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Physico-Chemical Study Of Soil From Different Localities Of Raipur Region, Chhattisgarh.

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Abstract

Soil is the component that contributes the most to fulfilling all of a person's basic needs. This study examines the physical and chemical characteristics of the soil in four villages of Naya Raipur region, Chhattisgarh including Palaud, Kotni, Tandul, Kuhera, and two open forests, including the Kuhera Village Forest and Parsada. This physico-chemical study of soil is based on various parameters such as moisture content, pH (H_2O), pH (KCl), pH(H_2O_2), and the requirement of lime content. The physico-chemical research of a region is particularly important since both physical and chemical characteristics affect the productivity of the soil. It was found that the moisture content was highest (2.50) in Kuhera village which can promote better crop-yielding capacity and lowest in the agricultural field of Kotni village (0.10). The pH level is high in the determination of H_2O as compared to KCl and H_2O_2. The pH of H_2O and KCl was found highest (7.94 and 7.38) in the agricultural land of Kuhera village and the village itself has the lowest pH of H_2O which is 6.52. The pH of KCl is lowest (5.85) in Kotni village farmland. The pH of H_2O_2 was found highest in the open forest of Kuhera village (7.57) and lowest in the Parsada open forest (6.18). For the requirement of lime content, it was found that the pH of all the soil samples was alkaline so lime addition is not required. This study will benefit the villagers of that region in agriculture and help in any agricultural development in that area.

Keywords: Soil, Physico-chemical study, Naya Raipur, Moisture content, pH, Lime content

1.Introduction

Soil is created as a result of a variety of processes, including the weathering of rocks, the residues of plant and animals, the deposition of volcanic ash, and animal and human activities (Rathore et.al, 2023). It is the foundation on which most life on Earth depends since it serves as a key source of food, fiber, and an important environmental interface (Dane and Topp, 2020). The agricultural ecosystem sustainability is also heavily reliant on maintaining the physico-chemical characteristics of the soil. Its viability depends on the understanding of the impacts of management practices on soil qualities and how they alter the relationships between soil, crops, and water (Chimdi,2012).

Mineral-based substances make up the components of soils. Water and organic materials are utilized in varying proportions to sustain plant development. Therefore, research on soil characteristics is necessary (Raut, 2012). The continued and uncontrolled use of inorganic fertilizers has raised severe concerns regarding long-term negative effects on soil structure, soil health, and environmental contamination. In contrast to synthetic fertilizers, green manures, and other organic materials may promote the exchange of nutrients, improve the structure of the soil, and maintain the quality of the soil (Bhagat et.al, 2013). Since optimal nutrient utilization, based on soil analysis, may improve crop yield and minimize nutrient wastage, soil test-based nutrient management has arisen as a critical problem in attempts to raise agricultural productivity and production (Soni, 2016). Therefore, anybody involved in agricultural production must be aware of the effectiveness and maintenance of soil (Rekha, 2003). It has been recognized that the soil is a limited resource with very little opportunity for regeneration or replenishment if it is incorrectly used or neglected. (Nortcliff, 2002). Information regarding the physico-chemical components of soil is needed for agriculture because of climate change and pollution, as well as knowledge of how it will affect agricultural output (Jaiswal et.al., 2023).

Chhattisgarh is situated between 17° 46'N and 24° 8'N latitude and between 80° 15'E and 84° 24'E longitude (Kumar et.al, 2014). It has a total size of 192,000 square km. It is well known for its abundant natural resources (Oraon et.al, 2018). The state is home to 4 different kinds of soils such as Entisols, Inceptisols, Alfisols, and Vertisols, these are often categorized with red and yellow soils. Nearly all soils have low levels of nitrogen and phosphorus and moderate to high levels of potassium (Kumar et.al, 2014). The state's primary economic activity is considered to be agriculture. The primary source of income for the villagers is agriculture and small-scale agricultural-based industries, which make up around 80% of the state's population. The state is referred to as the 'rice bowl of India'. Rice is the principal crop grown in this state as a monoculture. Some of the main causes of decreased productivity in the area are low levels of soil organic matter, the emergence of numerous nutrient shortages due to their over-mining by continuous cropping from soils, and inadequate management of agricultural residues (Kevat et.al., 2019).

The physico-chemical analysis of soil was studied by Shrivastava and Kanungo, (2014**)** in the Surguja district of Chhattisgarh, India. The factors are determined, including how the soil affects on its hydrogen ion concentration (pH), electrical conductivity (mS/cm), nitrogen, and potassium phosphorus. The study also demonstrates that the Surguja district is significantly impacted by soil physicochemical changes and that these changes might serve as useful markers of the gradient of land use intensity.

The study was done in the disturbed tropical forest of Katghora Forest Division, Bilaspur City, Korba district (Chhattisgarh) to find out how it affected litter production and soil characteristics. In comparison to deep soil samples (10–20 cm) in severely disturbed sites, surface soil samples (0–10 cm) had the greatest soil N (0.081%), C (1.638%), and K (369.03 kg ha-1) contents. The soil pH dropped to 5.34, and samples from deep soil layers showed reduced bulk soil density (Pawar et.al, 2014).

Dewangan et.al, (2023) research on the Physicochemical Analysis of Soil Taken from Ultapani Water Sources, Mainpat Area of Surguja Division, Chhattisgarh, India. They figured out the presence and number of physicochemical characteristics including conductivity, pH, Fe, Cu, Zn, Ca, Mg, S, N, etc. The results indicated that The Ultapani source's soil has a lower-than-average conductivity, which means that the silt there is not saline. The soil at Ultapani Source has a pH that is only a tiny bit below the crucial level, making it much less

acidic than other soils. Additionally, it was concluded that the soil from the Ultapani source had lower levels of the chemical elements Zn, Cu, Fe, Mn, B, & Mo.

The objective of our study is to know the physico-chemical features of the soil of the study area and to know the parameters of the soil i.e., pH of H_2O, pH of H_2O_2, pH of KCl, moisture content, and the lime requirement.

2. Study area

Description of the study area

Atal Nagar Naya Raipur (ANNR), Naya Raipur, Chhattisgarh is a recently established city that touches the borders of the cities of Raipur, Arang, Mahasamund, Rajim, and Abhanpur. It is located between 21.1650° N latitude, and 81.7753° E longitude. It has 41 villages spread across an area of around 80km^2, 27 of which make up the central region of Naya Raipur. The kind of vegetation that grows in ANNR is definitely impacted by its tropical climate. Typically, summer begins in the month of March and lasts through the month of July. June is said to be the warmest month of the year. During these days, the temperature has reached approximately 48-50°C. The rainy season lasts from mid-July up to mid-September. Winters continue from November through January and are generally mild, however, the lowest levels can fall below 15°C (Pandey, 2021). The average annual rainfall in the city is around 1300 mm. The three primary agricultural seasons of the study area are Kharif (June till October), Rabi (October till February), and Zaid (March till May). Paddy and vegetables are the main crops during the Kharif season, whereas gram, vegetables, wheat, mustard, lentil, and Lathyrus are the main crops during the Rabi season (Panigrahi and Das,2022). The majority of the soils in the study area are black soil and laterite soil. soil samples were collected from four (4) different villages of Atal Nagar including- Kotni, Palaud, Tandul, and Kuhera—as well as two open forests—the forest of Kuhera Village and Parsada. The study area was chosen for its accessibility, open forests, and to learn about the region's various soil compositions in order to examine various soil characteristics.

(Map not to scale)

Figure 1: India map showing Chhattisgarh state (*Source: alarmy stock images)*

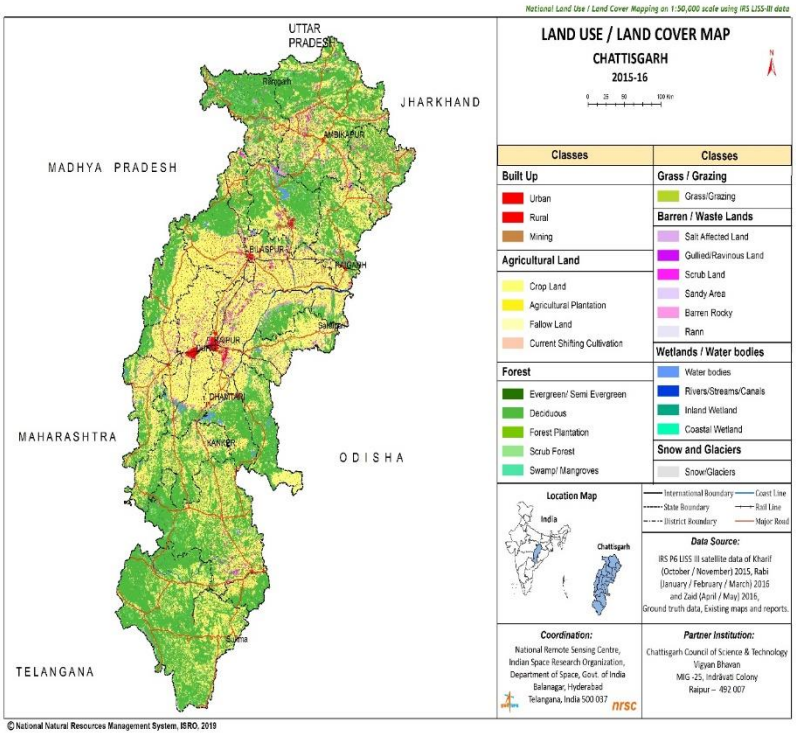

Figure 2: Land use/ land cover map of Chhattisgarh *(Source:NRSC)*

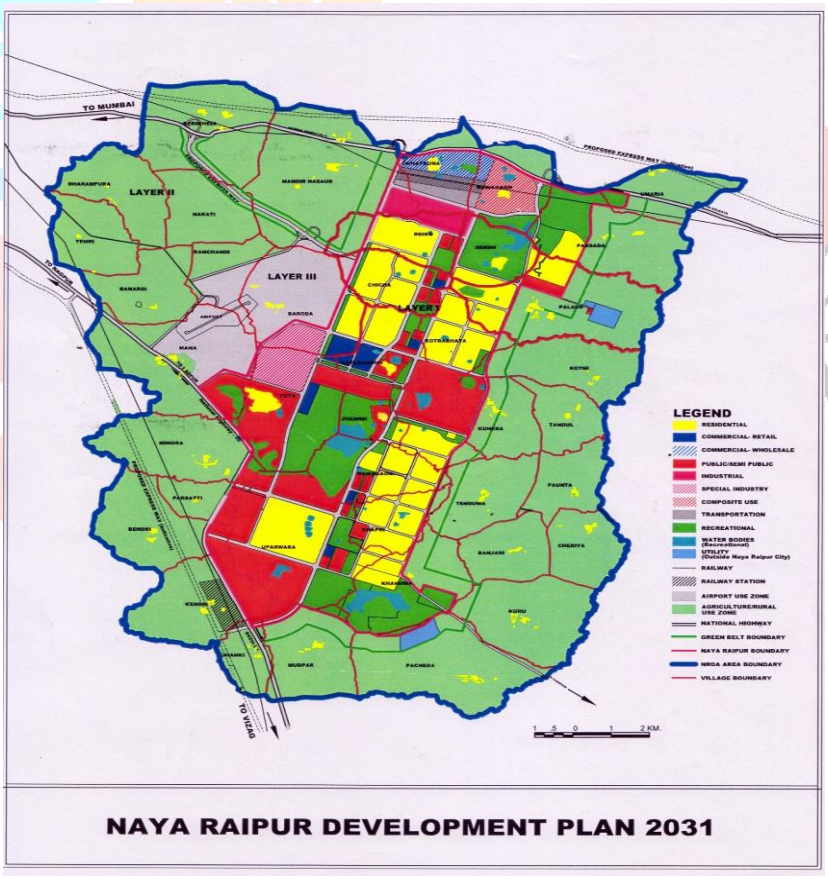

Figure 3: Map of the study area *(source -NRDA)*

3. Materials and Methods:

SAMPLE COLLECTION AND PREPARATION:

Soil sampling:

The sampling of soil is important for the successful analysis and interpretation. There was a total of 30 samples collected with a depth of 0-10cm from February-April 2023. The soil samples were collected at every 10 days intervals. For successful sampling, first of all, we removed the surface litter at the sampling spot and made a V-shaped cut to a depth of 10 cm. by using a 15cm. scale. ~~The soil samples were collected by using '*khurpi*'~~. The foreign materials like roots, stones, pebbles, gravel etc. were removed. Then the samples were thoroughly mixed and a quadratic structure was made by dividing the samples into four equal parts. Two opposite quarters were discarded and the remaining were mixed. The mixed samples were collected in a polythene bag and labelled with the required data.

Drying:

samples were collected from selected villages, agricultural fields, and open forests of the study area. Wet samples were spread on a newspaper sheet of about less than 1 cm in thickness. Clods were crushed by hands carefully and frequently. Samples were dried for 24 hours before being used.

Sieving of particles:

The air-dried samples were sieved through a strainer screen with 2mm circular holes. Large clods were crushed by mortar and pestle, and the sieved soils were then kept in a polythene bag.

LABORATORY ANALYSIS:

Moisture content:

The majority of soil analyses are carried out on air-dried soil; but for the determination of moisture content, it is necessary to measure the soil on a dry weight basis (Published by RARC, 2014).

Formula:

Soil moisture content of air-dried soil (%) = [(B-C)/(B-A)] ×100

Soil moisture correction factor (MCF) = (B-A)/(C-A)

Where, A = weight of the empty cup, B = weight of cup with soil, C = weight of cup with soil after drying

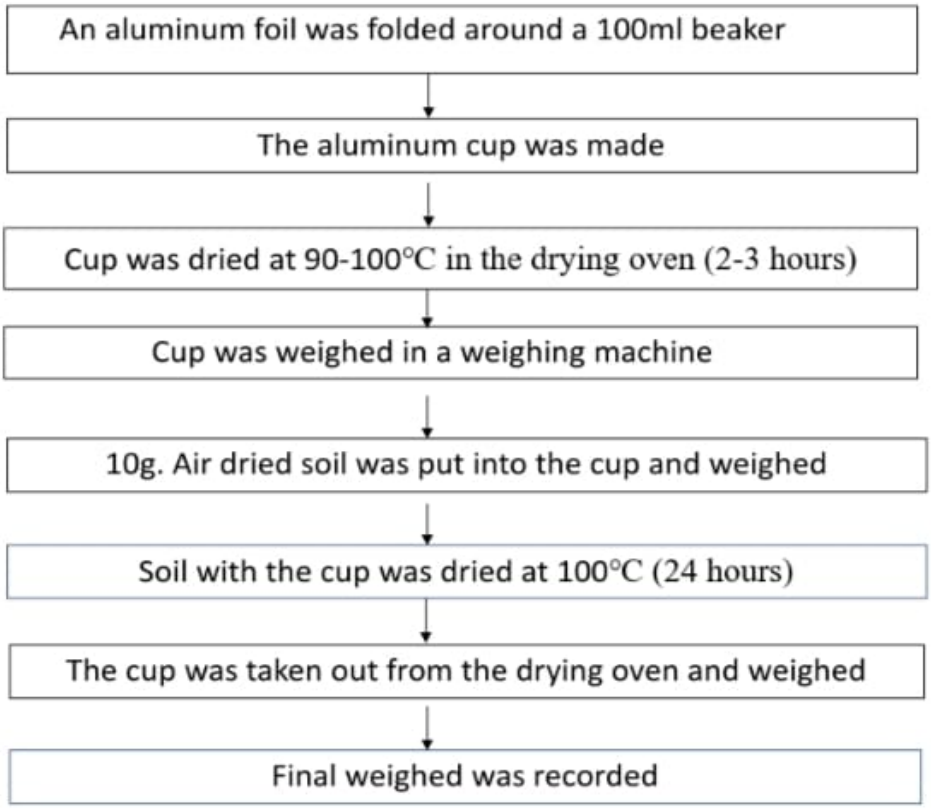

Figure 4: Flowchart of the soil sample analysis work for Moisture content

pH

pH (H_2O):

The pH (H_2O) of soil is usually measured in a soil-water suspension of 1:2.5 which indicates the soil-water ratio in the result. pH-7(neutral) buffer tablet was mixed with 100ml. of distilled water to prepare the buffer solution (Published by RARC, 2014).

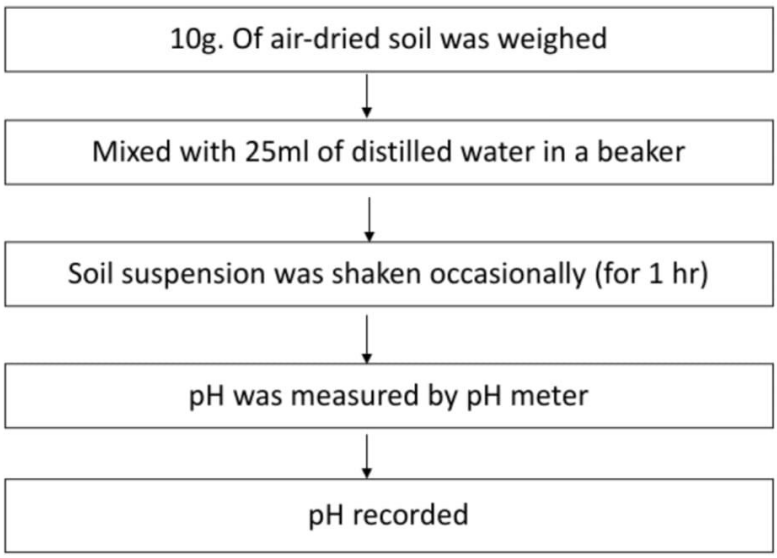

Figure 5: Flowchart of the work pH-H_2O

pH (KCl):

The pH (KCl) of the soil is typically 0.5–1.5 lower than the pH of the soil (H_2O). when pH (KCl)-pH (H2O) is -0.5 or larger than -0.5, the soil's salinity levels are similar to those of mangrove swamp soils or clay, which have different properties from normal soils. KCl solution was prepared by mixing 7.45g. KCl powder with 100ml. of distilled water (Published by RARC,2014).

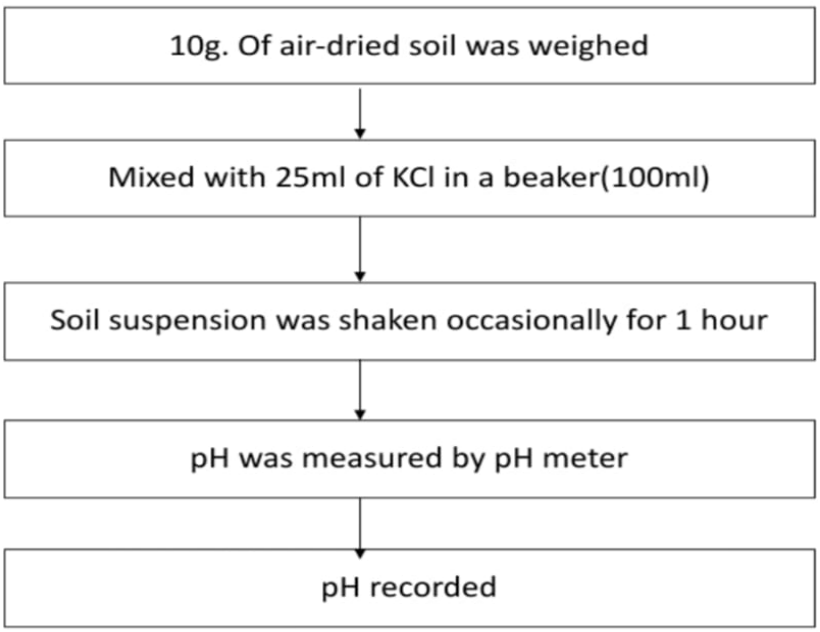

Figure 6: Flowchart of the work pH-KCl

pH(H_2O_2):

pH(H_2O_2) is one of the indicators for identifying acid-sulphate soils. When hydrogen peroxide is used to oxidize an acid sulphate soil, the sulphide that is present changes into sulphate ion, which significantly lowers the pH. If the pH of H_2O_2 is 3.5 or lower than this, acid sulphate content in the soil is probably high.

Hydrogen peroxide solution was used (30%) which is generally acidic. So, we maintained the pH up to 6.0 by adding dilute NaOH solution (0.1-0.01N) (Published by RARC, 2014).

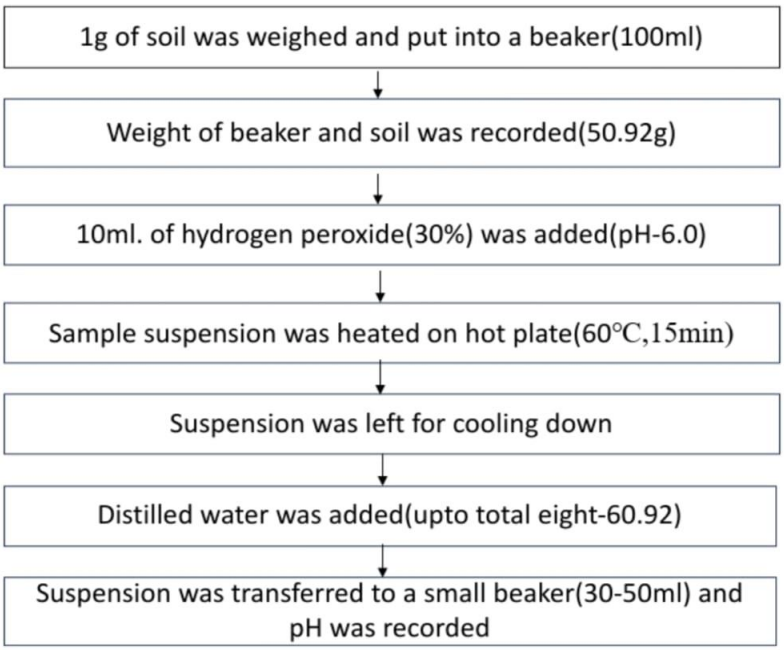

Figure 7: Flowchart of the work pH-H_2O_2

Lime requirement:

Lime materials are used to reduce the acidity of the soil to a certain level. There are many methods used to calculate how much lime is needed; the buffer solution technique is one of them. When graded rates of lime ($CaCO_3$) are added to soil, a buffer curve is formed, and the quantity read in the curve indicates the amount of lime needed in fields (Published by RARC, 2014).

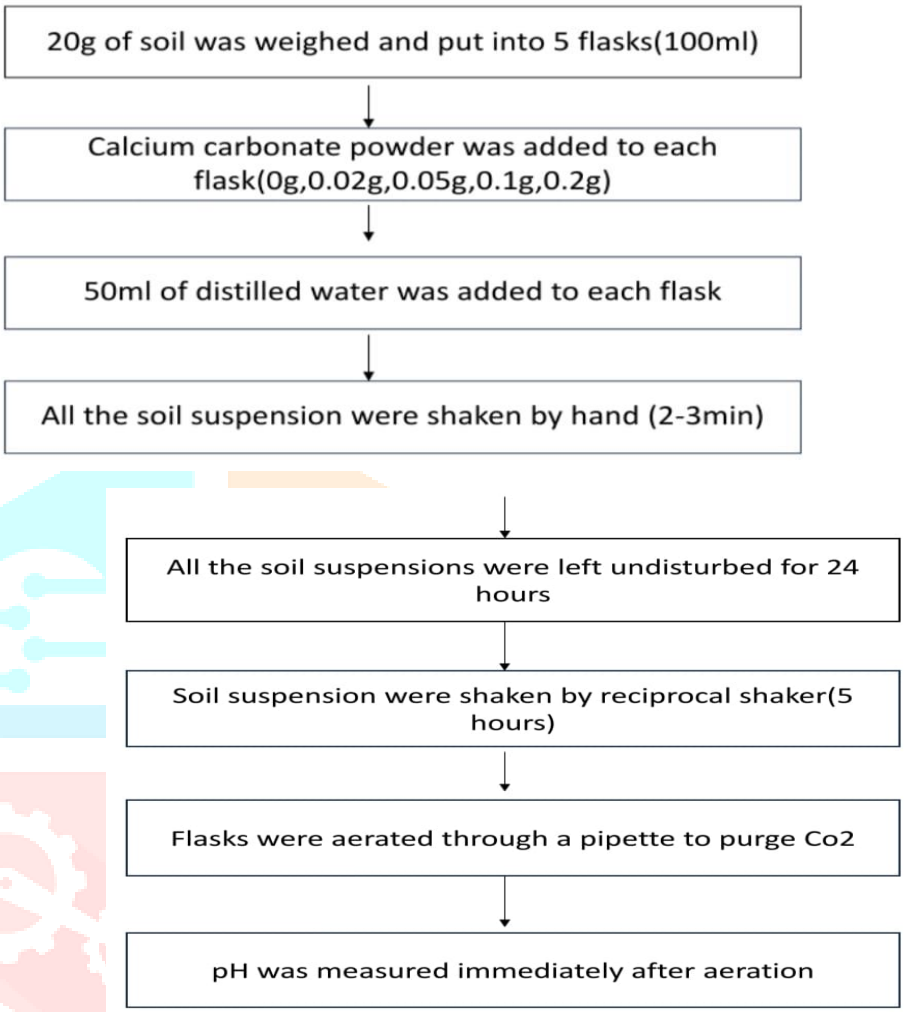

Figure 8: Flow chart of the work lime requirement

5. Results and discussion

The results of the current study, "Physicochemical Analysis of Soil from Different Localities of Raipur Region Chhattisgarh," is presented and discussed below:

Moisture content:

Table -1: Table showing the moisture content of soil samples

Location name	Sample no	Moisture content	SMCF (soil moisture correction factor)
Palaud village	S1	0.60%	1.0060g
	S2	0.30%	1.0030g
	S3	0.70%	1.0070g
Palaud agri-field	S4	0.24%	1.0024g
	S5	0.80%	1.0080g
	S6	0.80%	1.0080g
Kuhera village	S7	2.50%	1.0256g
	S8	0.20%	1.0020g
	S9	2.10%	1.0214g
Kuhera agri-field	S10	0.50%	1.0050g
	S11	0.71%	1.0071g
	S12	0.49%	1.0049g
Kuhera open forest	S13	0.20%	1.0020g
	S14	0.55%	1.0055g
	S15	0.82%	1.0082g
Kotni village	S16	1.80%	1.0183g
	S17	0.30%	1.0030g
	S18	0.50%	1.0050g
Kotni agri-field	S19	0.51%	1.0052g
	S20	0.82%	1.0083g
	S21	0.10%	1.0008g
Tandul village	S22	1.20%	1.0121g
	S23	0.50%	1.0050g
	S24	2.20%	1.0224g
Tandul agri-field	S25	1.30%	1.0131g
	S26	0.50%	1.0632g
	S27	0.20%	1.0020g
Parsada-3 open forest	S28	0.90%	1.0090g
	S29	1.30%	1.0131g
	S30	2.30%	1.0235g

The moisture content was found highest (2.50%) in the soils collected from Kuhera village as compared to other regions. However, the moisture content is minimum (0.10%) in the agricultural land of Kotni village.

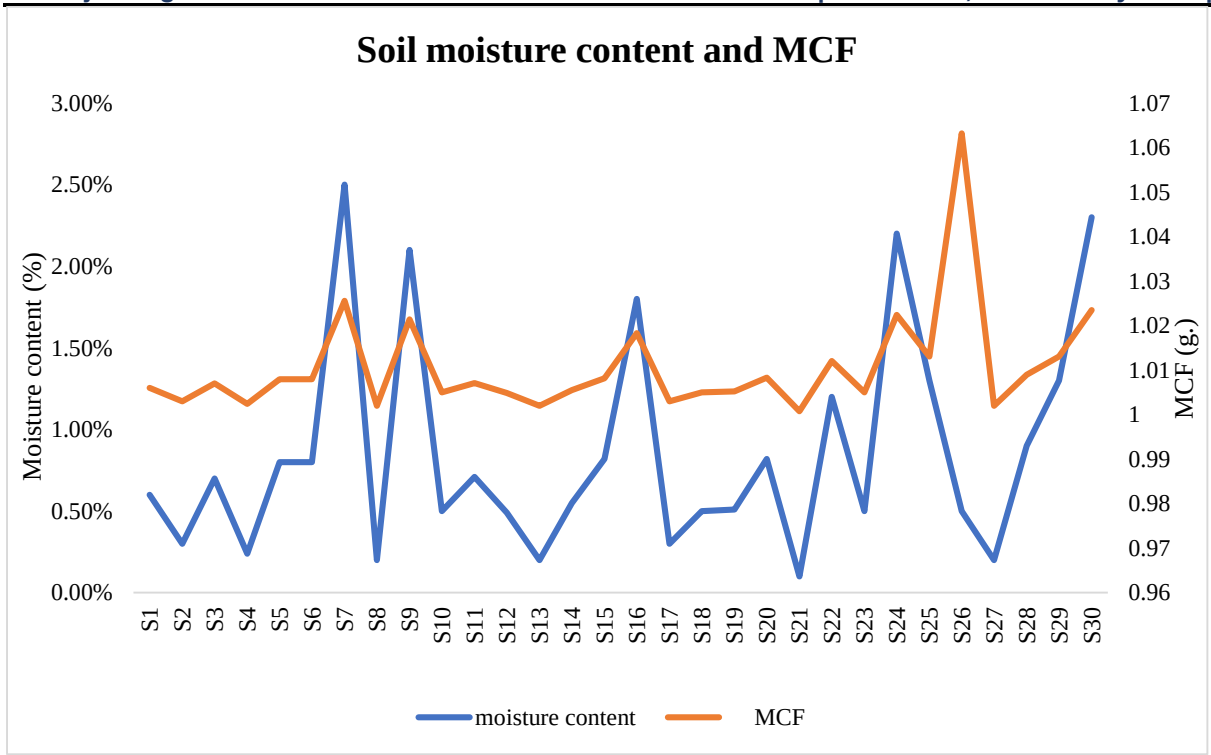

Figure: 9 (Graph showing soil moisture content and MCF)

The above graph shows the moisture content and the soil moisture correction factor (MCF) of 30 soil samples. There is a wide variation in all the samples taken from different regions. The graph indicates the moisture content was found highest in sample 7 which is 2.50% and lowest in sample 21 which is 0.10%. Similarly, the MCF was highest in sample 26 which is 1.0632g. and the lowest in sample 21 which is 1.0008g.

pH:

The soil reaction or pH is used to indicate the soil's acidity or alkalinity. The pH is an important characteristic of the soil that affects the fertility of the soil and plant growth.

pH (H_2O):

Table -2: Table showing the pH recorded for H_2O

Location name	Sample number	pH (H_2O)
Palaud village	S1	7.2
	S2	7.18
	S3	7.28
Palaud agri-field	S4	7.58
	S5	7.32
	S6	7
Kuhera village	S7	7
	S8	6.83
	S9	6.52
Kuhera agri-field	S10	7
	S11	7.94
	S12	7.81
Kuhera open forest	S13	7.66
	S14	7.38
	S15	7.41
Kotni village	S16	7.2
	S17	7.12
	S18	7.12
Kotni agri-field	S19	7
	S20	7
	S21	7.42
Tandul village	S22	7
	S23	6.72
	S24	7.29
Tandul agri-field	S25	6.8
	S26	7.15
	S27	7.43
Parsada-3 open forest	S28	7.25
	S29	7.37
	S30	7.2

The soil pH (H_2O) is highest in the agricultural land of Kuhera village (S11-7.94) and the village itself has the lowest pH (S9-6.52). The regions having neutral pH(pH-7) include Palaud agri-field(S6), Kuhera village(S7), Kuhera agri-field(S10), Kotni agri-field (S19 and S20) and Tandul village(S22). The pH of other villages showed a variation from 6.72-7.81.

pH (KCl):

Table-3: Table showing the pH recorded for KCl

Location name	Sample no.	pH (KCl)
Palaud village	S1	6.2
	S2	7
	S3	7
Palaud agri-field	S4	7
	S5	7
	S6	6.84
Kuhera village	S7	5.98
	S8	6.37
	S9	6.2
Kuhera agri-field	S10	6.55
	S11	7.38
	S12	7.34
Kuhera open forest	S13	6.45
	S14	7
	S15	7
Kotni village	S16	7
	S17	6.87
	S18	6.78
Kotni agri-field	S19	6.75
	S20	5.85
	S21	6.61
Tandul village	S22	6.8
	S23	6.64
	S24	6.25
Tandul agri-field	S25	6.64
	S26	6.76
	S27	6.6
Parsada-3 open forest	S28	6.5
	S29	6
	S30	6.54

The agricultural land of Kuhera village (S11) recorded the highest pH (KCl) value of 7.38. There is a neutral pH value of 7 was recorded from 7 different collection sites (S2 and S3 - Palaud village, S4 and S5-Palaud agri-field, S14 and S15-the open forest of Kuhera village, and S16- Kotni village). The localities with the highest concentrations of acidic soil include S7- Kuhera Village (5.98), and S20- Kotni Village Farmland (5.85). Other sites have pH (KCl) that varies from 6 to 6.87.

pH(H_2O_2):

Table-4: Table showing the pH recorded for H_2O_2

Location name	Sample no	pH (H_2O_2)
Palaud village	S1	6.75
	S2	7.13
	S3	7.16
Palaud agri-field	S4	7.45
	S5	7.2
	S6	6.87
Kuhera village	S7	6.35
	S8	6.39
	S9	6.5
Kuhera agri-field	S10	6.8
	S11	7.41
	S12	7.45
Kuhera open forest	S13	7.57
	S14	7.33
	S15	7.25
Kotni village	S16	7.12
	S17	6.91
	S18	6.8
Kotni agri-field	S19	6.8
	S20	6.45
	S21	6.68
Tandul village	S22	6.83
	S23	6.7
	S24	6.3
Tandul agri-field	S25	6.67
	S26	7
	S27	6.68
Parsada-3 open forest	S28	6.56
	S29	6.18
	S30	6.69

The pH(H_2O_2) fluctuates between 6.18 and 7.57 in all of the selected regions of the study area. The open forest of Kuhera village recorded the highest pH value 7.57 while the open forest of Parsada-3 recorded the lowest pH value 6.18. A neutral pH value of 7 was recorded from the agricultural land of Tandul village.

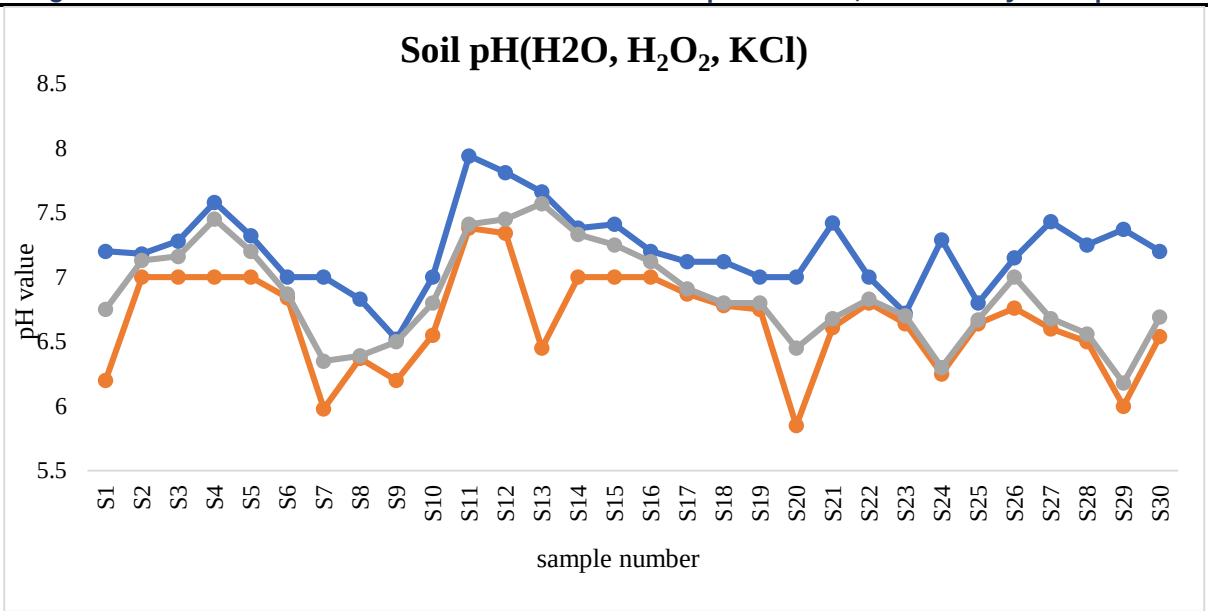

Figure:10 (Graph showing pH of H_2O, H_2O_2 and KCl)

From the above graph, sample 1 shows the pH (H_2O) recorded 7.2, sample 2 shows 7.18, and sample 3 shows 7.28. Similarly, samples 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, 26, 27, 28, 29, and 30 shows the pH recorded above 7.00. However, sample 8, 9, 23, and 25 shows the pH recorded below 7.00.

For pH (H_2O_2), the above graph shows that sample 13 has recorded the highest pH that is 7.57, and sample 24 shows the lowest pH that is 6.30. Similarly, the other samples such as samples 2, 3, 4, 5, 11, 12, 14, 15, and 16, showing the pH above 7.00 while sample 26 shows neutral pH that is 7.00. The other samples such as sample 1, 6, 7, 8, 9, 10, 17, 18, 19, 20, 21, 22, 23, 25, 27, 28, 29, 30 shows the pH recorded below 7.00.

For pH (KCl), the above graph shows that the pH is highest in sample 11 and lowest in sample 20. There are a total of 7 samples showing a neutral pH (7.00). The other sample shows a pH recorded below 7.00.

Lime requirement:

Table-5: Table showing the soil pH recorded for lime requirement (a (-) mark denotes sample not collected or assessed from that village)

Location name	Sample no.	pH				
		Concentration of $CaCo_3$				
		A=0g.	B=0.02g	C=0.05g.	D=0.1g.	E=0.2g.
Palaud village	S1	7.22	7.23	7.27	7.32	7.38
	S2	7.29	7.37	7.39	7.41	7.42
	S3	7.36	7.4	7.44	7.45	7.48
Palaud agri-field	S4	7.18	7.34	8.14	8.93	8.97
	S5	7.25	7.27	7.36	7.38	7.41
	S6	7.13	7.22	7.2	7.23	7.24
Kuhera village	S7	-	-	-	-	-
	S8	-	-	-	-	-
	S9	-	-	-	-	-
Kuhera agri-field	S10	7.28	7.44	7.49	7.51	7.52
	S11	7.44	7.51	7.53	7.56	7.6
	S12	7	7.33	7.4	7.43	7.5
Kuhera open forest	S13	7	7.4	7.6	7.65	7.81
	S14	7.8	7.82	7.9	8.18	8.42
	S15	7.82	7.77	7.78	8.56	8.91
Kotni village	S16	7.24	7.27	7.33	7.36	7.4
	S17	-	-	-	-	-
	S18	7.2	7.24	7.16	7.19	7.12
Kotni agri-field	S19	7.09	7.14	7.2	7.3	7.32
	S20	6.84	7.25	7.32	7.35	7.38
	S21	7	7.32	7.12	7.08	7.27
Tandul village	S22	-	-	-	-	-
	S23	7.46	7.5	7.53	7.63	7.65
	S24	-	-	-	-	-
Tandul agri-field	S25	7.19	7.21	7.26	7.29	7.33
	S26	-	-	-	-	-
	S27	6.81	7.1	7	7.18	7.13
Parsada-3 open forest	S28	-	-	-	-	-
	S29	-	-	-	-	-
	S30	7.16	7.2	7.21	7.35	7.38

To increase the pH of acidic soil we have to add lime which promotes yield.

Since most of the soil samples were observed to be alkaline, lime need not be added/lime addition is not required.

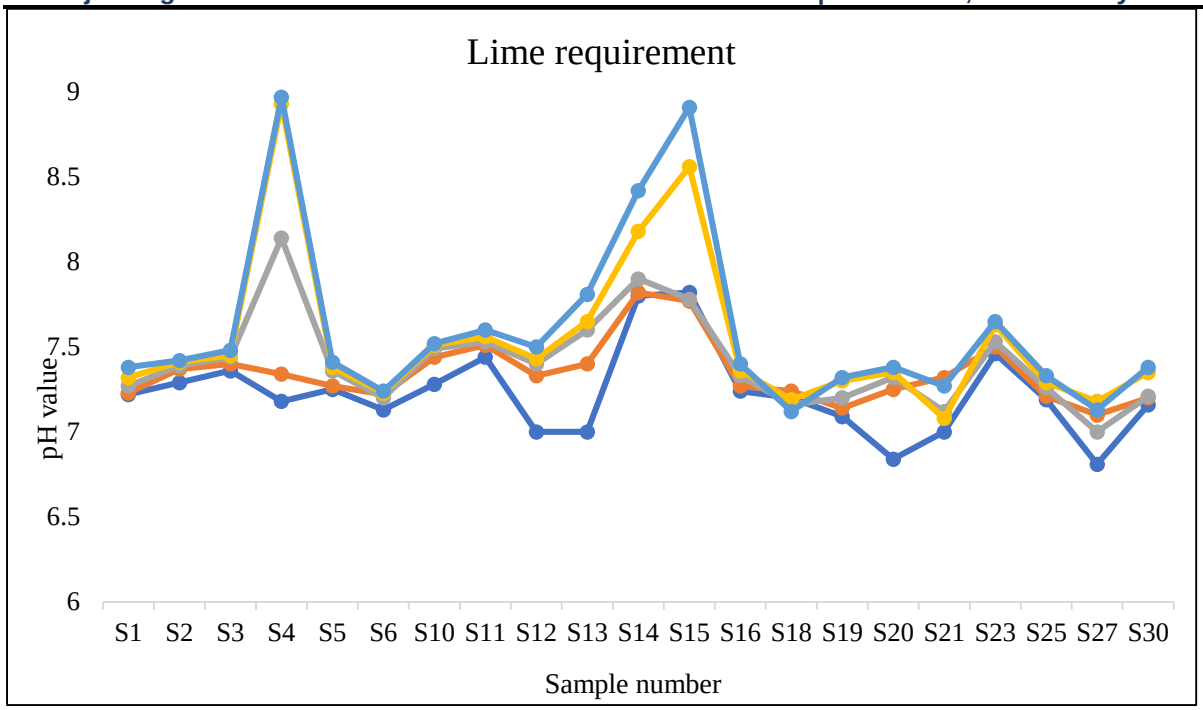

Figure -11: Graph showing the lime requirement

The above graph shows the lime requirement for 30 soil samples. As the pH value of all the soil samples shows above 7.00 which indicates all the samples are alkaline, therefore lime addition is not required.

Table- 6: Details of soil collection Sampling site

Sample no.	Location name	GPS coordinates		
		Latitude	Longitude	Altitude
1	Palaud village, ANNR, C.G	21'180902"N	81'820996"E	298m.amsl
2	Palaud village,ANNR,C.G	21'180868"N	81'820996"E	297m.amsl
3	Palaud village,ANNR,C.G	21'179827"N	81'820996"E	301m.amsl
4	Palaud agri-field,ANNR,C.G	21'168052 "N	81'819262"E	282m.amsl
5	Palaud agri-field,ANNR,C.G	21'178674"N	81'821985"E	295m.amsl
6	Palaud agri-field,ANNR,C.G	21'169646"N	81'817607"E	287m.amsl
7	Kuhera village,ANNR,C.G	21'157333"N	81'808085"E	299m.amsl
8	Kuhera village,ANNR,C.G	21'157355"N	81'808107"E	297m.amsl
9	Kuhera village,ANNR,C.G	21'157387"N	81.808042"E	299m.amsl
10	Kuhera agri-field,ANNR,C.G	21'158511"N	81'806972"E	302m.amsl
11	Kuhera agri-field,ANNR,C.G	21'158758"N	81'807066"E	300m.amsl
12	Kuhera agri-field,ANNR,C.G	21'158412"N	81'807023"E	299m.amsl
13	Kuhera open forest, ANNR,C.G	21'149201"N	81'802173"E	303m.amsl
14	Kuhera open forest,ANNR,C.G	21'149271"N	81'802004"E	296m.amsl
15	Kuhera open forest,ANNR,C.G	21'149276"N	81'801934"E	297m.amsl
16	Kotni village,ANNR,C.G	21'163126"N	81'831419"E	295m.amsl
17	Kotni village,ANNR,C.G	21'162971"N	81'831346"E	292m.amsl
18	Kotni village,ANNR,C.G	21'162939"N	81'831406"E	293m.amsl
19	Kotni agri-field,ANNR,C.G	21'164674"N	81'827892"E	297m.amsl
20	Kotni agri-field,ANNR,C.G	21'164784"N	81'828003"E	292m.amsl
21	Kotni agri-field,ANNR,C.G	21'165492"N	81'827816"E	295m.amsl
22	Tandul village,ANNR,C.G	21'155707"N	81'82603"E	303m.amsl
23	Tandul village,ANNR,C.G	21'155672"N	81'826119"E	298m.amsl
24	Tandul village,ANNR,C.G	21'155633"N	81'826283"E	297m.amsl
25	Tandul agri-field,ANNR,C.G	21'158104"N	81'819653"E	299m.amsl
26	Tandul agri-field,ANNR,C.G	21'157974"N	81'819825"E	298m.amsl
27	Tandul agri-field,ANNR,C.G	21'158004"N	81'819825"E	297m.amsl
28	Parsada open forest,ANNR,C.G	21'210751"N	81'823831"E	301m.amsl
29	Parsada open forest,ANNR,C.G	21'210737"N	81'823785"E	300m.amsl
30	Parsada open forest,ANNR,C.G	21'210699"N	81'823753"E	301m.amsl

Table-7: Details of the soil's physical characteristics, soil colour, and soil ribbon test

Sample no.	Location name	Soil colour	Ribbon test
1	Palaud village,ANNR,C.G	dark yellowish brown	Positive
2	Palaud village,ANNR,C.G	yellowish brown	Positive
3	Palaud village,ANNR,C.G	dark yellowish brown	Positive
4	Palaud agri-field,ANNR,C.G	light brown	Negative
5	Palaud agri-field,ANNR,C.G	dark yellowish brown	Positive
6	Palaud agri-field,ANNR,C.G	dark yellowish brown	Positive
7	Kuhera village,ANNR,C.G	brownish yellow	Positive
8	Kuhera village,ANNR,C.G	yellowish brown	Negative
9	Kuhera village,ANNR,C.G	yellowish brown	Positive
10	Kuhera agri-field,ANNR,C.G	light yellowish brown	Negative
11	Kuhera agri-field,ANNR,C.G	pale brown	Negative
12	Kuhera agri-field,ANNR,C.G	greyish brown	Negative
13	Kuhera open forest,ANNR,C.G	yellowish brown	Negative
14	Kuhera open forest,ANNR,C.G	very pale brown	Negative
15	Kuhera open forest,ANNR,C.G	very pale brown	Negative
16	Kotni village,ANNR,C.G	very pale brown	Negative
17	Kotni village,ANNR,C.G	pale brown	Negative
18	Kotni village,ANNR,C.G	pale brown	Negative
19	Kotni agri-field,ANNR,C.G	very pale brown	Negative
20	Kotni agri-field,ANNR,C.G	light yellowish brown	Negative
21	Kotni agri-field,ANNR,C.G	light yellowish brown	Negative
22	Tandul village,ANNR,C.G	yellowish brown	Negative
23	Tandul village,ANNR,C.G	yellowish brown	Negative
24	Tandul village,ANNR,C.G	yellowish brown	Negative
25	Tandul agri-field,ANNR,C.G	dark yellowish brown	Positive
26	Tandul agri-field,ANNR,C.G	very pale brown	Positive
27	Tandul agri-field,ANNR,C.G	very pale brown	Positive
28	Parsada open forest,ANNR,C.G	dark brown	Positive
29	Parsada open forest,ANNR,C.G	dark yellowish brown	Negative
30	Parsada open forest,ANNR,C.G	dark yellowish brown	Negative

6. Conclusion:

Assessing the suitability of the soil for agriculture is the goal of the soil analysis. The present study assessed the physico-chemical characteristics of the soil of different villages and open forests of the study area. According to the present study's findings, different soil physico-chemical qualities have been identified. The results revealed that all the parameters are optimum for agriculture.

In the determination of the moisture content of the soil, it can be concluded that the soil of Kuhera village is found suitable for agricultural purposes because the soil moisture content is high (2.50%) in that region as compared to other areas. The agricultural fields in the other areas, including Tandul village, Kotni village, and Palaud village, have poor moisture content due to poor water management practices. Consequently, these areas

are less suitable for agriculture but suitable for other purposes like making ceramic articles and beauty products.Further, the addition of organic matter and humus can enhance the soil moisture content and improve overall soil quality.

In the determination of pH level of soil sample, the pH of H_2O is found highest as compared to pH of KCl and pH of H_2O_2 in all the regions of the study area. The pH of H_2O is highest (7.94) in agricultural land of Kuhera village. So, this region is more suitable for rice and sugarcane cultivation. It was found that there is no source of irrigation in Tandul village as compared to other areas. This may be one of the main causes of the decline in agricultural productivity. But the soil of Tandul village, Kotni village and Palaud village are more suitable for growing vegetables, grasses and most ornamentals.

As the pH of KCl is lowest (5.85) in the agricultural field of Kotni village it can support crop production and overcome plant deficiencies. The Kuhera village farmland has the highest pH of KCl(7.38)due to extreme liming and lack of soil oxygen which can ultimately cause deficiencies in plants so the farmers have to supply potassium fertilizers to overcome nutrient deficiencies in the soil. But the soil of other areas like Tandul village, Palaud village and the open forests of Kuhera village and Parsada are suitable for growing vegetables like cabbage, cauliflower green beans and spinach.

Meanwhile, in the experiment of determination of the pH of H_2O_2 , it was found that the pH was highest (7.57) in the open forest of Kuhera village. So, the soil can support the growth and development of plants in that region and encourage healthy root growth because of the extra oxygen molecule. The parameters are optimized for culturing Oak tree (*Q. virginiana*), Paulownia (*Paulownia tomentosa*), Sassafras (*Sassafras albidum*), Sugarberry (*Celtis laevigata*), Walnut (*Juglans nigra*), etc in the open forest of Kuhera village and the open forest of Parsada. The forest can sustain a crucial ecology for both plant and animal life.

In addition, the pH levels of all the lime requirement tests demonstrate that the soil samples are alkaline, so there is no need to add lime. Results are more useful in decision-making and beneficial for any agricultural development in the study area.

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