAR-NDRI was evaluated in the seven adopted villages under "Farmer FIRST Programme" namely Garhi Gujran, Kamalpur Roran, Churni, Samora, Chand Samand, Dabkoli Khurd and Nagla Roarm villages of Karnal district, Haryana. Since total bovine population in Haryana is 6.5 million with total milk production of 9.8 MT becomes the ideal study area to assess the effect of cation based mineral supplement on milk production, composition and service period of dairy animals.

A total of 300 farmers were selected for study after complete enumeration of all seven villages. Out of 300 farmers, 210 most desirable farmers were selected for the study. Thereafter, 105 farmers each with either one buffalo or cattle were selected from the above mentioned villages of Karnal district. Total 190 samples were found suitable after performing power calculations and 20 additional samples (10% of population) were

taken to avoid attrition bias and stabilize the power. For selection of cattle and buffaloes; specific criteria was: i) lactating animals; ii) milk yield should be up to or more than 10 kg per day; and iii) they are not feeding by any kind of advanced feeding mineral supplements. These 105 farmers from both the buffalo and cattle strata was then randomly assigned to treatment (T) and control (C) groups of equal size using randomization procedures available in the computer software (MS Excel). Both the groups were tested for statistical similarity along observable characteristics using z-test before intervention. A random phase-in design of randomization was employed where the treatment group receives the cation-based mineral supplement in the first phase. After completion of the first phase of intervention and midline data collection on the outcome variables, control group also eventually received cation-based mineral supplement if it is found effective in field conditions also. At the end line, data was collected after two phases of intervention, and analyzed for the effectiveness of cation-based mineral supplement.

Outcome: Z test was used to measure the significant difference in baseline and follow-up information. It was found that there was significant ($P \leq 0.05$) difference in the average milk yield in control group and treated group. It was found in study that 12.00% increase in milk in case of buffaloes and 14.50% increase

in case of cows treated group from the baseline average milk yield of buffalo and cow. Similar findings were reported by others of increase in total milk yield from 23.9 to 26.2 kg/day in milking HF cows. In a comprehensive analysis, from 12 studies, researchers reported that total milk yield was more in lactating cows. Also total milk yield and 6% fat corrected milk yield were increased in lactating buffaloes. The case of ruminal acidosis was not observed in treatment group. This indicates that cation-based mineral supplement is equally effective for buffalo as well as cows. The net income to variable cost was more in case of buffalo rearing farmers' (₹17025) than cow rearing farmers' (₹13437). The total loss (milk production loss + treatment cost + mortality) due to ruminal acidosis was (₹3512). The cost of milk production in crossbred was slightly higher than buffalo because crossbred needs to be fed on high concentrates and cost of management is high.

CONCLUSION

There is increase in trend of milk productivity over the years, the risk of sub-acute ruminal acidosis is also increasing. The study revealed that feeding C-bMS effectively increases urine pH which reflects increase in blood pH, therefore rumen pH was expected to be more than 7 and effectively control ruminal acidosis. Therefore, the adoption of C-bMS should be promoted to prevent ruminal acidosis and losses. The finding state 12.00% increase in milk in case of buffaloes and 14.50% increase in case of cows of treated group from the baseline average milk yield of buffalo and cow. The intervention may widely be popularized among the farming community for adoption. General awareness about ruminal acidosis, loss incurred by it and prevention (cation-based mineral supplement), can be created among farmers through extension activities.

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