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## To analyze the physical properties of soil of different blocks of Jaintia Hills district, Meghalaya

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#### Abstract

An experiment was conducted in the Department of Soil Science and Agricultural Chemistry, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj during 2020-21 to analyze the physical of soil of Jaintia Hills District, Meghalaya. Soils samples were collected from three different blocks viz., Laskein, Khliehriat and Thadlaskein block from three profile depth. Physical properties of soil i.e. bulk density, particle density, pore space, water holding capacity, soil texture, soil colour and specific gravity were analyzed. The colour of the soil varied from yellowish brown in dry condition to dark reddish brown in wet condition. The bulk density values ranges from 1.2 to 1.65 Mg m<sup>-3</sup>, Particle density from 2 to 2.85 Mg m<sup>-3</sup>, porosity 34% to 52%, specific gravity ranges from 1.45 to 2.55 and water holding capacity from 31.5 to 62.8%.

**Keywords:** Physical properties of soil, Soil analysis, Jaintia Hills district

#### Introduction

Soil is defined as a natural body comprised of solids (minerals and organic matter), liquid, and gases that occurs on the land surface, occupies space, and is characterized by one or both of the following: horizons, or layers, that are distinguishable from the initial material as a result of additions, losses, transfers, and transformations of energy and matter or the ability to support rooted plants in a natural environment (Soil Survey Staff, 2014) [1].

Soil quality can be defined as the fitness of a specific kind of soil, to function within its capacity and within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation (Karlen *et al.* 1997) [5].

The physical properties of soil include color, texture, structure, porosity, density, consistence, aggregate stability and temperature. These properties affect processes such as infiltration, erosion, nutrient cycling, and biologic activity.

The area under study, Jaintia Hills District was created on 22 February 1972 and occupied an area of 3819 km<sup>2</sup>. The Latitude is 25°30'7.6"N and Longitude is 92°20'30.7"E. It had a population of 270,352 (as of 2011). The district is part of the Meghalaya subtropical forests ecoregion. With the bifurcation of the erstwhile Jaintia Hills District into East and West Jaintia Hills Districts, West Jaintia Hills District came into existence on 31 July 2012 with its headquarters at Jowai. The district comprises of 1 Civil Sub-Division viz. Amlarem Civil Sub-Division and 3(three) Community and Rural Development Blocks viz. Amlarem C&RD Block, Laskein C&RD Block and Thadlaskein C&RD Block. East Jaintia hills districts with its Head Quarter at Khliehriat. It comprises all the village of two community and rural development blocks viz. Saipung community & Rural Development Block and Khliehriat community & Rural Development Block

Agriculture is the major occupation in Jaintia Hills District, in which about 70% of the population depends primarily on agriculture for their livelihood. Maize are the major food crops grown throughout the district with appreciable improvement in yield. Wheat has been introduced recently and the result is quite encouraging. Potato, ginger, garlic and turmeric are some of the important cash crops of the district. The district is the native of the world famous turmeric Lakadong variety.

#### Materials and Methods

##### Locale site of study

The state of Meghalaya is situated in the northeast region of India. It extends for about 300 km

in length and about 100 km in width. It is bounded on the north and east by the state of Assam and on the south and west by Bangladesh. The Latitude is 25°30'7.6"N and Longitude is 92°20'30.7"E. A compact and isolated state in the northeastern region of India, Meghalaya extends to 22,429 sq km of land. The Jaintia Hills District was created on 22 February 1972 and occupied an area of 3819 km<sup>2</sup>. This research study includes three blocks *viz.*, Laskein, Khliehriat and Thadlaskein blocks as shown in table 2 and figure 1.

### Collection of Soil Samples

Soil samples were collected from different villages of the blocks of Jaintia hills district Meghalaya. The soil samples were collected by the help of soil auger, spade, khurpi, scale at a depth of 0- 15 cm, 15-30 cm and 30-45 cm from the site of different villages.

### Sample preparation

After collection the soil Samples were air dried in shade at room temperature till the soil samples will be completely dry. After drying all the unwanted materials such as roots, stones, pebbles were removed. The clods formed were broken down by wooden mallet and then the soil are sieved by 2 mm sieve.

### Physical Properties

#### Soil Colour

The soil colour was determined by Munsell soil colour chart as described in Hand Book of United State Department of America (Munsell, 1954)<sup>[8]</sup>.

#### Particle density (Mg m<sup>-3</sup>)

The Particle density was calculated from the 100 ml graduated Measuring Cylinder (Muthuvel *et al.*, 1992)<sup>[9]</sup>.

#### Bulk Density (Mg m<sup>-3</sup>) and Porosity (%)

The bulk density was calculated by Graduated Measuring Cylinder (Muthuvel *et al.*, 1992)<sup>[9]</sup>.

#### Water Holding Capacity (%)

Water Holding Capacity (%) was estimated by volume basis (Muthuvel *et al.*, 1992)<sup>[9]</sup>.

#### Soil Texture (Sand, Silt and Clay %)

Analysis of soil texture was done by Bouyoucos Hydrometer method (Bouyoucos, 1927)<sup>[11]</sup>.

#### Specific gravity

Specific gravity of soil was determined by the use of relative density bottle or pycnometer (Black, 1965)<sup>[2]</sup>.

### Results and Discussions

#### Soil colour

Soil colour of soil samples in dry method were observed as in table 1 were Yellowish Brown, Brown, Strong Brown,

Brownish Yellow, Dark Yellowish Brown, Greyish Brown and Reddish Brown. The soil colour of the samples in wet condition were observed Dark Brown, Dark Yellowish Brown, Brown. The soil colour is observed similar result was also reported by B.U Choudhury (2013)<sup>[3]</sup>.

#### Soil Texture (%)

In accordance to table 2 and figure 2, loam soil was found in Laskein, Khliehriat and Thadlaskein due to the fact that the percentage of sand ranges from 49.2% - 50.6%, percentage of silt ranges from 30.2% - 35.2% and percentage of clay ranges from 15.5 to 20.2%. Sandy loam was found predominant in Laskein and Thadlaskein because the percentage of sand is 52.4% to 54.6%, percentage silt is 24.8 to 33.3 and percentage of clay is 14.2% to 22.8%. Sandy Clay Loam was found in Khliehriat and Thadlaskein as the percentage of sand is 52.4% to 54.6%, percentage of silt is 24.8% to 25.2% and percentage of clay is 20.2% to 22.8%. The soil texture is varies from loam to sandy loam which is due to low in clay and high in silt content it was also reported by Mishra (2021)<sup>[7]</sup> North East India

#### Bulk density (Mg m<sup>-3</sup>)

It was found that the range for bulk density as in table 3 and figure 3 was ranged from 1.2 to 1.65 The soil bulk density is increased according to depth due to minerals content of the soil, Similarly reported by Kenye *et al.* (2019)<sup>[6]</sup> in the state of Mizoram.

#### Particle density (Mg m<sup>-3</sup>)

It was found that the range for Particle Density as shown in table 3 and figure 3 was 2 to 2.85. The particle density of soil decreased with depth. Particle density varies according to the mineral contain in the soil same result was also reported by Selassie and Ayanna (2013)<sup>[10]</sup>.

#### Porosity (%)

Porosity as in table 3 and figure 3 was found that the range from 34% to 52%, Pore space of soil contain the liquid and gas phase decreased due to compaction of soil similar result was reported by selassie and Ayanna (2013)<sup>[10]</sup>.

#### Water Holding Capacity (%)

It was found that the ranged for Water holding capacity as in table 3 and figure 3 was ranged from 31.5% to 62.7%. Water holding capacity is decreasing according to depth it might be high sand and less silt. Similar result was also reported by Devi *et al.*, (2020)<sup>[4]</sup>.

#### Specific Gravity

It was found that the range for specific gravity as in table 3 and figure 3 was 1.45 to 2.55. The soil containing organic matter and porous particles has specific gravity less than 2.0 similarly reported by Devi *et al.* (2020)<sup>[4]</sup>.

**Table 1:** Soil colour of different block of Jaintia hills in dry and wet condition

Block/Site	0-15 cm		15-30 cm		30-45 cm	
	Dry condition	Wet Condition	Dry Condition	Wet Condition	Dry Condition	Wet Condition
<b>Laskein</b>						
(1S1)	Yellowish brown	dark brown	Yellowish brown	dark brown	Yellowish brown	Darkbrown
(2S2)	Yellowish brown	dark brown	Brown	Darkbrown	Strongth brown	Darkbrown
(3S3)	brownish yellow	dark brown	Light yellowish brown	dark brown	yellow brown	dark brown
<b>Khliehriat</b>						
(4S1)	brownish yellow	Brown	yellowish brown	Brown	yellowish brown	Brown

(5S2)	dark yellowish brown	Dark brown	yellowish brown	dark brown	yellowish brown	Brown
(6S3)	yellowish brown	dark yellowish brown	yellowish brown	dark yellowish brown	yellowish brown	dark brown
<b>Thadlaskein</b>						
(7S1)	dark brown	Dark brown	yellowish brown	dark brown	10YR 5/8 yellowish	dark brown
(8S2)	yellowish brown	dark brown	yellowish brown	dark brown	dark yellowish brown	dark brown
(9S3)	Brown	Dark brown	greyish brown	dark brown	reddish brown	Brown

**Table 2:** Analyze the Soil texture of soil samples

Block/Site	Latitude(N°)	Longitude(E°)	%Clay	%Silt	%Sand	Textural Class
<b>Laskein</b>						
(1S1)	25°31'22.44"	92°26'22.2"	16.4	33.4	50.2	Loam
(2S2)	25°30'41.4"	92°27'21.6"	14.2	33.3	52.5	Sandy loam
(3S3)	25°31'12.72"	92°26'24.36"	15.5	35.2	49.2	Loam
<b>Khliehriat</b>						
(4S1)	25°26'30.84"	92°17'26.52"	18.3	30.2	51.5	Loam
(5S2)	25°27'19.08"	92°18'41.32"	20.2	30.2	49.6	Loam
(6S3)	25°27'25.56"	92°19'31.44"	22.8	24.8	52.4	Sandy clay loam
<b>Thadlaskein</b>						
(7S1)	25°27'52.92"	92°14'47.04"	17.2	32.2	50.6	Loam
(8S2)	25°27'33.84"	92°12'46.44"	17.8	26.9	55.2	Sandy loam
(9S3)	25°27'25.56"	92°12'8.64"	20.2	25.2	54.6	Sandy clay loam

**Table 3:** Analyze the Bulk Density, Particle Density and Porosity, water holding capacity and specific Gravity of soil samples

Block/site	Bulk Density (Mg m <sup>-3</sup> )			Particle Density (Mg m <sup>-3</sup> )			Porosity (%)			Water Holding Capacity (%)			Specific Gravity		
	0-15	15-30	30-45	0-15	15-30	30-45	0-15	15-30	30-45	0-15	15-30	30-45	0-15	15-30	30-45
<b>Laskein</b>															
(1S1)	1.25	1.45	1.65	2	2.22	2.5	37.5	34.68	34	52.2	48.8	40.8	2.55	1.91	1.94
(2S2)	1.35	1.55	1.7	2.22	2.6	2.85	39.18	41.72	40.35	60.4	42.5	38.7	1.82	1.45	1.9
(3S3)	1.2	1.45	1.6	2.5	2.5	2.66	52	42	39.84	62.7	59	50	1.87	1.79	1.08
<b>Khliehriat</b>															
(4S1)	1.25	1.4	1.65	2.22	2.66	2.66	43.69	47.36	37.96	52.1	47.8	50	1.82	1.8	1.6
(5S2)	1.45	1.55	1.7	2	2.5	2.85	27.5	38	40.35	58.1	47.8	40.8	1.82	1.82	1.81
(6S3)	1.35	1.55	1.6	2.5	2.66	2.85	46	41.72	43.85	59	56.8	53.4	1.7	1.8	1.9
<b>Thadlaskein</b>															
(7S1)	1.25	1.3	1.65	2.5	2.5	2.85	50	48	42.10	39.2	31.5	36.1	1.96	1.94	1.92
(8S2)	1.3	1.55	1.7	2	2.5	2.6	35	38	34.61	39.5	36	33.3	1.77	1.87	1.82
(9S3)	1.35	1.5	1.65	2.22	2.26	2.6	39.18	42.3	36.53	55.8	52.2	45.8	1.93	1.8	1.89



**Fig 1:** Different Block of Jaintia Hills Laskein (1S1, 2S2, 3S3), Khliehriat (4S1, 5S2, 6S3), Thadlaskein (7S1, 8S2, 9S3)

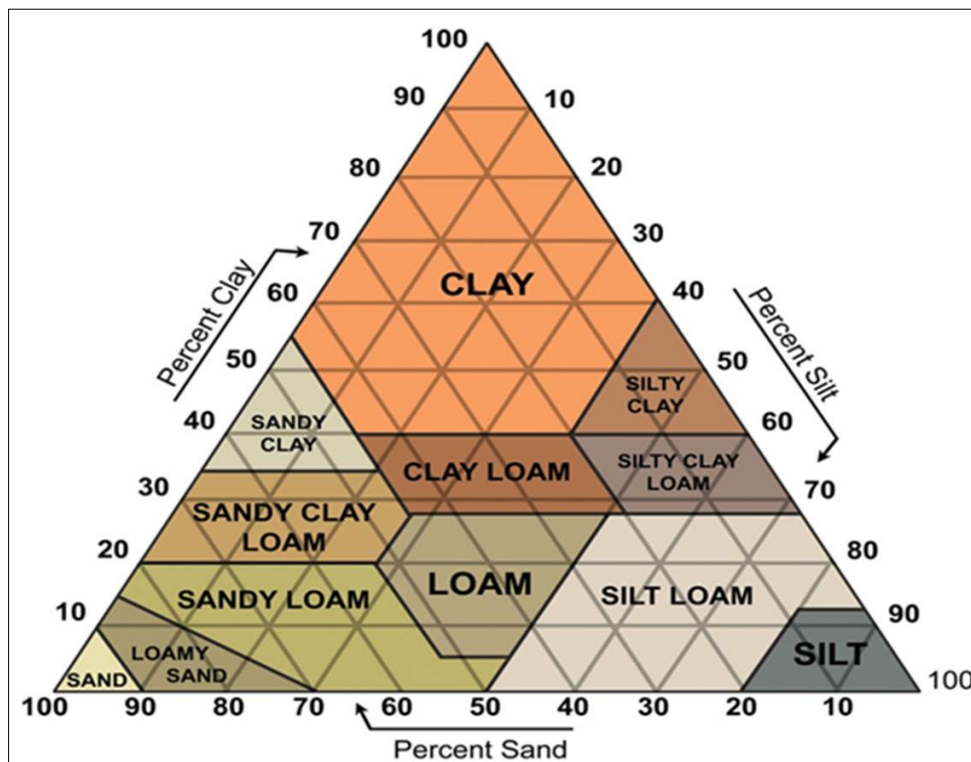


Fig 2: Triangular diagram of soil textural classification by USDA System (1975)

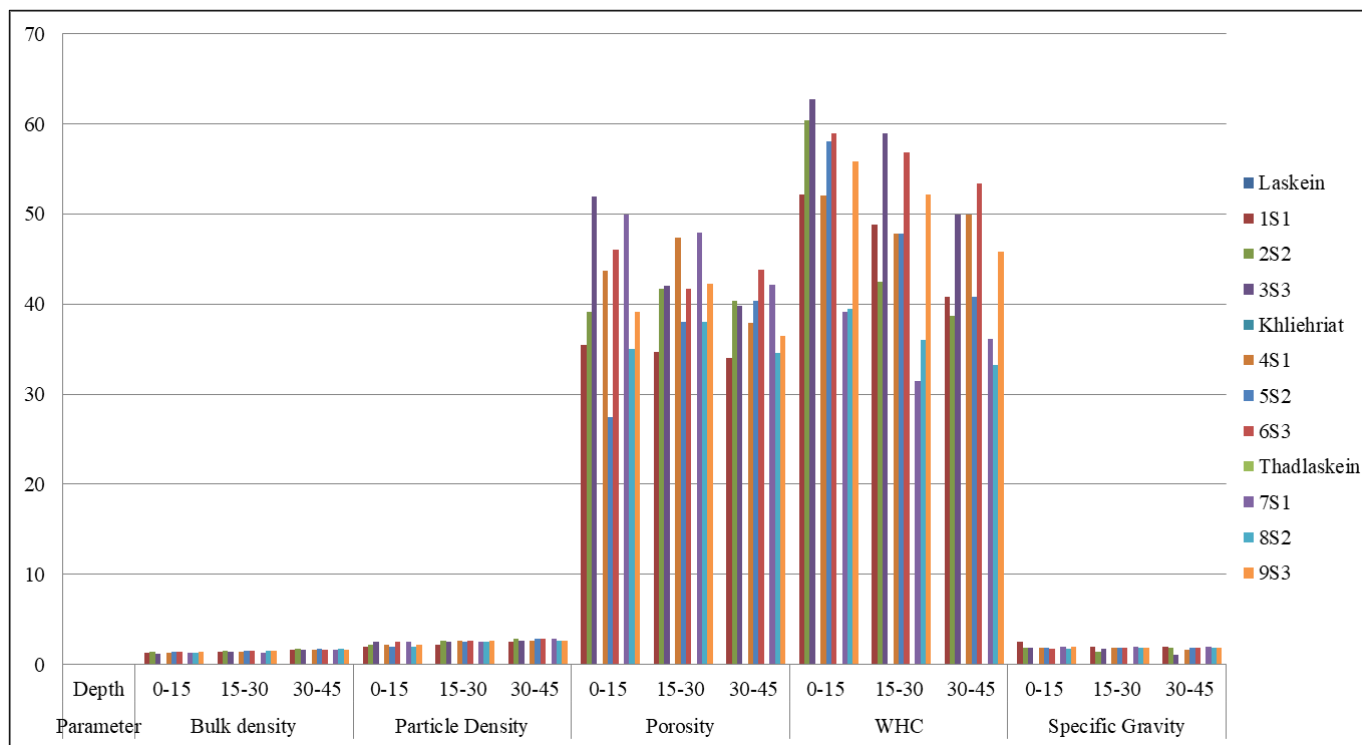


Fig 3: Physical properties of soil parameters

**Conclusion**

It was concluded that the present study of soil samples in Jaintia Hills during the course of investigation was responded good physical properties viz., Bulk density is increased according to depth due to minerals content of the soil, Particle density, porosity the liquid and gas phase decreased due to compaction of soil, Water holding capacity decreasing according to depth it might be high sand and less silt and Soil color and Specific Gravity The soil containing organic matter and porous particles.

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