



Comparative Analysis Of Soil Quality In Agricultural, Barren, Roadside, And Garden Areas Of Dholpur

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Abstract

Soil is a vital natural resource that supports terrestrial ecosystems and agricultural productivity. The present study focuses on the comparative analysis of soil quality in agricultural (farm), barren, roadside, and garden areas of Dholpur City, Rajasthan. Soil samples from these four distinct land-use types were analyzed for key physico-chemical parameters including pH, colour, texture, electrical conductivity, total alkalinity, total hardness, total dissolved solids (TDS), dissolved oxygen (DO), sulphate, and chloride using standard analytical methods.

The results revealed that all soil samples were alkaline in nature, indicating the predominance of carbonate and bicarbonate salts typical of semi-arid regions. Roadside soil exhibited the highest total alkalinity and TDS, suggesting accumulation of soluble salts due to anthropogenic activities. Garden soil showed comparatively higher electrical conductivity and chloride content, possibly due to fertilizer and irrigation inputs. Farm soil recorded maximum hardness, while barren land soil showed elevated sulphate concentration.

The observed variations demonstrate that land-use patterns significantly influence soil quality. The study emphasizes the importance of continuous soil monitoring and sustainable management practices to maintain soil fertility and environmental health.

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Keywords: Soil quality, Physico-chemical parameters, Land use, Alkalinity, Dholpur, Soil fertility

1. Introduction

Soil is the uppermost layer of the Earth's crust that supports plant growth and sustains terrestrial life. It is a complex and dynamic system composed of minerals, organic matter, water, air, and living organisms. The collective body of soil on the Earth's surface, known as the pedosphere, performs several critical ecological functions:

1. It provides a medium for plant growth.
2. It acts as a reservoir for water storage and purification.
3. It plays a significant role in regulating the Earth's atmosphere.

4. It serves as a habitat for diverse microorganisms and soil fauna.

A single gram of soil may contain billions of microorganisms belonging to thousands of species, contributing to nutrient cycling and organic matter decomposition. Soil is also a crucial component of the global carbon cycle, functioning both as a carbon sink and as a medium for natural attenuation, where contaminants are degraded and immobilized.

Typically, soil composition includes approximately:

- 50% solid material (45% mineral matter and 5% organic matter),
- 25% water, and
- 25% air.

The physico-chemical properties of soil, such as pH, electrical conductivity, alkalinity, hardness, and dissolved salts, directly influence soil fertility, nutrient availability, and crop productivity. Variations in land use—such as agriculture, gardening, roadside exposure, or barren conditions—can significantly alter soil characteristics due to differences in vegetation cover, irrigation practices, fertilizer application, and anthropogenic activities.

Dholpur city, located in Rajasthan, experiences semi-arid climatic conditions, which may contribute to alkaline soil formation and salt accumulation. Therefore, comparative evaluation of soils from agricultural, barren, roadside, and garden areas is essential to understand the impact of land-use patterns on soil quality.

The present study aims to assess and compare the physico-chemical characteristics of soils from different land-use zones of Dholpur city in order to evaluate their fertility status and environmental condition.

2. Study Area

The study was conducted in Dholpur, a region characterized by semi-arid climatic conditions. Soil samples were collected from four different sites:

1. Farm soil
2. Barren land soil
3. Roadside soil
4. Garden soil

These sites were selected to compare soils under different land-use patterns.

3. Materials and Methods

3.1 Sample Collection

Soil samples were collected from surface layers at each site. Samples were air-dried, sieved, and stored in clean containers for laboratory analysis.

3.2 Experimental Methods

Parameter	Method Used
pH	pH Strip Method
Electrical Conductivity	Conductivity Meter
Texture	Feel Method
Total Alkalinity	Neutralization (HCl Titration)
Total Hardness	EDTA Complexometric Method
Dissolved Oxygen (DO)	Winkler Method
Total Dissolved Solids (TDS)	Evaporation Method
Chloride	Mohr's Method
Sulphate	Gravimetric Method

Standard laboratory procedures were followed for each analysis.

4 Results

Table 1: Statistical Summary of Physico-Chemical Parameters of Soil Samples

Parameters	Farm Soil	Garden Soil	Barren Land Soil	Roadside Soil	Maximum Value	Minimum Value	Mean \pm SD
pH Nature	Alkaline	Alkaline	Alkaline	Alkaline	–	–	–
Colour	Black & Dark Grey	Red-Yellow	Blackish	Brown	–	–	–
Texture	Sandy Loam	Loamy	Loamy	Sandy Loam	–	–	–
Electrical Conductivity	0.2	0.7	0.2	0.4	0.7 (Garden)	0.2 (Farm & Barren)	0.38 \pm 0.23
Total Alkalinity (mg/L)	620	500	700	1100	1100 (Roadside)	500 (Garden)	730 \pm 268.7
Total Hardness (mg/L)	300	252	248	228	300 (Farm)	228 (Roadside)	257 \pm 30.9
TDS (mg/L)	320	150	300	820	820 (Roadside)	150 (Garden)	397.5 \pm 293.1
Dissolved Oxygen (mg/L)	14	12.48	10.64	74.4	74.4 (Roadside)	10.64 (Barren)	27.88 \pm 30.86
Sulphate (gm/ml)	2.80	1.46	6.08	4.5	6.08 (Barren)	1.46 (Garden)	3.71 \pm 1.99
Chloride (gm/L)	0.18	0.48	0.17	0.02	0.48 (Garden)	0.02 (Roadside)	0.21 \pm 0.20

5. Results and Discussion

5.1 Results

The physico-chemical characteristics of soil samples collected from four different locations (Farm soil, Garden soil, Barren land soil, and Roadside soil) were analyzed and statistically evaluated. The consolidated data including mean and standard deviation (Mean \pm SD) are presented in the table.

pH Nature

All soil samples were found to be **alkaline in nature**, indicating the dominance of basic salts such as carbonates and bicarbonates. No significant variation in pH nature was observed among the sampling sites.

Colour

- Farm soil: Black & dark grey
- Garden soil: Red-yellow
- Barren land soil: Blackish
- Roadside soil: Brown

The variation in colour reflects differences in organic matter content and iron oxide composition.

Texture

- Farm soil and Roadside soil: Sandy loam
- Garden soil and Barren land soil: Loamy

Loamy soils generally possess better water retention and nutrient-holding capacity compared to sandy loam soils.

Electrical Conductivity (Mean: 0.38 ± 0.23)

Electrical conductivity ranged from **0.2 to 0.7**, with the highest value observed in Garden soil (0.7) and the lowest in Farm and Barren land soils (0.2). The moderate standard deviation indicates variation in ionic concentration among sampling sites.

Total Alkalinity (Mean: 730 ± 268.7 mg/L)

Total alkalinity varied between **500 and 1100 mg/L**. The maximum value was recorded in Roadside soil (1100 mg/L), while the minimum was observed in Garden soil (500 mg/L). The high standard deviation suggests considerable variation in carbonate and bicarbonate content among sites.

Total Hardness (Mean: 257 ± 30.9 mg/L)

Hardness ranged from **228 to 300 mg/L**, with the highest in Farm soil (300 mg/L) and the lowest in Roadside soil (228 mg/L). The relatively low standard deviation indicates moderate variation in calcium and magnesium concentrations.

Total Dissolved Solids (Mean: 397.5 ± 293.1 mg/L)

TDS values ranged widely from **150 to 820 mg/L**. The highest value was found in Roadside soil (820 mg/L), whereas Garden soil showed the lowest (150 mg/L). The high SD indicates significant variability in soluble salt concentration.

Dissolved Oxygen (Mean: 27.88 ± 30.86 mg/L)

DO ranged from **10.64 to 74.4 mg/L**, with the maximum in Roadside soil and minimum in Barren land soil. The large SD reflects extreme variation between sites.

Sulphate (Mean: 3.71 ± 1.99 gm/ml)

Sulphate concentration ranged from **1.46 to 6.08 gm/ml**, highest in Barren land soil and lowest in Garden soil.

Chloride (Mean: 0.21 ± 0.20 gm/L)

Chloride values varied from **0.02 to 0.48 gm/L**, with maximum concentration in Garden soil and minimum in Roadside soil.

5.2 Discussion

The results indicate that soil properties vary significantly depending on land use and environmental conditions.

All soils being alkaline suggests the prevalence of carbonate minerals typical of semi-arid regions. Alkaline soils may reduce the availability of micronutrients such as iron, zinc, and manganese.

Electrical conductivity was highest in Garden soil, indicating higher ionic concentration, possibly due to fertilizers and organic amendments. Roadside soil showed high total alkalinity and TDS, which may result from accumulation of salts due to vehicular emissions, dust deposition, and runoff.

Farm soil exhibited maximum hardness, suggesting higher concentrations of calcium and magnesium ions, which are essential for plant growth but may affect soil structure at excessive levels.

The highest TDS and dissolved oxygen in Roadside soil indicate the presence of more soluble materials and possible external contamination sources. Barren land.

6. Conclusion:

The present study evaluated the physico-chemical characteristics of soil samples collected from four different land-use areas: farm soil, garden soil, barren land soil, and roadside soil. The analysis revealed significant variation in soil properties depending on land-use patterns and environmental exposure.

All soil samples were found to be alkaline in nature, indicating the dominance of carbonate and bicarbonate salts. While alkalinity is common in semi-arid regions, excessive alkalinity may reduce the availability of essential micronutrients such as iron, zinc, and manganese, thereby affecting plant growth.

Electrical conductivity showed moderate variation, with garden soil recording the highest value, possibly due to fertilizer application and organic inputs. Roadside soil exhibited the highest total alkalinity and total dissolved solids, suggesting accumulation of soluble salts from anthropogenic activities such as vehicular emissions, dust deposition, and surface runoff.

Farm soil showed the highest total hardness, indicating greater concentrations of calcium and magnesium ions, which are beneficial for plant development but may influence soil structure at elevated levels. Barren land soil recorded the highest sulphate concentration, which may be attributed to mineral weathering and limited vegetation uptake.

The large variation observed in TDS and dissolved oxygen values indicates differences in organic matter content, aeration, and external contamination among sampling sites. Chloride concentration was highest in garden soil, possibly due to irrigation practices or fertilizer application.

Overall, the study confirms that land use plays a crucial role in determining soil quality. Continuous monitoring and adoption of appropriate soil management practices are essential to maintain soil fertility, prevent salinity buildup, and ensure sustainable agricultural productivity.

7. References

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