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Assessment of Physical Properties of Soils from Different Blocks of Palakkad District of Kerala, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

An Assessment of Physical properties of soils of Palakkad District of Kerala was carried out during 2022. The objective of the study was to analyse the Physical properties of soil, their variation with soil depth in villages of Nemmara, Kollengode and Kuzhalmannam blocks. For the assessment 9 sampling locations were selected. A total of 27 Soil samples were collected at 0 -15 cm, 15-30 cm and 30-45 cm depth respectively. The Study found that the soils of these blocks were Sandy Clay Loam in texture. The Bulk Density increased with increasing soil depth. In most of the villages, the particle density showed slight changes only. The soil analysis were found to be Pore space was higher than Water retaining capacity. These soils have good Water Retaining Capacity and physical condition. Physical properties of soil are a key factor in determining soil's suitability for agricultural, environmental and engineering uses. These properties greatly influence its use and behavior towards plant growth. Plant support, root penetration, drainage, aeration, moisture retention, and plant nutrients are all related with the physical condition of the soil.

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Keywords: Soils properties; soil fertility; physical parameters; plant nutrients.

1. INTRODUCTION

Soil is one of the most important resources of the nature. Soil as a component of the terrestrial ecosystem fulfills many functions including those that are essential for sustaining plant growth [1].

"Soil fertility is influenced by a variety of factors, including soil depth, soil texture, soil structure, soil pore space, soil temperature, soil compaction and tillage, soil response, nutrient content, humus content, humic and non-humic substances. In order to determine soil fertility, it is necessary to examine both physical and chemical aspects of soil. Soil fertility affects soil production. Fertile soil usually yields high output. Every year, soil loses natural fertilizer throughout the production process. Hence it is important to carefully examine soil fertility and productivity in order to use soil rationally and intensively, and thus agricultural production can keep up with the growing population". [2].

"One of the most important factors affecting the success of soil testing is the proper and scientific soil sampling". [3].

Soil sampling and testing provides an estimate of the capacity of the soil to supply adequate nutrients to meet the needs of growing crops. Physical properties of soil are important in determining its suitability for agricultural, environmental, and engineering purposes. The physical properties of the soil are closely related to its supporting capabilities, movement, retention, and availability of water and nutrients to plants, ease of penetration of roots, and flow of heat and air.

"Physical characteristics of soil influence chemical and biological properties. All soils have different properties and working with them requires understanding of these properties. The knowledge of the physical and chemical properties of soil helps in managing resources while working with a particular soil" [4].

The term soil texture refers to the size range of particles in the soil. Soil texture is a permanent, natural attribute of the soil and the one most often used to characterize its physical makeup. High Bulk Density generally reduces soil productivity. Particle density of a solid is not impacted by land use, it is a measure of the mass of soil solids per given volume. Porosity, the percent by volume of a soil sample not occupied by solids, is directly related to bulk density and particle density.

Soil samples were collected from Nine villages coming under Nemmara, Kollengode and Kuzhalmannam blocks with this objective, a study has been undertaken in Nemmara, Kollengode and Kuzhalmannam blocks in Palakkad district of Kerala.

2. MATERIALS AND METHODS

2.1 Study Area

Kerala, southwestern coastal state of India stretches for about 360 miles (580 km) along the Malabar Coast. The average rainfall here is about 3100 mm and the monsoon begins by June and till the end of September. Palakkad is situated within the latitudes stretching from 10° 21' to11° 14' north and longitudes stretching from 76° 02' to 76° 45' east. The area of Palakkad district is 4,480 sq km, the gross cropped area is 272195 ha. Rice is produced in an abundant quantity in Palakkad.

2.2 Soil Sampling

A total of twenty-seven soil samples were collected from Different villages of Nemmara, Kollengode and Kuzhalmannam blocks in Palakkad district. Soil samples were taken using khurpi, spade, and meter scale. samples were collected from three depths: 0-15 cm, 15-30 cm, and 30-45 cm. Soil samples were mixed properly and were removed of foreign materials like roots, stones, pebbles and gravels. The bulk was then reduced to half by quartering. These samples were analysed for various Physical properties.

2.3 Analysis of Physical Parameters

The collected soil samples were analysed for physical parameters. "Soils were analysed for its textural class by Bouyoucos Hydrometer method (Bouyoucos,1927), Bulk density and Particle Density was determined by graduated measuring Cylinder method, The relative density bottle or pycnometer method, as given by Black ,1965 to determine the specific gravity of soil. The graduated 100 ml measuring cylinder method was used to determine Pore space and water retaining capacity.

3. RESULTS AND DISCUSSION

3.1 Physical Properties

3.1.1 Soil texture

The texture of a soil is important because it determines soil characteristics that affect plant growth. The Soil Textural class was identified as Sandy Clay Loam. The sand, silt and clay percentage varied from 63.84 to 70.13 sand, 9.14 to 13.50 silt and 20.16 to 24.16 clay in Sandy Clay Loam soil. Similar result were found by Suma et al [5].

3.1.2 Bulk density (Mg m-3)

Bulk Density was varied from 1.15 Mg m^{-3} to 1.39 Mg m^{-3}. Intensive cultivation increases the bulk density because more cultural operations enhance the compaction of the soil. Cropped soils generally have higher bulk densities than uncropped soils. Similar result were found by Amjad et al (2021)., in Malappuram region.

3.1.3 Particle density (Mg m-3)

The Particle Density varied from 2.44 Mg m^{-3} to 2.63 Mg m^{-3}. Particle Density varies according to mineral content of soil particles. Similar result was found by Gopan et al [6], in Kollam district.

3.1.4 Pore space (%)

The Pore Space (%) ranged from 44.13% to 49.88%. The pore space found to decrease with depth at attributed to increase in compaction in the sub surface. Similar result was found in Nair et al [7], in Attappadi region.

Table 1. Bulk density and particle density (Mg m-3) of soil from different villages of Palakkad district at 0-15,15-30 and 30-45 cm depth

Villages	Bulk density (Mg $m^{-3)}$		Particle density (Mg $m^{-3)}$	
	Range	Mean	Range	Mean
Nemmara (B1)				
V1	1.25- 1.29	1.27	2.52- 2.54	2.53
V2	1.37- 1.39	1.38	2.57- 2.63	2.59
V3	1.28- 1.31	1.29	2.53- 2.55	2.54
Kollengode (B2)				
V4	1.25- 1.29	1.27	2.47- 2.49	2.48
V5	1.25- 1.28	1.26	2.44- 2.48	2.46
V6	1.15- 1.21	1.18	2.51- 2.53	2.52
Kuzhalmannam (B3)				
V7	1.25- 1.28	1.26	2.46- 2.49	2.47
V8	1.17- 1.21	1.19	2.51- 2.55	2.53
V9	1.21- 1.26	1.23	2.53- 2.56	2.54

Table 2. Pore space (%) and water retaining capacity (%) of soil from different villages of Palakkad district at 0-15, 15-30 and 30-45 cm depth

Villages	Pore space (%)		Water retaining capacity (%)	
	Range	Mean	Range	Mean
Nemmara (B1)				
V1	46.97- 47.20	46.93	41.11- 42.41	41.81
V2	47.66- 49.88	48.61	42.46- 44.81	43.46
V3	44.23- 47.56	46.16	39.13- 42.43	41.07
Kollengode (B2)				
V4	44.13- 45.53	45.10	39.25- 40.58	39.99
V5	44.58- 47.48	46.13	39.28- 42.28	40.89
V6	44.63- 45.33	44.99	39.13- 40.33	39.83
Kuzhalmannam (B3)				
V7	44.25- 45.41	44.76	39.19- 40.87	39.93
V8	45.28- 47.45	46.53	40.25- 42.02	41.38
V9	44.78- 46.84	45.92	39.78- 41.96	41.00

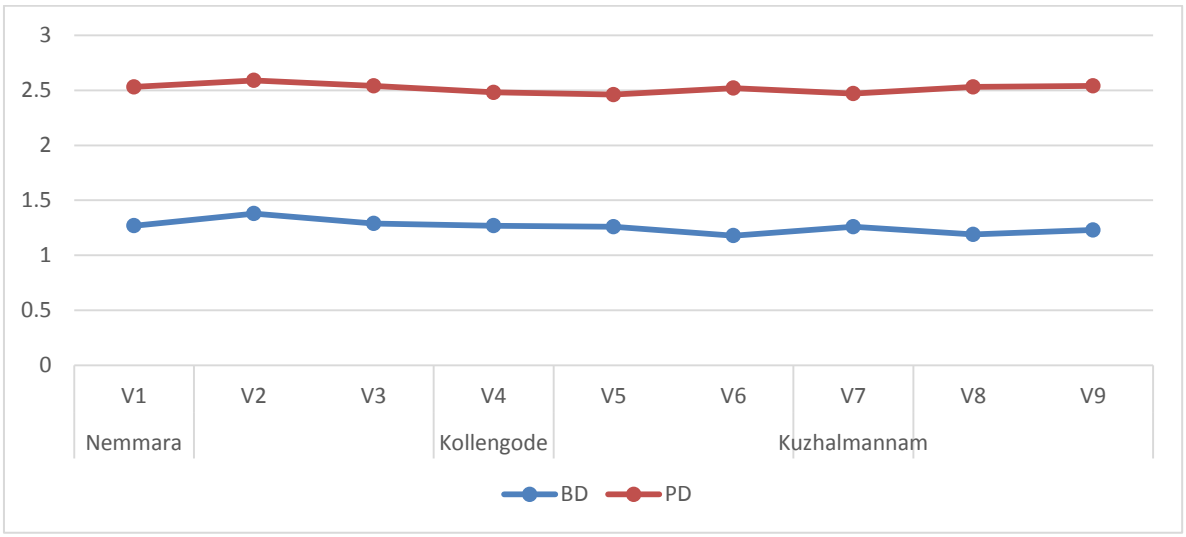

Fig. 1. Bulk density (Mg m-3) and particle density (Mg m-3) of soil from different villages at 0-15, 15-30 and 30-45 cm depth

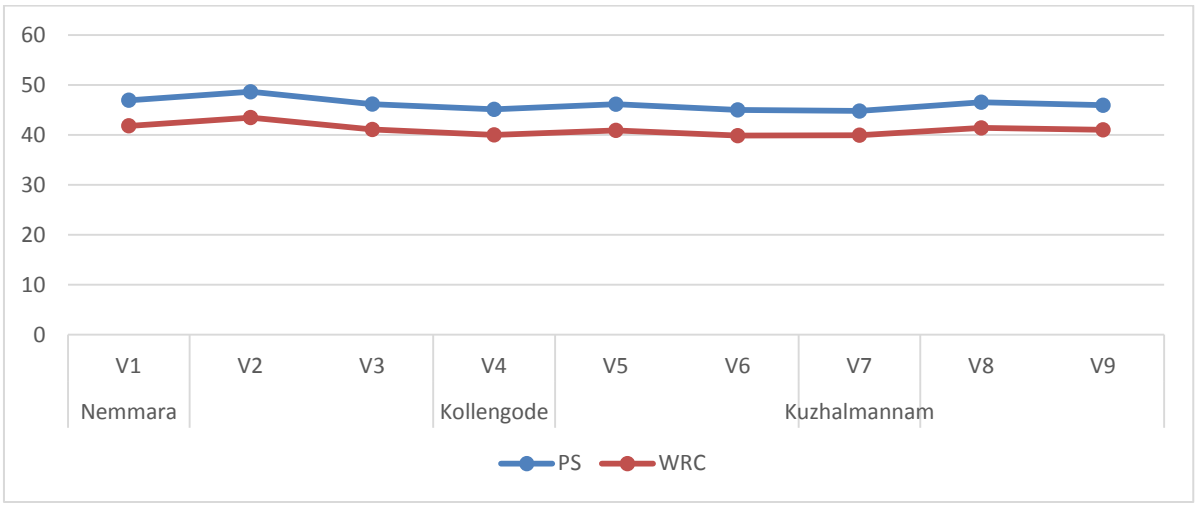

Fig. 2. Pore space (%) and water retaining capacity (%) of soil from different villages of Palakkad district at 0-15, 15-30 and 30-45 cm depth

3.1.5 Water retaining capacity (%)

The Water Retaining Capacity (%) ranged from 39.13 to 44.81%. Factors like Clay type, Organic content, Soil structure etc. influence soil water retention. Similar result was found by Nair et al. [7], in Attappadi region [8,9].

4. CONCLUSION

The soil Textural class was identified as Sandy Clay Loam. The Bulk Density was found increasing with soil depth. Particle density of the soil showed only slight variation. Pore space and water retaining capacity of these villages were found good. It can be concluded that the soils of Nemmara, Kollengode and Kuzhalmannam blocks have a good physical condition which favours cultivation of most crops. The knowledge gained through the current study will help to guide the farmers and form effective management practices for better crop yield.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Tale KS, Ingole S. A review on role of physico-chemical properties in soil quality. Chemical Science Review and Letters. 2015;4(13):57-66.
2. Flynn R, Shane TB, Baker RD. Sampling for plant tissue analysis. Guide A-123, College of Agriculture and Home Economics New Mexico State University; 2004.
3. Bhatt R, Sharma M. Importance of soil testing and techniques of soil sampling. Lap Lambert Academic Publishing; 2014.
4. Tewari G, Khati D, Rana L, Yadav P, Pande C, Bhatt S, Joshi PK. Assessment of physicochemical properties of soils from different land use systems in Uttarakhand, India. Journal of Chemical Engineering and Chemistry Research. 2016;3(11).
5. Suma M, George AV, Rekha VB, Leenamma J. An assessment of soil properties under different land use types of the Kallada river Basin, Kerala, India. Environmental Research, Engineering and Management. 2011;55(1):5-13.
6. Gopan VGM, Hasan A, Thomas T, David AA, Reddy IS. Correlation of physico-chemical parameters of soil and soil nutrient index status of Kollam district, Kerala, India. International Journal of Plant & Soil Science. 2022;34(20):270-276.
7. Nair JM, Swaroop N, Thomas T, Barthwal A. Assessment of soil fertility status of different villages from Palakkad district, Kerala; 2022.
8. Jackson ML. Soil chemical analysis. Prentice Hall, Inc. Englewood. Cliffe. N.J; 1958.
9. Muthuvel P, Udayasoorian C, Natesan R, Ramaswami PR. Introduction of soil analysis. Tamil Nadu Agricultural University, Coimbatore; 1992.

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