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Studies On Selected Physico-Chemical Properties Of Red Soil Type Of Maize Growing Areas Of Haveri District, Karnataka, India

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***Abstract:** The different physico-chemical properties of twenty representative red soil types spreading over seven taluks of Haveri district of Karnataka were studied during 2016-17 at UAS, Dharwad. The selected soils varied appreciably in their physico-chemical properties. The results on pH of red soils varied from 6.38 to 7.50. The lowest and highest pH was obtained in Medleri-5 and Savanur soils, respectively. The EC of the red soils varied from 0.03 to 0.25 dS m^{-1}. The lowest EC was obtained in Kengapur-3, Hulgur-2 and Guttal and highest in Savanur soils, respectively. Organic carbon was more in Byadgi-1 soils (7.90 g kg^{-1}) and less in Kengapur-2 soils (4.50 g kg^{-1}) in surface. The CEC of lower values in red soils might be due to the fact that these soils are coarser in nature and were having high sand and low organic matter content. The values of sum exchangeable cations ranged between 14.19 and 24.13 cmol (p^+) kg^{-1}. The sand, silt and clay content ranged from 36.32 to 60.96, 15.76 to 25.88 and 21.33 to 36.73 per cent, respectively. The highest values of exchangeable potassium percentage was recorded in Byadgi-1 and lowest in Hanumanamatti soils. The potassium adsorption ratio varied from 0.89 to 2.98. The available potassium varied from 268.80 to 483.84 kg ha^{-1}. The study revealed that variation in physico-chemical properties was be due to cultural practices, application of fertilizers, organic manures and other inputs.*

***Keywords:** CEC, Exchangeable potassium percentage, Potassium adsorption ratio and Available potassium.*

I. INTRODUCTION

Soil is a complex matter and comprises minerals, soil organic matter, water and air. These fractions greatly influence soil texture, structure, and porosity. These properties subsequently affect air and water movement in the soil layers, and thus the soil's ability to function. Therefore, soil physico-chemical properties have a greater influence on the soil quality. Soil texture especially can have a profound effect on many other properties. Thus, soil texture is considered one of the most important physical properties of soil. In fact, soil texture is a complex fraction, consisting of three mineral particles, such as sand, silt and clay. These particles vary by size and make up the fine mineral fraction. Farmers rely on pH testing to maintain quality soil that will produce the healthiest crops. The pH is master variable in soil, knowledge regarding pH helps in management of plant nutrients and their dynamics. The electrical conductivity of soil shows among other properties depending on temperature very interesting effects, which can be used technically. Soil organic carbon (SOC) is one of the major pools of carbon. The SOC pool is about double the size of the atmospheric carbon pool and about 3 times the size of the biotic carbon pool. Cation Exchange Capacity (CEC) is a measure of the ability of soil to hold positively charged ions. It is very important soil property influencing soil structure stability, nutrient availability, soil pH and reaction to fertilisers and other ameliorants. The surface of an individual clay particle or organic colloid is negatively (-) charged. As a consequence their surfaces attract and adsorb positively charged ions called cations. When water is added to soil, cations can move into solution, however, they are still attracted to the clay particle or organic colloid surface and as a result swarm around them. As rocks break down into the particles of sand, silt and clay that make up soil, potassium and other elements are released and may become available to plants. It is important to assess the quantity of potassium in the soil solution and the readily available pool to ascertain whether or not to apply potassium fertilizer.

II. MATERIAL AND METHODS

The surface (0-20 cm) samples was collected, based on predominance of soil type and dominance of cropped area (*i.e*., medium to shallow red soils and deep clayey black soils) under maize. The soil samples collected were air dried in shade, gently ground using wooden pestle and mortar and passed through 2 mm sieve. The sieved samples were preserved in polythene plastic covers for further analysis. Soil reaction was determined in 1:2.5 soil water suspension after stirring for 30 minutes using a pH meter (Jackson, 1973). It was determined in 1:2.5 soil: water suspension after obtaining supernatant as described by Jackson (1973) using conductivity meter. Organic carbon was determined by Walkley and Black's wet oxidation method as described by Piper (1996). The per cent distribution of particles of different size *viz.*, sand, silt and clay was determined by mechanical analysis using Bouyoucos Hydrometer method (Jackson, 1973). Soils (50 g) were shaken with 100 ml of 5 per cent solution of sodium hexa meta phosphate. Later, per cent silt and clay was estimated by hydrometer and per cent sand was calculated by subtracting silt and clay from 100. The exchangeable calcium and magnesium were determined in the neutral normal ammonium acetate the aliquot of the extract was titrated against standard versenate solution and sodium and potassium were determined by flame photometry (Jackson, 1973). Available potassium was determined by extracting soil with neutral normal ammonium acetate and the contents of K in solution and was estimated by flame photometery (Jackson, 1973). The exchangeable potassium percentage in soils was determined with following formula (U.S.D.A, 1954).

$$\text{EPP} = \frac{\text{Exchangeable K}}{\text{CEC}} \times 100$$

The potassium adsorption ratio in selected soils was calculated by following formula (U.S.D.A, 1954).

$$\text{PAR} = \frac{K}{\sqrt{\frac{(Ca+Mg)}{2}}}$$

III. RESULTS AND DISCUSSION

In the present study, pH of red soils varied from 6.38 to 7.50 with a mean of 6.92. The lowest and highest values of pH was obtained in Medleri-5 and Savanur soils, respectively. This might be due to development of these soils by acidic parent materials such as granite gneiss and laterites which lack in basic cations. The results are in corroboration with those of Bangroo *et al.* (2014). The EC of the red soils varied from 0.03 to 0.25 dS m^{-1} with a mean of 0.09. The lowest EC was obtained in Kengapur-3, Hulgur-2 and Guttal and highest in Savanur soils, respectively. The electrical conductivity values were well within the range indicating that no harmful effects of salts, which depict that soil are well drained. The lower EC in surface layer may be because of leaching of salts and its accumulation to sub surface layer. These research findings are in line with the findings of Jagmohan and Grewal (2014). Organic carbon was more in Byadgi-1 soils (7.90 g kg^{-1}) and less in Kengapur-2 soils (4.50 g kg^{-1}) with a mean of 5.72 g kg^{-1}. The lower values of OC may be due to low addition of organic matter into soils and continuous cropping. The findings are on par with the findings of Kundu *et al.* (2014). The presence of high organic carbon indicates that there is regular addition of organic substances to these soils. The CEC varied from 15.21 to 27.05 cmol (p^+) kg^{-1} with a mean of 20.72 cmol (p^+) kg^{-1}. The CEC of lower values might be due to the fact that these soils are coarser in nature and were having high sand and low organic matter content. These findings were in line with Kundu *et al.* (2014). The values of sum of exchangeable cations ranged between 14.19 and 24.13 cmol (p^+) kg^{-1} with a mean of 18.55 cmol (p^+) kg^{-1}. The surface samples of red soils recorded lower values of sum of exchangeable cations due to low adsorptive sites and coarse texture. Similar findings were obtained by Berthrong *et al.* (2009). The sand, silt and clay content ranged from 36.32 to 60.96, 15.76 to 25.88 and 21.33 to 36.73 per cent, respectively with a mean of 34.07, 21.88 and 43.24 per cent, respectively. The texture of red soils varied from sandy clay loam to clay loam. The sand content was high in these red soils which could be attributed to the parent material bed rock from which they have derived such as schists. Similar results were obtained by Vinay (2007). The highest value of Exchangeable Potassium Percentage (EPP) was recorded in Byadgi-1 (17.35) and lowest in Hanumanamatti (8.15) soils. The high EPP values may be due to high exchange sites offered for potassium. Similar result was obtained by Laurenson *et al.* (2011). The Potassium Adsorption Ratio (PAR) varied from 0.89 to 2.98 with a mean of 1.70. The higher values of PAR may be due to high adsorption sites offered for potassium and leaching of Ca ions from the surface layer. The results are on par with the findings of Parfitt (1992). The available potassium varied from 268.80 to 483.84 kg ha^{-1} with a mean of 339.53 kg ha^{-1}. The available potassium was medium to high in status. The variation in K status might be due to cultural practices, application of fertilizers, organic manures and other inputs. This may be due to the fact that application of water soluble potassium fertilizers and also high exchange sites offered for potassium at surface layer. Similar results were obtained by Jagadeesh (2003). Adequate level of available K in red soils of the study area may be due to the prevalence of K-rich clay minerals like illite and kaolinite.

IV. CONCLUSION

In present study, the major soil type i.e., red soil type under maize cultivation was evaluated for important physico-chemical properties of Haveri district (Karnataka). The soils varied appreciably in their physico-chemical properties. The study revealed that variation in physico-chemical properties was be due to cultural practices, application of fertilizers, organic manures and other inputs.

Sl. No.	Taluk	Location	Latitude	Longitude
1	Shiggoan	Kengapur-1	15° 02’ 23.0’’	74° 59’ 13.1’’
2	Shiggoan	Kengapur-2	15° 02’ 40.3’’	75° 15’ 37.3’’
3	Shiggoan	Kengapur-3	15° 02’ 29.7’’	75° 15’ 35.2’’
4	Shiggoan	Hulgur-1	15° 01’ 15.1’’	75° 18’ 42.0’’
5	Shiggoan	Hulgur-2	15° 02’ 25.5’’	75° 15’ 55.2’’
6	Savanur	Savanur	14° 53’ 55.2’’	75° 20’ 31.3’’
7	Haveri	Guttal	14° 58’ 12.2’’	75° 24’ 22.8’’
8	Ranebennur	Aremallapur-1	14° 59’ 18.0’’	75° 60’ 32.0’’
9	Ranebennur	Aremallapur-2	14° 59’ 20.0’’	75° 60’ 38.0’’
10	Ranebennur	Aremallapur-3	14° 59’ 38.1’’	75° 60’ 35.1’’
11	Ranebennur	Aremallapur-4	14° 59’ 38.2’’	75° 60’ 31.3’’
12	Ranebennur	Aremallapur-5	14° 59’ 17.0’’	75° 60’ 32.8’’
13	Ranebennur	Medleri-1	14° 59’ 19.9’’	75° 60’ 42.0’’
14	Ranebennur	Medleri-2	14° 59’ 57.2’’	75° 60’ 48.0’’
15	Ranebennur	Medleri-3	14° 58’ 59.1’’	75° 60’ 35.1’’
16	Ranebennur	Medleri-4	14° 58’ 37.1’’	75° 60’ 39.0’’
17	Ranebennur	Medleri-5	14° 58’ 36.2’’	75° 59’ 46.2’’
18	Byadgi	Byadgi-1	14° 49’ 54.0’’	75° 46’ 42.1’’
19	Byadgi	Byadgi-2	14° 44’ 15.3’’	75° 46’ 49.0’’
20	Ranebennur	Hanumanamatti	14° 59’ 11.8’’	75° 39’ 44.8’’

Table 1: Details of soil samples collected from different places (red type) of maize growing areas of Haveri district, Karnataka

Sample No.	$pH_{1:2.5}$	$EC_{1:2.5}$ (dS m^{-1})	OC (g kg^{-1})	Sand	Silt	Clay	EPP	CEC	Sum of Exch. Cations	PAR	Available K_2O (kg ha^{-1})	Textural class
				%				[cmol (p^+) kg^{-1}]				
1	6.59	0.05	6.04	60.96	16.74	21.33	14.33	15.21	14.19	2.23	328.56	scl
2	6.75	0.06	4.50	55.11	18.10	25.04	12.92	19.34	18.01	1.91	376.32	scl
3	6.50	0.03	5.01	56.71	18.20	24.16	8.75	23.65	20.83	1.08	274.30	scl
4	6.70	0.04	5.72	55.23	17.52	25.54	10.95	19.36	17.93	1.94	321.12	scl
5	6.66	0.03	5.35	60.36	17.04	22.11	12.47	16.92	15.36	0.89	271.80	scl
6	7.50	0.25	5.20	55.42	18.54	24.44	9.88	21.86	19.84	1.51	312.96	scl
7	6.68	0.03	4.63	52.48	19.11	27.23	14.49	24.15	22.59	2.98	483.84	scl
8	6.50	0.05	5.12	56.56	18.10	24.55	12.14	16.88	15.24	0.89	302.16	scl
9	6.75	0.04	5.78	36.32	25.67	36.73	8.32	26.32	23.85	2.12	322.56	cl
10	7.36	0.19	6.11	60.84	16.88	21.45	15.41	16.22	14.64	2.67	430.08	scl
11	7.30	0.18	5.07	55.42	18.40	23.64	9.27	22.76	19.80	1.10	268.80	scl
12	7.40	0.18	5.19	39.78	25.88	33.03	9.24	27.05	24.13	1.65	430.08	cl
13	7.41	0.09	6.40	60.39	16.85	21.98	11.93	18.43	16.27	1.85	341.26	scl
14	6.68	0.11	5.10	57.18	18.60	24.11	10.74	20.29	18.70	1.37	302.54	scl
15	7.24	0.22	6.20	58.81	16.87	23.13	13.07	17.21	15.22	1.38	323.51	scl
16	6.55	0.06	4.62	50.41	19.21	28.61	8.17	24.83	22.50	1.92	371.32	scl
17	6.38	0.07	6.90	59.17	15.76	24.78	10.89	18.36	16.34	0.95	269.80	scl
18	7.08	0.06	7.90	58.72	16.14	24.88	17.35	17.86	16.51	2.07	374.82	scl
19	7.00	0.05	7.00	47.30	22.84	29.37	9.20	23.14	20.62	2.21	376.22	scl
20	7.46	0.11	6.50	43.37	21.84	31.87	8.15	24.66	22.38	1.36	308.56	cl
Range	**6.38-7.50**	**0.03-0.25**	**4.50-7.90**	**36.32-60.96**	**15.76-25.88**	**21.33-36.73**	**8.15-17.35**	**15.21-27.05**	**14.19-24.13**	**0.89-2.98**	**268.80-483.84**	**Sandy clay loam to clay loam**
Mean	**6.92**	**0.09**	**5.72**	**54.02**	**18.91**	**25.24**	**11.38**	**20.72**	**18.55**	**1.70**	**339.53**	
S.D.	**0.380**	**0.069**	**0.901**	**7.13**	**2.91**	**4.15**	**2.63**	**3.63**	**3.23**	**0.58**	**59.08**	

Table 2: Chemical properties in selected maize growing red soils of Haveri district, Karnataka

REFERENCES

[1] Bangroo, S. A., Wani, M. A., and Bhat, M. I. (2014). Relationship between the quantity and intensity of potassium in some maize soils of Central Kashmir (India). Applied Biological Research, 16 (2), 255-260.

[2] Jackson, M. L. (1973). Soil Chemical Analysis, Prentice Hall of India Private Limited, New Delhi.

[3] Piper, C. S. (1996). Soil and Plant Analysis, Hans Publishers, Bombay, India.

[4] U. S. D. A. Handbook 60 (1954). Diagnosis and Improvement of Saline and Alkali Soils. U. S. Government Printing Office, Washington D. C.

[5] Jagadeesh, B. R. (2003). Dynamics of potassium in soils of selected agro-climatic zones of Karnataka. Ph. D. Thesis, University of Agricultural Sciences, Bangalore, Karnataka (India).

[6] Berthrong, S. T., Jobbágy, E. G. and Jackson, R. B. (2009). A global meta-analysis of soil exchangeable cations, pH, carbon, and nitrogen with afforestation. Applied. Ecology, 19(8), 28-41.

[7] Jagmohan, S. and Grewal, K. S. (2014). Vertical distribution of different forms of potassium and their relationship with different soil properties in some Haryana soil under different crop rotation. Advances in Plant Agricultural Research, 1(2), 1-5.

[8] Kundu, M. C., Hazra, G. C., Biswas, P. K., Mondal, S. and Ghosh, G. K. (2014). Forms and distribution of potassium in some soils of Hooghly district of West Bengal. Journal of Crop and Weed, 10(2), 31-37.

[9] Laurenson, N. S., Bolan, E. S. and McCarthy, M. (2011). Soil structural changes following irrigation with a potassium rich winery wastewaters. www.massey.ac.nz/~flrc/ workshops/11/Manuscripts, pp. 1-10.

[10] Parfitt, R. L. (1992). Potassium-calcium exchange in some New Zealand soils. Australian Journal of Soil Research, 30, 145-158.

[11] Vinay, L. (2007). Characterization and classification of soil resource of Bhanapur microwatershed (Koppal district) for land evaluation. M. Sc. (Agri.) Thesis, University of Agricultural Sciences, Dharwad, Karnataka (India).