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Evaluation of the physical and chemical characteristics of soil in specific natural habitats in and around the Agrara area, Rajanna Sircilla district, Telangana state, India

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Abstract
For the management of soil and plant growth, agricultural chemists find the physicochemical study of parameters to be crucial. All of the soil parameters, including conductivity, pH, Ca, Mg (%), N (%), P (%), and carbon (%), are within the normal range, according to physicochemical analyses of soil samples from the Rajanna sircilla district's Agraharam, Nimmapali Kudhurupakka, Shatrajpalii, and Tekkapalli locations. Farmers can then determine how much fertiliser and nutrient to add to the soil in order to increase the percentage of crops produced. These investigations offer details on the composition of the soil and its current nutrient content.

Keywords: Soil, pH, Ca, Mg, farmers

Introduction
The physicochemical properties of the soil impact forest growth and agricultural productivity. Soil quality can impact not only plant production but also waste treatment, water retention, and carbon sequestration. The "skin of the earth" consists of interfaces that connect the soil-based lithosphere, hydrosphere, atmosphere, and biosphere. Soil's solid component is composed of minerals and organic matter, while its porous section retains water and gases. Soils are commonly thought of as a three-state system. Soil is produced through the interaction of parent materials, biotic activity, and climate over time. The physical, chemical, and biological processes that lead to soil erosion and weathering are just a few examples of the many processes that constantly alter soil.
The combination of minerals, organic matter, gasses, liquids, and numerous organisms that support plant life is known as soil. This naturally occurring entity, which is a component of the pedosphere, serves four vital purposes: it provides as a growing medium for plants; it stores, supplies, and purifies water; it modifies the atmosphere; and it serves as a home for creatures that aid in the breakdown of organic matter and the formation of new habitats.
Soil is a dynamic medium made up of water, air, minerals, organic debris, and living things like bacteria and earthworms. Its development and continuous alteration are caused by five primary physical factors: geography, climate, time, and the parent material.

Physicochemical Properties in Soil Quality
pH: Among all the parameters that affect the quality of soil, pH is considered as the most important factor. This is the reason why pH is considered an important entity while carrying out soil analysis. An acidic soil is defined as having a pH of less than six; a normal soil has a pH of between six and eight; and an alkaline soil has a pH of greater than 8.5.

Electrical conductivity: This is another vital characteristic of the soil that is used to assess its quality. The amount of ions in a solution is measured [1]. With an increase in ion concentration, a soil solution becomes more electrically conductive. Electrical conductivity is a quick, simple, and reasonably priced method of evaluating the condition of soils. It represents the amount of ions in a solution. With an increase in ion concentration, a soil solution becomes more electrically conductive.

Organic matter in soil: It is also an essential component of soil. Insufficient organic matter in the soil speeds up the process of soil erosion. Utilising this soil for agricultural purposes can be advantageous if organic matter is found in it. You can add compost, animal manures, and other organic elements to the soil. The soil's higher than normal content of organic matter is another possible reason for the pH drop. From the surface to the subsurface, levelling has caused a decrease in the soil's organic matter content.

Nitrogen: Nitrogen, the most significant element that plants can obtain from the soil, acts as a growth inhibitor [2]. 80% of the atmosphere is made up of nitrogen. Nitrogen gas can be "fixed" into ammonia in water so that blue-green algae can use it. In addition to ammonia, inorganic nitrogen is another kind of nitrogen that can find its way into lakes and streams. Because it can enter aquatic systems through multiple pathways, nitrogen is widely available and easy to get.

Phosphorus: Phosphorus is a necessary element found in all living cells. It's one of the most important micronutrients needed for plant development. Phosphorus primarily acts as an energy reserve reservoir and regulates the amount of nutrients that remain in the plant nucleus.

Potassium: is one of the key components of plant development and plays a vital part in many different plant physiological functions. It is involved in a variety of plant metabolism processes, such as the production of plant sugars for a range of metabolic needs in plants [3], the control of photosynthesis, and the synthesis of lignin and cellulose, which are structural components of cells.

Calcium: Plant cell walls are largely constructed with the help of calcium, namely in the form of calcium pectate. New tissue, including root tips, early leaves, and shoot tips, frequently exhibits abnormal cell wall development when there is a calcium deficiency, which results in visual distortion in the emerging growth. Additionally, calcium is utilized in the signalling and enzyme activation processes that synchronize specific cellular functions.

Magnesium: The primary component of the chlorophyll molecule in plant tissue is magnesium. Plant growth is so poor and stunted if there is a magnesium deficiency due to a chlorophyll shortage. Certain enzyme systems are also aided by magnesium's activation.

Texture: Agricultural soils are categorized into classes based on their physical texture using the qualitative technique known as soil texture, which is used in both the field and the lab.
Particle size is the main factor that determines the texture of soil, and it varies according on location. Soil texture clearly affects aeration and root penetration. It has an impact on the nutritional value of the soil as well. The main determinant of soil texture is electrical conductivity.

Moisture: The amount of water (also known as moisture content) that is present in a substance, such soil, is known as soil moisture. One of the most significant characteristics of soil is moisture. The amount of moisture in the soil affects not just the texture of the soil but also how well nutrients are absorbed by the soil.

Soil temperature: The soil's temperature is determined by the interaction between absorbed and lost energy. Soil temperature ranges from 20 to 60 °C. Soil temperature is by far the most important factor because of its impact on the chemical, physical, and biological processes involved in plant growth. The temperature of the soil is influenced by the time of day, season, and local climate.

Objectives: (1) To Evaluate the Physicochemical characteristics (pH, Electrical conductivity) (2) To estimate the metal composition (Na, K, Fe, Ca & Zn).

Materials and Methods

Methods: Various Techniques were used to analyze the Soil samples. pH by pH meter, Colorimeter was used to determine composition of Iron and phosphorous, Flame emission spectrophotometer was used to determine the composition of Sodium & Potassium, Calcium was used determined by using UV-Visible spectrophotometer and finally Magnesium was determined by using Atomic Absorption Spectrophotometer. Colour of the sample was by viewing, amount of Organic carbon by wet oxidation and available nitrogen by Alkaline permanganate.

Collection of samples: Fresh soil samples were gathered from the Agraharam, Nimmapali Kudhurupakka, Shatrajpalii, and Tekkapalli and placed in sterile containers. In 2023, a soil quality test survey was carried out. Five representative soil samples were taken from various locations throughout the city at varying depths. There are three types of agricultural land in these areas: semi-irrigated, non-irrigated, and irrigated. For analysis, soil samples no. 1 through no. 5 from the city's eastern section were gathered. The top layer of vegetation, surface litter, and any stones or stubble were removed during the soil sample collection process. The layer of soil immediately below (0-20 cm) was then collected in a polythene bag.

Results and Discussion: Major physical and chemical parameters of soil quality, such as pH, electrical conductivity, organic carbon, accessible nitrogen, phosphorus, and potassium, were examined in the collected samples [4-11].

Table 1: Phytochemical parameters of various soil samples

Physicochemicalparameter	Sample-No.				
	1	2	3	4	5
pH	7.57	7.5	7.64	8.6	8.38
Electrical conductivity (ms/cm)	0.24	0.18	0.32	0.2	0.52
Organic matter (%)	0.60	0.39	0.47	0.01	0.47
Nitrogen (mg/kg)	219.45	175.56	199.68	240	250.8
Phosphorus (mg/kg)	30.56	61.90	304	39	11.8
Calcium (ppm)	34.5	27.5	220	220	225
Magnesium (ppm)	14.8	13.8	10	20	25

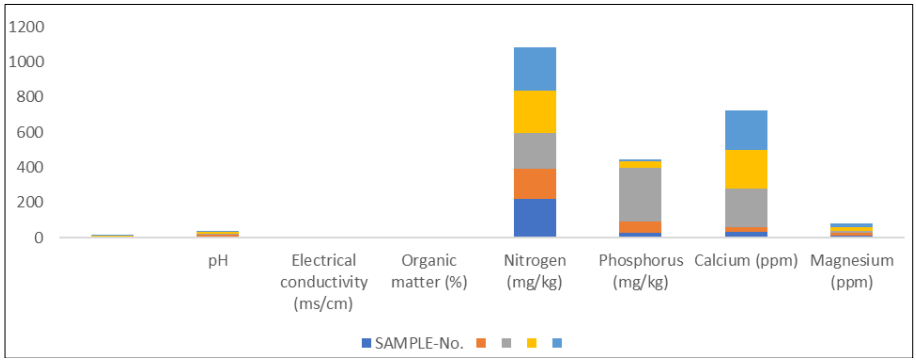

Fig 1: Physicochemical parameters

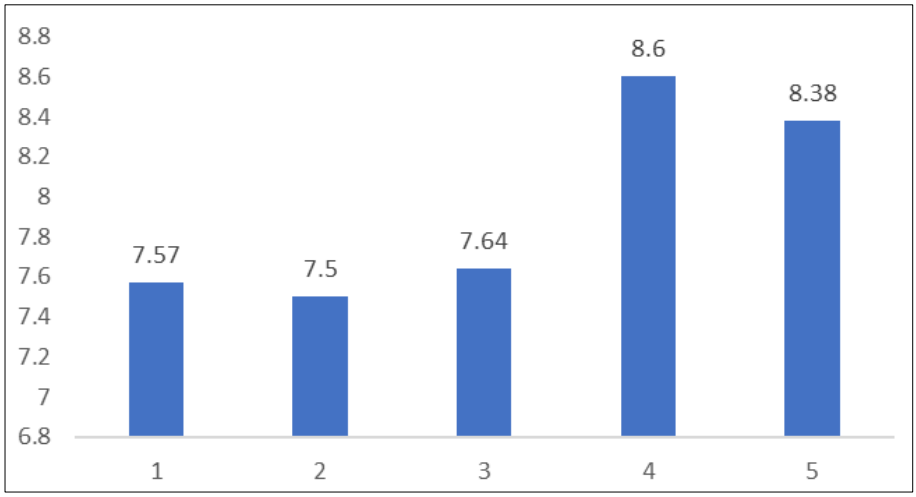

Fig 2: pH

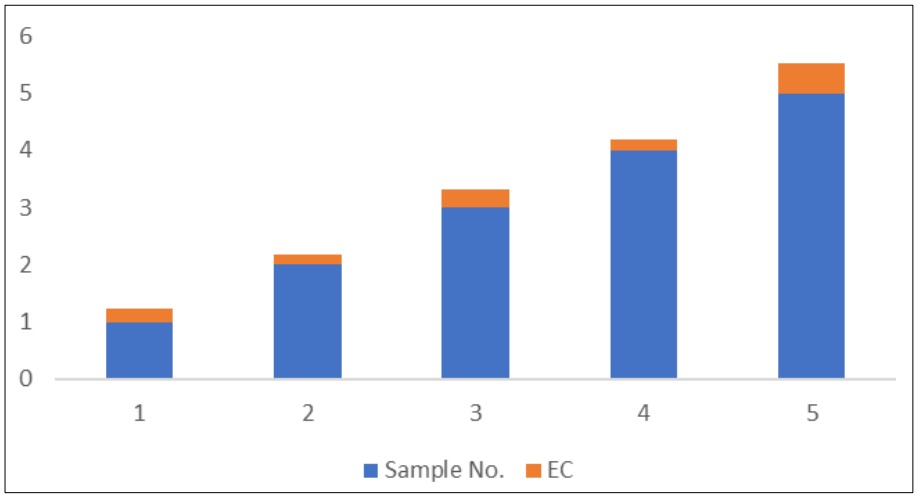

Fig 3: EC

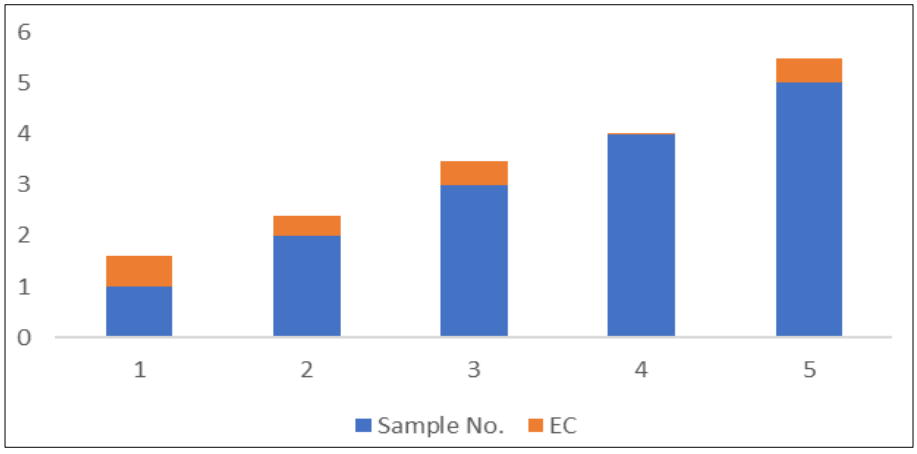

Fig 4: OC %

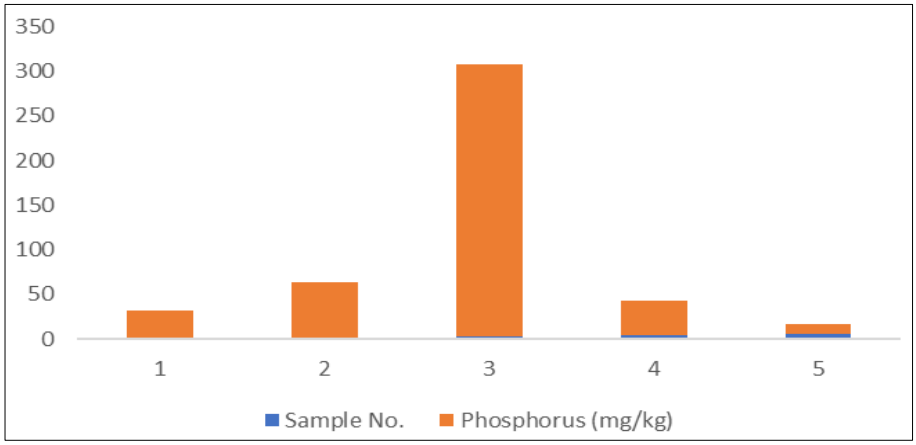

Fig 5: P (mg/kg)

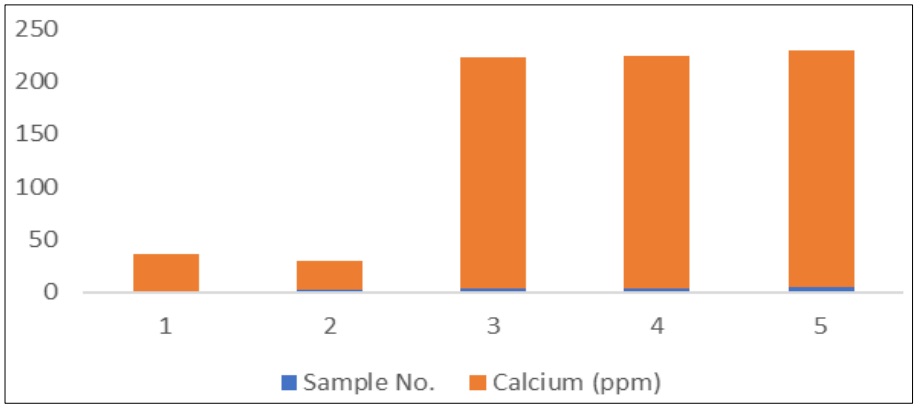

Fig 6: Ca ppm

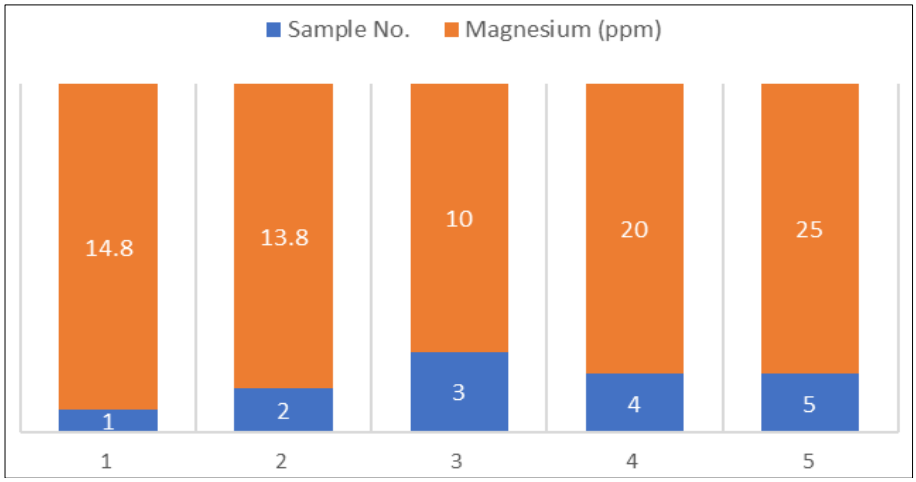

Fig 7: MG (PPM)

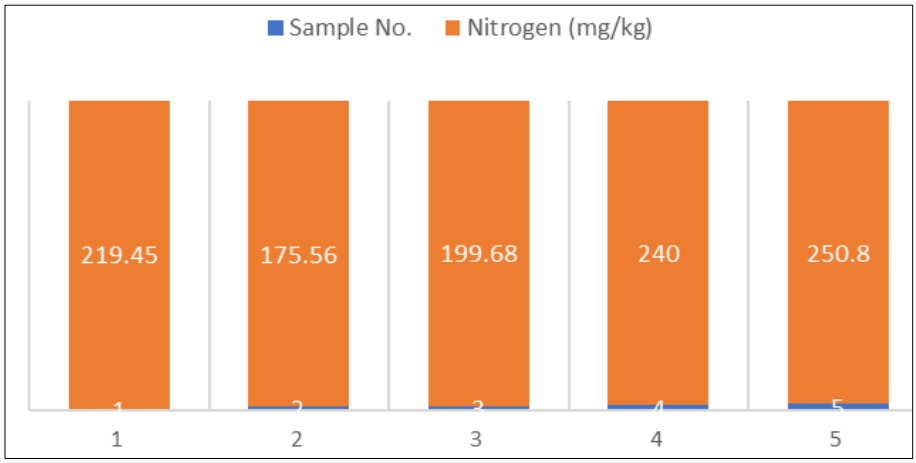

Fig 8: Nitrogen (mg/kg)

Conclusion

For the management of soil and plant growth, agricultural chemists find the physicochemical study of parameters to be crucial. All of the soil parameters, including conductivity, pH, Ca, Mg (%), N (%), P (%), and carbon (%), are within the normal range, according to physicochemical analyses of soil samples from the Rajanna sircilla district's Agraharam, Nimmapali Kudhurupakka, Shatrajpalii, and Tekkapalli locations. Farmers can then determine how much fertiliser and nutrient to add to the soil in order to increase the percentage of crops produced. Information regarding the composition of the soil and its current nutrient levels is provided by these research.

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