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Major Soils of Rayalseema Region: A Case Study at Rayachoty Mandal, YSR Kadapa District, Andhra Pradesh

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Abstract

Based on a detailed soil survey at a 1:10000 scale, Alfisols, Inceptisols, and Entisols were the major soils in the Rayachoty Mandal, YSR Kadapa district, Andhra Pradesh, belonging to the Rayalseema region. Calcium carbonate equivalent ranged from 0 to 13.39 %. Clay content ranged from 4.62 to 23.32 % on the surface and from 8.10 to 40.55% on the subsoils. The CEC ranged from 2.80 to 15.60 cmol (+) kg⁻¹ in the surface and 4.10 to 18.30 cmol (+) kg⁻¹ in the subsoil. Base saturation ranged from 56.76 to >100%. Soils are strongly acidic to strongly alkaline. Organic carbon is low to high. Available P, K and S are low. DTPA extractable Fe, Mn and Cu are sufficient, and Zn is deficient, and boron is low. Soils were classified as *Lithic Rhodustalfs*, *Lithic Ustipsamments*, *Rhodic Paleustalfs*, *Typic Haplustalfs*, *Typic Haplustepts*, *Typic Rhodustalfs* and *Typic Ustorthents*. Soils were mapped into 10 soil series and 53 mapping units.

1. Introduction

Detailed Land Resource Inventory (1:10000 scale) at the farm level is important for identifying the major soil types of a specific region/agro-ecological sub-region which further helps in land resource management for suitable land use planning and assists in the planning for future land use, particularly agriculture, because it provides basic soil information such as major type of soils and their morphological, physical and chemical properties of the specific region. Land resource inventory on a 1:10,000 scale is the prerequisite for land management, which paves the way for applying the right land use, and the right technology at the right place. Soil survey data and soil maps consisting of major soil types of the region have been widely used for interpretative purposes by defining the relative suitability or limitations of various soil types for different land uses. From the soil data collected at the farm level, conservation measures required for the area can be planned, the suitability of the area for the cultivation of crops can be worked out, and finally, viable and sustainable land use options suitable for particular landforms can be prescribed. With this view, a detailed soil survey was conducted at

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the Rayalseema region, particularly by selecting a Mandal, Rayachoty from YSR Kadapa district, Andhra Pradesh, belonging to the Agro-Ecological Sub Region, is 7.1, i.e., South Telangana Plateau (Rayalseema) and Eastern Ghat, a hot, dry semi-arid eco-sub region, to know the major soil types present in that region for suitable land use planning, particularly for agriculture.

2. Major Soils of Rayachoty Mandal, Rayalseema Region: Characteristics and Distribution

There are ten soils/ series and 53 mapping units identified in Rayachoty mandal (Chandrakala et al., 2022) (Figure 1). All the soils/ series formed from granites and gneisses and or their colluvium and alluvium in the lowlands. Soils of uplands together occupy the highest area of 15167.14 ha (65.27 %), followed by rock outcrop (2840.9 ha) and forest (1978.98 ha). Lowland soils occupy 1601.41 ha (6.88 %). Among 10 series identified, the Kumarapalli series (uplands) occupied dominant soils of 3718.06 ha (15.99 %), followed by the series Kondavandlapalli (2945

ha). Nayanurpalli series of lowlands occupied the lowest area of 378.42 ha (1.16 %) (Table 1) (Chandrakala et al., 2019). The climate is the major constraint for agricultural production in Rayachoty Mandal. The annual average total rainfall is 638 mm. Water scarcity is also a major problem for crop production. This is presently managed by tanks and borewell irrigation. Summer is too hot, which is not congenial for most crop production. Mango plantation occupies most of the drylands in the Mandal. Sandy texture and also gravel limit agriculture in the Mandal due to poor water holding capacity. Varied soil reaction and poor nutrient condition of soils have to be managed. Correction of soil reaction and external mineral plant nutrient supplements are necessary.

2.1. Soils of uplands

2.1.1. Sibyala series/soils

Sibyala series/soils occur in uplands having a very gentle slope of 1-3 % (Figure 2) and occupy around 2.66 % of the total geographical area.

The thickness of the solum ranges from 34 to 50 cm. The A horizon is 12 to 20 cm thick. Its colour is in the

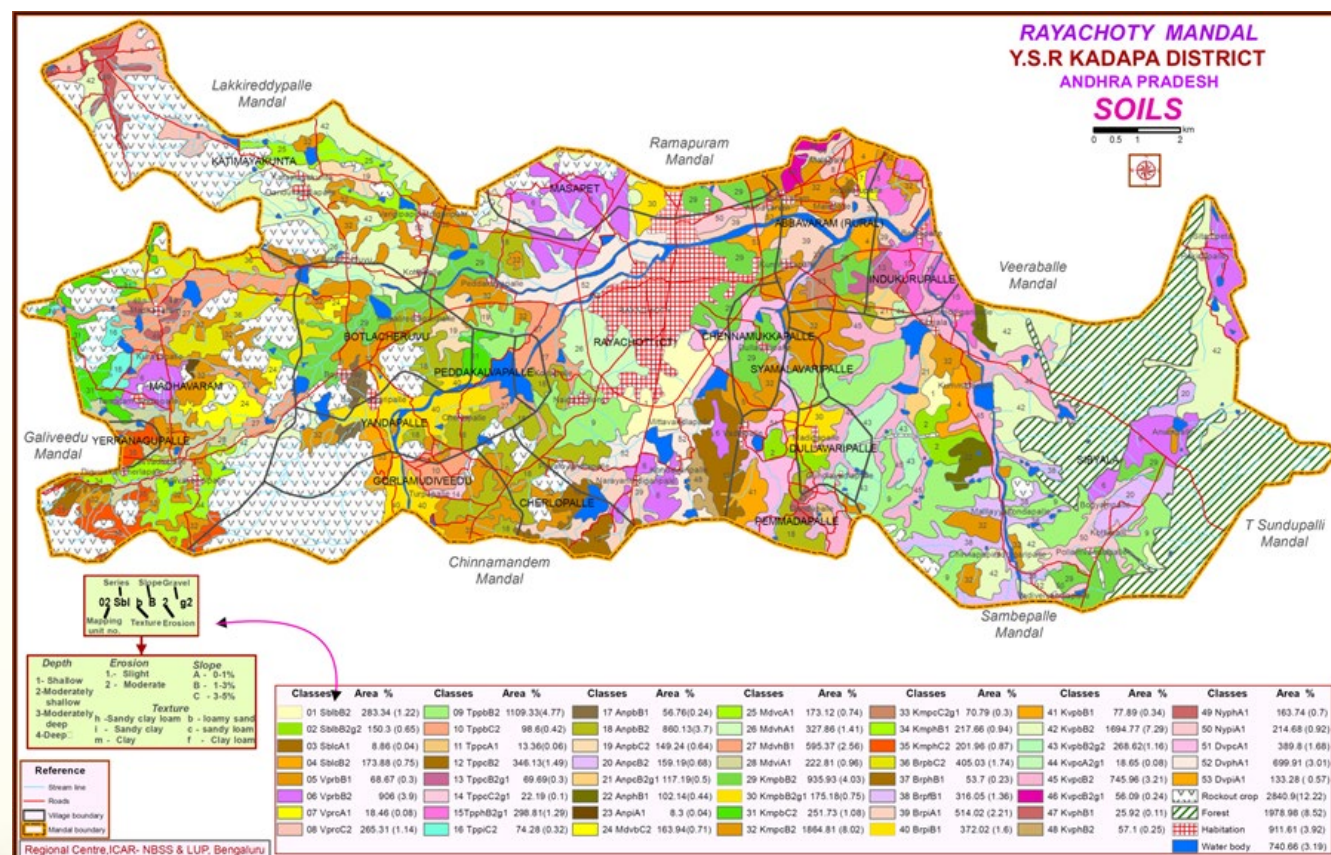


Figure 1: Soils of Rayachoty Mandal, Rayalseema region, India

Essential Oils- A Natural Alternative for Storage Pest Management

Table 1: Identified major soils/ series of Rayachoty Mandal, mapping units and area

Series Name	Mapping units	Area (ha)	Area (%)
Sibyala	1, 2, 3, 4	616.38	2.66
Variyapapireddypalli	5, 6, 7, 8	1258.44	5.40
Turpupalli	9, 10, 11, 12, 13, 14, 16	2032.39	8.75
Anumpalli	17, 18, 19, 20, 21, 22, 23	1452.95	6.20
Madhavaram	24, 25, 26, 27, 28	1483.1	6.38
Kumarapalli	29, 30, 31, 32, 33, 34, 35	3718.06	15.99
Balreddigaripalli	36, 37, 38, 39, 40	1660.82	7.10
Kondavandlapalli	41, 42, 43, 44, 45, 46, 47, 48	2945	12.68
Nayanurpalli	49, 50	378.42	1.16
Duganvandlapalli	51, 52, 53	1222.99	5.26
Soil total		16768.55	72.15
Rock outcrop		2840.9	12.22
Forest		1978.98	8.52
Habitation		911.61	3.92
Waterbody		740.66	3.19
Total		23240.7	100.00

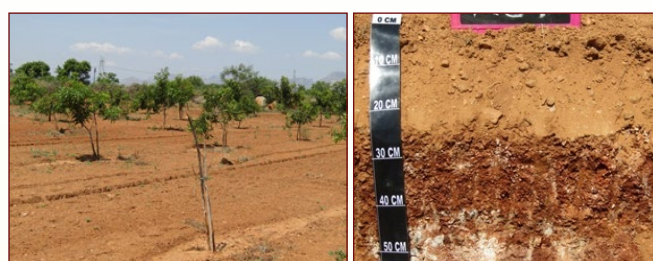


Figure 2: Landscape and soil profile of Sibyala series

hue 7.5YR to 5YR, value 4 to 5 and chroma 4 to 6. The texture is loamy sand to sandy loam. The thickness of the B horizon ranges from 21 to 37 cm. Its colour is in hue 2.5YR to 5YR, value 3 to 4 and chroma 3 to 6. The texture is sandy clay. Gravel content ranges from 35 to 60 % Cutans are present in subsoils.

Surface soil reaction was moderately acidic (pH: 6.0), non-saline, with organic carbon content low (0.32%), cation exchange capacity was 3.10 cmol (p+) kg⁻¹, and base saturation was 78.82 %. Soils were classified as clayey

skeletal isohyperthermic Lithic Rhodustalfs.

2.1.2. Variyapapireddypalli series/ soils

Variyapapireddypalli series/ soils occur in uplands having very gentle to gentle slopes of 1-5 % (Figure 3) and

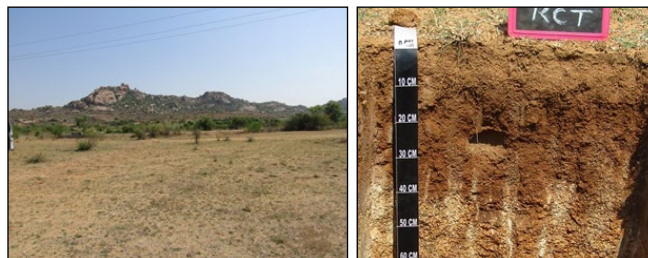


Figure 3: Landscape and soil profile of Variyapapireddypalli series

occupy around 5.42 % of the total geographical area.

The thickness of the solum ranges from 42 to 50 cm. The A horizon is 13 to 20 cm thick. Its colour is in the hue 7.5YR to 5YR, value 4 to 5 and chroma 3 to 4. The texture is loamy sand to sandy loam. The thickness of the B horizon ranges from 22 to 37 cm. Its colour is in hue 2.5YR, 5YR to 7.5YR, value 3 to 4 and chroma 4 to 6. The texture is sandy loam. Gravel content ranges from 35 to 60 %.

Surface soil reaction was moderately acidic (pH: 5.76), non-saline, with organic carbon content low (0.24 %), cation exchange capacity was 2.80 cmol (p+) kg⁻¹, and base saturation was 56.76 %. Soils were classified as mixed isohyperthermic Lithic Ustipsamments.

2.1.3. Turpupalli series

Turpupalli series/soils occur in uplands having very gentle to gentle slopes of 1-5 % (Figure 4) and occupy around 8.75 % of the total geographical area.



Figure 4: Landscape and soil profile of Turpupalli Series

The thickness of the solum ranges from 56 to 75 cm. The A horizon is 11 to 22 cm thick. Its colour is in the hue 5YR, 7.5YR to 10YR, value 4 to 5 and chroma 2 to 6. The texture is loamy sand to sandy loam. The thickness

of the B horizon ranges from 40 to 62 cm. Its colour is in hue 2.5YR to 5YR, value 3 to 4 and chroma 4 to 6. The texture is sandy clay. Gravel content ranges from 35 to 60 %.

Surface soil reaction was moderately acidic (pH: 5.88), non-saline, with organic carbon content medium (0.60 %), cation exchange capacity was 4.10 cmol (p+) kg⁻¹, and base saturation was 78.77 %. Soils were classified as mixed isohyperthermic Lithic Ustipsamments.

2.1.4. Anumpalli series

Anumpalli series/ soils occur in uplands having very gentle to gentle slopes of 1-5 % (Figure 5) and occupy around 6.24 % of the total geographical area.

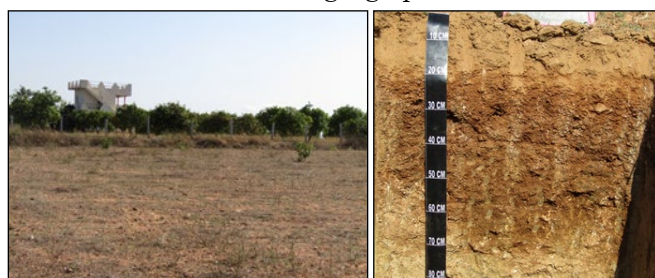


Figure 5: Landscape and soil profile of Anumpalli series

The thickness of the solum ranges from 54 to 75 cm. The A horizon is 14 to 20 cm thick. Its colour is in the hue 5YR to 7.5YR, value 4 to 5 and chroma 2 to 6. The texture is loamy sand to sandy loam and sandy clay loam. The thickness of the B horizon ranges from 40 to 58 cm. Its colour is in hue 2.5YR to 5YR and 7.5YR, value 3 to 4 and chroma 3 to 6. The texture is sandy clay loam. Gravel content ranges from 35 to 60 %.

Surface soil reaction was slightly acidic (pH: 6.20), non-saline, with organic carbon content low (0.42 %), cation exchange capacity was 2.80 cmol (p+) kg⁻¹, and base saturation was 85.91 %. Soils were classified as Loamy-skeletal mixed isohyperthermic Typic Haplustalfs.

2.1.5. Madhavaram series

Madhavaram series/soils occur in uplands (upland rice) having very gentle to gentle slopes of 1-5 % (Figure 6) and occupy around 6.38 % of the total geographical area. The thickness of the solum ranges from 52 to 75 cm. The A horizon is 12 to 20 cm thick. Its colour is in the hue 2.5YR to 10YR, value 4 to 5 and chroma 1 to 3. The texture is loamy sand to sandy loam and sandy clay loam. The thickness of the B horizon ranges from 36 to 54 cm. Its colour is in hue 2.5YR to 7.5YR and 10YR, value 4 to 5 and chroma 1 to 4. The texture is sandy clay

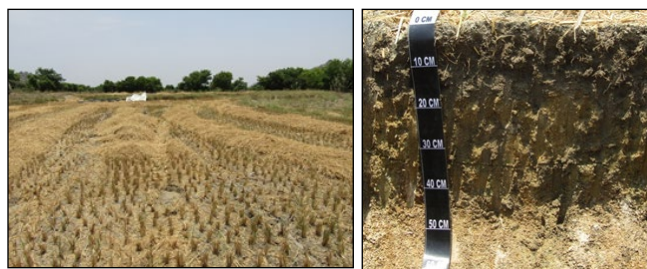


Figure 6: Landscape and soil profile of Madhavaram series

Surface soil reaction was moderately alkaline (pH: 8.28), non-saline, with organic carbon content high (0.90 %), cation exchange capacity was 12.60 cmol (p+) kg⁻¹ and base saturation was 100 %. Soils were classified as fine loamy mixed isohyperthermic Typic Haplusteps.

2.1.6. Kumarapalli series

Kumarapalli series/soils occur in uplands having very gentle to gentle slopes of 1-5 % (Figure 7) and occupy around 15.99 % of the total geographical area.

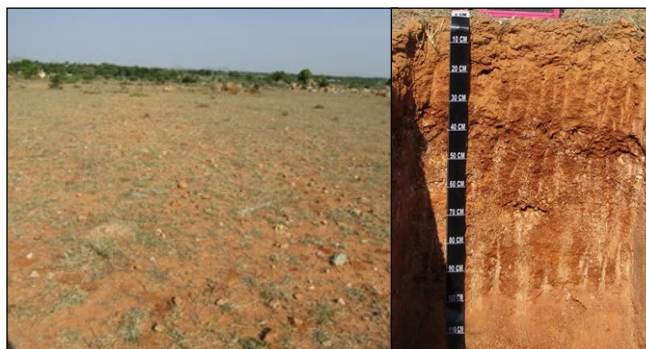


Figure 7: Landscape and soil profile of Kumarapalli series

The thickness of the solum ranges from 81 to 100 cm. The A horizon is 9 to 22 cm thick. Its colour is in the hue 5YR to 7.5YR, value 4 to 5 and chroma 3 to 6. The texture is loamy sand to sandy loam and sandy clay loam. The thickness of the B horizon ranges from 57 to 90 cm. Its colour is in hue 2.5YR to 5YR and 7.5YR, value 3 to 5 and chroma 3 to 6. The texture is sandy clay to sandy clay loam. Gravel content ranges from 35 to 60 %.

Surface soil reaction was neutral (pH: 6.61), non-saline, with organic carbon content low (0.46 %), cation exchange capacity was 5.90 cmol (p+) kg⁻¹, and base saturation was 79.82 %. Soils were classified as Loamy-skeletal mixed isohyperthermic Typic Haplustalfs.

2.1.7. Balreddigaripalli series

Balreddigaripalli series/soils occur in uplands having very

gentle to gentle slopes of 1-5 % (Figure 8) and occupy around 7.14 % of the total geographical area.



Figure 8: Landscape and soil profile of Balreddigaripalli series

The thickness of the solum ranges from 81 to 100 cm. The A horizon is 11 to 21 cm thick. Its colour is in the hue 10YR, value 4 to 5 and chroma 1 to 4. The texture is sandy clay loam to sandy clay. The thickness of the B horizon ranges from 71 to 85 cm. Its colour is in hue 7.5YR to 10YR, value 4 to 5 and chroma 1 to 4. The texture is sandy clay loam. Gravel content ranges from 15 to 35 %.

Surface soil reaction was moderately alkaline (pH: 7.80), non-saline, with organic carbon content high (1.64 %), cation exchange capacity was 8.70 cmol (p+) kg⁻¹, base saturation was 100 %, and calcium carbonate equivalent was 1.29 to 13.39 %. Soils were classified as loamy mixed isohyperthermic (calcareous) Typic Haplustepts.

2.1.8. Kondavandlapalli series

Kondavandlapalli series/soils occur in uplands having a very gentle slope of 1-3 % (Figure 9) and occupy around 12.68 % of the total geographical area.

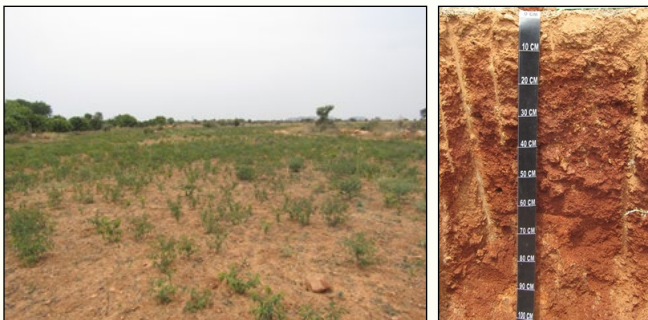


Figure 9: Landscape and soil profile of Kondavandlapalli series

The thickness of the solum ranges from 102 to 131 cm. The A horizon is 11 to 18 cm thick. Its colour is in the hue 5YR to 7.5YR, value 4 to 6 and chroma 3 to 6. The texture is sandy loam to loamy sand and sandy clay loam.

The thickness of the B horizon ranges from 86 to 116 cm. Its colour is in hue 2.5YR to 5YR, value 3 to 5 and chroma 3 to 6. The texture is sandy clay to sandy clay loam. Gravel content ranges from 35 to 60 %.

Surface soil reaction was moderately alkaline (pH: 8.25), non-saline, with organic carbon content low (0.48 %), cation exchange capacity was 6.30 cmol (p+) kg⁻¹ and base saturation was 100 %. Soils were classified as loamy-skeletal mixed isohyperthermic Typic Rhodustalfs.

2.2. Soils of lowlands / valley plain

2.2.1. Nayanurpalli series

Nayanurpalli series/ soils occur in lowlands having a nearly level slope of 0-1 % (Figure 10) and occupy around 1.62 % of the total geographical area.



Figure 10: Landscape and Soil Profile of Nayanurpalli Series

The thickness of the solum ranges from 110 to 150 cm. The A horizon is 13 to 21 cm thick. Its colour is in the hue 7.5YR to 10YR, value 4 to 5 and chroma 1 to 2. The texture is sandy clay to sandy clay loam. The thickness of the B horizon ranges from 89 to 132 cm. Its colour is in hue 10YR, value 4 to 5 and chroma 1 to 4. The texture is sandy clay loam to loamy sand and sandy loam.

Surface soil reaction was strongly alkaline (pH: 8.56), non-saline, with organic carbon content high (1.51 %), cation exchange capacity was 15.60 cmol (p+) kg⁻¹ and base saturation was 100 %. Soils were classified as sandy mixed isohyperthermic Typic Ustorthents.

2.2.2. Duganvandlapalli series

Duganvandlapalli series/ soils occur in lowlands having a nearly level slope of 0-1 % (Figure 11) and occupy around 5.26 % of the total geographical area.

The thickness of the solum ranges from 105 to 170 cm. The A horizon is 15 to 25 cm thick. Its colour is in the hue 10YR, value 3 to 4 and chroma 1 to 2. The texture is sandy clay to sandy clay loam. The thickness of the B

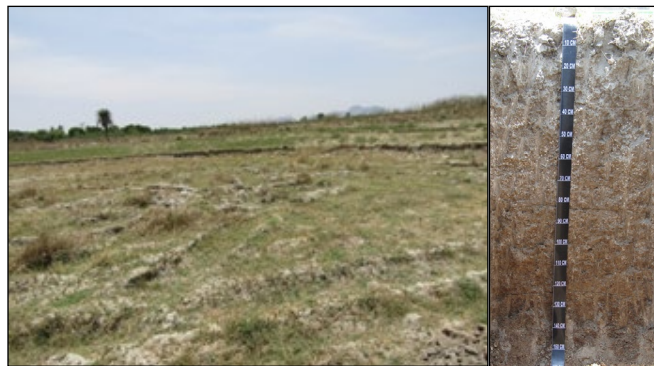


Figure 11: Landscape and soil profile of Duganvandlapalli series

horizon ranges from 86 to 155 cm. Its colour is in hue 10YR, value 3 to 6 and chroma 1 to 4. The texture is sandy loam, sandy clay and sandy clay loam.

Surface soil reaction was strongly alkaline (pH: 8.76), non-saline, with organic carbon content high (1.00 %), cation exchange capacity was 12.50 cmol (p+) kg⁻¹ and base saturation was 100 %. Soils were classified as Fine Loamy mixed isohyperthermic (calcareous) Typic Haplustepts.

3. Conclusion

Alfisols, Inceptisols and Entisols are the major soils occurring in the Rayachoty Mandal, Rayalseema region. All the soils (series) formed from granites and gneisses and or their colluvium and alluvium in lowlands. Uplands

together occupy the highest area of 15167.14 ha (65.27 %), and lowlands occupy 1601.41 ha (6.88 %). Soils of the Kumarapalli series occupied a dominant area of 3718.06 ha (15.99 %) belonging to uplands, and the Nayanurpalli series occupied the lowest area, belonging to lowlands.

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