# Dietary mineral status of lactating buffaloes in Kolhapur district of Maharashtra State in India

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**ABSTRACT**: Kolhapur district is located in the Western part of India and is well known for buffalo rearing. Buffaloes are mainly fed on crop residues and local grasses and need to be supplemented with deficient minerals for proper production and reproduction functions. In view of this, area specific mineral mixture was developed for the district by testing feeds and fodders for macro and micro minerals. The average calcium (Ca) content in straws of groundnut, *ragi* and soybean was high (0.97%), whereas, straws of sorghum and paddy had low (0.23%) level. Ca content in green fodder was 0.38 percent. Concentrate ingredients were particularly low (0.22%) in Ca. The phosphorus (P) content in crop residues and green fodders was 0.14 and 0.19 per cent, respectively, which was low, but higher (0.67%) in concentrate ingredients. The magnesium (Mg) content in roughages and concentrate ingredients was 0.38 and 0.32 percent, respectively. The sulphur (S) content was deficient in concentrate ingredients (0.13%) and crop residues (0.12%). Cobalt (Co) was deficient in the diet of animals; however, iron and manganese levels in most of the feed ingredients were adequate. The average copper (Cu) content was low in dry and green fodders (7.34 ppm), whereas, concentrate ingredients were better source of Cu (15.19 ppm). Molybdenum (Mo) content in feeds was within the safe limit (average level<0.31 ppm. Selenium (Se) content in most of the feed and fodders was adequate (0.40 ppm). Zinc (Zn) was deficient in most of the feedstuffs (average level<35.0 ppm). From the present study, it was apparent that certain minerals such as Ca, P, S, Zn, Cu and Co were deficient in the diet and needed to be supplemented.

**Key words:** Calcium, Phosphorus, Copper, Buffaloes.

**INTRODUCTION-**Poor performance and reproductive problems in livestock are associated with mineral deficiency. As plants mature, mineral concentrations decline due to natural dilution process and translocation of nutrients to the root system. As a result, mineral imbalance and deficiency exist widely in dairy animals and the severity of the deficiency depends upon the type of diet, age, physiological status of the animals and the agro-climatic condition of the region. In India, buffaloes often do not receive mineral supplements, except

common salt (Garg *et al.,* 2005). For mineral mixture supplementation, it is necessary to know the availability of minerals from feeds and fodder fed to animals. Therefore, a study was undertaken in Kolhapur district of Maharashtra, to assess the macro and micro minerals status in feeds and fodder and their requirement for buffaloes.

**MATERIAL AND METHODS -** At random, one village from each taluka of Kolhapur district was selected for taking representative samples of feeds and fodder. Information regarding amount and types of feeds and fodder being offered to the animals, rate of daily feed intake and milk yield of individual animal were collected from individual farmer, using standard sampling procedure. Total intake was compared against the requirements on dry matter basis (NRC, 2001), so as to identify quantitative deficiency, sufficiency or excess. Buffaloes are main dairy animals in the area and very little information on mineral requirements for milch buffaloes is available, so NRC (2001) and Kearl (1982) were taken as a base for calculation of mineral requirements of buffaloes. All feedstuffs samples were prepared and digested using 5 ml concentrated $HNO_3$ plus 1 ml concentrated HCl, by microwave digestion. All the samples were analyzed for macro and micro-minerals, using Inductively Coupled Plasma-Optical Emission Spectroscopy (Perkin-Elmer, OPTIMA – 3300 RL).

**RESULTS AND CONCLUSIONS -** The survey work revealed that paddy straw, sorghum straw, groundnut straw and local grass amongst the dry roughages, sugarcane tops and maize amongst the green forages were being used most commonly by the farmers of this area. As concentrate supplements cottonseed cake, rice bran, wheat bran and crushed maize were offered to the animals. The compound cattle feed was fed to milch animals, depending upon the level of milk production. The average calcium content in straws of groundnut, ragi and soyabean was higher (0.97%), whereas, straws of sorghum, paddy and local grass were low (0.26%) in Ca. Amongst the green fodders, local green grass and marvel grass (0.46%) had the highest Ca content. The phosphorus content in crop residues and green fodder was 0.14 and 0.19 per cent, respectively, which was low but higher (0.67%) in concentrate ingredients. The magnesium level was adequate in crop residues, green fodders and concentrates. Green fodder had around 0.33 per cent Mg, showing that considerable quantities of Mg were available in these forages, from the livestock requirement point of view. The sulphur content was low in most of the crop residues (0.12%), the reason being its transfer to seed proteins. The protein rich concentrate feed ingredients had higher (0.22%) sulphur than energy rich ingredients (0.10%). Straws of sorghum, paddy and ragi contained very low levels of copper (5.09 ppm) than straws of groundnut and soyabean (17.45 ppm). Green fodder contained around 5.66 ppm Cu. Cottonseed cake (11.04 ppm), groundnut cake (25.36 ppm), sunflower cake (33.47 ppm), rice bran (21.28 ppm), wheat bran (14.42 ppm) and urd chuni (31.39 ppm) were better source of copper. From the present surveillance, it was apparent that most of the feed ingredients, particularly straws, were low (32 ppm) in Zn content. The zinc content of the green fodders varied from 18.22 to 27.53 ppm. Grains had around 35 ppm Zn. Cottonseed cake (48.54 ppm), groundnut cake (71.96 ppm), sunflower cake (101 ppm) and wheat bran (75.85 ppm) were better sources of Zn content. The cobalt levels in this zone ranged from 0.49 to 1.07 ppm in straws, 0.24 to 0.67 ppm in green fodders and 0.06 to 0.87 ppm in grains. High levels of molybdenum (>2 ppm) in forages could interfere with copper metabolism. The molybdenum levels as estimated in the samples of crop

residues were within the safe limit. The selenium content of the crop residues varied from 0.12 to 1.12 ppm. However, Se level was recorded 0.24, 0.21, 0.12 and 0.10 ppm, in green local grass, sugarcane tops, sorghum and maize, respectively. A buffalo yielding 8 kg milk per day would need 55.20 g Ca, whereas, feeds and fodders available in the area when fed as per diet formulation given in Table 1, would provide only 28.95 g Ca, showing severe deficiency. When only green sugarcane tops were fed to animals, deficiency of Ca could be more severe. The estimated value of phosphorus intake from feedstuffs was 33.48 g, against requirement of 36.84 g per day for a milch buffalo yielding 8 kg milk, showing a marginal P deficiency. Furthermore, bioavailability of P from brans and plant sources is low due to phytic acid-P (McDowell, 1992), leading to problems of pica, infertility and haemoglobinuria in animals. The Mg requirement of a milch buffalo yielding 8 kg milk per day was 25.0 g (Table 1), whereas, feeds and fodders fed in that area provided 35.30 g of Mg per day. The availability of S from feed resources was 16.80 g and the requirement was 25.0 g per day, showing a deficiency of 8.20 g per day, for milch buffalo yielding 8 kg milk per day. A buffalo yielding 8 kg milk daily, would need 125.0 mg copper per day, as per the standard requirements, whereas, feeds and fodders available in the area when fed, provide only 96.73 mg, showing a deficiency of copper (Table 1). For milch buffalo, yielding 8 kg milk per day, the requirement difference for Zn was to the extent of 632 mg per day with a traditional feeding system (Table 1).

Table 1. Macro and micro-minerals requirement for a buffalo (400kg) producing 8 kg milk (6% fat) per day.

| Attribute | Tentative daily DMI (kg) | Ca (g) | P (g) | Mg (g) | S (g) | Cu (mg) | Zn (mg) | Co (mg) | Se (mg) |
|---|---|---|---|---|---|---|---|---|---|
| Maintenance | 12.50 | 18.00 | 13.00 | --- | --- | --- | --- | -- | --- |
| Milk production | --- | 37.20 | 23.84 | 25.0 | 25.0 | 125 | 1000 | 6.25 | 3.75 |
| Daily requirement | 12.50 | 55.20 | 36.84 | 25.0 | 25.0 | 125 | 1000 | 6.25 | 3.75 |
| Cottonseed cake | 2.00 | 5.50 | 17.75 | 10.25 | 5.25 | 22.08 | 97.08 | 1.88 | 0.32 |
| Wheat bran | 1.00 | 0.55 | 2.40 | 1.60 | 0.55 | 14.42 | 75.85 | 0.52 | 0.11 |
| Rice bran | 1.00 | 1.20 | 4.10 | 3.20 | 1.10 | 21.28 | 38.67 | 0.67 | 0.16 |
| Paddy straw | 2.50 | 4.25 | 2.50 | 4.25 | 2.50 | 11.17 | 42.07 | 0.85 | 2.80 |
| Sorghum straw | 1.00 | 2.90 | 1.40 | 3.00 | 1.40 | 5.18 | 16.88 | 0.50 | 0.12 |
| Local grasses | 1.50 | 5.10 | 1.18 | 3.75 | 1.50 | 6.07 | 29.14 | 0.67 | 0.25 |
| Sugarcane tops | 3.00 | 7.80 | 3.00 | 7.50 | 3.60 | 13.08 | 54.66 | 0.72 | 0.63 |
| Maize green | 0.50 | 1.65 | 1.15 | 1.75 | 0.90 | 3.44 | 13.70 | 0.25 | 0.05 |
| Daily availability | 12.50 | 28.95 | 33.48 | 35.30 | 16.80 | 96.73 | 368.06 | 6.06 | 4.44 |

The role of Cu and Zn in augmenting production and reproduction is well documented and are known to have a significant correlation with reproductive hormones (progesterone and estradiol), as they are specific activators of enzyme systems that assist in maintaining the activity of hypophyseal hormones in blood (McDowell, 1992; Underwood and Suttle, 1999). For a milch buffalo yielding 8 kg milk per day, would need 6.25 mg Co per day, as per standard requirements, whereas, feeds and fodder available in the area when fed, provide 6.06

mg Co, showing a deficiency. Selenium was found adequate with present feeding system for a milch buffalo yielding daily 8 kg milk, hence, its supplementation is not advocated in the ration of animals. It was apparent from the present studies that milch buffaloes yielding 8 kg milk (6% fat) per day in various talukas of Kolhapur district were deficient in calcium, phosphorus, sulphur, cobalt, copper and zinc when feed resources available in that area fed to the animal. Therefore, it is necessary to supplement these minerals in the diet by providing area specific mineral mixture having better bioavailable mineral salts.

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