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Characterization and classification of soils of Valapadi block of Salem district of Tamil Nadu

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Abstract
A detailed soil survey was carried out in Valapadi block of Salem district consists of 39 villages spread over 18551 hectares. Based on variation in physiography and landform, ten soil series and 57 soil mapping units were identified. Ten typifying pedons representing the soil series were analysed for its physico - chemical properties and characterized for mapping. Soils are deep to very deep, well drained to somewhat poorly drained, light to dark coloured, light to heavy textured. pH of soils ranged from 6.3 to 8.9 with mean value of 7.8, EC ranged between 0.1 to 0.5 dSm^{-1}, OC varied from 0.11 to 0.68% with mean value of 0.33%, CEC ranged from 8.5 to 27.4 cmol (p+) kg^{-1} with mean value of 17.87 cmol (p+) kg^{-1}. The land capability classification in the study area indicates that moderately good cultivated soils covered 18.6 percent area was affected with moderate limitations of erosion, where as the extent of moderate limitations of erosion and calcareousness was 65.9 percent. The land irrigability groupings indicate that about 18.6 percent area of the block may be used safely under irrigation. The erosion and calcareousness land covering 65.9 percent of the area were moderately suitable for sustained use under irrigation, provided proper soil and water conservation measures to be adopted.

Keywords: Soil survey, land resource inventory

Introduction
Soil is the base for every production system. Therefore, it is imperative to sustain the eco system (Becklett and Webster 1971; Gessler, 1996) [3, 5]. Standard soil survey helps to collect information about soil genesis, extent and to assess their potentials and limitations for specific purpose (Bouma 2001; Mermutt and Eswaran 2001 and Salehi, Eghbal and Khademi 2003) [4, 8, 11]. Agricultural intensification and massive infrastructure development enhances the risk of soil erosion and fertility depletion (Singh *et al*., 2007) [12]. To adopt good management practices and remedial measures for various soils, a systematic study of the soils is highly essential. The soils boundaries are demarcated based on actual traverses throughout the course. Soil test is the analysis of a soil sample to determine nutrient and contaminant content and also other characteristics such as salinity, acidity, alkalinity and calcareousness level of a particular soil. Since the above parameter mainly affect the growth of any crop. Tests are usually performed to measure the expected growth potential of a soil. To find out the soil types and fertility status of Valapadi block of Salem district, a systematic study was conducted by utilizing cadastral level maps.

Study area
Geographically, the Valapadi lies between 12^0 26' and 12^0 36' North latitude and 78^0 58' to 77^0 63' East with an area of 18550 ha. The general elevation of the area ranges from 221 to 986 m (Godumalai) above mean sea level (MSL) (Fig.1 and 2). The main drainage is the Anaimaduvu and their tributaries of vasita nadhi. The block is drained by gullies and small streams into tanks. All the streams and tanks are seasonal and dependent on rainfall. Soil erosion is very severe in the uplands due to occasional high intensity down pour and higher topographical position.

Climatic condition
Study area comes under North Western agro climatic zone. The climate of Valapadi is hot

moist and semi arid with mean annual rainfall of 892.3 mm. Mean annual temperature of 33^0c and PET of 1747.2 mm. The relative humidity is high during monsoon season. The area qualifies for iso hyperthermic soil temperature regime.

Geology

The geology of the study area, rocks belongs to the great metamorphic or gneissic series of South India of Archean age with patches of Dharwar places. Intrusive in this area, the older charnockite series and younger igneous intrusions of which the basic trap dykes and magnesite series of the chalk hills are the most conspicuous. Much of the block is covered by a very interesting series of igneous rocks which are recognized as charnockites.

Natural vegetation

The natural vegetation comprises of (Ficus clomerata), country ber (Zizyphus jujuba), babul (Acacia Arabica), nuna (Morinda tinctoria), banyan (Ficus bengalensis), Mangifera indica, Tamarindus indica, Azardirachta indica. Major crops are tapioca, maize, paddy, arecanut, turmeric, tomato in irrigated tracts sorghum and groundnut in rain fed uplands.

Experimental site

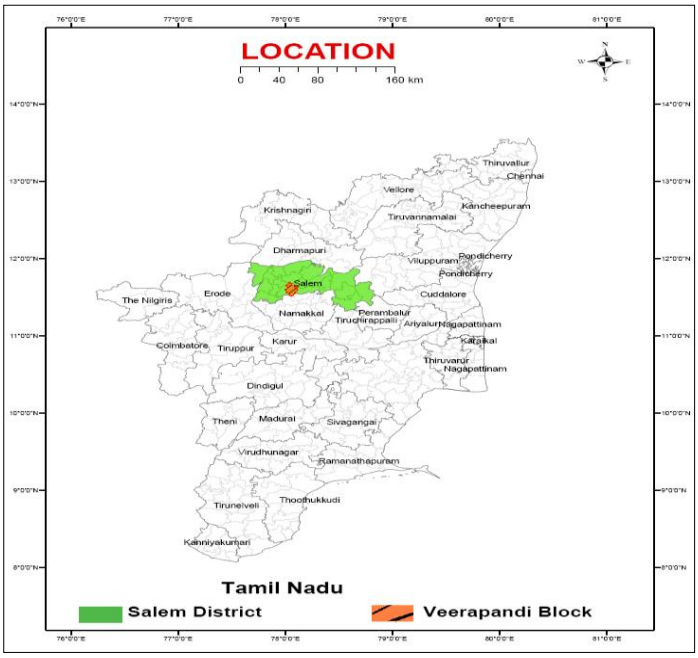

Fig 1: Location of Valapadi block of Salem district map

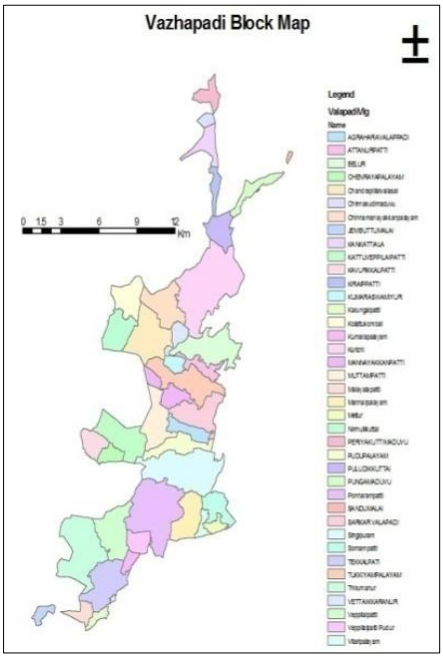

Fig 2: Valapadi block village map

Field studies

A detailed traverse of the revenue villages of Valapadi block was made to identify different soil series by utilizing cadastral maps of 1:3000 to 1:8000 scales. Pedon sites were located in transects along the slope from the upper to lower slopes. Ten pedons were exposed and studied for morphological characteristics as per soil survey manual (Soil Survey Division staff 1991) [13]. Horizon wise profile samples and mapping unit wise surface samples were collected, air dried and sieved through 2 mm sieve (0.2) mm sieve for organic carbon), labeled and stored, analysed for particle size distribution following international pipette method.

Laboratory analysis

The samples were analysed for parameters *viz*, pH, and EC (Jackson,1973) [7], organic carbon (Walkley and Black 1934) [14], cat ion exchange capacity (CEC) and exchangeable cat ions were determined as prescribed by (Jackson, 1958) [6].

Generation of thematic soil fertility maps

Database on LCC, LIC and FCC was generated in microsoft Excel package and theme maps generated by using Arc-GIS software version 10.1.

Results and Discussion

Ten soil series, namely were Attanurpatti, Belur, Chinnamanaickenpalayam Chandrapillaivalasu, Kankattiaala, Somampatti, Tukkiyampalayam, Valapadi, Vettaikaranoor, Vilaripalayam were identified and mapped in Valapadi block of Salem district based on their morphological properties (Table-1), physico-chemical properties (Table-2), Range and mean values of physico - chemical properties of Valapadi block soil series (Table-3) and soil taxonomic information is given in (Table- 4).

Table 1: Morphological characteristics of pedons in Valapadi block

Horizon	Depth	Colour	Texture	Structure	Effervescence	Root distribution
Pedon 1 Attanurpatti - Coarse loamy, mixed, calcareous, isohyperthermic Typic Haplustalfs						
A_p	0-17	5YR 4/4	scl	m2sbk	profuse	mf
B_{W1}	17-41	2.5YR 3/6	gsc	m2sbk	profuse	cf
B_{W2}	41-59	5YR 4/6	gsc	m2sbk	profuse	ff
B_{W3}	59-100	5YR 4/6	gscl	m2sbk	profuse	ff
Pedon 2 Belur- Fine loamy, mixed, calcareous, isohyperthermic Typic Haplustalfs.						
A_p	0-18	10YR 4/3	scl	m3 sbk	profuse	cf
B_{W1}	18-43	5YR 3/4	scl	m2sbk	profuse	cf
B_{W2}	43-79	7.5 YR 4/4	sc	m2sbk	profuse	cf

B_{W3}	79-115	7.5 YR 6/6	sc	m2sbk	profuse	cf
Pedon 3 Chinnamanaickenpalayam - Fine loamy, mixed, isohyperthermic Typic Rhodustalfs.						
A_p	0-22	5YR 5/6	scl	m2 sbk	nc	mf
B_{W1}	22-60	5YR 4/4	scl	m2sbk	nc	mf
B_{W2}	60-100	2.5YR 3/6	scl	m2sbk	nc	ff
Pedon 4 Chandrapillaivalasu - Fine loamy, mixed, isohyperthermic Typic Rhodustalfs.						
A_p	0-20	5YR 5/6	sl	m2 sbk	nc	cf
B_{W1}	20-40	5YR 3/3	sc	m2sbk	nc	ff
B_{W2}	40-80	2.5YR 3/6	scl	m2sbk	nc	cf
B_{W3}	80-150	2.5YR 3/6	gsc	m2sbk	nc	ff
Pedon 5 Kankattiaala- Fine loamy, mixed,isohyperthermic Typic Haplustepts.						
A_p	0-16	10YR 3/4	scl	m2 sbk	nc	cf
B_{W1}	16-26	5YR 4/3	scl	m2sbk	nc	cf
B_{W2}	26-45	5YR 3/4	scl	m2sbk	nc	cf
B_{W3}	45-73	5YR 3/2	sl	m2sbk	nc	cf
B_{W4}	73-106	5YR 3/2	scl	m2sbk	nc	cf
B_{W5}	106-153	5YR 3/2	scl	m2sbk	nc	cf
Pedon 6 Somampatti - Fine loamy, mixed, isohyperthermic Typic Rhodustalfs.						
A_p	0-20	5YR 5/6	sl	m2 sbk	nc	cf
B_{W1}	20-41	2.5YR 4/6	scl	m2sbk	nc	cf
B_{W2}	41-70	2.5YR 3/6	sc	m2sbk	nc	ff
Pedon 7 Thukkiyampalayam- Clay skeletal mixed, isohypothermic, Typic Rhodustalfs.						
A_p	0-18	7.5YR 4/4	scl	m2 sbk	nc	mf
B_{wt}	18-42	5YR 4/4	gsc	m2sbk	nc	cf
Pedon 8 Valapadi -Loamy skeletal, mixed, isohyperthermic shallow, Typic Haplustalfs.						
A_p	0-20	10YR 4/2	scl	m2 sbk	profuse	mf
B_{W1}	20-35	10YR 3/4	cl	m2sbk	profuse	ff
B_{W2}	35-60	10YR 3/3	sc	m2sbk	profuse	ff
B_{W3}	60-75	10YR 3/4	sc	m2sbk	profuse	ff
B_{W4}	75-110	10YR 4/3	scl	m2sbk	profuse	ff
Pedon 9 Vettaikaranur- Fine loamy, mixed,calcareous, isohyperthermic Typic Haplustalfs.						
A_p	0-20	10YR 5/2	scl	m2 sbk	profuse	mf
B_{W1}	20-40	10YR 3/4	cl	m2sbk	profuse	ff
B_{W2}	41-75	10YR 3/3	sc	m2sbk	profuse	ff
Pedon 10 Vilaripalayam- Fine loamy, mixed, isohyperthermic Typic Haplustalfs.						
A_p	0-18	5YR 5/6	scl	m3 sbk	profuse	mf
B_{W1}	18-40	5YR 3/4	sc	m2sbk	profuse	cf
B_{W2}	40-69	10YR 3/3	gscl	m2sbk	profuse	ff
B_{W3}	69-100	10YR 4/6	scl	m2sbk	profuse	ff

Table 2: Physico-chemical properties of typifying pedons in Valapadi block

Horizons	Depth	Sand	clay	silt	pH	EC	OC	CEC	Exchangeable				ESP	BSP
									Ca	Mg	Na	K		
Pedon 1 Attanurpatti - Coarse loamy, mixed, calcareous, isohyperthermic Typic Haplustalfs														
A_p	0-17	51	37	12	8.3	0.3	0.49	17.4	10.6	2.8	1.4	0.2	8.1	86.2
B_{W1}	17-41	50	40	10	8.4	0.2	0.32	21.4	12.8	3.5	2.1	0.3	9.8	87.3
B_{W2}	41-59	50	38	12	8.1	0.2	0.30	22.6	13.2	4.0	2.6	0.3	5.7	88.9
B_{W3}	59-100	60	32	8	8.0	0.3	0.24	14.2	8.9	1.9	1.1	0.1	7.7	84.5
Pedon 2 Belur- Fine loamy, mixed, calcareous, isohyperthermic Typic Haplustalfs.														
A_p	0-18	60	30	10	8.2	0.3	0.15	13.8	8.0	2.3	1.2	0.15	8.7	84.4
B_{W1}	18-43	67	25	8	8.5	0.3	0.23	12.0	7.6	1.6	0.9	0.13	7.5	85.3
B_{W2}	43-79	50	40	10	8.5	0.3	0.26	22.4	13.8	2.8	1.8	0.10	10.7	82.6
B_{W3}	79-115	50	42	8	8.3	0.5	0.18	20.8	12.2	2.6	1.9	0.12	9.1	80.9
Pedon 3 Chinnamanaickenpalayam - Fine loamy, mixed, isohyperthermic Typic Rhodustalfs.														
A_p	0-22	60	30	10	7.3	0.2	0.34	15.2	7.9	2.0	1.2	0.7	7.9	77.6
B_{W1}	22-60	57	35	8	7.7	0.2	0.37	14.6	9.2	1.8	0.8	0.2	5.5	82.2
B_{W2}	60-100	55	35	10	7.9	0.3	0.25	13.7	8.1	1.7	1.0	0.5	7.3	82.4
Pedon 4 Chandrapillaivalasu - Fine loamy, mixed, isohyperthermic Typic Rhodustalfs.														
A_p	0-20	80	15	5	6.3	0.2	0.27	8.5	4	0.8	0.8	0.6	6.9	72.9
B_{W1}	20-40	50	40	10	7.6	0.3	0.38	16.8	9.2	2.1	1.8	0.2	10.7	79.2
B_{W2}	40-80	55	35	10	7.9	0.1	0.31	13.8	7.9	1.8	1.2	0.15	8.7	80.4
B_{W3}	80-150	50	40	10	8.1	0.2	0.32	18.2	10.8	1.8	2.1	0.2	11.5	81.9
Pedon 5 Kankattiaala- Fine loamy, mixed,isohyperthermic Typic Haplustepts.														
A_p	0-16	62	30	8	7.8	0.1	0.11	14.0	8.2	1.9	1.2	0.07	8.6	81.4
B_{W1}	16-26	65	25	10	7.9	0.2	0.17	15.6	9.3	3.1	1.1	0.15	7.0	87.8
B_{W2}	26-45	60	30	10	7.7	0.2	0.21	12.8	9.0	1.6	0.9	0.10	7.0	90.6
B_{W3}	45-73	74	18	5	7.8	0.2	0.10	8.9	4.9	0.8	0.5	0.07	5.6	70.8
B_{W4}	73-106	55	35	10	8.0	0.2	0.15	15.1	10.1	1.4	0.8	0.10	4.7	82.1

B_{W5}	106-153	55	35	10	8.0	0.2	0.28	14.8	9.6	1.3	0.9	0.12	6.1	80.4
Pedon 6 Somampatti - Fine loamy, mixed, isohyperthermic Typic Rhodustalfs.														
A_p	0-20	15	5	80	7.3	0.2	0.52	11.8	7.5	1.2	0.5	0.2	4.2	79.6
B_{W1}	20-41	35	8	57	7.6	0.2	0.40	16.0	9.2	2.2	1.1	0.3	6.6	80.0
B_{W2}	41-70	40	12	48	7.2	0.5	0.43	26.2	17.2	3.6	2.3	0.3	8.8	89.3
Pedon 7 Thukkiyampalayam- Loamy skeletal, mixed, isohyperthermic shallow, Typic Haplustalfs.														
A_p	0-18	30	10	60	7.1	0.1	0.40	16.6	9.9	1.8	0.8	0.6	4.8	78.9
B_{wt}	18-42	40	10	50	7.2	0.1	0.27	26.2	16.2	3.1	2.4	0.3	9.2	83.9
Pedon 8 Valapadi - Loamy skeletal, mixed, isohyperthermic shallow, Typic Haplustalfs.														
A_p	0-20	37	10	51	8.5	0.3	0.31	16.5	9.2	2.2	1.3	0.4	7.8	79.4
B_{W1}	20-35	37	10	53	8.7	0.2	0.36	26.4	18.0	2.9	2.5	0.4	10.8	90.2
B_{W2}	35-60	30	8	60	8.5	0.2	0.41	23.2	13.9	2.9	2.7	0.5	11.6	86.2
B_{W3}	60-75	30	8	60	8.4	0.2	0.31	20.6	13.0	3.1	2.1	0.17	10.2	89.3
B_{W4}	75-110	30	10	60	8.5	0.1	0.22	14.8	8.6	2.1	1.6	0.2	10.8	84.4
Pedon 9 Vettaikaranur - Fine loamy, mixed,calcareous, isohyperthermic Typic Haplustalfs.														
A_p	0-20	35	8	57	8.0	0.3	0.40	15.1	8.6	2.2	1.1	0.5	7.3	82.1
B_{W1}	20-40	39	17	44	8.4	0.2	0.18	25.2	16.8	2.2	2.2	0.2	8.7	84.9
B_{W2}	41-75	40	13	47	8.5	0.2	0.20	23.4	16.1	1.2	1.9	0.2	8.1	82.9
Pedon 10 Vilaripalayam - Fine loamy, mixed, isohyperthermic Typic Haplustalfs.														
A_p	0-18	35	10	55	7.2	0.3	0.57	16.8	10.6	1.6	1.5	0.28	8.9	83.3
B_{W1}	18-40	40	13	52	8.0	0.2	0.33	27.4	18.4	2.9	2.7	0.10	9.9	87.9
B_{W2}	40-69	30	10	60	7.9	0.3	0.31	18.2	12.2	1.6	1.7	0.10	9.3	84.9
B_{W3}	69-100	35	10	55	7.8	0.2	0.25	15.8	9.6	1.8	1.2	0.12	7.6	80.5

Table 3: Range and mean value of physico-chemical properties of Valapadi block soil series

Ranges	Sand (%)	Clay (%)	Silt (%)	pH	EC (dSm^{-1})	OC (%)	CEC	Exchangeable cations (cmol(p) kg^{-1}				ESP	BSP
								Ca	Mg	Na	K		
Min	15.6	5.7	5.4	6.3	0.1	0.1	8.5	4	0.8	0.5	0.05	4.2	70.8
Max	80.4	42.3	80.3	8.7	0.5	0.7	27.4	18.4	4.1	2.9	0.9	12.6	90.6
Mean	44.1	19.9	36.2	7.8	0.24	0.3	17.87	10.9	2.21	1.60	0.28	8.6	83.6

Table 4: Classification of the soils identified.

Soil Series	Family or Higher Taxonomic Class	Ha	%
1. Attanurpatti	Coarse loamy, mixed, calcareous, isohyperthermic Typic Haplustalfs	1553.5	8.37
2.Belur	Fine loamy, mixed, calcareous, isohyperthermic Typic Haplustalfs	2359.2	12.71
3.C.N.Palayam	Fine loamy, mixed, isohyperthermic Typic Rhodustalfs	1588.2	8.56
4.C.P.Valasu	Fine loamy, mixed, isohyperthermic Typic Rhodustalfs	775.0	4.17
5.Kankattiaala	Fine loamy, mixed,isohyperthermic Typic Haplustepts	511.5	2.75
6.Somampatti	Fine loamy, mixed, isohyperthermic Typic Rhodustalfs	3722.2	20.06
7.Tukkiyampalayam	Loamy skeletal, mixed, isohyperthermic shallow, Typic Haplustalfs.	1259.0	6.78
8.Valapadi	Fine loamy, mixed, calcareous,isohyperthermic, Typic Haplustalfs	987.4	5.32
9.Vettaikaranoor	Fine loamy, mixed,calcareous, isohyperthermic Typic Haplustalfs	805.4	4.34
10. Vilaripalayam	Fine loamy, mixed, isohyperthermic Typic Haplustalfs	2120.8	11.48
		15682.2	84.54

Soil morphology

Soils of Attanurpatti series were moderately deep, calcareous, moderately well drained to somewhat poorly drained with slow permeability, sandy clay loam texture, moderate to very strong alkaline pH (8.0-8.4), non saline (ECe 0.2-0.3), brown (10YR4/3) to very dark grey (10YR3/1) colour, and classified as coarse loamy, mixed, calcareous, isohyperthermic Typic Haplustalfs. These soils are formed on the upper part of the gently sloping uplands with a slope gradient of < 1 percent and subjected to slight erosion. Belur series consists of deep, it is well drained with rapid to moderately slow permeability, calcareous with sandy clay loam to clay loam in surface texture, moderate to strong alkaline pH (8.2-8.5), non saline (EC 0.3-0.5), Its colour is dark yellowish brown to brown in the hue of 10 YR brown, and classified as fine loamy, mixed, calcareous, isohyperthermic Typic Haplustalfs. It is formed from calcareous weathered gneiss. Chinnamanaickenpalayam series consists of deep soil; it is moderately well drained with rapid to moderately rapid permeability, non calcareous with sandy loam to sandy clay loam in texture. Neutral to moderate alkaline pH(7.3-7.9), non saline (EC 0.25-0.37), Its colour is dark yellowish brown to brown in the hue of 10 YR brown, and classified as fine loamy, mixed, isohyperthermic Typic Rhodustalfs. These soils are formed on the upper part of the gently sloping uplands with a slope gradient of 0 -1 percent and subjected to slight erosion. Chandrapillaivalasu series consists of deep soil; it is well drained, with rapid to moderately rapid permeability, non calcareous with sandy loam to gravelly sandy clay loam in texture. Neutral to moderate alkaline pH(6.3-8.1), non saline (EC 0.1-0.3), Its colour is dark red in the hue of 2.5 YR to dark brown in the hue of 10 YR and classified as fine loamy, mixed, isohyperthermic Typic Rhodustalfs. These soils are formed on the upper part of the gently sloping uplands with a slope gradient of 0 -1 percent and subjected to slight erosion. Kankattiaala series consists of very deep soil; it is moderately well drained with rapid to moderately rapid permeability, non calcareous with sandy loam to sandy clay loam in texture. Neutral to moderate alkaline pH (7.7-8.0), non saline (EC 0.1-0.2), Its colour is dark red in the hue of 2.5 YR to light yellowish brown in the hue of 10 YR and classified as Fine loamy, mixed, isohyperthermic Typic Haplustepts. These

soils formed the upper part of the gently sloping uplands with a slope gradient of 0 -3 percent and subjected to moderate erosion.

Somampatti series consists of moderately shallow soil; it is well drained with rapid to moderately rapid permeability, non calcareous soil, with sandy loam to sandy clay loam in surface texture. It is formed from weathered gneiss. Neutral to moderate alkaline pH (7.2- 7.6), non saline (EC 0.2-0.5), Its colour is yellowish red in the hue of 5 YR to brown in the hue of 7.5 YR and classified as Fine loamy, mixed, isohyperthermic Typic Rhodustalfs. These soils formed the upper part of the gently sloping uplands with a slope gradient of 0-3 percent and subjected to slight to moderate erosion. Thukkiyampalayam series consists of shallow soil; it is well drained with rapid to moderately rapid permeability, non calcareous soil, with sandy loam to sandy clay loam in surface texture. Neutral pH (7.1- 7.2), non saline (EC 0.1), Its colour is reddish brown in the hue of 5 YR to brown in the hue of 7.5 YR and classified as loamy skeletal, mixed, isohyperthermic shallow, Typic Haplustalfs. These soils formed the upper part of the gently sloping uplands with a slope gradient of 0-3 percent and subjected to slight to moderate erosion.

Valapadi series consists of deep soil; it is well drained with rapid to moderately rapid permeability slightly calcareous in surface soils and highly calcareous in sub surface soils with sandy clay loam to clay loam in the surface and gravelly sandy clay loam to clay loam in the sub surface. It is noticed over calcium nodules. Moderate to strongly alkaline pH (8.4-8.7), non saline (EC 0.1-0.3), Its colour is dark reddish brown in the hue of 5 YR to dark yellowish brown in the hue of 10YR and classified as fine loamy, mixed, calcareous, isohyperthermic, Typic Haplustalfs. These soils formed the upper part of the gently sloping uplands with a slope gradient of 0-1 percent and subjected to slight erosion. Vettaikaranoor series consists of moderately shallow soil; it is moderately well drained with moderately slow permeability slightly, calcareous soil, with sandy clay loam to clay loam in surface texture. It is formed from conca weathered gneiss. Moderate to strongly alkaline pH (8.0- 8.5), non saline (EC 0.2-0.3), Its colour is dark grayish brown in the hue of 10 YR to light yellowish brown and classified as fine loamy, mixed, calcareous, isohyperthermic Typic Haplustalfs. These soils formed the upper part of the gently sloping uplands with a slope gradient of 0-1 percent and subjected to slight erosion. Vilaripalayam series consists of moderately deep soil; it is moderately well drained, calcareous soil, with sandy loam to clay loam in surface texture. It is formed from weathered gneiss. Neutral to moderate alkaline pH (7.2- 8.0), non saline (EC 0.2-0.3), Its colour is brown in the hue of 7.5 YR to dark grayish brown and classified as fine loamy, mixed, isohyperthermic Typic Haplustalfs. These soils are formed upper part of the gently sloping uplands with a slope gradient of 0-1 percent and subjected to slight erosion.

Physico-chemical characteristics

Physico-chemical characteristics of the soils are presented in Table-3. Sand content in low land soils ranged from 25.5 to 89.6 percent with mean value of 57.8, silt content ranged from 3.2 to10.6 percent with a mean value of 3.25 percent. The sand content was higher in surface horizons of low lands, where as higher clay content was found in the sub-surface horizon because of the illuviation of fine fractions from the surface layers (Balasubramanian *et al*, 2019) [1]. Sand content in soils of low lands was higher and decreased with increasing depth. The silt content in all the pedons have irregular trend with the depth. The pH of soils ranged from 6.3 to 8.9 with a mean value of 7.8, electrical conductivity ranged between 0.09 to 0.2 with an average value of 0.27dSm^{-1}, O.C varied from 0.3 to 0.5% with a mean value of 0.3%.

Exchangeable properties

Cat ion exchange capacity of typifying pedons ranged from 8.5 to 27.4 cmol (p^+)/kg with an average value of 17.87 cmol(p^+)/kg. The CEC increased with increase in clay content of the pedons. Higher values of CEC in sub surface horizons commensurate with the amount of clay. The CEC increased with depth in the pedons of Attanurpatti, Belur, Somampatti, Tukkiyampalayam due to increase in clay content of lower horizons. The CEC decreased with depth in the pedons of Chinnamanaickenpalayam and Vilaripalayam due to variation in clay and organic matter content (Mishra and Ghosh (1995) [9].

The exchangeable bases had distinct pattern regarding their sequential dominance. In all the pedons, the order followed was Ca>Mg>Na>K. The Ca^{2+} in soils ranged from 4.0 to 18.4 with mean value of 10.98 cmol(p^+)/kg, Mg^{2+} ranged from 0.8 to 4.1, with mean value of 2.21.cmol(p^+)/kg, Na^{2+} ranged from 0.5 to 2.9, with mean value of 1.6 cmol(p^+)/kg, K^+ ranged from 0.05 to 0.9, with mean value of 0.28 cmol (p^+)/kg. The variation observed in base saturation percentage (BSP) indicates the degree of leaching which was used as diagnostic character for classifying the soil orders. High base saturation was due to high Ca^{2+} followed by Mg^{2+}, Na^{2+}, K^+ (Patil and Dasog (1997) [10]. Exchangeable sodium percentage (ESP) varied from 4.2 to 12.6%, maximum from Belur, Chandrapillaivalasu and Valapadi series, values are above 11%. Similar result was also reported by (Balasubramanian *et al*., 2019 and 2020) [1, 2].

Land Capability classification

The land capability classification grouping study in the study area indicates that moderately good cultivated soils covered 18.6 percent area was affected with moderate limitations of erosion, where as extent of moderate limitations of erosion and calcareousness was 65.9 percent. Steep land and fairly good land occupied 0.5 percent in the block. The land capability classes and LCC sub classes are shown in fig 3 and table 5.

Table 5: Land Capability sub Classes in Valapadi block

Land Capability Subclass	Mapping Unit	Area	
		ha	%
II e	CnsclA1, CvsclA1, KasclA1, VmsclA1.	3409.4	18.60
IIIs	ApslA1, ApsclA1, ApclA1, ApscA1, BrsclA1, BrclA1, BrscA1, CnslA1, CvslA1, CvclA1, CvscA1, SpslA1, SpsclA1, SpscA1, TpslA1, TpsclA1, VksclA1, VkclA1, VkscA1, VmclA1, VmscA1, VpsclA1, VpclA1, VpscA1.	10284.8	55.23
III se	ApslB2, BrsclB2, CnslB2, CvslB2, KaslB2, SpslB2, SpgsclB2, SpsclB2, TpslB2, TpsclB2.VpslB2, VkslB2.	1900.5	10.24
IV se	CngsclC3,CnslC3, TpslC3, TpsclC3, VmsclC3.	87.5	0.47
	Total	15682.2	84.54

(Remaining areas of 2868.5 ha (15.46%) includes forest, settlement, water body and rockouts)

Land irrigability classification

The land irrigability groupings indicate that about 18.6 percent area of the block may be used safely under irrigation. The erosion and calcareousness land covering 65.9 percent of the area were moderately suitable for sustained use under irrigation, provided proper soil and water conservation measures to be adopted. About 0.5 percent area represents lands possessing severe limitations of erosion and run off, gravelliness, shallowness and texture are the limitations that require adequate care and management in the block. The land irrigability classes and irrigability sub classes are shown in fig 4 and table 6.

Table 6: Land Irrigability sub classes in Valapadi block

Land Irrigability Subclass	Mapping Unit	Area	
		ha	%
2	CnsclA1, CvsclA1, KasclA1, VmsclA1.	3409.4	18.60
2s	ApslA1, ApsclA1, AplcA1, ApscA1, BrsclA1, BrclA1, BrscA1, CnslA1, CvslA1, CvclA1, CvscA1, SpslA1, SpsclA1, SpscA1, TpslA1, TpsclA1, VksclA1, VkclA1, VkscA1, VmclA1, VmscA1, VpsclA1, VpclA1, VpscA1.	10284.8	55.23
3se	ApslB2, BrsclB2, CnslB2, CvslB2, KaslB2, SpslB2, SpgsclB2, SpsclB2, TpslB2, TpsclB2.VpslB2, VkslB2.	1900.5	10.24
4se	CngsclC3,CnslC3, TpslC3, TpsclC3, VmsclC3.	87.5	0.47
	Total	15682.2	84.54

(Remaining areas of 2868.5 ha (15.46%) includes forest, settlement, water body and rockouts)

Fertility Capability Classification (FCC)

The FCC showed that larger part of the upland is loamy / sandy top soil and is followed clayey subsoil in some areas of the block. Clayey top soil covers in a sizable area. Sandy top soil followed by loamy subsoil occurs in a very limited extent. Among the modifiers, free calcium carbonate and gravelliness play dominant role affecting the productivity significantly in the uplands and is followed by sodicity especially in low lands with heavy textured soils fig 5 and Table 7.

Table 7: Fertility Capability Classes in Valapadi block

Fertility Capability Class	Soil Mapping Unit	Area	
		Ha	%
LC/ (3-5%)	TpslC3, TpsclC3.	41.6	0.22
LCb/ (3-5%)	VmsclC3, CnslC3, CngsclC3.	45.9	0.25
LCb/ (1-3%)	BrsclB2,CnslB2,ApslB2.	292.3	1.58
Lb/(1-3%)	KaslB2, VkslB2, VpslB2.	452.5	2.44
LC/(1-3%)	SpslB2, SpsclB2, SpgsclB2, TpslB2, TpsclB2, CvslB2.	1155.7	6.23
LCb/(<1%)	ApslA1, ApsclA1, BrsclA1, CnslA1, CnsclA1, VksclA1, VmsclA1, VpsclA1.	5516.0	29.74
Cb/(<1%)	AplcA1, ApscA1, BrclA1, BrscA1, SpscA1, VkclA1, VkscA1, VmclA1, VmscA1, VpclA1, VpscA1.	3746.6	20.2
Lb/(<1%)	KasclA1.	88.0	0.47
LC/(<1%)	CvslA1, CvsclA1, CvclA1, CvscA1, TpslA1, TpsclA1, SpslA1, SpsclA1.	4343.6	23.41
	Total	15682.2	84.54

(Remaining areas of 2868.5 ha (15.46%) includes forest, settlement, water body and rockouts)

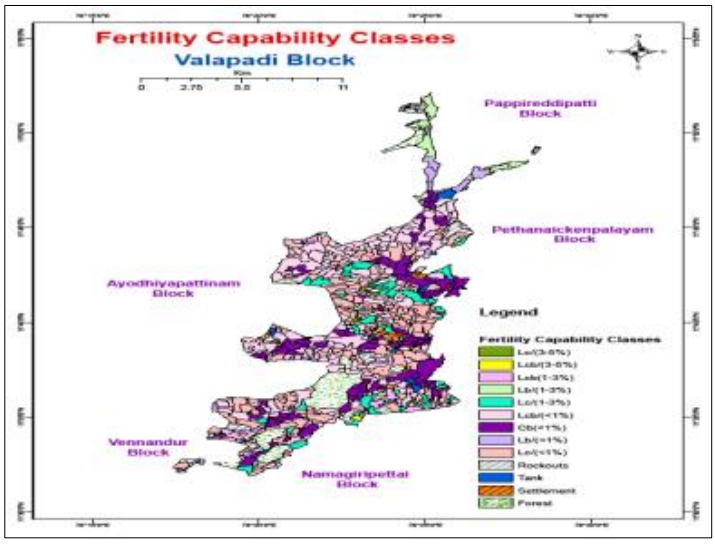

Fig 3: LCC of Valapadi block of Salem district.

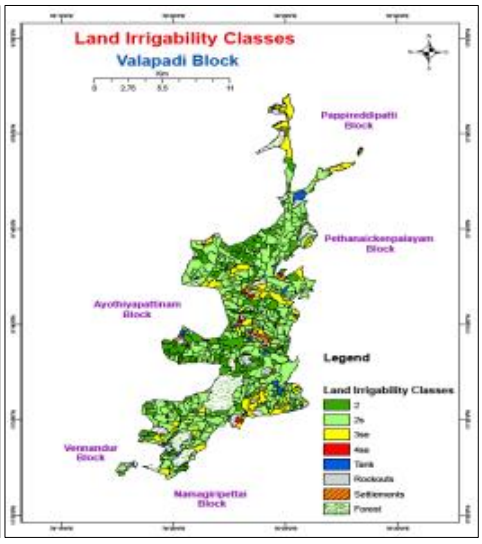

Fig 4: LIC of Valapadi block of Salem district.

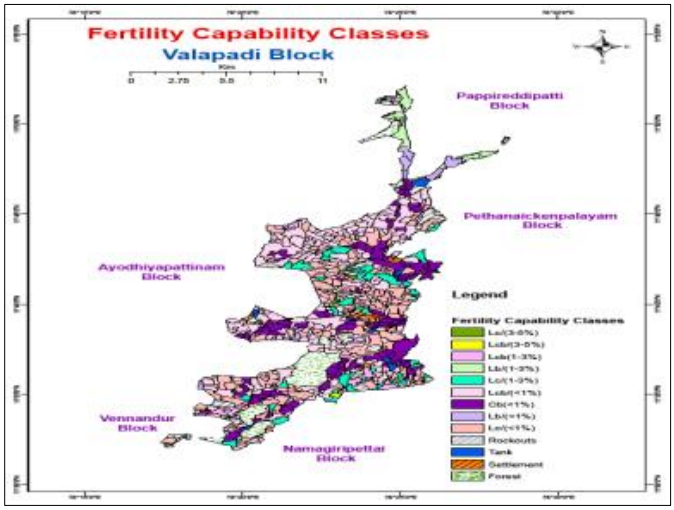

Fig 5: Fertility Capability Classes of Valapadi block of Salem district

4. Conclusion

Based on morphological, physical and physico-chemical properties of study area were neutral to moderately alkaline, non-saline, low to medium in OC and CEC. The exchangeable bases in all the pedons in the order of Ca2+>Na+>Mg2+> K+ on the exchange complex. The soils were classified as *Typic Haplus*talfs, *Typic Haplustepts*, and *Typic Rhodustalfs* at sub group level. Based on the variable soil properties land capability and irrigability classes were prepared which are key for sustainable soil and crop management in upland of Tamil Nadu.

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