

Calcium and phosphorus ratio in soil, native grasses, water and bovines and its correlation with productivity

Anandamoy Kundu^{1*}, Jaisunder¹, S. Jeya Kumar², R. B. Rai³

^{1*}ICAR-CIARI, Port Blair, India

²ICAR-NDRI regional centre,, Bangalore, India

³ICAR-IVRI,, Izatnagar, India

*Corresponding author e-mail : drakundu1@yahoo.com

Keywords: Ca, Bovines, Grass, P

Introduction

Minerals play vital role in growth, sexual maturity, conception and milk production. Reproductive problems viz. delayed puberty in heifers, post pubertal anoestrus, repeat breeding and prolonged post partum anestrus, prolonged service period and calving interval in cattle has been observed to be a major cause for poor productive and reproductive performance under this island ecosystem. Therefore, the study was undertaken to correlate the extent to which calcium and Phosphorus were responsible for reproductive performance of bovines. In Andaman & Nicobar Islands, the concentrate feeding to bovines is uncommon. Thus bovines are fully dependent on grazing or forage feeding. Most of the soil of ANI is acidic which makes phosphorus (P) less or unavailable to plants. Hence, fodder growing to these soils possesses poor phosphorous content. Similarly, high and intense rainfall washes topsoil leading to leaching of minerals from top soils. The plants growing on such soils will have lower content of these mineral(s). Animals reared on these fodders will thus get lower mineral content affecting the productivity. Lower calcium (Ca) level fails to onset estrous and lower phosphorous level results in prolonged but weak estrous without conception. Hence the present study was conducted to determine the calcium and Phosphorus content in soils of various terrains (valley, hilly and sloppy pasture land) and its availability to plants, forage, and animals through forages and its correlation with productivity.

Materials and Methods

The different villages of South Andaman district were surveyed to get preliminary information on status of livestock. Based on all these information finally 19 representative villages were selected to generate information on how the minerals are responsible for production performance of cattle in these islands. Soil and grass samples were collected from these selected villages in monsoon (June-September), dry (October-January), and pre-monsoon (February-May) period (2004-2007) from different sites viz valleys, slope and hilltops where animals were found grazing. Water samples were also collected from the same selected villages in all the three seasons. Blood samples from the various condition of cattle like fertile, infertile and calf of respective villages were also collected for the estimation of mineral, pH, moisture in. dry , heavy rainy and moderate rainy seasons.

A total of 513 soil samples i.e. 171 samples in each season and a total of 171 water samples viz 57 in each season, monsoon (June-September), dry (October-January), and pre-monsoon (February-May), from different sites i.e.; valleys, slope and hilltops of the 19 selected villages of South Andaman district were collected and analyzed.

Ten serum samples (n=10) in each group (calf, heifer, lactating local desi cows) were collected which remained constant in all 3 seasons analyzed for the ca and p estimation. Soil sample was collected as per standard method. The Ca was estimated by the method described by Jackson, (1958) in soil, grasses, and sera samples using AAS. Spectrophotometer (AAS, Shimadzu). Available Phosphorus in Soil was estimated as per the procedure described by Bray and Kurtz, (1945)

Results and Discussion

The overall result revealed that in soil, P showed low concentration. The level of Ca was close to its critical level. In fodder, P was lower than the critical level. However, Ca was within the normal range. In water, Ca was higher than the critical level but the concentration of P was undetectable. The results are in agreement with Jaisunder et al., (2007a and b). In sera of bovines though the level of Ca and P was within the normal range but Ca, concentration was significantly higher in fertile animals than in calf and infertile cows. The average P level was lower in the infertile cattle sera when compared with the calf and the fertile cattle sera. The Ca and P ratio (Ca: P) of the infertile cattle was low which might have adverse effect on production performance. The Ca: P ratio was also found to be closer to the required ratio (2:1) in the fertile animals than in infertile ones. Thus Ca: P mineral imbalance/ deficiency might be one of the major reasons for

the reproductive problems affecting the dairy animals of this Island. Overall, the status of these minerals in Soil, grass, water and sera indicated a widespread deficiency or lower level than the normal range and immediate attention is required in this regard as most of the animals are also reported to be associated with reproductive problems in different villages of South Andaman. Amount of Ca and P are required in small quantity with appropriate ratios and are important for maintaining healthy and productivity of bovines. Therefore, nutritionally balanced diet with mineral supplement, based on the deficiency in appropriate amount and ratios along with adequate amount of concentrate and good quality roughages is essential for good health and productive performance. It may be difficult to draw a direct correlation between the soil micronutrients and uptake by the plants/grass as seasonal factors govern the uptake of the minerals from the soil to grass/plants (Reid and Horvath 1980, Roy and Srivastava, 1988, Jaisunder *et al.*, 2007a,b). On the other hand, there are many factors that could affect an animal's response to mineral supplementation such as duration, concentration and bioavailability of mineral supplementation, the absence or presence of dietary antagonists, type of accompanying feed, environmental factors and breed difference in mineral metabolism (Engle, 2001). The P level was low in infertile cows. The most prevalent mineral deficiency affecting reproduction appeared to be lack of phosphorus (Samanta *et al.*, 1995). The Ca: P ratio of the infertile cows was also lower than the normal ratio which may have adverse effect on production performance.

Conclusion

Ca was present as per the requirement but the Ca: P ratio was low in the infertile cattle sera. The available P in soil, grasses and water were below the critical level which directly reflected in its concentration in serum of cattle. Serum analysis revealed when compared based on the fertility status of the animal that Ca concentration was significantly higher in fertile (lactating) animals than in calf and infertile (nonlactating) cows. The average P level was lower in the infertile cattle serum when compared with the calf and the fertile cattle serum. Even the Ca: P ratio was also found to be closer to the required ratio (2:1) in the fertile animals than the infertile ones. The sera sample analysis of the cattle representing the each village revealed lower level of Ca than normal value. It is therefore concluded that imbalance in the nutrient concentration in different agro climatic zones are responsible for problem in productive performance in bovines and immediate attention is required in this regard.

References

- Bray, R. H and L.T. Kurtz. 1945. Determination of total organic and available forms of phosphorus in soils. *Soil Sciences* 59: 39-45.
- Engle, T.E. 2001. Trace minerals, vitamins aid preventative nutrition. *Feedstuffs*. 73: 11-18.
- Jackson, M. L. 1958. *Soil chemical analysis*. Prentice-Hall, Inc., Englewood. Cliffs, N.J. p: 57-81.
- Jaisunder, R. B. Rai, A. Kundu and S Jeyakumar 2007a. Mineral status of infertile cattle of Andaman. *Indian Journal of Animal Sciences* 77:1135.
- Jaisunder, R. B Rai, J. Yasmeen, A. Kundu and S. Jeyakumar 2007b. Mineral profile in soil, grass water and cattle blood of South Andaman. *Indian Journal of Animal Sciences* 77:1103-7.
- Reid, R. L. and Horvath, DJ.1980. Soil chemistry and mineral problems in farm livestock: a review. *Animal Feed Science and Technology*. 5:95.
- Roy, H. K. and L. L. Srivastava, 1988. Removal of some micronutrients by forage crops in soils. *Indian Society of Soil Science* 36: 133-37.
- Samanta A. K., S. Sarkar, S. Bose, R. Duttgupta, P. K. Senapathi. and M. K. Bhowmik. 1995. Mineral status of Feeds and Fodders in Rohtak District of Haryana. *Indian Veterinary Journal* 72:1031.

Acknowledgement

The authors are thankful to the Indian Council of Agriculture, New Delhi for providing financial help and support under the grant of AP Cess Fund project. Authors also thank the Director, Central Island Agricultural Research Institute, Port Blair for providing necessary facilities and support to carry out the work.