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Mineral Composition of Green and Dry Roughage in Gurgaon District of Haryana, India

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A B S T R A C T

A survey was conducted to study the mineral composition of green and dry roughage in Gurgaon district of Haryana state. From each of the four blocks, three villages were randomly selected. To have a systematic and planned study, all the blocks were included in the survey. From each block, three villages were randomly selected to have a fairly representative sample. From each village, four categories of farmers i.e. landless, small (having up to five acres of irrigated land), medium (five to ten acres of irrigated land) and large (more than ten acres of irrigated land) and having dairy animals were purposefully selected. In each village, five families under each category were interrogated on the prescribed Performa for this study, thus, making a total of 240 families. Sorghum and wheat straw were the main green and dry fodder crops adopted in the area during *Kharif* season. Among the concentrate feeds, wheat dalia and cottonseed cake were found to be most popular. Results showed that Ca and P concentrations of sorghum are above than critical level i.e., 0.30% and 0.25% respectively. In sorghum Zn was highly deficient in all samples as its level was below than critical level (30 ppm). In case of Cu considering 8ppm as critical limit, none of the samples were deficient in the district. The average Fe content of sorghum in district was 179.09 ppm. Considering 50 ppm as critical limit, none of the samples were deficient in the district. Mn content of some samples of sorghum was below critical value (40 ppm). Few samples of straw in Ca content were below critical limit (0.30%). The P concentration of straw was below critical limit (0.25%). Samples of straw were highly deficient of P. Considering 8ppm as critical limit; half of the samples of straw were deficient in Cu. Samples were deficient of Zn as its level was below critical limit (30 ppm). None of the samples of straw were deficient in Fe in the district. The average Mn concentration of straw ranged from 43.58 ppm (Sohna) to 44.01 ppm (Farrukhnagar). Some samples were below critical value (40 ppm). Thus we can conclude from this study that Ca, P, Cu, Fe are above critical level, Zn highly deficient and Cu moderately deficient in sorghum. Whereas straw was deficient in Ca, P and Zn, moderately deficient in Cu and Mn and no deficiency was found in Fe content.

Introduction

India has enormous and diverse animal wealth generating livelihood opportunities for millions. Total livestock population in the country in 2012 as per the All India livestock census, was over 512 million – the largest in the world.

Livestock is the only source of livelihood in many arid and semi-arid regions in the country and cattle and buffaloes are prominent among them. However, in spite of its economic importance, the performance of the livestock sector has not been optimum, due to non-availability of critical inputs and services, and poor linkage with the market. Under such a situation, even these valuable assets turn into liabilities and start making negative contribution to sustainable development. Livestock keeping along with crop husbandry maximizes the agricultural production (Singh *et al.,* 1996). Profit from the dairy animals depends upon the input of nutrients supplied and output received in the form of milk. Poor inputs in terms of underfeeding will result in poor economic gains even from the high yielding animals. Underfeeding in dairy animals is the major obstacle in the development of an efficient animal production system in developing countries (Fahimuddin, 1975).

Mineral serve the body in different ways. As constituent of bone and teeth, they give rigidity and strength to skeletal structures. They are also constituent of biomolecules such as proteins and lipids which are important constituents of body organs, cells and tissues. Mineral elements are important in maintenance of homeostasis in the internal fluids and also play a significant role in maintenance of cell membrane equilibrium. Minerals are also important in the activation of many enzymes. Mineral status of animals also affects the symbiotic micro flora of gastrointestinal tract besides reproduction efficiency. Macro minerals such Ca, P, Mg and S are important in reproductive physiology. The interactions of macro minerals with certain inorganic trace elements like Zn, Cu, Mn, etc. can lead to complexes that are not available to the animal. The advent of organic sources of trace minerals has averted these imposed deficiencies.

In Haryana state farmers generally do not supplement mineral mixture and common salt in animal ration which leads to many reproductive and health problems due to deficiency of important minerals. Studies conducted on mineral status of buffaloes in Mohindergarh (Mandal *et al.,* 1996) and Rewari (Yadav *et al.,* 1998) districts of the state revealed that over fifty percent buffaloes show calcium, phosphorus and copper level below normal values. Therefore, there is an urgent need for determining mineral status of feed, fodder and animals; and advocating suitable corrective measures for optimal health and increased animal production.

Materials and Methods

A survey was conducted to study the conventional feeding systems and plane of nutrition of dairy buffaloes in Gurgaon district of Haryana state. The survey was conducted accordingly during July and August 2015 (Kharif season) through personal approach at the doorstep of individual farmers to collect the required information. Gurgaon district has four blocks. To have a systematic and planned study, all the blocks were included in the survey. From each block, three villages were randomly selected to have a fairly representative sample. From each village, four categories of farmers i.e. landless, small (having up to five acres of irrigated land), medium (five to ten acres of irrigated land) and large (more than ten acres of irrigated land) and having dairy animals were purposefully selected. In each village, five families under each category were interrogated on the prescribed Performa for this study, thus, making a total of 240 families. The farmers cooperated well in recording body weight, milk yield, feed intake and answering the questionnaire for collection of data. The samples of feed, fodders, blood and hair were collected for chemical analysis. The proximate analysis of feed and fodder

samples was done following standard procedure (AOAC, 2007). The data was statistically analyzed as per statistic methods of Snedecor and Cochran (1994). Feed and fodder samples collected were kept in hot air oven (at 100±5^{o}C for 24 hours) to express the result on dry matter basis. Fully automated Random Access Clinical Chemistry Analyzer (EM 200^{TM} Erba Mannheim – Germany) was employed for estimation of biochemical parameters using kits produced from Transasia Biomedical Limited, Germany.

Calcium was estimated by Arsenazo method.

Phosphorus was measured by UV phosphomolybdate method.

Results and Discussion

Green Roughage

Green roughage being fed to the buffaloes was sorghum. It was home grown. It was the major green roughage and was being fed by farmers at all the sites surveyed. Mineral composition of sorghum in different sites of Gurgaon district is given in Table 1. The concentration of Ca (%) in sorghum ranged from 0.34 to 0.61 and had an average value of 0.49±0.02. The average Ca concentration ranged from 0.46±0.03 (Sohna) to 0.55±0.04 (Farrukhnagar). The concentration of P (%) in sorghum ranged from 0.28 to 0.52 and had an average value of 0.42±0.02. The average P concentration ranged from 0.38±0.04 (Gurgaon) to 0.45±0.03 (Farrukhnagar). The Ca and P concentrations are above than critical level i.e., 0.30% and 0.25% respectively.

The average values of Zn concentration in sorghum of different blocks were 27.16, 22.07, 23.07 and 25.17 ppm. Concentrations of Zn, considering the whole data, ranged from 19.78-29.55 ppm. The average value of Zn content was highest (27.16 ppm) in block Gurgaon and the lowest (22.07) in block Pataudi (Table 1). Zn was highly deficient in all samples as its level was below than critical level (30 ppm). Dhore *et al.*, (2007) 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) reported that the Zinc was acutely deficient in most of the feedstuffs (average level< 26.30 ppm) in Bharatpur district of Rajasthan.

The average values of Cu concentration in sorghum of different blocks were 34.84, 34.45, 38.19 and 38.41 ppm. Concentrations of Cu, considering the whole data, ranged from 27.32-50.12 ppm. The average value of Cu content was highest (38.41 ppm) in block Sohna and the lowest (34.45 ppm) in block Pataudi (Table 1). Considering 8ppm as critical limit, none of the samples were deficient in the district. Lall *et al.*, (1994) 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) while surveying the Sabarkantha District of Gujarat reported that green roughages were good source of copper (12.31 ppm). Garg *et al.*, (2008) reported that the average value of Cu in green fodders is 9.68 ppm in Bharatpur district of Rajasthan. The values under the present investigation are also in the higher range as reported earlier.

The average Fe content of district was 179.09 ppm and had ranged from 147.32-203.63 ppm. Considering 50 ppm as critical limit, none of the samples were deficient in the district. According to Lall *et al.*, (1994), the Fe content in sorghum was about 200 mg/kg in Hisar district. Garg *et al.*, (2011) while surveying the Amritsar, Ludhiana and Patiala districts of Punjab reported that the average Fe content was very high in green roughages (>500 ppm).

Table.1 Mineral composition of sorghum in different sites of Gurgaon district

Site No.	Name of Block	N	Ca (%)	P (%)	Zn (ppm)	Cu(ppm)	Fe(ppm)	Mn(ppm)
1.	Gurgaon	60	0.49±0.02	0.38±0.04	27.16±2.01	34.84±3.25	165.75±4.68	54.53±2.29
2.	Pataudi	60	0.47±0.04	0.44±0.02	22.07±1.65	34.45±2.12	182.15±6.80	50.01±4.83
3.	Farrukhnagar	60	0.55±0.04	0.45±0.03	23.07±2.69	38.19±1.11	182.60±15.71	49.05±1.68
4.	Sohna	60	0.46±0.03	0.39±0.02	25.17±2.44	38.41±3.86	185.87±7.04	50.31±2.17
Mean			0.49±0.02	0.42±0.02	24.37±1.12	36.47±1.31	179.09±4.70	50.98±1.43
Range			0.34-0.61	0.28-0.53	19.78-29.55	27.32-50.12	147.32-203.63	37.89-64.25

± Standard error of mean

Table.2 Mineral composition of wheat straw in different sites of Gurgaon district

Site No.	Name of Block	N	Ca (%)	P (%)	Zn (ppm)	Cu(ppm)	Fe(ppm)	Mn(ppm)
1.	Gurgaon	60	0.34±0.02	0.20±0.02	16.95±0.85	7.51±0.82	222.03±4.35	43.95±1.48
2.	Pataudi	60	0.38±0.01	0.20±0.01	21.08±1.92	7.41±0.35	225.65±3.50	43.64±2.09
3.	Farrukhnagar	60	0.38±0.02	0.19±0.01	20.15±1.88	7.34±0.42	226.83±5.52	44.01±2.41
4.	Sohna	60	0.41±0.01	0.20±0.02	20.34±1.13	7.70±0.69	234.41±2.07	43.58±1.33
Mean			0.37±0.04	0.20±0.01	19.63±1.80	7.49±0.46	227.23±6.20	43.79±2.80
Range			0.28-0.45	0.14-0.25	12.56-27.72	5.88-9.48	207.33-247.18	36.89-54.04

± Standard error of mean

The values under the present investigation are also in the higher range as reported earlier. The concentration of Mn (ppm) in sorghum ranged from 37.89-64.25 and had an average value of 50.98. The average Mn concentration ranged from 49.05 ppm (Farrukhnagar) to 54.53 ppm (Gurgaon). Some samples were below critical value (40 ppm). Otherwise, as a whole data, district was not deficient in Mn content. Garg *et al.*, (2008) reported that the manganese contents were adequate in the diet of animals, with traditional feeding system.in Bharatpur district. The values under the present investigation are also in line with the ranges reported earlier.

Dry roughage

Main dry roughage fed to the animals was wheat straw. It was being fed by farmers at all the sites surveyed. Mineral composition of wheat straw in different sites of Gurgaon district is given in Table 2. The concentration of Ca (%) in wheat straw ranged from 0.28 to 0.45 and had an average value of 0.37±0.04. The average Ca concentration ranged from 0.34±0.02 (Gurgaon) to 0.41±0.01 (Sohna). Few samples were below critical limit (0.30%). Garg *et al.*, (2008) reported that the average calcium content in straws (0.34%) was higher in comparison to phosphorus (0.10%) in Bharatpur district of Rajasthan. Gami *et al.*, (2013) while surveying Dantiwada taluka in North Gujarat region, reported that dry roughages found in area are good source of calcium while poor source for phosphorus. The values under the present investigation are also in line with the ranges reported earlier.

The concentration of P (%) in wheat straw ranged from 0.14 to 0.25 and had an average value of 0.20±0.01. The P concentration was below critical limit (0.25%). Samples were highly deficient of P.

The average Zn concentration was 19.63 ppm and had ranged from 12.56-27.72 ppm. Samples were deficient of Zn as its level was below critical limit (30 ppm). Singh (1977) observed that the Zn content in wheat straw varied from 16.34 to 24.75 mg/kg. According to Rajora and Pachauri (1993) the Zn content in Tarai region in fodder ranged from 15.84 to 30.22 mg/kg at three livestock farms and revealed that Zn deficiency in 33 % fodder samples of Prag

livestock farm and 50 % samples of Livestock Research Centre. Mandal *et al.,* (1996) 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) the average Zn content in wheat straw was 23.05mg/kg in Hisar district. Dhore *et al.,* (2007) reported that the average value of Zn in feed and fodders was less than 25.06 ppm in Western Agro Climatic Zone of Vidarbha. The values under the present investigation are also at par with the ranges reported earlier.

The average values of Cu concentration in wheat straw of different blocks were 7.51, 7.41, 7.34 and 7.70 ppm. Concentrations of Cu, considering the whole data, ranged from 5.88-9.48 ppm. The average value of Cu content was highest (7.70 ppm) in block Sohna and the lowest (7.34 ppm) in block Farrukhnagar (Table 2). Considering 8ppm as critical limit, half of the samples were deficient in the district. According to Rajora and Pachauri (1993) the Cu content in fodder ranged from 5.95 to 15.68µg/g at three livestock farms and revealed that Cu deficiency in 50 percent fodder samples of Mehta Trust farm in Tarai region. Mandal *et al.,* (1996) 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) the average Cu content in wheat straw was 13.6mg/kg in Hisar district. Dry roughages are mostly deficient in Cu because in most circumstances cu concentration declines as plant mature (McDowell, 1985). Garg *et al.,* (2011) while surveying the Amritsar, Ludhiana and Patiala districts of Punjab reported that the average copper (Cu) content was low in straws (4.46 ppm). The values under the present investigation are also in line with the ranges reported earlier.

The average Fe content of district was 227.23 ppm and had ranged from 207.33-247.18 ppm. Considering 50 ppm as critical limit, none of the samples were deficient in the district. Rajora and Pachauri (1993) while surveying Tarai region reported that the iron content in fodder ranged from 173.30 to 500.77 mg/kg at three livestock farms. According to Mandal *et al.,* (1996) the average Fe content in wheat straw was 377.8 mg/kg in Mohindergarh district of Haryana state. Values of the present investigation are in corroboration with the values of previous findings.

The concentration of Mn (ppm) in wheat straw ranged from 36.89-54.04 and had an average value of 43.79. The average Mn concentration ranged from 43.58 ppm (Sohna) to 44.01 ppm (Farrukhnagar). Some samples were below critical value (40 ppm). Rajora and Pachauri (1993) while surveying Tarai region reported that the Mn content in fodder ranged from 22.68 to 40.88 mg/kg at three livestock farms. According to Mandal *et al.,* (1996) the average Mn content in wheat straw was 59.50 mg/kg in Mohindergarh district of Haryana state. Lall *et al.,* (1996) reported that the average Mn content in wheat straw was 18.5mg/kg in Hisar district. Bhanderi *et al.,* (2013) while surveying the Sabarkantha District of Gujarat reported that dry roughages were good source of Mn (47.88 ppm).

We can conclude from this study that Ca, P, Cu, Fe were above critical level, Zn highly deficient and Cu moderately deficient in sorghum. Whereas straw was deficient in Ca, P and Zn, moderately deficient in Cu and Mn and no deficiency was found in Fe content. So the mineral deficiency can be avoided in the animal feed by adding mineral mixture.

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