MINERAL STATUS IN SOIL, FODDER AND BLOOD SERUM OF DAIRY COWS IN MIZORAM

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ABSTRACT

Mineral status of dairy cows in relation to commonly fed tree fodders, and soil mineral status were studied in Mizoram. The soil Ca, P and Mg were found to be below critical levels; but Cu, Zn and Fe were optimum in all studied locations. Except Ca, other minerals were estimated to be optimum in the tree fodders. However, except Fe, other minerals were found to be deficient in the serum of dairy cattle. The study indicated that mineral supplementation is necessary for maintaining production status of dairy cows in Mizoram.

Key words: Mineral status, soil & fodder, dairy cattle, Mizoram.

INTRODUCTION

Minerals are essential for normal metabolic and physiological processes of animal body. The uptake of minerals by plants and in turn by animals is greatly influenced by soil chemistry, species and stage of maturity of plants (McDowell et.al. 1993). Minerals of soil reach animal body through plants (Baruah et al., 2000). It is therefore imperative to know mineral status of soil, plant and animal body for surveillance and monitoring the mineral deficiency disorders in livestock. Keeping this in view, the present study was undertaken to estimate certain macro and micro minerals in soil, fodders and blood serum of dairy cows in Mizoram for assessment of their adequacy.

MATERIALS AND METHODS

Random surveys were conducted by selecting 30 dairy farmers from ten different villages in Aizawl district of Mizoram, namely Selesih, Ramthar, Zonuam, Mission Veng (MSVT), Bungkawn, Sihphir, Durtlang, Chawlhhmun, Khatla South and Thuampui. A standard questionnaire was prepared to collect information on feeding practices, fodders used for feeding dairy cows, feeding of mineral mixture and history of diseases relating to mineral deficiency. Relevant information on mineral deficiency and diseases were also collected from the Department of Veterinary and Animal Husbandry, Aizawl district, Mizoram.

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A total of two hundred crossbred cows between 1st to 3rd lactation with average milk yield of 5-6 litres /day were selected and samples of fodders fed and blood serum were collected. One hundred blood samples were collected from the selected villages and blood serum was separated following standard procedure. The digestion of serums was done as per the method of Kolmer et al. (1951). A total of fifteen commonly fed fodder samples were collected from the study area following random sampling technique and processed as per the method of Trolson (1969) for analysis. Soil samples were collected from the surveyed areas and processed as per the method of Franeck (1992). One hundred soil samples, 10 from each village, were collected. All the processed samples were analyzed for calcium (Ca), magnesium (Mg), copper (Cu), iron (Fe), and zinc (Zn) by Atomic Absorption Spectrophotometer (AAS-100, PerkinElmer, Netherland). The Phosphorus (P) was estimated following method described by Talapatra et al. (1940). Statistical analysis of the data was done following methods of Snedecor and Cochran (1976).

RESULTS AND DISCUSSION

Mizoram is a hilly state which lies between 21.850 to 24.350N latitude and 92.150 to 93.290 E longitudes bordering 404 km with Myanmar in the East and 306 km with Bangladesh in the West. Mizoram receives more than 254 cm annual rainfall which is higher as compared to other North Eastern states of India.

The survey revealed that the rural Mizo farmers rear the dairy cows intensively in sheds and zero grazing system is followed.

Soil type varies from sandy loam, clay loam to clay, generally mature but leached due to steep gradient and heavy rainfall. Soil is acidic (pH 4.8) and porous with poor water holding capacity.

The average Ca, P, Mg, Cu, Fe and Zn level in soil were 0.154 ± 0.02 mg/dl, 0.082 ± 0.01mg/dl, 0.127 ± 0.03 mg/dl, 0.022 ± 0.00 mg/dl, 0.381 ± 0.03mg/dl and 0.025 ± 0.00 mg/dl, respectively (Table 1). It was observed that Ca, P, Mg, Cu, Fe and Zn levels in soil were comparatively higher in the samples collected from Durtlang, Bungkawn, Selesih, Khatla South (for Cu, Mg and Fe) and Zonuam, respectively and least values irrespective of minerals except magnesium and zinc were recorded in Zonuam area of Aizawl district.

In the present study, when mineral concentration of soil was compared with their critical values (Sharma et al., 2004), it was observed that concentration of Ca (0.154±0.02 mg/dl), P (0.082± 0.01 mg/dl) and Mg (0.127 ± 0.03 mg/dl) were below the critical level in all the locations studied. Similar findings were also reported by Gowda et al. (2002) in the hilly zone of Karnataka. However, the Cu, Fe and Zn concentration in soil of Aizawl district were found to be higher than the critical value (McDowell, 1985; McDowell et al., 1993).

Comparatively higher Ca (3.227±0.06 mg/dl), P (0.516±0.01 mg/dl) and Mg (2.019±0.00 mg/dl) were found in Curculigo grassifolia, Spirae lindleyana and Ficus hirsute, respectively and least Ca (0.382±0.00 mg/dl), P (0.096±0.01 mg/dl) and Mg (0.263±0.01 mg/dl) were recorded in Spirae lindleyana, Amomum dealbatum and Roydsia suaveolens, respectively. Similarly, highest Cu (0.036±0.00 mg/dl) and Zn (0.460+0.00 mg/dl) was found in Impereta cylindrica and highest Fe (0.625+0.00 mg/dl) was estimated in Kydia calycina.

The concentration of calcium, in all the tree fodders analyzed, were found to be above the critical level(McDowell et al., 1983), but phosphorous level in some tree fodders were observed to be below the critical level. The Mg and micro-minerals namely Cu, Zn and Fe levels were optimum in all the tree leaves studied. Buragohain

et al., (2006) also reported the concentrations of Ca, Mg, and Fe above the critical level in tree fodders fed to dairy animals in Assam which is one of the neighboring states of Mizoram. Copper availability in fodders is affected by soil pH (Aubert and Pinta, 1977) and available Cu^{2+} decreased with increased soil pH. At higher pH, Cu^{2+} adheres to soil components and it leads to decrease in Cu^{2+} in soil. As cupric ions the soil Cu2+ availability is also related to soil organic matter. Kabata-Pendias and Pendias (1992) reported that Cu^{2+} binding capacity of any soil and Cu^{2+} solubility were highly dependent to the amount and kind of organic matter. The higher copper levels found in the fodder crops under the present study might be due to presence of higher organic matter in the soil.

The average Ca, P and Mg concentration in blood serum of the dairy cattle were estimated to be 0.19+0.46 mmol/L, 0.12+0.03 mmol/L and 0.09+0.01 mmol/L, respectively. The average Cu, Zn and Fe were 6.0+0.03 µmol/L, 9.0+0.12 µmol/L and 60.0+0.12 µmol/L, respectively (Table 3). Comparatively lower serum Ca (0.17+0.51 mmol/L), P (0.10+0.01 mmol/L), and Mg (0.08+0.16 mmol/L) concentration were found in dairy cattle of Mission Vang, Zonuam & Khatla South, respectively. Similar serum Ca levels were recorded in Ramthar (0.21+0.46 mmol/L), Selesih (0.21+0.45 mmol/L) and Zonuam (0.21+0.46 mmol/L) areas; whereas similar P concentrations were recorded in dairy cattle of Khatla South, Bungkawn, Mission Veng, and Selesih area of Aizawl district. Highest Mg level was recorded in the serum samples of cattle of Sihphir area. The lowest serum Cu (4.0+0.03 µmol/L) and Fe (53.0+0.10 µmol/L) were found in dairy cattle of Mission Vang, whereas Zn (7.0+0.03 µmol/L) level was highest in Chawlhhmun area. Highest Cu, Zn and Fe concentration were estimated in Chawlhhmun (7.2+0.05 µmol/L), Sihphir (12.0+0.05 µmol/L) and Bungkawn (64.0+0.16 µmol/L), respectively.

It was observed that average Ca, P and Mg levels were below the critical level (Ca - 0.19 ± 0.46 mmol/L, P - 0.12 ± 0.03 mmol/L and Mg - 0.09 ± 0.01 mmol/L) in blood serum of dairy animals of all the locations studied. The Cu (6.0 ± 0.03 µmol/L) and Zn (9.0 ± 0.12 µmol/L) level in the blood serum of dairy cattle were also estimated to be below the critical levels in all the locations studied. But the Fe level (60.0 ± 0.12 µmol/L) was optimum which might be due to very high Fe status in fodders analyzed in the present study.

From the findings of the study, it was concluded that in spite of adequate levels in the commonly fed fodders, Ca, P, Mg, Cu and Zn were deficient in the blood serum of dairy cattle in Mizoram and hence proper supplementation is necessary.

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Table 1

Average mineral concentration in the soil of different areas of Aizawl District in Mizoram

Area	Ca (mg/dl)	P (mg/dl)	Mg (mg/dl)	Cu (mg/dl)	Fe (mg/dl)	Zn (mg/dl)
Selesih	0.223 ± 0.00	0.097 ± 0.00	0.403 ± 0.16	0.016 ± 0.00	0.496 ± 0.03	0.027 ± 0.00
Ramthar	0.151 ± 0.00	0.086 ± 0.00	0.094 ± 0.00	0.024 ± 0.00	0.414 ± 0.01	0.027 ± 0.00
Zonuam	0.071 ± 0.01	0.053 ± 0.00	0.081 ± 0.00	0.016 ± 0.00	0.267 ± 0.01	0.034 ± 0.00
MSVT	0.136 ± 0.00	0.058 ± 0.00	0.106 ± 0.00	0.025 ± 0.00	0.374 ± 0.00	0.028 ± 0.00
Bungkawn	0.137 ± 0.00	0.116 ± 0.00	0.105 ± 0.00	0.024 ± 0.00	0.372 ± 0.01	0.017 ± 0.00
Sihphir	0.088 ± 0.00	0.077 ± 0.00	0.105 ± 0.00	0.018 ± 0.00	0.271 ± 0.01	0.021 ± 0.00
Durtlang	0.248 ± 0.02	0.107 ± 0.00	0.095 ± 0.00	0.024 ± 0.00	0.418 ± 0.00	0.025 ± 0.00
Chawlh-hmun	0.143 ± 0.00	0.076 ± 0.00	0.100 ± 0.00	0.019 ± 0.00	0.354 ± 0.00	0.024 ± 0.00
Khatla South	0.213 ± 0.00	0.057 ± 0.00	0.076 ± 0.00	0.031 ± 0.00	0.509 ± 0.05	0.028 ± 0.00
Thuampui	0.126 ± 0.00	0.092 ± 0.00	0.103 ± 0.00	0.026 ± 0.00	0.335 ± 0.00	0.019 ± 0.00
Over All Mean	0.154 ± 0.02	0.082 ± 0.01	0.127 ± 0.03	0.022 ± 0.00	0.381 ± 0.03	0.025 ± 0.00

* Number of samples collected from each area - 10