



A Preliminary Study on Chemical Properties of Soil of Pakhal Wild Life Sanctuary, Telangana, India

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Plant growth depends on fertility and nutrient status of the soil. Presence of optimum range of these nutrients is inevitable for the growth survival of the flora. The present study was conducted during June 2021- June 2022 to know the chemical properties of black and red soils of the Pakhal wild life sanctuary, Telangana, India. Soil variables like P^H, EC, organic matter, N, P, and K were assessed to know soil fertility. The study revealed the PH of the soil samples was 7.2 and it was on slightly alkaline. The values of EC observed in the present study were 0.10 and 0.75 dS /m respectively for black and red soils. Soil organic carbon analyzed was 0.61 for the black soil and it was 0.51 for red soil. The amount of available nitrogen was 213 and 226 kg/ha respectively for black and red soils. The phosphorus content of black soil is 32.61 kg/ha and for red soil it was 16.29 kg/ha. Potassium was reported to be 396 kg/ha and 517 kg/ha respectively for black and red soils. The study revealed that the soil is favorable for the growth of the plants.

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1. INTRODUCTION

Telangana is a landlocked state situated in southern part of India in Peninsular part. It was carved out of Andhra Pradesh on 2 June 2014. The gigantic Godavari and Krishna are the major rivers draining through the state. In addition to this there are many other major rivers like Thunghabhadra, Bheema, Maneru, Manjira, Musi etc.

Forests cover 4.03 billion ha globally, approximately 30 percent of Earth's total land area [1]. Soil is the basis of survival and it is most complex, highly heterogeneous and a dynamic system. It provides the substratum for diversified, most successful and large number of ecological habitats. It performs vital functions for the ecosystem [2]. Soil affects climate also since it is one of the store houses of carbon, which is found in the soil in the form of organic matter [3].

Apart from microorganisms; nematodes, arthropods, and earthworms too inhabit in the soil [4]. Soil inhabiting organisms play a prominent role in organic matter decomposition, the nutrient recycling and in turn enrich the fertility of soil and also regulate the population size of other counterparts of soil, which also includes the community of crop pests [5].

They regulate the atmospheric composition in the form of bio geo chemical cycles, climate, water quantity and quality, and they are also part of bio remediation and reduce the pollution [6-8]. In addition to this, they are the components of food webs [9,10]. Furthermore they are the most significant ecological engineers [11,12].

Soil is a critical component in ecosystem and an important resource to mankind [13]. It contains organic matter, nutrients, water etc. Soil analysis is the most employed accurate method to measure soil fertility. To attain more production in order to meet the exploding population soil analysis is inevitable to know the soil fertility.

Abnormality in the soil condition certainly affects the growth, yield and finally the ecological balance due to the inter connectivity of

organisms in the form of food web in the ecosystem.

To get the food, water, medicine and all other resources soil must be in a healthy condition i.e physical, chemical and biological components has to be in optimum level [14].

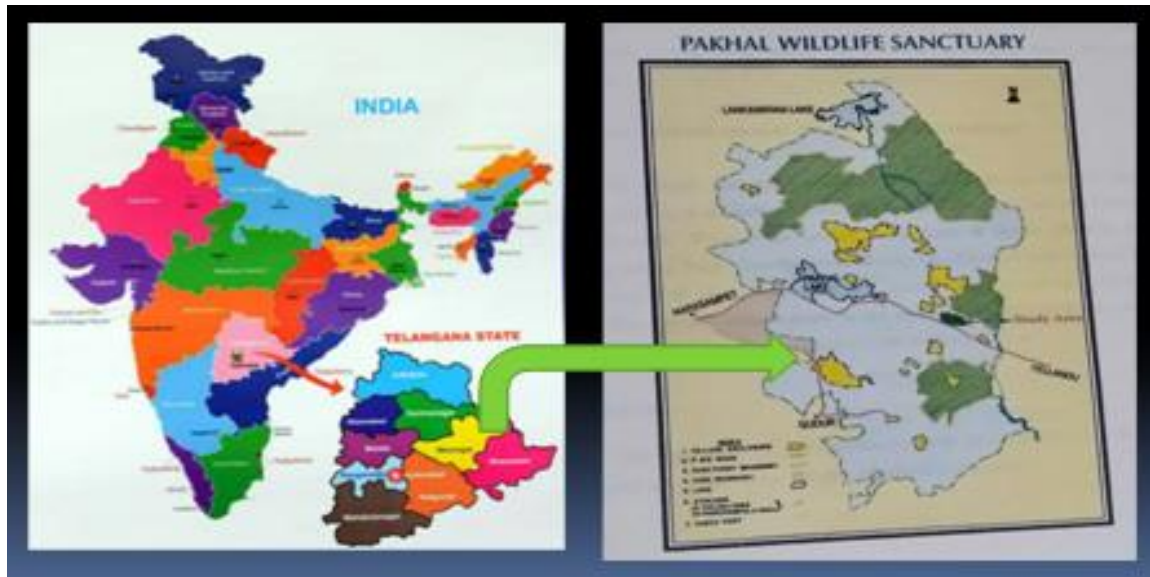
pH, electrical conductivity, organic matter and N, K, P elements are the significant factors that influences the biota on the planet earth, therefore soil analysis sheds light on better soil management and utilization [15]. Soil analysis reveals the status of acidity, salinity, alkalinity, organic matter and all other nutrients.

Decomposition of organic matter in terrestrial ecosystems is carried out by soil organisms by catabolic process. Several investigations have been carried out on the agricultural soils of the state but the data on forest soils is scanty so far. Due to the paramount significance in the economy, biodiversity and ecological balance, the present study was undertaken.

Keeping in view of importance of soil's physical and chemical properties, the present study of chemical properties of both black and red soil collected from different locations of the Pakhal wild life Sanctuary was carried out during June 2021 to June 2022. The control sample was red soil collected from Thimmapur village, an adjoining area of Pakhal Wild life sanctuary.

Pakhal Wild life Sanctuary is located at 17.57 N and 79.89 E in the erstwhile Warangal district of Telangana, a state in Southern India and extended in 900 sq km area. It harbors space for a wide variety of flora and fauna. Koya tribe is the indigenous people lives in and around the sanctuary. Agriculture, rearing of livestock, forest products collection is the main source of livelihood and economy. Since the forest is undisturbed, the soil is more fertile and enriched in nutrients due to decomposition of the litter.

The annual rainfall is between 700 and 1500mm and it is a semi-arid zone. Telangana receives rain from southwest monsoon. Annual mean maximum temperature of the district is 32.44 °C and minimum is 24.31°C. The mean minimum temperature is recorded during December (17°C) and maximum in May (42°C).



Map 1. Study site: Pakhal Wild Life Sanctuary

2. MATERIALS AND METHODS

Soil samples were collected from both black and red soils of the sanctuary. Collected samples were sealed and brought to the laboratory. The chemical properties of soil samples were determined by following standard protocols. Soil pH and EC were analyzed by using pH meter and EC meter with 1:2 and 1:2.5 soil water suspensions respectively. Soil organic carbon was determined by using Walkley and Black method [16]. Available nitrogen was analyzed by alkaline permanganate method [17]. Available phosphorus was analyzed by using sodium bicarbonate method [18]. Available potassium was analyzed by using neutral normal ammonium acetate method [19].

3. RESULTS AND DISCUSSION

The chemical analysis of the two soil samples was done in triplicates and the data is presented as Mean \pm Standard Error and the obtained results were presented in Table 1 and Fig. 1.

The measured P^H value is 7.20 for both the black and red soils. P^H is the degree of hydrogen ion concentration and it denotes the acidic or alkaline nature. A small deviation from the normal range would affect the growth, survival of flora by effecting nutrient availability and biological activity and metabolisms. Hence, it has paramount significance in nature [20]. The selected site under study is neutral to slightly alkaline and therefore favorable for the growth of the plants.

The P^H value is 7.30 for control soil sampled from the adjoining village Thimmapur.

Electrical conductivity (EC) is used as an indicator of salinity or salt content level. The values of EC observed in the present study were 0.10 and 0.75 dS /m respectively for black and red soils. None of the studied sites have salinity problem. Electrical conductivity values that were within the normal range. An EC value of less than 1.0 dSm⁻¹ is considered normal. EC value calculated for control soil was 0.18 dSm⁻¹.

Table 1. Chemical variables of the soil samples

	Red soil (control)	Red soil (Forest)	Black soil (Forest)
P^H	7.3 \pm 0.017	7.20 \pm 0.037	7.20 \pm 0.017
EC	0.18 \pm 0.067	0.10 \pm 0.014	0.75 \pm 0.017
Organic matter (%C)	0.32 \pm 0.047	0.51 \pm 0.027	0.61 \pm 0.057
N kg/hectare	192 \pm 0.043	226 \pm 0.134	213 \pm 0.576
P kg/hectare	12.3 \pm 0.041	16.29 \pm 1. 374	32.61 \pm 0.974
K kg/hectare	351 \pm 0.075	517 \pm 0.137	396 \pm 1.237

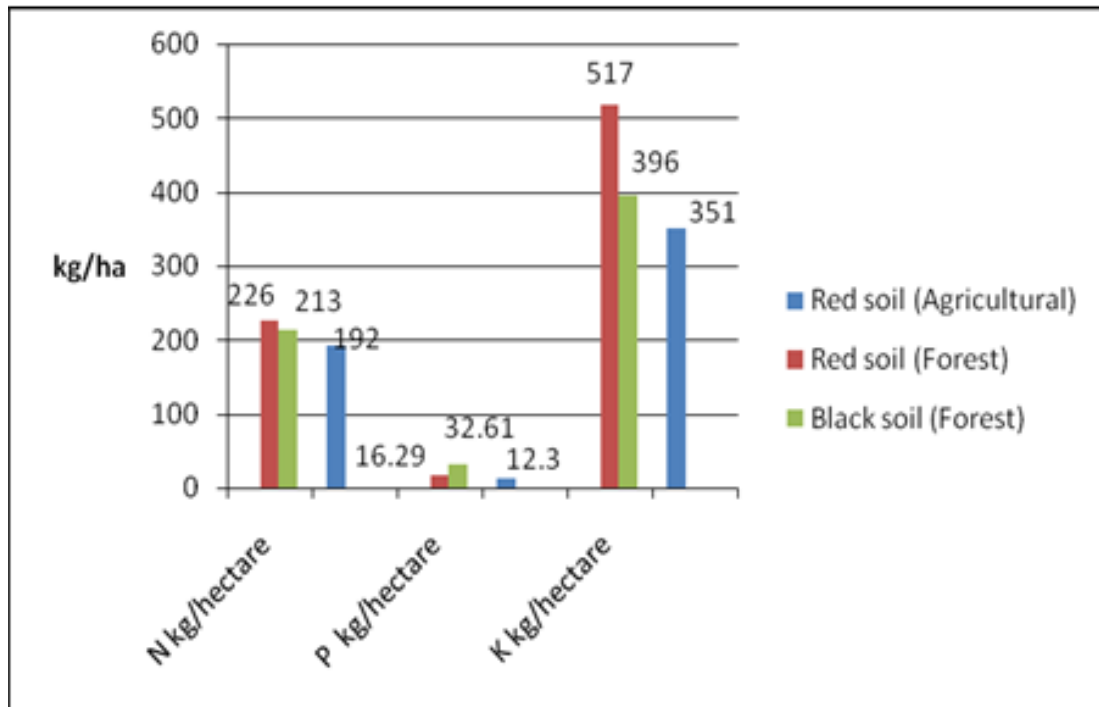


Fig. 1. NPK levels

Soil organic Carbon analyzed was 0.61 for the black soil and it was 0.51 for red soil, which is said to be medium (0.5-0.75) and this can be attributed to undisturbed and non-cultivated condition. Since the study site falls under semi-arid zone and due to the degradation of organic matter at a rapid pace. Soil organic Carbon for the control sample was 0.32.

The amount of available Nitrogen was 213 and 226 kg/ha respectively for black and red soils. And they are said to be low in N content (<280). Available N was found to be 192 kg/ha for the control. The low magnitude of nitrogen content may be due to leaching of dissolved organic nutrient and inorganic nitrogen [21].

The phosphorus content of black soil was 32.61 kg/ha which is a higher quantity (more than 25.6) and for red soil it was 16.29 kg/ha which is considered as medium (11-25.6). The phosphorus content of control was 12.3 kg/ha. Black soil is having higher P content comparatively to red soil. Another major nutrient potassium was reported to be 396 kg/ha, 517 and 350 kg/ha respectively for black, red soils of the forest and control sample and it is more than 280 kg/ha is treated as high.

The N, P and K are macronutrients essential for plant growth. Nitrogen is a component in

chlorophyll and its deficiency causes stunted growth. Phosphorus and Potassium are vital for many biological activities; phosphorus is a component of ATP. Both N and P are components of nucleic acids too.

The present findings are different from the earlier reports on forest soils of Hyderabad region from paddy fields [22,23]. However these observations were in agreement with the results from the Warangal region [24].

4. CONCLUSION

The study revealed the soil as neutral to moderately alkaline, non-saline and favorable for the growth of the plants. The study site is low in organic matter and N. P is more in black soil but medium red soil. Potassium is more in both the soils. The vegetation and flora is much greater in the study site since the forest soil is undisturbed for decades together in addition to the enriched nutrients.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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