Characterisation of soil properties of CRC-2 and CRC-3 at ITM University, under Gwalior region, M.P

Abstract

The present **"Characterisation of soil properties of CRC-2 and CRC-3 at ITM University, under Gwalior region, M.P"** was carried out during the year 2024 in the department of soil science and agricultural chemistry, school of agriculture, ITM University, Gwalior. I collect the soil by traversing representative areas of CRC-2 and CRC-3, the soil survey under the high intensity. For the CRC-2 the total soil is 36 and for the CRC-3 is 66 and the soil is collected surface (0-15cm) and sub-surface (15-30cm). The collected soil is preparing for the various analysed of soil physical parameters like bulk density, mechanical analysis, porosity, particle density, moisture content, osmotic pressure and total dissolved soil. The bulk density of surface for the CRC-2 is range from 1.32 to 1.38 mg m^{-3} and the sub-surface is 1.36 to 1.41 mg m^{-3} while for the CRC-3 surface value of bulk density is ranged from 1.32 to 1.39 mg m^{-3} and the sub-surface is ranged from 1.35 to 1.44 mg m^{-3}. The mechanical analysis of surface for the CRC-2 is ranged from 59.7 to 61.0% and the sub-surface is ranged from 55.7 to 57.3%, for the CRC-3, it ranged from the 59.7 to 61.5% for surface and the sub-surface is ranged from 55.7 to 57.6%. The porosity of CRC-2, it ranged from 49.5 to 49.8% in surface and 50.0 to 50.7% in the sub-surface, where for the CRC-3 it ranged from 49.5 to 50.7% in the surface and 49.6 to 50.9% in the sub-surface. The silt% in the CRC2 is ranged from the 18.5 to 20.2% in surface and 16.7 to 18.5% in sub-surface while, CRC3 the silt% are ranged from18.53 to 20.30 % in surface and 16.6 to 19.4% in sub-surface The clay (%) of the CRC 2 are ranged from the 19.6 to 21.8% in surface and 21.4 to 23.4% in sub-surface while for the CRC 3 are ranged from the 19.6 to 21.8% in surface and sub-surface is 21.3 to 23.5%. Particle density for the CRC-2 ranged from 2.33 to 2.59 g cm^{-3} in the surface and 2.61 to 2.80 g cm^{-3} in sub-surface, for the CRC-3 it ranged from 2.30 to 2.58 g cm^{-3} in the surface and 2.59 to 2.90 g cm^{-3} in sub-surface. The moisture content of CRC-2 is ranged from 12.33 to 12.77% in the depth of 0-15cm and 12.85 to 13.23% in the depth 15-30cm. And the CRC-3 the value is ranged from 12.35 to 12.87% in the depth of 0-15cm and 12.86 to 13.35% in the depth of 15-30cm. The osmotic pressure for the CRC-2 is ranged from 0.175 to 0.183 N m^{-2} in the depth of 0-15cm and 0.182 to 0.187 N m^{-2} in the depth of 15-30cm where for the CRC-3 it ranged from 0.174 to 0.184 N m^{-2} in the depth of 0-15cm and 0.182 to 0.190 N m^{-2} in the depth of 15-30cm. Total dissolved soil for the CRC-2 ranged from 493.0 to 497.1% in the depth of 0-15cm and

497.7 to 503.9% in the depth of 15-30cm and for the CRC-3 it ranged from 494.1 to 498.8% in the depth of 0-15cm and 497.2 to 503.5% in the depth of 15-30cm.

Keywords: Bulk density, Soil texture, Porosity, Particle density, Moisture content, Osmotic pressure and Total dissolved soil.

1. Introduction

Madhya Pradesh has five major types of soil: black soil, red and yellow soil, alluvial soil, laterite soil, and mixed soil. In Gwalior district most of the soil is the sandy loam soil in this region. In Madhya Pradesh, the total area of waste land is 3, 14, 000 hectares and the total area of under cultivation is 17.31 lakh hectares. Soil fertility is one of the main factors influencing crop productivity. A thorough grasp of the state of soil fertility is crucial for identifying barriers to crop production for sustained productivity and supporting agrotechnology transfer programs. Madhya Pradesh has varied soil, water, climate, and agricultural biodiversity. Gird zone is located in the central highlands. Except for the end of Rajasthan's Aravali ranges, the most of the region is flat and devoid of hills or mountains. Ravers can be found in Madhya Pradesh along the Yamuna's tributaries, including the Sindh, Chambal, Betwa, and Kunwari rivers. The majority of these are state's north-flowering peninsular rivers. About 6.83 lakh hectares (ha) of India's estimated 20.6 lakh ha of ravines are in Madhya Pradesh.

Madhya Pradesh's (MP) Gird zone has medium black soils, ravine land, and alluvial soils. Widespread ravines are a major issue for humans in the regions of Bhind and Morena. Alluvial soils erode to create these ravines. All soil-related landscape-scale environmental and agricultural research necessitates a spatial and frequently temporal understanding of the physio-chemical characteristics of the soil.

In addition to the thermal stress brought on by global warming, recent research on predicted climate changes investigated by global climate models (GCMs) indicates that stress on tropical Asia's water availability is likely to worsen in the future (IPCC, 1996a). Additionally, research points to a significant decline in crop yields in tropical regions that are both arid and subhumid (IPCC, 1996b). Although these are long-term evaluations that concentrate on average effects over time and space, the effects of climate change may be more severe at regional and local scales, especially in developing nations like India, which occupy just 2% of the planet's land area but are home to more than 15% of all livestock and approximately 18% of all people. India is heavily dependent on the monsoon rainfall, with over 65% of its gross cultivated area falling between June and September. The country receives 70% of its annual rainfall during this time. To maintain a balanced growth and development in

agriculture (growth rate of 2.37% year from 1990 to 1996), a thorough analysis and evaluation of the probable effects of climate variability and change on agricultural output is necessary.

Increased productivity of agricultural soils with a high degree of spatial variability due to the combined effects of physical, chemical, or biological processes can be achieved by soil test-based fertility management (Goovaerts, 1998). This included the predominance of small-holding farming practices in India and the dearth of infrastructure suitable for conducting thorough soil testing. In this regard, GIS-based mapping of soil fertility has emerged as a viable substitute. By adopting a more sensible approach than farmer practices or the general application of state-recommended fertilization, the use of such maps as a decision support tool for nutrient management will also lessen the need for complex plot-by-plot soil testing procedures. Information about this application of GIS-based fertility maps in India, however, is lacking.

2. Material and Methods

An evaluation based on the experiment with the title **"Characterisation of Soil properties of CRC-2 and CRC-3 at ITM University, M.P under Gwalior region"** will be conducted at CRC-2 and CRC-3 department of soil science and agricultural chemistry at ITM materials and methods used in the field and laboratory.

2.1. Experimental Site

The experimental field is located at $26^0$8'23.39'' N and $78^0$11'42'' E. The region is leis in 211.52 meter from above the sea level. In the field of the CRC 2 and CRC 3 of the department of soil science and agriculture chemistry, ITM University (School of Agriculture), Gwalior, MP is the site of the examination related to the topic.

2.2. Climate and Weather Condition

The research work is conducted on CRC 2 and CRC 3 the field of ITM University, Gwalior, MP. The region is exposed to both summer and winter condition. The climate and weather of the Gwalior is characterising as humid subtropical climate with dry hot summer (late March to June) and winter (mid-November to February). The moderate rainfall amount up to 780 milli-meter (30.7 inches) per year.

2.3. Collection and Processing of the Soil Sample

The soil sample is collected from the fields of the CRC 2 and CRC 3 of ITM University, Gwalior district, MP, in the zig zag pattern. The depth of the soil sample is from 10-15cm and 15-30cm while collecting the soil sample we use GPS. With the help of screw auger collect the soil and stored in the polythene bag. Collected soil sample will be air dried in shade (do not

use the sun light for soil dry). For the analysis the dry soil is crushed gently with the help of wooden roller and pass through the 2mm sieved to obtain a uniformed sample. The sieving soil will be properly level with the aluminium tag and carefully stored in the polythene bags for the research works.

2.4. Experimental parameter (Use Bullets)

1. Bulk Density
2. Soil texture
3. Porosity
4. Particle Density
5. Moisture Content
6. Osmatic Pressure
7. Total Dissolved Soils

1. Bulk Density

Soil bulk density was determined by the core method. Mass of solids and water content of the soil were determined by weighing the wet core, drying it to constant weight in an oven at 105˚C as described in Singh *et* al. (1989).

2. Soil texture

Soil texture of soil sample was determined by hydrometer method (Bouyoucos, 1962) as described in Baruah and Barthakur (1999) and the textural class was found from USDA textural triangle.

3. Porosity

Porosity is defined as the amount of space occupied by air and water inside the soil particles. The porosity of the soil samples are calculated using the formula-

Porosity = 1 - (Bulk Density \ Particle density)

4. Particle density

Particle density of a soil sample is calculated from two measured quantities namely mass of the soil solid and its volume. As pycnometer was used to determine the particle density and the method is known as “Pycnometer method”.

5. Moisture Content

Moisture content is the ratio of the mass of water contained in the pore spaces of solid mass of particles in the material, expressed as a percentage. It was described by the Coleman and Fellows (1925).

Moisture% = (Wet soil weight – Dry soil weight) / Dry soil weight

6. Osmotic pressure

Osmotic pressure = EC x 0.36 N m^{-2}

7. Total Dissolved Soil

TDs = EC x 1064 %

3. Result and Discussion

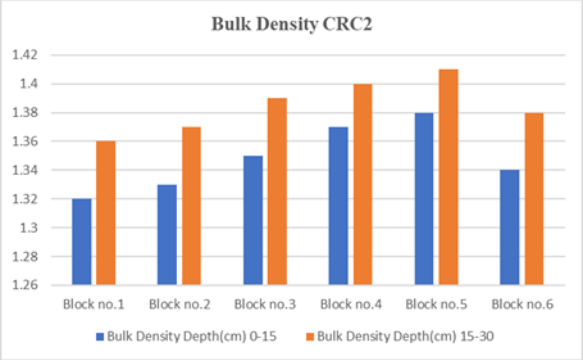
3.1. Bulk Density

The bulk density of soil at surface and subsurface various block of CRC2 and CRC3 of ITM university research field. The ranged of bulk density of soil of CRC2 is from 1.32 to 1.38 in the depth of 0-15cm and 1.36 to 1.40 in the depth of the 15-30cm of soil. And the block no.5 has the high bulk density as compared to the other blocks because of the higher prone sandy soil as compared to other. While for the CRC3 the bulk density of the soil are ranged from 1.32 to 1.39 in the depth of 0-15cm and 1.35 to 1.44 in the depth of 15-30cm of soil. For the CRC3 block no.3 has the higher as compared to other and the block no.6 is the lowest. E. Saki n et. al. (2011) and T. Aşkın, N. Özdemir (2003).

Bulk Density (Mg m^{-2})		
Location	**Depth(cm)**	
CRC2	**0-15**	**15-30**
Block no.1	1.32	1.36
Block no.2	1.33	1.37
Block no.3	1.35	1.39
Block no.4	1.37	1.40
Block no.5	1.38	1.41
Block no.6	1.34	1.38
C.D.	**0.03**	**0.03**
SE(m)	**0.01**	**0.01**
SE(d)	**0.01**	**0.01**
C.V.	**1.20**	**1.00**

Bulk Density (Mg m^{-2})		
Location	**Depth(cm)**	
CRC3	**0-15**	**15-30**
Block no.1	1.35	1.36
Block no.2	1.37	1.39
Block no.3	1.39	1.44
Block no.4	1.34	1.38
Block no.5	1.36	1.40
Block no.6	1.32	1.35
Block no.7	1.35	1.36
Block no.8	1.37	1.39
Block no.9	1.36	1.41
Block no.10	1.34	1.38
Block no.11	1.34	1.39
C.D.	**0.03**	**0.02**
SE(m)	**0.01**	**0.01**
SE(d)	**0.01**	**0.01**
C.V.	**1.20**	**0.98**

Table No.1 Bulk Density of the CRC-2 and CRC-3.



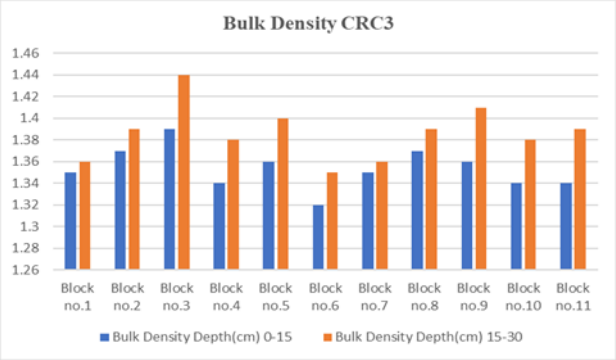


Fig. No.1 Bulk Density of the CRC-2 and CRC-3.

3.2. Soil texture

Sand (%)

The sand% in the different location of the CRC2 is ranged from the 59.7 to 61.0% in the depth of 0-15cm and 55.7 to 57.3% in the depth of 15-30cm. The block no.6 has the higher sand content as compared to other blocks because the water flows straight through it and the block no.3 is the lowest sand content. While for the CRC3 the sand% are ranged from 59.7 to 61.5% in the depth of 0-15cm and 55.7 to 57.6 in the depth of 15-30cm. In the CRC3 block no.8 has the higher as compared to the other blocks and block no.2 is the lowest. These results are also found with the observation of Wani, 2001 and Wani *et al.* 2016.

Silt (%)

The silt% in the different location of the CRC2 is ranged from the 18.5 to 20.2% in the depth of 0-15cm and 16.7 to 18.5% in the depth of 15-30cm. The block no.6 has the higher silt content as compared to other blocks because block no.6 had the lowlands as compared to other that's why heavy rain pound the soil some of these fine granular particles are carried by the runoff water and deposited. While for the CRC3 the silt% are ranged from18.53 to 20.30 % in the depth of 0-15cm and 16.6 to 19.4% in the depth of 15-30cm. In the CRC3 block no.11 has the higher as compared to the other blocks and block no.2 is the lowest. Shama *et al.* (2005), Dar (2009), Najar (2009). Naik (2014) reported similar observations which working with the soils Punjab and Kashmir respectively.

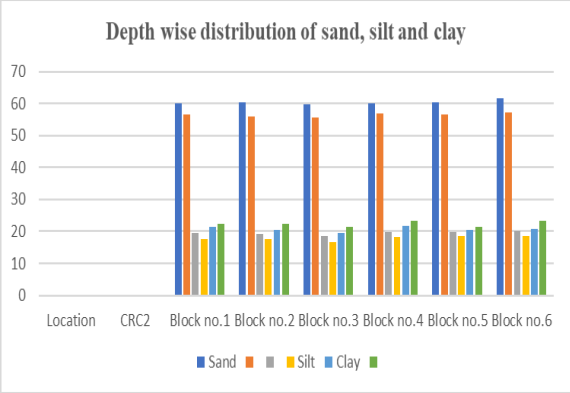
Clay (%)

The clay (%) of the soil of studied area of CRC 2 are ranged from the 19.6 to 21.8% in the depth of 0-15cm and 21.4 to 23.4% in the depth of 15-30cm while for the CRC 3 are ranged from the 19.6 to 21.8% in the depth of 0-15cm and in the depth 15-30cm is 21.3 to 23.5%.

Depth wise distribution of sand, silt and clay % of soil						
	Sand		Silt		Clay	
Location	Depth(cm)		Depth(cm)		Depth(cm)	
CRC2	0-15	15-30	0-15	15-30	0-15	15-30
Block no.1	60.0	56.4	19.5	17.6	21.5	22.3
Block no.2	60.2	56.0	19.3	17.5	20.6	22.3
Block no.3	59.7	55.7	18.5	16.7	19.6	21.4
Block no.4	60.1	56.9	19.8	18.3	21.8	23.4
Block no.5	60.3	56.5	19.7	18.4	20.4	21.5
Block no.6	61.5	57.3	20.2	18.5	20.7	23.3
C.D.	N/A	0.4	0.4	0.4	0.4	0.4
SE(m)	0.3	0.1	0.1	0.1	0.1	0.1
SE(d)	0.4	0.2	0.2	0.2	0.2	0.2
C.V.	0.7	0.4	1.2	1.3	0.9	1.0

Depth wise distribution of sand, silt and clay % of soil						
	Sand		Silt		Clay	
Location	Depth (cm)					
CRC3	0-15	15-30	0-15	15-30	0-15	15-30
Block no.1	60.2	55.9	18.87	17.73	20.4	23.4
Block no.2	59.7	55.7	18.53	16.63	21.5	22.8
Block no.3	60.1	56.5	19.50	18.36	21.8	23.5
Block no.4	60.5	56.4	19.33	16.70	20.6	22.3
Block no.5	60.3	56.0	19.77	17.47	21.5	21.4
Block no.6	61.0	56.9	18.53	18.33	21.4	22.4
Block no.7	60.2	57.3	19.33	17.63	20.6	22.3
Block no.8	61.5	57.6	20.23	19.40	19.6	21.3
Block no.9	60.5	56.4	19.77	18.43	21.5	22.3
Block no.10	60.5	55.7	19.67	18.30	20.4	21.5
Block no.11	60.3	56.0	20.30	17.63	20.7	23.3
C.D.	0.7	0.4	0.35	0.394	0.3	0.4
SE(m)	0.2	0.1	0.12	0.133	0.1	0.1
SE(d)	0.3	0.2	0.16	0.188	0.2	0.2
C.V.	0.7	0.4	1.04	1.292	1.0	1.0

Table No.2 Soil Texture of the CRC-2 and CRC-3.



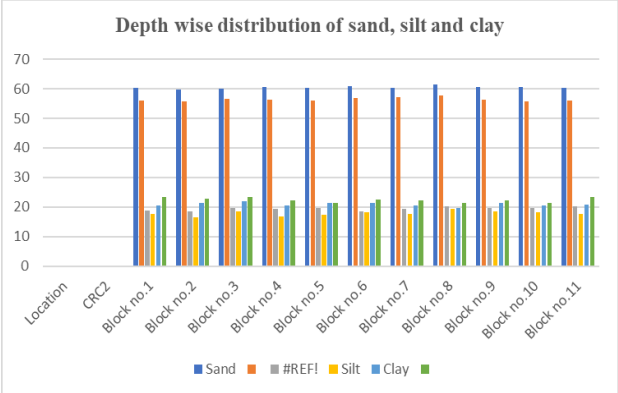


Fig. No.2 Soil Texture of the CRC-2 and CRC-3.

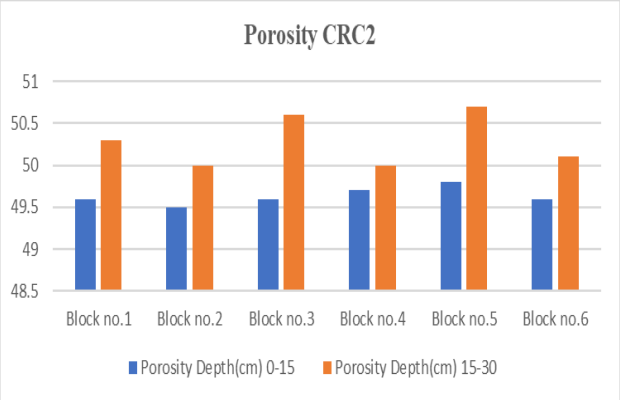
3.3. Porosity

The porosity% of the CRC2 of ITM University of the soil is ranged from the 49.5 to 49.8% in the depth of 0-15cm and 50.0 to 50.7% in the depth of 15-30cm. In CRC2 the block no.5 has the highest as compared to other blocked and block no.2 is the lowest as compared to other. Porosity is high because the content of organic matter is higher as compared to other blocks. The porosity% of the CRC3 are ranged from 49.5 to 50.7% in the depth of 0-15cm and 49.6 to 50.9% in the depth 15-30cm. For 0-15cm block no.7 is the lowest and block no.3 has the highest as compared to others. Yadav et. al. (2018), Singh et. al. (2017) and Mathan and Mahendra (1994) all noted the same tendency.

Porosity (%)		
Location	**Depth(cm)**	
CRC2	**0-15**	**15-30**
Block no.1	49.6	50.3
Block no.2	49.5	50.0
Block no.3	49.6	50.6
Block no.4	49.7	50.0
Block no.5	49.8	50.7
Block no.6	49.6	50.1
C.D.	**N/A**	**N/A**
SE(m)	**0.1**	**0.2**
SE(d)	**0.2**	**0.3**
C.V.	**0.5**	**0.6**

Porosity (%)		
Location	**Depth(cm)**	
CRC3	**0-15**	**15-30**
Block no.1	50.3	50.6
Block no.2	50.0	50.0
Block no.3	50.7	50.9
Block no.4	50.1	50.1
Block no.5	49.7	50.0
Block no.6	49.6	50.6
Block no.7	49.5	49.6
Block no.8	49.6	50.7
Block no.9	49.7	50.1
Block no.10	49.6	50.0
Block no.11	49.7	49.7
C.D.	**0.5**	**0.3**
SE(m)	**0.2**	**0.1**
SE(d)	**0.2**	**0.1**
C.V.	**0.5**	**0.4**

Table No.3 Porosity of the CRC-2 and CRC-3.



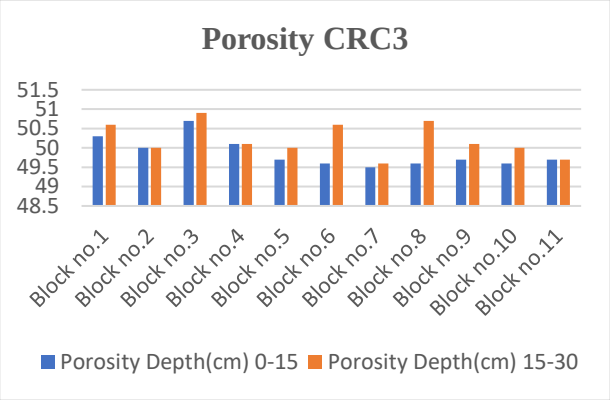


Fig. No.3 Porosity of the CRC-2 and CRC-3.

3.4. Particle Density

The particle density of the CRC2 of ITM University is ranged from 2.33 to 2.59g m^{-3} in the depth of 0-15cm and 2.61 to 2.80g m^{-3} and the CRC3 of the ITM University, particle density is ranged from 2.30 to 2.58g m^{-3} in the depth of 0-15cm and 2.59 to 2.90g m^{-3} in the depth of 15-30cm. For CRC2, In the depth of 0-15cm block no.3 has the lowest and block no.5 had the higher as compared to the other blocks. Particle density is high because of the void content of the particles and the chemical composition and structure of the minerals in the soil. For CRC3 block no.7 is the lowest and block no.9 is the higher in the depth of 0-15cm and 15-30cm. It showed that the increase in the depth increase the particle density in the soils. Chaudhari, P.R. Mire. D.V. and Ahire. V D. (2012) and Chohan, M. et. al. (2015).

Particle Density (g cm^{-3})		
Location	**Depth(cm)**	
CRC2	**0-15**	**15-30**
Block no.1	2.53	2.77
Block no.2	2.50	2.65
Block no.3	2.33	2.61
Block no.4	2.57	2.77
Block no.5	2.59	2.80
Block no.6	2.50	2.63
C.D.	**N/A**	**N/A**
SE(m)	**0.09**	**0.08**
SE(d)	**0.13**	**0.12**
C.V.	**6.41**	**5.32**

Particle Density (g cm^{-3})		
Location	**Depth(cm)**	
CRC3		
Block no.1	2.52	2.73
Block no.2	2.51	2.73
Block no.3	2.50	2.77
Block no.4	2.37	2.60
Block no.5	2.53	2.77
Block no.6	2.50	2.60
Block no.7	2.33	2.59
Block no.8	2.57	2.60
Block no.9	2.58	2.90
Block no.10	2.43	2.80
Block no.11	2.30	2.63
C.D.	**N/A**	**N/A**
SE(m)	**0.09**	**0.09**
SE(d)	**0.13**	**0.13**
C.V.	**6.54**	**5.92**

Table No.4 Particle Density of CRC-2 and CRC-3.

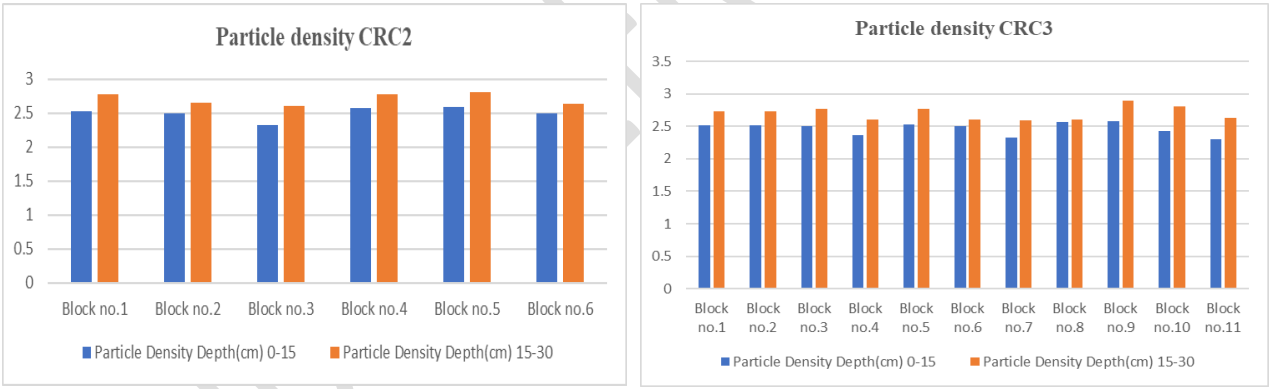


Fig. No.4 Particle Density of CRC-2 and CRC-3.

3.5. Moisture Content

The moisture content of the CRC2 of ITM University is ranged from the 12.33 to 12.77% in the depth of 0-15cm and 12.85 to 13.23% in the depth of 15-30cm. For CRC3 of the ITM University, moisture content is ranged from 12.35 to 12.87% in the depth of 0-15cm and 12.86 to 13.35% in the depth of 15-30cm. Deekor et. al. (2012) and Desavathu et. al. (2017).

Moisture Content%		
Location	Depth(cm)	
CRC2	0-15	15-30
Block no.1	12.50	13.04
Block no.2	12.33	12.85
Block no.3	12.43	12.98
Block no.4	12.67	13.21
Block no.5	12.77	13.23
Block no.6	12.73	12.87
C.D.	N/A	0.27
SE(m)	0.11	0.09
SE(d)	0.15	0.12
C.V.	1.49	1.13

Moisture Content%		
Location	Depth (cm)	
CRC3	0-15	15-30
Block no.1	12.77	13.21
Block no.2	12.87	13.35
Block no.3	12.57	13.23
Block no.4	12.43	13.03
Block no.5	12.67	13.10
Block no.6	12.77	13.18
Block no.7	12.73	13.13
Block no.8	12.50	13.04
Block no.9	12.35	12.86
Block no.10	12.57	12.98
Block no.11	12.67	13.21
C.D.	N/A	0.26
SE(m)	0.11	0.09
SE(d)	0.16	0.13
C.V.	1.52	1.17

Table No.5 Moisture Content of the CRC-2 and CRC-3.

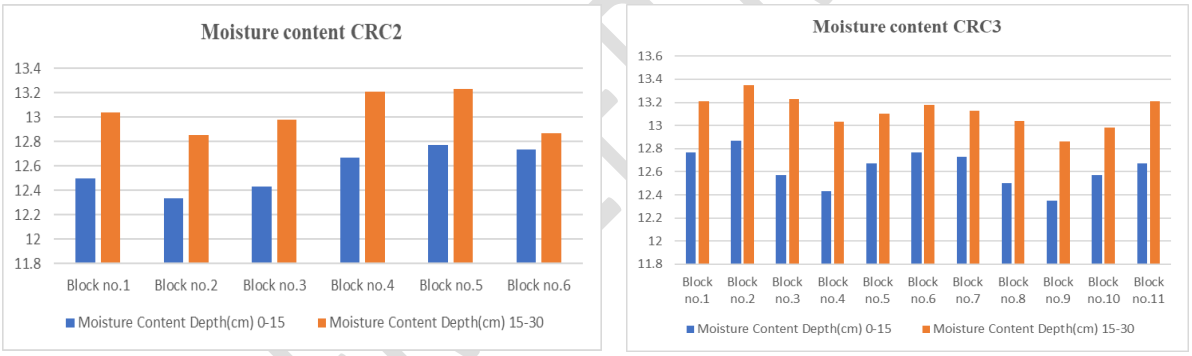


Fig. No.5 Moisture Content of the CRC-2 and CRC-3.

3.6. Osmotic Pressure

The osmotic pressure of the CRC2 of ITM University is ranged from the 0.175 to 0.183 N m^{-2} in the depth of 0-15cm and 0.182 to 0.187 N m^{-2} in the depth of 15-30cm. For CRC3 of the ITM University, osmotic pressure is ranged from the 0.174 to 0.184 N m^{-2} in the depth of 0-15cm and 0.182 to 0.190 N m^{-2} in the depth of 15-30cm.

Osmotic Pressure (N m^{-2})		
Location	**Depth(cm)**	
CRC2	**0-15**	**15-30**
Block no.1	0.175	0.182
Block no.2	0.176	0.185
Block no.3	0.179	0.184
Block no.4	0.182	0.185
Block no.5	0.183	0.187
Block no.6	0.179	0.186
C.D.	**0.003**	**N/A**
SE(m)	**0.001**	**0.001**
SE(d)	**0.001**	**0.001**
C.V.	**0.933**	**0.96**

Osmotic Pressure (N m^{-2})		
Location	**Depth (cm)**	
CRC3	**0-15**	**15-30**
Block no.1	0.174	0.182
Block no.2	0.181	0.186
Block no.3	0.177	0.185
Block no.4	0.176	0.184
Block no.5	0.179	0.187
Block no.6	0.182	0.185
Block no.7	0.184	0.190
Block no.8	0.179	0.185
Block no.9	0.176	0.186
Block no.10	0.18	0.187
Block no.11	0.177	0.185
C.D.	**0.003**	**0.002**
SE(m)	**0.001**	**0.001**
SE(d)	**0.001**	**0.001**
C.V.	**0.987**	**0.754**

Table No.6 Osmotic Pressure of the CRC-2 and CRC-3.

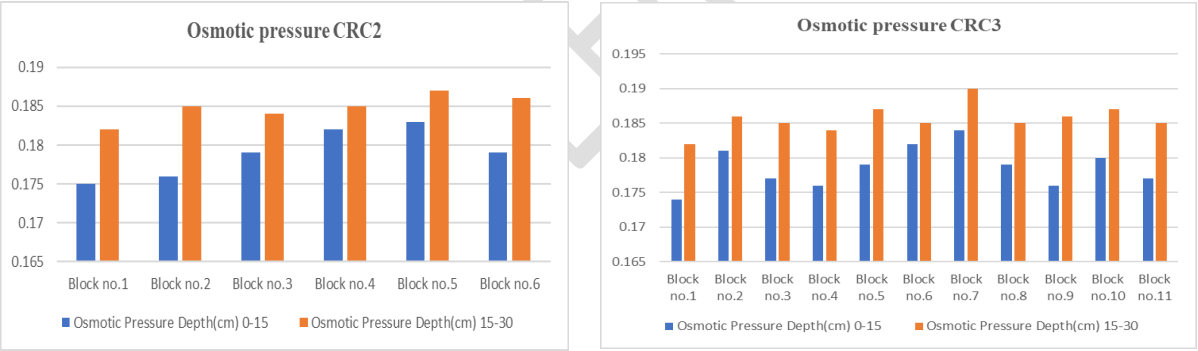


Fig. No.6 Osmotic Pressure of the CRC-2 and CRC-3.

3.7. Total Dissolved Soil

The total dissolved soil of the CRC2 of ITM University is ranged from the 493.0 to 497.1% in the depth of 0-15cm and 497.7 to 503.9% in the depth of 15-30cm. For CRC3 of the ITM University, total dissolved soil is ranged from the 494.1 to 498.8% in the depth of 0-15cm and 497.2 to 503.5% in the depth of 15-30cm.

Total Dissolved Soil (%)		
Location	Depth(cm)	
CRC2	0-15	15-30
Block no.1	493.0	497.7
Block no.2	493.2	500.4
Block no.3	495.4	502.7
Block no.4	494.4	500.5
Block no.5	495.5	501.9
Block no.6	497.1	503.9
C.D.	N/A	1.4
SE(m)	1.1	0.5
SE(d)	1.5	0.6
C.V.	0.4	0.2

Total Dissolved Soil (%)		
Location	Depth(cm)	
CRC3	0-15	15-30
Block no.1	494.4	497.7
Block no.2	495.5	500.4
Block no.3	497.1	502.7
Block no.4	498.8	503.5
Block no.5	497.3	500.7
Block no.6	493.2	500.4
Block no.7	495.4	502.7
Block no.8	494.1	497.2
Block no.9	495.5	501.9
Block no.10	497.1	500.9
Block no.11	496.9	502.2
C.D.	2.5	1.2
SE(m)	0.9	0.4
SE(d)	1.2	0.6
C.V.	0.3	0.1

Table No.7 Total Dissolved Soil of the CRC-2 and CRC-3.

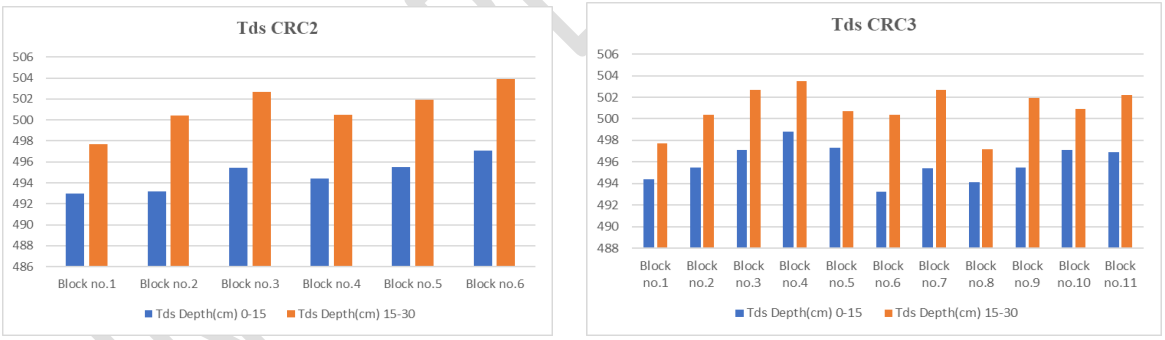


Fig. No.7 Total Dissolved Soil of the CRC-2 and CRC-3.

4. Conclusion

The recent distributions of physical properties of soil in different depths of soil has been analysed and collect at the different blocks of CRC2 and CRC3 of ITM University Gwalior. The bulk density of soil is increased while the depth of the soil is increased at all the blocks of the CRC2 and CRC3 fields. The mechanical analysis of the soil the sand and silt particles decrease significantly while the depth is increase and for the clay particles increase the depth increased the particles. The porosity of the soil for the both fields increase the depth of the soils

decrease the porosity of the soils. If the depth of the soil is increase then the moisture content will be increased. For the osmotic pressure the depth of the soil is increase then the osmotic pressure will be increased. If the depth of the soil is increase then the total dissolved soil will be increased.

5. References (Serial Numbers to be given)

Bashour, I., I. Sayegh and A.H. 2007. Methods of analysis for soils of arid and semi-arid regions. FAO Viale delle Terme di Caracalla, 00153 Rome, Italy.

Bashour, I., I. Sayegh and A.H. 2007. Methods of analysis for soils of arid and semi-arid regions. FAO Viale delle Terme di Caracalla, 00153 Rome, Italy.

Black CA, Methods of soil analysis, Part II. Am. Soc. Agron. *Madiosn, Wiscousin, U.S.A, 1965.*

Bouyoucos JG. A recalibration of hydrometer method for making mechanical analysis of soil. *J. Agron. 1951; 43:434-438.*

Catherine Pe´ rie´ and Rock Ouimet, "Organic carbon, organic matter and bulk density relationships in boreal forest soils," *Canadian journal of soil science, 2007.*

Chaudhari, P.R. Mire. D.V. and Ahire. V D. (2012). Correlation between Physio-chemical available nutrients in sandy loam soils of Haridwar J. of *Chemical, Bio. Phy. Sci* ***2****(3):1493-1950*

Chohan, M., Panhwar, R. N., Mastoi, l. M., Gular, N., Mari, A.H. and Gadehi. M. B. (2015). Relationship of physio-chemical properties and Macronutrients indexing at soils of Ghora Bari area district Thatta Sindh. Pakistan. *Soil Environ* ***34****(1):09-14.*

Corwin, D.L., Lesch, S.M., 2003. Application of soil electrical conductivity to precision agriculture: theory, principles, and guidelines. *Agron. J.* ***95*** *(3), 455–471.*

Corwin, D.L., Lesch, S.M., 2005a. Characterizing soil spatial variability with apparent soil electrical conductivity: I Survey protocols. Comp. Electron. *Agric.* ***46****, 103–133.*

Corwin, D.L., Lesch, S.M., 2005b. Characterizing soil spatial variability with apparent soil electrical conductivity: II Case study. Comp. Electron. *Agric.* ***46****, 135–152.*

Das K, Sarkar D, Nayak DC. Forms of potassium and their distribution in some soils representing red and laterite ecosystem of West Bengal. *J. Potassium Res. 2000;* ***16****(1-4):1-6.*

Deekor, T.N., Jowar, A.I., Ogundele, F.O., Amiolemen, S. O., & Ita, A.E. (2012). Changes in soil properties under different land use covers in parts of Odukpani, Cross River State. Nigeria. *J. Environ. Ecol.,* ***3****(1): 86- 99.*

Desavathu, R.N., Nadipena, A.R and Peddada, J.R. (2017). Assessment of soil fertility status in Paderu Mandal, Vishkhapatnam district of Andhra Pradesh, through geospatial technique. *The Egyptian J of Remote Sensing and Space Source.*

Dinagaran A, Singh Narendra, Grewal KS, Dahiya SS, Duhan BS. Distribution of potassium in some representative soil series of Haryana in relation to soil properties. *Haryana Agric. Univ. J Res. 2006;* ***36****(2):113- 118.*

E. Saki n, A. Deliboran and E. Tutar, "Bulk density of Harran plain soils in relation to other soil properties," *African Journal of Agricultural Research, 2011, Vol.* ***6****(7), pp. 1750- 1757.*

Erdal Sakin, "Organic carbon organic matter and bulk density relationships in arid-semi arid soils in Southeast Anatolia region," *African Journal of Biotechnology Vol.* ***11****(6), 2012, pp. 1373-1377.*

Foth, H.D. and B.G. Ellis. 1997. Soil Fertility, 2 Ed. Lewis CRC Press LLC. USA. pp: 290.

Gupta, P.K., 2005. Methods in Environmental Analysis: Water, Soil and Air. Published by Agro-bios (India), *Jodhpur. pp: 1-127.*

Gupta, P.K., 2005. Methods in Environmental Analysis: Water, Soil and Air. Published by Agro-bios (India), *Jodhpur. pp: 1-127.*

Hou, Q., Yang, Z., Ji, J., Yu, T., Chen, G., Li, J., Xia X., Zhang, M., & Yuan, X., (2014). Annual net input fluxes of heavy metals of the agro-ecosystem in the Yangtze River delta, China. *J. Geochem. Explor.* ***139****: 68–84.*

J. Leifeld, S. Bassin, and J. Fuhrer, "Carbon stocks in Swiss agricultural soils predicted by land-use, soil characteristics, and altitude", *Agri. Ecosyst. Environ., Vol.* ***105****, 2005, pp. 255–266.*

J.D Cure *et al.* Crop responses to carbon dioxide doubling - a literature survey Agric. Forest Meteorol (1986).

T. Aşkın, N. Özdemir, "Soil bulk density as related to soil particle size distribution and organic matter content," *Agriculture, Vol.* ***9****(2), 2003, pp.52-55.*

Yadav, T.C. H. K., Tagore, G.S, Chaubey. D, Dhakad R (2018). Assessment of spatial variability in physio-chemical properties of soil in Alirajpur district of Madhya Pradesh using Geostatistical approach. *Journal of soil water conservation and* ***17****(4):317-324.*