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A Comprehensive Evaluation of the Physicochemical Properties of Jaipur Soil

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Abstract

This article explores the physiochemical features of soil samples accumulated from numerous places within the city of Jaipur, India. The key purpose is to offer an extensive evaluation of important soil specifications that considerably affect farming performance and ecological quality. This article also studies the physicochemical properties such as soil pH, electric conductivity (EC), organic carbon, available nitrogen, phosphorus, and potassium.

Introduction

Jaipur, situated in Rajasthan, India, experiences varied climatic problems ranging from completely dry to semi-arid, causing soil to have differing physical or chemical attributes. Jaipur soil is primarily comprised of weathered rock products, minerals, and also different microorganisms. The appearance of Jaipur soil differs throughout various areas, varying from sandy silt to clayey soil. Sandy soils are common in the borders of Jaipur, identified by big fragments that provide excellent water drainage yet reduce water and nutrient retention. As a result, this examination intends to thoroughly analyze the physiochemical functions of soil obtained from various areas within Jaipur. (Sharma and Suryakant, 2022).

Materials and Methods

Soil Sampling

A representative soil sample was collected from different areas of Jaipur at a depth of 0-15 centimetres, 15-30 centimetres, and also 30-60 centimetres respectively. These samples were ultimately incorporated to develop a solitary composite sample, and further analysis was carried out.

Physiochemical Analyses

- **Soil pH:** Soil suspensions (1:2.5 w/v proportion) prepared utilizing deionized water was stirred for thirty minutes in a mechanical shaker prior to determining pH with a calibrated electronic pH meter. (Jakson, 1973).

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- **Electric Conductivity (EC):** EC is a measure of soluble salts in the soil which was determined by digital conductivity meter (Smith and Doran, 1996).
- **Organic Carbon:** Organic carbon was determined by rapid titration method of estimation outlined by Walkley and Black as described by Jackson (1973) and the result was expressed in g kg^{1}.
- **Available Nitrogen:** The available nitrogen was determined by alkaline potassium permanganate method suggested by Subbiah and Asija (1956) and the result was calculated in terms of kg ha^{-1}.
- **Available Phosphorus:** Available phosphorus was extracted with 0.03 N NH, F in 0.025 N HCI solutions. The procedure is primarily meant for soils which are moderate to strongly acidic with pH around 5.5 or less and determined by Brays and Kurtz method (1945).
- **Available Potassium:** Available potassium content in soil was extracted with neutral normal ammonium acetate (pH 7.0). The potassium content in the extract was determined by flame photometer (Jackson, 1973).

Result

Soil pH

The pH varied between 7.2 with 8.9, suggesting somewhat alkaline to moderately alkaline problems common in Jaipur soil. Such pH arrays are desirable for the majority of plants; nevertheless, mild adjustments could be essential for acid-loving plants or those conscious of high pH degrees.

Electric Conductivity (EC)

The mean EC value differed from 0.2 to 0.8 dS m^{-1} recommending a reduction to modest salinity degrees for plant development. High EC might possibly prevent seed germination as well as origin lengthening, calling for ideal water drainage systems as well as leaching approaches throughout watering.

Organic Carbon

Organic Carbon (%) ranges from 1.116 ±0.100 while organic matter (%) was 1.923±0.175 (Sanjoli Mobar et. al., 2015). There was a continuous reduction in organic which might be due to excessive tillage and intensive cultivation practices in semi-arid region owing to reduced soil organic carbon content (Singh *et al.*, 2007)

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Available Nitrogen

The overall nitrogen content ranges from 0.05% to 0.15%, indicating unsatisfactory levels that require external supplements in the form of natural or mineral plant meals. A well-balanced nitrogen management strategy that includes timely applications, divided treatments, and integrated plant turnings will provide optimal nutrient uptake while reducing environmental problems related to leaching and gaseous emissions.

Available Phosphorus

The available phosphorus content in the soil ranges from was 5.6 kg ha-¹ to 5. kg ha-¹, emphasizing the need for crucial therapies aimed at enhancing availability with slow-release agents, mycorrhizal groups, and specific band positionings. Additionally, regular screening is advised due to phosphorus' propensity to fix and immobilize under alkaline conditions, which are common in Jaipur soil.

Available Potassium

Potassium gets showed substantial irregularity varying from 150 to 350 kg ha-¹ representing an appropriate supply for the majority of plants. Nonetheless, routine evaluations as well as circumspect replenishment come to be vital when thinking about variables affecting potassium characteristics consisting of soil kind, environment, cultivars, as well as social procedures.

Table 1: Physiochemical attributes of Jaipur Soils of Last Three Years (2022-2024).

Year	pH	Electrical Conductivity (Ds/m)	Organic Carbon (%)	Available Nitrogen (Kg/ha)	Available Phosphorus (Kg/ha)	Available Potassium (Kg/ha)
2022	7.2± 0.3	0.2± 0.1	1.116±0.15	0.10±15.0	5.6±1.2	161±48
2023	7.6± 0.3	0.7± 0.1	0.128±0.16	0.13±14.9	5.7±1.3	253±49
2024	8.2± 0.3	0.3±0.1	0.563± 0.17	0.07±14.8	5.8±1.2	298±50

Conclusion

Comprehending the physicochemical attributes of Jaipur soil, farmers can now utilize this expertise to make educated choices relating to plant choice, soil changes, watering, and also nutrient monitoring. For instance, plants that are tailored to the leading soil appearance as well as pH can be selected to make the most of returns and also lessen input expenses. In

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addition, targeted application of natural modifications in plant foods and soil conditioners can enhance soil wellness and also efficiency with time.

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