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SOIL QUALITY EVALUATION IN MOTIPUR BLOCK, AMBIKAPUR: A PHYSICO-CHEMICAL PERSPECTIVE

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ABSTRACT
This study evaluates the physico-chemical properties of soil in the Motipur block, Ambikapur, located in the Surguja division of Chhattisgarh. The soil samples were analyzed for key parameters such as pH, electrical conductivity (EC), organic carbon, nitrogen, phosphorus, potassium, and micronutrients (iron, zinc, copper, and manganese). The findings reveal the soil's suitability for agriculture and highlight variations in nutrient content and chemical properties. This study provides essential baseline data for soil management and sustainable agricultural practices in the region.

KEYWORDS: *Physical properties, chemical properties, conductivity, Soil texture & pH-value.*

INTRODUCTION

Soil is a fundamental component of terrestrial ecosystems, serving as the medium for plant growth, a habitat for microorganisms, and a critical player in nutrient cycling and water filtration. Understanding the physico-chemical properties of soil is essential for assessing its quality and suitability for agricultural, ecological, and developmental purposes.

The Motipur block, located in the Ambikapur region of Surguja division, Chhattisgarh, is characterized by diverse land use patterns and varying soil textures. The region's soil quality plays a vital role in sustaining agricultural productivity, maintaining ecological balance, and supporting local livelihoods. Despite its importance, comprehensive studies evaluating the physico-chemical characteristics of soil in this region are limited.

This study aims to bridge this gap by conducting a detailed analysis of the soil from Motipur block. Key physico-chemical parameters, including texture (sand, silt, and clay percentages), bulk density, particle density, porosity, water holding capacity (WHC), permeability, pH, electrical conductivity, and nutrient content (such as carbon, zinc, copper, iron, manganese, and other essential elements), are examined. By understanding these properties, this research seeks to provide insights into soil fertility, potential constraints, and strategies for sustainable land management. The findings from this study will not only contribute to the scientific understanding of soil properties in the Motipur block but also serve as a reference for policymakers, agriculturalists, and environmentalists aiming to optimize land use and enhance soil health. Additionally, this research adds to the broader discourse on soil quality in the Surguja division, complementing previous studies conducted in related regions.

LITERATURE REVIEW

Soil quality assessment is a multifaceted approach that involves evaluating various physical, chemical, and biological properties to understand soil functionality and productivity. Previous research highlights the importance of soil texture, structure, and nutrient content in determining soil health and its capability to support plant growth (Brady & Weil, 2017). Studies have also emphasized the role of pH and electrical conductivity in influencing nutrient availability and microbial activity (Marschner, 2012).

In the Indian context, several studies have explored the physico-chemical properties of soil in various agro-climatic zones. For instance, Sharma et al. (2020) analyzed the soils of central India and reported significant variations in texture and nutrient availability based on land use patterns. Similarly, Singh and Yadav (2018) highlighted the impact of soil organic carbon and micronutrient levels on crop productivity in semi-arid regions.

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Specific to the Surguja division, Kumar et al. (2019) conducted a comparative study of soil properties across different blocks and identified key factors affecting soil fertility, including organic matter content, cation exchange capacity (CEC), and macronutrient levels. However, detailed studies focusing on the Motipur block remain scarce, underscoring the need for localized research.

Globally, research on soil quality has evolved to integrate sustainable land management practices. Lal (2020) underscored the significance of soil organic carbon in mitigating climate change and enhancing soil health. Furthermore, Blanco-Canqui and Rattan (2013) discussed the role of conservation tillage and crop residue management in maintaining soil quality.

This literature review establishes a foundation for understanding the critical parameters influencing soil quality. By contextualizing global and regional findings, the present study aims to address the knowledge gap specific to the Motipur block and contribute to the broader discourse on sustainable soil management.

MATERIALS AND METHODS

The study was conducted in the Motipur block, located in the Ambikapur region of Surguja division, Chhattisgarh. This area is characterized by a tropical climate with distinct wet and dry seasons. The topography comprises undulating plains and patches of forested land, providing diverse soil types for analysis.

Sampling Procedure

Soil samples were collected from multiple sites within the Motipur block using a stratified random sampling approach to ensure representative coverage of different land use types and soil textures. Each sample was taken from the topsoil layer (0-15 cm depth), following the guidelines outlined by FAO (2006). Samples were air-dried, sieved through a 2 mm mesh, and stored for further analysis.

Physico-Chemical Analysis

The following parameters were analyzed using standard laboratory methods:

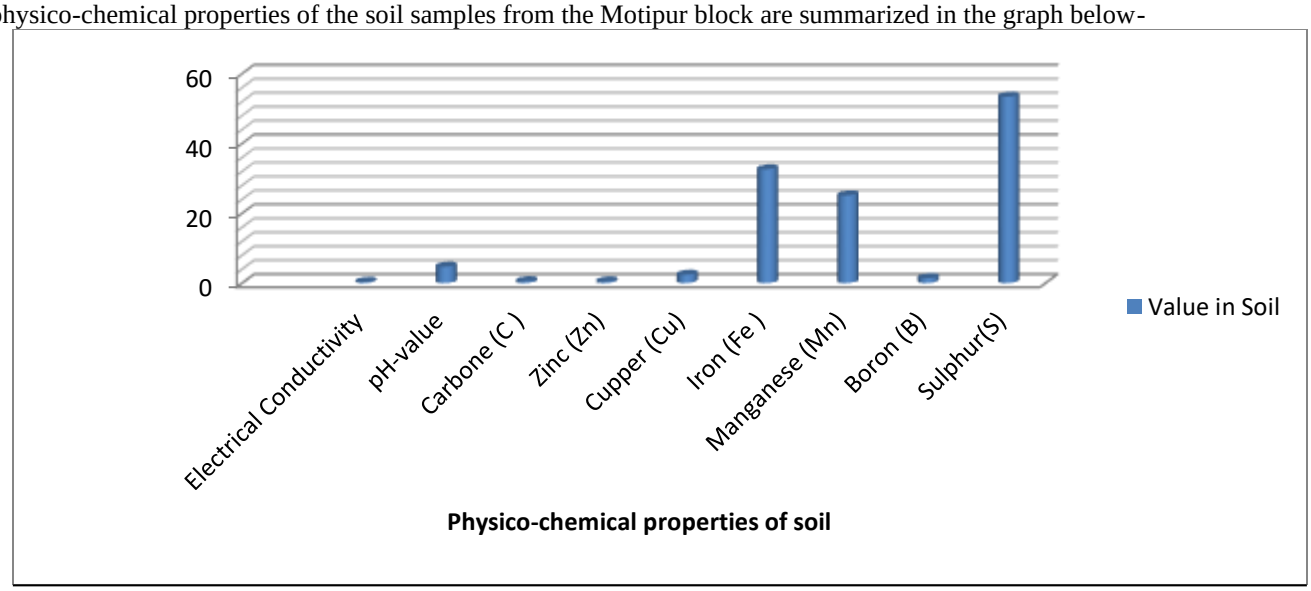
1. **Soil Texture**: Determined by the hydrometer method to quantify sand, silt, and clay proportions (Bouyoucos, 1962).
2. **Bulk Density and Particle Density**: Measured using the core sampling method (Blake & Hartge, 1986).
3. **Porosity**: Calculated based on bulk and particle densities.
4. **Water Holding Capacity (WHC)**: Determined gravimetrically by saturating soil samples and measuring retained water after drainage.
5. **pH and Electrical Conductivity**: Measured in a 1:2.5 soil-water suspension using a pH meter and conductivity meter (Jackson, 1973).
6. **Organic Carbon**: Estimated using the Walkley-Black method (Walkley & Black, 1934).
7. **Micronutrients (Zn, Cu, Fe, Mn)**: Extracted using DTPA solution and analyzed with an atomic absorption spectrophotometer (Lindsay & Norvell, 1978).
8. Table 1 : Physical properties of Soil sample taken from Motipur area, Ambikapur.

S.No.	Physio-chemical properties	Unit	Value in Soil	Level Description/ Critical Level
01	**Electrical Conductivity**	**Ds/m**	**0.34**	Less than 1.0-Normal
02	**pH-value**	**pH-Scale**	**4.7**	Neutral 7
03	**Carbone (C)**	**Kg/Hactare**	**0.54**	Less than 0.50- Lower
04	**Zinc (Zn)**	**ppm**	**0.49**	0.6
05	**Cupper (Cu)**	**ppm**	**2.39**	0.2
06	**Iron (Fe)**	**ppm**	**32.6**	4.5
07	**Manganese (Mn)**	**ppm**	**25.1**	3.5
08	**Boron (B)**	**ppm**	**1.4**	0.5
09	**Sulphur(S)**	**ppm**	**53.38**	10

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RESULT & DISCUSSION

The physico-chemical properties of the soil samples from the Motipur block are summarized in the graph below-



The data indicate that the soils in the Motipur block are generally low in organic carbon content but exhibit adequate levels of micronutrients such as copper, iron, manganese, and boron. The electrical conductivity suggests normal salinity levels, while the acidic pH value (4.7) could limit nutrient availability and require corrective measures such as lime application (Brady & Weil, 2017). Micronutrient analysis reveals that zinc is slightly below its critical threshold, potentially affecting crop yields. Conversely, the high levels of copper, iron, and manganese indicate adequate supply for plant growth. The elevated sulphur levels suggest favorable conditions for certain crops that thrive in sulphur-rich soils. The findings emphasize the need for targeted soil management practices to enhance fertility, particularly by addressing the low organic carbon content and acidic pH. Further research is recommended to investigate the relationship between soil properties and crop performance in the region.

CONCLUSION

The physico-chemical analysis of soil from the Motipur block, Ambikapur, highlights critical aspects of soil quality and fertility. Key findings include:

1. **Electrical Conductivity**: Normal levels (0.34 Ds/m), indicating low salinity and favorable conditions for crop growth.
2. **pH**: Acidic (4.7), necessitating corrective measures such as lime application to optimize nutrient availability.
3. **Organic Carbon**: Marginally above the lower threshold (0.54 Kg/Hectare), requiring improvement through organic amendments to enhance soil fertility.
4. **Micronutrients**: Adequate levels of copper (2.39 ppm), iron (32.6 ppm), manganese (25.1 ppm), and boron (1.4 ppm), ensuring sufficient supply for plant growth. Zinc (0.49 ppm) is slightly below its critical level (0.6 ppm).
5. **Sulphur**: High levels (53.38 ppm), providing favorable conditions for sulphur-demanding crops.

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