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Paddy lands of south Telangana plateau (Rayalseema), Andhra Pradesh, India: A detailed suitability assessment

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ABSTRACT

Soil survey in detailed was undertaken at Rayachoty mandal of YSR Kadapa district, Andhra Pradesh on 1:10,000 scale by using base maps toposheet, sentinel-2 imagery and google imagery. Master soil profile samples were analysed in laboratory for physico-chemical properties. Based on morphological, physical and chemical properties, four major paddy growing soil series were established. As per the USDA keys to soil taxonomy, soils are classified into Madhavaram (Fine loamy mixed isohyperthermic Typic Haplustepts), Balreddigaripalli (Loamy-skeletal mixed isohyperthermic (calcareous) Typic Haplustepts), Nayanurpalli (Sandy mixed isohyperthermic Typic Ustorthents) and Duganvandlapalli (Fine Loamy mixed isohyperthermic (calcareous) Typic Haplustepts) series. Total paddy land in the mandal is 4745.33 ha (20.42%) out of which paddy is moderately suitable (S2) in 4.24% area and marginally suitable (S3) in 12.29% area and 3.87% area is currently not suitable (N). However, in the total geographical area (23240.70 ha) 63% area is marginally suitable provided with irrigation. Major limitations for paddy cultivation are of climate, topography, soil texture, drainage, rooting condition, gravelliness and soil fertility. Soil quality index (SQI) of paddy lands varied from 182 to 237 with the respective relative soil quality index (RSQI) of 45.50 to 59.25. The soil erodibility (K) factor ranged from 0.44 to 0.67 (t ha h MJ^{-1} ha^{-1} mm^{-1}). Lower K factor in Balreddigaripalli series followed by Madhavaram series due to lower clay content and high sand content needs higher priority for erosion control. Hence, paddy can be cultivated in both uplands as well as in lowlands in the mandal with the application of external mineral nutrients along with organic manures with suitable agronomic management practices including soil and water conservation techniques.

1. INTRODUCTION

Soil erosion control is one of the key issues in current land management as which is affecting all natural and human-managed ecosystems. One of the important parameters for estimating soil erosion is soil erodibility, expressed as the K-factor indicates the susceptibility of a soil to erosional degradation which is widely used in soil erosion models, *viz.,* the universal soil loss equation (USLE) and its revised version (RUSLE). Rice the staple food and principal cereal crop, its total production during 2020-21 is estimated at record 121.46 M t. It is estimated the last five years' average production of 112.44 M t is higher by 9.01 M t. Rice has been the most important foods for mankind and now this irreplaceable grain is feeding about two-thirds of the world's population (Ryke, 1987). To achieve elevated rice production and productivity, land and soil characterization and classification (Chandrakala *et al*., 2018; Chandrakala *et al*., 2022), suitability assessment to specific crop (Chandrakala *et al*., 2019a; 2019b; 2022; Ramamurthy *et al*., 2020), land capability and irrigability (Ramesh Kumar *et al*., 2018b) and soil fertility mapping (Nalina *et al*. 2016; Chandrakala *et al*., 2020a) and fertility capability (Chandrakala *et al*., 2021) play key role in order to meet the food demand for current population. This allows identification of potentials and problems (Chandrakala *et al*., 2020b) of specific land unit for crop production and enables decision makers to develop crop management system. Any crop suitability

evaluation including paddy affects by the geomorphology / landscape, soil / land, slope / topography, land use / land cover, climate / rainfall-temperature, land capability, land irrigability, soil erosion, soil texture and soil drainability, soil depth, fertility capability. Moreno (2007) reported that, the topography conditions / slope of the land and narrow valleys of the any region compel the farmers to cultivate upland rice over paddy. Understanding the impact of land use and land management practices on soil quality and its indicators has been identified as one of the most important goals of sustainable agricultural land management (Mandal and Jayaprakash, 2012). Larson and Pierce (1994) suggested a minimum data set to describe the quality of a soil. In this paper quantified the soil quality with the available data set for the paddy lands (Mandal *et al*., 2021). Paddy is a major staple cereal crop of South Telangana plateau, Andhra Pradesh, which is being cultivating both in uplands as well as lowlands (Chandrakala *et al*., 2019c). In Andhra Pradesh, paddy is growing in the 21.05 lakh ha during 2016-2017 with a production of 120.03 lakh tonnes and productivity of 5702 kg ha^{-1}. In YSR Kadapa district, net area sown is 338000 ha, area sown more than once 37000 ha, total cropped area 375000 ha. Paddy is growing in an area of 51000 ha with production of 248000 tonne with a productivity of 4937 kg ha^{-1}. With these above background, the present study has been taken with the objective is to know the nature and properties of paddy lands and its classification, health and soil quality, erodibility status and suitability for its cultivation in South Telangana plateau (Rayalseema), in a selected mandal *i.e.,* Rayachoty mandal of YSR Kadapa district, Andhra Pradesh using GIS and remote sensing.

2. MATERIALS AND METHODS

Study Area

Rayachoty mandal comes under agro-ecological sub region (AESR) 7.1 *i.e.* South Telangana plateau (Rayalseema) and Eastern Ghat, hot, dry semi-arid eco-sub region. Total geographical area of the mandal is 23,240.7 ha (cultivated land is 16768.55 ha), lying between north latitudes 13°59' 45.28" and 14°7'12.263" and east longitudes 78°35'24.85" and 78°54'5.608" (Fig. 1). It is divided in to seventeen villages. This mandal has a tropical wet and dry climate with high temperatures in the entire year. Ustic soil moisture regime as the mean annual rainfall is 638 mm and iso hyperthermic soil temperature regime as the mean annual temperature varies between 23°C to 34°C (Fig. 2). Geology of Rayachoty mandal is granite-gneiss (Fig. 3). Length of growing period is 145 days. There are 6 landforms namely hills and ridges, isolated hillocks, gently sloping uplands, very gently sloping uplands, nearly level uplands and nearly level lowland/ valleys. Major land use in upland is rice, lowland rice, redgram, cowpea, groundnut, sunflower, sesamum, mulberry and coconut and mango plantation. Rice and also some irrigated crops such as sunflower, tomato and chillies occupied in valley plain or lowland.

Soil Characterization, Laboratory Soil Analysis and Classification

A detailed soil survey was carried out at 1:10,000 scale in the mandal using Survey of India toposheet (1:50,000 scale), sentinel-2 satellite data and google imagery as base map. Soils were excavated or dug to a depth of hardrock

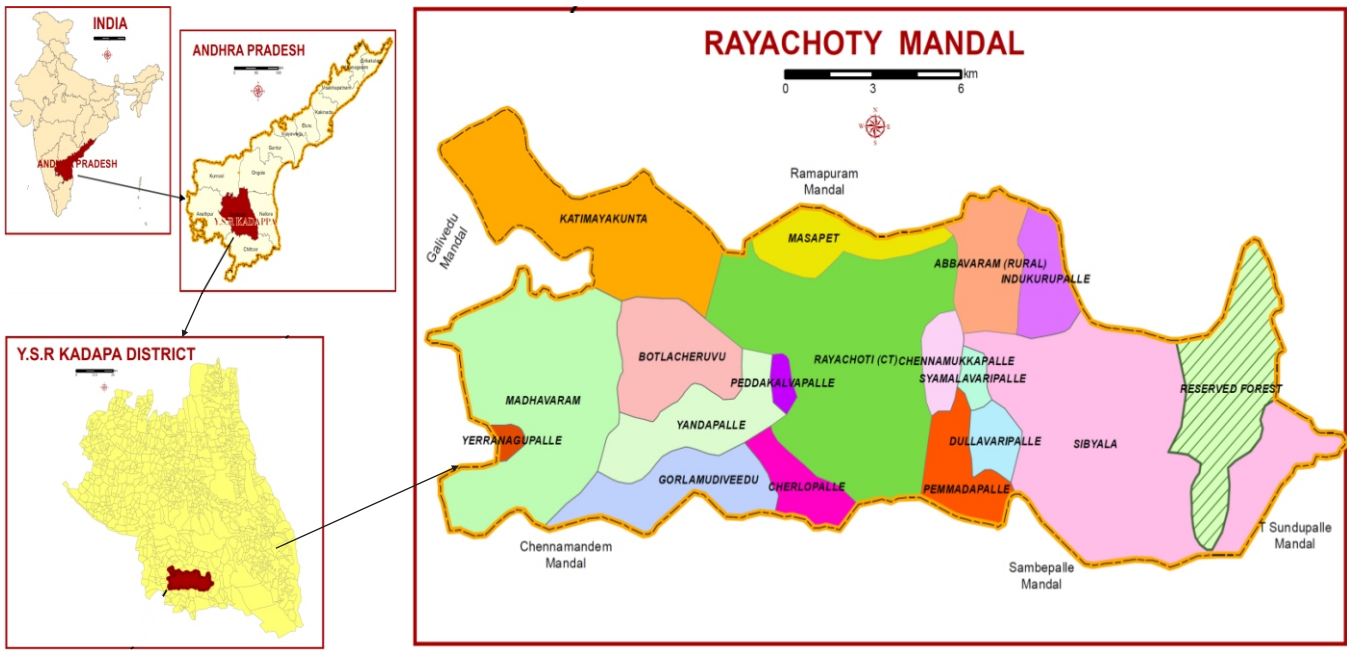


Fig. 1. Location map of Rayachoty mandal

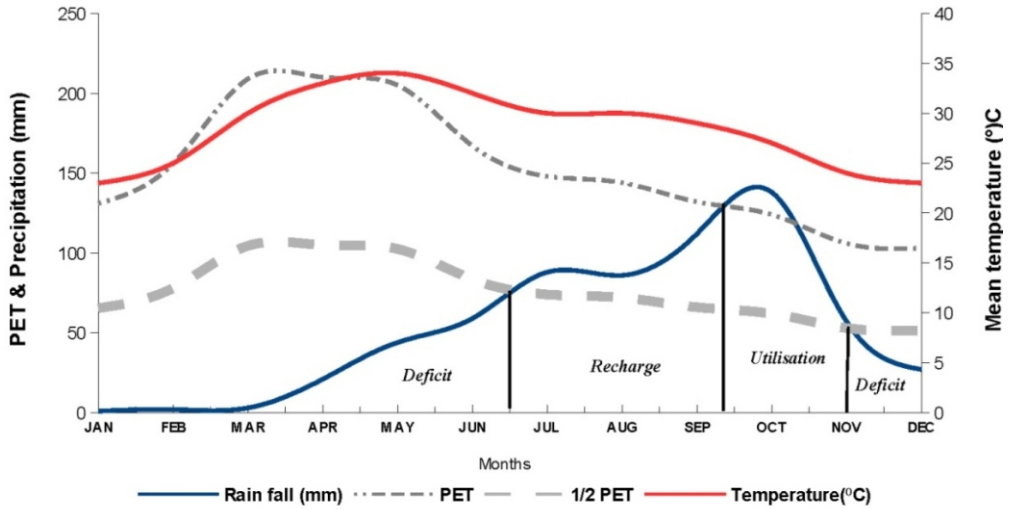


Fig. 2. Water balance diagrams of Kadapa district

Fig. 3. Granite gneiss in Rayachoty mandal, Rayalseema

(maximum two meter) in the selected transects / slope both in upland and lowlands of paddy lands. Soil site characteristics and morphological properties were noted down and selected master profile samples were brought to the laboratory. Processed soil samples were analysed in laboratory for physical and chemical properties using standard procedures. International pipette method (Piper, 1966) used for particle size analysis. Gravel content was determined by Gravimetry method (Govindarajan and Koppar, 1975). Soil pH and electrical conductivity (EC) were measured with 1:2.5 soil:water ratio (Jackson (1973). Organic carbon (OC) was determined by Walkley and Black (1934) method. Cation exchange capacity was determined by NN ammonium acetate method (Schollenberger and Dreibelbis, 1930), calcium carbonate ($CaCO_3$) equivalent (%) was determined by Piper method (1966). The soils were classified according to soil taxonomy (Soil Survey Staff, 2003) using morphological, physical and chemical properties.

Suitability Evaluation

The land suitability evaluation done in the four hierarchies *i.e.,* orders, classes, subclasses and units. Soil / land unit can be suitable or not suitable at the order level, based on kinds of suitability for the identified land use. These orders are subdivided into classes based on degrees of suitability and further classes are classified into subclasses based on the kinds of limitations, based on type of management required, subclasses are again categorised into land suitability units. Class S1 represents highly suitable, class S2 is moderately suitable, class S3 means marginally suitable, class N1 indicates currently not suitable whereas N2 will be permanently not suitable. Based on particular limitations in the study area, Classes S2 and S3 were further categorised into sub classes. There are no subclasses in S1. The identified limitations affecting paddy production in the area are climate: temperature, rainfall total and distribution, dry months and growing period (c), topography (l), soil depth or rooting condition (r), soil texture (sandy or heavy clay) (t), coarse fragments (g), soil fertility (calcareousness)(n), drainage (w). Lower case letters along with the class symbol indicates specific limitations. Using the soil site suitability criteria (NBSS&LUP, 1994; Naidu *et al.,* 2006), land resources of the Rayachoty mandal was assessed for the suitability of paddy. Then, using mapping units with assigned paddy suitability class details, suitability map has been prepared in the Arc-GIS environment.

Soil Quality Index (SQI), Relative Soil Quality Index (RSQI) Estimation

SQI was calculated as per the concept of Karlen and Stott (1994), the 8 soil parameters were allotted weights and the combined indicators is a SQI.

$$SQI = \Sigma Ci\, Mi$$

Where, Ci = Weights of the indicators, and Mi = the marks of the indicators classes.

SQI was calculated separately for every indicator by

multiplying weight of indicators and marks allotted to each class. For example, if the depth of soil is 75 cm, it belongs to class III. As the weight for depth is 13, and the mark for class III is 2, the indicator score for depth = 13 × 2 = 26. The SQI value is the sum of all 8 indicator scores. The change of soil quality was measured by computing RSQI.

$$RSQI = (SQI / SQIm) \times 100$$

Where, *SQI* = soil quality index, and *SQIm* = maximum value of *SQI* (400) (Wang and Gong 1998).

Soil Erodibility (K) Estimation

Using two soil properties *viz.,* the soil OC content and soil particle size distribution, soil erodibility (K) - factor was determined for the paddy soils (Sharply and Williams,1990). The eq. 1 used to calculate K value is as follows:

$$K= (0.2+0.3e^{[-0.0256SAN\,(1-SIL/100)]}) \times (SIL/CLA+SIL)^{0.3} \times [1 - \{0.25C/\,C+e^{(3.72-2.95C)}\}] \times [1-\{0.7SN_1/\,SN_1+e^{(22.9\,SN1-5.51)}\}] \quad ...(1)$$

Where, SAN is the sand content (%), SIL is the silt content (%), CLA is the clay content (%), C is the soil organic carbon content (%) and $SN_1 = 1\text{-}SAN/100$.

3. RESULTS AND DISCUSSION

Paddy lands of Rayachoty mandal (Table's 1 and 2), South Telangana plateau are moderately shallow (0-62 cm) to deep (upto 150 cm) which shows that soils are under developing and climatic condition is not congenial for weathering hence very deep soils have not been identified. Soil colour varied from 10YR4/1 (Dark grey) to 10YR 6/4 (Light yellowish brown) except Madhavaram series surface soil (2.5YR4/1: Dark reddish grey). This colour is developed due to parent materials influenced by submerged condition due to flooding and drying during paddy cultivation. Soil structure is weak to moderate, fine to medium subangular blocky structure. Consistency is loose to friable and very friable, non sticky to sticky and non plastic to plastic. Among four soil series, only Madhavaram series has got horizon specific gravel content in both surface and subsurface (5% to 35%) (Chandrakala *et al*., 2019c). At gravel-rich horizons / soils, gravel content influences very strongly the soil compaction behaviour and pre-compression stress, However, they do show that the overall compaction of fine earth decreases as gravel content increases (Rucknagel *et al*., 2013). Sand is the dominant particle size identified in the mandal hence developed soil texture sandy loam to sandy clay loam in surface to loamy sand to sandy clay loam in subsurface. Subsurface have more clay content than surface except Nayanurpalli series (pedon 3) due to the clay illuviation (Chandrakala *et al*., 2018; 2022). OC content is more in surface and decreased with depth due to the addition of organic matter through paddy roots and straw left over after harvesting which is ploughed to soil during puddling (Chandrakala *et al*., 2021). Soils are slightly alkaline to very strongly alkaline in reaction which is due to the high base saturation (100%) both in surface and subsurface and also accumulation of calcium carbonates in an average > 5%. Soils are non saline (EC: < 2 dS m^{-1}). Cation exchange capacity is good and it ranged from 8.70 to 15.60 (cmol (p+) kg^{-1}) in surface soils. All the soils have Iso-hyperthermic temperature and Ustic soil moisture regime. Based on morphological and physico-chemical properties soils have been classified as Typic Haplustepts due to presence of cambic (Bw) horizon and belongs to other Usteptss (pedon 1, 2 and 4). Pedon 3 belongs to other soils and not having diagnostic subsurface horizon hence classified as Typic Ustorthents. Balreddigaripalli (Pedon 2) and Duganvandlapalli (pedon 4) series have accumulation of calcium carbonate nodules (calcium carbonate equivalent 1.29% to 13.39%)

Table: 1
Morphological properties of paddy lands of Rayachoty madal, Rayalseema

Pedons	Series name	Depth (cm)	Colour (moist)	Texture	Structure	Consistence	Coarse fragments
Pedon 1	Madhavaram (Mdv)	0-17	2.5YR4/1	sl	m1sbk	fr, ss, sp	5
		17-36	10YR5/2	scl	m2sbk	fr, ms, mp	10
		36-62	10YR5/1	scl	m1sbk	fr, ms, mp	15
Pedon 2	Balreddigaripalli (Brp)	0-19	10YR4/1	sl	m2sbk	fi, ms,mp	30
		19-45	10YR4/1	scl	m2sbk	fr, ms, mp	35
		45-81	10YR5/2	scl	m1sbk	fr, ss, sp	35
Pedon 3	Nayanurpalli (Nyp)	0-18	10YR4/2	scl	m1sbk	vfr, s, p	-
		18-42	10YR4/2	scl	m2sbk	vfr, s, p	-
		42-64	10YR4/1	ls	f1sbk	vfr, s, p	-
		64-80	10YR4/1	ls	f1sbk	vfr, so, po	-
		80-120	10YR5/3	ls	f1sbk	l, so, po	-
		120-150	10YR5/3	sl	f1sbk	l, so, po	-
Pedon 4	Duganvandlapalli (Dvp)	0-15	10YR4/1	scl	m2sbk	fr, ss, sp	-
		15-40	10YR5/3	scl	m2sbk	fr, ss, sp	-
		40-80	10YR6/4	scl	m2sbk	fr, ss, sp	-
		80-125	10YR4/4	scl	m2sbk	fr, ss, sp	-
		125-155	10YR4/3	scl	m2sbk	fr, ss, sp	-

Table: 2
Physical and chemical properties of paddy lands of Rayachoty madal, Rayalseema

Depth (cm)	Horizon	Particle size distribution (% of <2 mm)			OC (%)	pH	EC (dS m^{-1})	Exchangeable bases (cmol (p+) kg^{-1})				CEC (cmol (p+) kg^{-1})	CEC/Clay Ratio	BS (%)	CCE (%)
		Sand	Silt	Clay				Ca	Mg	Na	K				
Pedon 1: Fine loamy mixed isohyperthermic Typic Haplustepts															
0-17	Ap	63.78	17.23	18.99	0.90	8.28	0.61	-	-	1.77	0.53	12.60	0.66	100	
17-36	Bw1	62.02	8.66	29.32	0.24	9.08	0.48	-	-	3.39	0.43	18.30	0.62	100	
36-62	Bw2	66.49	7.94	25.57	0.14	9.48	0.61	-	-	4.29	0.32	16.30	0.64	100	
Pedon 2: Loamy isohyperthermic (calcareous) Typic Haplustepts															
0-19	Ap	77.57	13.55	8.87	1.64	7.80	0.36	-	-	0.44	0.45	8.70	0.98	100	1.29
19-45	Bw1	60.47	15.78	23.75	0.40	8.64	0.23	-	-	0.32	0.54	17.80	0.75	100	11.98
45-81	Bw2	64.24	15.08	20.68	0.18	8.89	0.15	-	-	0.37	0.29	18.20	0.88	100	13.39
Pedon 3: Sandy mixed isohyperthermic Typic Ustorthents															
0-18	Ap	59.12	17.56	23.32	1.51	8.56	1.06			3.44	1.23	15.60	0.67	100	
18-42	A2	64.92	13.34	21.74	0.47	9.02	0.66			2.64	0.71	12.80	0.59	100	
42-64	C1	85.20	5.87	8.93	0.17	9.32	0.40			1.69	0.45	8.00	0.90	100	
64-80	C2	82.83	11.94	5.23	0.19	9.34	0.36			0.95	0.23	5.00	0.96	100	
80-120	C3	83.05	11.15	5.80	0.19	9.24	0.37			1.42	0.51	5.20	0.90	100	
120-150	C4	73.91	16.75	9.34	1.51	8.56	1.06			3.44	1.23	15.60	0.67	100	
Pedon 4: Fine Loamy mixed isohyperthermic (calcareous) Typic Haplustepts															
0-15	Ap	55.45	24.43	20.11	1.00	8.76	0.28			0.76	0.97	12.50	0.62	100	4.34
15-40	Bw1	54.51	25.46	20.03	0.29	9.01	0.30			1.52	0.92	14.10	0.70	100	3.17
40-80	Bw2	55.81	20.55	23.64	0.22	9.36	0.36			2.36	0.40	14.30	0.60	100	9.98
80-125	Bw3	52.05	24.92	23.02	0.22	9.45	0.36			2.49	0.42	15.90	0.69	100	6.58
125-155	Bw4	56.01	22.12	21.87	0.14	9.39	0.35			3.40	0.62	17.50	0.80	100	4.93

hence classified as calcareous. Fertility capability classification (FCC) of these paddy lands (Chandrakala *et al*., 2021) shows that Lbd (1-5) and Lbdr^{+} (1-5) of Madhavaram and Balreddigaripalli series, respectively whereas Nayanurpalli and Duganvandlapalli series have FCC unit Lbd (0-1). Loamy texture identified in all the soils which are good for paddy cultivation. Modifier b that is basic soil reaction exists in all the soils which needs gypsum application and modifier d that is Ustic soil moisture regime needs to be managed with regular irrigation in order to achieve elevated production and productivity. Slope of the land can be managed with graded bunding and ploughing and cultivating across the slope (Chandrakala *et al.,* 2019b) and technological interventions for sustainable management of soil and water resources (Sharda and Mandal, 2018; Sharda *et al*., 2019). The correlation study (Table 3) shows that there is highly positively correlation exists between CEC and clay (r = 0.84) and EC with OC (r = 0.59) and calcium carbonate equivalent with silt (r = 0.41) and CEC (r = 048).

Paddy is a water-loving plant requiring abundant water supply. The average temperature requirement during the paddy growing period ranged 21ºC to 35ºC. It can be cultivated on a variety of soils, either in waterlogged or poorly drained or well drained soils (Murthy, 1978). In India, rice is being grown in diverse soil conditions in acidic to alkaline soils (pH 4.5 to 8.0). Heavy soils *viz*., clay or clay loam and also loam soils are most suitable (Jha *et al.,* 1999). Soil suitability for paddy in Rayachoty mandal (Table 4 and Map 1) shows that moderately suitable (S2) in 4.24% of area and marginally suitable (S3) in 63% of total geographical area (23240.70 ha). Major limitations for paddy cultivation in S2 and S3 class land units are of topography, soil texture,

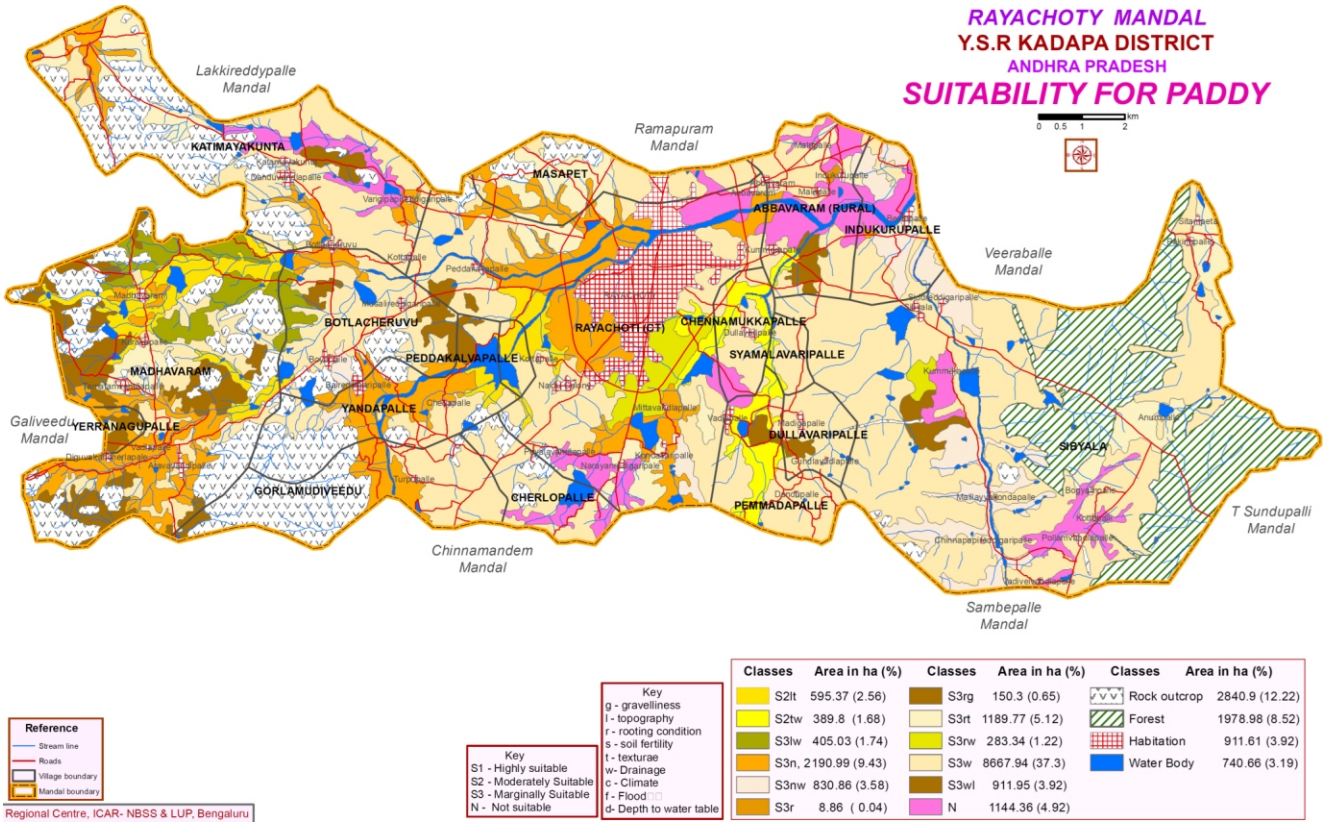
Table: 3
Correlation between physico-chemical properties of paddy lands of south Telangana plateau

Soil parameters	Sand	Silt	Clay	OC	PH	EC	Na	K	CEC	CEC/Clay	CCE
Sand	1.00										
Silt	-0.75	1.00									
Clay	-0.85	0.28	1.00								
OC	0.07	0.15	-0.21	1.00							
PH	-0.08	-0.07	0.17	-0.84	1.00						
EC	0.08	-0.13	-0.01	0.59	-0.24	1.00					
Na	-0.22	-0.10	0.40	-0.02	0.36	0.67	1.00				
K	-0.25	0.42	0.03	0.65	-0.36	0.64	0.26	1.00			
CEC	-0.76	0.32	0.84	-0.04	0.02	0.11	0.40	0.19	1.00		
CEC/Clay	0.69	-0.34	-0.73	-0.06	-0.10	-0.40	-0.56	-0.41	-0.59	1.00	
CCE	-0.48	0.41	0.37	-0.30	0.08	-0.58	-0.43	-0.25	0.48	0.01	1.00

Table: 4
Soil suitability for paddy in Rayachoty mandal, Rayalseema

Mapping unit no.	Suitability classes	Description	Area ha	Area %
MdvhB1(27)	S2lt	Moderately suitable land with slight limitation of topography and soil texture	595.37	2.56
DvpcA1(51)	S2tw	Moderately suitable land with slight limitation of soil texture and drainage	389.80	1.68
MdvbC2(24), BrpbC2(36)	S3lw	Marginally suitable land with slight limitation of topography and drainage	568.97	2.45
MdvhA1(26), MdviA1(28), BrphB1(37), BrpiB1(40), NyphA1(49), DvphA1(52), DvpiA1(53)	S3n	Marginally suitable land with slight limitation of soil fertility	1973.32	8.48
BrpfB1(38)	S3nw	Marginally suitable land with slight limitation of soil fertility and drainage	316.05	1.36
MdvcA1(25), BrpiA1(39), NypiA1(50)	N	Currently not suitable	901.82	3.87
		Total paddy land	4745.33	20.42
		Total cultivable land	16768.55	72.15
Rock outcrops			2840.9	12.22
Forest			1978.98	8.52
Habitation			911.61	3.92
Waterbody			740.66	3.19
Total geographical area			23240.7	100

Note: Climatic limitation is commonly present in Rayachoty mandal



Map 1. Soil suitability for paddy in Rayachotymandal, Rayalseema

Table: 5
Soil quality index (SQI), relative soil quality index (RSQI) and soil erodibility (K) status in Paddy lands of Rayachoty madal, Rayalseema

S.No.	Soil attributes	Soil series			
		Madhavaram (Mdv)	Balreddigaripalli (Brp)	Nayanurpalli (Nyp)	Duganvandlapalli (Dvp)
1.	Soil depth (cm)	0-62	0-81	0-150	0-155
2.	Soil texture	Sandy loam	Sandy loam	Sandy clay loam	Sandy clay loam
3.	Slope (%)	1-3	0-3	0-1	0-1
4.	pHs (1:2.5)	8.28	7.8	8.56	8.76
5.	Organic matter (g kg^{-1})	9.0	16.4	15.1	10
6.	Avail. P (mg kg^{-1})	2.68	21.87	3.57	4.02
7.	Avail. K (mg kg^{-1})	71.87	40.18	97.77	105.8
8.	CEC (Cmol(P+)kg^{-1} soil)	12.6	8.7	15.6	12.5
	SQI	182	215	237	233
	RSQI	45.5	53.75	59.25	58.25
	Soil erodibility (K) factor	0.58	0.44	0.61	0.67

drainage soil fertility, root restriction and gravelliness and 4.92% area is unsuitable. However, in Rayachoty mandal total paddy land is 4745.33 ha (Table 4). Within this total paddy land, paddy is moderately suitable (S2) in 985.17 ha (4.24%) with limitation of topography, soil texture and drainage. 2858.34 ha (12.29%) area is marginally suitable (S3) for paddy cultivation with the limitation of topography, drainage, soil fertility, root restriction and gravelliness. Mapping units MdvcA1(25), BrpiA1(39), NypiA1(50) are currently not suitable (901.82 ha). Madhavaram and Balreddigaripalli series are suitable for upland paddy cultivation whereas Nayanurpalli and Duganvandlapalli series are suitable for lowland paddy cultivation under irrigation. Similar findings on paddy suitability by Chandrakala *et al*. (2019a), Waqar *et al*. (2014), Soltani *et al*. (2013), Maddahi *et al*. (2017), AbdelRahman *et al*. (2016) and Reza *et al*. (2021) and pigeon pea suitability by Chandrakala *et al*. (2022), Sawan *et al*. (2021) have been reported.

SQI of paddy lands (Table 5) varied from 182 to 237 with RSQI of 45.50 and 59.25 which show that soils have

slight deviation from maximum SQI (400) and but above the minimum SQI value (100). Generally, an optimum soil will have a RSQI of 100, but real soils will have lower values. The deviation from maximum SQI and RSQI is mainly due to the lower available phosphorus and potassium content and higher pH. Hence, there is a need to apply external mineral fertilizer particularly phosphorus and also gypsum to enhance the SQI. Similar findings of SQI and RSQI for arable cropland reported by Mandal and Jayaprakash (2012); Mandal *et al.* (2021).

The soil erodibility factor (K) ranged from 0.44 to 0.67 (t ha h MJ^{-1} ha^{-1} mm^{-1}) (Table 5). The lower K-factor is due to the lower clay content and higher percentage of sand particle size (sandy loam texture) which are more prone to erosion, hence its need to apply tank silt or black clay for better paddy cultivation otherwise erosion will be more in those areas particularly in Balreddigaripalli (Brp) series followed by Madhavaram which needs suitable soil and water conservation measures. The other two series are having higher K factor due to sandy clay loam texture. Similar findings of K-factor reported by Wang *et al*. (2016); Jena *et al*. (2018); Warjri (2019); Reddy *et al*. (2016).

4. CONCLUSIONS

The study concludes that the SQI of paddy lands is above the minimum SQI but a slight deviation from the maximum is due to the lower soil depth, lower available phosphorus and potassium content and higher pH, particularly in Balreddigaripalli (Brp) and Duganvandlapalli (Dvp) series which are calcareous therefore needs reclamation through gypsum application before paddy cultivation along with an external application of phosphorus and potassium fertilizer. Paddy is moderately suitable (S2) in 4.24% area and marginally suitable (S3) in 63% area of the mandal due to very gentle slope, shallow to moderately deepwith sandy loam texture (lower clay content and higher percentage of sand particle size), needs suitable soil and water conservation measures *viz.,* graded bunding and ploughing and cultivating across the slope. As the erodibility factor is low, it can be managed with the application of tank silt or black clay for better paddy cultivation thereby controlling the soil erodibility / erosion.

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