Research Article

Estimation of available micronutrients on the basis of correlation between physico-chemical properties of pH, EC, OC and available Fe, Mn, Cu and Zn in *Inceptisol* of Akaltara block of Janjgir district of Chhattisgarh

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**Summary**

A systematic study was done of available micronutrient on the basis of correlation between physico-chemical properties of pH, EC, OC and available Fe, Mn, Cu and Zn in *Inceptisol* of Akaltara block of Janjgir district of Chhattisgarh. Soil samples (0-15 cm. depth) were collected from 79 villages in Akaltara block covering 1000 sites (10000 ha) using the GPS such that one sample represents each grid of 10 ha. based soil area represented. The soil pH varied from 4.8 to 6.70 (mean 5.83) and indicated that soils were found to be strongly acidic to neutral in reaction. The electrical conductivity of the soil varied from 0.06 to 0.36 with mean value of 0.12. The soil was low to medium in organic carbon and varied from 0.23 to 0.66 (mean 0.48). The soil pH showed significant and negative correlation with available Fe, Mn, Cu and Zn. Available Mn and Cu showed significant and negative relationship with electrical conductivity of the soils. The available Fe, Mn, Cu and Zn showed significant and positive correlation with organic carbon under the study.

**Key words:** *Inceptisol*, Micronutrients, Physico-chemical properties

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**Introduction**

Local name of *Inceptisol* is *Matast*. This soil is being used exclusively for growing rice after bunding and leveling. This is soft and non-sticky when wet, easily workable under wet cultivation for puddling and bushening operations (ploughing over standing rice crop) and, therefore, can easily be managed to improve surface water retention for rice cultivation. The soil is marginally suited for upland crops due to lack of structural stability, tendency to surface sealing and hard setting on drying, high susceptibility to erosion and limited water holding capacity. Akaltara is a Taluka comes under Janjgir district in the state of Chhattisgarh and about 79 villages are included under study. For estimation of available micronutrients on the basis of correlation between physico-chemical properties of *Inceptisol* of Akaltara block, a systematic survey was carried out. Surface (0-15 cm depth) soil samples were collected from different villages of this Taluka using GPS marked. The sampling points were taken from the cadastral map of different village by locating in such that from each 10 hectare area may represent one grid based soil sample.

**Resource and Research Methods**

The investigation to evaluate the available micronutrients on the basis of correlation between physico-
chemical properties, a suitable soil sampling strategy was very important. The area was divided into small systematic grids of agricultural land of each village. Spots were fixed, they were navigated and the correct spot with the help of global positioning system (GPS) was finalised. It was fixed sampling sites in the cadastral map, soil samples (15 cm) were collected from each grid point using soil auger and local spade with proper labels. For determination of soil pH glass electrode pH meter in 1:2.5 soil water suspensions was used after stirring for 30 minutes as described by Piper (1967). The soil samples used for pH determination were allowed to settle down the soil particles for 24 hours, and the electrical conductivity of supernatant liquid was determined by Solu-bridge as described by Black (1965). Organic carbon was estimated by Walkley and Black (1934) rapid titration method (1934) as described by Jackson (1967). The micronutrients Zn, Cu, Fe and Mn were extracted by using 0.005M diethylene triamine penta acetic acid (DTPA), 0.01M calcium chloride dehydrate and 0.1M triethanol amine buffered at pH 7.3 (Lindsay and Norvell, 1978) and concentrations were analyzed by atomic absorption spectrophotometer 4129. Standard statistical procedure including correlation studies was adapted to analyze the data.

**Research Findings and Discussion**

The findings of the present study as well as relevant discussion have been presented under following heads:

**Physico-chemical characteristics:**

<table>
<thead>
<tr>
<th>Soil characteristics</th>
<th>Range</th>
<th>Mean</th>
<th>S.D</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH (1:2.5, Soil : water)</td>
<td>4.8 – 6.70</td>
<td>5.83 ± 0.38</td>
<td></td>
</tr>
<tr>
<td>E.C. (dS m⁻¹)</td>
<td>0.06 – 0.36</td>
<td>0.12 ± 0.04</td>
<td></td>
</tr>
<tr>
<td>O.C. (%)</td>
<td>0.23 – 0.66</td>
<td>0.48 ± 0.06</td>
<td></td>
</tr>
</tbody>
</table>

**Correlation studies of micronutrients:**

**Iron:**

A significant negative correlation (r = -0.079*) was observed between Fe and pH (Table 3). This confirms the basic chemistry of Fe availability in various pH level of the soil. Similar results were reported by Minakshi et al. (2005) in soils of Patiala district of Punjab. Negative significant correlation was observed between available Fe and electrical conductivity (r = -0.067*) Table 3. Similar relationship was obtained by Sharma et al. (2006) in soils of Leh district of cold arid region of Ladakh. A significant positive correlation (r = 0.094**) was found between organic carbon and available Fe content (Table 3). The availability of metal ion (Fe) increase with increases in organic matter may supply chelating agents. Yadav and Meena (2009) also reported this similar relationship in Degana soil series of Rajasthan.
Manganese:
Soil pH was negative and significantly correlated with available Mn ($r = -0.122^{**}$) content (Table 3). The possible reason behind this may be due to the formation of insoluble higher valent oxides of Mn at high pH. Kumar et al. (2009) showed that negative significant correlation of available Mn in Dumka series in soils of Santhal Paraganas region of Jharkhand. Negative and non significant correlation was found between available Mn ($r = -0.052$) content and electrical conductivity (Table 3). Similar relationship was obtained by Sharma et al. (2006). Available Mn was positive and significantly correlated ($r = 0.071^*$) with organic carbon (Table 3). Sharma et al. (2006) reported that the available manganese was positively correlated ($r=0.029$) with organic carbon.

Copper:
It was observed a negative significant correlation ($r = -0.174^{**}$) with soil pH and available copper (Table 3). The availability of Cu content show higher values at low pH due to their solubility effects. Meena et al. (2006) reported same relationship between soil pH and available copper in soils of Tonk district of Rajasthan. Negative significant correlation was observed between available copper and electrical conductivity ($r = -0.093^{**}$) in Inceptisol of Akaltara block (Table 3). Similar relationship was obtained by Sharma et al. (2006). A significant positive relationship ($r = 0.116^{**}$) was observed between organic carbon and available copper (Table 3). The availability of metal ion (Cu) increases with increases in organic matter may supply chelating agents. Similar relationship was obtained Minakshi et al. (2005).

Zinc:
The available Zn showed significant and negative relationship ($r = -0.063^*$) with pH (Table 3), thereby indicating that availability of Zn decreased with increase in soil pH. Thakur and Bhandari (1986) also reported same relationship in soils of Saproon valley of Himachal Pradesh. Negative and non significant correlation was found between available Zn ($r = -0.54$) content and electrical conductivity (Table 3). Available Zn was positive and significantly correlated ($r = 0.1^{**}$) with organic carbon (Table 3). This micronutrient is present in sufficient amount so there is positive relation of organic carbon with micronutrient. Similar result was obtained by Minakshi et al. (2005) in soils of Patiala district of Punjab.

**Literature Cited**