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Analysis of Physico-Chemical Parameters of Soils in some parts of Warangal District

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ANALYSIS OF PHYSICO-CHEMICAL PARAMETERS OF SOILS IN SOME PARTS OF WARANGAL DISTRICT

ABSTRACT

Analysis and interpretation of soil analysis data are very important for effective management of agricultural fields. Understanding the physico-chemical parameters of the soils will help in directing agricultural activities in the area. In the present study, Physico-chemical parameters of soils in some parts of Warangal district were analyzed. The parameters analyzed were pH, organic content, electrical conductivity, available nitrogen, available phosphorous and available potassium.

Key words: Soil, physico-chemical parameters, organic carbon, electrical conductivity, NPK.

OBJECTIVES OF THE STUDY

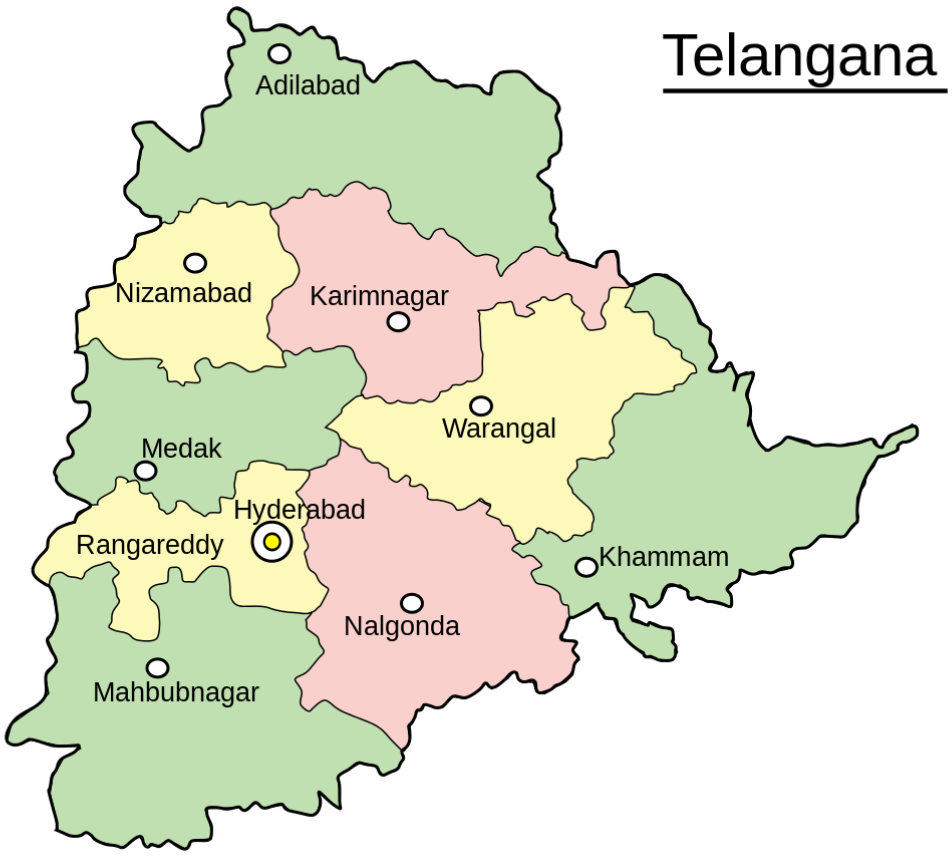
The main objective of this study is to make analysis of the physico-chemical properties of soils of Warangal district of Telangana. The specific objectives include –

- to study the physico-chemical parameters of soils like pH, electrical conductivity, organic carbon, total nitrogen, available phosphorus and Potassium in the chosen study area
- to unveil the potentialities of soils of the study area
- to identify the soil constraints, if any, for crop production and suggest corrective measures.

INTRODUCTION

Soil on the earth's surface is as vital as air and water for human survival and continuity of life in general. This has been an innate understanding in man, noticed in the sitting of ancient settlements and migration of ancient people which were in accordance with areas of fertile soils[1-3]. The soil is a basic and vital resource in the land for agriculture and non agriculture use. This is non-renewable resource and finite in quantity. With improper land use plan and unscientific crop management pattern, degradation of soil has been increasing. Characterization of soil helps in determining the soil potential and identifying the constraints in crop production besides giving detailed information about different soil properties. This knowledge will help us to harvest the nutrients from the soil with sustainable replenishment of nutrients. Understanding the physico-chemical status of the soils of the study area will go a long way in solving lot of problems afflicting the area and equally, it will help in directing agricultural activities in the area. Knowledge of soil helps in better management practice for increasing the productivity of the soil.

Telangana is the 29th state of India. It is carved out of Andhra Pradesh in 2014 with Hyderabad as capital. It is formed with 10 districts but later reorganised into 31 districts. It is situated in the central stretch of the Indian Peninsula on the Deccan Plateau. Telangana is bordered by the states of Andhra Pradesh to the south and east, Maharashtra to the north and north-west, Karnataka to the west and Chhattisgarh to the north-east. It is twelfth-largest state in the country with an extent of 114,840 square kilometres. Hyderabad, Warangal, Nizamabad, Karimnagar and Khammam are the major cities in the state.



Maps of Telangana: before and after reorganisation

The region is drained by two major rivers, with about 79% of the Godavari River catchment area and about 69% of the Krishna River catchment area, but most of the land is arid. Telangana is also drained by several minor rivers such as the Bhima, the Manjira and the Musi. The annual rainfall is between 900 to 1500 mm in northern Telangana and 700 to 900 mm in southern Telangana, from the southwest monsoons. Various soil types abound, including chalkas, red sandy soils, dubbas, deep red loamy soils, and very deep b.c. soils that facilitate planting mangoes, oranges and flowers.

Classification of soil leads to identification of soil problems and envisages the alleviating the problems and this knowledge is essential for utilizing the productivity of soils.There are four major types of soils India. They are: i) Red soils, ii) Black soils, iii) Laterite soils and iv) Alluvial soils.

1. Red soils:

Most of the part in Telangana state is covered by Red soils which is about 48%. These soils formed due to weathering of ancient metamorphic rocks. Red color is due to presence of iron oxides. these soils cover large part in Mahabubnagar, Nalgonda, Karim nagar, Khammam, Ranga reddy, Nizamabad districts and very less in Adilabad district.

2. Black soils

These soils accounts for 25% of total area of Telanagan. These are made up of volcanic rocks and lava flow. These are also called as regur soils. These soils are very much suitable for Cotton crop. The black color is due to fe, mg oxides. Water holding capacity of these soils is high. You can found most of the parts in Adilabad, Ranga reddy, Nizama bad districts and less parts of KNR, WGL, MBN districts.

3. Laterite soils

Covers 7% of the area. These soils formed due to intense leaching where high temperature and high rainfall occurs. These soils are sticky in nature. Found in Medak and Khammam districts.

4. Alluvial soils

These soils are formed by the deposition of sediments by rivers. These are rich in humas and very fertile. We can see soils present at river banks.

THE STUDY AREA

Warangal is one of the 10 erstwhile districts of Telangana extending over an area of 12834 square kilometers.Warangal district lies between 17º 19’ & 18 º 36’ N latitude and 78 º 49’ & 80 º 43’ E longitude. The district is bounded by Khammam district on the East, Karimnagar district on the North, Nalgonda on the South and Medak on the West. River Godavari serves as border on one side. The topography of the district consists of isolated hills, rainfed tanks, lakes and shrubby forests. River Godavari forms the North Eastern border of the district, but is not yet tapped fully for irrigation. The climate in Warangal district is generally dry. Temperature varies from 45^0C to 13^0C in various seasons. The soils of Warangal district have been classified as red earths, black soils (shallow to deep) and forest soils.

Map of Warangal District

In this region crop pattern is scientific. Farmers cultivate market driven crops without bothering the suitability of the crop. Hence, in present work is taken up to study the physic-chemical parameters of the soils and suggest the suitability of the crops.

METHODOLOGY

Organic carbon was determined by the application of walkley and Black method as outlined by and the available phosphorus was determined by the application of Bray and Kurtz method. Total Nitrogen was determined by the micro-Kjeldahl digestion method[4-6].

Soil pH

Soil pH measurement is useful, as it is a predictor of various chemical activities within the soil. It is also a useful tool in making management decisions concerning the type of plants suitable for location, the possible need to modify soil pH, and a rough indicator of the plant availability of nutrients in the soil. Usually, liming of Soils is done if the soil pH is greater than 0.2 units below the target pH. Acidifying Soil may be desirable to acidify the soil to lower soil pH. If the high soil pH is a natural condition, there is little that can be done to lower soil pH permanently. Treatment with sulfur will lower the pH for a few weeks, but the pH will eventually increase. In landscaping, it is often better to select plants which are adapted to the natural soil pH range

The soil sample was be air-dried and passed through a 2-mm sieve. Added 40 mL of pure water to 25 g of soil sample and stirred with a glass rod and let the sample stand for 30 min. The pH meter was calibrated with standard buffer solutions (Buffer 4 and 7). The electrodes were positioned in the solution just above the sand layer and recorded the pH to the nearest 0.1 pH unit (Table. 1).

Electrical Conductivity:

The EC of the soil has little direct detrimental effect on sandy mineral soils or on media. However, EC directly affects plants growing in the soil or media. The impact of EC on plants is also directly affected by water management[4].

The soil sample should be air-dried and passed through a 2-mm sieve. 25g of soil was mixed with 40 mL of pure water, resulting in a water:soil ratio of 2:1. Stirred the sample with a glass rod and let the sample stand for 4hours. This equilibration period provides time for some slowly-soluble constituents to approach solution equilibrium. Without stirring the sample, solution was filtered through a Whatman No. 41 (11 cm) paper and collected the extract in a container. This is to remove the soil and other debris from the solution. Calibrated the conductivity meter with a solution of 0.005 N KCl, which has an electrical conductivity of 720 ± 1 dS/m (mmho/cm) at 25°C). Measured the electrical conductivity of the extract contained in the funnel tube. (Table. 1)

Organic Matter:

The organic matter present in the soill is digested with excess of potassium dichromate $k_2Cr_2O_7$ and sulphuric acid H_2SO_4 , and the residual unutilized dichromate is then titrated with ferrous ammonium sulphate $(NH_4)_2Fe(So_4)_2 .6H_2O$.

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The elementary carbon present as graphite ,charcoal etc.Is not attacked in this method and only organic carbon is determined . The recovery of the carbon in this method is not 100 percent . Only about 60-90% of the total organic matter is recovered depending upon the kind.For example, in most cases ,the proteins remain unaffected by this method .

Take oven dried o r freeze dried soil sample and pass through a 0.5 mm non ferrous screen . Weigh a suitable quantity of soil not exceeding 10 g (containing about 10-25 mg carbon) and transfer to a dried 500 ml conical flask . Add 10 ml 1N of $k_2Cr_2O_7$ solution and add 20 ml conc. H_2SO_4 and mix by gentle swirling . Keep the flask to react the mixture for about 30 minutes .After the reaction is over , dilute the contents with 200 ml of distlled water and add 10 ml phosphoric acid H_3PO_4 followed by 1 ml of diphenylamine indicator $C_{12}H_{11}N$. Titrate the sample 0.4 N ferrous ammonium sulphate $(NH_4)_2Fe(So_4)_2 .6H_2O$ at the end point colour changes to brilliant green . If more than 8 ml of the 10 ml added $k_2Cr_2O_7$ is consumed (ml titrant less than 5 ml), repeat with less quantity of the sample.

Method of calculation :-

a. % of C (carbon) $= \frac{3.951}{g}\ (1 - \frac{T}{S})$

b. % of Orgnaic matter = %of C × 1.724

g = weight of sample in g .

s = ml ferrous solution with blank titration.

T = ml ferrous solution with sample titration.

The factor 1.724 is based on the assumption that carbon is only 58 % of the organic matter.

Nitrogen (N) determination in the laboratory according to John Kjeldahl (1883) method:

The sample was pre-treated to comply with the standard in the field of soil. Care was taken during the digestion so that not to loss amount of nitrogen, thus, the temperature was less than 400°C. Dried and grinded sample portion of 0.2 gram (expected nitrogen content equal to 0.5%) to one gram (expected nitrogen content approximately 0.1%) was used. When 10 ml sulfuric acid (4.2) was added, swirled until the acid was thoroughly mixed with the sample. The mixture was allowed to stand for cooling. Then 2,5 g of the catalyst mixture 4.3 was added and heated till the digestion mixture became clear. The mixture was boiled gently for 5 hours to allow the sulfuric acid condenses about 1/3 to the end of the tube. The temperature of the solution was maintained below 400 °C.

After digestion was completed, the tube was left to cool; and 20 ml of water was added with slowly shaking. Then the suspension was transfer to the distillation apparatus 5.4. When; 5 ml of boric acid 4.5 was added to a 200 ml conical flask and placed under the condenser of the distillation apparatus in such a way that the end of the condenser dips into the solution. Then 20 ml of sodium hydroxide 4.4 was added to the funnel of the apparatus and ran the alkali slowly into the distillation chamber. Thereafter, about 100 ml of condensate was distilled, rinse the end of the condenser, then few drops of mixed indicator 4.6 were added to the distillated and titrated with

sulfuric acid 4.7 to a violet endpoint. Steam distillation was used. Distillation was stopped when 100 ml of distillation was collected. From the submitted sample for analysis, two sub-samples were tested. Control limit for differences between the results of the tow sub sample was established, and precision was determined.

Method of calculation:

The content of nitrogen, (wN), in milligrams per gram was calculated using the formula:

$$wN = (V1 - V_0) \times c\,(H^+) \times MN \times 100/ (m \times mt)$$

Where:

V1 is the volume in millimeters of sulfuric acid (4.7) used in the titration of the sample.

V_0 is the volume in milliliters, of the sulfuric acid (4.7) used in the titration of the blank test

c (H^+) is the concentration of H^+ in the sulfuric acid (4.7) in moles per

MN is the molar mass of nitrogen in grams per mole (=14)

m is the mass of test sample

mt is the dry residue, expressed as g/100g on the basis of oven dried

Determination of Phosphorous[4] in the laboratory:

To extract Phosphorus, well shaked 1 g of air dried soil in 10 mL of 0.025 M HCl and 0.03 M NH4F for 5 minutes was prepared. Phosphorus was determined on the filtrate by the molybdate-blue method using ascorbic acid as a reluctant. Color development was measured at 880 nm on a Brinkmann PC 800 probe colorimeter.

Determination of Exchangeable Potassium

Potassium was extracted from the soil by mixing 10 milliliters of 1 normal, neutral, ammonium acetate with a 1 gram scoop of soil and shaken for 5 minutes. The exchangeable

potassium was measured by analyzing the filtered extract on an atomic absorption spectrophotometer set on emission mode at 776 mm. The results were reported as parts per million (ppm) of potassium (K) in the soil. Soil sample of 20 gm was well shaken with 40 ml of distilled water in a 250 ml conical flask for an hour. Then conductivity of the supernatant (saturation extract of soil) liquid was determined with the help of conductivity meter.

S. No.	Sample No.	pH	EC (dS/m)	OC (%)	Avl. N (kg/ha)	Avl. P_2O_5 (kg/ha)	Avl. K_2O (kg/ha)
1	SG-1	6.2	0.15	0.62	198	17	1269
2	SG-2	7.78	0.28	0.42	176	34	808
3	SG-3	7.51	0.22	0.52	151	16	1207
4	DH-1	6.0	0.16	0.53	151	188	629
SG: Station Ghanpur, Warangal District DH: Dharmaram, Warangal District							

Table-1: Soil macro parameters

Conclusions:

The study identified three types of soil in the study area, namely, the clay, sand and red soils. The results of data analysis of the macro nutrients, especially the N P K , soil pH and the EC showed variations between and within the locations. It is observed that, the cropping pattern is not scientific. Therefore, based on soil and nutrient variability, a suitable cropping pattern was proposed.

Recommendations:

The study has come up with the following recommendations:

- Increase the awareness by the officials of agriculture department on issues related to natural resources conservation and sustainability.
- The communities should take active part in policy, rule and legislation formulation, implementation and evaluation of the development projects.
- Introduction of suitable cropping pattern and follow course system.
- Further research is highly recommended

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హన్మకొండ కాకతీయ కళాశాల విద్యార్థులు

పవర్‌పాయింట్ ప్రజంటేషన్‌లో పాల్గొన్న విద్యార్థులు

నేలల భౌతిక, రసాయన విశ్లేషణ..

హన్మకొండలోని కాకతీయ ప్రభుత్వ డిగ్రీ కళాశాలకు చెందిన విద్యార్థులు జీవావరణానికి సంబంధించిన నేలలో భౌతిక, రసాయనాల పరిమితులపై ప్రాజెక్టును రూపొందించారు. ఎరువుల వాడకంపై రైతులకు అవగాహన లేకపోవడంతో విచ్చలవిడిగా వినియోగిస్తున్నారు. ఫలితంగా రైతులు ఆర్థికంగా నష్టపోవడంతో పాటు పర్యావరణం సైతం కలుషితం అవుతున్నది. దీన్ని దృష్టిలో పెట్టుకొని విద్యార్థులు భౌతిక, రసాయనాల పరిమితులపై నివేదికను తయారు చేశారు. విశ్వంలో ప్రతి జీవికి నేల ప్రధానమైనది. పంటలను పండించేందుకు సరైన రీతిలో నేలను ఉపయోగించుకోవాలంటే ఆ ప్రాంతంలోని నేల సహజ ధర్మాలపై అవగాహన తప్పనిసరి. నేలలో అనేక సహజ పోషకాలుంటాయి. వాటిలో ప్రధానంగా నైట్రోజన్, ఫాస్ఫరస్, పొటాషియం వంటి స్థూల పోషకాలతో పాటు ఐరన్, కాపర్, మాలిబ్డినం, బోరాన్, జింక్ వంటి సూక్ష్మ పోషకాలు అవసరమైనవే. వీటితో పాటు నేలలో పీహెచ్, విద్యుత్ వాహకత, కార్బన్ శాతం వంటి అంశాలపైనా అవగాహన ఉండాలి. ఈ పోషకాలు మోతాదు కంటే ఎక్కువగా ఉన్నా.. తక్కువగా ఉన్నా.. పంటల పెరుగుదల, ధాన్యం దిగుబడి తగ్గిపోతుంది. ఈ పోషకాలు ప్రాంతం, నేల స్వభావాన్ని బట్టి మారుతాయి. ఇవి సరైన మోతాదులో ఉంటే ఎరువుల అవసరం పెద్దగా ఉండదు. తక్కువగా ఉంటే మాత్రం ఎరువుల రూపంలో వీటిని నేలకు అందించాల్సి ఉంటుంది. అందుకే ఈ భౌతిక-రసాయన పరిమితులను నిర్ధారించి, తదనుగుణంగా రైతులు ఎరువులు, పురుగుల మందులను వాడితే ఖర్చు తగ్గడంతో పాటు పర్యావరణాన్ని కాపాడినవారమవుతాం. ఈ విషయంపై రైతులను చైతన్యపరిచేందుకు ఈ ప్రాజెక్టును రూపొందించారు. వరంగల్ జిల్లాలో డాక్టర్ బి.రమేష్, కె.సత్యనారాయణ అధ్వర్యంలో హేమశ్రీ, అనుష్య, స్నేహ, ఓమ్‌శిరీష్‌లు క్షేత్రస్థాయిలో నేలలను పరిశీలించి పోషకాల స్థాయిని నిర్ధారించారు.

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