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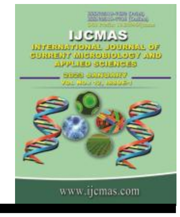

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Assessment of Soil Fertility Status of Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

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ABSTRACT

The current study was conducted at Research farm of IGKV, Raipur district, Chhattisgarh, to assess the macro and micro nutrient status of the soil. A random sampling procedure was used to gather surface (0-15 cm) soil samples, yielding a total of 139 samples for analysis of soil chemical characteristics. Soil response (pH), electrical conductivity (EC), organic carbon (OC), available macro-nutrients (e.g. N, P, K, S), & DTPA-extractable micro-nutrients (e.g. Iron, Manganese, Copper, Zinc, and hot water extractable Boron) were all tested in the soil samples. The soil pH of the study region ranged from 6.60 to 8.22.It indicates that the pH of the soil is in the neutral to slightly alkaline range.The electrical conductivity found to be fall under the normal category with average value of 0.23dS/m. Organic carbon in this soil was found to be around 0.49%. Available Nitrogen content was found between 100 to 204 kg ha^{-1}. The available Phosphorus content varied from 5.4 to 39.5kg ha^{-1}. Available Potassium content ranged from 277.31 to 484.96 kg ha^{-1}. The available Sulphur content ranged from 16.80 to 46.98 kg ha^{-1}. DTPA extractable micronutrient anions content was found that the Iron content varied from 5.8 to 18.9mg kg^{-1}. The Manganese content ranged between 3.5 to 10mg kg^{-1}. Copper content varied from 0.4 to 1.7 mg kg^{-1}. Zinc content ranged from 0.2 to 1.2mg kg^{-1}. Hot- water extractable Boron content found to be between 0.1 to 0.4mg kg^{-1}.

Introduction

Soil is a dynamic natural body that serves as a medium for plant growth and production. Soil fertility is a hidden element that plays a critical role in keeping soil intact. Of the many problems that the soil system faces. The enhancement of soil fertility is becoming a big concern on a daily basis. Soil fertility evaluation is also a common practice for long-term soil maintenance and crop production. There are a variety of strategies for evaluating soil fertility, but soil testing is an important method in soil fertility management for long-term soil productivity (Motghare *et al.*, 2020). Soil analysis is useful for gaining a deeper understanding of soils in order to improve crop productivity and achieve a long-term yield. One of the most significant factors influencing crop yield is soil fertility. Micronutrients

(Zn, Cu, Fe, Mn, and B) and Macronutrients (N, P, K, and S) are essential soil elements that regulate soil fertility. In the sense of sustainable agriculture production, soil characterization is critical for determining the fertility status of a soil, an environment, or a region. Chemical fertilizer nutrients' response performance has dropped dramatically under intense agriculture in recent years due to a disparity in fertilizer usage and poor efficiency of other inputs. Variation in nutrient supplies is a common occurrence, and certain nutrients can be abundant while others are scarce. There have been records of yield reductions even when using NPK fertilizers on a regular basis. The decline in yield is commonly attributed to a scarcity of secondary nutrients and micronutrients.

Soil fertility is the inherent capacity of the soil to supply nutrients to plants in adequate amounts and in adequate proportions. Soil productivity is the capacity of a soil to produce a certain yield of agricultural crops or other plants using a defined set of management practice. Soil fertility and productivity are the key factors for food production and soil quality is just as important in the context of soil degradation caused by many factors. All productive soils can be fertile, but all fertile soils cannot be productive due to some factors of influence, such as water logging, salinity or alkalinity conditions, unfavorable weather conditions etc.

Materials and Methods

The study area was carried out at research Farm, College of Agriculture and Research Station Raipur, District Raipur, Chhattisgarh is located at latitude 22°33'N and 21°14'N, and the longitudes of 82°6'E and 81°38'E with an altitude is 280*M.A.S.L.*The farm has a total area of 71.24 acres, which is mainly *Vertisols* and *Inceptisols* soils.

Sample collection

Surface soil samples (0-15 cm depth) were obtained from research and NSP farms of IGKV, Raipur based on the handheld GPS device. Total of 139 soil samples were obtained from the farm area for examination of soil chemical characteristics. The collected soil samples were air dried after grinding with wooden pestle and mortar, than sieved through 2 mm sieve, labelled and stored.

Laboratory analysis

The collected soil samples were analyzed at laboratory of soil science department. The different soil parameters tested as well as method adopted to analyze is shown on the table

Results and Discussion

Soil reaction

The soil pH of the study region ranged from 6.60 to 8.22, it indicates that the pH of the soil is in the neutral to slightly alkaline range. Majority of soil samples (66.90%) had a neutral soil reaction, while the remaining 33.10% had a slightly alkaline reaction (Table 1). It might be due tobarren nature of the field with *Vertisols* dominant soil (Mandal *et al.,* 2018).

Electrical conductivity

The electrical conductivity of the soil water suspension ranged from 0.11 to 0.58dS/m in soil of study area with a mean value of 0.23dS/m. Most of the 100% collected soil samples fall under normal E.C. (<1.0 dS/m) category (Table 2). It indicated that there is no soil limitation for crop production from soluble salt content in soil. Similar results were also reported bylike Balakrishna *et al.,* 2017 in Palari Block soil and Kasdol Block soil in Chhattisgarh.

Organic carbon

Organic Carbon content in study area ranged from 0.24 to 0.87% with a mean value of 0.49%. From all collected soil samples 57.55 % of the 139 samples gathered had a poor rating, while the remaining

42.45 % had a medium fertility category (Table 3). It may be ascribed due to low input of FYM and crop residues as well as rapid rate of decomposition due to high temperature (Sathish *et al.,* 2017).

Available nitrogen

Available N content in soil of study area ranged from 100 to 204kg $ha^{-1}$with mean value of 160.67kg ha^{-1}. It has been revealed that 100 % of the study area was deficient in available N (Table 4). It may be ascribed to the nitrogen is lost through various mechanisms like ammonia volatilization, nitrification, chemical and microbial fixation, leaching, runoff and these soils had a very low content of organic carbon. (Vaisnow *et al.,* 2010)

Available phosphorus

Available P content in the study area found to be varied from 5.38 to 29.5kg $ha^{-1}$with average content of 16.51kg ha^{-1}. It was revealed that 40% samples fall under deficient category, 45% samples in medium range and 15% falls under high range of available P content (Table 5). It might be due to the mostly affected by past fertilization, pH, Organic matter content, texture various soil management and agronomic practices (Balakrishna *et al.,* 2017).

Available potassium

Soil available K status ranged from 277.31 to 484.96 kg $ha^{-1}$with mean value of 364.18kg ha^{-1}. As 72% samples falls into the high category and the remaining 28% samples fall into the medium category (Table 6), indicating no K deficient area within the study area. These findings matched those of Balakrishna (2017) in the Palari block.

Available sulphur

Available S status was found to be ranged between 16.80 to 46.98kg $ha^{-1}$with a mean content of 29.22kg ha^{-1}. Also it was found that out of all collected samples 514.39% were classified as low, 70.50% as medium, and the remaining 15.11% as sufficient (Table 7).

Available boron

Hot water extractable B content in the study area found to be ranged between 0.16 to 0.37mg kg^{-1} with a mean value of 0.25mg kg^{-1}.It has been revealed that 100 % of the study area was deficient in available B. (Table 8).

DTPA extractable micronutrients

Available Fe content in the study area found to be ranging from 5.8 to 18.9mg $kg^{-1}$with mean value of 10.07mg kg^{-1}. The majority of soil samples were determined to be high (62.59%), with the remaining 37.41% in the sufficient range. (Table 9). Available Mn content found to be within 3.5 to 10mg $kg^{-1}$with a mean value of 6.42mg $kg^{-1}$of soil in the study area.

Out of 139 samples collected, 56.12% fall into the sufficient fertility category, while the remaining 43.88% fall into the high Mn fertility categories. (Table 10). Available Cu content in study area found to be ranges from 0.4 to 1.7 mg $kg^{-1}$with a mean value of 0.99mg kg^{-1}.It has been revealed that 100 % of the study area was high in fertility category.(Table 11).

Available Zn content in study area found to be ranges from 0.22 to 1.21mg $kg^{-1}$with a mean value of 0.60mg kg^{-1}. Also it was found that 57.55% samples were in deficient and 42.45% samples insufficient fertility category (Table 12). The soil of the area was found to be neutral to slightly alkaline in reaction with electrical conductivity less than 1 dS/m of NSP and instructional farms, IGKV, Raipur.

Organic carbon levels in soil were determined to be low to medium.Macro nutrient analysis results shows that the soils were low in available nitrogen and sulphur content. The status of available phosphorus and potassium in soil were found to be in medium to high range. In case of micronutrients, iron, zinc and manganese were found to be in sufficient condition but boron content of the soil was low. Copper status in soils of the farms were high.

Table.1 Laboratory analysis

S.N.	Parameters	Methods
1	Soil pH	Glass Electrode pH Meter (Piper, 1967)
2	EC	Conductivity Bridge(Black, 1965)
3	Organic matter	Walkely and Black(1934)
4	Available N	Kjeldahl (Bremner and Mulveney, 1982)
5	Available P	Modified Olsen's(Olsen, 1954)
6	Available K	Ammonium acetate(Jackson,1967)
7	Available S	Turbidimetric (Williams & Steinberg ,1969)
8	Available B	Hot water (Berger and Truog, (1977)
9	Available Fe	DTPA (Lindsay and Norvell, 1978)
10	Available Zn	DTPA (Lindsay and Norvell, 1978)
11	Available Cu	DTPA (Lindsay and Norvell, 1978)
12	Available Mn	DTPA (Lindsay and Norvell, 1978)

Table.2 Distribution of Soil Samples under different pH rating

Classes	Range	No. of Samples	% of Samples
Strongly acidic	< 4.5	0	0
Moderately acidic	4.5 - 5.5	0	0
Slightly acidic	5.5 - 6.5	0	0
Neutral	6.5-7.5	92	66.90
Slightly alkaline	7.5-8.5	47	33.10
Moderately alkaline	8.5-9.5	0	0
Strongly alkaline	> 9.5	0	0

Table.3 Distribution of Soil Samples under different E.C. rating

Classes	Range (dS/m)	No. of Samples	% of Samples
Low	< 1	139	100
Medium	1.0-2.0	0	0
High	2.0-3.0	0	0
Very High	> 3.0	0	0

Table.4 Distribution of Soil Samples under different Organic Carbon rating

Classes	Range (%)	No. of Samples	% of Samples
Low	< 0.5	81	57.55
Medium	0.5-0.75	58	42.45
High	> 0.75	0	0

Table.5 Distribution of Soil Samples under different Nitrogen rating

Classes	Range (kg/ha)	No. of Samples	% of Samples
Low	<280	139	100
Medium	280-560	0	0
High	> 560	0	0

Table.6 Distribution of Soil Samples under different Phosphorus rating

Classes	Range (kg/ha)	No. of Samples	% of Samples
Low	< 12.5	56	40.29
Medium	12.5 – 25	63	45.32
High	> 25	20	14.39

Table.7 Distribution of Soil Samples under different Potassium rating

Classes	Range (kg ha^{-1})	No. of Samples	% of Samples
Low	< 135	0	0
Medium	135 – 335	39	28.06
High	> 335	100	71.94

Table.8 Distribution of Soil Samples under different Sulphur rating

Classes	Range (kg ha^{-1})	No. of Samples	% of Samples
Low	< 22.5	20	14.39
Medium	22.5 – 35	98	70.50
High	> 35	21	15.11

Table.9 Distribution of Soil Samples under different Boron rating

Classes	Range (mg kg^{-1})	No. of Samples	% of Samples
Deficient	< 0.5	139	100
Sufficient	0.5 – 1.0	0	0
High	> 1.0	0	0

Table.10 Distribution of Soil Samples under different Iron rating

Classes	Range (mg kg^{-1})	No. of Samples	% of Samples
Deficient	<4.5	0	0
Sufficient	4.5-9.0	52	37.41
High	>9.0	87	62.59

Table.11 Distribution of Soil Samples under different Copper rating

Classes	Range (mg kg^{-1})	No. of Samples	% of Samples
Deficient	<0.2	0	0
Sufficient	0.2-0.4	0	0
High	>0.4	139	100

Table.12 Distribution of Soil Samples under different Manganese rating

Classes	Range (mg kg^{-1})	No. of Samples	% of Samples
Deficient	<3.5	0	0
Sufficient	3.5-7.0	78	56.12
High	>7.0	61	43.88

Table.13 Distribution of Soil Samples under different Zinc rating

Classes	Range (mg kg^{-1})	No. of Samples	% of Samples
Deficient	<0.6	80	57.55
Sufficient	0.6-1.2	59	42.45
High	>1.2	0	0

References

Balakrishna. 2017. Evaluation of Soil Fertility Status in Soils of Palari Block Under Balodabazar District of Chhattisgarh, M.Sc. (Ag.) Thesis, I.G.K.V. Raipur (Chhattisgarh), Pp.39-80.

Bremner, J.M. and Mulvaney, C.S. (1982) Nitrogen-Total. In: Methods of soil analysis. Part 2. Chemical and microbiological properties, Page, A.L., Miller, R.H. and Keeney, D.R. Eds., American Society of Agronomy, Soil Science Society of America, Madison, Wisconsin, 595-624.

Black, C. A. 1965. Method of soil analysis American Agro Inc., Madison, USA:131.

Lindsay, W. L. & Norvell, W. A. 1978. Development of DTPA soil test for zinc, iron, manganese and copper. *Soil Sci. Soc of Amer. J.* 42: 421-428.

Mandal, S. 2018. Characterization and Delineation of Farming Situations of Chhattisgarh Plains, M. Tech. (Agril.Engg.) Thesis, I.G.K.V. Raipur (Chhattisgarh): 34-50.

Motghare, R., Meher, S. K., Motghare, H., Banwasi, R. and Sahu, K. K. 2020. Evaluation of Soil Fertility Status and its Variation in Arang Block of Raipur District in Chhattisgarh. *Int. J. Curr. Microbio. App. Sci.*, 10: 461-469.

Olsen, S. R., Watanabe F. S., C. V. Cole, & L. A. Dean. 1954. Estimation of Available P in Soils by Extraction with Sodium Bicarbonate. U.S.D.A. Circular No. 939.

Piper, C. S. 1967. Soil and plant analysis. Asian publishing House, Bombay, New Delhi. 85-102.

Sathish, A., Ramachandrappa, B. K., Devaraja, K., Savitha, M. S., Gowda, M. N. T. and Prashanth, K. M. 2017. Assessment of spatial variability in fertility status and nutrient recommendation in alanatha Cluster Villages, Ramanagara District, Karnataka using GIS. *Int.J.Curr.Microbiol.App.Sci* (2017) 6(5): 211-224 https://doi.org/10.20546/ijcmas.2017.605.025

Vaisnow, B., 2010. Evaluation of Soil Fertility Status in *Vertisol* of Dhamtari Block, under

Dhamtari District in Chhattisgarh, M. Sc. (Ag.) Thesis, I.G.K.V. Raipur (Chhattisgarh): 49-115.

Walkely and Black. 1934. Estimation of soil organic carbon by the chromic acid titration method. Soil Sci. 37, 29-38.

Williams, C. & Steinbergs, A. (1969). The evaluation of plant-available sulphur in soils. *Plant and Soil*, 17(3): 279-294.

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