

## Soil texture and Total organic matter content and its influences on Soil water holding capacity of Municipality soils of Moran in Sivasagar district of Assam, India.



### Environmental Science

**KEYWORDS :** : Clay content, Sand content, Total organic matter content and Water holding capacity.

Juri Konwar

Associate Professor, Department of Chemistry, Moran College, P.O. Moranhat-785670, Dist-Sivasagar, Assam, India

### ABSTRACT

*The water holding capacity (WHC) of municipality soil depends on both the soil texture and total organic matter (TOM) content. A study was carried out to determine the soil texture and TOM and its influences on WHC of soils in Moran municipality. Thirty three composite soil samples were collected from the top soil (0-15 cm) from the eleven wards. The samples were analyzed for texture, TOM and WHC. The results showed that the soil samples have high WHC and TOM. It was concluded that soil texture and TOM had influenced on WHC of municipality soil. It was suggested that high percentage of clay fraction and TOM on soil should be incorporated to the soils with improving WHC. A significance positive relationship was observed between WHC with clay and TOM, while, a negative relationship was found with sand content.*

### INTRODUCTION

Soil is the natural body of animal, mineral and organic constituents differentiated into horizons of variable depths, which differ from the material below in morphology, physical make up, chemical properties and composition and biological characteristics (Waugh, 1995). Soil possesses physical, chemical and biological properties. Physical properties such as available water holding capacity is controlled by texture of the soil, amount of organic matter content and structure of the soil (Adamu and Aliyu, 2012). Textural and structural, and organic matter characteristics determine how water is held in soil (Das et al., 2005). The productivity of crops depends upon the availability of soil moistures as well as nutrients status of soils. The physical properties of a soil play an important role in determining its suitability for crop production (Debnath et al., 2012). The basic need of crop production is to maintain soil fertility and soil productivity. Soil fertility is the inherent capacity of soil to provide essential chemical elements for plant growth. Soil fertility in modern day agriculture is a part of a dynamic system. Nutrients are constantly being exported in the form of plant and animal products.

Soil texture refers to the sizes that make up the soil and proportion of particle sizes determines a soil texture (Gabler et al., 2009). Soil texture is one of the most stable properties and a useful index of several other properties that determine the agricultural potential of soil. It affects the properties of soil including its water supplying power, rate of water infiltration, aeration, soil fertility, ease of tillage and erosion. Clays soil have low infiltration rates, retain much water and may be poorly drained, but sandy soils are porous, have high infiltration rates, and retain little water.

Soil organic matter, organic fraction of the soil, is a complex mixture of plant and animal products in various stages of decomposition (Chan et al., 2001). The surface soil, plough layer contains considerable organic matter. Organic carbon influences the soil compactibility (Soane et al., 1972). Soil organic carbon in the form of humus supplies nutrients to the soil and improves its ability to retain moisture (Adamu and Aliyu, 2012). Soil organic matter plays a key role in nutrient cycling and can help improve soil structure. Organic matter is an important source of nutrients for plants..

Water holding capacity of soil is defined as the amount of water of the soil can hold for the use of plants roots for certain period of time (Yusuf, 2010). Clay soils held more water than sandy soil (White, 1987). Organic matter has a high affinity for water. Soils high in organic matter retain more water than similar soils with low organic matter. Therefore, the present study aims to investigate the influences of texture and organic matter on water holding capacity of soils of Moran municipality areas in Sivasagar

district of Assam.

### MATERIAL AND METHODS

The study was conducted in Moran municipality area which covers about 2000 hectares of Sivasagar district of Assam and constitute of 11 wards. Tea and paddy are the important cultivation in this area. A total of 33 surface soil samples (0-15cm) were collected from roadside and agricultural areas. Composite soil samples were taken and prepared for necessary analysis in the laboratory (Gupta, 2007). The locations of sampling sites were determined by using Global Positioning System (GARMIN e-Trex 30).

Texture in the present experiment is determined by the Hydrometer method (Bouyoucos, 1962). Organic matter was determined by the procedure (Walkley and Black, 1974). Water holding capacity was determined by using the procedure (Gupta, 2007).

### RESULTS and DISCUSSION

#### Soil texture

The texture of the soil samples is given in Table 1. The results show that sand dominates over clay and silt, and the values could be arranged in the ranges of sand: 66.64 to 73.84%, silt: 4.84 to 6.04% and clay: 20.12 to 28.52 % respectively. It was reported that clay loam soil is considered as more preferable for agricultural crops (White, 1987), it is true for the present study because the municipality soil falls in this category.

**Table 1. Soil texture of Municipality soil samples**

(Surface soil, 0-20 cm depth)						
Sl.No	Name of ward	No of samples collected	Sand (%)	Silt (%)	Clay (%)	Textural class
1	ward 1	3	73.84	6.04	20.12	Sandy clay loam
2	ward 2	3	69.80	5.41	24.79	Sandy clay loam
3	ward 3	3	70.61	5.53	23.86	Sandy clay loam
4	ward 4	3	69.02	5.26	25.72	Sandy clay loam
5	ward 5	3	73.04	5.91	21.05	Sandy clay loam
6	ward 6	3	66.64	4.84	28.52	Sandy clay loam
7	ward 7	3	67.41	4.97	27.62	Sandy clay loam
8	ward 8	3	72.08	5.78	22.14	Sandy clay loam
9	ward 9	3	71.44	5.64	22.92	Sandy clay loam
10	ward 10	3	67.00	4.92	28.08	Sandy clay loam
11	ward 11	3	68.26	5.09	26.65	Sandy clay loam
	Min		66.64	4.84	20.12	
	Max		73.84	6.04	28.52	
	Mean		69.92	5.39	24.68	

**Soil total organic matter**

The total organic matter of the soil samples is given in Table 2. In the present study the values of total organic matter are ranges of 2.36 to 4.08 %. All the soil samples in study area contains sufficient amount of organic matter.

**Soil WHC**

The results of soil WHC (Table 2) were found to be 48.31 to 70.37 %. The municipality soils have sufficient WHC. It was found that as the clay fraction increases in the soil, the WHC increases, because clay can bind the water molecules more effectively. Thus soil possessing the high amount of clay will have increased WHC. Similar findings have been reported previously (Debnath et al., 2012; Nath,2015). It was also observed that as the total organic matter increases the WHC of soil increases. This clearly indicated that soil organic matter influences the ability of soils to retain water. Similar result was reported that addition of soil organic matter would increases the soil WHC (Debnath et al., 2012; Nath,2015).

**Table 2. TOM and WHC of Municipality soil samples**

(Surface soil, 0-15 cm depth)				
Sl.No	Name of ward	No of samples collected	TOM (%)	WHC (%)
1	ward 1	3	2.36	48.31
2	ward 2	3	3.09	60.54
3	ward 3	3	2.92	58.09
4	ward 4	3	3.24	63.05
5	ward 5	3	2.54	50.76
6	ward 6	3	4.08	70.37
7	ward 7	3	3.59	67.96
8	ward 8	3	2.68	53.21
9	ward 9	3	2.73	55.65
10	ward 10	3	3.84	69.63
11	ward 11	3	3.42	65.50
	Min		2.36	48.31
	Max		4.08	70.37
	Mean		3.13	60.28

**Relationship between Soil texture and WHC of the soil samples**

The simple correlation coefficient between soil texture and WHC of soil samples are given in Table 3. It was observed that the WHC of municipality soil depends upon the soil texture i.e. mainly clay fraction of the soil. As the percentage of clay fraction of the soil increases the WHC increases and on the other hand

as the percentage sand fraction increases the WHC decreases. It was found positive correlation between clay content and WHC (0.80). Similar relationship was also reported by the following workers (Upadhyaya et al., 2003; Ramesh et al., 2008; Debnath et al., 2012 and Nath, 2015). A negative correlation was observed between sand content and WHC (-0.78 ).Similar relationship was also reported by the following workers (Upadhyaya et al., 2003; Ramesh et al., 2008; Debnath et al., 2012 and Nath,2015).

**Table 3. Simple correlation coefficient between soil texture and TOM**

Related soil properties	Correlation coefficient	Level of significance
Clay content (%) - WHC (%)	0.80	Positive
Sand content (%) - WHC (%)	-0.78	Negative
TOM (%) - WHC (%)	0.82	Positive

**Relationship between TOM and WHC of the soil samples**

It was observed that the WHC of municipality soil also depend upon the TOM. As the TOM of the soil increase the WHC increases. It was found positive correlation between TOM and WHC of the soil (0.82). Similar relationship was also reported by the following workers (Upadhyaya et al., 2003; Ramesh et al., 2008; Debnath et al., 2012 and Nath, 2015).

**CONCLUSION**

The WHC of municipality soil is one of the important parameter of soil which controls the soil moisture. A strong positive relationship exists between soil texture, TOM and WHC. It was concluded that the increase of clay fraction and TOM of soil could increase soil WHC. Therefore, soil texture and TOM could influence the soil WHC.

**ACKNOWLEDGMENT**

The author is gratefully acknowledging the financial support of MRP (No.F.5-28/2013-14/MRP/NERO/431 of UGC-NERO, Guwahati, Assam, India.

**REFERENCE**

Adanu, G. K., Aliyu, A.K., Determination of the Influence of Texture and Organic Matter on Soil Water Holding Capacity in and Around Tomas Irrigation Scheme, Dambatta Local Government Kano State. Research Journal of Environmental and Earth Sciences. 4(12):1038-1044 (2012). Bouyoucos, G.J., Hydrometer Method improved for making particle size Analysis of Soil-Agron. J, 54, pp 464 (1962). Chan, K.Y.,Bawman,A.,and Oates,A.,Oxidizable organic carbon fractions and soil quality changes in an Oxie Paleustaff under different pasture leys. Soil Sc.,166 (1):61-67(2001). Das, T.H., Sarkar,D., Bera, R., and Gajbhiye, K.S.,Water retention characteristics of some typical inceptisols developed on all plain of Damodar catchment's ( part ),West Bengal, Ind.Soil. Cons., 33(2), 123-127(2005). Debnath, P., Deb,P., Sen,D., Pattnaik, S.K., Sah, D., and Ghosh, S.K., Physico-chemical properties and its relationship with water holding capacity of cultivated soils along altitudinal gradient in Sikkim., Int. J. Agric.Env. Biotech.,5(1),99-102,(2012). Gabler, R.E., Peter,J.F., Trapson,M., and Sack,D.,Physical Geography: Brooks/Cole. Belmont, USA (2009). Gupta, P.K., Method in Environmental analysis of water, soil and air. Second Edition, Agrobios, India (2007). Nath, T.N., Physico-chemical properties and its relationship with water holding capacity of roadside tea cultivated soils in Dibrugarh district of Assam, India. Indian Journal of Advances in Chemical Science, 3 (3):288-292(2015). Ramesh,V., Ballot, K.L., Sharma, Kausalya, R., Konwar, G.K., and Ramkrishna, S., Indian J. Dryland Agric. Res. Develop., 23,102-109 (2008). Soane, B.D.,Compell, D.J., and Herkes, S.M., The characterization of some Scottish arable topsoil by agricultural and engineering methods. I.Bid., 23:93-104(1972). Upadhyaya, A.S., Arunachalam,K.A., and Arunachalam, K.,Indian J. Soil Conservation.,5(1), 152-156(2012). Walkley, A., Black, C.A., Critical examination of rapid method of determining organic carbon in soil, Soil Sc.63:251-164(1974). Waugh, D., Geography: An Integrated Approach. 2nd Edn.,Nelson.UK (1995). White, R.E., In: Introduction to the principles and practice of soil science. English Language Book Society, Blackwell Scientific Publication, London(1987). Yusuf, M.A.,Soil survey and classification lecture series. Geography Department Batero University, Kano Ohler (2010).