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"STUDY OF PHYSICO-CHEMICAL CHARACTERIZATION OF AGRICULTURAL SOIL IN AJIRMA AREA, AMBIKAPUR (C.G.)"

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ABSTRACT

The present study focuses on the physico-chemical characterization of agricultural soil from the Ajirma area of Ambikapur, Chhattisgarh, to evaluate its fertility status and suitability for sustainable crop production. Soil samples were collected from different agricultural fields at varying depths using standard sampling techniques. The collected samples were analyzed for key physico-chemical parameters including pH, electrical conductivity (EC), organic carbon (OC), texture, bulk density, water holding capacity (WHC), and essential nutrients such as nitrogen (N), phosphorus (P), potassium (K), and micronutrients (Zn, Fe, Mn, Cu) using standard laboratory methods. The results indicated that the soil in the study area is predominantly acidic to slightly acidic in nature, with moderate electrical conductivity, suggesting non-saline conditions. Organic carbon content ranged from low to medium, reflecting moderate soil fertility. The soil texture was mainly found to be sandy loam to clay loam, which influences moisture retention and nutrient availability. Nutrient analysis revealed variability in macronutrients, with nitrogen generally deficient, while phosphorus and potassium levels varied from medium to adequate. Micronutrient analysis showed sufficient levels of iron and manganese, while zinc deficiency was observed in some locations.

KEYWORDS: Soil Physico-Chemical Properties, Soil Analysis, NPK Nutrient Status, Soil pH and Electrical Conductivity.

INTRODUCTION

Soil is a fundamental natural resource that plays a vital role in sustaining agricultural productivity and maintaining ecological balance. The physico-chemical properties of soil, such as pH, electrical conductivity (EC), organic carbon, texture, bulk density, and nutrient content, significantly influence plant growth, soil fertility, and crop yield. Understanding these properties is essential for effective soil management and sustainable agricultural practices. The Ajirma area of Ambikapur, located in the Surguja district of Chhattisgarh, is predominantly an agricultural region where crops like paddy are widely cultivated. However, variations in soil characteristics due to climatic conditions, topography, and anthropogenic activities can affect soil quality and productivity. In this region, soils are often reported to be acidic with variable nutrient status, which may limit crop growth if not properly managed.

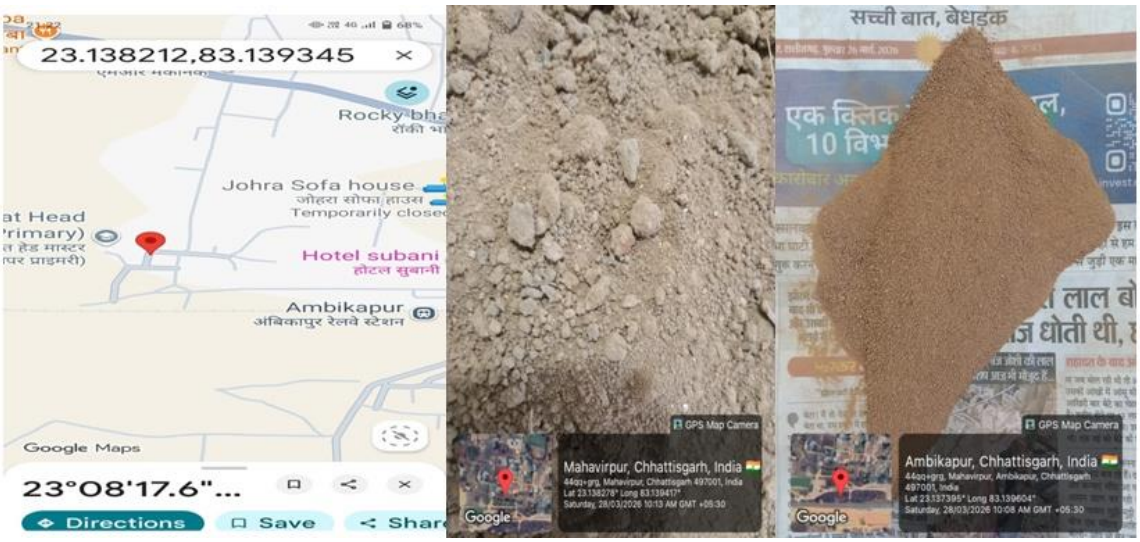


Figure 1: sampling area and sample.

Physico-chemical characterization of soil provides valuable information about nutrient availability, soil structure, water retention capacity, and overall soil health. Parameters such as nitrogen, phosphorus, potassium, and micronutrients (zinc, iron, manganese, and copper) are crucial for plant development and must be maintained at optimal levels. Additionally, soil texture and water holding capacity play a key role in determining irrigation requirements and crop suitability.

The present study aims to analyze the physico-chemical properties of agricultural soils in the Ajirma area to assess their fertility status and identify potential limitations for crop production. The findings of this study will help in recommending appropriate soil

management practices, including the use of fertilizers and organic amendments, to improve soil health and ensure sustainable agricultural development in the region.

MATERIALS AND METHODS

Soil Sampling

Following standard sampling procedures, soil samples were collected from a depth of 15–30 cm using a soil auger. The samples were air-dried, ground, and sieved through a 2 mm sieve to remove debris and stones. Subsequently, the sample was quartered, and one portion was sieved through a 0.5 mm sieve. This portion was then quartered again, and one part was sieved through a 0.02 mm sieve.

Materials Used

Standard laboratory equipment and chemicals were utilized, including a pH meter, electrical conductivity meter, weighing balance, oven, glassware, and reagents necessary for nutrient analysis.

Analytical Methods

The soil pH value was determined using a digital pH meter in a 1:2.5 soil-water suspension. Electrical Conductivity (EC) was measured using a conductivity meter. Organic carbon was assessed using the 'Walkley and Black method.' Available nitrogen was determined using the 'Alkaline Permanganate method.' Available phosphorus was analyzed using the 'Olsen method.' Available potassium was assessed using a flame photometer. Micronutrients such as zinc, iron, copper, and manganese were analyzed using standard extraction methods.

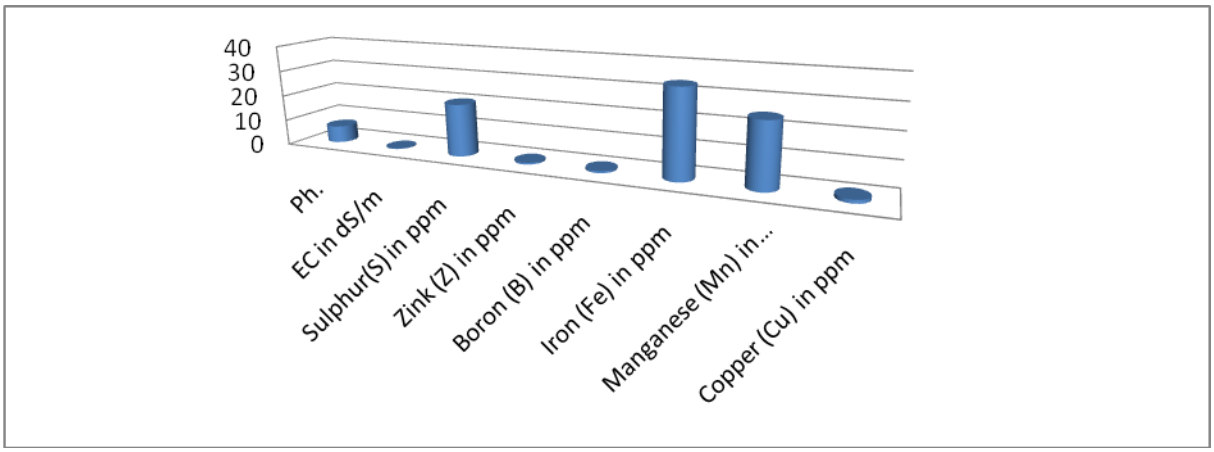
Data Analysis

Observations derived from the analysis of the soil samples are as follows:

Table 1: Physico-chemical properties of soil sample taken from Dhanpuri village.

Ph.	EC in dS/m	Sulphur(S) in ppm	Zink (Z) in ppm	Boron (B) in ppm	Iron (Fe) in ppm	Manganese (Mn) in ppm	Copper (Cu) in ppm
5.4	0.19	25.9	0.74	0.7	30.2	18.4	1.34

RESULTS AND DISCUSSION



Graph: 1: All Physico-chemical properties of soil sample.

The physico-chemical analysis of the soil sample from the Ajirma area reveals important insights into its fertility status and agricultural suitability.

The **soil pH (5.4)** indicates that the soil is **acidic in nature**, which is a common characteristic of soils in the Surguja region. Acidic soils can limit the availability of certain essential nutrients, particularly phosphorus, while increasing the solubility of micronutrients like iron and manganese.

The **electrical conductivity (EC) value of 0.19 dS/m** suggests that the soil is **non-saline**, which is favorable for most agricultural crops as it does not pose any salinity hazard.

The **sulphur content (25.9 ppm)** is found to be in the **adequate range**, indicating sufficient availability for plant growth and protein synthesis.

Among micronutrients, **zinc (0.74 ppm)** is near the **deficiency threshold**, suggesting that zinc supplementation may be required for optimal crop yield. **Boron (0.7 ppm)** is within the **adequate range**, supporting proper plant metabolic activities.

The **iron content (30.2 ppm)** and **manganese (18.4 ppm)** are relatively **high**, which is typical in acidic soils due to increased solubility. These levels are generally beneficial but may become toxic if excessively accumulated.

The **copper content (1.34 ppm)** is within the **sufficient range**, indicating no immediate deficiency or toxicity concern.

Overall, the soil exhibits **moderate fertility with acidic characteristics**, adequate sulphur and micronutrient levels, but a potential **zinc deficiency**. Proper soil management practices such as **lime application to reduce acidity and balanced micronutrient fertilization** are recommended to enhance soil productivity and ensure sustainable agriculture.

CONCLUSION

The present study on the physico-chemical properties of soil from the Ajirma area, Ambikapur (C.G.), indicates that the soil is **acidic in nature (pH 5.4)** and **non-saline (EC 0.19 dS/m)**, making it generally suitable for agricultural use with proper management. The **sulphur content (25.9 ppm)** is adequate, supporting normal plant growth and development.

Micronutrient analysis reveals that **iron (30.2 ppm), manganese (18.4 ppm), and copper (1.34 ppm)** are present in sufficient quantities, which is typical for acidic soils. **Boron (0.7 ppm)** is also within the adequate range. However, **zinc (0.74 ppm)** is close to the deficiency level, which may limit crop productivity if not corrected.

Finaly, the soil possesses **moderate fertility status**, but its acidic nature and marginal zinc content may affect nutrient availability. Therefore, appropriate soil management practices such as **lime application to reduce soil acidity** and **zinc supplementation through fertilizers or organic amendments** are recommended. These measures will help improve soil health, enhance nutrient availability, and ensure **sustainable agricultural productivity** in the Ajirma region.

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