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Research Article

To study the soil analysis of Shivgaon village in Boisar city and Umroli village, from Palghar taluka in Palghar district, Maharashtra

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Abstract

The present investigation entitled "Soil Analysis of Shivgaon and Umroli of Palghar Taluka in Palghar District, Maharashtra" was undertaken with the objective of evaluating the physicochemical properties of soils from three different localities. Soil samples were systematically collected from agricultural fields and analyzed for a range of important parameters including soil pH, electrical conductivity (EC), organic carbon (OC), available macronutrients such as nitrogen, phosphorus, and potassium, along with selected micronutrients. These parameters play a vital role in determining soil fertility, crop productivity, and long-term sustainability of agricultural systems. The analytical results revealed distinct site-specific variations in the fertility status and chemical characteristics of the soils studied. Umroli soils exhibited moderate pH values within the favorable range for crop growth, thus indicating suitability for diverse agricultural practices. On the other hand, soils from Shivgaon showed nutrient imbalances and deficiencies in certain essential elements, highlighting the need for corrective soil fertility management strategies. Overall, this study generates valuable baseline data that can aid in sustainable agricultural planning, effective soil fertility management, and environmental monitoring within Palghar Taluka.

INTRODUCTION

Soil is one of the most vital natural resources that sustains life on Earth by serving as the primary medium for plant growth and agricultural production. It forms the interface between the lithosphere, atmosphere, hydrosphere, and biosphere, and plays a crucial role in nutrient cycling, water retention, and ecological balance. In India, where agriculture continues to be the backbone of the economy, soil fertility management is of utmost importance for ensuring food security and sustainable land use. Maharashtra, particularly the Palghar district, represents a region with diverse land-use patterns, ranging from industrial development to traditional agriculture. The physicochemical characteristics of soil largely determine its fertility status and its capacity to support sustainable agriculture. Parameters such as soil pH, electrical conductivity (EC), organic carbon (OC), and availability of macro- and micronutrients are important indicators of soil health and directly influence crop productivity.

Soil forms the intermediate zone between the atmosphere, lithosphere, and hydrosphere, making it a vital part of the biosphere. It is the uppermost weathered layer of the earth's crust that supports plants and contains inorganic matter, organic matter, soil organisms, moisture, solution, and air. Typically, soil consists of 50–60% minerals, 25–35% water, 15–25% air, and a small amount of organic matter (Chatwal et al., 2005). These proportions vary by location, which is why nutrient levels, pH, organic content, and other factors must be studied across regions.

Derived from the Latin word *solum*, soil is formed from rock weathering and is a mixture of minerals, organic materials, water, air, and organisms. It provides plants with support, nutrients, water, air, and protection, while also filtering impurities and recycling organic matter. Since soil fertility directly affects crop yield, characterization of soil is crucial for sustainable agriculture, especially under conditions of imbalanced fertilizer use (Yadav and Meena, 2009).

To assess soil fertility and identify nutrient deficiencies, 15 representative soil samples from Palghar district were collected and analyzed for pH, electrical conductivity, nitrogen, phosphorus, potassium, and carbon.

MATERIALS AND METHODS

Preparing soil sample solution:

1. Take a beaker and a stirrer.
2. Take 10g of soil sample.
3. Dissolve it in 100 ml Distilled water using stirrer.
4. Keep the solution so that the soil particle gets settled at the bottom.
5. Filter the supernatant.

TEMPERATURE - Atmospheric and Soil temperature will be measured on situ with calibrated mercury thermometer or digital temperature measuring prmeter**.**

pH - pH will be measured on situ with calibrated digital pH meter or Calomel reference pH meter.

ELECTRICAL CONDUCTIVITY

Requirements: Conductivity meter, thermometer, water sample, 2 millimho KCl solution.

Protocol:

1. Switch on the instrument, warm up 15–20 min.
2. Set range knob to 2 millimho.
3. Standardize to 1.000 using 2 millimho KCl solution.
4. Record soil temperature, dip conductance cell in sample, wait for stable reading, note value and calculate.

Reagent

2 millimho KCl solution: Dissolve 0.745 mg KCl in 1000 ml distilled water.

Salinity (Argentometric Method)

Take 10 ml sample → add few drops 5% K_2CrO_4 → titrate with 0.2N $AgNO_3$ till yellow → brick red ppt.

Alkalinity

1. Take 10 ml sample.
2. Add phenolphthalein: pink → titrate with 0.02N HCl (P-alkalinity).
3. Add methyl orange: yellow → orange (M-alkalinity).

Water Holding Capacity

100 g dry soil in funnel → add 100 ml water → measure drained water → calculate retained water.

Moisture Content

1. Weigh cup (A).
2. Add soil, weigh (B).
3. Dry at 105°C, weigh (C).
4. % Moisture = [(B–C)/(B–A)] × 100.

Total Organic Carbon (Walkley & Black)

1. 1 g soil + 10 ml $K_2Cr_2O_7$ + 20 ml H_2SO_4 → keep 30 min.
2. Add NaF/orthophosphoric acid + water + diphenylamine.
3. Titrate with 0.5N FAS till violet → green.

Nitrates (Di-Azo Method)

1. Prepare standards + sample → add Zn dust (10 min) → transfer supernatant → analyze with reagents.

Reagents:

Stock solution (100 µg/ml): Dissolve 0.7 g KNO_3 in 1 L D/W.

Working solution (1 µg/ml): Dilute 1 ml stock to 100 ml with D/W.

Sulphanilamide solution: 10 g sulphanilamide + 100 ml conc. HCl → make up to 500 ml with D/W.

NEDD solution: 0.5 g NEDD in 5 L D/W (store in brown bottle).

Zinc dust.

NITRITES (Di –Azo Method)

Requirments **-** Stock nitrate solution, working Nitrate solution, NEDD, Sulphanilamide solution.

Protocol –

1. Prepare a range of concentration of standard Nitrate Solution as per the table.

Reagents:

Stock (100 µg/ml): 0.490 g $NaNO_2$ + 1 L D/W + few drops chloroform (brown bottle).

Working (1 µg/ml): 1 ml stock → dilute to 100 ml D/W.

Sulphanilamide sol.: 10 g + 100 ml conc. HCl → make up to 500 ml D/W (brown bottle).

NEDD sol.: 0.5 g in 5 L D/W (brown bottle).

PHOSPHATE CONTENT (ASCORBIC ACID REDUCTION METHOD)

Requirments-Std.PO4-Solution, (100mg/ml), Working Std PO4 Solution (1mg/ml), Acid molybdate reagent, ascorbic acid solution.

Reagents

1. Stock phosphate solution (100mg/ml)– 0.420mg KH2PO4 + 100 ml D/W.
2. Working std Phosphate Solution (1mg/ml) – 1ml stock + 100ml D/W.
3. Acid molybdate reagent – 2.5gm of ammonium molybdate + 100mlD/W +60ml 10N Sulphuric acid10N H_2SO_4- 28ml of H_2SO_4 + 100ml D/W.
4. Ascorbic acid Solution –200mg Ascorbic acid + 100D/W.

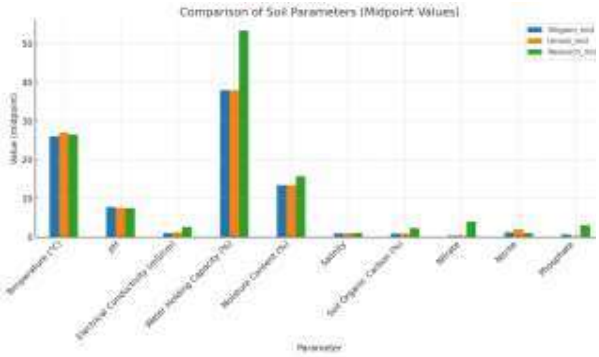
RESULTS AND DISCUSSION

The present investigation on the soils of Boisar, Shivgaon, and Umroli from Palghar Taluka provided significant insights into their physicochemical properties. The soil samples from each locality showed distinct variations in fertility parameters, reflecting the influence of local environmental conditions, land use patterns, and agricultural practices. The physicochemical analysis of Shigaon and Umroli farm soils revealed distinct variations in temperature, pH, EC, moisture, and nutrient status when compared with reported literature values. Soil temperature showed a steady rise during pre-monsoon months, peaking at 26–27°C, which falls within the general range of 23–30°C. The pH values indicated slightly alkaline conditions, with Shigaon soil (7.9–7.6) being more alkaline than Umroli soil (7.7–7.3), aligning with reported ranges (7.2–7.66). Electrical conductivity was comparatively lower (0.8–1.2 ms/cm in Shigaon and 1–1.4 ms/cm in Umroli) than the reported range (1–4.12 ms/cm), suggesting reduced salt accumulation. Water holding capacity was higher in Shigaon (32–44%) than Umroli soil, though both were on the lower side of reported values (33–73.86%). Moisture content varied from 17.37% to 9.5%, closely matching reported data (21.29–10.12%). Alkalinity values were higher in riverside soils (13–13.2) than hillside soils (10–10.1), while salinity remained low (0.8–1), consistent with reported values up to 1. Soil organic carbon content ranged between 0.12–1.56%, lower than reported values (1.22–3.45%), possibly due to differences in vegetation and land use. Nitrate levels (0.41–0.24 mg/L) and nitrite levels (1.1–2.03 µg/ml) were also below reported concentrations, indicating lower nitrogen availability. Phosphate content showed a wide disparity, with Shigaon soil (0.58–0.67 µg/ml) higher than Umroli soil (0.12–0.21 µg/ml) but much lower than reported values (3.05 ± 0.18 mg/L). These findings highlight site-specific soil fertility variations and suggest the need for proper nutrient management practices to enhance agricultural productivity.

Soil Analysis Data

Table 1: Table showing soil analysis data of Shigaon and Umroli village from Palghar talukas :

Parameter	Shigaon Farm / Riverside Soil	Umroli Farm / Hillside Soil	Reported in Research
Temperature (°C)	26	27	23 – 30
pH	7.9 – 7.6	7.7 – 7.3	7.2 – 7.66
Electrical Conductivity (mS/cm)	0.8 – 1.2	1.0 – 1.4	1 – 4.12
Water Holding Capacity (%)	32 – 44	32 – 44	33 – 73.86
Moisture Content (%)	17.37 – 9.5	17.37 – 9.5	21.29 – 10.12
Alkalinity	13 – 13.2	10 – 10.1	–
Salinity	0.8 – 1	0.8 – 1	Up to 1
Soil Organic Carbon (%)	0.12 – 1.56	0.12 – 1.56	1.22 – 3.45
Nitrate (mg/L)	0.41 – 0.24	0.41 – 0.24	Up to 3.96 µg/ml
	0.58 – 0.67 µg/ml	0.12 – 0.21 µg/ml	**Phosphate**



Graph 1: Graph showing comparative data of soil analysis in Shigaon and Umroli village from Palghar taluka

CONCLUSION

The Physico-Chemical parameter were studied and determined by using standard procedures. From the results, it is revealed that there was slight variation in some physicochemical parameters among the study area It is evident that mostly all the values of physicochemical parameters fall under the permissible limit. It was observed that different areas of soil had influences on the physicochemical characteristics of the soils. Comparison of samples under consideration is done and discussed in the discussion section. Range of Temperature, electrical conductivity, moisture content, Nitrate and Nitrite is found more inkohoj hill than vaitarna river soil. Similarly pH, Salinity, alkalinity, carbon content, water holding capacity, Phosphate content of Vaitarna River soil is more than the Kohoj hill soil.

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