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Analytical Study of Physico-Chemical Parameters of Soil in Korba Block of Korba District, Chhattisgarh, India

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KEYWORDS

Soil, pH, Electrical conductivity, Nutrient content, Organic carbon.

ABSTRACT:

Objective: The objective of this study is to determine the physico-chemical parameters of soils at various stations such as Arsena, Bahera, Bundeli, Chuiya, Dhangaon, Garhuproda, Godhi, Jilga and Kesala villages of Korba block of Korba district.

Method: The physico-chemical parameters such as pH was measured using pH meter; electrical conductivity (EC) was measured by conductivity meter; organic carbon (OC) was determined by Fourier-transform infrared and with ultraviolet (UV) spectrophotometer; nitrogen (N2) was estimated by Kjeldahl method; potassium (K), sodium (Na), and calcium (Ca) were estimated using flame photometer and magnesium (Mg) was estimated by titrimetric method.

Results: Among these, pH (6.30-6.58), EC (0.12-0.76 ds/m), OC (0.32% - 0.64%), N (176.20-320.50 Kg/Ha), P (9.31-74.13 Kg/Ha), K (95.45-301.65 Kg/Ha), S (17.50-50.30 ppm), Zn (0.30-2.35 ppm), B (0.02-0.50 ppm), Fe (13.93-28.00 ppm), Mn (19.31-38.70 ppm) and Cu (1.26-3.38 ppm) ranges were recorded at all the stations.

Conclusion: The present study is a preliminary attempt to study the nature of soils in different agricultural areas in Korba block of Korba district of Chhattisgarh, India. This could help to understand the nutrient profile of the district and to prescribe the nutrients levels of the crops for their effective growth.

Introduction

The intricate combination of water, minerals, organic matter, air, and innumerable living things that makes up soil is what keeps life on Earth possible. Usually, the land's surface is made of soil. It is known as the "Earth's Skin." Both the natural world and plant life can be sustained by soil. The "pedosphere," a naturally occurring body found in soil, serves a number vital purposes, including allowing plants to flourish, which provides, stores, and purifies water [1,2].

Generally speaking, soil is the loose organic or mineral matter that is present on the earth's surface and acts as a natural growing medium for plants [3]. There is a decrease in seed germination when soil saline concentrations rise [4].

The mixture of inorganic elements (such as sand, silt, and clay particles), inorganic stuff that is not alive, and living things is called soil. The particles are arranged into soil structures with spaces between them that hold soil solution and air. Crop development and quality maintenance are significantly impacted by the hydro-physical characteristics of the soil [5].

The primary resource in agriculture is soil, and maintaining crop productivity as well as the quality and fertility of the soil depend on appropriate management of the soil. In addition to serving as a growing substrate for plants, soil is essential for many animal and human activities. The soil serves as a storehouse for water and nutrients, meeting the needs of the plants for these elements as they grow.

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Materials and Methods

Previous literature review revealed that no analytical method has been devised for determining the physico-chemical parameters of agricultural soils found in the Korba district. In order to ascertain the physic-chemical characteristics and nutrient content of a few agricultural soils in the Korba district, an attempt was made.

Study area

The total area of Chhattisgarh is 1, 35,194 km^2, of which 6598 km^2 are in the Korba district. This study includes the Korba block in the Korba district. The Korba block is situated in Chhattisgarh's Korba district. Korba Block is situated on the eastern part of Korba district of Chhattisgarh and is bounded on the north by Podi Uprora block and sarguja district, in the west by Katghora Block, in the south by Kartala block and in the east by Raigarh district.The block area lies between 22.19° and 22.75° N latitudes and 82.60° and 83.13° E longitudes. Administrative mapof the block is shown in Fig.1.

Soil samples collection

Soil samples were collected from various stations such as Arsena, Bahera, Bundeli, Chuiya, Dhangaon, Garhuproda, Godhi, Jilga and Kesala villages of Korba block of Korba district.

Instruments required

Fourier-transform infrared (FTIR), ultraviolet (UV) spectrophotometer, sonicator (Ultrasonic Sonicator), conductivity meter, flame photometer, pH meter (Thermo Scientific), and microbalance (Sartorius) were used.

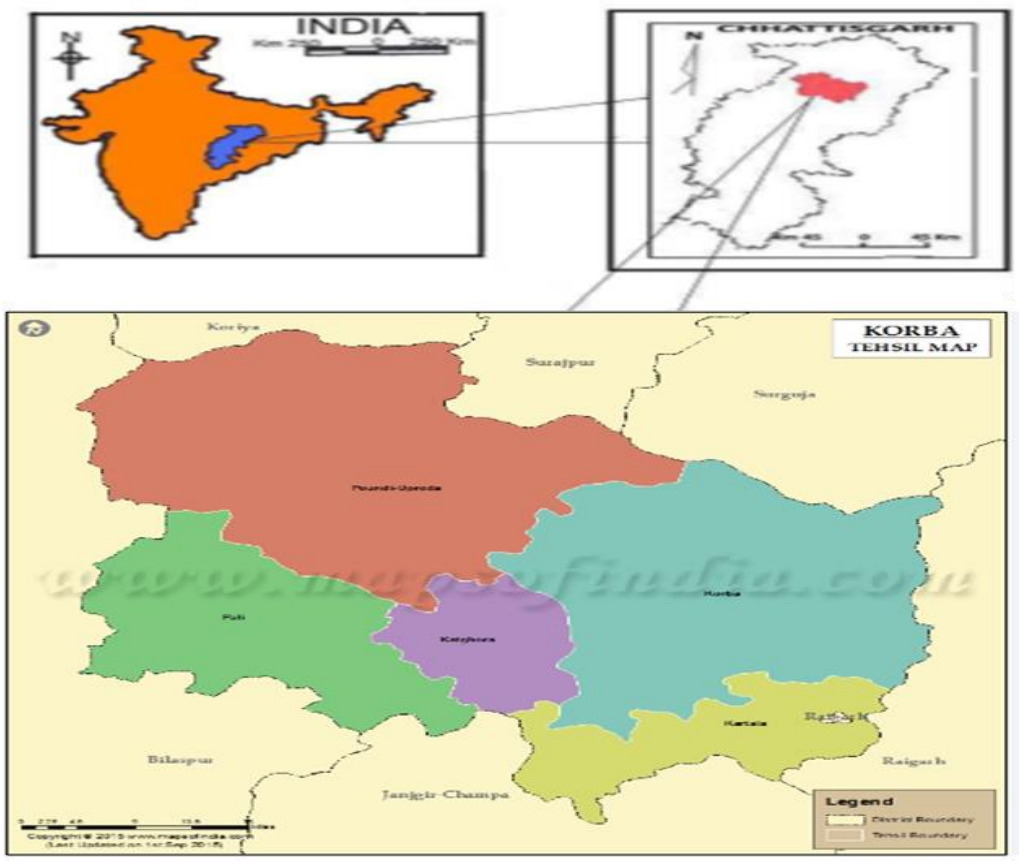

Fig. 1: Korba District Location Map

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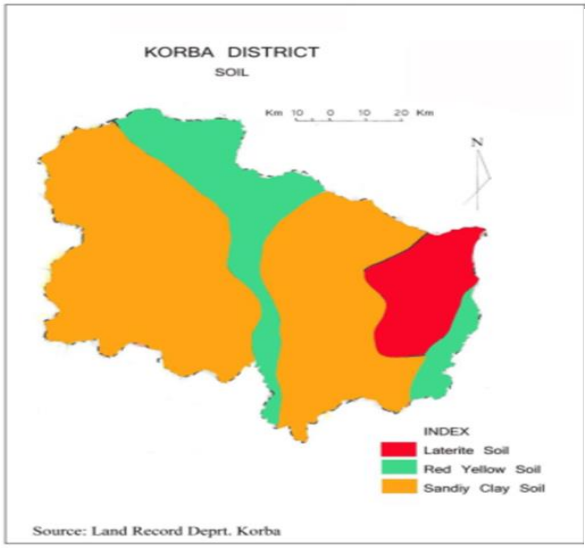

Fig.2: Korba District Soil Index

Fig.3: Map of the Chhattisgarh State

Table 1: Procedure used for Physico-Chemical Analysis of Soil

Particulars	**Methods**	**Scientist (years)**
Texture	Bouyoucos Hydrometer	Bouyoucos (1927)
Soil Colour	Munsell Colour Chart	Munsell, (1971)
Particle Density (Mg m^{-3})	Graduated measuring cylinder	Muthuaval *et al*., (1992)
Bulk Density (Mg m^{-3})	Graduated measuring cylinder	Muthuaval *et al*., (1992)
Pore Space (%)	Graduated measuring cylinder	Muthuaval *et al*., (1992)
Water retaining capacity (%)	Graduated measuring cylinder	Muthuaval *et al*., (1992)
Soil pH	Digital pH meter	Jackson, (1958)
Electrical Conductivity	Digital EC meter	Wilcox, (1950)
Organic Carbon (%)	Rapid titration method	Walkley and Black, (1947)
Available Nitrogen (kg ha^{-1})	Kjeldahl method	Subbaiah, (1956)
Available Phosphorous (kg ha^{-1})	Calorimetric method	Olsen *et al.*, (1954)
Available Potassium (kg ha^{-1})	Flame photometer method	Muthuaval *et al*., (1992)
Calcium and Magnesium (meq/100g)	EDTA method	Muthuaval *et al*., (1992)
Zinc (meq/100g)	DTPA method	Jackson, (1958)

Table: 2 Physical Properties of Soil in Korba District in Korba Block

Village Name	Sand %	Silt %	Clay%	Porosity	Bulk Density gm / cm^3
Arsena	75.05	2.06	22.89	-0.203	1.83
Bahera	76.82	2.18	21.00	-0.1574	1.81
Bundeli	77.89	2.30	19.81	0.2368	1.82

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Chuiya	78.03	2.49	19.48	0.2425	1.83
Dhangaon	78.53	2.60	18.87	0.2653	1.84
Garhuproda	78.79	2.69	18.52	0.271	1.88
Godhi	78.83	2.75	17.42	0.2995	1.89
Jilga	81.06	2.89	16.05	0.3394	1.82
Kesala	85.00	3.00	12.00	0.4477	1.88

Table: 3 Chemical Properties of Soil in Sarangarh-Bilaigarh District in Bilaigarh Block

Sample Element	**Name of Village**								
	Arsena	Bahera	Bundeli	Chuiya	Dhangaon	Garhuproda	Godhi	Jilga	Kesala
pH (1:2.5)	6.39	6.3	6.58	5.96	6.41	5.4	6.5	6.48	6.31
EC (dS/m)	0.24	0.25	0.19	0.67	0.12	0.21	0.49	0.76	0.41
OC (%)	0.51	0.54	0.57	0.61	0.64	0.32	0.52	0.46	0.52
N (Kg/Ha)	187.2	176.2	200.7	200.6	320.5	190.2	284.2	182.8	189.31
P (Kg/Ha)	14.04	13.44	9.31	13.35	37.5	74.13	18.42	15.16	14.87
K (Kg/Ha)	198.4	241.08	286.6	134.17	95.45	200	174.2	301.65	221.61
S (ppm)	19.5	21.7	49.25	17.5	37.8	50.3	25.4	34.5	36.63
Zn (ppm)	0.51	0.34	0.42	0.3	2.35	6.3	0.67	0.51	0.76
B (ppm)	0.06	0.04	0.09	0.02	0.12	0.04	0.44	0.5	0.06
Fe (ppm)	23.4	14.56	13.93	21.5	24.5	28	17.01	16.19	15.71
Mn (ppm)	25.5	21.61	20.3	22.6	38.7	20.1	19.31	22.99	21.86
Cu (ppm)	2.71	1.96	2.07	1.26	3.34	2.2	1.98	2.49	3.38

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Result and Discussion

- **Physical Properties**

.The texture of soil is a physical quality. Soil texture is an important component of soil science because it affects water retention in the soil, tiltability, aeration levels, infiltration rates, and soil fertility. The soil texture has a major impact on the electrical properties of the soil. It is shown that the dielectric constant value decreases with increasing sand percentage. Moreover, the dielectric constant value decreases as the amount of silt increases [6].

The sand, silt and clay percentage ranges from 75.05-85.00%, 2.06-3.00% and 12.00-22.89% respectively. The majority of the soil sample's high clay concentration indicates that the soil is suited for paddy production. The same research was done by Thakre[7].

The porosity ranged from -0.1574% to 0.4477%, in line with findings published by Ahmadi and David. The settlement of Bahera had the lowest porosity (-0.1574%). The settlement of Kesala had the maximum porosity (0.4477%).

The bulk density ranged from 1.81 to 1.89 mg m^{-3}, with Bahera & Godhi having the lowest and greatest bulk densities, respectively. The bulk density decreases with increasing soil depth. Chaudhari et al. (2013) reported similar outcomes [8].

- **Chemical Properties**

The pH value ranges from 6.30 to 6.58 and the highest value was recorded in Bundeli. The low levels of organic matter and nutrient leaching could be the cause of the low pH readings. Similar results were reported by Upadhyay and Chawla [9].

The electrical conductivity varied from 0.12 dS m^{-1} to 0.76 dS m^{-1}, with Dhangaon having the greatest EC. For soil, an EC value of 0.5 dS m^{-1} is ideal. Belwal and Mehta reported similar outcomes [10].

The soil organic carbon percentage varied from 0.32 % to 0.64 % and the highest soil organic carbon % was found in Dhangaon. The organic carbon content decreased with depth. Upreti *et al.,* (2016) reported similar outcomes [11].

The Available Nitrogen ranges from 176.20 kg ha^{-1} to 320.50 kg ha^{-1} and Dhangaon has the maximum amount of accessible nitrogen. The available nitrogen content found to be maximum in surface layer. Upadhyay *et al.,* (2014) reported similar outcomes [12].

The Available Phosphorus ranges from 9.31 kg ha^{-1} to 74.13 kg ha^{-1} and the highest available phosphorus was found in Garhuproda. The surface layer has been shown to have the highest accessible phosphorous concentration, which fluctuates randomly with depth. Similar results were reported by Sannappa and Manjunath [13].

The Available Potassium ranges from 95.45 kgha^{-1} to 301.65 kg ha^{-1} and the highest available potassium was found Jilga. Similar results were reported by Patel [14].

The Available sulpher ranges from 17.50 ppm to 50.30 ppm and the highest available sulpher was found in Garhuproda.

The Available zinc ranges from 0.30 ppm to 2.35 ppm and the highest available zinc was found in Dhangaon. The availability of zinc declines as soil pH rises. Similar results were reported by Shukla [15].

The Available boron ranges from 0.02 ppm to 0.50 ppm and the highest available boron was found in Jilga.

The Available iron ranges from 19.31 ppm to 38.70 ppm and the highest available iron was found in Garhuproda.

The Available manganese ranges from 8.56 ppm to 46.61 ppm and the highest available manganese was found in Dhangaon.

The Available copper ranges from 1.26 ppm to 3.38 ppm and the highest available copper was found in Kesala.

Conclusion

Analyzing the physical and chemical properties of soil, including its pH, bulk density, texture, porosity, electrical conductivity, organic carbon content, and macro- and micronutrient composition, is essential. Soil nutrients decrease with depth because of plant absorption and leaching. The amount of organic matter in the soil was modest. Because varying pH ranges impact the amount of macro and micronutrients in the soil, the pH of the soil is important. According to this investigation, the soil of the Korba block of Korba district is fertile and productive, making it perfect for

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farming. Broad beans, cabbage, cauliflower, tomatoes, brinjal, chillies, rice, arhar, gram, lentil, lineseed, and mustard can all be grown. Appropriate integrated soil can improve soil health and reduce cultivation costs.

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