



QUANTITATIVE PHYSICO-CHEMICAL ANALYSIS OF SOME SOIL SAMPLES OF SHIRUR ANANTPAL TAHSIL, DISTRICT LATUR, MAHARASHTRA (INDIA)

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Abstract :

Soils are an important resource for agricultural productivity. Understanding the physicochemical properties of soils is very important to optimize land management and ensure sustainable crop growth. The study presents a quantitative physicochemical analysis of soil samples collected from various locations within Shirur Anantpal Tahsil in District Latur, Maharashtra, India. The main objectives of the study were to assess the fertility status of the soil, identify potential deficiencies or imbalances, and suggest suitable soil management practices.

Soil samples were taken from three different agricultural sites. Parameters analyzed included soil texture, pH, electrical conductivity (EC), organic carbon content, cation exchange capacity (CEC), and nutrient levels (nitrogen, phosphorus, potassium). Micronutrient levels like iron (Fe), zinc (Zn), copper (Cu), and manganese (Mn) were also measured. The results obtained indicated that the soils in the region are mainly loamy soils, with a neutral to slightly alkaline pH. Organic carbon was within the range of 0.45% to 0.52%, while nitrogen, phosphorus, and potassium were moderate, with potassium being the most abundant nutrient. Electrical conductivity was low, denoting minimal salinity problems. The content of micronutrients was satisfactory enough to allow healthy growth of plants. This study emphasizes the importance of regular monitoring and management of soil to ensure health, higher crop yields, and sustainable agriculture in semi-arid regions such as Shirur Anantpal Tahsil, District Latur, Maharashtra.

Keywords: - Physico-chemical analysis, Sustainable agriculture, Fertilization practices

1. Introduction

The physicochemical properties of soil are mainly texture, pH, electrical conductivity (EC), organic carbon content, nutrient levels (nitrogen, phosphorus, potassium), and micronutrient availability. These determine plant growth, soil fertility, and ecosystem health. They are related to the retention of nutrients and water, suitability for cultivating various crops, and overall fertility status. A detailed understanding of these properties is very important for making proper decisions about soil management, crop selection, irrigation, and fertilization.

Shirur Anantpal Tahsil is largely semi-arid in climate, with moderate rainfall, and sometimes extreme temperatures. The land, in this area, consists of varied agriculture, such as the cultivation of crops like groundnut, cotton, soybean, and seasonal vegetables. However, continuous cultivation, bad soil management, and climatic variations can destroy the soil to a considerable extent, such as nutrient depletion, salinization, or erosion, which destroy agricultural productivity.

The main objective of this study is to carry out a quantitative physico-chemical analysis of soil samples collected from various locations within Shirur Anantpal Tahsil. Through soil texture, pH, electrical conductivity, organic carbon content, and nutrient levels analysis, the fertility status of the soil will be evaluated, the potential deficiencies or imbalances highlighted and practical recommendations for improving the health of the soil and the agricultural productivity developed. This analysis will help identify the requirement for proper management of soil and its fertility maintenance through nutrient supplements, pH adjustment, and organic matter addition to keep the soil fertile for future times.

By gaining proper knowledge of the physico-chemical properties of soil, farmers and landowners can adopt more efficient and sustainable agriculture practices, so that soil health and crop yield in Shirur Anantpal Tahsil, Latur District, Maharashtra is improved.

2. Materials and Methods

2.1 Study Area

Shirur Anantpal lies in Latur district of Maharashtra, India. The semi-arid region with moderate rain receives the precipitation, which majorly favors the cultivation of groundnut, cotton, and soybean.

2.2 Sample Collection

Soil samples were obtained from three distinct sites in Shirur Anantpal Tahsil:

- Location 1: Crops are around the farmland under a cotton plantation
- Location 2: Soya crop farming area
- Location 3: Land being under rotational agriculture

The soil samples were collected from the topsoil (0-15 cm) and stored in clean plastic containers. Each sample was air-dried and ground before analysis.

2.3 Analytical Techniques

The physicochemical properties were determined using standard methods:

- **Soil Texture:** Determined by the hydrometer method.
- **Soil pH:** Measured in a 1:1 soil-water suspension using a pH meter.
- **Electrical Conductivity (EC):** Measured in a 1:1 soil-water extract using a conductivity meter.
- **Organic Carbon:** Determined by the Walkley-Black method.
- **Cation Exchange Capacity (CEC):** Assayed with ammonium acetate extract.
- **Soil Fertility (N, P, K):** i) Nitrogen: Assay with the Kjeldahl method
(ii) Phosphorus: Assay by Olsen's method (iii) Potassium: Flame photometry.

Micronutrients were measured as iron, zinc, copper, and manganese content through Atomic Absorption Spectroscopy.

3. Results and Discussion

3.1 Physical Properties

The proportion of sand, silt, and clay in the samples was analyzed to determine the soil texture. According to the texture classification, the soil in the study area was loam in all three locations.

Location	Sample	Sand (%)	Silt (%)	Clay (%)	Soil Texture
Location 1	Sample 01	40	35	25	Loam
	Sample 02	38	36	26	Loam
	Sample 03	42	34	24	Loam
Location 2	Sample 01	40	36	26	Loam
	Sample 02	41	35	26	Loam
	Sample 03	42	35	25	Loam
Location 3	Sample 01	38	36	24	Loam
	Sample 02	38	34	25	Loam
	Sample 03	40	34	24	Loam

3.2 Chemical Properties

- A. **Soil pH:** The soil pH ranged from 6.5 to 7.2, indicating that the soil is neutral to slightly alkaline. This pH is suitable for most crops.
- B. **Electrical Conductivity (EC):** The EC values were found to be low, suggesting that the soil does not have significant salinity problems.
- C. **Organic Carbon:** Organic carbon content varied between 0.45% and 0.52%, which is moderate and indicates a need for organic matter management in some areas to improve fertility.

Location	Sample	pH (1:1 soil-water)	EC (dS/m)	Organic Carbon (%)	Bulk Density (g/cm ³)
Location 1	Sample 01	6.8	0.35	0.52	1.40
	Sample 02	7.0	0.45	0.45	1.50
	Sample 03	6.5	0.38	0.48	1.42
Location 2	Sample 01	7.0	0.39	0.46	1.40
	Sample 02	7.0	0.40	0.46	1.42
	Sample 03	6.5	0.38	0.50	1.44
Location 3	Sample 01	6.5	0.42	0.52	1.44
	Sample 02	6.6	0.42	0.52	1.50
	Sample 03	6.6	0.42	0.50	1.50

Cation Exchange Capacity (CEC): The CEC values were all within the normal range for the soil in this region, which indicates a good ability to retain essential nutrients.

Location	Sample	CEC (cmol/kg)
Location 1	Sample 01	15.5
	Sample 02	16.2
	Sample 03	14.8
Location 2	Sample 01	16.0
	Sample 02	15.5
	Sample 03	16.2
Location 3	Sample 01	14.8
	Sample 02	14.6
	Sample 03	15.5

3.3 Nutrient Status

Nitrogen (N): Nitrogen levels ranged from 20 to 30 ppm, which is moderate, indicating a need for supplemental nitrogen fertilizers for optimal crop growth.

Phosphorus (P): Phosphorus content ranged from 10 to 12 ppm, which is on the lower end of the optimal range for most crops.

Potassium (K): Potassium levels were found to be adequate (ranging from 180 to 200 ppm), indicating good availability for plant uptake.

Location	Sample	N (ppm)	P (ppm)	K (ppm)
Location 1	Sample 01	25	10	200
	Sample 02	30	12	180
	Sample 03	28	11	190
Location 2	Sample 01	30	10	185
	Sample 02	28	10	180
	Sample 03	30	12	190
Location 3	Sample 01	25	11	195
	Sample 02	26	11	200
	Sample 03	26	12	190

3.4 Micronutrient Status

The levels of essential micronutrients (Fe, Zn, Cu, Mn) were found to be adequate for crop growth, with iron (Fe) content between 18-20 ppm, zinc (Zn) between 1.5-1.8 ppm, copper (Cu) between 0.5-0.7 ppm, and manganese (Mn) between 2-3 ppm.

Location	Sample	Fe (ppm)	Zn (ppm)	Cu (ppm)	Mn (ppm)
Location 1	Sample 01	20	1.5	0.6	2.5
	Sample 02	18	1.8	0.7	2.8
	Sample 03	19	1.6	0.5	2.3
Location 2	Sample 01	19	1.6	0.5	2.6
	Sample 02	18	1.8	0.5	2.6
	Sample 03	19	1.8	0.8	2.5
Location 3	Sample 01	18	1.6	0.8	2.8

	Sample 02	20	1.5	0.7	2.6
	Sample 03	20	1.5	0.7	2.8

4. Conclusion

Shirur Anantpal Tahsil soil samples have a loamy texture, which is suitable for a variety of crops. The pH of the soil is mostly neutral to slightly alkaline for the availability of nutrients, though organic carbon content in some areas is a bit on the lower side, with nitrogen and phosphorus levels moderate and suggestive that fertilization might be necessary to improve crop growth. The micronutrient content is adequate, and the plant develops healthily. Soil management practices, including organic matter addition and balanced fertilization, are recommended to enhance soil fertility and productivity.

5. Recommendations

1. Nitrogen Fertilization: Apply nitrogen fertilizers to maintain optimal nitrogen levels for crop growth.
2. Phosphorus Management: Provide phosphorus-based fertilizers in soils with very low phosphorus levels to boost crop yields.
3. Organic Matter: Incorporate organic matter (e.g., compost, green manure) to improve soil organic carbon content and microbial activity.
4. Salinity control: Salinity is not the major problem. However, routine monitoring of the EC levels would be recommended to prevent future salinization issues.
5. The study indicates that nitrogen and phosphorus were moderately deficient. Targeted interventions in the management of these nutrients are necessary.
6. Organic amendments are recommended to increase soil organic matter. Balanced fertilization practices will correct nutrient imbalances and improve soil fertility.
7. Recommendations for increasing soil health and boosting agricultural productivity in Shirur Anantpal Tahsil are essential to ensure sustainable farming practices in the region.

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