Original Research Article

Assessment of Physical Properties of Soil from Different Villages of Devikulam Block of Idukki District of Kerala

Comment [AB1]: Assessment of physical properties of soil from different villages of Devikulamblock of Idukki district of Kerala, India.

ABSTRACT

Assessment of Physical properties of soil from Different villages in the Devikulam block of idukki district of Kerala was carried out in 2022. The study was conducted with the objective of evaluating the physical characteristics of soil, over various soil depths in the Devikulam block. Nine sampling locations were selected for the study. A total of 27 soil samples were taken at depths of 0-15 cm, 15-30 cm and 30-45 cm respectively. The result indicated that the soil of Marayoor, Kanthaloor and Keezhanthoor villages were sandy clay loam in texture.The bulk density and particle density did not vary much with increasing soil depth. The particle density remained constant because the total amount or chemical composition of the soil mineral particles remains unaltered.Water Retaining Capacity of these villages were found to be good. The pore space was found to be higher than water retaining capacity in all the villages.For sustainable soil use and agricultural Production, the physical characteristics of the soil are crucial.The movement of air and water/dissolved chemicals through soil, as well as conditions affecting germination, root growth, and erosion processes are defined by soil physical properties.

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Key words: *Devikulam Block, Idukki District, Physical Properties, Kerala*

Comment [AB4]: The keywords are traditionally written in alphabetical order separated by semicolons.

Introduction

Soilisnecessaryforthedevelopmentofmostplantswhichprovidesphysicalsupportas well as nutrients. Plants are bind in the soil by their roots. Nutrients dissolve in soilwater,whichisrequiredforplantdevelopment.Soilscontainavariousoforganicmatters,including dead minerals from plants and animals, as well as organisms that choose to livein soil. Soil is a store of various nutrients such as carbon and nitrogen which plays animportant role in the global nutrient cycles in hydrological cycles and atmospheric system (Abdulkareem*etal.*,2012).

Comment [AB5]: bound

Comment [AB6]: minerals from dead and decayed plants and animals

Comment [AB7]: biogeochemical cycles

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 required to study both the physical and chemical properties of the soil. The productivity of soil is dependent on soil fertility.

The physicalproperties of soil influence the plant's capacity to extract water and nutrients. High-quality soils not only provide more food and fiber, but also aid in the establishment of natural ecosystems and the improvement of air and water quality. The physical properties of soil are determined by its amount, shape, structure, size, pore spaces, organic content, and mineral composition.Particle density plays an important role in the determination of other physical properties, including bulk density and porosity.The dry weight of soil per unit volume of soil is referred to as bulk density. Bulk density can be increased by tillage because it breaks down aggregates and enables soil separates to pack more tightly. Adding organic material decreases bulk density because organic material has a lower bulk density. Bulk density is crucial because it provides information about a soil's porosity. Depending on the size and aggregation of the particles, porosity varies.The physical properties of the soil are crucial for agricultural production and soil sustainability.(Tewari*etal.*,2016).

Methodology:

Keralahasatropicalwarmhumidenvironmentwithanaverageannualrainfallof3000mm.Thecoordinatesofthe DevikulamBlockare 10°4′0.12″N, 77°6′26.28″E.Theplacehas anarea of215 km^2. The Devikulam Block economy is mostly focused on agriculture. IdukkiisKerala'ssecondlargestdistrict,coveringanareaof4358squarekilometer sand constituting 11.2% of the state's total area. There are four major soil types present inthe district, which include forest loams, lateritic soils, brown hydromorphic soils, andalluvial soils. Around 60% of the region is covered in forest loams, which are the result ofweathering of the rock under forest cover. They have a very rich organic matter surfacelayer The soils in Idukki district are formed as a result of transportation and sedimentation ofmaterials from adjoining hill slopes and are brownish black in colour. Alluvial soils are seen as narrow strips along the banks ofrivers in the district. They are more common along the banks of Thodupuzha River. Devikulam Taluk in Kerala's Idukki district is situated on the eastern slopes of theWestern Ghats. Kanthaloor village in the Devikulam block is regarded as the "VegetableBowl of Kerala"

Soil samples were collected from three different villages in the Devikulam block ofIdukki district of Kerala. They are MarayoorKanthaloor andKeezhanthoor. Soil samples were takenusing a khurpi, spade, and meter scale. In each village, three sampling locations were chosen, andsoilsampleswerecollectedfromthreedepths:0-15cm,15-30 cm,and30-45 cm. Soilsampleswereмixed properly and wereremovedof foreign materials like roots, stones, pebbles and gravels. Thebulk was then reduced tohalfbyquartering.And the samples were then analyzed for various physical properties.The data was recorded during the course of investigation were subjected to statistical analysis by analysis of Completely Randomized Design (CRD) as per the method of “Analysis of Variance” (ANOVA) technique.

Table1:ProcedureusedforPhysical analysisof soil

S. No.	Parameter	Scientist
1	SoilTexturalClass(Sand,Silt,Clay)	Bouyoucos,(1927)
2	BulkDensity(Mgm^{-3})	Muthuvel*etal.* (1992)
3	ParticleDensity(Mgm^{-3})	
4	PoreSpace(%)	
5	WaterHoldingCapacity(%)	

Resultand Discussion

Soil Texture

The Soil Textural classes identified was Sandy Clay Loam. The proportion of the different soil separates in a soil determines its texture. The sand, silt and clay percentage varied from 62.49% to 70.11 %, 8.38% to 13.19% and 20.16 to 24.32%.

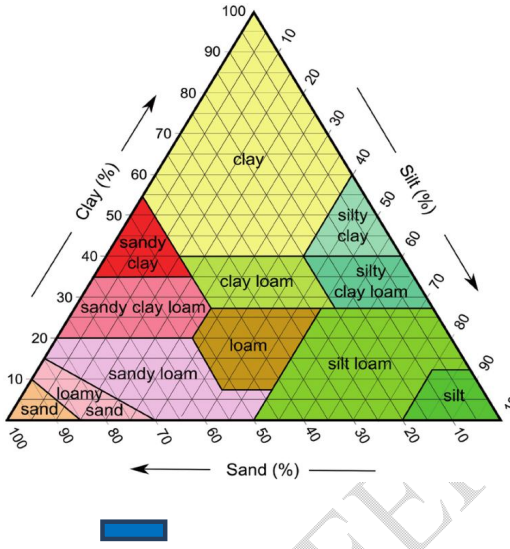

Fig.1: SoilTexturalTriangle(Sand,siltandclay%) by USDA

Bulk Density(Mg m^{-3})

Bulk Density was varied from the 1.28 Mg m^{-3} to 1.49 Mg m^{-3}.Bulkdensity was found to increase withthe increase soil depth due to increase in compaction in the subsurface comparatively. Similar results werefoundbySwathi*etal.*, (2020)in southernKerala.

Particle Density (Mg m^{-3})

The Particle Densitywas varied from 2.43 Mg m^{-3} to 2.59 Mg m^{-3}. The mineral content of soil particles affects particle density.Similarresultswere foundbyGopan *et al.*, (2022) inKollamdistrict.

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Table2: Bulk density and Particle density (Mgm^{-3}) of soil in different villages of Devikulam Block at 0-15, 15-30 and 30-45 cm Depth.

Farmer's Field	Bulk Density (Mgm^{-3})		Particle Density (Mgm^{-3})	
	Range	Mean	Range	Mean
Marayoor (V_1)				
F_1	1.36-1.38	1.37	2.45-2.48	2.46
F_2	1.32-1.34	1.33	2.53-2.55	2.54
F_3	1.41-1.43	1.42	2.51-2.54	2.52
Kanthaloor (V_2)				
F_4	1.28-1.31	1.29	2.50-2.54	2.51
F_5	1.33-1.35	1.34	2.47-2.50	2.48
F_6	1.34-1.36	1.35	2.56-2.59	2.57
Keezhanthoor (V_3)				
F_7	1.47-1.49	1.48	2.49-2.54	2.51
F_8	1.38-1.41	1.39	2.43-2.46	2.44
F_9	1.31-1.33	1.32	2.57-2.59	2.58

Pore space(%)

The Pore Space (%) ranged from 40.96 % to 49.02 %. The pore space was found to decrease with increase in depth attributed to increase in compaction in the subsurface. Similar results were found by Nair *et al*., (2022) in Attappadi region.

Water Retaining Capacity (%)

The Water Retaining Capacity (%) ranged from 37.23 to 44.31 %. Factors like Clay type, Organic content, Soil structure etc. influence soil water retention. Similar results were found by Nair *et al*., (2022) in Attappadi region.

Table3:PorespaceandWater RetainingCapacity(%)ofsoilindifferentvillages of Devikulam Block at 0-15,15-30 and 30-45 cm Depth.

Farmer's Field	Porespace (%)		Water RetainingCapacity(%)	
	Range	Mean	Range	Mean
Marayoor(V_1)				
F_1	42.35-44.48	43.40	39.35-41.48	40.40
F_2	44.45-47.82	46.30	40.45-42.82	41.63
F_3	41.09-44.22	42.78	39.01-40.22	39.74
Kanthaloor (V_2)				
F_4	47.81-48.81	48.41	42.18-44.31	43.27
F_5	43.81-46.15	45.04	40.72-42.51	41.62
F_6	45.49-47.65	46.72	41.48-43.12	42.52
Keezhanthoor(V_3)				
F_7	40.96-41.96	41.41	37.23-38.18	37.81
F_8	42.68-43.72	43.14	37.91-39.55	38.74
F_9	48.21-49.02	48.68	42.17-44.21	43.34

Conclusion

It can be concluded that the soil Textural class was identified as Sandy clay Loam. The bulk density of the soil was increased with increase in depth and the particle density also increased slightly with depth.The Water Retaining CapacityofthesoilandtheoverallPhysicalconditionofthesoilwasfoundgood andsupportiveforplantgrowth.Proper management can be carried out by analysing these various test results.It was found that organicmatterincorporation mulching,tillagepractices,properirrigationetc.canimprovethesoilconditionsandthusimprovefarmer'syield.

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