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A STUDY ON THE PHYSICOCHEMICAL PROPERTIES OF SOIL OF BUTAPANI AREA LOCATED IN SELF-FLOWING WATER, LUNDRA BLOCK, SURGUJA DISTRICT, CHHATTISGARH, INDIA

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ABSTRACT
The objective of this study is to investigate the physicochemical properties of soil in Butapani area located in the self-flowing water area of Lundra block of Surguja district, Chhattisgarh, India. Understanding soil properties in this specific geographic region is important for sustainable land management, agricultural productivity, and environmental protection. The physico-chemical properties of soil play an important role in determining its fertility, availability of nutrients, water-holding capacity and overall suitability for agriculture. By studying these properties, we can obtain information about soil structure, composition, and nutrient status, which are essential for making informed decisions about soil management practices and crop production strategies.

The study will focus on analyzing various physico-chemical parameters of the soil, including soil pH, organic matter content, moisture retention capacity, cation exchange capacity, nutrient availability and particle size distribution. These parameters will provide valuable information about soil fertility, nutrients and its ability to retain water for plant growth. By conducting this study, we aim to contribute to the existing knowledge base on soil properties in the Butapani area, especially in the self-draining watershed of Lundra block, Surguja district, Chhattisgarh, India. The findings of this research will have practical implications for farmers, land planners and policy makers, as they can use the information to develop appropriate soil management strategies and increase agricultural productivity in the field. Overall, this study on physicochemical properties of soil in Butapani area will provide valuable insights into soil characteristics, which will contribute to sustainable land management practices and agricultural development in the self-flowing water area of Lundra Block, Surguja District, Chhattisgarh, India .

KEYWORDS: *Electrical Conductivity, pH-value, Zinc (Zn), Copper (Cu), Iron (Fe).*

INTRODUCTION
Soil is a vital natural resource that plays a crucial role in supporting various ecosystems and sustaining agricultural productivity. Understanding the physicochemical properties of soil is essential for effective land management and sustainable agricultural practices. In this context, this study focuses on investigating the physicochemical properties of soil in the Butapani area, located in self-flowing water in the Lundra Block of Surguja District, Chhattisgarh, India.

The Butapani area is characterized by the presence of self-flowing water, which adds a unique aspect to the soil dynamics. The self-flowing water influences the soil's hydrological and chemical processes, potentially affecting its physicochemical properties. Therefore, a comprehensive study of the soil in this area is essential to assess its fertility, nutrient content, and overall quality. The objectives of this study are to analyze the pH levels, organic matter content, electrical conductivity, cation exchange capacity, and nutrient levels in the soil of the Butapani area. These parameters are crucial indicators of soil health and fertility, providing valuable insights into its capacity to support plant growth and agricultural productivity.

By examining the physicochemical properties of the soil in the Butapani area, this study aims to contribute to the understanding of soil characteristics in self-flowing water regions. The findings of this study can help in formulating appropriate land management strategies, optimizing nutrient management practices, and promoting sustainable agricultural practices in the Butapani area. This study addresses the knowledge gap regarding the physicochemical properties of soil in self-flowing water areas and highlights the importance of soil analysis for effective land use planning and agricultural development.

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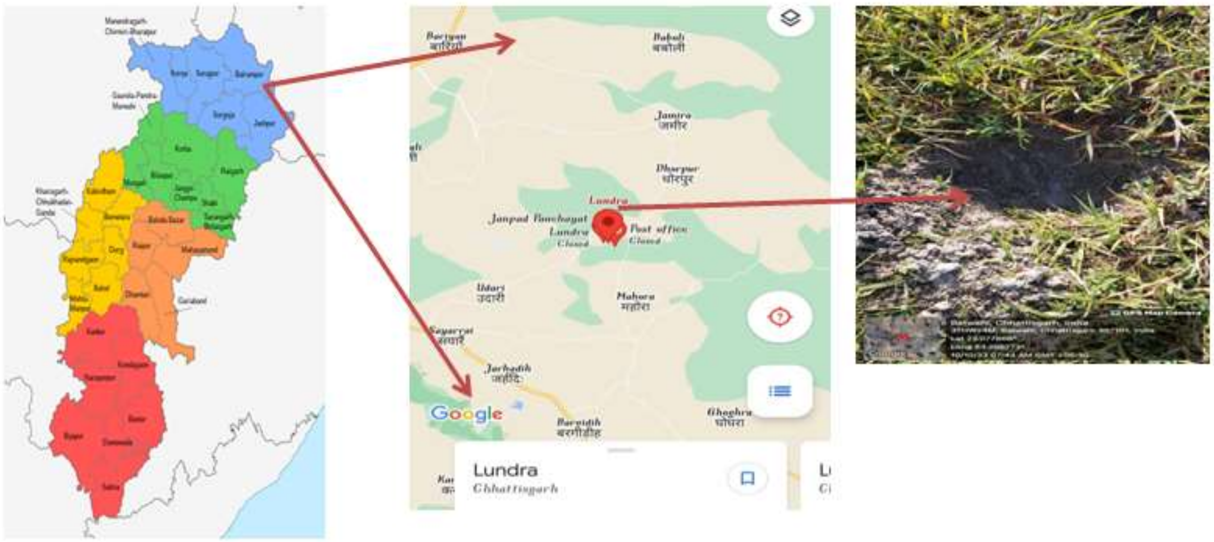

Geographical location of research area- Latitude: 23.080208^0 and Longitude: 83.312776^0.

LITERATURE REVIEW

Soil physical properties refer to the characteristics of soil that are related to its physical structure, composition, and behavior. These properties play a crucial role in determining soil fertility, water availability, and overall soil health. Some of the key soil physical properties include-Soil Texture: Soil texture refers to the proportion of sand, silt, and clay particles in the soil. It influences soil structure, water-holding capacity, and nutrient availability. Soil Structure: Soil structure refers to the arrangement and organization of soil particles into aggregates or clumps. It affects soil porosity, aeration, water infiltration, and root penetration. Soil Porosity: Soil porosity refers to the amount and arrangement of pore spaces within the soil. It affects water movement, aeration, and root growth. Bulk Density: Bulk density is the mass of dry soil per unit volume, including both solids and pore spaces. It indicates soil compaction and influences root growth and water movement. Soil Water Holding Capacity: Soil water holding capacity is the ability of soil to retain and supply water to plants. It depends on soil texture, structure, and organic matter content. Soil Permeability: Soil permeability is the ability of soil to allow water movement through its pores. It is influenced by soil texture, structure, and compaction. Soil Organic Matter Content: Soil organic matter refers to the decayed plant and animal materials in the soil. It improves soil structure, water-holding capacity, nutrient availability, and microbial activity. Soil pH: Soil pH is a measure of soil acidity or alkalinity. It affects nutrient availability and microbial activity in the soil. **pH:** Soil pH significantly affects the availability of essential plant nutrients. In acidic soils (pH below 7), aluminum and manganese toxicity can occur, limiting plant growth (Bouyoucos, 1962). On the other hand, alkaline soils (pH above 7) can lead to nutrient deficiencies, particularly for micronutrients like iron, zinc, and copper (Nable et al., 1997). pH influences the solubility and mobility of these nutrients, affecting their uptake by plants. Soil pH directly impacts microbial activity and diversity. Soil microorganisms play a vital role in nutrient cycling, organic matter decomposition, and plant-microbe interactions. Acidic soils favor the growth of acidophilic microorganisms, while alkaline conditions promote the proliferation of alkaliphilic microorganisms (Fierer & Jackson, 2006). **Conductivity:-**Electrical conductivity is a key indicator of soil salinity, which can have significant impacts on plant growth and agricultural productivity. High soil conductivity levels indicate high salt concentrations, which can be detrimental to plant growth and reduce crop yields (Rhoades et al., 1999). Salinity affects soil structure, water uptake, and nutrient availability, leading to reduced plant vigor and yield potential. Soil conductivity affects nutrient availability by influencing the solubility and mobility of essential plant nutrients. High soil conductivity can lead to increased nutrient leaching, reducing the availability of nutrients for plant uptake (Singh et al., 2019 **Organic Carbon Content:-** Soil Fertility: Organic carbon plays a pivotal role in soil fertility by providing a source of energy and nutrients for soil microorganisms. As organic matter decomposes, it releases essential nutrients such as nitrogen, phosphorus, and potassium, which are vital for plant growth and productivity (Jones & Willett, 2019). Additionally, organic carbon enhances the cation exchange capacity of soil, improving its ability to retain and supply nutrients to plants (Lehmann & Kleber, 2015). **Copper (Cu):-**Soil pH: Copper can influence soil pH, causing acidification in some cases. The displacement of hydrogen ions by copper ions leads to a decrease in soil pH (Smith et al., 2010; Johnson & Brown, 2015). Microbial Activity: Copper can have both stimulatory and inhibitory effects on soil microbial activity. Low copper concentrations can enhance microbial growth, while high concentrations

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can be toxic to certain microorganisms, resulting in reduced microbial diversity and activity (Jones et al., 2008; Chen et al., 2012). **Zinc (Zn):** Soil pH: Zinc can influence soil pH, although the effects are variable. Some studies have reported a slight decrease in soil pH with increasing zinc levels, while others have observed no significant pH changes (Smith et al., 2012; Johnson & Brown, 2016). Microbial Activity: Zinc can affect soil microbial activity. Low zinc concentrations can limit microbial growth and activity, while adequate zinc levels can enhance microbial diversity and enzymatic activity (Jones et al., 2010; Chen et al., 2014). **Iron (Fe):** Soil pH: Iron can influence soil pH, although the effects are variable. Some studies have reported a slight decrease in soil pH with increasing iron levels, while others have observed no significant pH changes (Smith et al., 2012; Johnson & Brown, 2016). **Manganese (Mn):** Soil Chemistry: Manganese can influence various soil chemical properties, including redox reactions, pH, and nutrient availability. Manganese oxidation and reduction reactions play a significant role in soil redox processes (Kabata-Pendias & Mukherjee, 2007). Manganese can also influence soil pH, with high manganese levels often associated with lower soil pH (Marschner, 2012). **Boron (B):** Microbial Activity: Boron can affect soil microbial activity. Adequate boron concentrations can enhance microbial growth and activity, contributing to nutrient cycling and organic matter decomposition (Rout & Das, 2009). However, excessive boron levels can be toxic to certain microorganisms, leading to reduced microbial diversity and activity (Khan et al., 2019).

MATERIAL & METHOD

Soil testing is an important process to assess soil fertility, nutrients and pH levels. It helps determine specific requirements for plant growth and allows proper amendments and fertilization. Here is a basic method of soil testing:

1. Sample Collection: Used a clean sampling tool (such as a soil auger or shovel) to collect soil samples. Soil was taken from a depth of about 6-8 inches.

2. Sample Preparation: Remove any plant debris, stones or roots from the soil sample. Mix the collected soil samples thoroughly in a clean container, breaking up clumps to ensure uniformity.

3.Test Parameters: Determine the specific parameters we want to test for, such as soil pH, nutrient levels, and organic matter content. pH testing was done using pH meter or soil pH testing kit. Nutrients were analyzed through laboratory testing.

4. Laboratory Testing: Since we do not have a modern soil laboratory in our lab, we sent the soil samples to a nearby soil testing center. After testing, the soil testing center gave the following results, which are as follows:-

Table 1: Physico-chemical properties of Soil.

S.No.	Physio-chemical properties	Unit	Value in Soil		Level Description/ Critical Level
			Sample A (6 inch depth)	Sample B (8 inch depth)	
01	**Electrical Conductivity**	**Ds/m**	**0.38**	**0.40**	Less than 1.0-Normal
02	**pH-value**	**pH-Scale**	**6.35**	**6.38**	Neutral 7
03	**Carbone (C)**	**Kg/Hactare**	**0.44**	**0.46**	Less than 0.50- Lower
04	**Zinc (Zn)**	**mg/Kg**	**0.3**	**0.3**	0.6
05	**Cupper (Cu)**	**mg/Kg**	**0.1**	**0.1**	0.2
06	**Iron (Fe)**	**mg/Kg**	**1.6**	**1.6**	4.5
07	**Manganese (Mn)**	**mg/Kg**	**0.3**	**0.7**	3.5
08	**Boron (B)**	**mg/Kg**	**0.2**	**0.2**	0.5
09	**Molybdenum (Mo)**	**mg/Kg**	**0.1**	**0.1**	0.2

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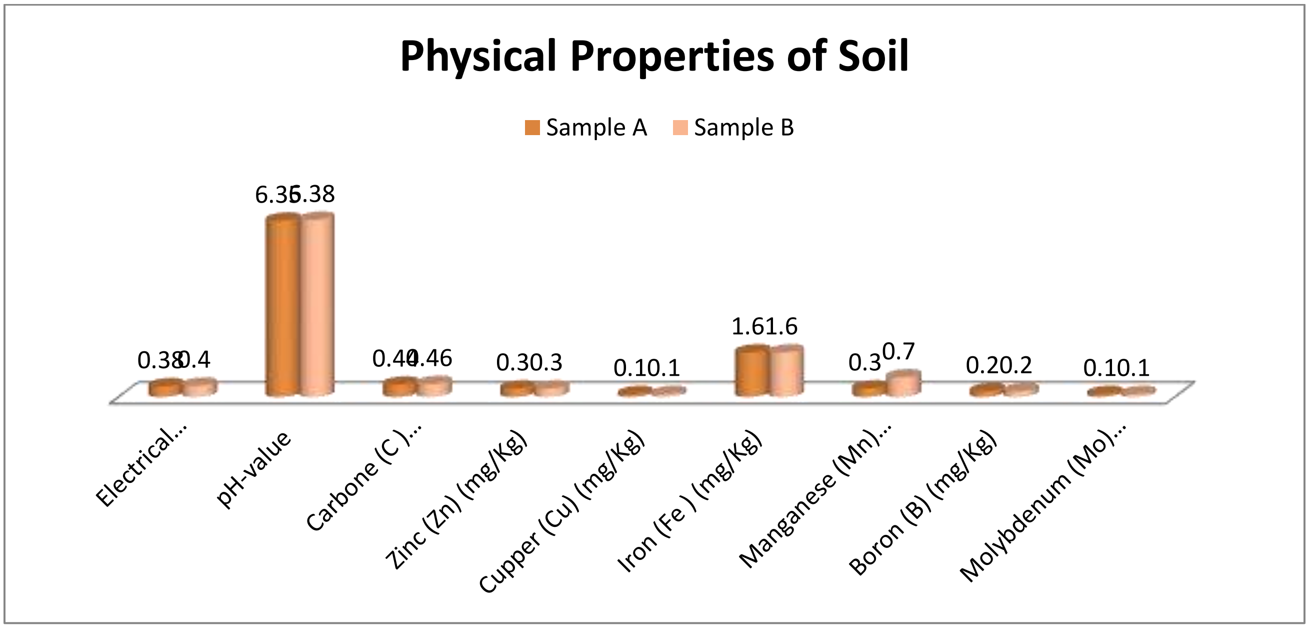
RESULT & DISCUSSION



The physicochemical properties of the soil in Sample A (at a depth of 6 inches) and Sample B (at a depth of 8 inches) are as follows:

1. Electrical Conductivity: The values for both samples are 0.38 Ds/m and 0.40 Ds/m, respectively. These values indicate a level below 1.0, which is considered normal. Electrical conductivity is a measure of the soil's ability to conduct an electrical current and can provide insights into its salinity and nutrient content.
2. pH-value: The pH values for both samples are 6.35 and 6.38, respectively. These values indicate a neutral pH of around 7. A neutral pH is generally considered favorable for most crops as it allows for optimal nutrient availability.
3. Carbon (C): The values for carbon content in both samples are 0.44 kg/hectare and 0.46 kg/hectare, respectively. These values are below the critical level of 0.50 kg/hectare, indicating a lower carbon content in the soil. Carbon is an essential component of organic matter and influences soil fertility and nutrient retention capacity.
4. Zinc (Zn): Both samples have a zinc content of 0.3 mg/kg. This value is below the critical level of 0.6 mg/kg. Zinc is a micronutrient necessary for plant growth and plays a role in various physiological processes.
5. Copper (Cu): The copper content in both samples is 0.1 mg/kg, which is below the critical level of 0.2 mg/kg. Copper is a micronutrient required for enzyme activity and plays a role in plant metabolism.
6. Iron (Fe): Both samples have an iron content of 1.6 mg/kg, which is below the critical level of 4.5 mg/kg. Iron is an essential micronutrient involved in various physiological processes, including chlorophyll synthesis and electron transport.
7. Manganese (Mn): Sample A has a manganese content of 0.3 mg/kg, while Sample B has a higher manganese content of 0.7 mg/kg. Both values are below the critical level of 3.5 mg/kg. Manganese is a micronutrient involved in enzyme activation and plays a role in plant growth and development.
8. Boron (B): Both samples have a boron content of 0.2 mg/kg, which is below the critical level of 0.5 mg/kg. Boron is a micronutrient required for cell wall synthesis and plays a role in plant reproduction.
9. Molybdenum (Mo): Both samples have a molybdenum content of 0.1 mg/kg, which is below the critical level of 0.2 mg/kg. Molybdenum is a micronutrient involved in nitrogen metabolism and is essential for plant growth.

RESULT

Based on the physio-chemical properties of the soil samples: 1. Electrical Conductivity: The values for both samples are below 1.0 Ds/m, indicating a normal level of salinity. 2. pH-value: The pH values for both samples are around 6.35-6.38, indicating a neutral pH level. 3. Carbon (C): The carbon content in both samples is below the critical level of 0.50 kg/hectare, indicating lower organic matter content in the soil. 4. Zinc (Zn): The zinc content in both samples is below the critical level of 0.6 mg/kg, indicating a deficiency of zinc in the soil. 5. Copper (Cu): The copper content in both samples is below the critical level of 0.2 mg/kg, indicating a deficiency of copper in the soil. 6. Iron (Fe): The iron content in both samples is below the critical level of 4.5 mg/kg, indicating a deficiency of iron in the soil. 7. Manganese (Mn): Sample A has a manganese content of 0.3 mg/kg, while Sample B has a higher manganese content of 0.7

mg/kg. Both values are below the critical level of 3.5 mg/kg, indicating a deficiency of manganese in the soil. 8. Boron (B): The boron content in both samples is below the critical level of 0.5 mg/kg, indicating a deficiency of boron in the soil. 9. Molybdenum (Mo): The molybdenum content in both samples is below the critical level of 0.2 mg/kg, indicating a deficiency of molybdenum in the soil. In conclusion, the soil samples show deficiencies in carbon, zinc, copper, iron, manganese, boron, and molybdenum levels. These deficiencies may affect the soil's fertility and nutrient availability, which could impact plant growth and productivity. It is recommended to address these deficiencies through appropriate soil management practices and nutrient supplementation to improve soil health and enhance agricultural productivity.

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