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Assessment of physical properties of soil in East Khasi Hills district, Meghalaya, India

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Abstract

A study was conducted to analyse the physical properties of soil of East Khasi Hills District, Meghalaya. The objective of this study is to do the physical analysis of soil samples and to provide information to the farmers due to lack of information in the selected areas. Soil samples were collected from three blocks of East Khasi Hills District with three depths viz., 0-15, 15-30 and 30-45 cm. Soil parameters like soil texture, soil colour, Bulk density (1.09 Mg m^{-3}), particle density (2.31 Mg m^{-3}), pore space (61.48%), water holding capacity (67.20%) and specific gravity were analyzed. The soil of the study area varies from brown to dark reddish brown in colour and its texture varies from loam to clay loam. The result of the study area shows that the soil has a very good physical condition.

Keywords: Physical properties, soil analysis, East Khasi Hills District

Introduction

Soils are the vital pedestal for most of terrestrial ecosystem services. It is storehouse of nutrients and water which help plants in manufacture of food, sustenance and in various life processes and in due course soils absorb and store carbon dioxide (sequester). Besides, soils alleviate likelihood of floods, play important role in purification of water by acting as a filter and also help to immobilize various air pollutants. In addition, provide strong structural support to buildings and roads (Dominati *et al.*, 2010) [7]. However, these functions have been subjected to impairment due to widespread soil degradation (Edmondson *et al.*, 2011) [8]. Soil may also be defined as “A natural body developed by natural forces acting on natural materials. It is usually differentiated into horizons from mineral and organic constituents of variable depth which differ from the parent material below in morphology, physical properties and constituents, chemical properties and composition and biological characteristics” (Joffe and Marbut). Soil may also be defined as the part of the earth crust in which humus is present as in organic part.

The physical properties of the soil depend upon the amount, shape, structure, size, pore spaces, organic matter and mineral composition of soil. The chemical properties of the soil are the interactions of various chemical constituents among soil particles and the soil solution. These physical properties are soil texture, bulk density particle density, percent pore space, water holding capacity, soil structure, soil colour.

The area under study, East Khasi Hills District is a hilly area in the state of Meghalaya. East Khasi Hills is one of the eleven districts of Meghalaya. Shillong is the district headquarters of East Khasi Hills which is also the capital of Meghalaya. The district has a forest area of 1068 sq. km., i.e. about 39% of the total geographical area. The net area sown is 377.85 sq. km. and the total cropped area is 456.26 sq. km. Fallow land covers about 4%, net area sown is about 14%, while the total cropped area is about 17%.

Materials and Methods

Study area

Meghalaya occupying an area of 22,720 km² including the area of East Khasi Hills district which is 2748 Km². The district forms a central part of Meghalaya lying approximately between 25°49'70.41" & 25°41'82.41" N Latitude and 91°89'53.21" & 92°88'53.09" E Longitude and ranging from 50-1961 metres above main sea level (msl) and covers 22.4 lakhs ha (22,429 Sq.kms)

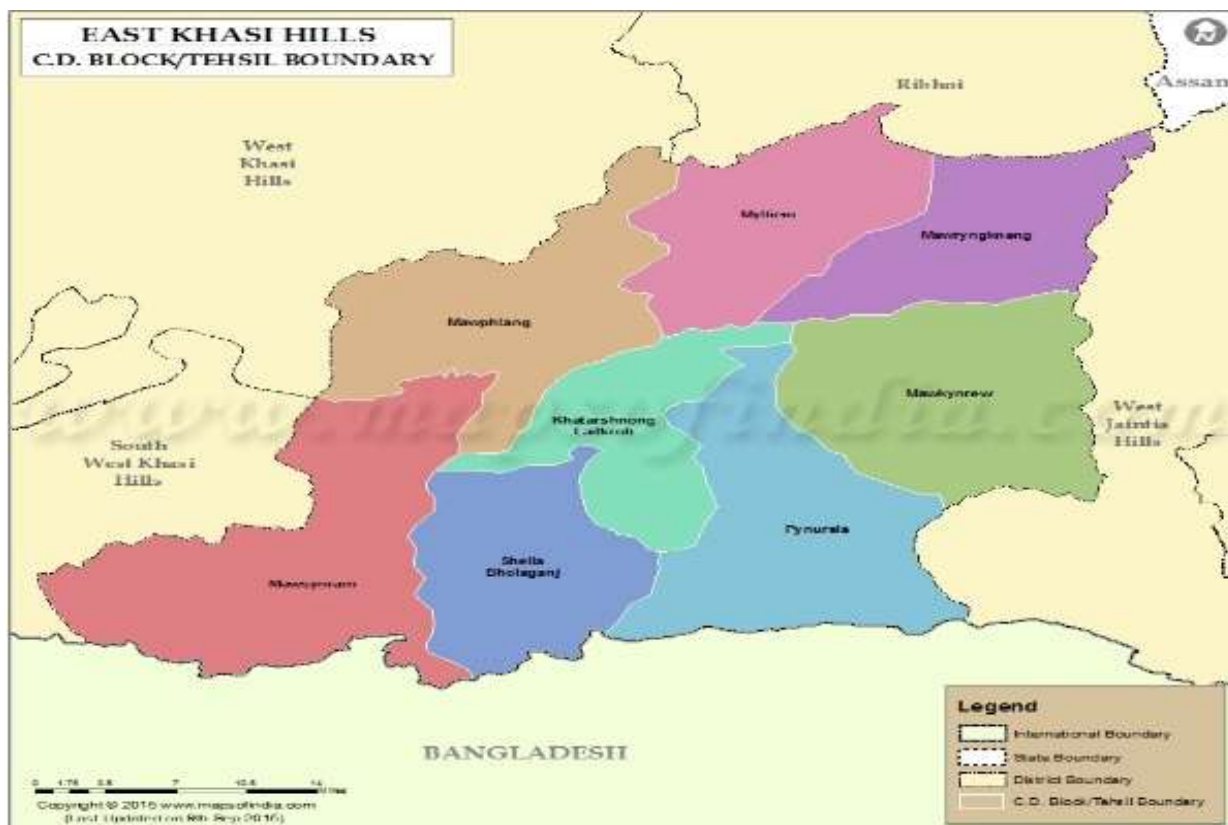


Fig 1: Different blocks from where soil samples were collected. B1-Mawryngkneng, B2- Mawkyntrew, B3- Myllem

Sampling and Analysis

Collection of the soil samples

Soil samples were collected randomly from a site using soil auger and screw auger, Khurpi Knife at the depth of (a) 0-15cm and (b) 15-30 cm. All these samples will be mixed and the mixed sample has been divided into four parts and then among them two samples are collected and only half kg sample is being taken for the soil analysis by the coning and quartering method.

Processing of soil samples

After sampling the samples were air dried in shade and then these samples were processed for various physical and chemical tests. The processing was done as follows: After drying all the unwanted materials like roots, stones, and others were removed. The clods formed were broken by using wooden pallet. Then the samples were sieved with 2 mm sieve Sieved samples were stored in polybags for further estimation of different physical and chemical parameters.

Analysis of the soil of physical parameters

Soil textural analysis was performed by Hydrometer method (Bouyoucos, 1927) [3]. For soil colour the soil samples were matched against standard Munsell soil colour chart (Munsell, 1971) to obtain hue, value and chroma. Bulk density, particle density, pore space and water holding capacity was determined by 100 ml measuring cylinder (Muthuvel *et al.* 1992) [10]. Specific gravity of soil was determined by relative density bottle or pycnometer (Black, 1965) [4]

Result and Discussion

Soil texture

The soil texture (Table 1) in Mawryngkneng and Myllem varies from clay loam to sandy clay loam while in Mawkyntrew it is Loam. Similar results were reported by Das

et al. (2014) [5]

Soil colour

The soil colour (Table 2) varied from brown to Yellowish brown in dry condition while dark reddish brown in wet condition. Similar result. was obtained by Ram *et al.* (2016) [12]

Bulk density and Particle density (mg m^{-3})

The maximum bulk density (Table 3) obtained was 1.11 mg m^{-3} in both Mawkyntrew and Myllem. The minimum bulk density obtained was 0.9 mg m^{-3} in both Mawryngkneng and Mawkyntrew. The bulk density was found to increase with increase in depth due to increase in compaction. Similar results were obtained

by Baishya *et al.* (2017) [1]. The maximum particle density (Table 3) obtained was 2.85 mg m^{-3} in both Mawryngkneng and Mawkyntrew and minimum particle density obtained was 2.00 mg m^{-3} . Similar results were obtained by Barthwal *et al.* (2019).

Pore space and water holding capacity (%)

The pore space (Table 3) values ranged from 52.63 to 68.18%. The pore space of the soil was found to decrease with increase in depth. Similar results were obtained by Pandey *et al.* (2018) [11].

The water holding capacity (Table 4) ranged from 46.14 to 68.18% which indicates of high clay content. Similar results were obtained by Deb *et al.* (2019).

Specific gravity

The specific gravity (Table 4) ranged from 2.0 to 2.2 which indicate of porous particles and high organic matter. Similar results were obtained by Sujatha *et al.* (2016) [13].

Table 1: Soil texture

Blocks	% Sand	%Silt	%Clay	Textural class
Mawryngkneng				
S1	51.2	18.3	30.5	Sandy clay loam
S2	23.5	37	39.5	Clay loam
S3	53.2	20.12	26.7	Sandy clay loam
Mawkynrew				
S1	48.21	11.7	40.1	Sandy clay
S2	35.1	44.32	20.6	Loam
S3	37.2	45.5	17.3	Loam
Mylliem				
S1	32.3	36.5	31.2	Clay loam
S2	29.6	24.2	46.2	Clay loam
S3	53.6	17	29.4	Sandy clay loam

Table 2: Soil colour

Blocks	0-15		15-30		30-45	
	Dry	Wet	Dry	Wet	Dry	Wet
Mawryngkneng						
S1	Dark brown	Dark reddish brown	Dark brown	Dark reddish brown	Dark brown	Very dark gray
S2	Very dark gray	Black	Very dark gray	Black	Very dark gray	Black
S3	Very dark grayish brown	Very dark gray	Dark reddish brown	Dark reddish brown	Dark brown	Dark reddish brown
Mawkynrew						
S1	Yellowish brown	Dark reddish brown	Brownish yellow	Dark reddish brown	Yellowish brown	Dark reddish brown
S2	Yellowish brown	Dark brown	Yellowish brown	Dark brown	Yellowish brown	Dark brown
S3	Yellowish brown	Very dark grayish brown	Dark yellowish brown	Dark brown	Yellowish brown	Dark brown
Mylliem						
S1	Pale brown	Very dark grayish brown	Brown	Very dark grayish brown	Yellowish brown	Dark brown
S2	Dark yellowish brown	Dark brown	Yellowish brown	Dark brown	Light yellowish brown	Dark reddish brown
S3	Yellowish brown	Very dark grayish brown	Yellowish brown	Dark brown	Dark yellowish brown	Dark brown

Table 3: Bulk density (mg m^{-3}), Particle density (mg m^{-3}) and pore space (%)

Blocks / Site	Bulk density (mg m^{-3})			Particle density (mg m^{-3})			Pore space (%)		
	0-15	15-30	30-45	0-15	15-30	30-45	0-15	15-30	30-45
Mawryngkneng									
S1	1.00	1.00	1.05	2.00	2.00	2.22	54.5	52.63	50.0
S2	0.9	1.05	1.1	2.22	2.5	2.85	68.18	63.63	52.63
S3	1.00	1.00	1.05	2.5	2.5	2.5	63.63	61.9	55.53
Mawkynrew									
S1	0.9	1.11	1.11	2.00	2.00	2.22	54.5	54.3	50.0
S2	1.00	1.05	1.11	2.22	2.5	2.85	65.0	55.5	52.63
S3	1.00	1.05	1.11	2.00	2.00	2.5	55.0	55.0	47.3
Mylliem									
S1	1.00	1.00	1.05	2.22	2.22	2.5	60.0	55.0	52.63
S2	1.00	1.05	1.11	2.22	2.22	2.5	57.89	52.63	50.0
S3	1.05	1.11	1.11	2.22	2.22	2.5	57.89	55.55	50.0

Table 4: Water holding capacity (%) and specific gravity

Blocks / Site	Water holding capacity (%)			Specific gravity		
	0-15	15-30	30-45	0-15	15-30	30-45
Mawryngkneng						
S1	69.04	67.44	65.11	2.1	2.1	2.1
S2	62.79	59.52	59.18	2.0	2.0	2.1
S3	68.18	65.9	56.81	2.2	2.2	2.2
Mawkynrew						
S1	60.97	55.0	54.7	2.0	2.0	2.0
S2	69.04	58.53	56.09	2.0	2.0	2.0
S3	60.52	60.52	56.41	2.0	2.1	2.1
Mylliem						
S1	61.53	61.53	58.53	2.0	2.1	2.1
S2	56.41	50.0	46.41	2.1	2.1	2.2
S3	63.15	62.5	62.5	2.1	2.2	2.3

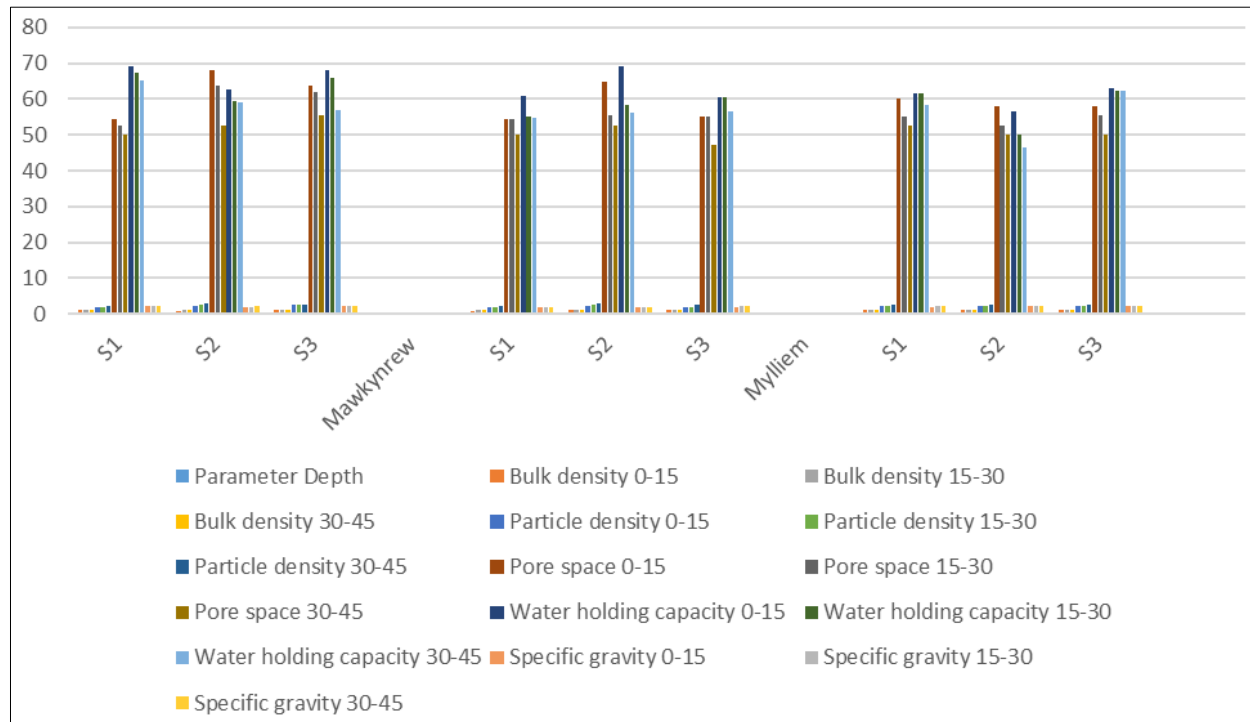


Fig 2: Physical parameters of soil sample

Conclusion

Physical analysis of soil under study show different values for various sites. Base on the results of the present study, it can be concluded that the soils of East Khasi Hills District are in good physical condition. The texture of the soil is predominantly clay loam which favours paddy cultivation. The bulk density values were considerably low and increased with increase in depth. The particle density also increased with depth. The Specific gravity values of soil were low which indicate high organic matter.

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