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Short communication

MICRONUTRIENT STATUS OF ALLUVIAL SOILS AND THEIR RELATIONSHIP WITH SOIL CHARACTERISTICS

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Micronutrients are important for maintaining soil health and also increasing productivity of crops (Rattan et al. 2009). The soil must supply micronutrients for desired growth of plants and synthesis of human food. Micronutrient deficiency in soils has started limiting several field crops since the introduction of high yielding crop varieties coupled with the use of high analysis fertilizers and increased cropping intensity. Variation in nutrient supply is a natural phenomenon and some of them may be sufficient where others deficient. Although widespread micronutrients deficiency has been observed in soils of Uttar Pradesh (Singh and Singh 1996), the information with respect to availability of micronutrients and soil characteristics of the studied area are lacking. The changes in soil properties may alter the status of available Fe, Mn, Cu and Zn in the soil. The information regarding the status of available micronutrient cations in alluvial soils of Aligarh district, the potential area with respect to crop production, is lacking. The present investigation was, therefore, undertaken to assess the status of available Zn, Cu, Fe and Mn in soils of Aligarh district of Uttar Pradesh in relation to some important soil characteristics.

One hundred and ten surface soil samples (0-15 cm. depth) from alluvial soils of Aligarh district of Uttar Pradesh were collected. The sites selected for the study fairly covered the entire area of the district. The samples were processed and passed through a 2 mm sieve and analysed for some important soil characteristics. The soil pH was measured in 1: 2.5 soils: water suspension by pH meter using glass electrode. The EC was measured in 1: 2.5 soil - water suspensions (Jackson 1973). Organic carbon was determined by Walkley and Black method as outlined by Jackson (1973) and rapid titration method was followed for the estimation of calcium carbonate in soil samples. The available Zn, Cu, Fe and Mn in these soil samples were extracted with DTPA solution (Lindsay and Norvell 1978). Micronutrients were determined in the clear aliquot with the help of an atomic absorption spectrophotometer.

Some important and relevant physico-chemical properties of the soils under study have been presented in Table 1. The pH values of soils ranged from 7.0 to 9.5 indicating that the soils were, in general, alkaline in reaction. EC ranged from 0.12 to 2.87 dSm^{-1} with a mean value of 0.56 dSm^{-1}. Organic carbon content in these soils ranged from 2.6 to 5.9 g kg^{-1} with a mean value of 3.7 g kg^{-1}. Most of the soil samples were rated low in the soil organic carbon content. The low content of organic carbons in these soils has been attributed to high temperature, low rainfall and light texture of the soils. The calcium carbonate ranged between 5.0 and 45.0 g kg^{-1} with a mean value of 17.5 g kg^{-1}. The available Fe in these soils ranged from 2.60 to 19.80 mg kg^{-1} with an average value of 7.47 mg kg^{-1} (Table 1). Yadav and Meena (2009) also reported similar values in soils of Rajasthan. Considering 4.5 mg kg^{-1} as the critical value of DTPA - extractable Fe (Katyal and Rattan 2003), it may be said that 24.5 % soils of Aligarh district were deficient in available Fe. Available Fe was negatively correlated with pH (r = -0.49**) and $CaCO_3$ (r = -0.43**) and positively with organic carbon (r = 0.62**). This increase may be because organic matter acts as chelating eagent. A non significant correlation between available Fe with EC was recorded. Similar relationship of available Fe and pH, $CaCO_3$ and organic carbon was reported by Kumar *et al.* (2011).

Table 1: Physico- chemical characteristics and status of micronutrients in soils Aligarh district

Soil Properties	Range	Mean	Remarks
pH	7.0 - 9.5	--	
EC(dSm^{-1})	0.12 - 2.87	0.56	
$CaCO_3$ (g kg^{-1})	5.0 - 4.50	17.5	
Org. Carbon (g kg^{-1})	2.6-5.9	3.7	
Available Fe(mg kg^{-1})	2.60-19.80	7.47	24.5% Deficient
Available Mn(mg kg^{-1})	1.45-11.40	4.14	34.0% Deficient
Available Cu(mg kg^{-1})	0.15-0.96	0.32	10.0% Deficient
Available Zn(mgkg^{-1})	0.36-1.51	0.61	55.0% Deficient

The available Mn in these soils ranged from 1.45 to 11.40 mg kg^{-1} with a mean value of 4.14 mg kg^{-1} (Table 1). Chaudhary *et al.* (2012) also reported almost similar values in soils of Agra district. On the basis of 2.0 mg kg^{-1} DTPA-extractable Mn as the critical limit (Katyal and Rattan, 2003), it may be assumed that 34 % soils of Aligarh district are

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deficient in available Mn. A significant negative correlation with pH (r = -0.32*) and $CaCO_3$ (r = -0.33*) and positive one with organic carbon (r = 0.62**) was recorded. The EC was found to have non significant correlation with available Mn. Earlier reports of Meena et al. (2006) and Chaudhary et al. (2012) also suggested the negative correlation between pH, $CaCO_3$ and available Mn and positive one between organic carbon and available Mn. It appears from the correlation studies that available Fe, Cu, Zn and Mn have almost similar nature of association with soil properties.

Table 2: Correlation coefficients between physico chemical properties and total and available cationic micronutrients

Soil Properties	Fe	Mn	Cu	Zn
pH	-0.49**	-0.32 *	-0.50**	-0.39**
EC	0.18	0.20	0.19	0.17
CaCO	-0.43**	-0.33*	-0.36**	-0.65**
Org.Carbon	0.62**	0.66**	0.74**	0.81**

**Significant at 5% level **Significant at 1% level*

The available Cu in these soils varied from 0.15 to 0.96 mg kg^{-1} with a mean value of 0.32 mg kg^{-1} (Table 1). Similar results were reported by Bhanwaria et al. (2011) in Mokala soil series of Rajasthan. On the basis of 0.20 mg kg^{-1} DTPA extractable Cu as the critical concentration (Katyal and Rattan 2003), the soils of the district are well supplied with available Cu and only 10% soil samples are deficient in available Cu. These results are comparable with the findings of Kumar et al. (2011) (Table 1). Available Cu was negatively correlated with pH (r = -0.50**) and $CaCO_3$ (r = -0.36**) and positively with organic carbon (r = 0.76**). Similar relationship of available Cu with pH, $CaCO_3$ and organic carbon was reported by Kumar et al. (2011). The available Zn in these soils ranged from 0.36 to 1.51 mg kg^{-1} with a mean value of 0.61 mg kg^{-1} (Table 1). Meena *et al.* (2006) also reported similar results in Tonk soils. Taking 0.60 mg kg^{-1}as the critical value of available Zn in these soils (Katyal and Rattan, 2003), it may be assumed that 55% soils of Aligarh are deficient in available Zn. Available Zn was found to be correlated negatively with pH (r = -0.39**) and $CaCO_3$ (r = -0.65**) but positively with organic carbon (r = 0.81**). The inverse relationship between pH and $CaCO_3$ and available Zn was reported by Meena *et al.* (2006). The positive correlation between organic carbon and available Zn indicates that organic matter increases the availability of soil Zn as indicated by Sharma *et al.* (2003).

Among the four micronutrient cations, deficiency of Zn was found to be widespread in alluvial soils of Aligarh district, Uttar Pradesh. Available Zn, Cu, Fe and Mn were significantly and negatively correlated with pH and calcium carbonate and positively with organic carbon.

REFERENCES

Bhanwaria, R., Kameriya, P.R. and Yadav, B.L. (2011) Available micronutrient status and their relationship with soil properties of Mokala soil series of Rajasthan. *Journal of the Indian Society of Soil Science*, 59, 392-396.

Chaudhary, S., Singh, V. and Bhogal, N.S. (2012) Status of total and available manganese in soils of Agra. *Journal of the Indian Society of Soil Science*, 60: 68-70.

Jackson, M.L. (1973) *Soil Chemical Analysis Prentice*. Hall of India Pvt.Ltd, New Delhi.

Katyal, J.C. and Rattan, R.K. (2003) Secondary and micronutrients: Research gaps and future needs. *Fertilizer News*, **48**, 9-14 and 17-20.

Kumar, Mahesh, Singh, S.K., Rama, P and Sharma, B.K. (2011) Status of available major and micronutrients in arid soils of Churu district of western Rajasthan. *Journal of the Indian Society of Soil Science* **59**, 188-192.

Lindsay, W.L., and Norvell, W.A. (1978) Development of DTPA soil test for zinc, iron, manganese and copper. *Soil Science Society of America Journal* 42, 421-428.

Meena, H.B., Sharma, R.P. and Rawat, U.S. (2006) Status of macro and micronutrients in some soils of Tonk district of Rajasthan. *Journal of the Indian Society of Soil Science* **54**, 508-512.

Rattan, R.K., Patel, K.P., Manjaiah, K.M. and Datta, S.P. (2009) Micronutrients in soil, plant animal and human. *Journal of the Indian Society of Soil Science* 57, 546-558.

Sharma, R.P., Megh Singh and Sharma, J.P. (2003) Correlation studies on micronutrients vis-à-vis soil properties in some soils of Nagaur district in semi arid region of Rajasthan. *Journal of the Indian Society of Soil Science* **51**, 522-527.

Singh, V. and Singh, S. (1996) Relation of available micronutrients in soils and plants. *Journal of the Indian Society of Soil Science* **44**, 800-802.

Yadav, R.L. and Meena, M.C. (2009) Available micronutrients status and their relationship with soil properties of Degana soil series of Rajasthan. *Journal of the Indian Society of Soil Science*, 57, 90-92.