Original Research Article

ASSESSMENT OF PHYSICAL PROPERTIES OF SOILS FROMDIFFERENTVILLAGES OF OSMANABAD DISTRICT,MAHARASHTRA, INDIA

Abstract:

The study was carried out with the objective of analysing the physical properties for determining depth wise nutrient distribution and variationfrom three different villages of Osmanabad district, Maharashtra.The twenty-seven soil samples were collected from three different villages on different depth that is 0-15 cm, 15-30 cm and 30-45 cm of farmer's fields. The colour of the soil sample in dry condition varies at different depths from dark yellowish brown to very dark brown and in wet condition it varies from very dark brown to black. The results revealed that the texture of soil was clay found in all the three respective depths. The Bulk density of different depths varied from 1.17 to 1.21 Mg m^{-3},Particle density from 2.46 to 2.53 Mg m^{-3}, PercentPore Space from 40.88% to 48.40%,Water Holding Capacity from 42.02% to 45.00 %.To maintain fertility of soil, farmers have to test their soils to obtain higher crop yield.

Comment [FKM1]: The abstract should be written in one paragraph

The researcher could have considered determining the macro and micronutrients distribution in the selected soil depths

Keywords: Physical Properties,Osmanabad District, Black cotton soil, WHC

Introduction:

The word soil represents one of the most active and complex natural systems on the earth's surface. It is essential for the existence of many forms of life and provides medium for plant's growth and also supplies the organisms with most of their nutritional requirements (Tewari*et al.*,2016).Soil is a natural body consisting of layers (soil horizons) of mineral constituents of variable thicknesses, which differ from the parent materials in their morphological, physical, chemical, and mineralogical characteristics.

It is composed of particles of broken rock that have been altered by chemical and environmental processes that include weathering and erosion. Soil differs from its parent rock due to interactions between the lithosphere, hydrosphere, atmosphere, and the biosphere. The soil is a complex organization being made up of some six constituents namely inorganic

matter, organic matter, soil organisms, soil moisture, soil solution and soil air (Nisha*et al.*,2017).

The physical and chemical characteristics of soil play a big role in the plant's ability to extract water and nutrients. Soil is that the product of biochemical weathering of the parent material and its formation is influenced by the soil formation factors like climate, organism, parent material, relief, and time (Belwal and Mehta, 2014). The physical properties of the soil depend upon the amount, shape structure, size, pore spaces, organic matter, and mineral composition of the soil. The chemical property of soil is the interaction of different chemical constituents between soil particles and solutions.

The physical properties are Bulk Density(Mg m^{-3}), Particle Density(Mg m^{-3}), Pore space (%), Water Holding Capacity (%), Soil Colour, Soil Texture. All soil properties differ and working with them needs an understanding of these properties. The knowledge about the physical and chemical properties helps in managing the resources while working with a particular soil. This study aimed to examine the structural status of soils in the different villages of Osmanabad district, Maharashtra. The aim is to set appropriate guidelines for sustainable productivity for better utilization and management of the soil for particular land use.

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Under this section explain how depth and the selected properties affects soil management

Also include latest references

Materials and Methods:

Site description~~Location:~~

Osmanabad is a district of Maharashtra and is located between 18.2070°N and 76.1784°E.The district has an area of 7,569 km^2 (District book, 2023). The entire study area divided into three villages i.e., Upla(Village1), Alani(Village2), Javla(Village3) of a Osmanabad District. From each village three plots were selected like Plot 1, Plot 2, Plot 3.

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Soil and climate

In Maharashtra, ‘Residual’ is the status of Soil and is derived from the underlying basalts.It composes the black soil, which is present in large amount in the Maharashtra. This type of soil is clayey, retains moisture and is rich in humus. The soil is commonly known as 'black cotton soil' or 'regur'. Osmanabad district lies in the southern part of Maharashtra. Osmanabad’s weather is dry and arid during summer months followed by humid climate in the rainy season and moderate to cool in winter months.

Data Collection

Soil sampling and analysis

Soil samples were collected from the three different villagesof Osmanabad district, Maharashtra. Three plots are selected for sampling from each village. Samples are taken from three depths i.e 0-15 cm, 15-30 cm, 30-45cm totally 27 soil samples were collectedwith the help of spade/garden hoe and khurpi.The sample was collected by cutting a V-shaped slice of the proper depth of about 15-20 cm then the samples were dried in shade and large clods were broken using wooden mallet. Using 2 mm sieve the powdered soils were sieved and were collected in a polythene bag and was labelled properly for laboratory analysis.

The collected samples were analysed for physical parameters.Soils were analyzed for its textural class by Bouyoucos hydrometer method (Bouyoucos, 1927), soil colour by using Munsell soil colour chart (Albert H. Munsell, 1954), bulk density and particle density was determined by graduated measuring cylinder method (Muthuvel*et al.*,1992) and Water Holding Capacity by keen’s cup method(Muthuvel*et al.*, 1992).

Result and discussion

Physical Properties

1. Soil colour

The colour of the soil sample in dry condition varies at different depths from dark yellowish brown (10YR, 3/2) to very dark brown (10YR,2/1)and in wet conditions; it also varies different depths from very dark brown (10YR, 2/2) to black (10YR,2/1). The similar research was also done by Kumar *et al.*, (2018).

2. Soil texture

The soil texture was clay found in all the three respective depths. The sand, silt and clay percent ranges from 10% - 12%, 15% - 20%, 70% - 75% respectively. A similar result analysis was reported by Patel *et al.*, (2017).

3. Bulk Density

The bulk density increases with the increase in soil depth. The bulk density decreased due to high organic matter content or vice versa. The mean bulk density of different depths varied from 1.17 to 1.21 Mg m^{-3}.The similar analysis was done by Bhuyan*et al.,* (2013).

4. Particle Density

Particle density varies according to the mineral content of soil particles.According to the farmer's field, the mean particle density of different depths of soil varied from 2.46 to 2.53 Mg m^{-3}.The similar analysis was done by Kumar *et al.,* (2018).

5. Pore Space (%)

Soil containing high organicmatterpossesses high porosity.Thepercent porespacedecreases with an increasein the depth ofsoil.The PercentPore Space of different soil depths varied from 40.88% to 48.40%. Similar resultwasreportedbyChoudhary*et al.*,(2020).

6. Water Holding Capacity

The water-retaining capacity of different soil depths varied from36.77% to 42.00 %. These variations were due to clay, silt, and organic carbon content. The WHC increased with an increase in the clay content at the sites and decreases with an increase in the depth of soil. The similaranalysis wasreportedbySahu*et al.*,(2014)and Sharma*et al.,* (2010).

Table1:Bulk density and Particle density (Mg m^{-3}) of soil in different villages of Osmanabad district at 0-15 cm, 15-30 cm, 30-45 cm depths.

Villages	Bulk Density (Mg m^{-3})			Particle Density(Mg m^{-3})		
	0-15cm	15-30cm	30-45cm	0-15cm	15-30cm	30-45cm
Upla (V_1)						
F1	1.15	1.19	1.19	2.41	2.47	2.50
F2	1.15	1.17	1.21	2.44	2.48	2.48
F3	1.17	1.19	1.20	2.46	2.46	2.50
Alani (V2)						
F1	1.17	1.21	1.24	2.49	2.49	2.51
F2	1.19	1.21	1.23	2.49	2.53	2.53
F3	1.18	1.19	1.21	2.46	2.47	2.50
Javla (V3)						
F1	1.16	1.16	1.19	2.49	2.47	2.49

F2	1.18	1.19	1.23	2.50	2.49	2.52
F3	1.17	1.17	1.21	2.47	2.49	2.50
	F-test	**S.Em(±)**	**C.D@5%**	**F-test**	**S.Em(±)**	**C.D@5%**
Depth(0-15cm)	NS	0.20	-	NS	0.04	-
Depth(15-30cm)	NS	0.016	-	NS	0.03	-
Depth(30-45cm)	NS	0.016	-	NS	0.03	-

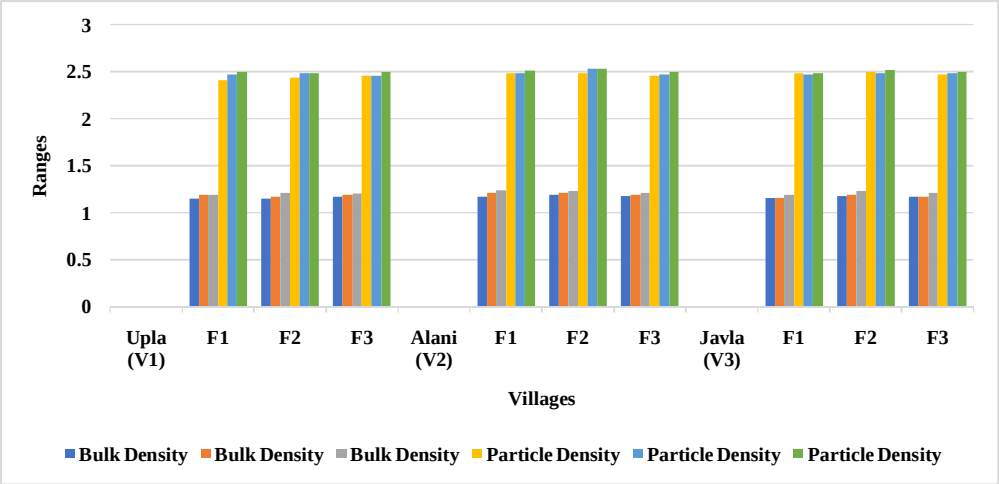

Fig 1:Bulk density and Particle density (Mg m^{-3}) of soil in different villages of Osmanabad district at 0-15 cm, 15-30 cm, 30-45 cm depths.

Table 2:Pore Space and Water Holding Capacityof soil in different villages of Osmanabad district at 0-15cm, 15-30cm, 30-45cm depths.

Villages	**Pore Space (%)**			**Water Holding Capacity (%)**		
	0-15cm	**15-30cm**	**30-45cm**	**0-15cm**	**15-30cm**	**30-45cm**
Upla (V_1)						
F1	47.40	47.05	46.80	44.10	43.89	43.56
F2	43.12	43.01	42.37	43.98	43.36	42.92
F3	47.96	46.36	45.93	43.88	43.01	42.86
Alani (V2)						

F1	48.36	47.93	46.86	43.78	42.62	42.02
F2	43.20	41.71	40.10	44.00	43.87	43.52
F3	49.36	48.98	48.36	44.89	44.07	43.96
Javla (V3)						
F1	46.13	45.27	43.26	45.00	44.84	44.10
F2	43.20	41.71	40.10	44.36	44.08	43.66
F3	42.39	40.70	40.10	43.38	43.01	42.78
	F-test	**S.Em(±)**	**C.D@5%**	**F-test**	**S.Em(±)**	**C.D@5%**
Depth(0-15cm)	S	0.69	2.01	NS	0.50	-
Depth(15-30cm)	S	0.78	2.32	NS	0.52	-
Depth(30-45cm)	S	0.59	1.77	NS	0.57	-

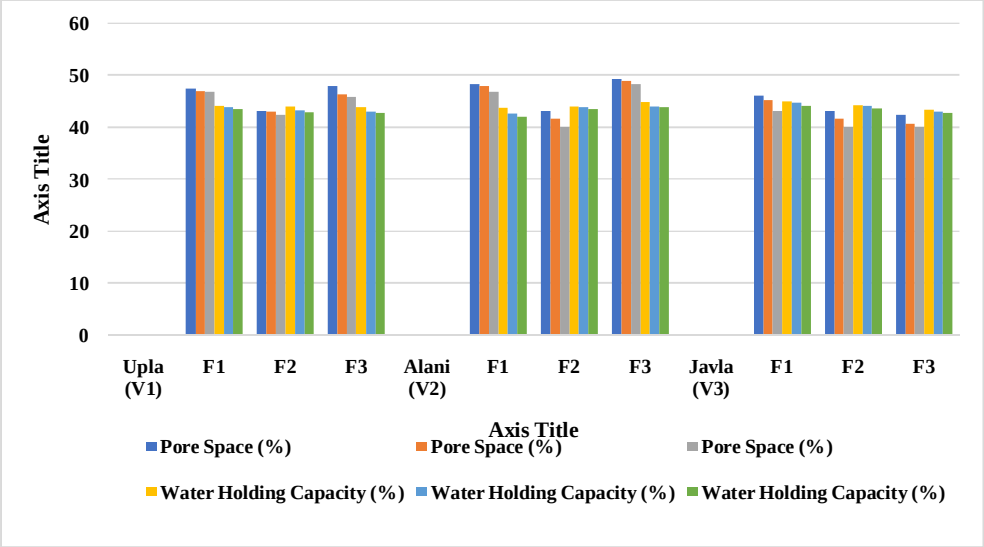

Fig 2:Pore Space and Water Holding Capacity (%) of soil in different villages of Osmanabad district at 0-15cm, 15-30cm, 30-45cm depths.

Conclusion

It can be concluded that the soils of different villages of Osmanabad district have a good physical condition which favours the cultivation of most of crops.The colour of soils slightly differs from dark brown to black. The soil texture showed high clay percentage therefore the water holding capacity of soil is also high.The bulk density of these soils was found

high.Because of the high fertility, good physical properties and retentivity of moisture the black soil is widely used for producing several important crops like cotton, wheat,jowar, linseed, castor, sunflower and millets.

References

Comment [FKM2]: Include more recent references

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