A Review: Status of macro and micro minerals in feed, fodder, blood, and hair of buffaloes

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Abstract
Mineral deficiencies or imbalances in forages have long been responsible for low productivity and reproductive problems in animals of tropical countries. This is because livestock are dependent largely on forages to obtain their mineral requirements. Hence to meet the requirements of animals through supplementation, scanning of available feeds and fodders for their mineral content is necessary. An effort has been made to review the concentrations of different minerals in feed, fodders, serum and hair.

Keywords: feed, livestock, deficiencies, forage

Introduction
The importance of minerals in nutrition and health of animals and plants has been greatly realized in the recent years. Their deficiency in livestock ration may lead to enormous health problems and reproductive disorders. Farm animals derive their mineral requirement mainly from the feeds and fodders offered to them under field conditions as little or no mineral mixture was supplemented. With the introduction of high yielding crop varieties, intensive cropping system and extensive fertilizes application in the new strategy of agriculture, the mineral profile in soil and thus in plants or animal feedstuffs are rapidly changing. It is, therefore, necessary to generate zone-wise information on mineral status, encompassing water, feeds, fodders and animals, so as to identify deficiency or toxicity, if any, so that a low cost balanced mineral mixture could be advocated to improve health and production.

Zinc (Zn)
The role of Zn as a cofactor of enzymes in the rumen physiological functions, somatic and sexual development, taste acuity, normal vision, wound healing and nucleic acid and protein metabolism is well established. The clinical signs of deficiency viz. decreased feed intake, loss of weight, rough coat, parakeratosis, dermatitis, cessation of spermatogenesis and testicular development are usually common among grazing tropical livestock population due to its imbalance in the soils and forages.

Zinc (Zn) in Plants and Diet
Singh (1977) [28] observed that the Zn content in wheat straw varied from 16.34 to 24.75 mg/kg. According to Rajora and Pachauri (1993) [24] the Zn content in Tarai region in fodder ranged from 15.84 to 30.22 mg/kg at three livestock farms. Mandal et al. (1996) [19] reported that the average Zn content in pearl millet straw and wheat straw and wheat grain were 25.08, 18.25 and 23.59 mg/kg, respectively in Mohindergarh district of Haryana state. According to Lall et al. (1996) [15] the average Zn content in wheat straw and wheat flour were 23.05 mg/kg and 15.63 mg/kg, respectively in Hisar district. Dhore et al. (2007) [7] reported that the average value of Zn in feed and fodders was less than 25.06 ppm in Western Agro Climatic Zone of Vidarbha. Garg et al. (2008) [10] reported that the Zinc was acutely deficient in most of the feedstuffs (average levels 26.30 ppm) in Bharatpur district of Rajasthan. According to Malik (1991) [18] the concentration of mineral elements in the animal foodstuffs, especially the agricultural products depends upon different factors, such as genus, species or strain of plant, nature of soil on which the plant grows, the climate or seasonal conditions during growth and the stage of maturity of plant. According to Lall et al. (1994) [16] the Zn content of fodders grown at CIRB, Hisar farm ranged from 25-30 mg/kg in berseem and 25-30 mg/kg in jowar and oats was on much lower side against a mean value of 50 mg/kg in these crops.
Zn uptake by plants was found to be significantly and positively related to soil organic matter content and negatively to soil pH. These factors were responsible for Zn deficiency in most soil types of Haryana.

Garg et al. (2011) [9] reported that the levels of certain minerals such as Ca, P, S, Zn, Cu and Co were inadequate in the ration, as per the prevailing feeding practices and requirement of buffalo yielding daily 10 kg milk (6% fat) in the Central Plain Zone of Punjab. Maan et al. (2014) [17] reported that in Rohtak and Bhiwani district of Haryana state, dry and green fodder are deficient in Zn, Cu, Mn. Concentrates are also deficient in these minerals. Deficient also reflected in serum, hair and milk.

Zinc in Blood
The Zn concentration in serum or plasma was the most widely used indicator of deficiency but also lacks certainty and sensitivity as a diagnostic criterion (Underwood, 1981) [30]. Zinc is a constant constituent of blood plasma, serum, erythrocytes and leucocytes. Yadav et al. (1994) [31] reported that the average value of Zn content was 2.76 mg/kg in blood serum of buffaloes in Rewari district. According to Mandal et al. (1996) [19] the average Zn content in blood serum of milch buffaloes was 2.80 mg/kg in Mohindergarh district.

Zinc in Hair
Mineral levels in hair must reflect the concentration and (or) activity of the certain minerals in other parts of the body and reflect dietary mineral status of animals (Combs et al., 1987) [5]. The normal level of Zn in hair was 115-135 ppm (O,Mary et al., 1969) [23]. Mandal et al. (1996) [19] reported that the average Zn contents in buffalo hair were 150.87 mg/kg in Mohindergarh district of Haryana state. Bhanderi et al. (2013) [3] while surveying the Sabarkantha District of Gujarat reported that the average level of Zn in hair was 73.51 ppm.

Copper (Cu)
Cu is an activator of several enzymes and is needed for the formation of haemoglobin with iron. All over the world certain soils do not provide adequate quantities of this element to plants and in turn to livestock. Such fodders having low Cu content are liable to induce various deficiency symptoms in animals (Maynard and Loosli, 1979) [20].

Copper in plants and diet
According to Rajora and Pachauri (1993) [24] the Cu content in fodder ranged from 5.95 to 15.68μg/g at three livestock farms in Tarai region. Mandal et al. (1996) [10] reported that the average Cu content in pearl millet straw and wheat straw and wheat grain were 8.34, 3.56 and 9.50 mg/kg, respectively in Mohindergarh district of Haryana state. According to Lall et al. (1996) [15] the average Cu content in wheat straw, wheat flour and cottonseed cake was 13.6 mg/kg, 9.51 mg/kg and 32.36 mg/kg, respectively in Hisar district. Garg et al. (2011) [9] while surveying the Amritsar, Ludhiana and Patiala districts of Punjab reported that the average copper (Cu) content was low in straws (4.46 ppm) and in concentrate feed ingredients, it was 10 ppm.

According to Malik (1991) [18] the average value of Cu in cottonseed cake was 25.8 mg/kg in Pakistan. Lall et al. (1994) [16] reported that Cu content was quite high in sorghum (10-16 mg/kg) compared to the requirement of this element in diet is 10 mg/kg. Bhanderi et al. (2013) [3] while surveying the Sabarkantha District of Gujarat reported that green roughages were good source of copper (12.31 ppm). Garg et al. (2008) [10] reported that the average value of Cu in green fodders is 9.68 ppm in Bharatpur district of Rajasthan. Dry roughages are mostly deficient in Cu because in most circumstances Cu concentration declines as plant mature (McDowell, 1985) [21]. Rajora and Pachauri (1993) [24] found that the Cu content in concentrate mixture ranged from 15.28 to 16.36 mg/kg in Terai region. Cereal grains generally contain 4.8μg/g as reported by Davis and Mertz (1987) [6]. Arora et al. (1993) [2] studied on changing nutrient status of crop plants in intensive agriculture and found that over the period of study the concentrations of Zn and Fe in wheat increased noticeably but those of Cu had a tendency to decrease. A comparison of various fodders with regard to their Cu content showed that leguminous fodders contained higher amount of Cu followed by non-leguminous fodders and cereal straws.

Sawhney et al. (1977) [25] found mild to severe deficiency of this mineral in the locally grown fodders of Himachal Pradesh and Jammu & Kashmir states. He also reported that Cu content of berseem was 9.60 mg/kg and that of wheat bhoosa was 6.20 to 16.73 mg/kg. The Cu content in the locally available fodders of drought prone areas of Maharashtra state was found to be a limiting factor for normal growth and production in large ruminants. Yadav et al. (1998) [32] reported that there was deficiency of Ca, P, Zn, Mn, Cu and Fe in feeds and fodder of Rewari district of Haryana state. They reported that bajra stover, wheat straw, cottonseed and wheat grain were deficient in copper. Iron was much higher in all the ingredients than its specified level in ration. According to Anke et al. (1994) [1] the content of all investigated trace elements (Fe, Mn, Zn, Cu, I) decreased with increasing plant age. Wakelin (1992) [31] reviewed the methods of supplementing Cu to ruminants including pasture top dressing, oral supplement and parental administration.

Copper in Blood
The lower critical value of Cu in serum has been reported as 0.6 ppm (Underwood, 1981) [30]. Yadav et al. (1994) [33] reported that the average value of Cu content was 0.47 mg/kg in blood serum of buffaloes in Rewari district. According to Mandal et al. (1996) [19] the average Cu content in blood serum of milch buffaloes was 0.67 mg/kg in Mohindergarh district. Chauhan and Nderingo (1997) [3] reported the Cu content ranged from 0.64 to 0.75 mg/kg in Tanzania. Sharma and Prasad (1983) [27] found the Cu content in blood of lactating buffaloes with average of 1.21 mg/kg. According to Nasser (1995) [22] the most important symptoms of Cu deficiency were anaemia, unthriftiness, hair looseness and discoloration, nervous manifestations and diarrhea. Diseased cows had very low blood and liver concentrations of Cu.

Copper in Hair
Cu level in hair below 8 ppm was associated with deficiency in cattle (Underwood, 1977) [29]. Mandal et al. (1996) [10] reported that the average copper contents in buffalo hair were 10.55 mg/kg in Mohindergarh district of Haryana state. Bhanderi et al. (2013) [3] while surveying the Sabarkantha District of Gujarat reported that the average level of Cu in hair was 6.28 ppm. Combs et al. (1987) [5] found that concentrations of Ca, P and Cu in hair were not affected by dietary intake of these minerals.

Iron (Fe) in Plants and Diet
reported that the iron content in fodder and concentrate mixture ranged from 173.30 to 500.77 mg/kg and 531.40 to 777.45 mg/kg, respectively at three livestock farms in Terai region. According to Mandal et al. (1996) [19] the average Fe content in wheat straw was 377.8 mg/kg in Mohindergarh district of Haryana state. According to Lall et al. (1994) [16], the Fe content in sorghum was about 200 mg/kg in Hisar district. Garg et al. (2011) [9] while surveying the Amritsar, Ludhiana and Patiala districts of Punjab reported that the average Fe content was very high in roughages (>500 ppm). According to Malik (1991) [18] the average value of iron in cotton seed cake was 158.0 mg/kg in Pakistan. Garg et al. (2008) [10] reported that the Fe contents were adequate in the diet of animals, with traditional feeding system in Bharatpur district. According to Kadiyan (1985) [14] the average Fe content in wheat flour was 119.0 mg/kg in Haryana. Garg et al. (2008) [10] reported that the Fe contents were adequate in the diet of animals, with traditional feeding system in Bharatpur district.

According to Lall et al. (1994). [16] the Fe content varied from 200-340 mg/kg in berseem and about 200 mg/kg in jowar and oats. It was sufficiently high to meet the requirement (50 mg/kg). Henry and Miller (1995) [13] reviewed the Fe bioavailability and found that citrate, fumarate and gluconate forms of iron had been found to be equal in bioavailability to ferrous sulphate. Fe as ferrous chloride was well utilized whereas ferric chloride was less available.

Iron in Blood
Iron occurs in blood as haemoglobin in the erythrocytes and as transferring in the plasma in a ratio of nearly 1000:1. Yadav et al. (1994) [31] reported that the average value of Fe content was 1.45 mg/kg in blood serum of buffaloes in Rewari district. According to Mandal et al. (1996) [19] the average Fe content in blood serum of milch buffaloes was 2.18 mg/kg in Mohindergarh district. Sharma (1991) [26] observed Fe content in serum under different levels of mineral feeding were 1.47, 1.64 and 1.69 mg/kg in three different treatments, respectively. Intake of Fe was very high due to high content in feed and fodders but its level in serum was within the reported range of 1.1 to 2.5 ppm (Georgievskii et al., 1982) [11].

Iron in Hair
The lower critical value of Fe in hair is 40 ppm (Underwood, 1981) [30]. Yadav et al. (1994) [33] reported that the average value of Mn content was 0.39 mg/kg in blood serum of buffaloes for Rewari district. According to Gupta and Chaudhari (1984) [12] the average Mn content in blood serum of milch buffaloes was 0.43 mg/kg in Mohindergarh district. Sharma (1996) observed Mn content in serum under different levels of mineral feeding were 0.59, 0.65 and 0.65 mg/kg in three different treatments, respectively.

Manganese (Mn) in plants and diet
Rajora and Pachauri (1993) [24] while surveying Tarai region reported that the Mn content in fodder and concentrate mixture ranged from 22.68 to 40.88 mg/kg and 24.40 to 30.29 mg/kg, respectively at three livestock farms in Terai region. According to Mandal et al. (1996) [19] the average Mn content in wheat straw was 59.50 mg/kg in Mohindergarh district of Haryana state. Lall et al. (1996) [15] reported that the average Mn content in wheat straw and wheat flour was 18.5mg/kg and 17.66 mg/kg, respectively in Hisar district. Bhanderi et al. (2013) [3] while surveying the Sabarkantha District of Gujarat reported that dry roughages were good source of Mn (47.88 ppm). Garg et al. (2008) [10] reported that the manganese contents were adequate in the diet of animals, with traditional feeding system in Bharatpur district. According to Malik (1991) [18] the average value of Mn in cotton seed cake was 25.0 mg/kg in Pakistan. According to Kadiyan (1985) [14] the average Mn content in wheat flour was 48.6 mg/kg in Haryana. Gami et al. (2013) [8] while surveying Dantiwada taluka in North Gujarat region reported that the average value of Mn in concentrate mixture was 40.09 mg/kg. Maan et al. (2014) [17] reported that in Rohtak and Bhiwani district of Haryana state, dry and green fodder are deficient in Zn, Cu, Mn. Concentrates are also deficient in these minerals. Deficient also reflected in serum, hair and milk. Yadav et al. (1998) [32] reported that there was deficiency of Ca, P, Zn, Mn, Cu and Fe in feeds and fodder of Rewari district of Haryana state. Gami et al. (2013) [8] reported that there was significant low level of Cu and Zn while Mn was in good amount in high yielding cattle's diet of Dantiwada taluka in North Gujarat region.

Manganese in Hair
Underwood (1981) [30] stated that hair apparently reflects the dietary status of animals and 8 ppm was the lower critical level in adult cattle (Underwood, 1977) [29]. According to Gupta and Chaudhari (1984) [12] the cattle poll hali Mn content ranged from 1.70 to 40.76 mg/kg in the hilly tracts of Darjeeling. Mandal et al. (1996) [19] reported that the average Mn contents in buffalo hair were 13.72 mg/kg in Mohindergarh district. Yadav et al. (1994) [33] reported the average value of Mn in blood serum of buffalo was 0.39 mg/kg in Rewari district of Haryana state.

Conclusion
Minerals in feed and fodder is decreasing due mineral deficiency due to mineral deficiency.

References
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