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STATUS OF MICRONUTRIENTS IN SOILS OF DISTRICT BHIMBER (AZAD JAMMU AND KASHMIR)

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ABSTRACT

A study of the micronutrient status of soils of district Bhimber (Azad Jammu and Kashmir) was made at 30 different locations. The objective of the experiment was to study the status of micronutrients and their relationship with various physiochemical properties. Soil samples were collected at a depth of 0-30cm and analyzed for AB-DTPA extractable Iron, Copper, Zinc, Manganese and hot water soluble Boron. The AB-DTPA extractable Iron, Copper, Zinc and Manganese ranged from 5.37-23.36, 0.59-4.38, 0.74-2.08 and 4.59-21.08 mg kg^{-1}. AB-DTPA extractable Iron, Copper and Manganese was found high in all sites while Zinc was low in 26.66%, medium in 70% and high in 3.34% sites. Hot water soluble (HWS) Boron ranged from 0.02-0.84mg kg^{-1}. Hot water soluble Boron was found low in 80% and medium in 20% sites. AB-DTPA extractable Iron and Manganese gave negative significant correlation with soil pH and lime content, Iron was positively significantly correlated with silt. Copper, Zinc and hot water soluble Boron were positively significantly correlated with organic matter. Both Iron and hot water soluble Boron gave negative significant correlation with sand. Other physiochemical properties of soil showed either negative or positive non-significant correlation with micronutrient during the study.

Keywords: micronutrient, soil, fertility, texture, plant growth.

INTRODUCTION

Soil fertility is an important factor, which determines the growth of plant. Soil fertility is determined by the presence or absence of nutrients i.e. macro and micronutrients. Out of the 16 plants nutrients Zinc, Copper, Iron, Manganese, Molybdenum, Chlorine and Boron are referred as micronutrients. These elements are required in minute quantities for plant growth.

Although micronutrients are required in minute quantities but have the same agronomic importance as macronutrients have and play a vital role in the growth of plants. Micronutrients also increase plant productivity, leaf and grain yield.

Most of the micronutrients are associated with the enzymatic system of plants. Whenever a micronutrient is deficient the abnormal growth of plant results which sometime cause complete failure of crop plants. Grains and flower formation does not take place in severe deficiency.

The main sources of these micronutrients are parent material, sewage sludge, town refuse, farmyard manure (FYM) and organic matter. These nutrients are present in small amounts ranging from few mg kg^{-1} to several thousand mg kg^{-1} in soils.

The availability of micronutrients is particularly sensitive to changes in soil environment. The factors that affect the contents of such micronutrients are organic matter, soil pH, lime content, sand, silt, and clay contents revealed from different research experiments. There is also correlation among the micronutrients contents and above-mentioned properties.

Perveen *et al.* (1993) studied micronutrient status of some agriculturally important soil series of the Northwest Frontier Province, Pakistan, and their relationship with various physic-chemical properties for 30 soil series. DTPA extractable Zinc, Copper, Iron and Manganese and hot water extractable Boron ranged from 0.36-1.84, 0.51-7.92, 3.08-51.00, 0.23-23.75 and 0.10-5.45mg Kg^{-1}, respectively. Zinc was deficient in 4 soil series, marginal in 16 and adequate in remaining soils. Copper and Iron were sufficient in all soils, and Manganese deficient in only one soil series. B was deficient in 10 soil series. Zinc and Boron were positively and significantly correlated with organic matter, and Copper was positively and significantly correlated with soil clay content.

Most sandy soils (coarse texture) are deficient in micronutrients. Clay soils (fine texture) are not comparatively to be low in plant available micronutrients. The study indicates that there is a positive correlation of clay contents with Iron, Copper, Zinc and Boron.

Chhabra *et al.* (1996) studied that available Manganese and Iron decreased with soil pH and available Copper increased with clay and organic carbon content and available Iron decreased with sand content.

Azad Jammu and Kashmir is the liberated part of the state of Jammu and Kashmir. It is lies between longitude 73° 75° and latitude 33° 36° and comprises 5134 square miles. The elevation ranges from 360 meters in the south to 6325 meters in the north. The total area under cultivation is around 172821 hectares. The major crops cultivated are maize, wheat, rice and millet while minor crops include gram, pulse, oil seed, and vegetables. Azad Kashmir divided into seven administrative Districts namely Bhimber, Mirpur, Kotli, Poonch, Bagh, Palandri and Muzaffarabad. District Bhimber comprises mostly plain lands. The soils of this region are generally used for vegetables and crop production. Keeping in view above points this research project was designed to study the micronutrient status of soils of District Bhimber Azad Kashmir.

MATERIALS AND METHODS

This study was designed to determine the status of micronutrients in agriculturally fertile soils of District Bhimber, Azad Jammu and Kashmir. 30 sites were selected for the study. Represented soil samples were collected with wooden tools to avoid any contamination of the soils. Four to six pits were dug for each sample. From each pit sample was collected at a depth 0-30cm. A composite sample of about 1kg was taken through mixing of represented soil sample. All composite samples were dried, ground with wooden mottle and passed through 2mm sieve. After sieving all the samples were packed in the polythene bags for laboratory investigations.

Determinations:

The ammonium bicarbonate diethylene triamine penta acetic acid (AB-DTPA) extractable Zinc, Iron, Copper and Manganese were determined using the method given by Havlin and Sultanpour (1981). Hot water soluble (HWS) Boron was determined by using method as described by Jackson, (1958).

Soil pH was determined in 1:5 soil water suspensions. (U.S.D.A. Hand Book, 1954). Organic matter was determined by Walkely and Black procedure as recommended by Jackson, 1958. Lime content was determined by acid neutralization method. (Black, 1965). Soil texture was determined by hydrometer method. (Koehler *et al.* 1984)

RESULTS AND DISCUSSION

The range and average values of the physio-chemical of the soil samples are shown in the Table-1. The results showed that majority of the soil sites were alkaline in nature with medium amount of organic matter and lime content. Considering textural classes most of the sites were sandy loam. The soil pH ranged from 6.88 to 8.06 (average 7.56). The organic matter content ranged from 0.65 to 2.07 % (average 1.18 %). The lime content ranged from 1.00 to 9.37 % (average 4.18 %).

The range and average values of micronutrient are presented in Table-2. By comparing the extractable micronutrients (Iron, Copper, Zinc and Manganese) and hot water soluble Boron contents with the established criteria of **Soltanpour (1985) and *Johnson and Fixen, 1990, Table-3 , all the soil sites were found high in Iron, Copper and Manganese contents. It was found that 3.34% samples had high, 70% samples had medium and 26.66% samples had low in Zinc content. Boron was found low in 80% sites and medium in 20% sites.

Table-1. Range and average values of Physio-Chemical properties of tested soil samples of District Bhimber, Azad Kashmir.

S. No	Physio-chemical Properties		
		Range	Average
1	**Soil pH**	6.88-8.06	7.56
2	**Organic Matter %**	0.65-2.07	1.18
3	**Lime %**	1.00-9.37	4.18
4	**Sand %**	31.12-81.12	64.39
5	**Silt %**	8.56-46.00	22.99
6	**Clay %**	8.88-26.88	12.95

Table-2. Range and average values of Micronutrients of tested soil samples of District Bhimber, Azad Kashmir.

S. No	Micronutrients ……………mg Kg^{-1}……………..		
		Range	Average
1	**Fe**	5.37-23.36	13.17
2	**Cu**	0.59-4.38	1.70
3	**Zn**	0.74-2.08	1.07
4	**Mn**	4.59-21.08	11.22
5	**B**	0.02-0.84	0.24

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Table-3. Critical soil test values of AB-DTPA extractable Copper, Iron, Manganese, Zinc and HWS B *Johnson and Fixen, 1990 and ** Soltanpour, 1985.

S. NO.	Micronutrients	**Nutrient Content** (mg kg^{-1})		
		Low	**Medium**	**High**
1	**HWS Boron**	<0.5	0.5-1	>1
AB-DTPA-DTPA Extraction Method				
2	**Iron**	<3.0	3.0-5.0	>5.0
3	**Copper**	<0.3	0.3-0.5	>0.5
4	**Zinc**	<0.9	0.9-1.5	>1.5
5	**Manganese**	<0.6	0.6-1.0	>1.0

CORRELATION STUDIES

Simple linear correlation studies of AB-DTPA extractable Fe, Cu, Zn, Mn and hot water soluble B were made with various physio-chemical characteristics are shown in Table-4.

Relation between Iron and Physio-Chemical properties:

The r-value between Iron and soil pH was -0.714. The soil pH was negative significant correlated with Iron content. It can be observed that Iron like the other micronutrients decreases with the increase in soil pH. These results were supported by Rajakumar *et al.* (1996) and Chinchmalatpure *et al.* (2000) who reported negative significant correlation between Iron and soil pH. The correlation coefficient (r) between Iron and organic matter was 0.224. The results revealed that Iron had a positive non-significant correlation with organic matter content. It means that soil rich in organic matter contain more Iron. These results are in agreement with Khalifa *et al.* (1996) and Goldberg *et al.* (2002). The correlation result between Iron and lime content obtained was -0.588. The results showed that Iron had a negative significant correlation with lime content. The result was supported by Chattopadhyay *et al.* (1996) and Chinchmalatpure *et al.* (2000) who reported that Iron was negative significant correlated with lime content. The data given in table 4 shows that there was a negative significant correlation between Iron and sand as r-value was -0.405. It might due to the leaching of nutrients in sandy soils. These results were supported Chhabra *et al.* (1996) who reported negative correlation between Iron and sand content. The r-value between Iron and silt was 0.416. It means that there was positive significant correlation between Iron and silt. Similar results were reported by Sharma *et al.* (1996) who found positive correlation between Iron and silt. The r-value calculated between Iron and clay was 0.068. The result was positive non significant. These findings were supported by Sharma *et al.* (1996) and Haque *et al.* (2000) who found positive correlation between Iron and clay.

Relation between Copper and Physio-Chemical properties:

The r-value between Copper and soil pH was -0.145. It showed that there was negative non-significant correlation between Copper and soil pH. These results were supported by Khattak *et al.* (1994), and Sudhir *et al.* (1997) who calculated negative correlation between Copper and soil pH. The data given in Table-4 shows that Copper was positively significantly correlated with organic matter. The r-value was 0.647. Similar results were reported by Khalifa *et al.* (1996) and Rajakumar *et al.* (1996) who found positive significant correlation between Copper and organic matter. The data presented in Table-4 shows the correlation of Copper with lime content in soil. The r-value was -0.113. The result showed that there was negative non-significant correlation between Copper and lime. These results were similar to Sudhir *et al.* (1997) and Ganai *et al.* (1999) who reported negative correlation between these two. The data regarding the relationship between Copper and sand are given in Table-4. The r-value analyzed was -0.351. The result was negative non-significant. The result was in agreement with Chinchmalatpure *et al.* (2000) who calculated negative correlation between copper and sand content. The correlation value (r) between Copper and silt was 0.287. It showed that silt was positive non-significant correlated with Copper. Similar results studied by Sharma *et al.* (1996) who studied positive correlation between copper and silt content. The r-value obtained between Copper and clay was 0.336. It showed that there was a positive non-significant correlation between Copper and clay. These findings are in agreement with Perveen *et al.* (1993), and Chhabra *et al* (1996) who reported positive correlation between Copper and clay content.

Relation between Zinc and Physio-Chemical properties:

The r value obtained between Zinc and soil pH was 0.086. It means there was positive non-significant correlation between Zinc and soil pH. Similar results were studied by Sheeja *et al.* (1994), Sadashiva *et al.* (1995), and Patiram *et al.* (2000). The correlation coefficient (r) obtained between Zinc and organic matter was 0.623. It concluded that Zinc was positive significant correlated with organic matter. The positive correlation may be due to the formation of organic complexes between organic matter and Zinc that protect it from leaching. These results were similar to the findings of Perveen *et al.* (1993) and Chinchmalatpure *et al.* (2000). The r-value of Zinc Vs lime content was 0.053. It showed that positive non-significant correlation between Zinc and lime content. Similar results were

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derived by Sheeja *et al.* (1994) and Gupta *et al.* (2000). The r-value calculated between Zinc and sand was -0.082. The result was negative non-significant correlation. It might be due to the leaching of Zinc from sandy soils. Similar result was analyzed by Chinchmalatpure *et al.* (2000). The correlation value between Zinc and silt was 0.035. Zinc had positive non-significant correlation with silt. Similar results were studied by Sharma *et al.* (1996) who reported positive correlation between Zinc and silt content. The r value obtained between Zinc and clay was 0.149. The result was positive non-significant. The result was in agreement with Patil and Sonar (1994) and Sharma *et al.* (1996).

Relation between Manganese and Physio-Chemical properties:

The correlation value (r) between Manganese and Soil pH was -0.392. Manganese had negative significant correlation with soil pH. It showed that as pH increases availability of Manganese decreases. These results were in agreement with Chattotadhyay *et al.* (1996) and Patiram *et al.* (2000). The correlation result (r) between Manganese and organic matter was 0.246. The result was positive non-significant. The similar result was studied by Khattak *et al.* (1994) and Chinchmalatpure *et al.* (2000). The correlation value (r) between Manganese and lime content was -0.462. It means Manganese was negatively and significantly correlated with lime content. It may be concluded that liming decreases Manganese content in soil. The result was in agreement with the findings of Chattopadhyay *et al.* (1996) and Sudhir *et al.* (1997). The r-value analyzed between Manganese was -0.249. The result was negative non-significant correlation between Manganese and sand. The result was supported by Chinchmalatpure *et al.* (2000). The correlation coefficient (r) between Manganese and silt was 0.353. The result was positive non-significant. This result was supported by Sharma *et al.* (1996). The correlation value (r) between Manganese and clay was -0.212. The result was negative non-significant correlated between Manganese and clay content. This result was dissimilar to the findings of Sharma *et al.* (1996) and Chinchamalatpure *et al.* (2000) who reported positive correlation between Manganese and clay content.

Relation between Hot Water Soluble Boron and Physio-Chemical properties:

The correlation coefficient (r) obtained between hot water soluble Boron and soil pH was -0.056. The result was negative non-significant. This result was supported by Abid *et al.* (2002) and Kumar and Singh (2003). The r-value recorded between hot water soluble Boron was 0.638. It means hot water soluble Boron was positively significantly correlated with organic matter. These findings were in agreement with Perveen *et al.* (1993) and Goldberg *et al.* (2002) who reported positive significant correlation between hot water soluble Boron and organic matter content. The correlation value calculated between hot water soluble Boron and lime content -0.164. Hot water soluble boron was negative non-significant correlated with lime content. Sudhir *et al.* (1997) and Abid *et al.* (2002) also reported negative correlation between hot water soluble Boron and lime content. The r-value obtained between hot water soluble Boron and sand was -0.407. The results were negative significant correlated between hot water soluble Boron and sand content. These results were supported by Yu and Bell (2002). The correlation coefficient (r) between hot water soluble Boron and silt was 0.342. The results were positive non-significant. Similar results were studied by Yu and Bell (2002) who found positive correlation between hot water soluble Boron and silt content. The correlation value (r) between hot water soluble Boron and clay was 0.274. The result was positive non-significant between hot water soluble Boron and clay content. This result was in agreement with the findings of Goldberg *et al.* (2002) and Nuttall *et al.* (2003) who reported positive correlation between hot water soluble Boron and clay content.

Table-4. Relationship among micronutrients and soil properties of the tested soil samples of District Bhimber, Azad Jammu and Kashmir

Soil	Fe		Cu		Zn		Mn		B	
Properties	r-value	p-value	r-value	p-value	r-value	p-value	r-value	p-value	r-value	p-value
Soil pH	-0.714	0.000**	-0.145	0.444	0.086	0.650	-0.392	0.032*	-0.056	0.767
O.M.	0.224	0.234	0.647	0.000**	0.623	0.000**	0.246	0.189	0.638	0.000**
Lime	-0.588	0.001**	-0.113	0.553	0.053	0.781	-0.462	0.010*	-0.164	0.386
Sand	-0.405	0.026*	-0.351	0.057	-0.082	0.666	-0.249	0.184	-0.407	0.025*
Silt	0.068	0.722	0.336	0.124	0.035	0.856	0.353	0.055	0.342	0.064
Clay	0.146	0.022*	0.287	0.069	0.149	0.430	-0.212	0.261	0.274	0.142

** 1% Significant * 5% Significant

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