



ISSN: 0975-833X

Available online at <http://www.journalcra.com>

International Journal of Current Research
Vol. 15, Issue, 06, pp.25050-25053, June, 2023
DOI: <https://doi.org/10.24941/ijcr.45499.06.2023>

INTERNATIONAL JOURNAL
OF CURRENT RESEARCH

RESEARCH ARTICLE

PHYSICO-CHEMICAL ANALYSIS OF SOILS IN RANCHI

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ARTICLE INFO

Article History:

Received 24th March, 2023
Received in revised form
14th April, 2023
Accepted 20th May, 2023
Published online 30th June, 2023

Key words:

Physical and Chemical Attributes,
Organic Matter Content, water Retention,
Soil Ecosystem.

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Citation: Taskeen Nishat, Mouli Chakroborty and Dr. Priya Srivastava. 2023. "Physico-chemical analysis of soils in Ranchi". *International Journal of Current Research*, 15, (06), 25050-25053.

ABSTRACT

The growth of vegetation of any area depends on many factors. One of the most important factor is soil which is of various types. In this research paper, the physico-chemical attributes which have been chosen are colour, texture, pH, total moisture content, organic carbon, chloride content and calcium carbonate, etc. These samples have been taken from 5 different areas of Ranchi district. Collection of soil samples is the first step which has been done in a proper manner. The samples have been collected upto the depth of 0-25 cm free from any litter and pebbles. The colour of the samples were light brown to dark brown. The texture of the soil sample varied from sandy loam to silty loam. The pH of the collected samples varied between 6.9 to 7.4. The moisture content of these soils ranged from 19% to 47%. The chloride content varies from 110.05 mg/l to 532.5 mg/l. The organic matter in the samples were moderate to higher with values ranging from 0.20% to 2.81%. The calcium carbonate content of these areas varied from 6% to 13.5%.

INTRODUCTION

India is a country with a diverse topographic, geographic and climatic variations. Here we can find a variety of flora and fauna. The agricultural productivity of any nation depends on many factors. One of the key element is soil. Soil is a wonderful gift to us from our mother earth. The quality of soil is very necessary for the growth of plants. It performs various important functions like providing water to the roots, site of accumulation of many beneficial bacteria and providing necessary nutrients to the plants. Ranchi is the city which is the state capital of Jharkhand present in the north-eastern region of India. The climatic factors and soil variability of this area is suitable for the growth of many plants like babul, neem, khair, bamboo, bel, etc. Therefore the quality estimation of soil is very important to know its various physical and chemical characteristics. The attributes which have been chosen here are the colour, texture, pH, total moisture content, organic carbon content, chloride and calcium carbonate content which have been taken from five different places of Ranchi district. This report will be helpful to students, researchers and agriculturists to know about the quality of soils in Ranchi and they can take various measures to enhance the productivity of this area.

MATERIALS AND METHODS

Five representative samples were collected from different places of the Ranchi district which are Lalpur, Ratu, Angara, Kantatoli, Kanke. The collection of soil samples was done upto a depth of 0-25 cm.

While taking the soil samples it was made sure that any kind of stones, pebbles, dry leafy vegetation, surface litter were removed. After that the clear soil was collected in a sample bag. In the laboratory, the various attributes of soil mentioned above were tested by standard procedures and methods to analyze the physical and chemical characteristics of soil.

RESULTS AND INTERPRETATIONS

After testing the soil samples in the laboratory, the results were analyzed. The soil samples of Ranchi showed a great variability in their various attributes which have been presented in the form of tables and bar graphs:-

Colour: The colour of the soil tells a lot about it. Whenever we look at the soil colour we already interpret certain things. Its colour indicates its various properties like its water retention capacity, its parent material, its organic matter content, its weathering process and drainage characteristics also. The colour of the soil

LALPUR

The colour of the soil samples of Lalpur area shows an increase in humus content (decomposed organic matter). They will have less to average phosphorus fixation and moderate plant available water.



Fig 1. Soil colour of Lalpur area (Light brown colour)

Table 1. Procedures used for assessment of soil attributes

Attributes	Procedures
1 Colour	By viewing
2 Texture	Soil texture triangle method
3 Ph	Digital ph meter
4 Moisture content	Oven drying method
5 Organic matter	Chromic acid wet digestion
6 Chloride content	Silver nitrate titration
7 Calcium carbonate	Dissolution of carbonate in HCL

RATU



Fig 2. Soil colour of Ratu area(Red colour)

The presence of oxidised ferric iron oxides is indicated by its red colour. It shows good drainage property. Due to the higher oxygen content, iron found within the soil is oxidised more readily. It results in the development of a rusty colour in soil.

ANGARA



Fig 3. Soil colour of the Angara area(Dark brown colour)

The dark brown colour indicates poorer drainage property of these soils. The iron components present in these soils are in hydrated form and that is why they don't develop any rusty colour.

They have moderate phosphorus fixation and low plant available water and more compaction.

KANTATOLI



Fig 4. Soil colour of the Kantatoli area (Dark brown)

The colour of these soils indicate high levels of organic matter content. Waterlogging and drainage problems are common in these soils. They will have low Ph value and high denitification.

KANKE



Fig 5. Soil colour of the kanke area(Greyish black)

These soils present a problem of poorer drainage and waterlogging. Iron and manganese form compounds due to the lack of air spaces in these soils which gives them a characteristics greyish black colour.

Texture: The texture of the soil refers to the various proportions of sand, silt and clay particles which form the mineral fraction of soil. The texture of the soil present its effects on the root penetration of plants and aeration property of the soils. The knowledge of the texture of soil is very important for the growth of plants. The soil texture has been determined by soil texture triangle method.

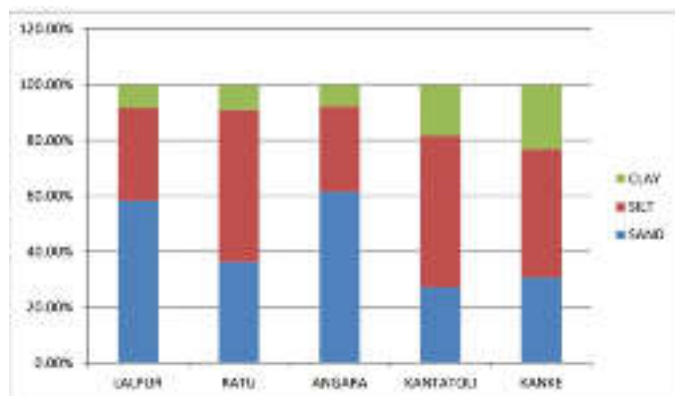


Table 2. Comparison of the different samples

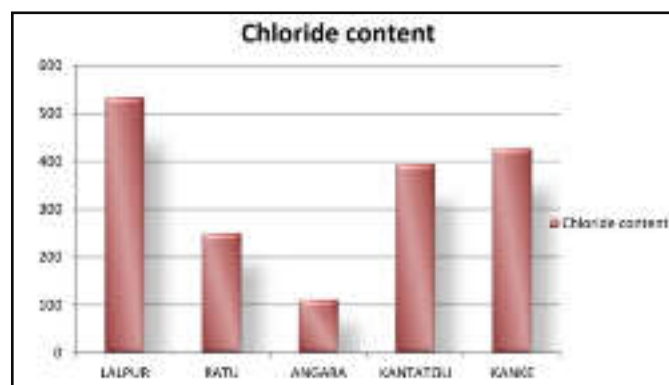
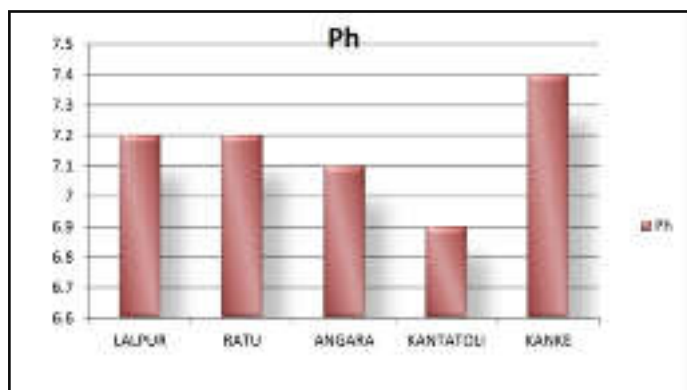
SAMPLES	COLOUR	TEXTURE	PH	MOISTURE CONTENT	CHLORIDE CONTENT	ORGANIC MATTER	CALCIUM CARBONATE
1.Lalpur	Light brown	Sandy loam	7.2	19%	532.5 mg/l	0.20%	6%
2.Ratu	Red	Silt loam	7.2	38%	248.5mg/l	0.10%	10%
3.Angara	Dark brown	Sandy loam	7.1	19%	110.05mg/l	1.65%	13.5%
4.Kantatoli	Dark brown	Silt loam	6.9	47%	394.05mg/l	2.81%	4%
5.Kanke	Grevish black	Loam	7.4	22%	426.0mg/l	1.96%	9%

Table 3. Soil Texture Table

Sample	Total depth(cm)	Depth of sand layer(cm)	Depth of silt layer(cm)	Depth of clay layer(cm)	% Sand	% Silt	%Clay	Soil type
LALPUR	6	3.5	2	0.5	58.3	33.3	8.3	Sandy loam
RATU	5.5	2	3	0.5	36.3	54.5	9.0	Silt loam
ANGARA	6.5	4	2	0.5	61.5	30.7	7.7	Sandy loam
KANTATOLI	5.5	1.5	3	1	27.2	54.5	18.1	Silt loam
KANKE	6.5	2	3	1.5	30.7	46.1	23.0	Loam

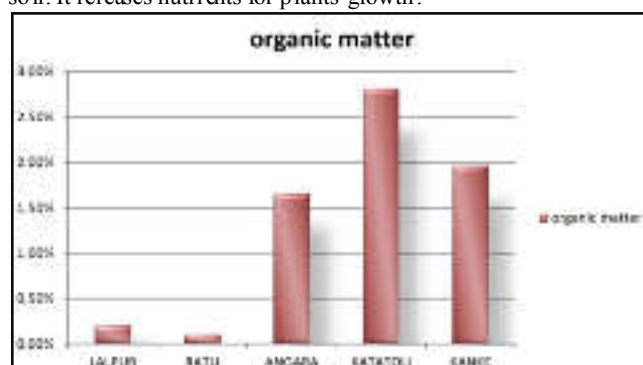
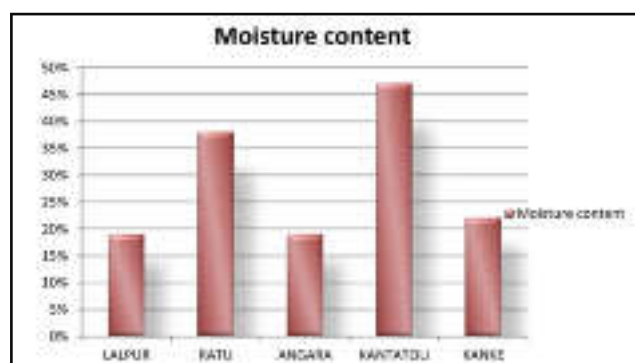
Ph: A ph value refers to the measure of hydrogen ion concentration. Soil ph indicates its acidity or alkalinity. Soil ph affects the nutrient availability to the plants and the solubility of various chemicals in the soil water. Digital ph meter have been used for the determination of the ph of the samples. The ph of the different samples of soils of Ranchi area is neutral or slightly alkaline. The neutral ph is good for the growth and development of different kind of plants. The pH of the soil samples varied between 6.9 to 7.4. Ph indicator against sample

Chloride Content: Chlorine is a very important nutrient for crops as it is necessary for its fertility. It is the most important inorganic osmotic active substance present in plant cells and tissues and play an important role to neutralize the charges. It helps in the opening and closing of stomata. The chloride content of the samples have been determined by silver nitrate titration. The chloride content of these areas were high with values ranging from 110.05mg/l to 532.5mg/l.



Moisture Content: Soil moisture content refers to the quantity of water present in the soils. Plants absorb nutrients from the soil depending on its moisture content. The texture of the soil is also influenced by its moisture content. The moisture content of the various samples of Ranchi have been determined by 'oven drying method'. The moisture content of these soils ranged from 19% to 47%.

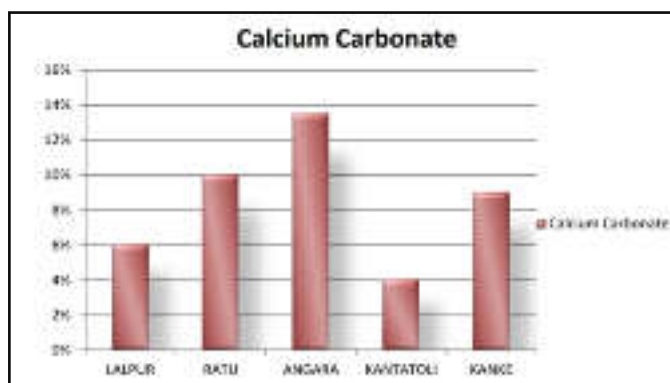
Organic Carbon: The percentage of organic carbon present in the soil determines its health and its fertility. Although only 2-10 % of soil's mass is occupied by organic matter yet it plays an important role in regulating some physical, chemical and biological functions of soil. It releases nutrients for plants growth.



The organic matter of the following samples has been determined by chromic acid wet digestion method. In this process first the organic matter in soil is digested with excess of potassium dichromate and

sulphuric acid and after that the residual unutilized dichromate is then further titrated with ammonium iron sulphate. The value percentage of organic matter present in soil was found in the range of 0.20% to 2.81%.

Calcium Carbonate: The presence of calcium carbonate in the soil is very important because it helps in binding of soil particles together by acting as a cementing agent through physico-chemical mechanisms. It helps in the creation of a stable soil structure. A soil that is dominated by the presence of calcium carbonate is referred to as calcareous soil. The presence of calcium carbonate in the sample has been determined by dissolution of carbonate in excess of 1N HCl. The calcium carbonate of these samples ranged from 6% to 13.5%.



CONCLUSION

The maintenance of the soil ecosystem is very necessary if we want a healthier and productive environment. The study of the soil samples have revealed the proportions of its various parameters. We can conclude from the study that the soils samples of Ranchi shows a moderate proportion of organic carbon content and a high chloride level. Rest of the parameters were bit higher or lower than the admissible limits. Thus it is necessary to control some of the harmful anthropogenic activities which are leading to the deterioration of the soil quality of this area.

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