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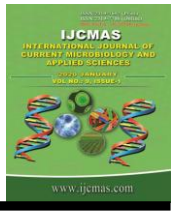

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Relationship between Soil Properties and Available Micronutrient in Inceptisols of Jaijaipur Block of Janjgir-Champa District in Chhattisgarh

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A B S T R A C T

A Study was undertaken to evaluate the fertility status of Jaijaipur block in Janjgir- Champa district, Chhattisgarh covering 105 villages during 2011-2012. The systematic collection of samples in geo–referenced surface (0-0.15m) soils samples from 1507 sites representing *Inceptisols.* using Global Positioning System. The samples were analyze for DTPA-extractable zinc, copper, iron, manganese content for delineation of the fertility status in relation to salient physico-chemical characteristics. The statistical description of soil characteristics indicated that the pH of the soils varied from 4.3 to 6.9. The electrical conductivity of soil-water suspension ranged from 0.06 to 0.38 dS m^{-1}. The organic carbon content in these soils varied from 0.22 to 0.68%. The DTPA-extractable copper content ranged from 0.04 to 10.80 mg kg^{-1}. The available Mn, Fe and Zn content ranged from 2.9 to 57, 4.3 to 64.8 and 0.1 to 1.98 mg kg^{-1}, respectively. These results indicated that zinc is likely to be constraint for crop production in soils of Jaijaipur block. A positive significant correlation was found between pH and EC in *Inceptisols*, pH had negative and significant correlation ship with available Fe in *Inceptisols* Further, the correlation ship between OC and available micronutrient was found negative & significant with Mn & Fe in *Inceptisols*. The soils are moderately acidic to neutral in reaction, low to medium in organic carbon, The available copper, manganese and iron content showed high level, whereas about 90% area under soils delineated as sufficient in available zinc content.

Introduction

In developing nations like India, where the land-person ratio is rapidly declining, the population of our country is continuously increasing; the only means to fulfill the needs of agricultural produce is through increased productivity without detriment to environment and sustainability. Modern crop production technology has considerably raised the out-put, but has created problem of land degradation, pesticide residual in farm produce, atmospheric and water pollution. In general, Indian soils are poor in fertility, since their nutrients reserves are being consistently depleted over the years with continuous cultivation.

Soil fertility must be periodically estimated as there is continuous removal of macro and micro nutrients by the crop intensively grown in every crop season. In order to achieve higher productivity and profitability, every farmer should realize that fertility levels must be measured as these measurements can then be used to manage soil fertility. It is determined by the presence or absence of nutrients i.e. macro and micronutrients. Balanced nutrient use ensures high production level and helps to maintain the soil health.

Materials and Methods

The soil of experimental site was analyzed for the physico-chemical properties like pH, electrical conductivity, organic carbon, Soil pH was determined in 1:2.5 soil-water suspension after stirring for 30 minutes, by glass electrode pH meter as suggested by Piper. The sample soil used for pH determination was allowed to settle down for four hours then conductivity of supernatant liquid was determined by Solu- bridge as described by Black (1965). Organic carbon was determined by Walkley and Black's (1934) rapid titration method. The micronutrients Cu, Fe, Mn and Zn were extracted by using 0.005M DTPA (Diethyl triamine penta acetic acid), 0.01M calcium chloride dehydrate and 0.1M triethanol amine buffered at 7.3 pH Lindsay and Novell (1978) and concentrations were analyzed by atomic absorption spectrophotometer 4129.

Results and Discussion

Soil fertility is one of the important factor controlling yields of the crops. Soil characterization in relation to evaluation of fertility status of the soils of an area is an important aspect in context of sustainable agriculture production. Soil testing is the key to fertility management while reclamation and rehabilitation of degraded lands is strategic to maintain over all soil health.

The results achieved from the present investigation are presented in this chapter determining the assessment of the soil fertility status of the Jaijaipur Block of Janjgir-champa district. The soil samples were analysed for the physico-chemical properties i.e. pH, electrical conductivity and organic carbon content. DTPA- extractable content of Zn, Fe, Cu and Mn elements determined the micronutrient status of soils. The salient significant correlation findings of the investigation are also presented in systematic manner.

Physico-chemical characteristics

Soil reaction (pH)

A study on soil pH presented in (Table 1) revealed that the soils of farmer's field was acidic to neutral in reaction and pH ranged from 4.3 to 6.9 in *Inceptisols* of Jaijaipur block. In general, out of 1507 samples, 17.5% soils were found slightly acidic, 1% neutral, 72.5% moderately acidic and 9.1% strong acidic in reaction (Table 1).

Electrical conductivity (EC)

The EC ranged from 0.06 to 0.32 dS m^{-1} in *Inceptisols* with an average of 0.16 dS m^{-1}. Data presented in table 1 revealed that in Jaijaipur block, 1256 soil samples were found under 83.3% (0.1-0.2 dS m^{-1}), 0.8% samples under (<0.1 dS m^{-1}), 15.7% samples under (0.2-0.3 dS m^{1}) limits.

Organic carbon (OC)

Data presented in table 1 revealed that most of the soils are having low to medium status of organic carbon. It ranged from 0.22 to 0.68 % with a mean value of 0.45% in *Inceptisols* of Jaijaipur block. The soils of Jaijaipur had 0.3% soil samples in very low, 75% in low and 24.7 % in medium OC status.

The data pertaining to status of available zinc, copper, iron and manganese of Jaijaipur block under investigation are summarized.

Available iron

The available Fe content ranged from 4.3 to 64.8 mg kg^{-1} with an average of 25.85 mg kg^{-1} in *Inceptisols* of study area. High available Fe content in soils of Jaijaipur block might be due to its topography and cultivation of rice, which induced prolonged submergence coupled with reducing conditions. It was concluded from the table 2 that 92% samples recorded higher level of Fe and 0.2 samples observed deficient level of Fe, whereas 7.8 samples recorded sufficient Fe in *Inceptisols*.

Table.1 Distribution and categorization of pH,EC and organic carbon status in soils of Jaijaipur block

Classes	Inceptisols		Limits EC (dS m^{-1})	No. of Samples	Samples %	Organic carbon (%)	No. of Samples	Samples %
	No. of Sample	**% Sample**						
Strongly acid (<5.0)	137	9.1						
Moderately acid (5.0 - 6.0)	1092	72.5	**<0.1**	**12**	**0.8**	**Very Low** (<0.25)	4	0.3
Slightly acid (6.1 – 6.5)	263	17.5	**0.1-0.2**	**1256**	**83.3**	**Low** (0.25-0.50)	1131	75.0
Neutral (6.6 – 7.5)	15	1.0	**0.21-0.3**	**237**	**15.7**	**Medium** (0.50-0.75)	372	24.7
Slightly alkaline (7.6 – 8.5)	0	0.0	**>0.3**	**2**	**0.1**	**High** (>0.75)	0	0.0

Table.2 Available micronutrients status of soils

Available Fe (mg kg^{-1})	Inceptisols		Available Cu (mg kg^{-1})			Available Mn (mg kg^{-1})			Available Zn (mg kg^{-1})		
	No. of Samples	**% Samples**		**No. of Samples**	**% Samples**		**No. of Samples**	**% Samples**		**No .of Samples**	**% Samples**
Deficient <4.5	3	0.2	**Deficient** 0.2	15	1.0	**Deficient** <3.5	1	0.1	**Deficient** <0.6	68	4.5
Sufficient 4.5-9	117	7.8	**Sufficient** 0.2-0.4	70	4.6	**Sufficient** 3.5-7.0	94	6.2	**Sufficient** 0.60-1.2	1374	91.2
High level >9	1387	92.0	**High level** >0.4	1422	94.4	**High level** >7.0	1412	93.7	**High level** >1.2	65	4.3

Table.3 Correlation coefficients (r) between physico-chemical properties and DTPA-extractable Zn, Cu, Fe and Mn in *Inceptisols* of Jaijaipur block

Soil properties	Available Micro-nutrients			
	Cu	**Mn**	**Fe**	Zn
pH	-0.023	-0.014	-0.125**	-0.105**
EC	-0.016	-0.043	-0.022	-0.020
O.C.	0.006	-0.133**	-0.137**	0.009

Available Cu status

The available Cu ranged from 0.04 to 10.80mg $kg^{-1}$with an average value of 1.77g kg^{-1} in *Inceptisols* of study area. Considering deficient (<0.2), sufficient (0.2-0.4) and high (>0.4 mg kg^{-1}) level DTPA-extractable Cu as critical limit (Follett and Lindsay, 1970) in table 2, 94.4% soil samples were found to be in higher level, and only 4.6% in sufficient available content of Cu. in soils of Jaijaipur block (Table 2).

A major group of soils fell under higher level of available copper (>0.4 mg kg-1) *Inceptisols* of Jaijaipur block.

Available Mn status

The available Mn content ranged from 2.9 to 57 mg kg^{-1} with an average of 22.85 mg kg^{-1} in *Inceptisols* of Jaijaipur block.

The DTPA-extractable Mn content estimated from total 1507 soil samples of Jaijaipur block covering about 105 villages observed that nearly 93.7 % samples were having higher level (>7.0 mg kg^{-1}), 6.2% in **s**ufficient level (3.5-7.0 mg kg^{-1}) and 0.1% in deficient (<3.50 mg kg^{-1}) level in available Mn under *Inceptisols.*

Available Zn status

The available Zn ranged from, 0.1 to 1.98 mg kg^{-1} with an average of 0.83 mg kg^{-1} in *Inceptisols*. Considering the soil test rating for DTPA-extractable Zn (<0.6 as deficient, 0.6-1.2 as sufficient and >1.2 mg kg^{-1} as high level) as critical limit for Zn deficiency (Lindsay and Norvell, 1978), 4.5% samples were found to be deficient, 91.2% sufficient and only 4.3% samples were found to be under higher level in available content of Zn (Table 2).

Relationship between soil characteristics and DTPA-extractable Zn, Cu, Fe and Mn in *Inceptisols*

A (Table 3) significant negative correlation was observed between available Fe with pH (r = -0.125**). The possible reason might be due to the formation of insoluble higher valent oxides of Fe at high pH.

The negative and significant correlation (r = -0.105**) of pH was reported with available zinc. The correlation (r = -0.022) of Fe with EC showed a negative and non significant result (Table 3).

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