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## Physico-chemical properties in soils from Washi tahsil of Osmanabad district

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### Abstract

A survey was conducted to know physico-chemical properties in soils from Washi Tehsil of Osmanabad district by GIS technique. For this purpose 180 soil samples were collected from 30 villages of Washi tahsil according to their representative depths during the year 2012-2013. Collected soil samples were categorized into different soil orders. From each village 2 soil samples of Vertisol (> 30 cm), Inceptisol (10-30 cm) and Entisol (0-10 cm) were collected. These soil samples were analysed for physico-chemical properties. In physical analysis, bulk density, particle density, porosity, soil colour were studied. Average bulk density, particle density, porosity 1.53 Mg m<sup>-3</sup>, 2.39 Mg m<sup>-3</sup>, 35.95 per cent, respectively. The soils under the study were neutral to alkaline in reaction, safe in electrical conductivity, low to moderate in organic carbon content and non-calcareous to calcareous in nature.

**Keywords:** Physico-chemical properties, vertisol, inceptisol, entisol

### Introduction

Osmanabad district is the south western part of Marathwada region of Maharashtra state. This district comprises 8 tahsils, out of these, Washi tahsil is selected for study. Geographically, Osmanabad district is located between 18° 28' to 19° 28' North altitude and 76° 25' to 77° 25' East latitude. The geographical area of Osmanabad district is 7512.40 sq.km. The climate of the area is hot and dry having average annual rainfall 767.5mm. The major soils of the district were derived from "Deccan trap" rocks. The soils (Osmanabad district) are dominant in Smectite clay minerals, while Chlorite and Illite were moderately found in few soils. The geographical area of Washi tahsil is 53.03 sq.km. Washi tahsil, there is cultivation of different cereals, pulses, oilseed and horticultural crops. Average annual rainfall was 715.6 mm. The physico-chemical properties like pH, EC, calcium carbonate and organic carbon play important role in relation to availability of nutrients in soils and thereby on crop growth and production. The organic carbon is the store house of all plant nutrients. It provides good aeration, increases microbial activity, water holding capacity; maintain the soil pH, CO<sub>2</sub> level and calcium carbonate content in the soils. (Malewar,1995)<sup>[3]</sup>.

**Materials and methods:** Out of 54 villages of Washi tahsil 30 villages were selected for this study. The villages were selected randomly in such way that it should cover whole area of the tahsil. Total 180 soil samples were collected from thirty villages and six soil samples from each village of Washi tahsil were collected according to their representative depths. Further, from each village depth wise 2 soil samples of Vertisol (> 30 cm) Inceptisol (10-30 cm) and Entisol (0-10 cm), respectively. These soil samples were dried and processed. The samples were analysed for particle density and bulk density by Pycnometer and clod coating methods, respectively., (Das and Agrawal, 1997). The soil colour was determined in situ by using munsell names and munsell notations from munsell soil colour chart (Das and Agrawal, 1997). pH and Electrical conductivity (E.C.) in 1:2.5 soil water suspension (Jackson, 1978). Modified method of Walkely and Black (1934)<sup>[9]</sup> was used for determination of organic carbon. The free calcium carbonate was determined by rapid titration method as outlined by Piper (1966)<sup>[7]</sup>. The data obtained from present study was discussed under the following heads.

### Result and Discussion

#### Physical Characteristics

The data present in table 1 revealed that the average particle density, bulk density and porosity of soils of Washi tahsil was 2.39 Mg m<sup>-3</sup>, 1.53 Mg m<sup>-3</sup>, 35.95 %, respectively. In physical characteristics no remarkable differences was observed in between different soil orders except soil colour. In case of soil colour black, dark reddish brown in Vertisol, Inceptisol, Entisol, respectively.

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**Table 1:** Physical characteristics of soils under Washi tahsil

Soil orders	No of samples		Particle density(Mg m <sup>-3</sup> )	Bulk Density (Mg m <sup>-3</sup> )	Porosity (%)	Soil Colour
Vertisols	60	Range	2.00-2.96 (2.39)*	1.24-1.95 (1.53)*	13-55 (35.95)*	Black
Inceptisols	60	Range	2.03-2.96(2.40)*	1.13-1.86 (1.50)*	20-56 (37.66)*	Dark reddish brown
Entisols	60	Range	2.06-2.83(2.38)*	1.20-1.97 (1.52)*	10-50(36.15)*	Dark reddish brown

\*Figures in paranthesis are mean

### Chemical properties

The data presented in table 2 revealed that the pH of Vertisols, Inceptisols and Entisols ranged from 4.5 to 8.1, 6.3 to 8.5 and 6.7 to 8.3, with mean values of 7.46, 7.53, 7.59, respectively. In Vertisol, Inceptisol and Entisols soil order 60, 53 and 55 % soil samples were alkaline in reaction, respectively. (Table 3, Fig 1). These values of soil pH indicated that most of the soils under study are neutral to alkaline in reaction. The relative high content of pH in these soils might be due to origin of soil from basaltic parent material which is inherently rich in basic cations. Padole and Mahajan (2003) [6] reported that the pH of swell-shrink soils of Vidarbha region of Maharashtra state were ranged from 7.2 to 8.9. The EC of soils varied from 0.08 to 0.54, 0.10 to 0.42 and 0.08 to 1.70 dS m<sup>-1</sup>, in Vertisol, Inceptisol and Entisol., respectively. The values indicated that the soils of Washi tahsil were safe to normal in EC. The low EC in these soils might be due to proper management of soil and thereby leaching of salts take place from surface to subsurface. (Patil and Kharche, 2000) [5].

From below data, it is observed that the soils of Washi tahsil were 57 per cent low, 27 per cent medium and 16 per cent high in organic carbon content. (Fig 2) .The values indicated that the soils of Washi tahsil were low to medium in organic carbon content. The organic carbon content in the Vertisols,

Inceptisols and Entisols were ranged from 0.60 to 10.40, 0.50 to 10.40 and 0.10 to 0.40 g kg<sup>-1</sup> with mean value 4.55,4.81 and 4.31 g kg<sup>-1</sup>., respectively. Waikar *et al.* (2004) [8] reported that the organic carbon in the soils of Marathwada region were ranges from 7.0 to 25.0 g kg<sup>-1</sup>.

The calcium content in Vertisols, Inceptisols and Entisols ranged from 11 to 123 g kg<sup>-1</sup>, 4.0 to 168 and 4.0 to 202 g kg<sup>-1</sup>., respectively, (Table 2). Among three categorizations, it showed that low CaCO<sub>3</sub> was found in Vertisol (53 %), Inceptisol (47 %) and Entisol (28 %), respectively, while the medium CaCO<sub>3</sub> was found in Vertisol (47 %), Inceptisol (48 %) and Entisol (63%), respectively and highly calcareous soils were found only in Inceptisol (5 %) and Entisol (8 %) CaCO<sub>3</sub>, (Table 3). The data narrated that CaCO<sub>3</sub> content of these soils were found non calcareous in Vertisol, calcareous in Entisol and Inceptisol. Highly calcareous soils was found in Entisol. The values indicated that the soils of Washi tahsil were non calcareous to calcareous in nature. The low to medium CaCO<sub>3</sub> content in soils might be due to fact that presence of CaCO<sub>3</sub> in powdery form and hyper thermic temperature regime of Washi tahsil. The CaCO<sub>3</sub> content of the pedons increased with depth, which explains downward movement of calcium and decomposition of CaCO<sub>3</sub>.These results are in confirmatory with the results reported Meena *et al.* (2006) [4].

**Table 2:** Chemical properties of soils under Washi tehsil

Soil orders	No of samples		pH	EC (dS m <sup>-1</sup> )	Organic carbon (g kg <sup>-1</sup> )	Calcium carbonate (g kg <sup>-1</sup> )
Vertisols	60	Range	4.5-8.1(7.46)*	0.08-0.54 (0.192)*	0.60-10.40 (4.55)*	11-123 (54.36)*
Inceptisols	60	Range	6.3-8.5 (7.53)*	0.10-0.42 (0.193)*	0.50-10.40 (4.81)*	4.0-168 (46.52)*
Entisols	60	Range	6.7-8.3 (7.59)*	0.08-1.70 (0.235)*	0.10-0.40 (4.31)*	4.0-202 (83.51)*

\*Figures in paranthesis are mean

N.ca- Non calcareous, Ca. - Calcareous, H.ca-Highly calcareous

**Table 3:** Order wise categorization of soils from washi thasil on the basis of chemical properties

Parameters	Soil order								
	Vertisol			Inceptisol			Entisol		
pH	Acidic (<6.5)	Neutral (6.5-7.5)	Alkaline (>7.5)	Acidic (<6.5)	Neutral (6.5-7.5)	Alkaline (>7.5)	Acidic (<6.5)	Neutral (6.5-7.5)	Alkaline (>7.5)
%	3	37	60	2	45	53	0	45	55
No of samples	2	22	36	1	27	32	0	27	33
EC (dS m <sup>-1</sup> )	Safe (<0.8)	M.Safe (0.8-2.5)	Unsafe (>2.5)	Safe (<0.8)	M.Safe (0.8-2.5)	Unsafe (>2.5)	Safe (<0.8)	M.Safe (0.8-2.5)	Unsafe (>2.5)
%	100	-	-	100	-	-	97	3	-
No of samples	60	-	-	60	-	-	58	2	-
Organic carbon (g kg <sup>-1</sup> )	Low (<5)	Medium (5-10)	High (>10)	Low (<5)	Medium (5-10)	High (>10)	Low (<5)	Medium (5-10)	High (>10)
%	58	30	12	52	31	17	62	20	18
No of samples	35	18	7	31	19	10	37	12	11
Calcium carbonate (g kg <sup>-1</sup> )	N.Ca (<50)	Ca. (50-150)	H. Ca (>150)	N.Ca (<50)	Ca. (50-150)	H. Ca (>150)	N.Ca (<50)	Ca. (50-150)	H. Ca (>150)
%	53	47	0	47	48	5	28	64	8
No of samples	32	28	0	28	29	3	17	38	5

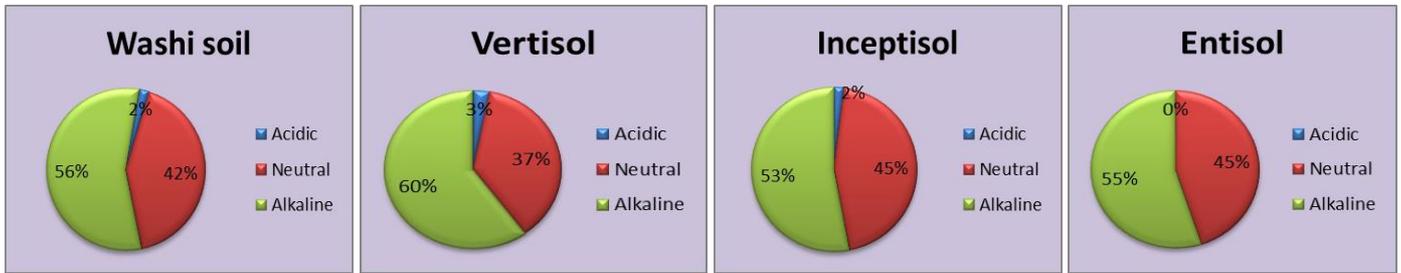


Fig 1: Soil pH of Washi tahsil

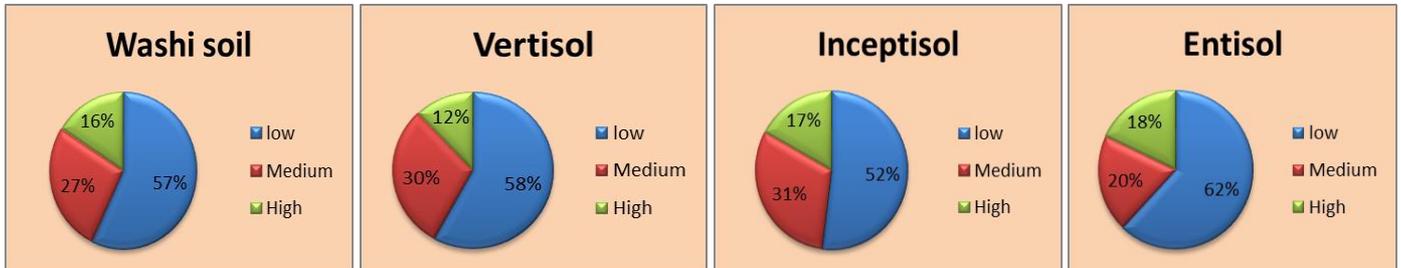


Fig 2: Organic carbon content content in soils of Washi tahsil

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