

**Assessment of Physical properties of soil from different villages of
Karnal district, Haryana, India**

ABSTRACT

An appraisal of Physical properties of soils from different villages of 'Karnal District' of Haryana was carried out in 2022-2023. The prime objectives of this study were to carry out the survey, to collect the information of sampling sites and to analyse physical properties of soil and macro-micro nutrient status and its relation to various chemical properties of soil. For assessment purpose, nine sampling sites were selected. Soil samples were collected at various depths of 0-15, 15-30, and 30-45 cm. The result indicated that soil of Kalampura, Dabri and Pundrak villages are sandy loam in texture, has good Water Holding Capacity and Pore Space(%) and optimum Bulk Density and Particle Density and good overall physical condition.

Keywords: Physical properties, analysis, texture, bulk density, particle density.

1. Introduction

“Soil is composed of a mixture of minerals, organic matter, water, air, and a diverse array of microorganisms” (Brady and Weil, 2016). “It is the product of biochemical weathering of the parent material and its formation is influenced by various soil formation factors like climate, organism, parent material, relief, and time” (Belwal and Mehta, 2014). “An independent body in nature with singular morphology from the surface till the parent material is expressed by the sample profile” (Tan, 1995). Soil properties can be broadly categorized into various physical and chemical parameters. The physical properties include bulk density (Mg m^{-3}), particle density (Mg m^{-3}), pore space (%), water holding capacity (%), and soil texture. The chemical properties consist of pH, electrical conductivity, percentage organic carbon, available nitrogen, available phosphorus, available potassium, exchangeable calcium, magnesium, and available zinc. Understanding these properties is critical for effective soil management and sustainable productivity. “Physical properties play a very important role in determining soil’s suitability for agriculture. The supporting capability, retention and availability of nutrients and water to the plants, ease of penetration of roots and flow of heat and air are associated directly with physical properties of the soil. Physical properties also have an influence on the chemical and biological properties. Chemical properties of soil include the following aspects; inorganic matters in soil, organic matters in soil, colloidal properties of particles of soil and soil reactions and buffering action in acidic and basic soils. The chemical side of a soil is extremely important and is about the correct balance of the available nutrients in the soil” (Das *et al.*, 2020).

“Soil testing means the qualitative analysis of soils and it is well recognized as a scientific means for characterization of the inherent fertility status of soils” (Meena *et al.*, 2018). “Soil test-based fertility management is an efficient tool for increasing the productivity of agricultural soils that have a high degree of spatial variability resulting from the combined effects of physical, chemical, or biological processes” (Majumdar *et al.*, 2015). The fertility and health of soil form the foundation for the healthy existence of flora, fauna, and humans.

Materials and Methods

Location:

Karnal district in Haryana is located on the map with the GPS coordinates of 29°25'05"N latitude and 76°27'40"E longitude with height of 240m above the mean sea level.

Soil and Climate:

Karnal district lies in the Eastern Haryana plain which has Gangetic type, sub-tropical continental monsoon climate with mean annual rainfall of 842 mm. A lot of rain falls in the months: July, August and September with July being the wettest month. Climatic conditions are usually suitable for the normal cultivation of paddy, maize, jute, wheat, barley and other crops. The district is divided into three sub-micro regions based on soil and topography namely: Assandh Plain, Karnal Bhangar and Yamuna Khadar. Soil of Karnal is formed almost completely of alluvium and the textural class is loamy sand to sandy loam on the surface and sandy loam to clay loam in the sub surface.

Sampling and Analysis

The soil sample collection is from 3 villages of Karnal district in the state of Haryana each selecting 3 farmers. Samples were collected from a site of each village using soil khurpi by composite sampling method at a depth of 0-15, 15-30 and 30-45 cm.

After sampling, the samples were dried in shade and then various physical and chemical tests were carried out with them.

The data hence recorded during the course of investigation was then subjected to Statistical Analysis by Completely Randomized Design (CRD) as per the method of "Analysis of Variance" (ANOVA) technique.

Methods

"Analysis of the soil samples were under the methods, the physical parameters include Soil Colour, Soil Texture, Bulk Density, Particle Density, Pore Space and Water Holding Capacity. Soil textural class was determined by using Hydrometer" (Bouyoucos, 1927). "Bulk density, Particle density, Water holding capacity was determined by using Graduated Measuring Cylinder method" (Muthuaval *et al.*, 1992).

Result and Discussion

Physical properties

Soil Texture

The percent of sand, silt and clay varied from 62.23-75.16%, 12.94-23.90% and 8.76-16.65% respectively. Similar results were reported by Narwal *et al.* (2006).

Bulk density

The bulk density of different depths varied from 1.18 to 1.32 Mg m⁻³. Similar results were reported by Singh *et al.*, (2016).

Particle density

The range of particle density of different depths of soil varied from 2.39-2.47 Mg m⁻³. Similar results were reported by Singh *et al.*, (2017).

Percent pore space

The maximum percent pore space was found 48.37% and the minimum 44.60%. Similar result was reported by Singh *et al.*, (2014).

Water holding capacity

The maximum water retaining capacity 45.2% and minimum of 38.2%.. Similar result was reported by Sharma *et al.*, (2016)

Table 1: Bulk density and Particle density (Mg m⁻³) of soil from different villages of Karnal district at 0-15, 15-30 and 30-45 cm depth

Villages	Bulk Density (Mg m ⁻³)		Particle Density (Mg m ⁻³)	
	Range	Mean	Range	Mean
Kalampura(V1)				
F1	1.23-1.26	1.24	2.373-2.385	2.379
F2	1.26-1.32	1.29	2.418-2.425	2.421
F3	1.22-1.29	1.25	2.391-2.405	2.398
Dabri (V2)				
F4	1.21-1.28	1.24	2.457-2.469	2.463
F5	1.18-1.22	1.2	2.383-2.392	2.387
F6	1.16-1.19	1.17	2.425-2.433	2.429
Pundrak (V3)				
F7	1.2-1.24	1.22	2.432-2.440	2.436
F8	1.19-1.22	1.2	2.403-2.412	2.407
F9	1.26-1.29	1.27	2.416-2.424	2.420

Table 2: Pore space and Water holding capacity (%) of soil from different villages of Karnal at 0-15, 15-30 and 30-45 cm depth

Villages	Pore Space (%)		Water Holding Capacity (%)	
	Range	Mean	Range	Mean
Kalampura(V₁)				
F₁	43.4-47.1	45.25	39.4-42.2	40.8
F₂	45.2-48.3	46.75	41.5-44.4	42.95
F₃	46.9-49.2	48.05	41.8-45.2	43.5
Dabri (V₂)				
F₄	43.8-45.5	44.65	38.9-41.5	40.2
F₅	44.7-46.9	45.8	39.6-41.9	40.75
F₆	44.4-47.8	46.1	40.2-43.1	41.65
Pundrak (V₃)				
F₇	47.8-49.1	48.45	42.3-44.3	43.3
F₈	43.8-45.4	44.6	38.2-40.8	39.5
F₉	46.4-48.8	47.6	41.5-44.1	42.8

Fig.1: Bulk density and Particle density of soil from different villages of Karnal at 0-15, 15-30 and 30-45 cm depth

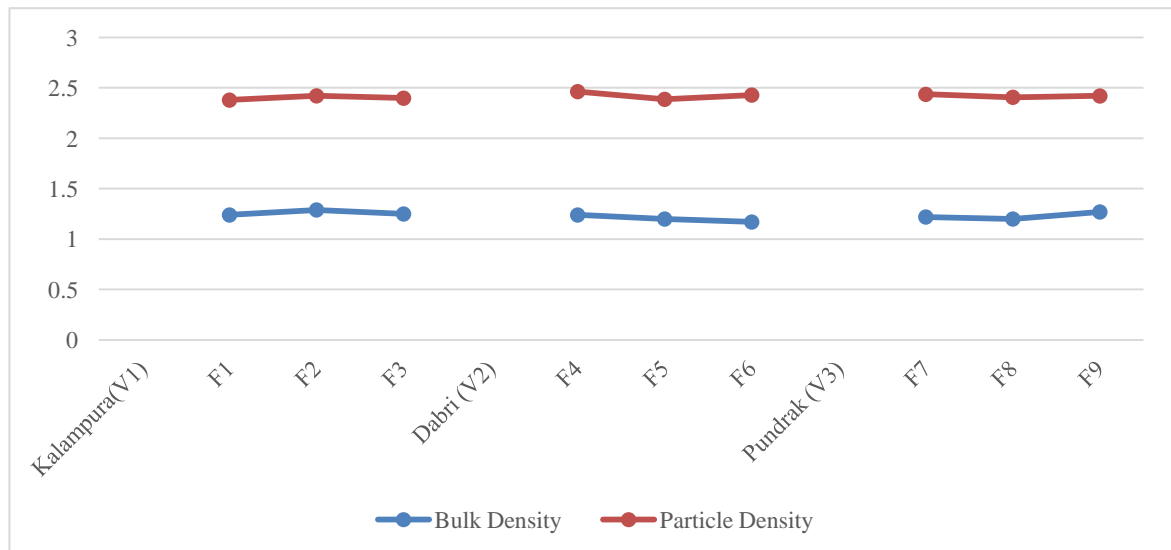
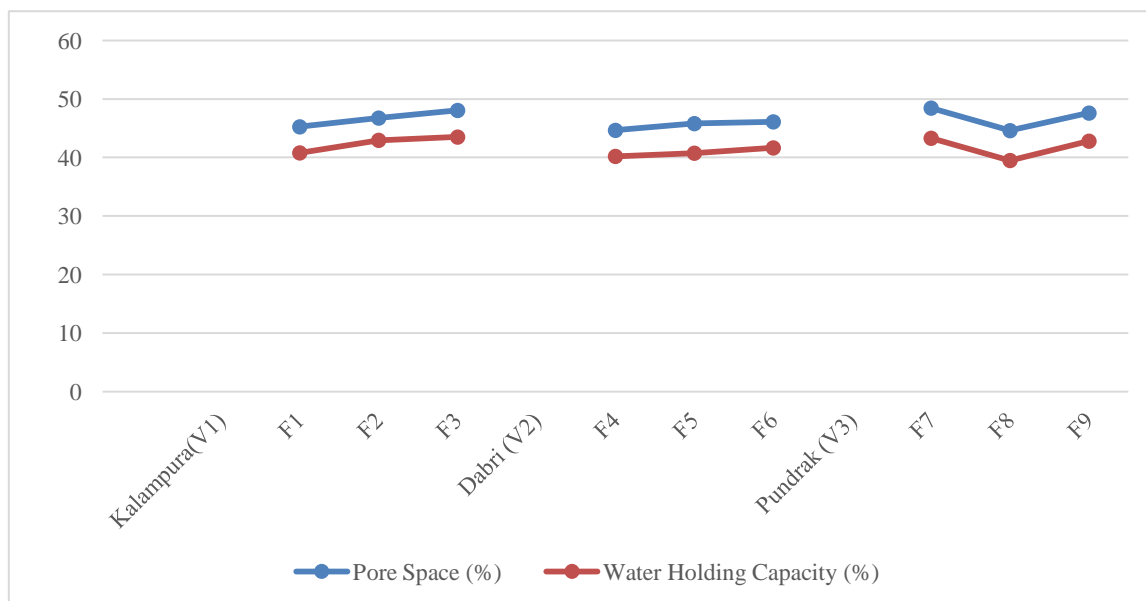


Fig.2: Pore space (%) and Water holding capacity (%) of soil from different villages of Karnal at 0-15, 15-30 and 30-45 cm depth



Conclusion

According to the results obtained from soil tests of villages of Karnal district of Haryana, it clearly shows that the soil has optimum Physical properties namely Bulk density, Particle density, Percent pore space and Water holding capacity. It is suggested that improvement can still be done by improvement of the cropping pattern, decomposition of organic waste, mulching, tillage practices and proper irrigation with the help of management practices with knowledge and experience gained through studies and suggest the farmers to achieve the quality produce and high yield through Soil Health Card report as well as practices of soil conservation.

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