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A Comparative study of soil sample of Naya Raipur, Chhattisgarh

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Abstract

Soil an essential natural resource, it is vital to agriculture and the global ecology. A field experiment was conducted to evaluate the physical and chemical properties of the soil from Naya Raipur, being the capital of Chhattisgarh, is located in the tropical wet and dry climate zone of central India. Two Soil samples were collected includes agricultural soil from nearby village Palaud and garden soil from Kalinga University. Soil samples were tested and it was observed that soil pH for agricultural soil is 8 and garden soil is 7. It is slightly alkaline in nature. The soil colour is dark brown of agricultural soil and light brown is of garden soil. The moisture content of agricultural soil is 40% and garden soil is 30%. It is optimal for plant growth. The porosity of agricultural soil is high and garden soil is low. This concludes that the agricultural soil is more fertile as compared to garden soil and the variation in physical and chemical properties is due to natural environment, climate changes, water irrigation and fertilizers.

Key words: Soil, Capital, Agriculture, Chemical Properties, Physical Properties, Garden Soil

Introduction

The majority of the earth's surface is covered in a thin layer of soil. The top layer of soil is created by various natural forces acting on natural materials (Bhardwaj S et al.,2020). Soils, along with forests and water, are one of the largest contributors to environmental deprivation in developing nations. Even though the chemical attributes of soil are affected by poor cultivation practices, desertification, severe /frequent irrigation, and excessive application of pesticides, the physical attributes of soil affect lushness through movement of water and wind. One of nature's greatest gifts to humanity is soil, which needs to be used wisely. (Vikram Kumar et al.,2016)

Geographically, Chhattisgarh is divided into three distinct land areas viz. –

I. Chhattisgarh Plains
II. Bastar Plateau
III. Northern Hill Zones

There are number of types of soil found in Chhattisgarh area, but four major type of soil that is found in the Chhattisgarh plain.

Bhata, also known as lateritic soil, is a coarse, red, sandy-gravelly soil found in Chhattisgarh, India. It's characterized by its high iron and aluminium oxide content, which gives it its reddish colour.

Matasi soil - It is a yellow or gray soil with a clay admixture and a texture that ranges from loam to clay loam. Matasi soil is suitable for cultivation and is often used for growing paddy, maize, and deep-rooted pulses.

Dorsa soil -It is a loamy soil that is brown to yellow in color. Dorsa soil is a mixture of Kanhar soil and Kachhari silt.

Kanhar (Clay)- It is deep, dark brown to black in color, and has a high capacity to retain moisture. Kanhar soil is also known as Vertisol.

This study was conducted as a three stage process: soil survey, soil sampling, and analysis of different soil parameters. Two soil samples were collected; one is a Paloud agriculturual soil and the second is a garden soil from Kalinga University, Raipur.

This particular literature review on soils was undertaken to gain knowledge on the soil types as well as the geographical location of the place and to find out what has already been done previously in that particular location. We have conducted a soil analysis through compounds estimation and several other processes.

Literature Review

- (SA Tigga et al.,) Important markers of soil fertility and health include nutrient availability, pH, electrical conductivity (EC), and organic carbon (OC). Sarguja District's somewhat acidic pH (. to .), for example, encourages the best possible nutrient availability for plants. Low levels of available nitrogen, phosphorus, potassium, and sulfur point to possible nutrient shortages. It is advised to use soil management techniques to raise nitrogen levels.
- (KA Wani et al.,) Agricultural soils are often more fertile than market, industrial, and barren soils, according to research on the physical and chemical characteristics of soil in Gwalior. Topography has a significant impact on the physical and chemical variability in the moderate fertility found in industrial soils. Fertility is decreased in industrial and arid soils, most commonly as a result of contamination or a lack of organic amendments. Sustainable farming methods are seriously threatened by the expansion of industrial and development projects on Gwalior's agricultural land.
- (R Bednarek et al.,) This study examines the physical and chemical properties of garden soils in Toruń, which are largely anthropogenic and altered due to human activity. The research focused on evaluating if the soils met the criteria for Hortic Anthrosols, according to the World Reference Base for Soil Resources (WRB). The results revealed that although some horticultural criteria were met, the phosphorus content was too low to qualify for the hortic horizon classification. This study emphasizes the need for further research on garden soils to assess nutrient levels and potential heavy metal accumulation, as well as the appropriateness of WRB standards for these soils.
- (S Tresch et al.,) The study evaluates the quality of soil in urban gardens, emphasizing how garden management affects nutrient cycling, soil characteristics, and ecosystem services. It demonstrates that the degree of soil disturbance, as in annual vegetable sites, influences soil organic carbon and microbial biomass, with the maximum earthworm biomass occurring in these regions. The amount of heavy metals in the soil varied and was more correlated with traffic and industrial activities than with garden care. In order to assess urban garden soil quality and manage soil sustainably, the study highlights the necessity of multi-indicator frameworks that take into account both biotic and abiotic components.
- (Y Qian et al.,) With a particular focus on soil pH, electrical conductivity (EC), and exchangeable sodium percentage (ESP), the study examines how irrigation with recycled water affects the chemical characteristics of soil. The findings demonstrate that irrigation with recycled water raised soil pH and ESP over time, suggesting that sodicity is more of an issue than salinity. Although gypsum application had little impact on deeper layers, it did assist reduce salt build-up at surface depths. In urban environments, soils irrigated with recycled water may need extra measures to avoid long-term deterioration due to pH and sodium build-up, in contrast to garden soils, which are frequently maintained for ideal nutrient cycling.

- (AS Khanday et al.,) This paper's main focus is on assessing how various fertilizer amounts and irrigation techniques affect the physico-chemical characteristics of the soil and pea yield in a sub-humid, sub-tropical area of Himachal Pradesh. The study emphasizes how crop output and soil health are impacted by nitrogen management and irrigation techniques.
- (LR Bullack et al.,) The influence of synthetic and organic fertility supplements on crop yields, physical and chemical characteristics, and soil microbial populations in conventional and organic farming systems is the main topic of this article. The study emphasizes how organic additions support sustainable agricultural practices by influencing nutrient availability, enhancing beneficial microbes, and improving soil quality. (Fuchs et al.,) A rich organic matter profile enhances soil structure, increases water retention, and improves nutrient availability for plants. For instance, the incorporation of compost and dig estate into soil not only recycles nutrients but also fosters beneficial microbial activity that supports plant health.
- (NN Dubenok et al.,) The creation and assessment of a novel irrigation method for garden plantings is the focus of this article. It centers on the implementation of the agrotechnical technique known as "slitting" to increase irrigated agriculture's water efficiency. In order to optimize irrigation by lowering water and energy consumption while guaranteeing efficient soil moisture retention, the study emphasizes the employment of specialized equipment to establish a natural water-intercepting and conveying network.
- (EM Cook et al.,) The multidisciplinary examination of residential landscapes as intricate social-ecological systems is the focus of this research. It examines how ecological results and human decision-making interact in yard management, highlighting the necessity of a multi-scale approach to comprehend tradeoffs, feedbacks, and ecosystem services. The paper highlights important research gaps and suggests a framework to direct next multidisciplinary investigations into the dynamics of residential landscapes

Methodology

Data Collection Method

The data used in this research is the soil samples. The soil samples have been collected from Naya Raipur region of Chhattisgarh state. One sample is from the Kalinga University, Naya Raipur and another sample is from a village named Palaud in Naya Raipur. There are two different types of soils in which one is an agricultural land soil and the other is garden soil.

Soil sample collection involves removing surface debris then digging a hole and then collecting a soil sample from the hole.

Analysis Techniques

Soil samples are compared and analyzed on the basis of their physical analysis (particle size distribution, porosity, moisture content) and chemical analysis (pH value and nutrient levels like nitrogen, phosphorous and potassium).

Tools for research

Colorimeter: A colorimeter detects the intensity of colour in a soil solution after a chemical reaction to quantify the amount of specific soil nutrients, like nitrogen or phosphorus, based on the colour developed.

Hot Air Oven: In order to use a Hot Air Oven to estimate the moisture content of a soil sample, the weight of the sample is measured both before and after the moisture has been removed.

Parameters

pH

The soil's pH value shows its acidity or alkalinity. The pH of a soil is an important factor that is affected by several other factors, including climate, fertiliser, and vegetation. A pH paper can be used to measure the pH of any soil; a soil is deemed acidic if its pH is less than 6 and alkaline or basic if it is greater than 6.

In this research, we collected the soil samples from Kalinga University, Naya Raipur and a village in Naya Raipur (Palaud). In the soil sample of the university, it is found that the pH of the soil is 7 and the pH of soil from the village is 8. And hence both the soil samples are alkaline in nature.

Moisture Content

The moisture content of a soil can be determined by measuring the amount of water present. The quantity of sand, slit, and clay may reduce the moisture content of the soil.

Using the formula:

Soil moisture percentage = [(Wet soil weight – Dry soil weight) / Dry soil weight] * 100

In the agricultural land soil, the moisture content is 40% and the garden soil sample is 30%. On comparing both the samples, we conclude that agricultural soil is moister in nature.

Porosity

Soil porosity, or the amount of free space in the soil, influences the storage and transmission of heat, gases, and liquids. It affects root penetration, water storage, and water drainage.

The agricultural soil sample is more porous and the soil of garden is less porous as compared to the agricultural soil.

Soil Colour

Soil colour serves as a key indicator of the proper soil properties and is the visual appearance of soil. It is susceptible to weathering and climate.

The colour of the Palaud's agricultural soil sample is comparatively darker brown in colour than garden soil sample of Kalinga University, this shows the health of soil.

Isolation of microorganisms

The isolation of microorganisms from soil requires separating one specific type of microbe from a diverse mixture, to obtain a pure culture for in-depth study.

Out of both the soil samples, the sample of garden soil from Kalinga University has more microbes present as compared to the sample of Palaud’s agricultural soil.

Nutrients

Nitrogen (N): A limiting ingredient in both garden and agricultural soils, nitrogen is necessary for the growth of leaves and stems.
Phosphorus (P): Essential for plant health, phosphorus plays a key role in root formation, blooming, and fruiting.
Potassium (K): Another critical nutrient, potassium is essential for water balance, disease resistance, and general plant health.

Nitrogen, phosphorus, and potassium (NPK) are more abundant in agricultural soil than in garden soil, which could not have the same degree of nutrient control.

Conclusion

When comparing garden soil to agricultural soil, notable differences in their composition, structure, and suitability for specific purposes become apparent. Garden soil typically consists of a mixture of organic matter, sand, and clay, which aids in drainage and is perfect for various ornamental plants, flowers, and small-scale gardening. The texture and nutrient levels of this soil can vary by region, and it often requires improvements such as compost or fertilizers to promote optimal plant growth.

In contrast, agricultural soil is purposefully developed and enhanced for the sake of farming. It generally holds a higher concentration of nutrients, supported by regular farming practices and fertilizers, making it more conducive for large-scale crop production. The texture of agricultural soil, which ranges from loamy to clay, allows it to retain moisture and establish a more consistent setting for plant growth.

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