Characterization and Classifications of Soils ~~of~~ inan Experimental Ffarm inthe Tiruvannamalai District, Tamil Nadu, India

ABSTRACT

It is essential to characterize and calssify~~Characterization and classification of~~ soil resources ~~is essential scientifically~~ in order to plan agricultural land use agroforestry, agri-horticulture and silvipastoral farming systems. In the present study, an attempt was made to characterize and classify the soils occurring on different topography in an experimental farm ~~of~~ in Tiruvannamalai District of Tamil Nadu, India. Six representative pedons (covering all the soil types) very shallow to moderately deep, dark reddish brown to yellowish red (red soils) in colour with sub-angular blocky in structure, These soils were sandy loam to sandy clay loam in texture, slightly acidic to mildly alkaline (3.28-7.70) in reaction (non-saline soils) and had low to medium (1.2 to 6.4 g/kg)organic carbon content. Calcium and magnesium were the dominant exchangeable cations followed by sodium and potassium. Soils were grouped under Alfisols and, Inceptisols orders.

Keywords:*Soil survey, soil characterization, soil classification, soil physical and chemical characteristics*

1. INTRODUCTION

Soil is recognized as a base for every production system and knowledge of their properties, extent and spatial distribution is extremely important to maintain soil resources to sustain the ecosystem [1] and site-specific soil management practices. The systematic study of morphology, physicochemical characteristics and taxonomy of soils provides information on the nature and type of soils, their constraints, potentials, capabilities and their suitability for various uses [2,3]. The data generated through systematic soil resource inventory and characterization will help to formulate agro-interventions for management of these soils under existing delivery extension systems agriculture schemes, and value chains, so that new technologies could be adopted for sustainable production.

2. MATERIALS AND METHODS

2.1 Description of the study area

The study was carried out in in soils of experimental farm of Agricultural college and Research Institute, Vazhavachanur, Tamil Nadu Agricultural university in Tiruvannamalai district. Geographically the study area is located between 12°4'15" N to 12°4'45" N Latitude and 78°59'0" E to 77°59'25" E Longitudes (Fig.1). The annual rainfall of the region is 759.4 mm. The mean maximum and minimum temperatures are 38°C and 21°C, respectively. Geologically it is underlain by granites. Geomorphologically, the Vazhavachanur farm is categorized as Pediplain.

2.2 Soil sampling methodology

A detailed soil survey was carried out using cadastral map of Vazhavachanur village. The soils belong to Kurumbalur series. Six typical pedons were selected based on landform and their soil morphological properties (Table 2). The horizon-wisesoil samples were collected, processed and analysed using standard analytical methods and soils were classified [4].

Comment [fT1]: Revise the sentences. Improve the writing.

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Comment [fT3]: The Introduction section is too short! Extend it and write some research background. Use previous studies carried out all around the world.

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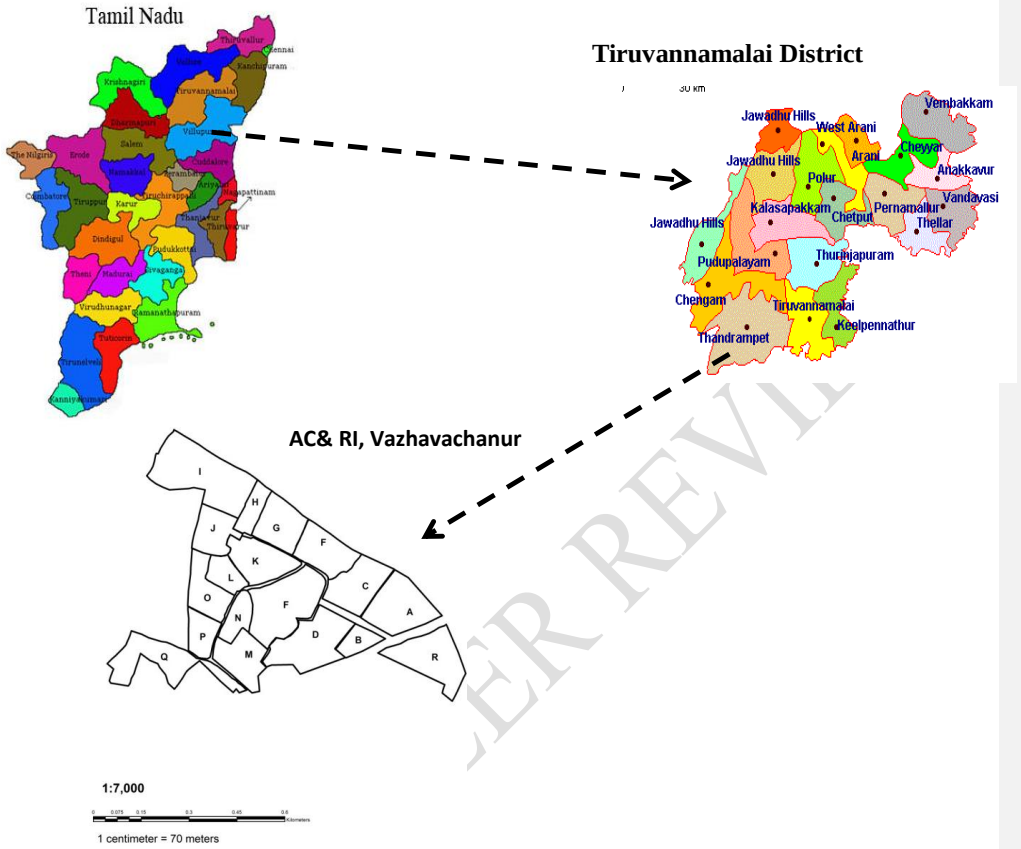

Fig.1. Study area located in AC & RI, Vazhavachanur farm of Tiruvannamalai District,Tamil Nadu, India

3. RESULTS AND DISCUSSION

3.1 Physiography and Soils

Physiographically, the area has been characterized into Pediplain shallow weathered and Pediplain moderately weathered which were further subdivided based on slope and erosion categories. Six soil profiles were dug in C, D, G, J, O and P blocks of AC&RI, Vazhavachanur farm based on the physiography of the soils. The soils of C, D and O Block are categorized as pediplain moderately weathered. The soils of G, J and P block belongs to pediplain shallow weathered.

3.2 Morphological features of soils

The soils of Pediplain shallow weathered (soils of G, J and P block) are moderately shallow, well drained, noncalcareous and severely eroded. The soils of nearly level pediplain moderately weathered (soils of C, D and O Block) are moderately deep, moderately well drained, non calcareous

and moderately eroded. The soils of the farm belong to the Kurumbalur soil series. Based on the properties, the soils were grouped under Inceptisol andAlfisol (Table 1).

3.3 Physical properties of soils

The coarse fragments of the pedons varied from 9.55 to 59.89 per cent (Table 1). The coarse fragments were mainly of quartz fragments. The irregular nature of gravels suggested that they were formed in situ. The surface soils possessed loamy sand to sandy clay loam texture and subsurface soils possessed sandy loam to sandy clay loam texture. The clay content of these soils ranged from 11.00 per cent in G block to 38.28 per cent in P Block. Unimodal distribution i.e., increase of clay upto certain depth and then decrease was observed in soils of O block. An increase in clay content was primilary due to illuviation. The clay content gradually increased with the depth in soils of C,D and J blocks. This may be due to combined effect of *insitu* clay formation and illuviation[5].In P block there was no wide textural class variation. This could beascribed to increased compaction and decreasedaggregation caused by decreased OC and clogging ofpores by dispersed clay in sub-soil layers [6].

Table 1. Morphological and physical properties of soils of AC &RI, Vazhavachanur farm

Horizon	Depth	Colour	Texture	Structure	Bulk density M gm^{-3}	Particle density M gm^{-3}	Gravel (%)	Clay (%)	Silt (%)	Sand (%)
C block- Loamy skeletal, Mixed, isohyperthermic, TypicRhodustalfs										
Ap	0-35	5YR4/6	sl	2msbk	1.27	2.30	26.47	15.10	9.20	75.70
Bt1	35-60	2.5YR4/6	scl	3msbk	1.33	2.00	31.76	25.00	22.20	52.80
Bt2	60-80	2.5YR4/6	scl	2msbk	1.41	1.80	59.89	27.60	22.00	50.40
D Block –Loamy skeletal, Mixed, isohyperthermic, TypicHaplustalfs										
Ap	0-30	7.5YR 6/6	sl	2msbk	1.14	2.50	9.55	18.90	13.50	67.60
Bt1	30-50	5YR5/6	scl	2msbk	1.43	2.20	15.76	24.38	10.73	64.89
Bt2	50-60	5YR5/6	scl	2msbk	1.51	2.00	25.81	29.43	9.99	60.58
G Block –Fine loamy, Mixed, isohyperthermic, TypicHaplustalfs										
Ap	0-20	5YR3/4	ls	1mgr	1.26	2.22	28.47	11.00	13.40	75.60
Bw	20-50	2.5YR3/6	scl	1msbk	1.42	2.00	43.35	37.28	4.82	57.90
J Block – Fine loamy, Mixed, isohyperthermic, VerticHaplustepts										
Ap	0-20	10YR 3/2	scl	3msbk	1.46	2.16	9.68	19.20	15.68	65.12
B1	20-40	7.5YR3/4	sl	3msbk	1.22	2.05	24.68	14.20	12.26	73.54
O Block–Fine loamy, Mixed, isohyperthermic, TypicHaplustalfs										
Ap	0-25	5YR 4/4	scl	2msbk	1.11	2.22	11.67	24.00	5.10	70.90
Bt1	25-40	2.5YR 4/8	scl	2msbk	1.25	2.17	15.93	26.80	7.00	66.20
Bt2	40-70	2.5YR 4/6	scl	2msbk	1.17	1.96	22.83	23.20	18.80	58.00
P Block –Fine loamy, Mixed, isohyperthermic, TypicHaplustepts										
Ap	0-30	5YR 4/3	scl	2msbk	1.33	1.81	13.74	38.28	8.25	53.47
B1	30-60	5YR 4/6	scl	3msbk	1.25	1.66	24.93	36.11	3.87	60.02

Soil texture : sl - Sandy loam; scl – sandy clay loam; ls - loamy sand; cl - Clay loam; sc – sandy clay; c - Clay
Soil structure : f- fine; m - Medium; c - coarse; 1 -weak; 2 - moderate; 3-strong;gr – granular; sbk - subangular blocky, abk -angular blocky

3.4 Chemical properties of soils

The soils are slightly acidic (pH 6.28) to mildly alkaline (pH 7.70) and this variation was attributed to the nature of parent material (Table 2). The electrical conductivity values (dS m^{-1}) varied from 0.01 in

C Block to 0.40 in J Block. The OC content ranged from 1.2 to 6.4 g/kg, and categorized as low to the medium. The surface horizons had higher than the sub-surface horizons because of more biomass addition [7]. The $CaCO_3$ ranged from 0.13 to 0.88 %. The cation exchange of the soils ($cmolP^{(+)}\ kg^{-1}$) varied from 6.44 in D Block to 27.57 in C block. The wide range of CEC is related to the amount and type of clay, and the of organic carbon content in these soils [8].The depth wise distribution of CEC had same trend as that of clay distribution. The exchangeable bases in the all the pedons were in the order of Ca^{+2}> Mg^{+2}> Na^{+}> K^{+}[9].

Table 2. Chemical properties of soils of AC &RI, Vazhavachanur farm

Horizon	Depth	PH (1:2.5)	EC (dSm^{-1})	OC (g/kg)	$CaCO_3$ (%)	CEC cmol (p^{+}) kg^{-1}	Exchangeable Cations cmol (p^{+}) kg^{-1}				BSP (%)	ESP (%)
							Ca	Mg	Na	K		
C block- Loamy skeletal, Mixed, isohyperthermic, TypicRhodustalfs												
Ap	0-35	6.56	0.02	6.4	0.75	27.57	15.00	4.50	0.54	0.19	73.40	1.97
Bt1	35-60	6.28	0.01	5.6	0.25	16.92	8.00	4.00	0.22	0.16	73.15	1.28
Bt2	60-80	6.15	0.01	3.6	0.13	21.41	4.24	2.12	0.26	0.15	31.62	1.21
D Block –Loamy skeletal, Mixed, isohyperthermic, TypicHaplustalfs												
Ap	0-30	6.30	0.10	5.1	0.53	6.44	2.38	1.92	0.05	0.05	68.32	0.78
Bt1	30-50	6.60	0.10	4.8	0.35	13.35	2.12	1.06	0.44	0.28	29.14	3.26
Bt2	50-60	6.90	0.10	3.9	0.18	10.00	4.00	1.62	0.44	0.28	63.30	4.35
G Block –Fine loamy, Mixed, isohyperthermic, TypicHaplustalfs												
Ap	0-20	6.90	0.05	4.8	0.42	9.25	5.00	2.50	0.51	0.03	86.96	5.52
Bw	20-50	7.10	0.02	4.5	0.28	15.62	10.80	0.42	0.68	0.02	76.31	4.35
J Block – Fine loamy, Mixed, isohyperthermic, VerticHaplustepts												
Ap	0-20	7.20	0.40	4.6	0.48	21.41	4.24	2.12	0.26	0.15	31.62	1.21
B1	20-40	6.90	0.30	3.0	0.41	14.72	7.50	3.00	0.22	0.19	74.11	1.48
O Block– Fine loamy, Mixed, isohyperthermic, TypicHaplustalfs												
Ap	0-25	6.85	0.12	2.4	0.65	10.60	3.20	1.40	0.07	0.39	47.74	0.66
Bt1	25-40	6.27	0.17	4.5	0.45	9.80	2.40	2.40	0.01	0.27	51.84	0.10
Bt2	40-70	7.15	0.22	4.2	0.33	8.60	2.10	1.70	0.01	0.12	45.70	0.12
P Block – Fine loamy, Mixed, isohyperthermic, TypicHaplustepts												
Ap	0-30	6.40	0.20	2.9	0.88	16.19	10.05	4.38	0.36	0.11	92.07	2.41
B1	30-60	7.70	0.20	1.2	0.75	14.76	9.49	4.75	0.36	0.15	98.97	2.43

3.5 Classification of soils

Based on the morphological, physical and chemical properties of the soils were classified (4 Soil Survey Staff 2022).viz. Inceptisol and Alfisols. J Block and P block soils were grouped under Inceptisols based on the presence of Cambic subsurface horizon. J Block soils was placed under VerticHaplustepts due to the presence of Vertic properties. C Block soils were classified as classified as Rhodustalfs because of occurrence of sub-horizons in the upper 100 cm of the argillic horizon or throughout the entire argillic horizon if less than 100 cm thick, more than 50 per cent colours that have hue of 2.5YR or redder and value, moist, of 3 or less. Similarly at sub group level, these soils did not exhibit any integration with other taxa nor deviated from central concept of Rhodustalfs are placed in TypicRhodustalfs. C, D and G block soils were grouped under Alfisols since the illuviation of clay and the presence of base saturation more than 35% throughout the depth of the soil horizons and ustic moisture regime.

Table 3. Soil mapping units and taxonomic classification of AC &RI, Vazhavachanur farm

Name of the block-name of the series	Mapping unit	Taxonomic classification
C Block - Kurumbalur	$\frac{\text{Kbr-sl(g)-d}_4}{\text{A-e}_2}$	Loamy skeletal, Mixed, isohyperthermic, TypicRhodustalfs
D Block- Kurumbalur	$\frac{\text{Kbr-sl(g)-d}_4}{\text{A-e}_2}$	Loamy skeletal, Mixed, isohyperthermic, TypicHaplustalfs
G Block- Kurumbalur	$\frac{\text{Kbr-ls-d}_3}{\text{B-e}_1}$	Fine loamy, Mixed, isohyperthermic, TypicHaplustalfs
J Block- Kurumbalur	$\frac{\text{Kbr-scl-d}_3}{\text{B-e}_1}$	Fine loamy, Mixed, isohyperthermic, VerticHaplustepts
O Block- Kurumbalur	$\frac{\text{Kbr-scl-d}_4}{\text{B-e}_1}$	Fine loamy, Mixed, isohyperthermic, TypicHaplustalfs
P Block- Kurumbalur	$\frac{\text{Kbr-scl-d}_4}{\text{B-e}_1}$	Fine loamy, Mixed, isohyperthermic, TypicHaplustepts

4. CONCLUSION

The soils of the study area were slightly acidic to mildly alkaline inreaction (non saline) and had low to medium OC contentand low to medium CEC. These soils were classified asTypicRhodustalfs, TypicHaplustalfs, TypicHaplustepts and VertifHaplustepts. The main constraints were depth, slope,excessive drainage and low water holding capacity in these soils.

Comment [fT6]: Extend this Section and write the main findings.

REFERENCES

Comment [fT7]: Use more references.

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