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Mineral Status of Feeds, Fodder and Dairy Animals in Jalgaon District of Maharashtra State

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Abstract: A study was carried out to assess the dietary status of macro and micro-minerals of milch animals in Jalgaon district of Maharashtra, for developing area specific mineral mixture. Feed and fodder samples were collected at random from various locations, following standard sampling procedure. The average calcium content in straws of bajra, jowar, maize and wheat was high (0.37%), but low (0.10%) phosphorus level. Calcium content in green fodder such as hybrid napier, jowar and green local grasses was 0.42 per cent. Concentrate ingredients such as cottonseed cake and crushed maize were particularly low (0.15%) in calcium, but high (0.44%) in phosphorus. The phosphorus content in green fodders was 0.22 per cent. The magnesium content in roughages and concentrate ingredients was 0.25 and 0.23 per cent, respectively. The sodium content was below the critical level (<0.06%) in concentrate ingredients, dry and green fodders. Potassium content in concentrates (0.87%) and roughages (1.46%) was found to be adequate in surveyed area. The sulphur content was deficient in concentrate ingredients (0.21%) and crop residues (0.09%); hence, its supplementation was necessary in the ration. Cobalt was occasionally deficient in the diet of animals; however, iron level in most of the feed ingredients was adequate (average level>769 ppm), with the prevailing feeding system. The manganese (Mn) was low in concentrate ingredients (27.84 ppm), whereas, dry (65 ppm) and green (47.55 ppm) fodders were adequate in Mn. The average copper content in dry and green fodders was 12.85 and 14.35 ppm, respectively. Concentrate ingredients were low in copper (11.49 ppm). Molybdenum content in feeds was within the safe limit (average level<0.37 ppm) and gave Cu:Mo ratio wider than 12.0. Selenium content in most of the feeds and fodder samples was adequate (0.76 ppm) and its supplementation in the ration was not necessary. Zinc was acutely deficient in most of the feedstuffs (average level<38.0 ppm) and need to be supplemented in the ration for proper productive and reproductive functions. From the present study, it was apparent that the levels of certain minerals such as calcium, phosphorus, magnesium, sodium, sulphur, zinc, copper, manganese and cobalt were inadequate, as per the estimates for the requirement of buffaloes and cows yielding 8 kg milk per day. However, the levels of some other mineral elements such as potassium, iron, selenium and molybdenum were found to be adequate in Jalgaon district.

Keywords: Minerals, Feed, Fodder, Buffalo, Jalgaon district

INTRODUCTION

The mineral profile of feeds and fodder depends upon the cropping pattern, soil type, rainfall and feeding system of that particular region of the country. In India, these above parameters vary from different agro-climatic zones. Thus, deficiency and surplus of a particular mineral varies between different regions of the country and may be called as area specific [1]. Proper production and reproduction of animals can only be maintained by supplementing area specific mineral mixture. The present study was under taken in Jalgaon district, to assess the mineral profile of different feeds and fodders, for developing area specific mineral mixture for that particular agro-climatic zone of Maharashtra.

MATERIALS AND METHODS

Sampling procedure

At random, one centrally located village from each taluk of Jalgoan district was selected for taking representative samples of feeds and fodder. In this study, two dimensional survey was adopted to map relevant mineral elements, by collecting feeds and fodder samples in a particular village, according to random sampling design based on conceptual landscape units [2]. Within the village, help was sought from village milk producers and Jalgaon District Cooperative Milk Producers' Union, for identification of 4 to 5 farmers. The recorded parameters were number of livestock, land area, irrigated facilities, fodder and other crops being grown etc. In identification of farmers, land location was considered essentially, one each from Northern, Eastern, Western and Southern directions, to cover soil types on each side of the selected village.

Further information regarding the amount and types of feeds and fodder being offered to the animals, actual rate of daily feed intake and milk yield of individual animal were collected from individual farmer, using standard sampling procedure. Total intakes were compared against the requirements on dry matter basis[3,4], so as to identify quantitative deficiency, sufficiency or even excess. In India, hardly any information on mineral requirements for milch animals is available; hence, Kearl [5] and NRC [4] were taken as a base for calculation of mineral requirements of buffaloes and cows, respectively.

Sample preparation and analytical methods

Composite samples of green fodder, dry fodder, individual concentrate ingredients and the compounded cattle feed (concentrate mixture) were collected from all over the surveyed area. Green samples were dried in oven at 80^{o}C for 24 hrs and subsequently ground (1mm). Ground samples of concentrate and fodder were stored in airtight bags until analysis. Samples were prepared and digested using 5 ml concentrated HNO_3 plus 1 ml concentrated HCl by microwave digestion method for preventing evaporation of volatile elements and total volume of mineral extract was made to 25 ml with deionized water. All the samples were analyzed for Ca, P, Mg, Na, K, S, Cu, Zn, Mn, Fe, Co, Mo and Se, using Inductively Coupled Plasma-Optical Emission Spectrometer (Perkin-Elmer, OPTIMA – 3300 RL). The data were analysed statistically as per Snedecor and Cochran [6].

RESULTS AND DISCUSSION

Feeding and Management

From the survey work, it was revealed that most of the farmers rear their animals by feeding locally available green grasses. Additionally, some progressive farmers fed their animals with cultivated fodders like jowar, maize, hybrid napier etc. Different parts of banana tree were also being fed in few cases. Among crop residues, jowar and maize straws were most common. Other than these two, bajra, soybean, tur, wheat and urd straws were also being fed by the farmers.

Farmers were feeding their animals with one or two concentrate feed ingredients. Although cottonseed cake was mostly being fed in this area, feeding compound cattle feed was also practiced. The level of feeding concentrate depends on the production status of animals.

Macro minerals profile of the feeds and fodder

The survey revealed that locally available green grasses as green roughage and jowar straw as dry roughage were most commonly fed to animals. Among concentrate ingredients, cottonseed cake was most commonly fed to animals. The status of macro minerals (Ca, P, Na, K, Mg and S) in feeds and fodder are given in Table 1.

Average Ca and P content in local green grass were 0.45% and 0.19%, respectively. Though Ca content was adequate, P content was lower than the critical level. In other green sources, Ca content ranged from 0.23% to 1.57%. Different parts of banana tree were also found adequate in Ca content. Anjan leaves were having high Ca content (1.57%), but it may contain some secondary plant metabolites which may cause binding with Ca. The range of Ca in straws was 0.18% to 1.64%. Urd straw was having high Ca content, but very few farmers fed their animals with urd straw. Except wheat straw, Ca content of others straws were found adequate, but that Ca may not be available to animals due to high oxalate content in the straw. In most of the green forages, P content was found below the critical level. It ranged from 0.13% to 0.37%. Except banana rhizome, other parts of banana tree were found adequate in P content. All the crop residues were found deficient in P. It can be concluded that both the green and dry roughages were low in Ca and P content. Ca and P ratio could not be maintained by feeding roughages. The concentrate ingredients were deficient in Ca, but adequate in P content. P content of cottonseed cake was found to be 0.57%, whereas, Ca content was 0.18%. Both the Ca and P content were found adequate in compound feed (1.19% Ca and 1.15% P).

The Mg level in most of the green roughages was found to be adequate. In whole sugarcane, jowar green and sugarcane top, Mg was found deficient. Banana leaves (0.47%) and suckers (0.48%) were found to be good source of Mg. Except bajra and wheat straw, all crop residues were found adequate in Mg content. Soybean straw was found to be a good source of Mg (0.38%). Compound cattle feed and cotton seed cake was adequate in Mg content, whereas, crushed maize and jowar grain were deficient in it. In general, Na content was found low in all fodders, Na content ranged from 0.014% to 0.095% in dry roughage and from 0.01% to 0.14% in green roughages. Except crushed maize, other two concentrate ingredients were inadequate in Na content. As common salt is added to compound feed, Na content of compound feed was found adequate.

Potassium (K) content was found adequate in most of the green feeds and fodders. Crushed maize and jowar grain were found deficient. K content of anjan leaves (0.64%) was also found deficient. Except it, K content in other roughages ranged from 1.06% to 5.30%. Both cotton seed cake and compound cattle feed were found high in K content. The high K content in feeds and fodders may be due to use of potash fertilizer in the soil and its high uptake by plats than Na[7]. Sulphur content was found lower in almost all the roughages. In dry roughages the S content ranged from 0.064% to 0.12% whereas in green roughage the range was 0.12% to 0.29%. Both cotton seed cake and

compound cattle feed was adequate in S level. The finding was similar to Garg *et al.* [8], where they found adequate S level in cotton seed cake (0.24%) and lower level in grains. S content in the plant varies due to variation in different S containing amino acid present in plant tissues [9, 7].

Micro or trace mineral profile of feeds and fodder

Almost all the feeds and fodder were deficient in Cu content (Table 2). The Cu level ranged 5.19 ppm to 38.62 ppm in roughages. Wheat and maize straw were inadequate in Cu content whereas all banana tree parts were high in Cu content. Other than jowar grain, other concentrate ingredients were found adequate in Cu. Zn is found to be deficient in feeds and fodder in many parts of the country [10, 1]. In present study also, Zn content of feeds and fodder was found either deficient or marginally deficient. In dry roughages Zn content varied from 19.28 ppm to 48.59 ppm. Wheat straw was found deficient in Zn content. Zn content varied from 27.52 ppm to 62.99 ppm in green roughages. Banana sucker was found high in Zn content. Local green grass was also containing adequate amount of Zn (45.11ppm). Though grains were found low in Zn, cottonseed cake contained adequate Zn (42.75 ppm). Zn content of compound feed was found to be 76.10 ppm.

Mn content in the dry roughage ranged from 34.74 to 187.10 ppm. Urd straw contained high Mn level. Maize straw contained 46.71 ppm of Mn. Among green roughage sugar cane tops contained lower Mn level (41.62 ppm). Green grass was found to contain adequate level (53.43 ppm) of Mn. The entire banana tree parts contained high level of Mn. Highest content was found in banana suckers (173.30 ppm) followed by banana rhizome (145.63 ppm). All the individual concentrate feed ingredients were found to be deficient in Mn. Cotton seed cake contained 17.91 ppm Mn. As compound feed was incorporated with mineral mixture, the Mn level was found adequate (96.93 ppm) in it. Iron content in feeds and fodder of animals was found to be adequate in most parts of the country [11, 12]. In the presents survey also Fe content was found in the range of 344.73 to 2175 ppm in dry and green roughages. In concentrate feed ingredients, the range was from 91.24 to 713.35 ppm. Cobalt level in this zone ranged from 0.05 to 1.89 ppm which was marginally deficient.

Selenium content in the green and dry fodder ranged from 0.20 to 2.07 ppm. The range of Se was found to be from 0.19 to 0.92 ppm in concentrate ingredients. Thus the Se level in the feeds and fodder was marginal to high. But the Se content was below the toxic level [4]. The maximum critical level for Mo is considered to be 6 ppm. The entire feeds and fodder in the Jalgaon district was found to contain Mo below toxic level. As the Mo level was found low, the Cu : Mo ratio became wider than 12. It would reduce the chance of Copper- Molybdenum interaction.

Macro and micro minerals intake by animals

Daily expected intake of different minerals for a buffalo having 450 kg body weight and yielding 8 liters milk per day (Table 3) and a cow having 400 kg body weight (Table 4) with same production level was calculated from the existing feeding practices in Jalgaon district. Surplus and deficit values were calculated considering the intake and daily recommended requirement by the animals.

A buffalo having the profile as above would require 55.2 g calcium daily (Fig. 1). But she was getting 33.95 g calcium from existing feeding regime rendering the ration deficient in calcium. In case of cow, the feeds and fodder was sufficient in meeting daily requirement of Ca (Fig. 2). Deficiency of Ca is frequently recorded where concentrate mixture was not available. This would ultimately cause milk fever in freshly calved animals. The same scenario happened in case of phosphorus. The buffalo diet was deficient in P by 15.5 g, whereas, the cow was getting 2.6 g extra P from daily intake of feeds and fodder. But, phosphorus may become less available to the animals due to presence of phytic acid in fodder leading to pica and infertility to the animals [9]. Thus regular supplementation of P is required in the ration.

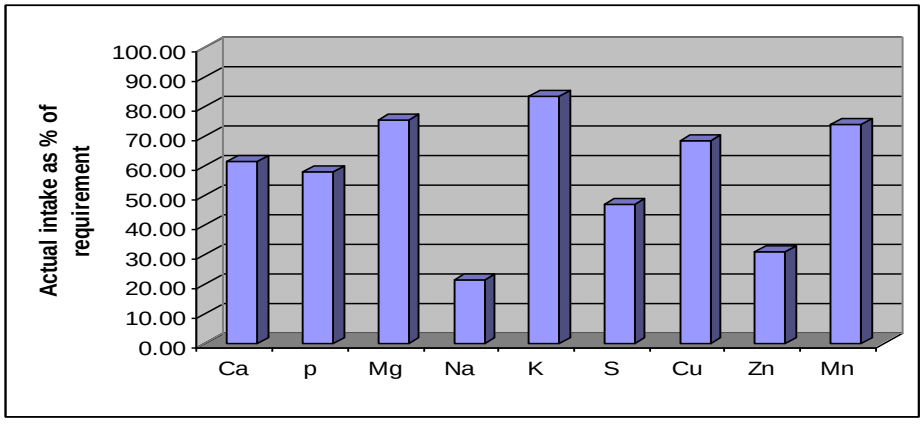

Fig-1: Daily minerals intake as % requirement for a buffalo yielding 8 liter milk day

Magnesium, sodium, potassium and sulphur were found deficient in both the buffalo and cattle ration. Sulphur is required in the ruminant ration for efficient utilization of nitrogen by rumen microbes [9, 7]. Among micro- minerals, copper, zinc and manganese was found deficient in the animal feed. Clinical and sub clinical symptoms occurred in copper deficiency leading to poor growth rate, rough and de-pigmented hair coat, infertility etc. [13]. Zn deficiency also leads to several diseases namely night blindness, parakeratosis and reproductive failure. Cu and Zn are having role in production of several reproductive hormones. Thus several reproductive problems occur due to the deficiency of these two minerals.

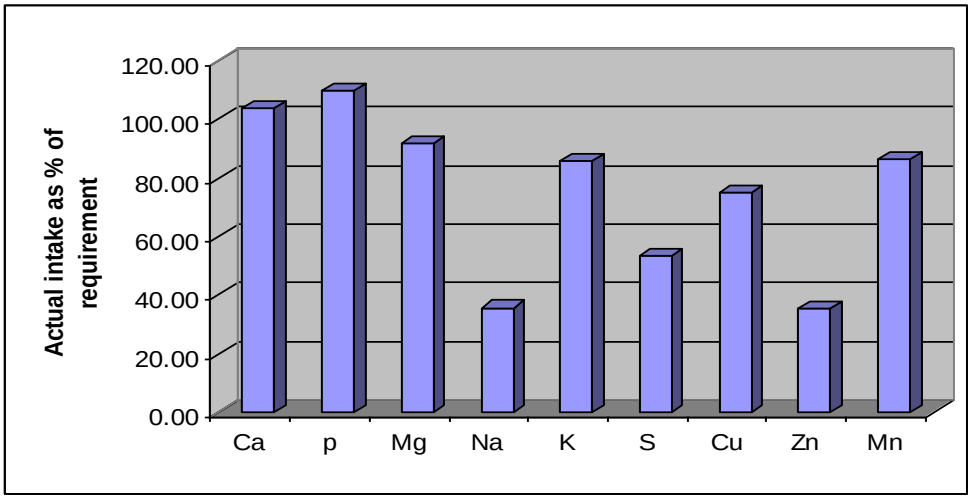

Fig-2:Daily minerals intake as % requirement for a cow yielding 8 liter milk day

It was revealed from the present study that the existing feeding practices in the Jalgaon district was sufficient in meeting the requirement of iron, cobalt and selenium. Though molybdenum content was found slightly higher, the level was below toxicity.

CONCLUSION

It is evident from the study that Ca, P, Mg, Na, K, S, Cu, Zn and Mn are deficient in the feeds of buffalo and cow yielding 8 liters of milk. Thus these minerals are required to be supplemented in the ration of dairy animals through area specific mineral mixture prepare by highly bio-available mineral salts and trace mineral chelates.

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