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Physico-Chemical Soil Analysis of Agriculture Farm in Sangam University, Bhilwara, Rajasthan

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Abstract: ***The current study, conducted in 2022, examined the physico-chemical characteristics of soil at Sangam University (SU) in Bhilwara, Rajasthan. Soil sample was collected 15 cm depth from Sangam crop cafeteria and Sangam farm and them analyzed for assessing the soil physical properties and availability of macro-nutrient present in soil of selected locations. Soil textural classes were clay loam and sandy loam. Bulk density 1.06gcm^{-3} (SU farm) and 1.11 gcm^{-3}(SU Campus) in both field water holding capacity 59% and 54% was good. Electrical conductivity 0.25- 0.66 dSm^{-1} (SU farm) & 0.26- 0.80dSm^{-1}(SU Campus) are safe range and organic carbon 0.43% & 0.42% is in sufficient amount of both area. Soil pH 7.5 & 8.0 is neutral to slightly alkaline. The available Phosphorus 54 kg ha^{-1} and 42 kg ha^{-1}, Potassium 140 kg ha^{-1} and 130 kg ha^{-1} in Sangam farm and campus. Hence, it is suggested to add required amount of gypsum, FYM and compost in the soil.***
Keywords: Physico-chemical properties pH, Soil texture, Bulk density and Organic matter

I. INTRODUCTION

Soil development depends on the systems of the lithosphere, hydrosphere, atmosphere, and biosphere. Soil is a naturally occurring material that supports plant growth. The soil's biological, chemical, and physical properties effect on plant growth. Crop productivity, plant development, and germination are all impacted by the right movement of water and air through the soil. The surface textural class distribution of Bhilwara soils generally shows that sandy loam soils are predominant, followed by sandy clay loam to clay soils. Sandy loam soil covers more than half of the Aravali region, particularly the eastern plains. Bulk density, particle density, porosity, water-holding capacity, soil structure, and soil texture are examples of physical indicators of soil. The vital nutrients that support plant growth are found in the soil and water. Long-term soil fertility and productivity depend on robust physical, chemical, and biological components. These characteristics affect how plants grow, and the ongoing use of pesticides, herbicides, fungicides, and acidic or salty fertilizers throws off the delicate balance between the biological, chemical, and physical components of soil fertility. (Karlen, et al.,1997).

Around the world, groundwater is utilized for agriculture as well as for home and industrial water supplies. The demand for fresh water has increased dramatically over the past few decades as a result of the fast-paced industrialization and population rise. The quality of groundwater cannot be readily recovered once it has been contaminated. Soluble minerals in soils account for a larger portion of the soluble components found in groundwater. Commonly soluble components include ions of calcium, sodium, bicarbonate, and sulphate. Water quality and soil quality requires constant sampling and monitoring for and since it is influenced by a variety of complicated elements, including weather patterns and activities by humans and animals (Pai, et al.,2014).

The percentage of porosity spans from the maximum at 55.67% to the lowest at 42.35%, and the water-holding capacity of fine-sand to loamy-sand soil ranges from 42.42% to 62.5 %. The soil of sandy, loamy, and sandy loam types lacks organic matter and is poor in nitrogen. Potassium level ranges from medium to high, while phosphorus content is low to medium. The pH and EC of this soil are high (Bhati (2017). diverse blocks in the Bhilwara district have diverse physico-chemical soil qualities. In most regions, the EC is in a decent range, the pH ranges from neutral to strongly alkaline, the water TDS is high, and the organic matter is low to medium. However, in some areas, the pH is slightly acidic. Few soils have medium to high levels of available phosphorus (Khajanchi and Mehta,2019).

Soils impacted by salt because of the persistently moist soil conditions, there are fewer mottles in the middle horizons immediately after 40 to 45 cm of depth. These soils had a sandy loam to clay loam texture, were dark greyish brown to yellowish brown in colour, and were moderately to imperfectly drained.The soils were generally alkaline, with pH, EC, and ESP being higher at the surface and decreasing as depth was reached. it occures a higher clay content(Katiyar, et al., 2015) The effects of soil salinity,which is higher in the winter, on pH (9.88), EC (9.45 dSm^{-1}), and sodium (8565.15 µgkg^{-1}) (Thaker, et al.,2023)

II. MATERIAL AND METHOD

A. Study Area And Data Collection

The district of Bhilwara in the state of Rajasthan was chosen for the study. The study area has a large number of textile industries, which contributes to the increase in water pollution. This water used for the irrigation which leads adverse effect on soil physicochemical properties. The district was located in Rajasthan's southeast. Geographically, the location is 25.27 degrees North latitude and 74.62 degrees East longitude. The school of Agriculture Science and Technology is located in the Bhilwara district, close to NH 79 Atton. Which taken from of soil sample that was taken between 0 and 15 cm deep from 15-20 place to agricultural farm, fields under cultivation and areas that were irrigated provided samples 500 gram of soil were taken from each soil sample. After being allowed to dry in the shade and going through a 2 mm sieve, the soil sample was used in a laboratory for physico-chemical analysis and data collected primary and secondary.

B. Analysis Method

Analysis of soil texture was done by Bouyoucos hydrometer method (Bouyoucos,1927). The pore space percent was calculated from the 100ml measuring cylinder (Black, 1965). pH meter using by electrometric method in 1:2 ratio (soil :water) as described by Jackson (1967),and EC was determined by Electrical conductivity meter. Walkley and Black's wet digestion method was used for calculating organic carbon (Piper 1950). Phosphorous in the soil extract is determined using spectrophotometer this is used for calcareous, alkaline and neutral soils (Olsen et al., 1954). And potassium was determined by flame Photometer (Toth and Prince, 1949).

C. Results and Discussion

The Sangam University Bhilwara agriculture farm generally occurs in medium black soil. The soil texture are clay Loam and sandy loam etc. There is a lot of humus, organic matter, and nitrogen in the black soil. Microorganisms in the soil have a significant impact on crop productivity and soil characteristics. The fertility of black soil is higher than that of red and yellow soil (Jain and Singh,2014)

TABLE -1 Status of Soil Physical Properties of Research Study

S.n.	Parameter	NH-79 SU farm	SU Campus
1	Soil texture	Clay loam	Sandy loam
2	Bulk density (Gram cm^{-3})	1.06	1.11
3	Porosity (%)	60	58
4	Water holding capacity (%)	59	54

TABLE -2 Status of Soil Chemical Properties of Research Study

S.n.	Parameter	NH-79 farm	Campus
1	pH	7.5	8.00
2	EC (dSm^{-1})	0.25- 0.66	0.26- 0.80
3	Organic carbon (%)	0.43	0.42
4	Phosphorous ($kgha^{-1}$)	54	42
5	Potash ($Kgha^{-1}$)	140	130

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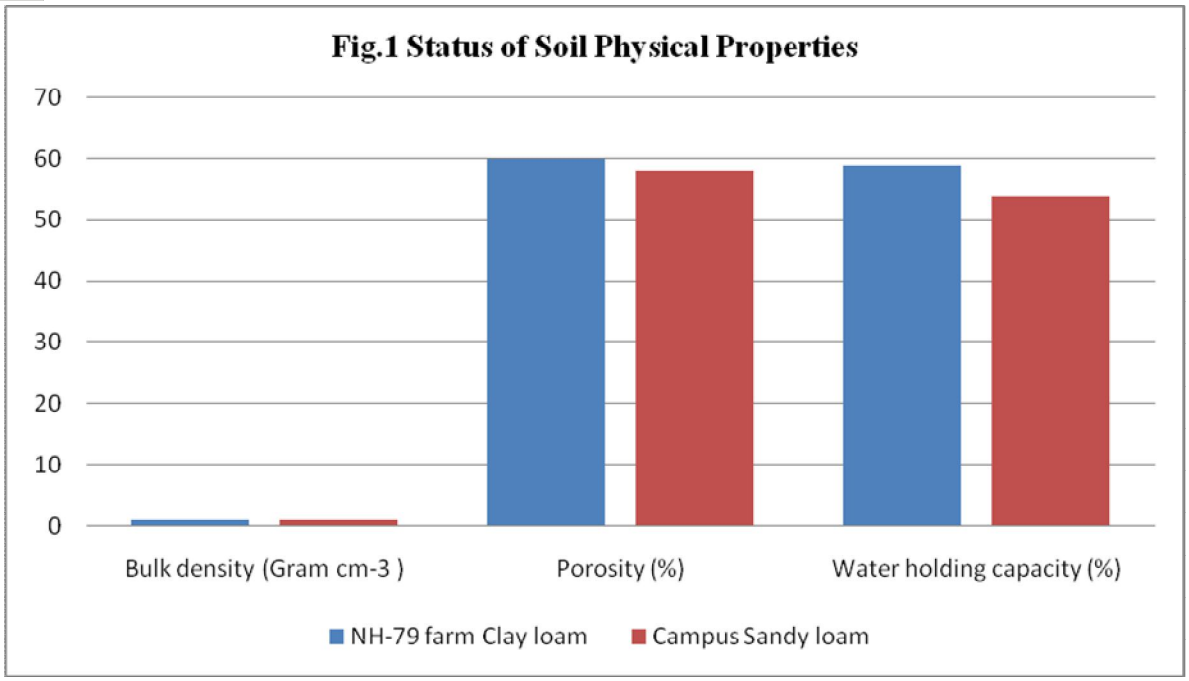

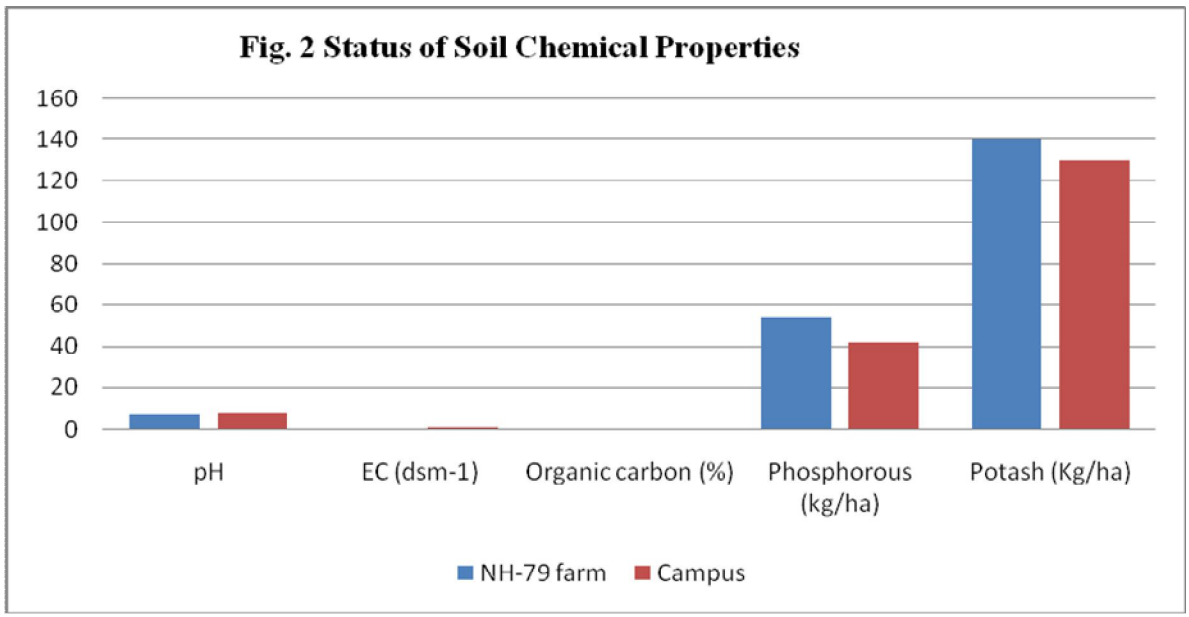

As mentioned in (Table-1) soil texture of soil was found to be NH 79 Gathila Kedha clay loam, Bulk density, porosity percent and water holding capacity of were1.06 gcm^{-3}, 60 % and 59 % respectively. While for campus soil it was found to be sandy loam to clay loam,1.11 gcm^{-3}, 58 % and 54 % respectively. Previous study show that the soil bulk density range from 1.09-1.30 gcm^{-3}, porosity percent from 33.00 to 60.00 %, water holding capacity from 54.27 to 69.51 % (Choudhary, et.al.,2020). Found that bulk density of soil was 1.46 gcm^{-3} and the pore space was of 41.30 % (Yadav, et at., 2021). In good physical condition the cultivation of clay loam paddy has low bulk density values that increase with depth (Nongrum, et al., 2021). According to the study, there are variations in particle density between 2.40 and 2.66 $gcm^{-3,}$ bulk density between 1.08 and 1.23 gcm^{-3}, water holding capacity between 43.40 and 60.50 %, and soil texture between sandy soil and sandy loam soil. Excellent physical attributes that make it appropriate for practically all oil seeds and tropical and subtropical crops(Kaur, et at.,2017). The physiochemical analysis of the soil reveals that farmers primarily use excessive amounts of phosphorus, potassium, and other chemical fertilizers, which causes the soil to become alkaline due to the area's poorer drainage conditions (Wagh, et al.2013).

As mentioned in (Table-2) pH of NH 79 Gathila Kedha soil was found 7.5. and campus 8.0 respectively and electrical conductivity was 0.25-66 $dsm^{-1}$for Gathila Kheda farm and campus 0.26-80 dSm^{-1},organic carbon was found to be 0.43 % and 0.42 %. Phosphorous 54 $kgha^{-1}$ and 52 $kgha^{-1}$ and Potash 140 $kgha^{-1}$and 130 $kgha^{-1}$ respectively. The industrial area of soil is rich in calcium and magnesium and pH of most of the sample was alkaline. The high amount of sodium betonites and organic carbon was present in soil (Singhal, et al., 2016). The primary nutrient which are low to medium range and to increase crop production use of compost or vermin-compost manure in the agricultural fields. Soil physical condition was normal and sulphur range was medium (Kothyari, et al., 2018). and available Potassium ranges from 169 to 298 Kg ha-1 (Yadav, et al.,2020).The physical properties of soil different crop production land use systems in Mollisol and Vertisol. The textile industrial effluents affect the on soil properties forest area. It contaminated soil like pH, colour, organic carbon, acidity, alkalinity, moisture content, electrical conductivity, bulk density of the soil that effluent of textile industry has a direct impact on physio-chemical properties of soil (Malik,2017).

The previous study's findings focused on the physical characteristics of soil, including its bulk density, water-holding capacity, particle and soil content. The area had a variety of soil textures, including clay loam, sandy loam, loam, and sandy clay. There was variation in the bulk density from 1.05 to 1.30 gcm^3. The soil at the investigated sites was determined to be in good condition for a variety of tropical and subtropical crop cultivation based on the results of physical parameters.(Vyas, et al.,2017). For wasteland soil samples, the ranges for soil electrical conductivity and pH were 0.10 to 0.89 dSm^{-1} and 7.52 to 8.80, respectively. The ranges for organic carbon and calcium carbonate were 0.27 to 0.82 % and zero to 9.96 percent, respectively. (Sharma,et al.,2016) in Bhilwara. For the majority of the soil, the availability of organic carbon was rated as low to medium. In contrast, the phosphorus status of agricultural soil was found to be medium to high. It was shown that the electrical conductivity of the soil was normal (Sharma and Khajanchi 2018). At the crop harvest stage, there was a significant increase in soil porosity, moisture retention, organic carbon, and available N, S, and Zn content; however, bulk density of soil decreased significantly as levels of FYM increased. In soil considerably increased when mineral nutrients (S+Zn) were added (Jat, et al.,2012)

Through scientific principles of land management and land use the physical properties of soil and land benefits can be maximized (Das and Mipun,2021). Fluoride toxicity suffer from fluorosis. Fluoride ion concentration in soil samples varied from 1.0ppm to 8.23 ppm range (Iram, and Khan, 2018). The natural events like floods and drought etc. causes increases in soil degradation of the ecosystems. The huge erosion of the top fertile soil comes loss in natural disaster and adverse effect on soil physical properties and less agriculture production(Kumar, et al.,2016).

III. CONCLUSION

The soil analysis concluded indicates that the area has a substantial textile industry, which exacerbates soil and water pollution. The effects of this irrigation water on the physiochemical properties of the soil happen gradually. The physical characteristics of the soil, such as bulk density, porosity, and water holding capacity, are impacted by irrigation water and have an impact on crop growth. Irrigation water causes a slight change in the solubility and alkalinity of salt in the soil, and high salinity can also increase. These changes will have an impact on crop growth and yield. Could eventually cause land to become desertified if appropriate steps are not done to lessen the amount of salts and alkalis in the soil; soil crop affects productivity. The relationship between soil and plant growth can be established with the aid of recorded soil parameters. which farmers can use to increase soil fertility. Crop productivity can be raised, and agriculture can be made more sustainable, by utilizing manure, FYM, compost, and biofertilizer among other materials.

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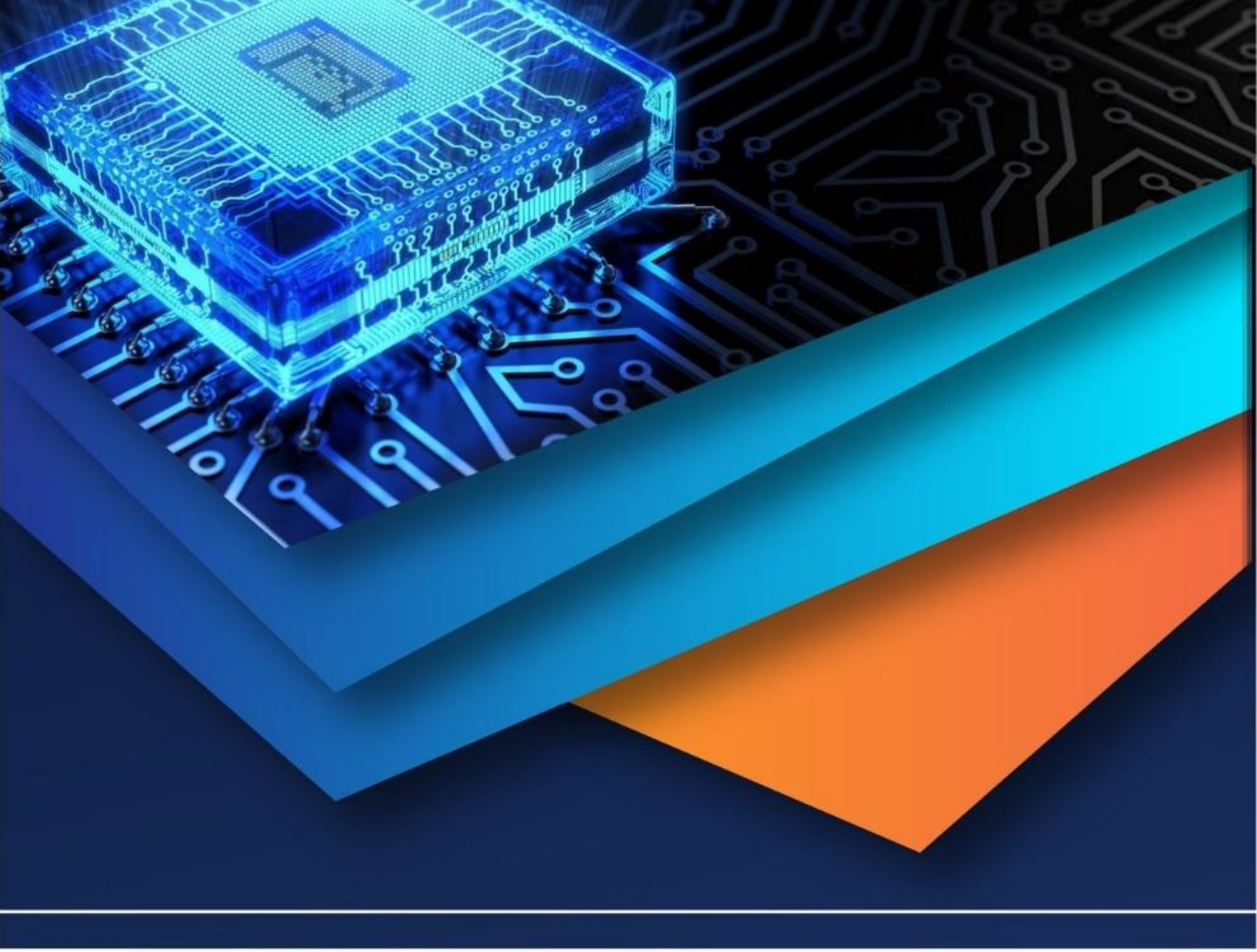

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