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Mayank Gothwal
Research Scholar, Department of Soil Science and Agricultural Chemistry Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India

Tarence Thomas
Professor, Department of Soil Science and Agricultural Chemistry Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India

Narendra Swaroop
Associate Professor, Department of Soil Science and Agricultural Chemistry Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India

Raghunandan Singh Khatana
Ph.D. Scholar, Department of Soil Science and Agricultural Chemistry Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India

Corresponding Author
Mayank Gothwal
Research Scholar, Department of Soil Science and Agricultural Chemistry Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India

Evaluation of soil physical properties of farmer's field of Mahendergarh district, Haryana, India

Mayank Gothwal, Tarence Thomas, Narendra Swaroop and Raghunandan Singh Khatana

Abstract
The lab experiment was conducted for an evaluation of soil physical properties of farmer's field of Mahendergarh district of Haryana. A certain depth wise soil samples were collected from various depth *viz.* 0-15 cm, 15-30 cm and 30-45cm. The analysis of the soil samples manifested that the soil samples fall under sandy loam soil texture. The soil color (Dry condition) varied from Dark brown (10 YR 3/3), yellow (2.5 Y 7/6), Olive yellow (2.5 Y, 6/8), Greyish brown (2.5 Y, 5/2) and in (wet condition) very dark grayish brown (10YR, 3/2), dark brown (10TR, 3/3). Soil having bulk density range from 1.01 to 1.36 Mg m^{-3},particle density range from 1.02 to 2.45 Mg m^{-3}.The pore space ranges from 32.35% to 51.90%. Solid space varied from 30.26 to 5507%. The value of sand, silt and clay in the soils varied from 70% to 80.80%, 14.30% to 20% and 10 to 2.5%.Water retaining capacity varied from 7.04 to 9.22Mg m^{-3} specific gravity varied from 1.57 to 2.38 Mg m^{-3}.The results obtained thus indicate that the study soils mainly fit for cultivation of pearl millet, cowpea, wheat, barley, mustard, coriander and fenugreek. On the basis of analysis, it was found that using organics with in – organics to managed present and future deficiencies of nutrients in these soils and also improve soil health for future generation.

Keywords: soil analysis, density, Mahendergarh etc.

Introduction
The soil is a natural environment for the production of crops. Plants get their nutrients, water and support from the soil. The suitability of soil as a growing medium for plants depends on its ability to provide sufficient water and nutrients in the available form which in turn is controlled by its Properties. Knowledge of soil properties helps in its management, improvement of problematic soils and the implementation of effective fertilization techniques.
The district is located between the north latitude of 27 ° 47'51 "to 28 ° 26'83" and the east longitude of 75 ° 56'27 "to 76 ° 51'09". It is bordered on the north by the districts of Bhiwani and Rewari, on the east by the districts of Rewari and Alwar, on the south by the districts of Alwar, Jaipur and Sikar and on the west by the districts of Sikar and Jhunjhunu. The climate of the district is arid to semi-arid. The annual average temperature is 25.1 ° C according to (koppen climate classification in BSH). In one year, the average rainfall is 686.6 mm. (District Factbook, Mahendergarh, 2019)
The analysis of physical properties generally includes simple, quick and inexpensive methodologies. The physical properties of the soil that were evaluated were bulk density, particle density, soil porosity and color, density, water holding capacity. The graph describes the three-dimensional proportion of soil particles and the fineness or roughness of a soil. Soil texture is an important factor affecting the balance between water and gas, but it is very stable over time, regardless of soil management. Therefore, bulk density and total porosity may better represent the effects of land use and management on water-air relationships (Beutler *et al.*, 2002) [1].

Methodology
The district is located between latitude 27 ° 47'51 "north at 28 ° 26'83" and longitude east 75 ° 56'27 "at 76 ° 51'09". The climate of the district is arid to semi-arid. The annual average temperature is 25.1 ° C according to (koppen climate classification in BSH). In one year, the average rainfall is 686.6 mm. Soil sampling was carried out in a total of nine villages in Mahendergarh district. A total of 27 soil samples were taken from different sites using an auger, auger and khurpi at depths of 012 cm, 1530 cm and 3045 cm. The collected soil samples were air dried in the shade, the clods were broken up with a wooden hammer, and the fed soil was sieved with a 2mm sieve and analyzed.

for physical parameters in laboratory. The physical parameters include soil texture, soil color, bulk density, partical density, Soil Pore Space and specific gravity. Soil textural class was determined by using Bouyoucos. Hydrometer (Bouyoucos, 1927) [2]. Bulk density and Partical density was determined by using Graduated Cylinder method (Muthuval et al., 1992). Specific gravity by R.D. Bottle. Soil Colour was determined by using Munsell Colour Chart (Albert Henry Munsell, 1971) [5].
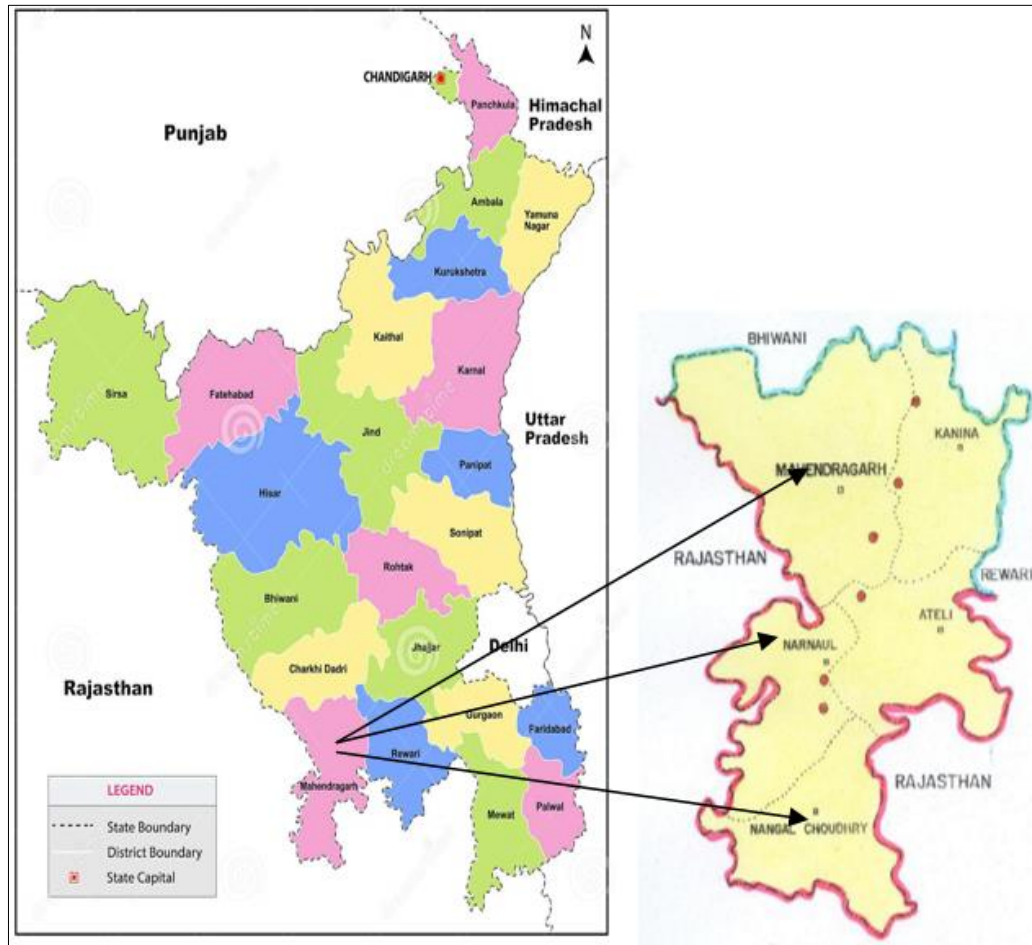

Fig 1: Shows map of Haryana and map of Mahendergarh district

Results and Discussion

The results revealed that most of soil colour of Farmer′s field in dry condition of soil. The soil color (Dry condition) varied from Dark brown (10 YR 3/3), yellow (2.5 Y 7/6), Olive yellow (2.5 Y, 6/8), Greyish brown (2.5 Y, 5/2) and in (wet condition) very dark grayish brown (10YR, 3/2), dark brown (10TR, 3/3) in soil profile. Soil texture of soil samples was fall under loamy sand and the sand content in the studied soils ranges from 70 to 80.80%, silt from 14.30% to 20% and clay from 10 to 2.5%. The bulk density of soils in ranged from 1.01 to 1.36 Mg m^{-3}. The soils under study showed an increasing trend with the depth of soil profile. The higher value of Bulk density of soils was due to the coarse texture,

presence of low organic carbon content. Similar results were obtained by Laxaman *et al.,* (2019) [3]. The Particle density of soils in ranged from 1.02 to 2.45 Mg m^{-3}. The soils under study showed an increasing trend with the depth of soil profile. In general higher value of particle density was observed in sub– surface horizon of the profiles which might be due to relatively higher amount of weather able minerals which is dominant in area, lower value of organic carbon content leading to increase in weight of soil solid. The value of pore space of soils in ranged from 32.35% to 51.90%.The soils under study showed a decreasing trend with the depth of soil profile. Similar results were obtained by Laxaman *et al.,* (2019) [3].

Table 1: Representing Soil Colour (dry condition) at different depth of Farmers field of Mahendergarh district, Haryana

Site	Farmer′s Field	0-15 cm	15-30 cm	30-45 cm
Mahendergarh	Pali(MV$_1$)	2.5Y,6/4 light yellowish brown	2.5Y,6/6 Olive yellow	5Y, 7/3 Pale yellow
	Doli(MV$_2$)	2.5Y,7/4 Pale yellow	2.5Y,6/4 light yellowish brown	2.5Y,6/4 light yellowish brown
	Jat (MV$_3$)	2.5Y,7/2 light grey	2.5Y,7/4 Pale yellow	5Y,6/3 Pale olive
Narnaul	Nasibpur(NV$_4$)	5Y,7/4 Pale yellow	5Y,6/8 Olive yellow	5Y,6/6 Olive yellow
	Nangtehari (NV$_5$)	5, 6/4 Pale olive	5Y,5/4 Olive	2.5Y,6/2 light brownish grey
	Balava (NV$_6$)	5Y, 6/4 Pale Olive	5Y, 6/3 Pale Olive	5Y, 6/4 Pale Olive
Nangal choudhary	Sareli (NCV$_7$)	5Y,6/8 Olive yellow	2.5Y,6/4 light yellowish brown	2.5Y,6/6 Olive yellow
	Nizampur (NCV$_8$)	5Y,6/6 Olive yellow	5Y,6/8 Olive yellow	5Y,5/4 Olive
	Bigopur (NCV$_9$)	5Y,6/4 Pale yellow	5Y,5/5 Olive	Dark yellowish brown

Table 2: Representing Soil Colour (wet condition) at different depth of Farmers field of Mahendergarh district, Haryana

Site	Farmer′s Field	0-15 cm	15-30 cm	30-45 cm
Mahendergarh	Pali(MV₁)	2.5Y,4/4 Olive brown	2.5Y, 4/4 Olive brown	5Y,4/3 olive
	Doli(MV₂)	10YR,5/4 yellowish brown	10YR,5/4 dark greyish brown	2.5 Y,4/2 dark greyish brown
	Jat (MV₃)	2.5y,4/3 olive	5Y,5/4 olive	5Y,5/4 olive
Narnaul	Nasibpur(NV₄)	5Y,4/4 olive	5Y, 5/4 olive	5Y,4/4 olive
	Nangtehari (NV₅)	2.5Y, 4/2 dark greyish brown	2.5Y, 4/2 dark greyish brown	5Y, 4/3 Olive
	Balava (NV₆)	2.5Y,5/2 garyish brown	5Y, 4/3 Pale Olive	5Y,4/4 olive
Nangal choudhary	Sareli (NCV₇)	2.5Y,4/4 Olive brown	2.5Y,4/4 Olive brown	2.5Y,4/4 Olive brown
	Nizampur (NCV₈)	10YR,4/3Brown/Dark brown	10YR,5/4Yellowish brown	10YR,3/3 Dark brown
	Bigopur (NCV₉)	2.5Y,4/2 Dark greyish brown	2.5Y,4/2 Dark greyish brown	5Y,4/3 olive

Table 3: Representing Soil Pore Space at different depth of Farmers field of Mahendergarh district, Haryana

Site	Farmer′s Field	0-15 cm	15-30 cm	30-45 cm
Mahendergarh	Pali(MV₁)	42.70	36.52	41.00
	Doli(MV₂)	54.50	44.57	36.58
	Jat (MV₃)	35.80	34.11	33.79
Narnaul	NASIBPUR(NV₄)	36.51	32.35	30.26
	Nangtehari (NV₅)	43.40	36.55	34.65
	BALAVA (NV₆)	52.01	41.15	40.48
Nangal choudhary	SARELI (NCV₇)	51.90	36.55	30.22
	NIZAMPUR (NCV₈)	47.01	37.92	36.04
	BIGOPUR (NCV₉)	53.50	52.69	49.08

Table 4: Representing Soil Texture, Bulk density and Particle density of soil at different depth (cm) of Farmers Field of Mahendergarh district, Haryana

Site	Farmers Field	Soil Texture	Bulk Density ($Mg\ m^{-3}$)			Particle Density ($Mg\ m^{-3}$)		
			0-15 cm	15-30 cm	30-45 cm	0-15 cm	15-30 cm	30-45 cm
Mahendergarh	Pali(MV₁)	Loamy sand	1.20	1.28	1.21	2.01	2.02	1.01
	Doli(MV₂)	Loamy sand	1.06	1.13	1.27	2.16	2.52	1.05
	Jat (MV₃)	Loamy sand	1.13	1.19	1.09	1.80	1.74	1.68
Narnaul	NASIBPUR(NV₄)	Loamy sand	1.36	1.29	1.22	2.45	2.02	1.84
	NANGTEHARI (NV₅)	Loamy sand	1.07	1.28	1.19	2.00	2.02	1.84
	BALAVA (NV₆)	Loamy sand	1.08	1.09	1.14	1.98	1.84	2.02
Nangal choudhary	SARELI (NCV₇)	Loamy sand	1.29	1.11	1.01	2.18	2.02	1.84
	NIZAMPUR (NCV₈)	Loamy sand	1.07	1.13	1.13	2.16	1.84	2.52
	BIGOPUR (NCV₉)	Loamy sand	1.11	1.21	1.19	2.45	2.52	2.33

Conclusion
The soils of study area were sandy loam in soil texture and colour from dark yellowish brown to yellowish brown. There for using organics in combination with in-organics to managed present and future deficiencies of nutrients in these soils and also improve soil health for future generation. The main aim of this investigation was to determine the physical properties of soil due to paucity in information in the selected study areas. Not only would this benefit the farming to make practical decisions in adopting farming techniques and incorporate fertilizer based on soils test thereby improving productivity and yield but also add to the database on soils in these areas for reference for further scientific research. The results of the investigation have been summarized below. Range has been included considering both the profile depths.

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