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## Distribution of DTPA-extractable micronutrients in *Inceptisol* of Balodabazar block in Balodabazar District of Chhattisgarh

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### Abstract

Evaluation of the soil fertility status of *Inceptisol* group of Balodabazar block of Balodabazar district of Chhattisgarh was carried out during 2016-17. Grid based surface (0-15 cm) soil samples were collected by systematic survey from 55 villages in Balodabazar block in such that each 10 ha area represented one sampling point and total 566 soil samples covering all soil types out of this, 566 samples were identified from *Inceptisol*. These samples were analyzed for pH, EC, organic C and DTPA-extractable Zn, Cu, Fe, Mn. The pH varied from 5.0 to 7.9 with the mean value 6.4, EC ranged from 0.10 to 0.70 with the mean value 0.25 dS m<sup>-1</sup>. The variation in organic C content in soil samples was ranged from 0.30 to 0.75 with the mean value 0.59 %. DTPA-extractable Fe, Mn, Cu and Zn status were recorded as 2.30 to 41.98 (19.24 mg kg<sup>-1</sup>), 3.08 to 45.70 (22.59 mg kg<sup>-1</sup>), 0.42 to 3.06 (1.79 mg kg<sup>-1</sup>) and 0.20 to 2.90 (0.81 mg kg<sup>-1</sup>), respectively. Soil pH showed significant and positive correlations with DTPA-extractable Zn and showed negative significant Mn and Fe. EC indicated significant and positive correlated with pH (r=0.199) and positive nonsignificant OC (r=0.057). Soil organic C showed positive and significant correlation with DTPA-extractable Mn and Zn.

**Keywords:** DTPA-extractable Micronutrient, Fertility status, *Inceptisol*

### Introduction

There is an increasing concern about the sustainability of Indian agriculture because of deterioration in soil fertility. The soil is the critical component of the earth system, functioning not only for the production of food, fodder, and fiber but also in the maintenance of local, regional and global environmental quality. Crop production in any particular zone is based on the application, uptake and efficient utilization of plant nutrients by the crops under a specified condition.

A system is sustainable when it improves or at least maintains the quality of soil, water, and atmosphere. Application of chemical fertilizers has been rated as one of the most important production factor affecting the sustainability. Micronutrients are important for maintaining soil health and also increasing the productivity of crops (Yadav and Meena, 2009) [10]. These are needed in very small amounts. The soil must supply micro nutrients for desired growth of plants and synthesis of human food. The status of micronutrients and their interrelationship with soil characteristics is helpful in understanding the inherent capacity of the soil to supply these nutrients to plants. Besides soil characteristics, land use pattern also plays a vital role in governing the nutrient dynamics and fertility of soils (Venkatesh *et al.*, 2003) [8]. Due adoption of intensive exhausting cropping system under a particular land use system may influence physicochemical properties which may modify DTPA-extractable micro nutrients content and their availability to crops. So, analysis of these properties along with micronutrient status of different land use systems may have significant importance.

### Materials and Methods

Balodabazar block is located in Balodabazar district of Chhattisgarh. The nearest major railhead is Bhatapara railway station is 24.8 km away from its district main city. It is located 85.7 km away from capital city Raipur of the Chhattisgarh. A different group of soils covered *viz Inceptisol*, *Alfisol Entisol*, and *Vertisol* under Balodabazar block. The *Inceptisol* group of the soil has been taken for fertility evaluation under various aspects. Soil samples (0-15 cm depth) were collected from Balodabazar block using GPS marked.

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The scale of 1:4000 has been used as the cadastral map for conducting the field survey works. Soil samples (15 cm) were collected from each grid point using soil auger and local spade with proper labels. Soil samples collected from the study area were dried and crushed with the help of wooden rod and passed through 2 mm sieve and stored in properly labeled plastic bags for analysis by adopting standard laboratory methods.

Soil pH was determined by glass electrode pH (Piper, 1967) [5], Electrical Conductivity with Solu-bridge method (Black, 1965) [9], Soil organic C (Walkley and Black, 1934) [9]. Micronutrients Zn, Cu, Fe, and Mn were extracted by using 0.005 M diethylene triamine penta acetic acid (DTPA), 0.01M calcium chloride dehydrate and 0.1M tri-ethanol amine buffered at pH 7.3 (Lindsay and Norvell, 1978) [4] and concentrations were analyzed by atomic absorption spectrophotometer. The data on available Fe, Cu, Mn and Zn of soils were characterized for deficient and adequate status using the threshold values 4.5 mg kg<sup>-1</sup> for Fe, 0.2 mg kg<sup>-1</sup> for Cu, (Katyal and Randhawa, 1983) [3], 3.5 mg kg<sup>-1</sup> for Mn (Shukla and Gupta, 1975) [7] and 0.6 mg kg<sup>-1</sup> for Zn (Katyal, 1985) [2]. The samples were categorized as per the rating limit is given in Table 2.

## Results and Discussion

### Physico-chemical properties of soils

The results of soil analysis pertaining to some salient properties under study are presented in Table 1. The mean values of different parameters indicated that Inceptisol of the area under study was slightly acidic in nature, normal in salinity, low in organic C, available N, P and medium in available K. The mean values of micronutrient status (Zn, Fe, Mn, and Cu) of the soil had sufficient level.

**Table 1:** Salient soil properties of study area

Soil characteristics	Range	Mean
pH (1:2.5, Soil water)	5-7.9	6.4
E.C. (dS m <sup>-1</sup> )	0.10-0.70	0.25
O.C. (%)	0.30-0.75	0.59
Available N (kg ha <sup>-1</sup> )	105-236	202
Available P (kg ha <sup>-1</sup> )	1.2-32.3	18.1
Available K (kg ha <sup>-1</sup> )	116-604	389
Available Fe (mg ha <sup>-1</sup> )	2.30-41.98	19.24
Available Zn (mg ha <sup>-1</sup> )	0.20-2.29	0.81
Available Cu (mg ha <sup>-1</sup> )	0.42-3.06	1.79
Available Mn (mg ha <sup>-1</sup> )	3.08-45.70	22.59

**Table 2:** Limits for the soil test values used for rating the soil

Classification for Ph Values			
Acidic Neutral Saline Alkaline			
<6.5	6.5-7.5	7.5-8.5	7.5-8.5
Classification for total soluble salt content (EC as dS/m)			
Very low Low Medium High			
<1.0	1.0-2.0	2.0-3.0	>3.0
Parameters Very low Low Medium High			
O.C.% <0.25	0.25-0.50	0.50-0.75	>0.75
Micronutrients		Deficient Sufficient High level	
Available Fe (mg ha <sup>-1</sup> )	<4.50	4.50-9.00	>9.00
Available Zn (mg ha <sup>-1</sup> )	<0.60	4.60-1.20	>1.20
Available Cu (mg ha <sup>-1</sup> )	<0.20	0.20-0.40	>0.40
Available Mn (mg ha <sup>-1</sup> )	<3.50	3.50-7.00	>7.00

### Available micronutrient status of soils

The DTPA-extractable Fe content of understudy samples varied from 2.30 to 41.98 mg kg<sup>-1</sup> with an average value of

19.24 mg kg<sup>-1</sup> (Table 1). These findings corroborate with results as reported by Rajeshwar *et al.* (2009) in soils of Krishna district of Andhra Pradesh and also confirm the findings of Vaisnow (2010) in the DTPA-extractable Fe in the soils of Dhamtari block under Dhamtari district in Chhattisgarh. Similar results were also reported by Jatav (2010) [1] in the soils of *Inceptisols* group of Baloda block of Janjgir-Champa district of Chhattisgarh and Shukla (2011) [6] in the *Inceptisols*, *Alfisols* and *Vertisols* orders of Pamgarh block of Janjgir-Champa district of Chhattisgarh. Considering 4.50 mg kg<sup>-1</sup> DTPA-extractable Fe as a critical limit (Table 2) (Lindsay and Norvell, 1978) [4], 1.06% soil samples were found deficient, and 14.84% found sufficient however 84.10% samples recorded higher level of available Fe content (Table 3).

Copper content of *Inceptisol* under study area ranged from 0.42 to 3.06 mg kg<sup>-1</sup> and average value 1.79 mg kg<sup>-1</sup> (Table 1). Considering deficient (<0.2 mg kg<sup>-1</sup>), sufficient (0.2-0.4 mg kg<sup>-1</sup>) and high (>0.4 mg kg<sup>-1</sup>) level DTPA-extractable Cu as a critical limit (Follett and Lindsay, 1970) [4] in table 2, total samples are high level reported by Shukla (2011) [6] and Jatav (2010) [1]. The available Mn content ranged from 3.08 to 45.70 mg kg<sup>-1</sup> with a mean value of 22.59 mg kg<sup>-1</sup> table 1, Considering the soil test rating for DTPA-extractable Mn (<3.50 mg kg<sup>-1</sup> as deficient, 3.50-7.00 mg kg<sup>-1</sup> as sufficient and >7.00 mg kg<sup>-1</sup> as higher level), the data presented in table 3 revealed that 3% of samples were deficient, 15.19% of samples were sufficient and 81.80% samples were found in higher range of available Mn in soils of Balodabazar block. Similar results were also reported by Jatav (2010) [1] in the soils of *Inceptisols* group of Balodabazar block of Janjgir-Champa district of Chhattisgarh and Shukla (2011) [6] in *Inceptisols*, *Alfisols* and *Vertisols* orders of Pamgarh block in Janjgir-Champa district (C.G.).

Available zinc varied from 0.20 to 2.29 mg kg<sup>-1</sup> with an average value 0.81 mg kg<sup>-1</sup> table 1, respectively study area. Considering the soil test rating for DTPA-extractable Zn (<0.60 mg kg<sup>-1</sup> as deficient, 0.60-1.20 mg kg<sup>-1</sup> as sufficient and >1.20 mg kg<sup>-1</sup> as a high level) as the critical limit for Zn deficiency (Lindsay and Norvell, 1978) [4] (Table 2). 44.35% samples were found to be deficient, 33.57% samples sufficient and 22.08% samples were found to be under higher level in available Zn content (Table 3). The results were also supported by Jatav (2010) [1] in the soils of *Inceptisols* group of Baloda block of Janjgir-Champa district of Chhattisgarh and Shukla (2011) [6] in the *Inceptisols*, *Alfisols* and *Vertisols* orders of Pamgarh block of Janjgir-Champa district (C.G.).

**Table 3:** Limits for the soil test values used for rating the soil

Classification for pH values			
Acidic Neutral Saline Alkaline			
50.71	39.40	9.89	-
Classification for total soluble salt content (EC as dS m <sup>-1</sup> )			
Very low Low Medium High			
100	-	-	-
Parameters Very low Low Medium High			
O.C% - 19.79	73.67	6.54	
Micronutrients		Deficient Sufficient High level	
Available Fe (mg ha <sup>-1</sup> )	1.06	14.84	84.10
Available Zn (mg ha <sup>-1</sup> )	44.35	33.57	22.08
Available Cu (mg ha <sup>-1</sup> )	-	-	-
Available Mn (mg ha <sup>-1</sup> )	3.00	15.19	81.80

### Relationship between soil characteristics and available Fe, Mn, Zn and Cu in *Inceptisol* of Balodabazar block

A negative non-significant correlation ( $r = -0.048$ ,  $r = -0.068$ , and  $r = -0.024$ ) of pH was reported with available Fe, Mn, and Cu respectively (Table 4). These results are in conformity with the finding of Shukla (2011). The available Zn was found a positive and significant correlation ( $r = 0.110$ ) with soil pH.

EC showed positive and significant correlation with pH ( $r = 0.199$ ) and there is a positive and non-significant correlation was found between the Fe and OC (0.057) in table 4. Mn showed positive and significant correlation with OC (0.173) it also showed negative and non-significant correlation with pH (-0.068) this result is in accordance with Jatav (2010) [1] and Shukla (2011) [6].

Available Zn showed positive and significant correlation with Mn ( $r = 0.386$ ) followed by OC ( $r = 0.179$ ) and pH ( $r = 0.110$ ). Available Cu showed positive nonsignificant correlation with OC ( $r = 0.025$ ) in table 4.

**Table 4:** Correlation coefficient (r) between physical-chemical properties and DTPA-extractable Fe, Mn, Cu, and Zn of *Inceptisol* of Balodabazar block.

	pH	EC	OC	Fe	Mn	Zn	Cu
pH							
EC	0.119**						
OC	-0.027	-0.032					
Fe	-0.048	-0.001	0.057				
Mn	-0.068	-0.099*	0.173**	0.027			
Zn	0.110**	0.074	0.179**	-0.007	0.386**		
Cu	-0.024	-0.028	0.025	0.087*	0.518**	0.182**	

\*\*Significant at 1% level

\*Significant at 5% level

### References

- Jatav GK. Evaluation of soil fertility status in *Inceptisol* of Baloda blocks in Janjgir district of Chhattisgarh, M. Sc. (Ag.) Thesis, I.G.K.V. Raipur, (Chhattisgarh), 2010, 73.
- Katyal JC. Research achievements of the all India coordinated scheme on micronutrients in soils and plants. *Fertilizer News*. 1985; 30(4):67-81.
- Katyal JC, Randhawa NS. In Micronutrient F. A. O. fertilizer and plant nutrition bulletin No.5, Rome. 1983, 92.
- Lindsay WL, Norvell WA. Development of DTPA soil test for Zn, Fe, Mn, and Cu. *Soil Science Society of America Journal*. 1978; 42:421-428.
- Piper CS. *Soil and Plant Analysis*. Inter science publisher Inc., New York, 1967.
- Shukla AG. Evaluation of soil fertility in soils of Pamgarh blocks, district Janjgir-Champa of Chhattisgarh, M. Sc. (Ag.) Thesis, I.G.K.V. Raipur, 2011.
- Shukla UC, Gupta BL. Response to Mn application and evaluation of chemical extractants to determine available Mn in some arid brown soils of Haryana. *Journal of Indian Society of Soil Science*. 1975; 23:357-364.
- Venkatesh MS, Majumdar B, Kumar K, Patiram. Status of micronutrient cations under various land use systems of Meghalaya. *Journal of Indian Society of Soil Science*. 2003; 51:60-64.
- Walkley A, Black CA. An examination of the deg-jar method for determining the soil organic matter and a proposed modification of the chromic acid titration method. *Soil Science*. 1934; 37:29-38.

- Yadav RL, Meena MC. Available Micronutrients Status and their Relationship with Soil Properties of Degana Soil Series of Rajasthan. *Journal of Indian Society of Soil Science*. 2009; 57:90-92.