



Physicochemical analysis Of Soil In Kasdol Block, Baloda Bazar District, Chhattisgarh

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This study delves into the detailed analysis of soil physicochemical properties from Kasdol Block, Baloda Bazar District, Chhattisgarh. The investigation aims to understand the soil's inherent characteristics, nutrient status, and potential limitations for agricultural productivity. Soil samples were collected from various locations within the block, subjected to a rigorous laboratory analysis, and evaluated for parameters such as pH, electrical conductivity, organic carbon content, total nitrogen, phosphorus, potassium, micronutrients (iron, zinc, manganese, copper), and textural composition. The results obtained provide valuable insights into the soil health and fertility status of the region. The study also highlights the need for judicious nutrient management practices to optimize crop yields and maintain soil quality.

Keywords: soil analysis, physicochemical properties, Kasdol Block, Baloda Bazar District, Chhattisgarh, soil fertility, nutrient management, sustainable agriculture.

Introduction

Soil, the foundation of agriculture, plays a crucial role in sustaining food production and environmental health. Understanding its physicochemical properties is essential for making informed decisions regarding crop selection, fertilization, and irrigation practices. This study focuses on the Kasdol Block, Baloda Bazar District, a region with significant agricultural potential. By analyzing the soil's physical and chemical characteristics, we aim to identify strengths, weaknesses, and potential constraints that may impact agricultural productivity. Both the physical (colour, texture, moisture content, pH, organic matter content, etc.) and chemical (cation exchange capacity, organic matter contents, phosphate phosphorous, nitrate nitrogen, nitrite nitrogen, etc.) characteristics of soil affect its quality. A soil's fertility determines its potential uses and, to a greater extent, its yields, while its physical and chemical characteristics primarily define its suitability for its intended use and management requirements to maintain its maximum productivity (Jaiswal, 2004). The physico-chemical characteristics of the soil are crucial in establishing the degree of heavy metal contamination. When a soil is analysed, its colour reveals its state. The soil's surface ranges from nearly white to various colours of brown, grey, and

Materials and Procedures

2.1 Climate and Location :-

The Kasdol block, which is situated in Chhattisgarh's Baloda Bazar district, is 270 metres above mean sea level and is situated in latitude 21.53° N and longitude 82.16° E. According to the Chhattisgarh state map, the study region consists of 18 villages that have had their soil fertility condition assessed. Kasdol block, located in the Baloda Bazar district of Chhattisgarh, lies at 21.53° N latitude and 82.16° E longitude, with an altitude of 270 m above mean sea level. The study area includes 18 villages, evaluated for soil fertility status, as shown on the map of Chhattisgarh state.

2.2 Soil Samples Collection:- Soil samples were collected from diverse locations within Kasdol Block, ensuring representation of various soil types and land use patterns. The sampling depth was standardized to 0-15 cm to assess the topsoil layer, which is critical for plant growth. The soil was spread on a sanitised surface, such as paper or polythene, break up any clods with a wooden mallet, then sieve through a 2 mm mesh screen to create soil samples. Continue until the sieve only contains items larger than 2 mm. A comprehensive survey was carried out in Kasdol block to assess soil fertility. Samples of surface soil (0–15 cm depth) were gathered from several locations utilising..

Result & Discussion -The values of physicochemical parameters are reported in Table 1 and figure 1 to 4. Colour of the soil sample was seen visually and black and red colour. [Present the detailed results of the soil analysis, including statistical analysis and interpretation. Discuss the implications of the findings for agricultural practices, potential nutrient deficiencies or toxicities, and recommendations for sustainable soil management.]

Table :- 1

Sample no.	Colour	pH	EC dSm ⁻¹	Organic carbon%	Available nitrogen kg/ha	Available Phosphorous kg/ha	Available Potassium kg/ha
1	Black	7.18	0.225	0.40	263.42	15.23	1332.8
2	Black	7.95	0.511	0.33	238.33	4.48	706.72
3	Black	5.30	0.163	0.29	288.51	7.16	197.12
4	Black	7.30	0.083	0.14	150.52	11.64	201.6

1. Measurement of Physico-chemical Parameter

a. Ph Measurement: Twenty grams (20 g) of each air-dried soil sample was weighed into a 50 ml beaker. Subsequently, 20 ml of distilled water was added to the beaker. The mixture was stirred thoroughly using a glass rod and allowed to stand undisturbed for 30 minutes. A calibrated HANNA pH meter (Model H 1991000) was then inserted into the clear supernatant, and the pH value was recorded. Soil pH is a measure of the acidity or alkalinity of the soil, reflecting the concentration of hydrogen ions. Since hydrogen ion concentration spans a wide range, a logarithmic scale (pH) is used, where a decrease of 1 in pH corresponds to a tenfold increase in acidity. The scale is "reverse" in that very acidic soils have low pH and high hydrogen ion concentrations, while alkaline soils have high pH and low hydrogen ion concentrations. Most soils have pH values between 3.5 and 10. In regions with higher rainfall, natural soil pH typically ranges from 5 to 7. To analyze the given soil pH results (7.18, 7.95, 5.30, and 7.30), we can organize the data, discuss its significance, and present it in graphical form. Below is a detailed 1. pH Range: pH 7.18: Slightly alkaline. pH 7.95: Moderately alkaline. pH 5.30: Acidic. pH 7.30: Neutral to slightly alkaline. The soil pH results are: Sample 1: 7.18- Sample 2: 7.95- Sample 3: 5.30- Sample 4: 7.30,- Soil pH is a critical parameter in soil science, as it affects nutrient availability, microbial activity, and plant growth. The pH scale ranges from 0 to 14, with: - pH 0-6.9: Acidic- pH 7: Neutral- pH 7.1-14: Basic (Alkaline), based on the results: - Sample 1 (7.18), Sample 2 (7.95), and Sample 4 (7.30) have pH values that are slightly alkaline to neutral.- Sample 3 (5.30) has a pH value that is slightly acidic. These pH values may have the following implications: Slightly alkaline to neutral pH (Samples 1, 2, and 4): Most plants prefer a slightly acidic to neutral soil pH (6.0-7.0). However, some plants like alfalfa, asparagus, and sweet corn can tolerate slightly alkaline conditions. Slightly acidic pH (Sample 3): Acidic

conditions can be beneficial for plants like blueberries, strawberries, and potatoes, which prefer a more acidic soil pH. table 1

b. EC Measurement: -EC, or Electrical Conductivity, is a measure of the ability of a solution to conduct electricity. It's a crucial parameter in various fields, especially in agriculture, hydroponics, and aquaculture.* Nutrient Monitoring: High EC often indicates high salt concentrations, which can negatively impact plant growth. Water Quality Assessment: It helps determine the suitability of water for irrigation or other purposes. Soil Health: EC can provide insights into soil salinity and fertility. EC meter is used to measure electrical conductivity. It consists of two electrodes that are placed in the solution. A small electrical current is passed between the electrodes, EC meter is used to measure electrical conductivity. Ec Indicates the salt content in the soil. The EC results-table 2 Sample 1: 0.225 dS/m- Sample 2: 0.511 dS/m- Sample 3: 0.163 dS/m Sample 4: 0.083 dS/ Electrical conductivity (EC) measures the soil's ability to conduct electricity, which is related to the concentration of dissolved ions (salts). EC is an important parameter in soil science, as it affects plant growth, water availability, and nutrient uptake. The EC values are generally classified into the following categories:- Low EC (<0.2 dS/m): Low salt concentration, suitable for most crops.- Moderate EC (0.2-0.5 dS/m): Moderate salt concentration, may affect sensitive crops.- High EC (0.5-1.0 dS/m): High salt concentration, may limit crop growth. Very High EC (>1.0 dS/m): Extremely high salt concentration, may be toxic to plants. Based on the results:- Sample 1 (0.225 dS/m) and Sample 3 (0.163 dS/m) have low EC values, indicating low salt concentrations.- Sample 2 (0.511 dS/m) has a moderate EC value, suggesting a moderate salt concentration.- Sample 4 (0.083 dS/m) has a very low EC value, indicating an extremely low salt concentration.

c. Organic Carbon - SOC is a crucial component of soil health. It plays a vital role in: Soil fertility: It provides essential nutrients for plant growth. Soil structure: It improves soil structure, enhancing water retention and aeration. Carbon sequestration: It helps store carbon, mitigating climate change. The provided SOC values indicate a range of organic carbon content in the soil samples. Higher values generally suggest better soil health and fertility. However, the interpretation of these values depends on various factors. Sample 1 (0.40% OC): High organic carbon content. Sample 2 (0.33% OC): Moderate organic carbon content. Sample 3 (0.29% OC): Slightly lower organic carbon content. Sample 4 (0.14% OC): Low organic carbon content. The organic matter is an important of the soil that contributes to soil fertility. Soil organic carbon is the basis of soil fertility. It release nutrient for plant growth. , increasing soil organic carbon improves soil health and fertility [16]. The data given in table 2. Organic carbon ranges from shows 0.52 to 0.72 %. Medium proportion of organic carbon. High OC (0.40%): This indicates healthy soil with good nutrient availability, supporting optimal microbial activity and soil fertility. Moderate OC (0.33%, 0.29%): These values suggest moderate organic matter content, which supports moderate fertility but may need improvement for high-yield crops. Low OC (0.14%): This suggests poor soil structure and fertility, which may limit plant growth and nutrient availability. 1. Impact of Organic Carbon: High OC: Soils with high organic carbon improve water retention, nutrient supply, and microbial activity, leading to healthy plant growth. These soils are generally more fertile. fertilizers to improve fertility and structure. 2. Potential Causes of OC Variations: Organic matter decomposition rate, influenced by factors like temperature, moisture, and microbial activity. Human activities like tillage, fertilizer use, and crop rotation can affect OC levels. Soil texture and the presence of clay, sand, or loam can influence organic carbon retention.

d. Nitrogen- Nitrogen is an essential nutrient for plant growth, contributing to the production of chlorophyll, proteins, and other vital components. In soil, nitrogen exists in various forms, including organic nitrogen (from decomposing organic matter) and inorganic nitrogen (ammonium and nitrate). The provided nitrogen values indicate a range of nitrogen content in the soil samples. Higher values generally suggest a greater potential for plant growth, but the interpretation of these values depends on several factors: Soil type: Different soil types have varying capacities to retain and supply nitrogen. * Crop requirements: The nitrogen needs of different crops vary significantly.* Fertilization history: Past fertilization practices can influence the current nitrogen levels. Climate and weather conditions: Climate and weather can affect nitrogen mineralization and loss. soil nitrogen values: 263.42, 238.33, 288.51, and 150.52. These values likely represent the total nitrogen content in the soil samples, often measured in parts per million (ppm) or milligrams per kilogram (mg/kg). N (Nitrogen): Essential for plant growth and development. The available nitrogen was determined by alkaline per magnet method [23] Nitrogen is an

essential plant nutrient, for growth of plant canopy. Deficiency of nitrogen shows stunted growth development of yellowish green leaves and also deduces protein content and yields. Nitrogen is low in all soil samples.

e. Phosphorus -Phosphorus -is an essential nutrient for plant growth, playing a crucial role in energy transfer, root development, and seed production. In soil, phosphorus exists in various forms, including organic and inorganic compounds. Higher values (15.23, 11.64): These values suggest relatively high phosphorus levels, which may be sufficient for many crops. However, excessive phosphorus can lead to environmental issues like water pollution. Lower values (4.48, 7.16): These values may indicate lower phosphorus levels, which could limit plant growth, especially for phosphorus-demanding crops. You've provided the following soil phosphorus values: 15.23, 4.48, 7.16, and 11.64. These values likely represent the amount of available phosphorus in the soil, often measured in parts per million (ppm) or milligrams per kilogram (mg/kg). Phosphorous is called the master key element in soil quality. It is a most important element in every living cell. It is essential for growth, cell division root growth and elongation seed and fruity development and early ripening [17]. Also it helps in energy storage and transfer. In study Phosphorous is called the master key element in soil quality. It is a most important element in every living cell. It is essential for growth, cell division root growth and elongation seed and fruity development and early ripening [17]. Also it helps in energy storage and transfer.

f. Potassium:-*Potassium plays an important role in different physiological processes of plants. Potassium is a major nutrient for the production of superior quality crop. Its main role is catalytic in Available potassium content ranges from 125.31 to 630.15 kg/ha. Majority of the soil samples show high available potassium. The soil of the Marathw Potassium Potassium . high available potassium. The soil of the Marathwada contained high to medium available potassium. The soil potassium results are- Sample 1: 1332.8 ppm (or mg/kg) Sample 2: 706.72 ppm (or mg/kg)- Sample 3: 197.12 ppm (or mg/kg)- Sample 4: 201.6 ppm (or mg/k* Soil potassium is an essential nutrient for plant growth, and its availability affects crop yields and quality. Potassium plays a critical role in:- Photosynthesis- Water balance- Cell wall development- Disease resistance The potassium values can be classified into the following categories:- Low K (<200 ppm): Potassium deficiency may limit plant growth- Moderate K (200-400 ppm): Adequate potassium for most crops- High K (400-600 ppm): Optimal potassium for high-yielding crops- Very High K (>600 ppm): Excessive potassium may lead to environmental concerns Based on the results:- Sample 1 (1332.8 ppm) has a very high potassium level, indicating excessive potassium that may lead to environmental concerns, Sample 2 (706.72 ppm) has a high potassium level, indicating optimal potassium for high-yielding crops- Sample 3 (197.12 ppm) and Sample 4 (201.6 ppm) have moderate potassium levels, indicating adequate potassium for most crops 1. For Sample 1, consider taking measures to reduce soil potassium levels, such as using potassium-free fertilizers or implementing conservation tillage 2. For Sample 2, monitor soil potassium levels regularly to ensure they remain within the optimal range 3. For Sample 3 and Sample 4, maintain current soil management practices, as potassium levels are adequate for most crops.

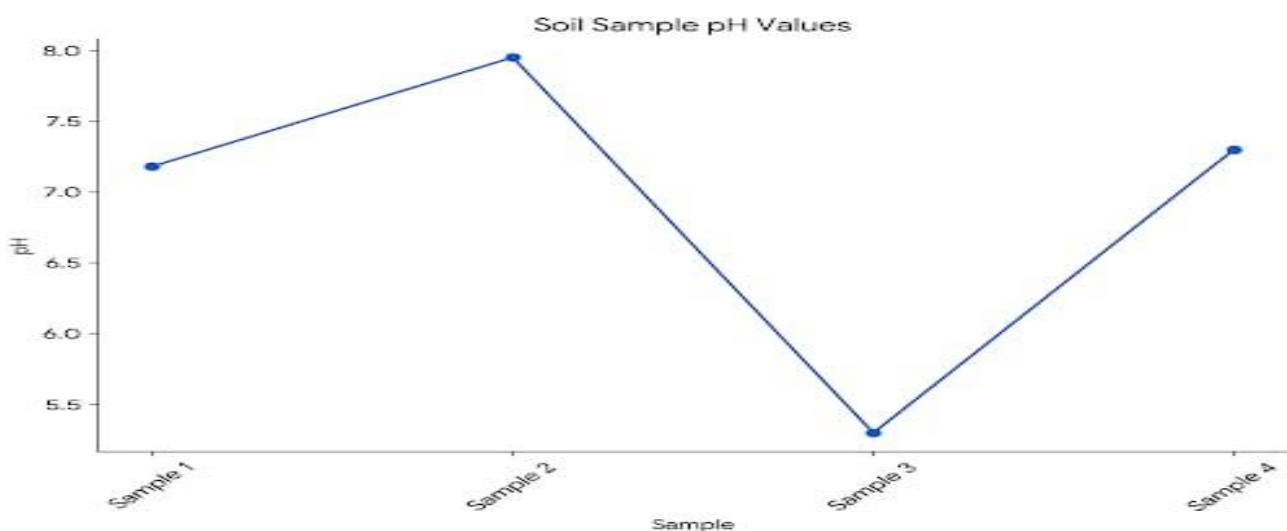


Fig.1:-ph value of some soil sample in balodabazar district

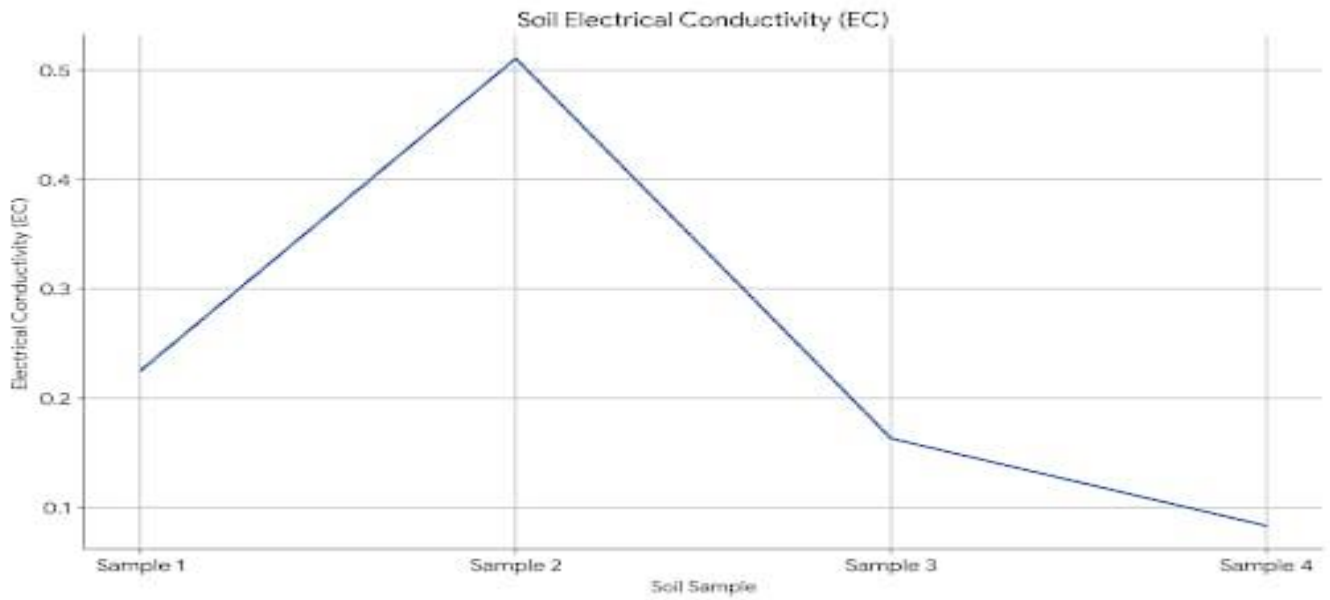


Fig.2:- Ec value of some soil sample in balodabazar district

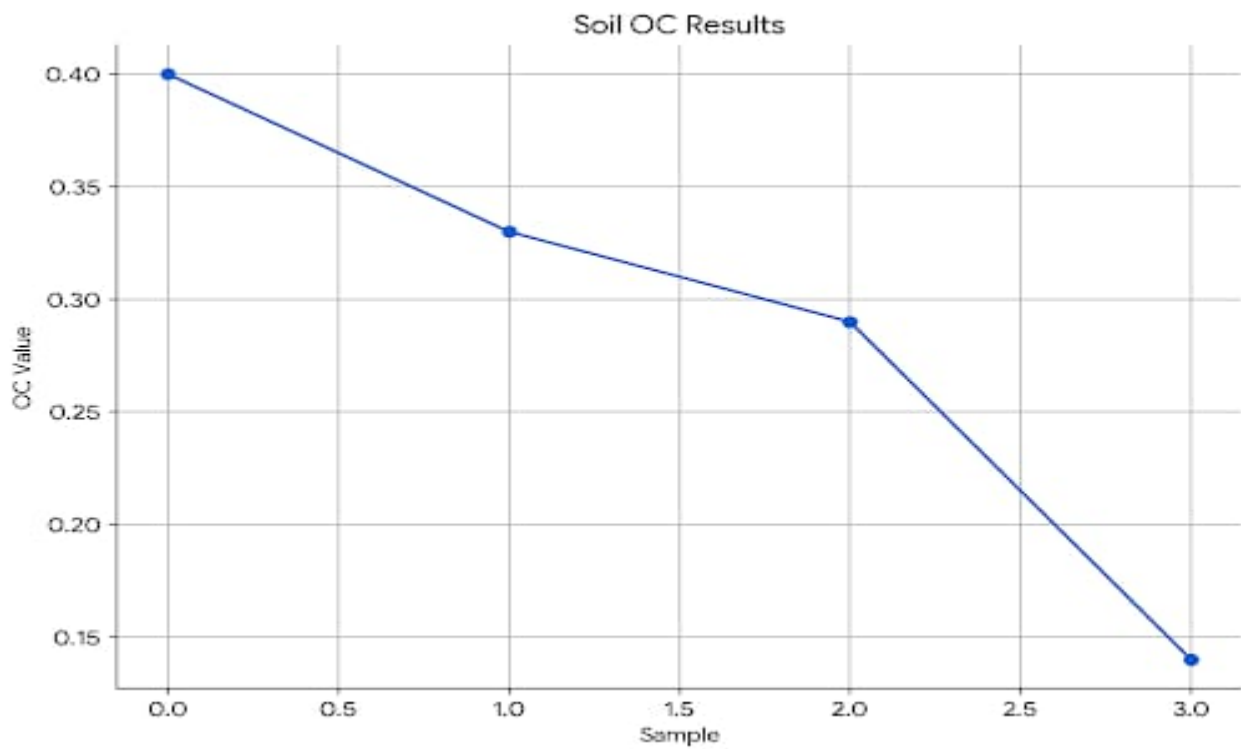


Fig.3:- Oc value of some soil sample in balodabazar district

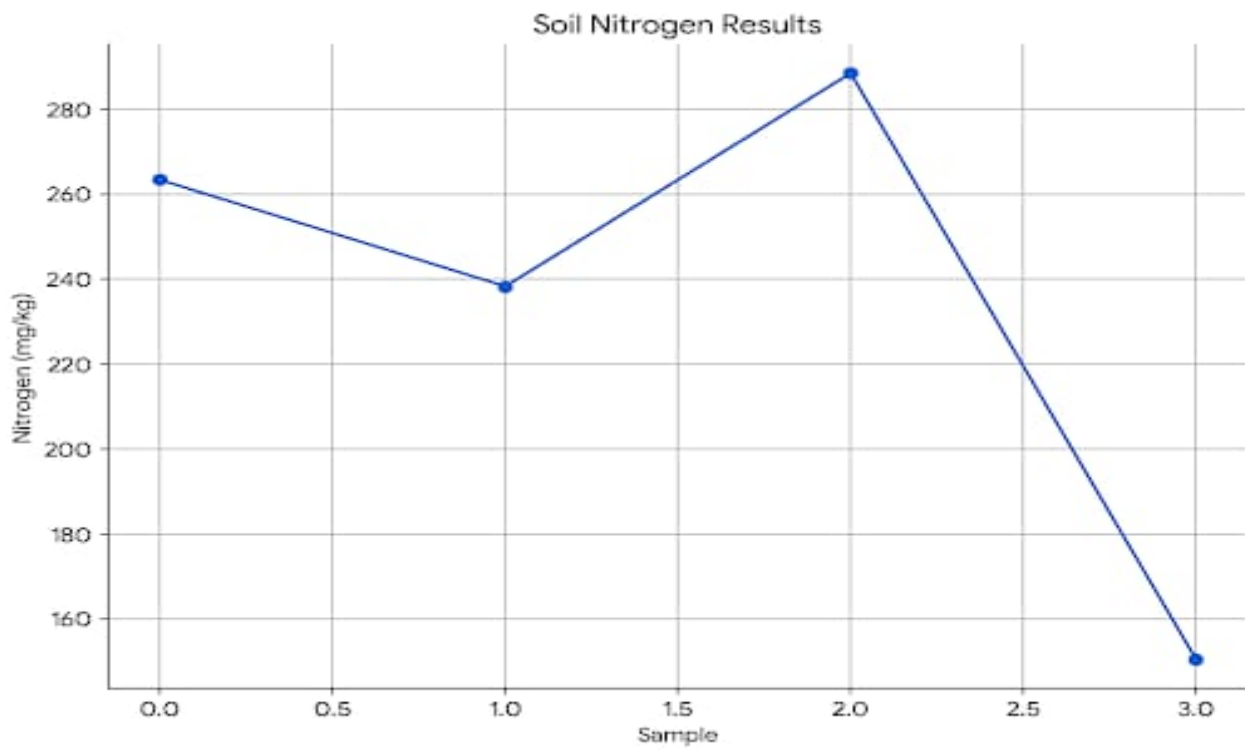


Fig.4:- Nitrogen value of some soil sample in balodabazar district

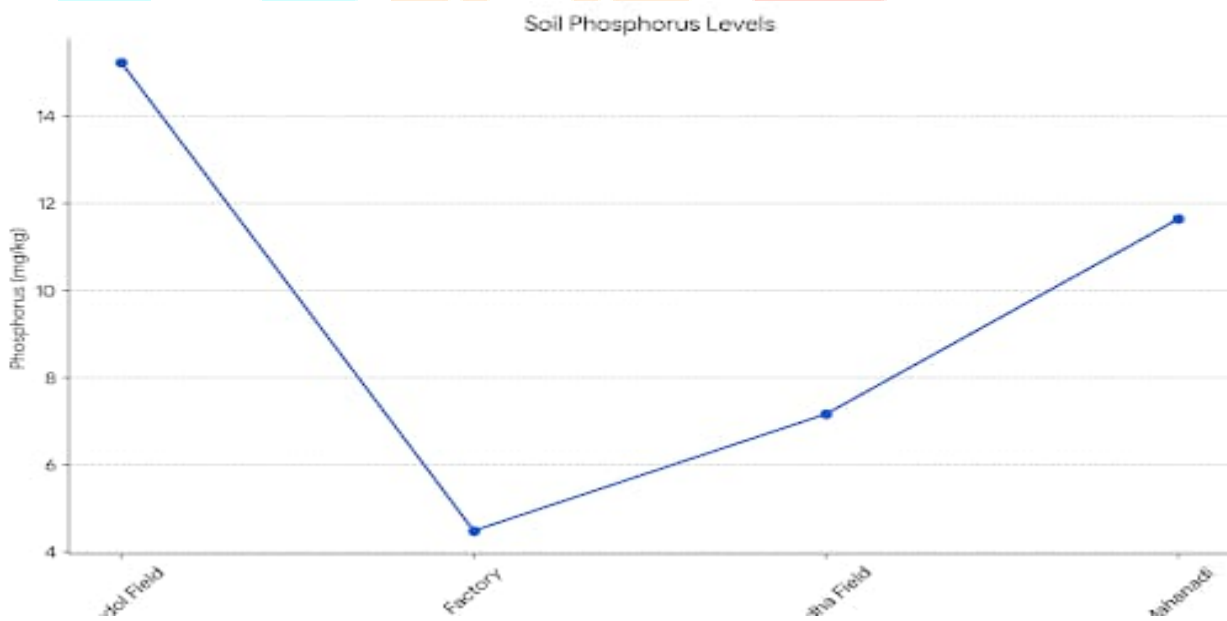


Fig.5:- Phosphorous value of some soil sample in balodabazar district

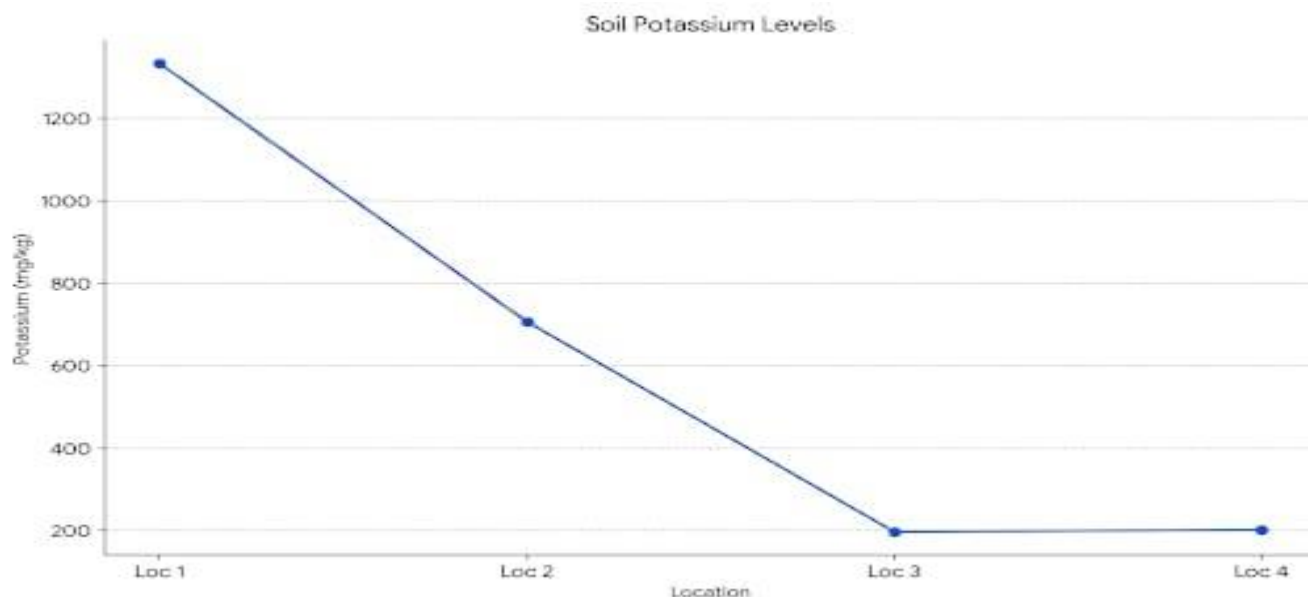


Fig.6:- Potassium value of some soil sample in balodabazar district

Conclusion

The comprehensive analysis of soil physicochemical properties in Kasdol Block provides valuable insights into the soil health and fertility status of the region. By understanding the soil's strengths and limitations, farmers and policymakers can make informed decisions to optimize crop production and minimize environmental impact. The study emphasizes the importance of regular soil testing, balanced fertilization, and sustainable agricultural practices to ensure long-term soil productivity and food security. study area soil sample show medium proportion of organic carbon. The higher nutrient fertility status in irrigation fields might be associated with intensive cultivation and plantation of cash crops like sugarcane, cotton, fruit crops etc. in which use of fertilizers as practiced by the cultivators. Classification criteria the study area soils showed normal pH. The majority of soil samples low status of available phosphorous was found in all soil samples the generated nutrient status information can serve as an effective tool for farmers and policy makers in adoption of site specific nutrient management practices.