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Study the micro and macro-nutrient status of soil and fodder of Banswara District of Rajasthan

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Abstract
A study was conducted to estimate the level of selected macro and micro-nutrients in the soils of ten tehsils of Banswara district of Rajasthan. Soil analysis indicated that major nutrients *viz*., phosphorous, potassium, calcium and magnesium were moderate in the soils of this district. In the same way iron and copper level in all the soils was adequate. Average zinc content of soils of Banswara district was found to be intermediate and was highest in soils of Kushalgarh. Higher mean manganese content was found in this district and was highest in the soils of Choti Sarvan. This study exhibited that the soils of Ganoda, Choti Sarvan and Abapura were deficient in sulphur contents. Fodders were found to contain adequate contain of Ca (>0.30%), Fe (50 ppm) and Co (0.10 ppm). Fodders were found to be deficient in phosphorous (except soybean). Content of magnesium (0.20 %) in all fodder were found adequate. Fodders were found to be deficient in zinc (except Soybean and Barseem straw) and deficient in manganese content (40ppm) (except soybean and barseem). Fodders were found to be deficient in copper (except lucerne and barseem).

Keywords: Soil, micronutrients, macronutrients, organic matter and fertility, fodder

Introduction
Soil is a mixture of weathered rock fragments, minerals and organic matter that are on earth's surface. Macronutrients (N, P and K) and Micronutrients (Fe, Mn, Zn, and Cu) are important soil elements that control its fertility. The importance of soil fertility and plant nutrition to the health and survival of all life is well understated. As human population continue to increase, human disturbance of earth's ecosystem to produce food and fiber will place greater demand on soils to supply essential nutrients. Therefore, it is critical that we increase our understanding on the chemical, biological, and physical properties and their relationships in the soil-plant-atmosphere continuum that control nutrient availability. Nutrient balance is the key component to increase crop yields. Soil characterization in relation to evaluation of fertility status of the soils of an area or region is an important aspect in context of sustainable agriculture production. Micro nutrients also known as trace elements are required in micro quantities but their lack can cause serious crop production and animal health problem. Soil test-based fertility management is an effective tool for increasing productivity of agricultural soils that have high degree of spatial variability resulting from the combined effects of physical, chemical or biological processes.

Macro and micro-nutrients like Ca, Fe, P, Zn, Cu, Mn, Mg are the important essential minerals for normal growth, fertility and productivity of animals. Deficiency of these elements in soil or plants affects the mineral status of animals resulting in various maladies, which have been observed to be widely prevalent even under natural grazing conditions in most of the countries throughout the world, particularly in the tropics, suffers from minerals deficiency, affecting the productive and reproductive performances of animals (Garg *et al.* 2005) [8]. Mineral supplementation dramatically improves the condition of dairy animals suffering from mineral deficiency (McDowell, 1992) [13]. In India, livestock are mainly maintained on grazing with little or no supplementation of mineral mixture except common salt. Under such feeding practices, the deficiency of minerals in animal is expected owing to poor mineral content of grazing resources in the tropics. The mineral composition of grasses and browse on grassland in India is also highly variable due to seasonal variation in the maturity and chemical composition of forage. In the hilly area the cereal straws are deficient in copper and zinc. Barring rice straw and all others straw have border line manganese content, while iron is found to be adequate.

Material and Methods

A survey to assess micro and macro nutrient status of the soil and fodder was conducted in ten tehsils of Banswara district. The samples collected from each tehsil were dried and digested in tri acid and then volume was made to 50 ml. The nutrients *viz*., P, Ca, Mg, Fe, Zn, Mn, Cu, Pb and S were estimated by Atomic Absorption Spectrophotometer. Phosphorus in soil samples was estimated calorimetrically by AOAC (1975) [1].

Results and Discussion

Mean nutrient status of different micro and macro nutrients in ten tehsils of Banswara district of Rajasthan is presented in the table 1. Phosphorus is the second most important major nutrient required by plants after nitrogen for proper growth and development and like nitrogen, phosphorus (P) is also an essential part of the process of photosynthesis, involved in the formation of all oils, sugars, starches etc. Phosphorous content was intermediate in this district. The low available phosphorous content soils might be due to fixation of available phosphorous by free oxides and exchangeable Aluminium. Potassium is absorbed by plants in larger amounts than any other mineral element except nitrogen and, in some cases, calcium. Mean Potassium contents indicated the presence of this element in intermediate quantity. Higher potassium may be due to higher organic carbon content as well as due to addition of potassium bearing fertilizers in surface horizons. Similar results were observed by Pal and Singh (1993) [14]. The surface soils of all most all pedons except hill and valley were generally rich in potassium content which may be because of management practices followed in cultivated soils (Gaikwad *et al.,* 1974) [7]. Similar results have also been observed by Rathore (1993) [18] and Sharma (1994) [21]. The soils of this district were medium in Calcium and Magnesium contents. These results indicate that Ca has to be supplied externally through organic or inorganic fertilizers.

All the investigated micronutrients (Fe, Cu, Zn and Mn) are influenced by the soil environment (Brady, 1995) [4]. Iron level in all the soils was adequate. Average Zinc content of soil of Banswara distinct was found to be intermediate and was highest in soil of Kushalgarh. Higher mean manganese content was found in this district and was highest in the soils of Choti Sarvan. Copper contents were adequate in all tehsils and was found highest in soils of Anandpuri. This study exhibited that the soils of Ganoda, Choti Sarvan and Abapura were deficient in sulphur contents.

These findings are in agreement with the findings of Bhanderi *et al.* (2016) for Ca, Sharma *et al.* (2015) for Ca, P and Mg, Panda *et al.* (2015) [15] for Ca and P, Devi *et al*. (2014) [6] for Cu, Ramesh *et al.* (2014) [17] for Cu, Sharma *et al.* (2006) [20] for Ca, P, Mg, Cu and Zn were found below the critical level.

The variation in the mineral content in different soil may be due to plant species, cultivar differences, soil and climatic conditions in which plants were grown (Turner *et al.* 1978). Higher concentration Fe, Mg, Cu and Zn soils reported by Choudhary *et al.* (2015) [5], Panda *et al.* (2015) [15] and Ramesh *et al.* (2014) [17] in Soils of Rajasthan, Orrisa and Andhra Pradesh, respectively. Bhat *et al.* (2011) [3] and Yatoo *et al.* (2011) [27] had also reported higher concentration of Ca, P, Mg, Cu and Zn in Kashmir soils. Similar reports were also reported earlier by various workers (Shukla et al. 2010, Gowda *et al.* 2001. Panda *et al*. (2015) [24, 11, 16, 15] and Devi *et al.* (2014) [6]. Yatoo *et al.* (2011) [27] reported lower Fe and Zn in Kashmir, and P in Assam (Kalita *et al.* 2003) [12], which was less as compared to present investigation.

Common feed resources available for feeding of animals in Banswara districts located in tribal belt of Rajasthan were cereal grains, cereals straws, forest tree leaves and green grasses. Mineral content of these locally available feeds and fodder resources fed to cattle, buffaloes and goats in the tribal belt are presented in table 2. Calcium content was consistently higher in green fodders, straw and tree leaves, however P content was lower in green fodders, straw, tree leaves and grasses and had wider Ca: P ratio. It has been reported that wider Ca: P ratio interferes in the utilization of these minerals in animal system. Singh *et al.* (2006) reported that most of the feedstuffs in the arid and semiarid regions are poor in P and responsible for acute to sub acute deficiencies in animals. Fe contents were reasonably higher in all the feedstuffs of the region. Similar higher Fe contents of feedstuff across the country have been reported by several workers (Ramana *et al.,* 2001, Garg *et al*., 2005, Shinde *et al.*, 2007) [11, 16, 8, 23]. It has been reported that almost all the fodders contained higher Fe than required concentration in semiarid region of Rajasthan (Shinde *et al.,* 2006) [22]. The probable explanation could be contamination of feeds with soil or inert and insoluble iron dust of machinery origin while harvesting in field to processing in mills and other extraction plants. It has been reported that higher content of Fe in the feed interfered the copper absorption and metabolism in animals (Youssef *et al.,* 1999) [28]. Mg level in all the feedstuffs was adequate. Earlier studies in different agro-climatic zones of Rajasthan also indicated that common feed resources of semiarid Rajasthan are adequate in Mg (Shinde *et al.,* 2006) [22]. Zinc was deficient in all fodders except maize and sorghum straw. Zinc deficiency in fodder of many agro-climatic zones of the country has been reported (Ramana *et al.,* 2001, Garg *et al*., 2003 and Udar *et al.*, 2003) [11, 16, 10, 25]. Mn content in fodder was inadequate except barseem and Soybean. Copper quantity was recorded low especially in dry roughages. Straw of rice sorghum, maize, soybean and wheat contained very low level of copper. Berseem contained higher level of copper.

Table 1: Mean nutrient status of different micro and macro nutrients in ten tehsils of Banswara district of Rajasthan

SN.	Element/Tehsil	P (kg/ha)	K (kg/ha)	Ca (cmol/kg)	Mg (cmol/kg)	Fe (ppm)	Zn (ppm)	Mn (ppm)	Cu (ppm)	pb (ppm)	S (ppm)
	Critical limits	**10-25 (kg/ha)**	**140-280 (kg/ha)**	**1.5-30 (cmol/kg)**	**1-12 (cmol/kg)**	**0.5-1.0 (ppm)**	**2.5-5.8 (ppm)**	**2-4 (ppm)**	**0.2-0.5 (ppm)**	**1-2 (ppm)**	**10-15 (ppm)**
1	Ghatol	19.70	203.80	10.44	7.37	2.41	0.40	3.90	0.35	1.19	10.80
2	Ganoda	18.20	206.60	15.34	4.98	2.34	0.40	4.36	1.62	1.37	9.80
3	Gadi	16.80	198.70	11.14	8.58	3.04	0.43	6.53	1.17	2.70	12.60
4	Banswara	17.90	207.70	11.43	9.05	3.37	0.54	3.20	1.37	2.83	10.70
5	Bagidori	18.30	211.50	16.40	5.80	2.66	0.38	5.38	0.31	3.13	11.10
6	ChotiSarvan	16.60	208.10	16.57	6.97	2.43	0.41	8.54	0.34	2.99	9.60
7	Abapura	18.70	208.10	15.21	7.13	3.39	0.48	6.25	1.36	3.54	9.30
8	Sajjangarh	17.60	212.70	15.77	6.39	2.47	0.36	5.26	0.32	3.68	12.30
9	Anandpuri	18.10	214.00	17.50	5.70	3.41	0.40	6.62	1.66	3.40	11.10
10	Kushalgarh	17.40	218.80	14.95	4.11	2.18	0.69	6.47	1.58	3.17	11.00
	Average	17.93	209.00	14.47	6.61	2.77	0.45	5.65	1.01	2.80	10.83

Table 2: Mean nutrient status of different micro and macro nutrients in fodders of Banswara district of Rajasthan

Element	P %	K %	Ca %	Mg %	Mn (ppm)	Zn (ppm)	Fe (ppm)	Cu (ppm)
Critical limit	<0.25	<0.80	< 0.30	<0.20	<40	<30	< 50	<8
Grass	0.09	1.13	0.49	0.25	38.66	26.60	267.80	6.77
Rice straw	0.09	2.21	0.30	0.21	35.83	27.86	191.36	6.31
Maize straw	0.16	1.69	0.36	0.25	36.31	26.62	244.91	7.05
Barseem straw	0.09	1.32	0.95	0.39	42.74	18.74	522.40	9.49
Soybean straw	0.36	2.49	1.91	0.47	45.68	40.71	558.00	5.40
Sorghum straw	0.14	1.70	0.37	0.29	38.03	24.41	203.75	6.89
Average	0.15	1.76	0.73	0.31	39.54	27.49	331.37	6.99

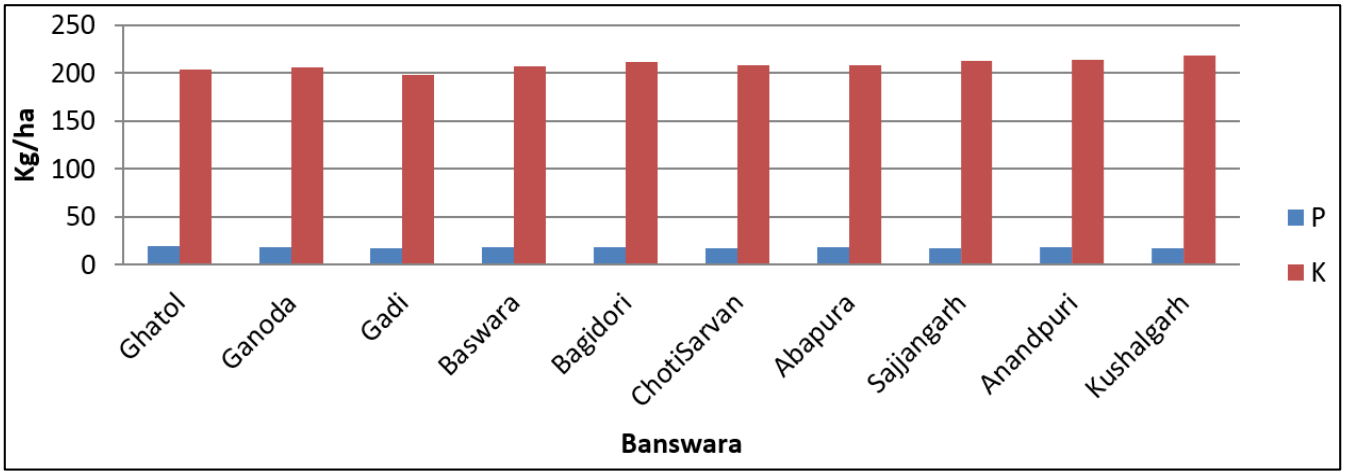

Fig 1: Macronutrient in soil

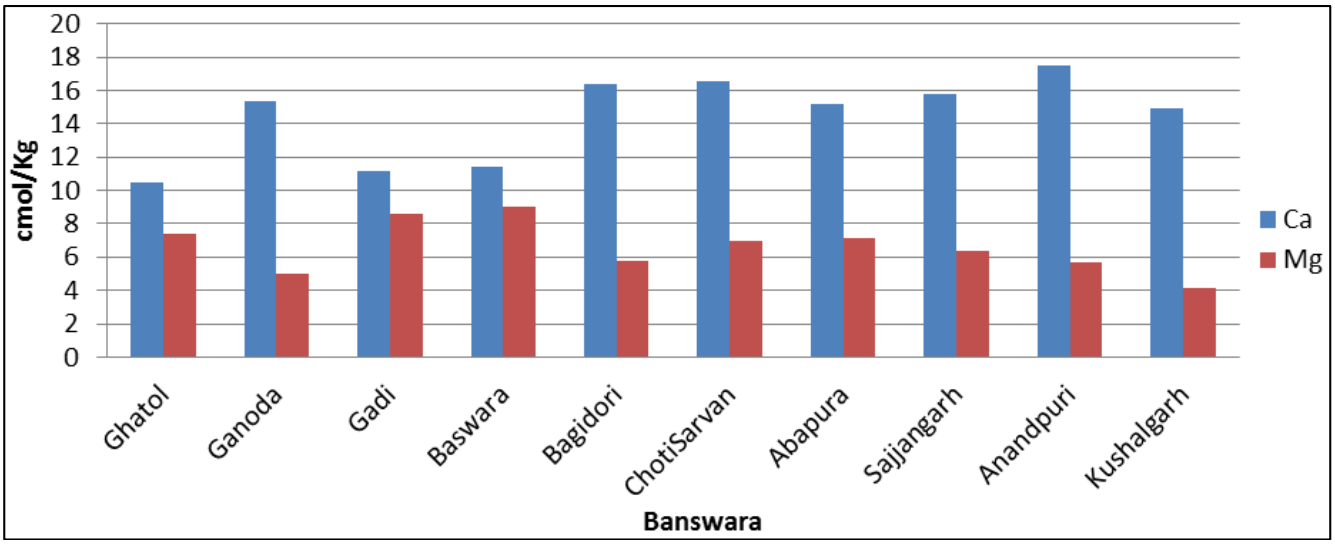

Fig 2: Ca and Mg in soil

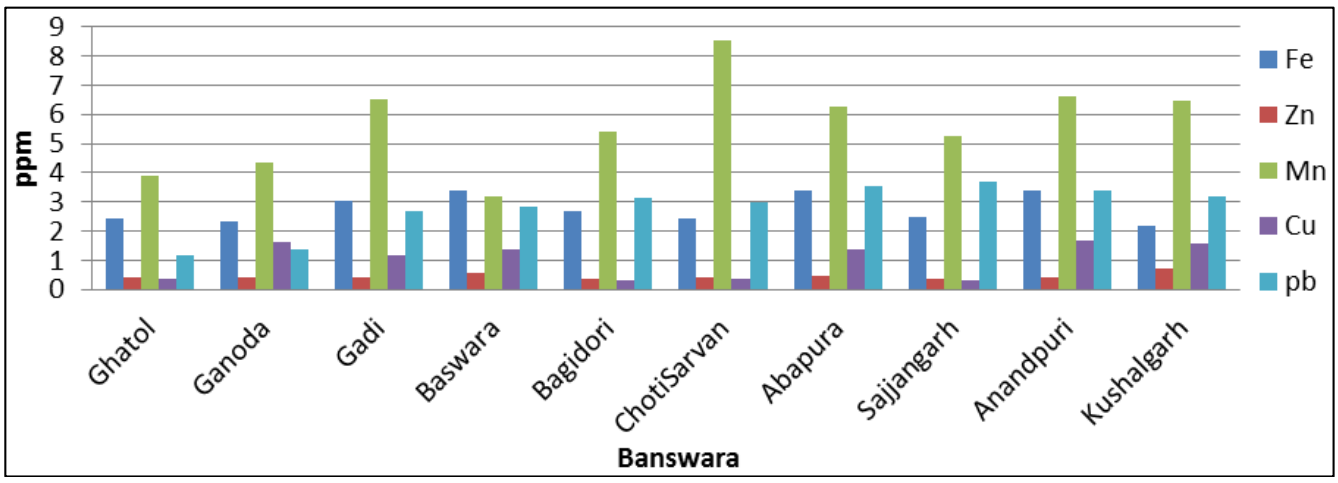

Fig 3: Micronutrient in soil

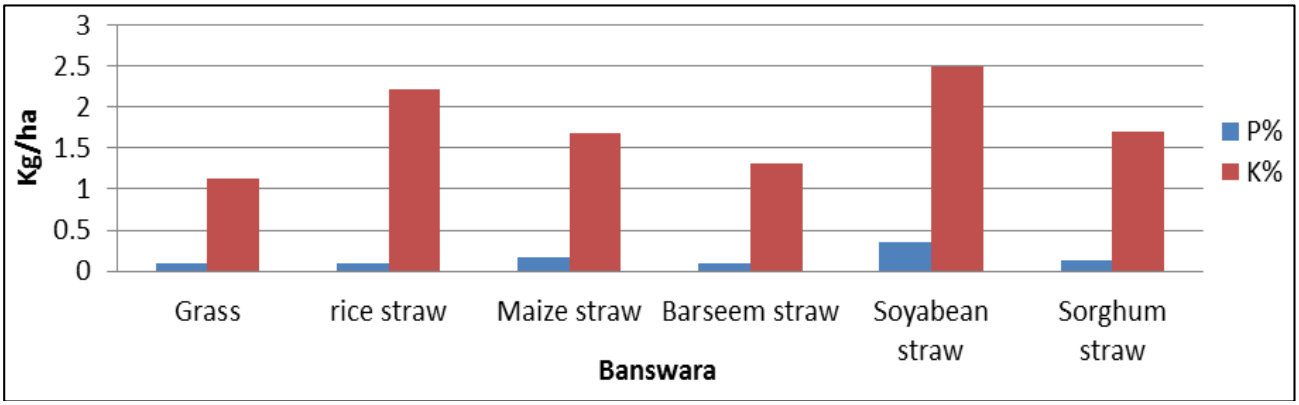

Fig 4: Macronutrient in fodder

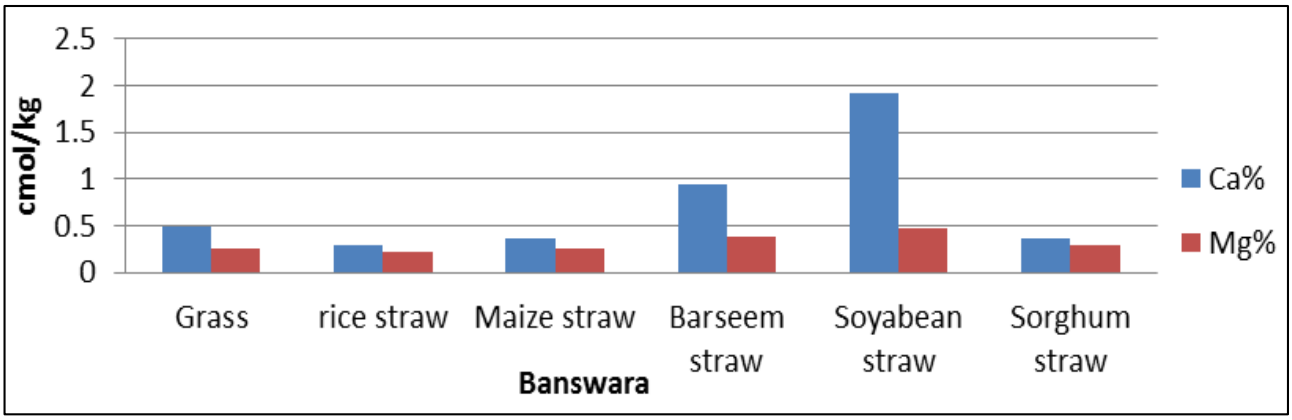

Fig 5: Ca and Mg in fodder

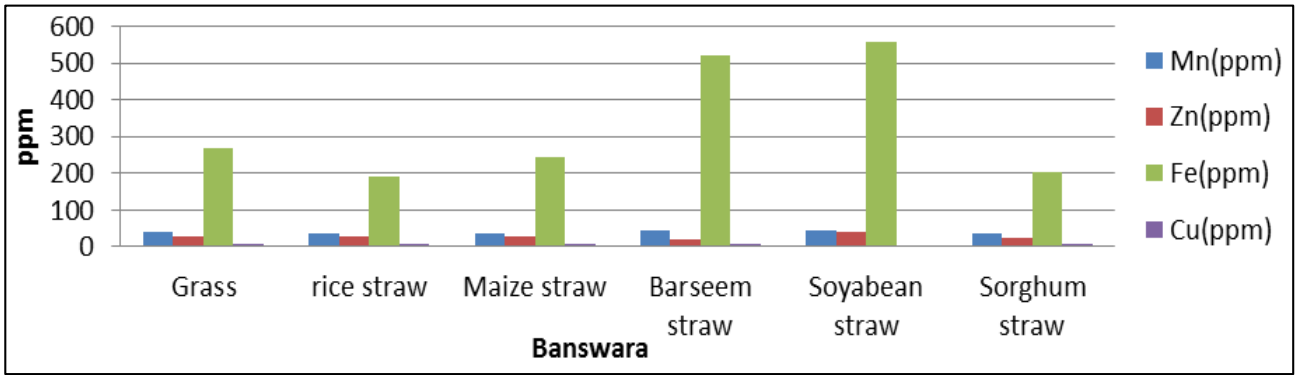

Fig 6: Micronutrient in fodder

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References

1. AOAC. Official Methods of Analysis. Feed total phosphorus estimation by photometric method. Association of Official Analytical Chemists, 12th ed. Washington, DC, 1975.
2. Bhanderi BM, Garg MR, Sherasia PL. Mineral status of feeds, fodder and dairy animals in Jalgaon district of Maharashtra state. Scholars Journal of Agriculture and Veternary Sciences. 2014; 1(4A):222-226
3. Bhat MS, Shaheen M, Zaman R, Muhee A. Mineral inter relationship among soil, forage and dairy cattle in Kashmir, India. Veterinary World. 2011; 4(12):550-553
4. Brady NC. The Nature and Properties of Soils. Prentice Hall of India Private Ltd., New Delhi, 1995.
5. Choudhary S, Ramkesh, Choudhry SD, Yadav P. Mineral status of livestock, soil, feeds and fodders in Ajmer district of Rajasthan. In: 13th International Grassland Congress (IGC 2015) held on 24-24 Nov, 2015.
6. Devi G, Sharma MC, Dimri U, Shekhar P, Deepa PM. Micro-mineral status of soil, fodders and cattle from Idukki and Ernakulam districts of Kerala state, India and their interrelation. International Journal of Advanced Research. 2014; 2(7):11-15.
7. Gaikwad ST, Rao YS, Verma HK G. Characteristics of catenary soils development on basalt parent rock in

Nagpur district of Maharashtra state. Journal of Indian Society of Soil Sciences. 1974; 22:181-190.
8. Garg MR, Bhanderi BM. Recent advance on optimum use of available feed resources and feeding strategies for economic milk production. Proceeding of CLFMA's 47th national symposium on safety first: "farm to fork" held at Goa, September 15 - 16, 2005, 119-129.
9. Garg MR, Arora SP, Bhanderi BM, Sherasia PL, Singh DK. Mineral status of feeds and fodders in Kaira district of Gujarat. Indian Journal of Dairy Sciences. 2000; 53:291-297.
10. Garg MR, Bhanderi BM, Sherasia PL. Macro-mineral status of feeds and fodders in Kutch district of Gujarat. Animal Nutrition Feed Technology. 2003; 3:179-188.
11. Gowda NKS, Prasad CS, Ramana JV, Shivaramaiah. Mineral status of soil, feeds, fodders and animals in coastal agriculture eco-zone of Karnataka. Animal Nutrition. Feed Technology. 2001; 1:197-104.
12. Kalita DJ, Sarmah BC, Sarmah DN, Mili DC. Mineral status and their relation in lactating cows in relation to soil, fodder and feed in Kamrup district of Assam. Indian Journal of Animal Nutrition. 2003; 20(4):421-429.
13. McDowell LR. Minerals in Animal and Human Nutrition. Academic Press, San Diego, Calif, 1992.
14. Pal SK, Singh M. Monitoring the potassium fertility levels of four soil seroes from Northern India over a period of time. Journal of Indian Society of Soil Science. 1993; 41:674-677.
15. Panda MK, Panda N, Swain RK, Behera PC, Sahoo SP, Jena SC *et al*. Minerals profile of soil, feed, fodder and serum of dairy cattle in North Eastern Ghat (Neg) of Odisha. Journal of Animal Research. 2015; 5(2):341-346.
16. Ramana J, Prasad CS, Gowda NKS, Ramachandra KS. Levels of micro-nutrients in soil, feed, fodder and animals of North East transition and dry zones of Karnataka. Indian Journal of Animal Nutrition. 2001; 18:235-242.
17. Ramesh S, Nagalakshmi D, Reddy YR, Reddy AR. Mineral status of soils, water, feeds and fodders of dairy animals in Mahaboobnagar district of Andhra Pradesh. Global Journal of Biological Science and Biotechnology. 2014; 3(3):273-277.
18. Rathore KS. Characterization and classification of soils in a centenary sequence of Jhadole region of Rajasthan. M.Sc. thesis submitted to Rajasthan Agriculture of University, Bikaner, 1993.
19. Sarma K, Buragohain R, Kalita G. Mineral status in soil, fodder and blood serum of dairy cows in Mizoram. Indian Journal Veterinary Animal Science Research. 2015; 44(2):142-145.
20. Sharma MC, Kumar P, Joshi C, Kaur H. Status of serum minerals and biochemical parameters in cattle of organized farms and unorganized farms in western Uttar Pradesh. Asian Journal of Animal Veterinary. 2006; 1(1):33-41.
21. Sharma SS. Characterization and classification of soils across a toposequence over basaltic terrain in humid southern Rajasthan M.Sc. (Ag.) Thesis, R.A.U., Bikaner, Campus, Udaipur, 1994.
22. Shinde AK, Sankhyan SK, Karim SA, Kumar R, Sing VK. Mineral limits of ruminant in Rajasthan. CSWRI, Avikanagar, Rajasthan, India, 2006, 55.
23. Shinde AK, Sankhyan SK. Mineral profile of cattle, buffaloes, sheep and goats reared in humid southern eastern plains of semiarid Rajasthan. Indian Journal of Small Rumin. 2007; 13(1):39-44.
24. Shukla S, Tiwari DP, Mondal BC, Kumar A. Mineral interrelationship among soil, plants and animals in Pithoragarh district of Uttarakhand. Animal Nutrition and Feed Technology. 2010; 10:127-132.
25. Udar SA, Chopde S, Dhore RN. Mineral profile of soil, feeds and fodder and buffaloes in Western Agro-climatic Zone of Vidarbha. Animal Nutrition and Feed Technology. 2003; 3:165-172.
26. Wilson SD, David T. Quadratic variation in old- field species richness along gradients of disturbance and nitrogen. Ecology. 2002; 83:492-504.
27. Yatoo MI, Devi S, Kumar P, Tiwari R, Sharma MC. Soil-plant-animal micro mineral status and their interrelation in Kashmir valley. Indian Journal of Animal Sciences. 2011; 81(6):68-70.
28. Youssef FG, McDowell LR, Brathwaite RAI. The status of certain trace minerals and sulphur of some tropical grasses in Trinidad. Tropical Agriculture. 1999; 76:57-62.