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Nutrient Status in Relation to Silt and Clay Content of Some Typical Soils of South India

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Profile samples were collected from alluvial, black, red, laterite and colluvial soil groups and analysed for nutrient status in order to study the relationship between nutrient status and clay and silt. The study revealed that total and available phosphorus, available and exchangeable potash contents are related to the silt content of the soils. The cation exchange capacity and nutrients calcium and magnesium contents of the soils are influenced by the clay content of the soil groups.

Leather (1898) distinguished four major groups of soil namely, indogangetic alluvium, black cotton or regur soils, red soils or metamorphic rocks and laterite soils. South India is blessed with all these types of soils besides a small portion of colluvial soils near hillocks. Their nutrient status and exchange capacity are controlled by mechanical fractions especially silt and clay. Venkataramanan (1962) observed that cation exchange capacity was almost linearly correlated with clay percentage. Woelawek (1964) observed that the colloidal fraction of deluvial soil containing high amount of clay was richer in nitrogen and humus. The selective enrichment of phosphorus with clay fraction was indicated by Bates and Baker (1960) in their studies on Nigerion soils. Rengasamy *et al.* (1966) observed that total and citrate soluble potassium were significantly correlated with clay in alluvial and laterite soils. Studies were undertaken to compare the nutrient status in relation to clay and silt of South Indian soils. This paper deals with the results of the investigation.

MATERIALS AND METHODS

Profile samples were collected from alluvial, black, red, laterite and colluvial groups of soils. The alluvial soils were collected from Cumbum and Cholavandan of Vaigai belt, black soils from Thirumangalam and Chellampatti of black soil area, red soils from Theni and Palani of red soil area, laterite soils from Kodaikanal and Kumuli of laterite area and colluvial soils from areas near Anaimalai and Alagarkoil. These above areas are typically represented by all the types of soils and so these areas were choshen for profiles. The collected samples were air dried and processed for the various analysis. The processed samples were analysed for clay and silt content, various nutrients and exchange capacities. The nutrient status was acertained by the methods pres-

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cribed by Piper (1950) and Jackson (1967). For cation exchange capacity method prescribed by Schollenberger (1930) was adapted. The results are furnished in the table. With the results available simple correlations were worked out.

RESULTS AND DISCUSSION

The investigation revealed that A_{ii} layer of laterite soil was comparatively richer in organic carbon (Table). The amount of humus and nitrogen progressively decreased with depth in the profile which was in accordance with the work of Czerwinski (1963). Total and available nitrogen contents of the soils were observed to decrease with decrease in depth. This was also in agreement with the work of the above author. All the soils were found to be poor in nitrogen and phosphorus; the phosphorus content showed a uniform downward gradiant. The same trend was observed by Ghani and Aleem

TABLE.

Depth in cms	Total Nitrogen %	Total Phosphorus %	Total Potassium %	Available Nitrogen ppm	Available Phosphorus ppm	Available Potassium ppm	Total cation exchange capacity m.e/100 g soil	Exchangeable calcium m.e/100 g soil	Exchangeable magnesium m.e/100 g soil	Exchangeable potassium m.e/100g soil	Organic carbon %
					Alluvial Soil: 1						
0- 30	0.071	0.18	0.87	36.5	3.25	29.0	6.6	3.1	1.5	1.0	0.18
30- 60	0.068	0.17	0.88	31.0	0.90	20.5	7.2	4.0	7.8	0.6	0.06
60- 75	0.065	0.17	0.72	22.5	0.70	23.0	8.6	5.0	2.0	0.7	0.03
75-115	0.058	0.16	0.86	19.5	0.50	18.5	6.4	2.8	1.6	1.0	0.03
115-165	0.047	0.16	0.91	33.5	0.50	37.5	18.3	13.1	2.1	1.0	0.03
					Alluvial Soil: 2						
0- 30	0.087	0.67	0.71	47.5	10.00	108.0	15.1	9.8	2.9	1.1	1.77
30- 60	0.083	0.65	0.85	50.5	12.51	328.0	26.2	14.1	4.4	3.9	1.14
60- 90	0.078	0.46	0.85	33.5	13.50	315.5	25.7	14.1	4.7	3.7	0.90
90-120	0.075	0.41	0.87	22.5	13.70	323.5	19.4	9.2	2.4	4.0	0.48
120-165	0.046	0.38	0.96	28.0	8.40	199.0	9.9	1.5	0.7	3.7	0.15
					Black Soil: I						
0- 30	0.97	0.03	0.71	33.5	0.35	45.5	25.0	17.1	3.5	2.2	0.18
30- 60	0.097	0.02	0.91	75.5	1.05	35.5	38.1	29.8	3.7	2.4	0.15
60- 95	0.058	0.01	0.94	22.5	1.60	31.0	38.0	28.9	4.3	2.1	0.06
95- 120	0.052	0.01	0.94	22.5	0.90	24.50	41.0	31.7	3.1	2.9	0.03
					Black Soil: 2						
0-22.5	0.110	0.09	0.91	47.5	2.80	24.50	39.0	30.2	4.9	2.3	0.39
22.5- 45	0.110	0.03	0.64	61.5	0.90	23.00	33.7	25.6	3.2	2.5	0.21
45- 85	0.100	0.02	0.74	39.0	0.90	16.50	36.3	27.5	5.1	1.5	0.24

				Red Soil : 1								
9- 20	0.130	0.04	0.41	53.00	0.70	37.50	5.3	2.3	1.2	0.9	0.15
20- 40	0.100	0.04	0.54	0.59	1.40	24.50	5.8	2.5	1.4	0.9	0.15
40-100	0.042	0.03	0.71	59.00	0.50	24.50	6.5	3.3	1.7	0.8	0.15
				Red Soil :2								
0- 45	0.082	0.12	0.56	50.5	4.40	16.50	8.6	4.6	2.5	1.0	0.24
45- 80	0.079	0.12	0.91	50.5	4.40	16.50	16.2	10.2	3.6	1.2	0.15
80-115	0.074	40.09	0.75	47.5	4.40	16.50	14.7	8.5	3.6	1.3	0.15
115-150	0.055	0.07	0.44	33.5	4.20	20.50	11.4	7.2	2.9	0.7	0.15
				Laterite Soil : 1								
0- 45	0.360	0.18	0.63	78.50	1.40	23.0	17.1	9.1	4.5	3.4	3.60
45- 90	0.210	0.03	0.50	36.50	1.40	20.5	15.2	8.1	3.4	2.9	0.12
90-135	0.150	0.03	0.61	3.00	1.60	20.5	13.8	7.5	3.4	2.9	0.12
135-192.5	0.150	0.02	0.56	11.00	1.25	14.5	11.3	6.6	2.3	1.9	0.06
192.5-222.5	0.110	0.01	0.62	22.50	2.10	12.0	4.5	2.5	0.9	0.7	0.06
222.5-272.5	0.085	0.01	0.87	22.50	1.40	12.00	9.1	5.1	1.8	1.7	0.03
				Laterite Soil : 2								
0- 30	0.120	0.08	0.44	1.00	1.05	23.0	11.8	7.8	2.5	1.2	1.17
30- 75	0.072	0.07	0.56	61.50	0.35	18.5	6.6	3.8	1.8	0.5	0.57
75-112.5	0.059	0.05	0.65	87.00	0.35	12.0	5.4	2.9	1.5	0.9	0.45
112.5-180	0.029	0.05	0.71	45.00	0.35	8.0	4.7	2.7	0.9	0.8	0.12
180-222	0.016	0.03	0.91	22.50	0.90	8.0	3.4	1.5	0.7	1.1	0.68
				Colluvial Soil : 1								
0- 25	0.140	0.04	0.61	70.00	0.50	29.0	12.3	7.0	2.9	1.2	0.09
25- 50	0.130	0.03	0.71	45.00	0.50	29.0	15.0	9.1	3.2	1.5	0.06
50- 75	0.120	0.03	0.74	47.50	0.35	24.5	17.0	10.2	3.5	1.4	0.06
75-107.5	0.110	0.03	0.91	75.50	1.60	29.0	14.7	8.2	2.8	1.9	0.06
				Colluvial Soil : 2								
0- 25	0.048	0.10	0.71	59.00	3.00	20.50	4.5	2.4	1.4	0.4	0.24
25- 50	0.035	0.09	0.73	42.00	2.10	16.50	4.0	2.0	1.1	0.4	0.18
50- 75	0.030	0.09	0.81	53.00	1.75	9.00	4.0	2.1	1.2	0.5	0.18
75-105	0.030	0.08	0.80	56.00	0.90	12.00	3.9	1.9	1.2	0.3	0.18

(1943). A significant correlation was observed between silt and total phosphorus and available phosphorus (r = 0.38 and 0.44). Potassium content in soils are reported to be related to the nature of parent material, the degree of weathering and leaching. A significant correlation (r = 0.54) was observed between silt and available potash which may be due to parent material. This observation was in conformity with the work of Salmon (1964) who observed that high amount of potassium was found in sand fractions and it decreased with decrease in size of particles.

The cation exchange capacity was found to be more in black soils than in other soils (Table) probably due to higher amount of clay and also due to nature of clay. This was in agreement with the work of Grim (1953). A highly significant correlation was observed between the cation exchange capacity and the clay content of the soils (r= 0.75) indicating a close relationship between, these two properties, which was similar to the work of Joachim and Kandiah (1947) and Durairaj (1961). A highly significant correlation was observed between clay and the exchangeable calcium of various soils (r=0.75). A significant correlation was also observed between clay and exchangeable magnesium (r=0.58). These may be due to nature and amount of clay present in the soils. A significant correlation was observed between silt and exchangeable potassium (r=0.59) which may be due to presence of potassium minerals in the finer complex.

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