Assessment of morphological and physico-chemical properties of dominantsoil series in Western and North-Western Zones ofTamil Nadu

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ABSTRACT

A comprehensive soil analysis was conducted in the Western and North-Western regions, encompassing four districts: Coimbatore, Tiruppur, Erodeand Salem in Tamil Nadu, India. Owing to differences in topography and terrain features, seven distinct soil series i.e. Somayanur, Ammapettai, Palathurai, Tulukkanur, Yethapur, Suramangalam and Salem were recognized. Seven representative pedons were examined for their morphological, physical and physico-chemical attributes. The soils range from shallow to profoundly deep, with drainage varying from well-drained to poorly drained. When moist, they exhibit a hue from light brown to dark red to dark brown and when dry light brown to light yellowish brown. Soils have textures spanning from light (sandy loam) to heavy (silty clay). The pH values ranged from 6.2 to 8.92 in water, 5.41 to 7.68 in $CaCl_2$ and 5.65 to 7.89 in KCl, Electrical conductivity (EC) varied between 0.11 and 0.41 dS m^{-1}, organic carbon content was between1.2 $g.kg^{-1}$ and 9.6 $g.kg^{-1}$, cation exchange capacity varies from 5.60 to 30.80cmol(p+).kg^{-1}, base saturation percentage and exchangeable sodium percentage varies from 81.0 to 98.2 % and 0.37 to 3.88 %. Free calcium carbonate of soil ranges from 0 to 10 % which indicates non-calcareous to calcareous nature of soils. Implementing suitable site-specific technologies is essential for attaining sustainable productivity of the soils of Western and North-Western Zones of Tamil Nadu.

Keywords: Western, North-Western zone, morphological parameters, texture, Physico-Chemical parameter

1. INTRODUCTION

Soil is one of the most important natural resources in nature, and preserving its health is crucial to supplying the growing demand for food, fibre, fuel, and fodder. In order to address some of the specific soil difficulties facing the ecosystem, soil characterisation provides the fundamental knowledge necessary to create useful soil categorization systems and quantify soil fertility. Soil Characterization is a part of study of soil properties in which soils are characterized and classified based on their properties in a specific area. Soil characterization is done by analysing and comparing the properties of soil from one to another area of study. As the soil forming processes changes it leads to changes in soil properties in different area or agro-ecological zones so that it's dynamic in nature.

Knowledge of soil capabilities and limitations is critical for scientific soil management. A thorough analysis of the soils is absolutely necessary before adopting effective management practices and corrective solutions for different soils. A soil test involves analysing a soil sample to ascertain the amount of nutrients and contaminants present as well as other soil properties including salinity, acidity, alkalinity, and level of calcareousness. Since each crop's growth is mostly influenced by the aforementioned characteristics. Typically, tests are carried out to determine the soil's anticipated potentials, especially in terms of crop growth. This study specifically conducted to assess the potentials and constraints of seven major soil

series of four districts of Western and North-Western Tamil Nadu and suggestproper management practices for better crop growth.

2. MATERIAL AND METHODS

2.1 Study area

This study covers soil series comes under Western and North-Western zones of Tamil Nadu and covers Coimbatore, Tiruppur, Erode and Salem districts. Geographical distribution of study areas are given in Table 1.

Table 1: Geographical Distribution of study area

District	Village	Block	Taluk	Latitude	Longitude	Soil series
Coimbatore	Samichettipalayam*	P.N.Palayam	Coimbatore North	11^0 10'17.3" N	76^0 56'09.0"E	Somayanur
Erode	Ammapettai	Ammapet	Bhavani	11^0 37'12.3'' N	77^0 44' 09.4''E	Ammapettai
Salem	Yethapur	Pethanaickenpalayam	Attur	11^0 39'06.7"N	78^0 28'14.2"E	Yethapur
	Pallipatty	AyothiyaPattinam	Salem	11^0 41'46.8"N	78^0 14'22.6"E	Salem
	Old Suramangalam	Salem	Salem	11^0 40' 02.1'' N	78^0 6' 30.4'' E	Suramangalam
Tiruppur	Manakadu	Dharapuram	Dharapuram	10^0 42'19.8" N	77^0 32'56.8" E	Tulukkanur
	Ragalpari	Udumalaipettai West	Udumalaipettai	10^0 34'54.6"N	77^0 10'56.4"E	Palathurai

2.2Climate

Southwest monsoon brings 400mm of rain to the North Western zone, which is located between 200 and 600 metres above sea level. The average maximum temperature is between 30°C and 37°C, and the average minimum temperature is between 19°C and 25.5°C. In this zone, the growing season lasts 180 days. In this region, a variety of crops including finger millet, sorghum, peanuts, horse gram, sugarcane, cotton, tapioca, and vegetables are produced extensively (Soil and Land Use Survey of India,2022)

Mean annual precipitation is 715 mm within 45 rainy days falls on the Western zone, which has a similar height range, with 49 percent of that total falling during the northeast monsoon season. In January and April, respectively, the mean minimum and maximum temperature is 30°C and 35°C. While sorghum, groundnut, tiny millets, pulses, cotton, sorghum, bengal gram, and sunflower are grown as rainfed crops, rice, sugarcane, and banana are grown in wetland conditions (Soil and Land Use Survey of India , 2022)

Table 2 :Climatic and vegetation Data of Western and North-Western Zones

Agro-Climatic Zone	Climatic attributes				Crops Grown	Natural Vegetation
	Max Temperature	Min Temperature	Altitude	Rainfall		
North Western Zone	30°C to 37°C	19°C to 25.5°C	200 to 600 metres above sea level	400mm (mean annual) With 27 rainy days	finger millet, sorghum, peanuts, horse gram, sugarcane, cotton, tapioca, and vegetables etc	Coconut, Mango, Teak, Banana, Tamarind, Neem, Moringa, Sapota
Western Zone	35°C	30°C	200 to 600 metres above sea level	715 mm (mean annual) with 45 rainy days	sorghum, groundnut, tiny millets, pulses, cotton, sorghum, bengal gram, sunflower etc	Neem, Palm, Teak, Prosopios, Tamarind, Errukku

Kavitha and Ravichandran(2020) , Soil and Land Use Survey of India (2022)

2.3 Methodology

According to the soil survey handbook, seven pedons were excavated with dimensions of 2 meters in length and 1 meter in width, with a depth ranging between 1.5 to 2 meters. The specific depth was determined by the presence of the parent rock in the underlying layers.
Horizon wise samples were collected, air-dried, sieved through a 2 mm sieve, and weighted separately for the amount of gravel present. The samples were analyzed for physical parameters like soil texture, Bulk Density, Particle Density, Colour, porosity, Physico-chemical properties like pH, EC , CEC, Exchangeable Cations, free $CaCO_3$ were determined.(Table 3)

Table 3 : Parameter analysed, techniques adopted and reference for soil sample analysis

Parameters		Methods adopted	References
Physical parameters			
Bulk Density		Cylinder Method	Tan (1998)
Particle Density			
Porosity			
Colour		Munsell Colour Chart	Soil Survey Staff (1970)
Texture		Robinson Pipette Method	Piper (1966)
Gravel content		After wetting the horizon sample as such, wet seiving through a 2 mm sieve	Govindarajan and Koppar (1975)
Chemical Parameters			
pH	Water(1:2.5)	pH Meter	Jackson(1973)
	0.15M $CaCl_2$(1:2.5)		
	1 M KCl(1:2.5)		
Electrical Conductivity		Electrical Conductivity Meter	Jackson(1973)
Organic Carbon		Chromic acid digestion	Walkley and Black(1934)
Free $CaCO_3$		Rapid Titration Method	Piper (1966)
Cation Exchange Capacity		Neutral Normal Ammonium acetate method(soil pH <8.2)	Schollenberger and Dreibelbis, 1930
		Sodium Acetate method(Soil pH>8.2)	Schollenberger and Dreibelbis(1930)
Exchangeable Ca and Mg		Versenate titration	Jackson(1973)
Exchangeable K and Na		Flame photometry,Sanford and English(1949)	Sanford and English(1949)
Base Saturation %		Calculated from CEC and exch. cations	
Effective Sodium %		Calculated from CEC and exch. Sodium	
interpretive categories and soil taxonomy			
Detail soil survey		Soil Survey Staff (2014)	
Pedon description and		Soil Survey Staff (2014)	

sample collection	
Interpretative groupings	Soil Survey Staff (2014)
Soil Taxonomy	Soil Survey Staff (2014)

3. RESULTS AND DISCUSSION

Seven dominant soil series present in Western and North western zone of Tamil Nadu viz., Somayanur series (82228 ha), the Ammapettai series (59508 ha), the Palathurai series (116878 ha), the Tulukkanur series (422121 ha), the Yethapur series (41300 ha), the Suramangalam series (67849 ha), and the Salem series (66255 ha) were identified for assessing the morphological (Table 4), physico-chemical properties (Table 5).

3.1 Differentiation of Horizons:

Pedon 1 belongs to Somayanur series has 6 distinct horizons, Pedon 2,Ammapettai series with 4 horizons,Pedon 3, Palathurai series has 4 horizons, Pedon 4 comes under Tulukkanur series having 4 horizons, Pedon 5 is coming under Yethapur series with 7 horizons, Pedon 6 and 7 belong to suramangalam and salem series having 5 and 4 horizons respectively .

3.2 Morphological Properties:

Table 4 lists the physical along with the morphological properties of soils. The depth of the soil varies with pedon, which is moderately deep (50-100 cm) (pedon-2,3,4,6,7), to deep (>100 cm) (Pedon-1,5).

The moist soil colour of the Somayanur series varies from 10 YR 3/3 in surface to 7.5 YR 3/4 in subsurface soil, whereas dry colour varies from 10 YR 4/3 in surface to 7.5 YR 5/4 in subsurface soil. In Ammapettai soil series, colour varies from 10 YR 3/1 to 10 YR 6/3 when moist and 10 YR 3/2 to 10 YR 7/2 when dry. Soils of Palathurai series found have the soil colour varies from 5 YR 3/4 to 7.5 YR 4/3 (Moist) and from 5 YR 4/4 to 7.5 YR 5/3 in dry. Tulukkanur soil series are found with the colour of 5 YR 4/6 to 5 YR 4/4 (Moist) and 5 YR 4/4 to 7.5 YR 5/4 when dry . The Yethapur soils are having moist soil colour of 2.5 YR 3/4 to 5 YR 4/6 and dry soil colour of 2.5 YR 3/6 to 5 YR 5/8. The soils of Suramangalam series found to have the soil colour of 10 YR 3/1 to 10 YR 4/3 (Moist) and 10 YR4/2 to 10 YR5/3 when dry. The colour of the Salem soil series found between 7.5 YR 3/4 to 5 YR 3/4 when moist and 7.5 YR 4/4 to 5 YR 4/3 when dry. According to earlier research by Mohekar and Chella (2000), the nature and kind of soil formation processes are responsible for the variance in soil hues.

Somayanur soil series found to have the texture of sandy clay loam in surface to sandy loam in subsurface, moderate to well drained, angular blocky to sub-angular blocky in structure with slight to violent effervescence (surface horizon gives moderate effervescence compared to next two horizon with slight effervescence). These soils are having very gentle slope of 1-3%. Soils of Ammapettai series are calcareous, clay loam (surface) to sandy loam (subsurface) in texture with moderate to violent effervescence that increases with depth, poor to moderately drained, subangular blocky in structure, Soils of Palathurai series are calcareous, well-drained, sandy loam(surface) to sandy (subsurface) in texture with low to moderate effervescence. Soils are having very gentle slope of 0-1%. The structure is mostly sub-angular blocky. The calcareous, red insitu soils of the Tulukkanur series are found on top of bedding composed of calcareous material combined with weathered Quarz-felspathic gneiss. The texture of the soil is Sandy Loam (surface) to Sandy (subsurface) and poor to moderately drained, shows slight to moderate effervescence, which increases with depth. The structure of these soils varies from weak single grained to subangular blocky.

Yethapur soil series are non calcareous, well drained, red soil with sandy clay loam (surface) to loamy Sand(subsurface) in texture with no to slight effervescence with depth. The structure is subangular blocky with gravels of different sizes. Slope varies from 2-5 % which results in moderate erosion. The soils of Suramangalam series are calcareous, poorly drained soils with level (0-1%) slope and slight erosion. The texture of the soils varies from sandy clay to loamy sand texture with silt rich silty clay in middle horizons.. With increasing depth this soil gives slight to strong effervescence with 1:1 HCl. Soil structure is subangular blocky in the upper layers to massive in the lower layer. Salem series consists of weathered gneissic parent material-derived soil which is moderately drained , non-calcareous and having Fe mottles in lower layers. The texture varies from sandy clay loam(surface) to sandy(subsurface). The structure is subangular blocky in the upper layers and hard massive in the lower layers.

3.3 Physical Properties:

Table 4 list the complete soil's physical characteristics. According to information on particle size distribution, the clay concentration ranged from 6.12 to 41.48 percent among all 7 pedons. In the subsoils of Pedon 6, and Pedon 7, more clay was found. Except for pedons 3 and 7, all of the pedons' silt content displayed an uneven tendency with varying depth. This may be caused by variations in the way soil forms and the effects of different weathering processes. Soils of Pedon 6 had the highest silt concentration in second and thirdhorizon, which may be related to greater water changes from various sources at various times (Srinivasan *et al*.,2015). Pedon 2 and Pedon 6 soils had the highest sand variation, with sand contributions ranging from 16.82 to 88.79 percent. Sand contribution is highest in classes of textures, which might be attributed to the Granite-gneiss's parent rock being siliceous. Sandy soils have poor nutrient retention and water-holding capacity, which restricts the amount of moisture available to the crop. In order to increase agricultural output, these soils must be carefully maintained. The soils' bulk densities ranged from 1.05 to 1.33 Mg m-3. In pedons 6 and 7, the gradual rise in bulk density along with depth was seen. It might be caused by an increase in coarse soil fragments. The soils ranged in particle density from 1.81 to 3.33 Mg m^{-3} and in porosity from 34.8 to 78%, however, the bulk of samples have porosity of around 50%, which has an erratic distribution pattern with depth.

Table 4 : Morphological and physical characteristics of 7 soil series in the study area

Depth (Cm)	Horizon	Colour		Mechanical Analysis(%)			Texture	BD (g.cm^{-3})	PD (g.cm^{-3})	Effervescence
		Moist	Dry	Sand	Silt	Clay				
Pedon 1 : Somayanur Series										
0-18	Ap	10 YR 3/3	10 YR 4/3	56.45	14.28	29.23	Sandy Clay Loam	1.05	2.64	medium
18-40	Bt	5 YR 3/4	2.5 YR 3/4	60.28	4.47	35.24	Sandy Clay	1.05	2.68	slight
40-62	B1	2.5 YR 2.5/3	2.5 YR 2.5/4	56.62	10.23	33.12	Sandy Clay Loam	1.11	2.59	slight
62-81	B2	5 YR 3/4	2.5 YR 3/4	67.88	12.18	19.90	Sandy Loam	1.11	2.28	medium
81-110	B3	5 YR 3/3	5 YR 3/4	70.00	11.74	18.21	Sandy Loam	1.17	3.33	violent
110-130	Ck	7.5 YR 3/4	7.5 YR 5/4	69.51	11.56	18.88	Sandy Loam	1.11	2.50	violent
Pedon 2 : Ammapettai Series										
0-14	Ap	10 YR 3/1	10 YR 3/2	44.23	19.24	36.48	Clay Loam	1.33	2.65	medium
14-36	A1	10 YR 3/2	10 YR 4/2	50.98	12.60	36.42	Sandy Clay	1.17	2.50	medium
36-74	Bk	10 YR 4/3	10 YR 5/3	62.21	8.54	29.23	Sandy Clay Loam	1.18	2.86	violent
74-110	Ck	10 YR 6/3	10 YR 7/2	70.02	10.76	19.17	Sandy Loam	1.25	2.50	violent
Pedon 3 : Palathurai Series										
0-18	Ap	5 YR 3/4	5 YR 4/4	61.23	21.57	17.18	Sandy Loam	1.05	2.22	slight
18-40	B1	5 YR 3/3	5 YR 4/4	64.41	15.79	19.78	Sandy Loam	1.17	2.85	slight
40-82	B2	5 YR 3/4	5 YR 4/3	70.13	12.74	17.12	Sandy Loam	1.25	3.33	medium
82-88	Ck	7.5 YR	7.5 YR	88.7	5.00	6.21	Sand	1.17	3.33	medium

		4/3	5/3	9						
Pedon 4 : Tulukkanur Series										
0-15	A	5 YR 4/6	5 YR 4/4	63.02	16.95	19.98	Sandy Loam	1.33	2.85	slight
15-30	B1	5 YR 3/3	5 YR 4/4	82.81	4.77	12.41	Loamy sand	1.18	3.33	medium
30-60	B2	5 YR 3/4	5 YR 4/4	83.07	4.57	12.34	Loamy sand	1.25	2.86	medium
60-90	Ck	5 YR 4/4	7.5 YR 5/4	88.38	5.34	6.25	sand	1.25	3.33	violent
Pedon 5 : Yethapur Series										
0-20	Ap	2.5 YR 3/4	2.5 YR 3/6	59.19	9.82	30.89	Sandy Clay Loam	1.18	2.61	nil
20-40	Bt1	2.4 R 3/4	2.5 YR 3/4	60.05	4.40	35.45	Sandy Clay	1.05	2.22	nil
40-62	Bt2	2.5 YR 2.5/3	2.5 YR 3/4	57.28	4.56	38.64	Sandy Clay	1.11	2.85	Very slight
62-89	B3	2.5 YR 3/4	2.5 YR 3/6	65.36	5.74	28.87	Sandy Clay Loam	1.18	2.85	Very slight
89-121	B4	2.5 YR 3/6	2.5 YR 4/4	69.96	8.74	21.28	Sandy Clay Loam	1.18	2.85	slight
121-150	BC1	2.5 YR 3/6	2.5 YR 4/8	83.78	5.76	10.46	Loamy Sand	1.25	3.33	slight
150-180	BC2	5 YR 4/6	5 YR 5/8	84.22	6.54	9.24	Loamy Sand	1.25	3.33	slight
Pedon 6 : Suramangalam Series										
0-10	Ap	10 YR 3/1	10YR 4/2	60.00	4.79	35.16	Sandy Clay	1.05	2.22	slight
10 to 20	Bt1	10 YR 3/1	10YR 3/2	17.46	40.56	41.48	Silty Clay	1.11	2.22	slight
20-68	B2	10 YR 3/4	10 YR 4/3	16.82	42.10	40.98	Silty Clay	1.18	2.85	medium
68-100	Bk3	10YR 4/3	10 YR 5/3	86.96	2.05	10.96	Loamy Sand	1.18	2.85	violent

Pedon 7 : Salem Series										
0-13	Ap	7.5 YR 3/4	7.5YR 4/4	59.34	18.30	22.34	Sandy Clay Loam	1.05	2	Nil
13-40	Bt	5 YR 3/3	5 YR 4/4	61.21	15.72	26.67	Sandy Clay Loam	1.18	3.33	Nil
40-65	Bc	5 YR 3/4	5 YR 4/4	64.69	10.63	23.87	Sandy Clay Loam	1.18	2.85	Nil
65-80	C	5 YR 3/4	5 YR 4/3	88.25	5.63	6.12	Sand	1.18	2.22	Very slight

3.4 Chemical and Physico-Chemical Properties:

Soil pH found to be slightly acidic (pedon 5,7) to moderately alkaline (pedon 1,2,3,4,5,6), with pH varying from 6.2 to 8.92 in water, 5.41 to 7.68 in $CaCl_2$ and 5.65 to 7.89 in KCl. The less pH value in $CaCl_2$ and KCl due to the exchange of H^+ ion by Ca^{2+} and K^+ ion of solution results more H^+ ion concentration in solution which lowers pH value of solution compared to water. This extensive variation in pH among all soil series was attributed to the properties of the parent material, capacity of leaching, free $CaCO_3$ as well as exchangeable cations. The highest pH has been shown in Suramangalam series (pedon 6) and the lowest in Salem Series (pedon 7). The electrical conductivity (EC) measurements varied between 0.11 (pedon 5) and 0.41(pedon 6) dS m^{-1}, indicating that the soils were not saline. Such observations align with the studies conducted by Nayak *et al*. (2000) and Vijayakumar *et al.* (1994). The organic carbon content was found to be minimal in pedon 2 at 1.2 $g.kg^{-1}$ while pedon 1 exhibited a higher content of 9.6 $g.kg^{-1}$. Organic carbon content demonstrated a reduction as depth increased across all the pedonswhere as irregular pattern was recorded in sugarcane growing soils (Sellamuthu *et al*, 2001) The organic carbon content in surface soils was observed to be greater than in sub-surface soils. This can be attributed to the accumulation of litter, crop residues, as well as the application of manure and fertilizers to the topsoil layers. Pedons 1,2,3,4,6 are calcareous in nature and free Calcium Carbonatecontent varies from 0.00 to 10.00% and pedon 5 and 7 are slightly calcareous to non calcareous in nature having free Calcium Carbonate ranging from 0 to 1.87%. The cation exchange capacity (CEC) of pedon7was found to be5.60cmol (p+) kg-1, whereas pedon6 exhibited a higher value of 30.80cmol (p+) kg-1. Such differences can be ascribed to the nature and amount of clay and organic material present . The cation exchange capacity (CEC) of pedons 1,2, 3,5,6 and 7 exhibited an initial increase followed by a decrease as the depth progressed except pedon 4. In all the pedons, the sequence of abundance for exchangeable cations was as follows: Ca^{2+}> Mg^{2+}>K^+>Na^+. The high base saturation in these soils ranging from 81.0 to 98.2 % can be attributed to the exchangeable Ca^{2+} and Mg^{2+}. Notably, the exchangeable sodium percentage (ESP) in all the pedons was found to be significantly below the crucial threshold of 15%.

Table 5 :Physico-Chemical and Exchangable properties of soil Series in the study area

Depth	Horizon	pH (1:2.5)			EC (dS. m^{-1})	OC (g. Kg^{-1})	Free $CaCO_3$ (%)	Exch. Bases (C mol Kg^{-1})					CEC (C mol Kg^{-1})	BSP (%)	ESP (%)
		Water	$CaCl_2$	KCl				Ca	Mg	K	Na	Total			
Pedon 1 : Somayanur Series															
0-18	Ap	7.25	6.68	7.01	0.24	9.6	2.50	16.01	5.00	0.42	0.10	21.53	22.40	96.1	0.45
18-40	Bt	7.31	6.71	6.95	0.22	5.7	1.25	18.89	7.31	0.82	0.21	27.23	30.20	90.2	0.69
40-62	B1	7.28	6.77	6.99	0.19	7.4	1.25	17.98	6.09	0.68	0.22	24.97	27.00	92.5	0.81
62-81	B2	7.77	7.13	7.24	0.20	3.9	3.75	11.60	5.01	0.56	0.32	17.49	18.80	93.0	1.69
81-110	B3	7.98	7.41	7.72	0.19	2.7	5.75	13.05	2.23	0.41	0.23	15.91	17.60	90.4	1.29
110-130	Ck	8.02	7.53	7.88	0.26	1.5	7.25	11.02	4.10	0.29	0.22	15.62	17.00	91.9	1.29
Pedon 2 : Ammapettai Series															
0-14	Ap	7.55	6.84	6.91	0.37	8.7	3.75	15.54	8.50	0.41	0.18	24.63	27.80	88.6	0.63
14-36	A1c	7.81	6.93	7.00	0.29	4.5	5.00	16.12	7.91	0.42	0.17	24.62	28.40	86.7	0.60
36-74	B2c	7.83	7.01	6.98	0.38	3.6	6.25	14.16	7.05	0.44	0.17	21.82	24.90	87.6	0.70
74-110	C	8.02	7.12	7.22	0.24	1.2	10.00	12.23	4.71	0.43	0.14	17.50	21.60	81.0	0.65
Pedon 3 : Palathurai series															
0-18	Ap	7.23	6.51	6.8	0.16	7.2	2.50	10.91	4.0	0.4	0.0	15.48	18.20	85.0	0.4

				9					8	1	7				0
18-40	B1	7.38	6.71	6.85	0.14	6.9	2.50	11.26	5.81	0.44	0.08	17.59	20.20	87.1	0.37
40-82	B2	7.45	6.7	6.99	0.17	3.3	3.75	11.02	6.07	0.43	0.11	17.63	18.00	97.9	0.60
82-88	Ck	7.95	7.01	7.27	0.14	3.0	6.25	6.67	3.04	0.36	0.10	10.16	10.40	97.7	0.94
Pedon 4 : Tulukkanur Series															
0-15	A	7.55	6.98	7.13	0.16	6.0	1.25	11.01	5.20	0.36	0.38	16.95	18.80	90.2	2.01
15-30	B1	7.78	7.01	7.24	0.16	5.4	2.50	6.12	2.93	0.35	0.42	9.81	11.20	87.6	3.72
30-60	B2	7.82	7.11	7.14	0.25	5.1	5.00	6.45	3.00	0.33	0.44	10.22	11.80	86.6	3.73
60-90	Ck	7.84	7.09	7.21	0.23	2.4	8.25	5.67	2.13	0.34	0.36	8.49	9.20	92.3	3.88
Pedon 5 : Yethapur Series															
0-20	Ap	7.63	6.59	7.18	0.15	9.1	0.25	12.65	5.32	1.31	0.11	19.40	19.80	98.0	0.58
20-40	Bt1	7.81	6.43	7.29	0.10	7.8	0.25	12.75	6.90	1.26	0.13	21.04	23.20	90.7	0.57
40-62	Bt2	7.03	6.17	6.89	0.18	7.2	0.45	14.04	7.91	1.19	0.12	23.27	25.30	92.0	0.49
62-89	B3	6.73	6.01	6.41	0.19	5.4	0.62	11.05	5.15	0.86	0.11	17.17	18.40	93.3	0.60
89-121	B4	6.87	6.21	6.48	0.21	3.3	1.25	9.55	5.35	0.54	0.11	15.54	16.40	94.8	0.65
121-150	BC1	6.57	5.99	6.23	0.20	3.0	1.25	6.90	3.50	0.39	0.12	10.91	11.60	94.0	1.05
150-180	BC2	6.2	5.92	5.98	0.20	1.8	1.87	6.80	3.04	0.38	0.13	10.35	11.00	94.1	1.17
Pedon 6 : Suramangalam, Series															

0-10	Ap	7.49	6.96	7.17	0.20	7.5	1.25	13.80	6.25	0.75	0.09	20.88	23.60	88.5	0.38
10 - 20	Bt1	8.02	7.21	7.36	0.20	7.8	1.25	16.50	8.45	0.49	0.11	25.56	30.80	83.0	0.37
20-68	B2	8.33	7.47	7.58	0.41	6.6	3.50	17.05	8.80	0.33	0.25	26.42	28.80	91.7	0.85
68-100	Bk3	8.92	7.68	7.81	0.28	1.8	7.00	8.60	3.80	0.22	0.19	12.81	13.20	97.1	1.45
Pedon 7 : Salem Series															
0-13	Ap	6.53	5.41	5.65	0.28	9.9	0.00	10.90	5.50	0.57	0.09	17.06	17.40	98.1	0.51
13-40	Bt	6.67	5.58	5.81	0.22	8.4	0.25	13.80	6.25	0.20	0.08	20.33	22.19	91.6	0.37
40-65	Bc	6.61	5.66	5.89	0.16	4.5	0.62	11.01	5.20	0.28	0.10	16.59	18.20	91.1	0.53
65-80	C	6.69	5.78	5.99	0.24	2.7	0.62	3.95	1.20	0.22	0.14	5.50	5.60	98.2	2.42

4. CONCLUSION

Soils of Western and North-Western zones of Tamil Nadu specifically 4 districts under study having slightly acidic to moderately alkaline pH, high to medium organic carbon , low to medium CEC, high base saturation percentage. Most of the soils are having level land to gentle slope and having no to slight erosion. All the pedons found to have the sequence of abundance for exchangeable cations in the order of Ca^{2+}> Mg^{2+}>K^{+}>Na^{+} with high base saturation. Notably, the exchangeable sodium percentage (ESP) in all the pedons was found to be significantly below the crucial threshold of 15%. Calcareousness, nutrient deficiency and drainage is the common constraints of those soils. Implementing suitable site-specific technologies is essential for attaining sustainable productivity.

REFERENCES

1. Balasubramanian, V., Ragunath, K. P., Mugilan, G. R., &Pazhanivelan, S. (2019). Characterization and classification of soils of Veerapandi block of Salem district of Tamil Nadu-South India. Madras agricultural Journal, Doi, 10.
2. Balasubramanian, V., Ragunath, K. P., Srinivasan, R., Manikandan, E., & Suresh, K. (2020). Mapping and classification of upland soils formed from peninsular gneiss in rasipuram block, Namakkal District of Tamil Nadu. International Journal of Bio-resource and Stress Management, 11(3), 232-239.
3. Chandrakala, M., Srinivasan, R., Kumar, K. S., Sujatha, K., Ramesh, M., Hegde, R., ... & Nirmala, H. R. (2018). Characterisation and Classification of Rubber Growing

Soils of Kerala, India. Current Journal of Applied Science and Technology, 32(1), 1-12.
4. Jackson, M.L.1973. Soil chemical analysis. Prentice Hall of India. Pvt Ltd., New Delhi. p.495.
5. Jayakumar, M., Balasubramanian, V., & Manickam, T. S. (2012). Characterization of Sodic Soils of North Western Zone of Tamil Nadu. Madras Agricultural Journal, 99(oct-dec), 1.
6. Kavitha, S., & Ravichandran, K. (2020). A study on rainfall and temperature of Salem district Tamil Nadu. India. J. emerg. technol. innov. res, 7(10), 3644-3655.
7. Mohekar, D. S., & Challa, O. (2000). Characterization and classification of orange growing soils in Nagpur district of Maharashtra and the effect of soil parameters on crop performance. Agropedology, 10(2), 173-182.
8. Nayak, D. C., Mukhopadhyay, S., & Sarkar, D. (2000). Distribution of some available micronutrients in alluvial soils of Arunachal Pradesh in relation to soil characteristics. Journal of the Indian Society of Soil Science, 48(3), 612-614.
9. Page, A.L., Miller, R.H. and Keeney, D.R. 1982. Methods of Soil Analysis, Part 2, 2nd Ed., Soil Science Society of America, Madison, USA.
10. Palaniappan, S., Natarajan, S., & Thiyagarajan, T. M. (1993). Agro-ecology and soils of Tamil Nadu, India. In SARP Research Proceedings (p. 150).
11. Sankar, M., &Dadhwal, K. S. (2009). Characterization and classification of red soils from Tamil Nadu. Asian Journal of Soil Science, 4(1), 81-85.
12. Soil Survey Staff. 'Keys to Soil Taxonomy', 12th Edition,;(U.S.D.A.: Washington, D.C.) 2014.
13. Sellamuthu, K.M**.,** S. Natarajan, R.Sivasamy and S.Mani. 2001. Depthwise distribution of nutrients in sugarcane growing areas of Uttiramerur taluk, Tamil Nadu, *J. Environ. Research. 11*(1): 47-50.
14. Somasundaram, J., Nataranjan, S., Mathan, K.K., Kumar, V.A. and Sivasamy, R. 2010. Characterization of some typical pedons in lower Vellar basin of Pudukottai district in Tamil Nadu. Agropedology 20: 103-111.
15. Srinivasan, R., Hegde, R., Karthika, K., Maddileti, N., & Singh, S. (2019). Effect of different land uses on soil pedogenic properties and sodicity development in Krishnagiri reservoir project dam catchment in Tamil Nadu. Indian Society of Soil Salinity and Water Quality (Registered under Societies Registration Act XXI of 1860) Editorial Board, 11(1), 10-17.
16. Srinivasan, R., Kumar, K. A., Chandrakala, M., Niranjana, K. V., Maddileti, N., & Hegde, R. (2021). Characterization and classification of major coconut growing soils in South Eastern Ghats of Tamil Nadu, India. Journal of Plantation Crops, 49(2), 94-103.
17. Srinivasan, R., Singh, S. K., Chattopadhyay, T., Gangopadhyay, S. K., Nayak, D. C., & Mukhopadhyay, S. (2017). Characterization of Soils and Cropping Pattern of Coastal West Bengal-A Case Study in Canning II Block. Journal of Soil Salinity and Water Quality, 9(2), 249-256.
18. Stanford, G., & English, L. (1949). Use of the flame photometer in rapid soil tests for K and Ca.
19. Walkley A, Black IA. An examination of the Degtjareff method for determining soil organic matter and a proposed modification of the chromic acid titration method. Soil Science 1934;37:29-38