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A study of the physico-chemical Analysis of chosen soil samples in the Thiruvarur district, Tamilnadu, India

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ABSTRACT

The purpose of this research is to conduct an analytical investigation on chosen soil samples collected in and around the Thiruvarur district. The current investigation was conducted to investigate the pH metric analysis of 48 soil samples selected from four taluks. Each village contributes five samples, with forty of them chosen for study based on thirteen parameters. The results show that a paddy field soil sample had higher quantities of carbon, nitrogen, and iron. Drilling dirt has a higher pH and electromagnetic conductivity. While riverbed soil contains more potassium, garden soil contains more phosphorus. Pond soil contains more zinc. Boron levels are higher in riverbed soil. The bulk of the soil samples were also depleted of manganese, copper, and molybdenum wastes, which contribute to soil degradation, or were completely devoid of these components, according to the study.

Key words: *Physico-chemical analysis, pH, Soil, Glass electrode and electrometer.*

Introduction

Soil originates as a natural body during and after the weathering of rocks, allowing plants and other forms of life to grow. Changes and modifications inside the mantle, which forms a loose surface layer overlying the earth's crust, are caused by genetic forces. The soil becomes a dynamic body or entity as a result of these changes and alterations. Soil is mostly constituted of mineral materials, with a trace of organic substance. It also contains water, certain gases, and a vast number of species in addition to these two. As a result, the soil can be divided into five types of components (Sudha, *et al.,* 2020). Organic matter is produced through the decomposition of rocks and plant remains, which is formed from plant wastes and animal remains. Rain, snow, and dew can all be used to obtain water from the sky. In addition to the atmosphere, air or gases are produced by soil microbial activity, which can occur in a variety of ways, including large (macro) species such as rodents, worms, and insects, as well as small (micro) organisms such as bacteria and fungus, which are abundant in the soil. Soil is a three-phased system composed of mineral and organic matter, salt water and some gas solutions, a liquid phase, and gaseous gases. Each phase includes multiple components that are extremely complex for the entire system. Because of the continuous fluctuations in the soil, the mechanism is never in control (Nepal,

et al., 2018).

When dumping and managing garbage, soil degradation is sometimes overlooked. As a result, soil quality suffers. The capacity of soil to sustain environmental quality, support plant and animal health, and function within an environment is characterised as biological efficiency. Soil quality is crucial in reducing trash dumping and management systems for sustainable development and environmental protection. In measuring soil quality, different management and environmental conditions necessitate the incorporation of static and dynamic chemical, physical, and biological components (Han, *et al.,* 2020). Soil quality is determined by external influences in addition to land use and soil management methods, ecosystem interactions, and socioeconomic considerations. Instead, specific soil quality functions are quantified using specified physical, chemical, and biological parameters. As a result of the chemical composition and qualities of soil, many reactions and processes occur. In soil quality assessments, a small number of indicators is frequently employed to identify important soil functions economically and efficiently.

The current effort attempts to analyse the appropriateness of a soil from a certain place. Though there are many parameters available to measure soil suitability, only thirteen are chosen to determine quality. Organic carbon (%), pH, electrical conductance (EC) (mmho cm1), available nitrogen (kg ha1), water holding capacity (WHC) (%), available phosphorus-(kg olsen's ha1), available phosphorus-Bray (kg ha1), available potassium (kg ha1), available zinc (Zn) (ppm), available copper (Cu) (ppm), available iron (Fe) (ppm), available boron (B) (ppm), available (Mo).

Literature survey

Physicochemical and microbiological parameters of soil samples collected in the Thiruvarur district of Tamil Nadu, India, to estimate soil fertility. Five representative villages were selected, and a variety of surface soil samples (0-15 cm) were collected and analysed for microbiological and physicochemical features. The greatest bacterial and fungal population was found in sample-5, followed by 1, 4, 3, and 2. Sample-1 had the highest bacterial population, followed by samples 5, 4, 3, and 1. The EC values ranged between 0.13 and 0.54 dS/m. Soil pH and organic carbon percent ranged from 7.62 to 8.43 and 0.07 to 0.3%, respectively. The nitrogen, phosphorus, and potash levels ranged from 67.17 to 184 kg/ha, 2.56 to 47.50 kg/ha, and 225 to 1012 kg/ha, respectively (Selvi *et al.,* 2020).

Dhanalakshmi *et al.* performed physicochemical analysis and structural characterization on soil samples from the Pudukkottai area of Tamil Nadu. Soil samples were tested for pH, EC, Nitrogen, Phosphorus, Potassium, Zinc, and Iron. In addition, FTIR experiments were carried out to assess the sample's structural conformation. The soil collected had a sandy clay loam texture and was red, according to the report. The pH of the soil was 9.29 and the EC was 0.02 dSm-1. Paddy field soil samples were found to have 118, 11, and 160 kg/ha of nitrogen, phosphorus, and potassium, respectively. The vibration frequency for C-H deformation vibrations in soil FT-IR spectra was discovered to be 1402. At 1644, a C=C stretch occurs, whereas an N-H stretch occurs at 2344 (Dhanalakshmi, *et al.*, 2020).

(Arivoli *et al.,* 2021). From January to December 2019, soil samples from Puliyanthangal village were tested, as were bore well, well, and pond water samples from Kathiyavadi village, a village 10 kilometres from the industrial region, and a village 20 kilometres from the industrial area. The soil texture in each zone was sandy loam. In zones 1 and 2, pH, electrical conductivity (dS/m), organic carbon (%), available nitrogen, phosphorus, potassium, iron, manganese, zinc, and copper (mg/Kg) were measured. The physicochemical characteristics (water temperature, electrical conductivity, turbidity, total dissolved solids, pH, total alkalinity, and total hardness) of the samples in the research region were also obtained (Palani, *et al.,* 2021). Conducted several soil fertility analyses. The study was carried out in Kanchipuram district, Tamil Nadu, at Mambattu village, Maduranthakam block. Based on the examination of twenty geo-referenced soil samples collected from the research village, an accurate soil fertility index (SFI) was created. pH, EC, macronutrients, secondary nutrients, and micronutrients were all measured. Using a soil sample from Mambattu village, it was observed that the pH ranged from acidic to alkaline, with roughly 40% neutral, and that the electrical conductivity revealed a non-saline and medium level of Organic Carbon. The majority of the soil samples contained adequate quantities of N and micronutrients (Fe, Mn), with a medium quantity of S and B and a shortfall in P, K, Ca, Mg, Zn, and Cu. Soil fertility evaluation has proven to be an effective technique in the early stages of soil

health improvement (Rasith Ali, *et al.,* 2021).

Materials and Methods

Organic carbon (%), pH, electrical conductance (EC) (mmho cm1), available nitrogen (kg ha1), available phosphorus-Bray (kg ha1), available potassium (kg ha1), available zinc (Zn) (ppm), available copper (Cu) (ppm), available iron (Fe) (ppm), available boron (B) (ppm), available manganese (Mn) (ppm), available molybdenum (Mo) (Chandrasekaran, A., et.al 2015).

Materials Required

Various soil samples, distilled water, a 250 ml beaker, a glass rod, and a well-calibrated digital Eutech pH Tester-30 with a glass electrode and electrometer.

Preparation of Samples

Soil samples are obtained from several locations within the Thiruvarur District.

Study area

They are as follows: Sample A (ONGC-well), Sample B (Trash), Sample C (Moisture mass), Sample D (Pond), Sample E (Paddy field), Sample F (Garden), Sample G (Erukattur-Pipelinesite), Sample H (Mettupalayam-Pipelinesite), Sample I (Velangudi-Pipelinesite), Sample J (Alivalam-Drilling site), Sample K (Erukattur- (Perunkudi-Drillingsite).

Extraction of soil samples

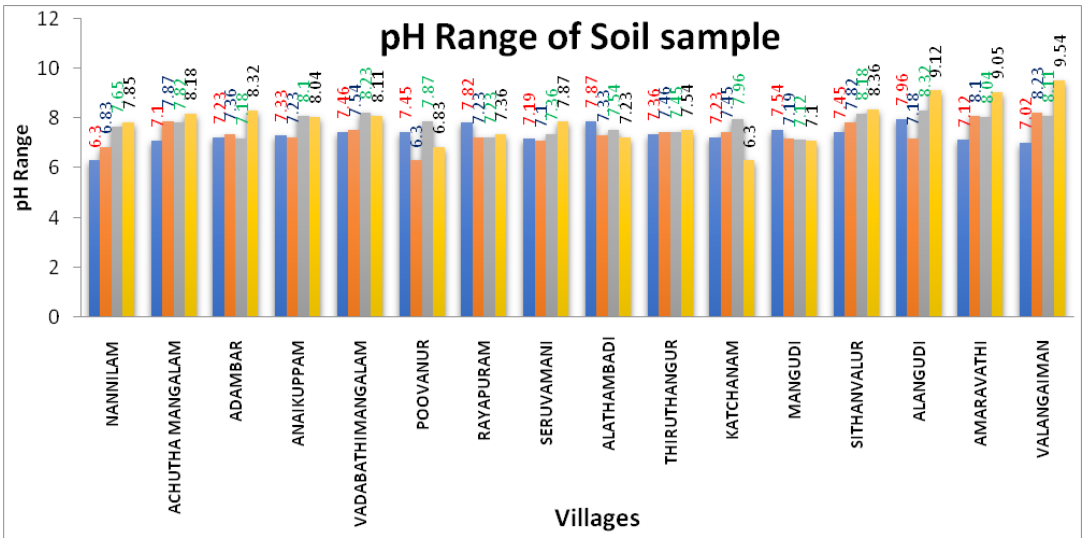
The beakers and glass rods used in this experiment are carefully cleaned and rinsed with distilled water. Five grammes of each soil sample are placed in a beaker with 50 ml of distilled water. For 15 minutes, the soil mixture is agitated so that heavy particles settle to the bottom. Meanwhile, the pH metre electrodes are being washed with distilled water. The immersible pH-meter device is then placed inside the beaker and the "pH" value is read from the scale16, and the pH values of the additional samples are calculated in the same manner. Table contains a summary of the readings.

Results and Discussion

The study's research begins with the collecting of various sorts of soil samples, including pond dirt, riverbed soil, garden soil, barren land soil, and paddy field soil, from eight villages in four taluks, including Nannilam, Thiruthuraipoondi, Valangaiman, and Needamangalam. This part includes a soil evaluation, which looks at experimental evidence that might help validate theoretical analyses. The research involves eight villages (2 villages from each taluk). 48 samples were analysed using 12 parameters. Table 2 lists the parameter values for the various types of soils collected.

pH Range of Soil Sample for Villages and Taluks in Thiruvarur district

TAULK	VILLAGE	pH Range			
		1	2	3	4
	Nannilam	6.3	6.8	7.7	7.9
Nannilam	Achutha Mangalam	7.1	7.9	7.8	8.2
	Adambar	7.2	7.4	7.2	8.3
	Anaikuppam	7.3	7.2	8.1	8
	Vadabathimangalam	7.5	7.5	8.2	8.1
Needamangalam	Poovanur	7.5	6.3	7.9	6.8
	Rayapuram	7.8	7.2	7.2	7.4
	Seruvamani	7.2	7.1	7.4	7.9
Thiruthuraipoondi	Alathambadi	7.9	7.3	7.5	7.2
	Thiruthangur	7.4	7.5	7.5	7.5
	Katchanam	7.2	7.5	8	6.3
	Mangudi	7.5	7.2	7.1	7.1
	Sithanvalur	7.5	7.8	8.2	8.4
	Alangudi	8	7.2	8.3	9.1
Valangaiman	Amaravathi	7.1	8.1	8	9.1
	Valangaiman	7	8.2	8.1	9.5



pH Range Parameter

Discussion

The parametric values of six different soil samples from different parts of Thiruvarur districts are calculated in this study. Organic carbon of 0.55 is found in paddy field soil sample 25-2019 from Alathambadi, and pH of 8.19 is found in drilling soil sample 85-2019 from Erakattur. Drilling soil sample 85-2019 from Erakattur has a high electrical conductivity of 6.65, paddy field soil sample 20 from Achuthamangalam has a higher available nitrogen level, and garden soil sample 92-2019-6 from Vadabathimangalam has a higher available phosphorus content. Potassium is greater in Nannilam's river bed soil sample 89, available zinc is higher in Vadabathimangalam's pond soil sample 90-2019-4, iron is higher in Achuthamangalam's paddy field soil sample 19, and boron is higher in Nannilam's river bed soil sample 89.

Conclusion

The current study of soil analysis in the Thiruvarur district was completed. The district is further subdivided into four taluks, with two villages chosen from each. Five soil samples are obtained from each hamlet, and the 40 selected soil samples are analysed using thirteen parameters. According to the findings, paddy field soil sample had a greater carbon content, nitrogen content, and iron content. The pH and electrical conductivity of drilling soil are increased. Garden soil contains more phosphorus, but river bed soil contains more potassium. The zinc content in pond soil is higher. Boron content is higher in river bed soil. This study also reveals that the majority of the soil samples collected are either low in manganese, copper, or molybdenum. This research will pave the road for adequate soil management to ensure its long-term viability. It will also aid us in understanding the role of garbage in soil deterioration.

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