INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD)
© 2026 IJNRD | Volume 11, Issue 4, April 2026 | ISSN: 2456-4184 | IJNRD.ORG

Physicochemical Study And Ph Assessment Of Soil

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ABSTRACT:

Soil health is the primary determinant of agricultural productivity and ecosystem stability in the Bilaspur district, a region characterized by its undulating terrain and diverse land-use patterns ranging from dense forest to intensive agricultural plains. Understanding the spatial variability of soil properties is essential for sustainable land management and precision farming.

This research paper investigates the soil chemical environment across the Bilaspur district, focusing on the spatial variability of the soil reaction (pH) and its relationship with the local topography. The study specifically examines the transition between the regions characteristic **Matasi** (upland) and **Kanhar** (lowland) soil type to determine how these district profiles influence nutrient availability and agricultural potential.

KEYWORDS: Soil Ph, Bilaspur Soil, Ph Assessment, Matasi-Kanhar sequence, Chhattisgarh Agriculture, Soil Nutrient, Physico-chemical Study.

INTRODUCTION:

Soil is a complex and dynamic natural system that plays a fundamental role in sustaining terrestrial ecosystems and agricultural productivity. It serves as a medium for plant growth, a reservoir for nutrients, and a regulator of water and environmental quality. The physicochemical properties of soil significantly influence its fertility, structure, and biological activity, thereby determining its suitability for agricultural and environmental applications.

Some fig. of soil samples.

Among various soil parameters, soil pH is considered a master variable because it governs nutrient availability, microbial activity, and the mobility of toxic elements. Variations in soil pH can alter the chemical forms of essential nutrients such as nitrogen, phosphorus, and potassium, directly affecting plant uptake. For instance, acidic soils often lead to deficiencies of calcium and magnesium, whereas alkaline soils can reduce the availability of micronutrients like iron and zinc.

In addition to pH, other physicochemical properties such as electrical conductivity (EC), organic matter content, bulk density, and moisture content play crucial roles in defining soil quality. Electrical conductivity reflects soil salinity, which can adversely affect plant growth when present in excess. Organic matter improves soil structure, enhances water retention, and supports microbial activity, while bulk density influences soil compaction and root penetration.The assessment of these parameters is essential for understanding soil health and developing sustainable land management practices. Rapid urbanization, industrial activities, and intensive agricultural practices have significantly altered soil properties, leading to degradation in soil quality in many regions.This study focuses on the evaluation of physicochemical characteristics and pH assessment of soil samples collected from different locations in Bilaspur, Chhattisgarh. The objective is to analyze variations in soil properties across different land-use patterns and to assess their implications for soil fertility and agricultural productivity.

AIM AND OBSERVATION:

The purpose of this research paper is to investigate the physicochemical properties and pH variation of soil samples from different land-use areas, with particular emphasis on the impact of long-term agricultural practices and chemical inputs on soil quality.

MATERIAL AND METHODS:

The research was conducted in the Bilaspur district of Chhattisgarh, region characterized by a subtropical climate with significant seasonal monsoon activity.

- Site selection- respectively soil samples were collected from the diverse land use categories, including agricultural paddy field, undisturbed forest patches (from a long time non disturbed land/area),home garden too from Bahatarai, Mopka, mangla, ratanpur (Bilaspur) so that to capture a broad spectrum of pH variability
- Sampling technique- there this a "V-shaped" sampling method is used in this dissertation process to collect soil from the tropical layer (0-15 cm depth) with help of stainless-steel spade, which is most chemically active zone for nutrient exchange.

The soil was not tested immediately; it was spread out on newspapers and allowed to air-dry naturally in the shaded area for two days to remove any "temporary" moisture that could fluctuate the pH readings.

RESULT & DISCUSSION:

The physicochemical parameter measured across the study area was the soil reaction (pH). The data obtained from the digital pH meter through which we analysis sites in Bilaspur are summarized in the table below. Each value represents the mean of triplicate measurement to ensure statistical precisions done by us.

observation table:

(A) Bahtarai

S.No	Location/land use	Observed pH	classification
01	Intensive paddy field	5.45	Strongly acidic
02	Traditional vegetable farm	6.10	Moderately acidic
03	Undisturbed forest/ grassland	6.85	Near neutral
04	Urban construction site	7.90	Slightly alkaline

(B) Mopka

S.No	Location/land use	Observed pH	classification
01	Intensive paddy field	5.60	Strongly acidic
02	Traditional vegetable farm	6.25	Moderately acidic
03	Undisturbed forest/ grassland	6.70	Near neutral
04	Urban construction site	7.75	Slightly alkaline

(C) Mangla

S.No	Location/land use	Observed pH	classification
01	Intensive paddy field	5.30	Strongly acidic
02	Traditional vegetable farm	6.05	Moderately acidic
03	Undisturbed forest/ grassland	6.95	Near neutral
04	Urban construction site	8.05	Slightly alkaline

(D) Ratanpur

S.No	Location/land use	Observed pH	classification
01	Intensive paddy field	5.50	Strongly acidic
02	Traditional vegetable farm	6.20	Moderately acidic
03	Undisturbed forest/ grassland	6.80	Near neutral
04	Urban construction site	7.85	Slightly alkaline

The present study analyzed soil pH under different land-use systems across Bahtarai, Mopka, Mangla, and Ratanpur, revealing clear variations influenced by management practices and environmental conditions. In all four locations, intensive paddy fields exhibited strongly acidic conditions (pH 5.30–5.60). This acidity can be attributed to continuous waterlogging, which creates anaerobic conditions and promotes the accumulation of organic acids, along with the frequent use of nitrogenous fertilizers such as urea that further lower soil pH. Slight variations among locations, such as the comparatively lower pH observed in Mangla, may be due to differences in organic matter content and intensity of cultivation.

In contrast, soils from traditional vegetable farms were found to be moderately acidic (pH 6.05–6.25), indicating a relatively balanced condition compared to paddy fields. This can be explained by better aeration, periodic tillage, and the addition of organic manures and compost, which help buffer soil acidity. Minor variations, such as the slightly higher pH in Mopka, may reflect improved soil management practices or reduced reliance on chemical fertilizers.

Undisturbed forest and grassland soils across all locations showed near-neutral pH values (6.70–6.95), representing a stable and natural soil environment. The accumulation of leaf litter, continuous organic matter recycling, and minimal anthropogenic disturbance contribute to this balance. These conditions support healthy microbial activity and enhance the soil's buffering capacity, maintaining pH close to neutral.

On the other hand, soils from urban construction sites were slightly alkaline (pH 7.75–8.05), with the highest value observed in Mangla. This alkalinity is primarily due to the presence of construction materials such as cement, lime, and other calcareous substances that increase calcium carbonate content in the soil. Such changes in soil pH can negatively affect nutrient availability and overall soil quality.

Overall, a distinct pattern in soil pH was observed across all study areas, with paddy fields being the most acidic, followed by vegetable farms, forest soils near neutral, and urban soils tending toward alkalinity. This trend clearly demonstrates that soil pH is strongly influenced by land use and human activities, with agricultural practices leading to acidification and urbanization contributing to alkalization, while natural ecosystems maintain a balanced soil condition.

location	Near pH(average)	Classification
Bahtarai	6.6	Slightly acidic to near neutral
Mopka	6.6	Slightly acidic to near neutral
Mangla	6.6	Slightly acidic to near neutral
Ratanpur	6.6	Slightly acidic to near neutral

Fig: comparative observation

ACKNOWLEDGEMENTS:

My sincere thanks to Dr. Priti Mishra (HOD) for her guidance and to Dr. Pratap Pandey (Principal), for the support which we receive from him. Gratitude is also extended to D.L.S.P.G college for providing necessary facilities.

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