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Estimation of Soil Organic Carbon, Soil Organic Matter and Bulk Density of Mill Corner Area of Aurangabad City, Maharashtra (India)

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ABSTRACT: Soil organic matter is an important soil property improves soil structure and soil ecological health. Soils rich in organic matter always better in their basic properties and productivity. Bulk density is an important parameter in the estimation of soil quality which is a correlated with soil organic matter. The present study was aimed at examining the relationship between bulk density, organic matter and organic carbon content in the collected soil samples. In the present research work soil samples were collected from Mill corner areas of Aurangabad city on monthly basis for a year. The samples were analysed for soil organic carbon in %, soil organic matter in % and bulk density in g/cm³. The average percentage of soil organic carbon during the rainy season is 1.789%, during the winter it is 1.45%, and during the summer it is 1.473%. The average percentage of soil organic matter during the rainy season is 2.43%, during the winter it is 2.457%, and in the summer it is 1.988%. The average bulk density during the rainy season is 1.007 g/cm³, in the winter it is 1.258 g/cm³, and in the summer it is 1.219 g/cm³. The standard method prescribed by APHA, developed in 1996 was used in the present research work. It is observed that soil is partially contaminated. Bulk density, Organic carbon and matter affected by many factors such as water, aeration status, root penetrate, clay content, texture, land use and management therefore it is a very important soil parameter.

KEYWORDS: bulk, density, soil, carbon, average, organic, matter

I. INTRODUCTION

There are many natural things are present on the Earth which is necessary for living organism for survival. Soil is the most important component of the global carbon cycle [2]. Soil organic carbon, being the largest terrestrial carbon pool performs a very significant role in global terrestrial ecosystem carbon balance [3]. Soil is a good medium for many reactions in the earth ecosystem [1]. Soil organic carbon has important role in alleviating the effects of greenhouse gases and storing, and it is very necessary for enhancing soil quality, sustaining and developing food production, maintaining clean water and reducing CO₂ in the ambient atmosphere. Soil organic carbon concentration is generally measured to evaluate soil "quality" [4]. Soil is the material consists of the important components like minerals, soil organic matter, living organisms, gas, and water. The soil carbon density and the information of its general distribution help us to determine the carbon sequestering potential of soil [5]. Increasing the soil organic carbon (SOC) content of arable land is closely interrelated with food security and mitigation of climate change [17], as SOC is the cornerstone of soil ecological health and plays a crucial part in maintaining major soil functions [19][18]. Good quality of soil retains water and release nutrients, enhancement and consistent root growth whilst maintaining biotic environment conditions, providing the expected result and resist filth. Most of the agricultural soil types in India are deficient in primary nutrients. Organic matter serves as a reservoir of the nutrients and water in the soil which aids in reducing compaction, surface crusting and increases water infiltration into the soil. To provide a meaningful spatial data to investigate various types of soils, the remote sensing techniques plays a vital role [6]. As soil is important component for growth of plants and surviving for living being. The color of various type of soil and the soil organic matter is strongly correlated with each other. The darker soils have large number of organic contents that shows bonding between the soil organic matter and visible reflectance [7]. To estimate these pools correctly, it is needed to determine the organic carbon contents and bulk density of the soils [8]. Soil is the source for most of the essential nutrients required by crops for their healthy growth. These nutrients are not always enough in the soil for a plant to grow healthy [15]. The quality of soil changes

significantly with the change in duration. The percentage of soil organic carbon, soil organic matter and bulk density varies in rainy, winter and summer months.

II. METHODOLOGY

Aurangabad city is located mainly in Godavari Basin on the bank of its tributary of Khamriver. The city is surrounded by hills in all directions, latitude 19° 53' and longitude 75° 23' of Aurangabad in Marathwada region. The average rainfall of Aurangabad district is about 734 mm and minimum temperature is 5.60 °C and maximum temperature is 45.90 °C [10]. SOC density of a soil sample with a depth (20 cm) is represented in SOCDD[11]. Soil samples were collected from various areas from mill corner area of Aurangabad city to check the quality of soil. Aurangabad is one of the fastest growing city of Marathwada. The average temperature observed in summer max 43°C and min. 28°C and in winter temperature max 32°C to 5°C, it was also observed by [13]. Soil sample from 10 different areas of mill corner of Aurangabad city and determined the percentage of soil organic carbon, soil organic matter, and bulk density in those areas on monthly basis. Bulk density was estimated by the field moist core sampling method of Kulte (1986) [9]. The soil samples were analysed for physical and chemical properties like electrical conductivity, soil fertility, water holding capacity, soil density, soil texture, pH, organic carbon, available P and K, % Ca, % Mg, % Na and % free lime using standard methods [12]. Aurangabad district is moderately alkaline in nature with soil pH range 7.4 to 8.4 with a mean value of 7.89 [16].



Fig 1: A map showing study area.

Figure 1 shows the study area for the soil organic carbon, soil organic matter, and bulk density of soil in the different seasons.

III. RESULT AND DISCUSSION

The results analysis of various soil samples are given in the table 1. We have taken a soil sample from 10 different areas in Aurangabad city to find the percentage of soil organic carbon, soil organic matter, and bulk density in Mill corner area. It is observed that percentage of carbon is varied as there is change in duration.

Table 1: Soil organic carbon, Soil organic matter and Bulk density observed at study area.

Study areas	Soil organic carbon (%)			Soil organic Matter (%)			Bulk density (g/cm ³)		
	Rainy	Winter	Summer	Rainy	Winter	Summer	Rainy	Winter	Summer
S1	0.75	1.78	2.07	2.46	3.45	2.93	1.73	0.49	1.32
S2	0.57	1.46	1.12	3.34	3.32	2.23	0.47	0.78	1.23



S3	2.46	2.35	2.01	1.98	2.52	2.69	0.94	0.98	0.87
S4	2.45	2.58	0.67	1.46	1.22	1.78	1.56	1.65	0.67
S5	2.76	1.35	1.45	2.74	3.21	2.34	1.78	1.54	1.56
S6	1.45	1.57	0.89	2.75	3.11	1.77	0.90	1.38	1.23
S7	1.23	1.32	0.92	1.89	2.66	1.45	0.15	1.75	0.98
S8	1.75	0.56	2.23	2.58	1.35	1.23	0.68	1.24	1.43
S9	2.45	0.67	2.03	3.67	1.97	1.98	0.48	1.65	1.34
S10	2.02	0.86	1.34	1.43	1.76	1.48	1.38	1.12	1.56
Average	1.789	1.45	1.473	2.43	2.457	1.988	1.007	1.258	1.219
Min.	0.57	0.56	0.67	1.43	1.22	1.23	0.15	0.49	0.67
Max.	2.76	2.58	2.23	3.67	3.45	2.93	1.78	1.75	1.56

The graphical representation of average, minimum and maximum percentage the soil organic carbon, soil organic matter and bulk density of 10 different areas is shown below. For the soil organic carbon, the average percentage during the rainy season is 1.789%, the minimum is 0.57%, and the maximum is 2.76%. During the winter season, the average percentage is 1.45%, with a minimum of 0.56% and a maximum of 2.58%. The average percentage during the summer season is 1.473%, the minimum is 0.67%, and the maximum is 2.23%. For the soil organic matter, the average percentage during the rainy season is 2.43%, the minimum is 1.43%, and the maximum is 3.67%. During the winter season, the average percentage is 2.457%, with a minimum of 1.22% and a maximum of 3.45%. The average percentage during the summer season is 1.988%, the minimum is 1.23%, and the maximum is 2.93%. For the bulk density, the average percentage during the rainy season is 1.007%, the minimum is 0.15%, and the maximum is 1.78%. During the winter season, the average percentage is 1.258%, with a minimum of 0.49% and a maximum of 1.75%. The average percentage during the summer season is 1.219%, the minimum is 0.67%, and the maximum is 1.56%.

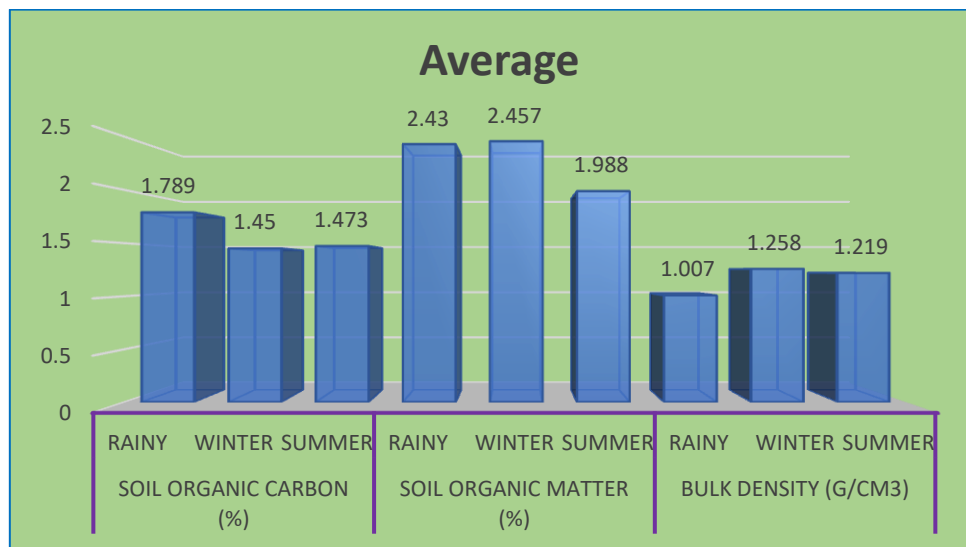


Fig 2: Graph showing average percentage of soil organic carbon, soil organic matter and bulk density.

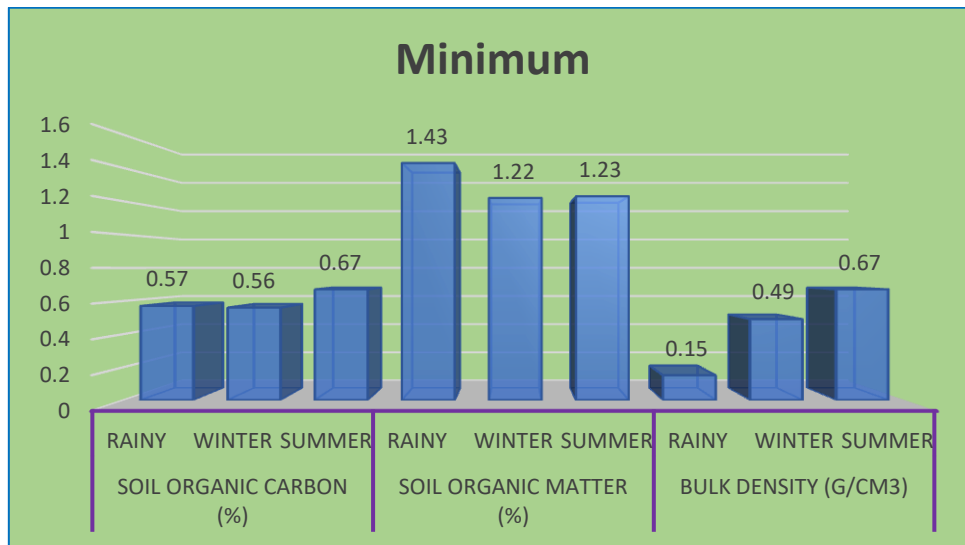


Fig 3: Graph showing minimum percentage of soil organic carbon, soil organic matter and bulk density.

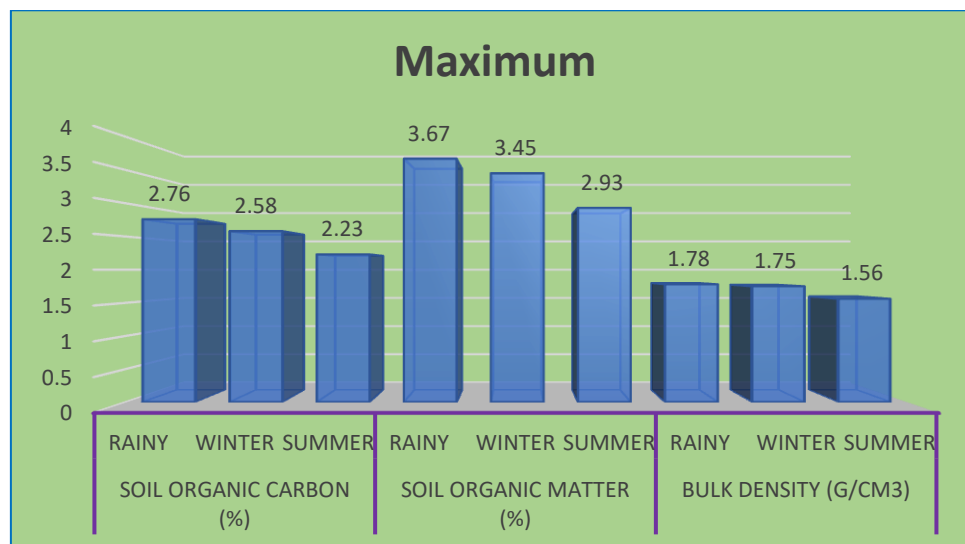


Fig 4: Graph showing maximum percentage of soil organic carbon, soil organic matter and bulk density.

Soil organic carbon is main component of the soil organic matter. Soil organic matter is a small but critical parameter of soils which contributes to better soil structure, fertility and a range of other chemical, physical and biological roles[14]. Polymerization reactions basically stabilize soil organic carbon either physically, ascribed to increased size and complexity of the micro/macro-aggregates or chemically, via enhancing the energy threshold to be overcome in microbial respiration[21]. The bulk density should be estimated at standardized moisture conditions, to prevent issues caused by water content variations in the swelling or shrinking of soils[20].

IV. CONCLUSION

Soil organic matter play a integral role in the transition of agriculture from an industrial model where high volumes of energetically expensive and ecologically damaging inputs are needed to achieve a high volume of outputs, to an ecosystem model, where adequate food is generated within sustainable energy and biogeochemical boundaries of the Earth planet. The standard method APHA, developed in 1996 was used for the present research work carried out at mill corner area of Aurangabad city soil in ten areas during 2021. The average percentage of soil organic carbon during the rainy season is 1.789%, during the winter it is 1.45%, and during the summer it is 1.473%. The average percentage of soil organic matter during the rainy season is 2.43%, during the winter it is 2.457%, and in the summer it is 1.988%. The average bulk density during the rainy season is 1.007 g/cm³, in the winter it is 1.258 g/cm³, and in the summer it is



1.219 g/cm³. Bulk density provides a crystal clear picture of the physical conditions of a soil. Soil samples collected from study area shows partial contamination of soil. Soil is the source for most of the essential nutrients needed by crops for their healthy growth.

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