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Research Article

TO STUDY THE MICRONUTRIENTS STATUS OF KOWGA AREA DISTRICT BUNER

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Abstract

The project was aimed to study the micronutrients status of some important sites of Kowga, district Buner. Soil samples were collected at a depth of 0 – 30 cm from 16 sites of Kowga district Buner and analyzed for AB-DTPA extractable Zn, Fe, Cu and Mn. The concentration of AB-DTPA extractable Zn, Fe, Cu and Mn ranged from 0.42 – 0.95, 0.57 – 4.02, 2.42 – 3.99 and 4.66 – 9.98mg kg^{-1} with an average of 0.61, 2.87, 3.16 and 6.81mg kg^{-1} respectively. 90 % samples were deficient in Zn while 10 % medium. 50 % samples were found deficient, 30 % medium and only 20% found adequate in Fe concentration. Mn and Cu concentration was found 100 % in soils, which showed that adequate levels of micronutrients in soils are important for optimum crop yield. Soil pH ranged from 7.97 – 8.35 with an average value of 8.2. All the soil samples had pH value above 8 except one which was 7.97. It showed that majority of the sites were alkaline in nature which shows that. Soil electrical conductivity (EC) ranged from 0.30 – 0.43dS m^{-1} which showed that soils were non saline, normal. Soil organic matter (SOM) ranged from 0.15 to 2.12% with an average value of 0.95 %. Lime content ($CaCo_3$) ranged from 7. 43 to 17.5 % with an average value of 11.94 %. According to criteria set by Rashid and Ahmad (1998), 15 samples were found deficient, while only one sample was in medium range. Fe; 10 soil samples collected were found low, 5 samples were in medium and 1 sample was in adequate iron concentration. The AB-DTPA extractable copper was found high in all the sites. The AB-DTPA extractable manganese was found high in all the sites.

Key words: AB-DTPA extractable Zn, Fe, Cu and Mn

Introduction

Soil fertility is the important factor, which determines the growth of plant. Fertility refers to the ability of soil to supply essential nutrients to the soil in adequate, balanced and available amount. So fertility is determined by the presence or absence of nutrients i.e. macro and micronutrients.

Out of the 16 plant nutrients zinc, copper, iron, manganese, molybdenum, chlorine and boron are referred as micronutrients. These nutrients are required in minute quantities for plant growth but are equally essential. [1]**.** Although micronutrients are required in lesser quantities but have the same agronomic importance as macronutrients have, and play a vital role in the growth of the plants. Micronutrients also increase plant productivity, leaf and grain yield [2].

Most of the micronutrients are associated with the enzymatic system of plants [1]. Whenever a micronutrient is deficient the abnormal growth of plant results which sometimes cause complete failure of crops plants. Grains and flower formation does not take place in severe deficiency.

Zinc plays essential metabolic role in plant and is component of a variety of enzymes such as anhydrases, dehydrases, proteinases, and peptidases.

Copper has an important role in oxidation, photosynthesis, and protein and carbohydrates metabolism and is constituent of a variety of enzymes such as cytochrome oxidase, ascorbic oxidase and lactase.

Manganese is involved in photoproduction of oxygen in chloroplasts and is component of a variety of enzymes such as arginase and phosphotransrase.

Iron is essential in photosynthesis, nitrogen fixation and energy transformation. It is concentrated mainly in chloroplast. It is an important constituent of hemo-proteins and nonheme-proteins, dehydrogenases and ferrodoxins.

Boron activates certain dehydrogenase enzymes and facilitates sugar translocation. It is important for the synthesis of nucleic acid and plant hormones and is essential for cell division and development. It is related to some basic processes such as protein synthesis, nitrogen and carbohydrate metabolism.

The main sources of these micronutrients are parent material, sewage sludge, town's refuse, farmyard

manure (FYM) and organic matter. These nutrients are present in small amounts ranging from few Kg^{-1} to several thousand mg Kg^{-1} in soils [3].

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. There is also correlation among the micronutrients content and above mentioned properties [3].

Most sandy soils (coarse texture) are deficient in micronutrients. Clay soils (fine texture) retain micronutrients more strongly and low in plant available micronutrients. The study indicates that there is a positive correlation of clay contents with Fe, Cu, Zn and B [4].

High pH of Pakistani soils renders the micronutrients less soluble, less bioavailable and therefore their losses through water percolation is restricted, but micronutrients in sloping land are subjected to removal by soil erosion. Farmers rarely add micronutrients through chemical fertilizer and continuous cropping causes nutrients deficiency in some soils. Therefore this study was undertaken to evaluate the status of Zn, Fe, Cu and Mn in part of district Buner.

Material and Methods

Background of the sampling site

The study was designed to determine the status of micronutrients on some agriculturally fertile sites of Kowga, district Buner. Buner is small valley divided into six administrative tehsils. The “Mura Hills” and the “Ilam range” divide it from Swat valley, the “Sinawar range” from Yousafzai, the “Guru Mountains” from Chamla valley and the “Duma range from Puran valley. The total area of Buner is 1,865 square kilometers (720.1 square mi), and the total population is 506,048 (1998). Kowga is the central part of district Buner. The major crops cultivated are maize, wheat, tobacco while minor crops include oil seed, sugarcane and vegetables. It comprises mostly plain lands. The soils of this region are generally used for maize, wheat, tobacco and vegetables production. Keeping in view above points, soil analysis was done to study the micronutrients.

Collection of samples

Sixteen sites were selected for the study. Represented samples were collected. Three to four pits were dug for each sample. From each pit sample was collected at a depth of 0-30 cm. A composite sample of about one kilogram was taken through mixing of represented soil sample. All composite samples were dried, ground with wooden mottle and passed through 2-mm sieve. After sieving all the samples were packed in polythene bags for laboratory analysis.

Determinations

The following soil properties were determined.

Micronutrient status in soil samples

The ammonium bicarbonate diethylene triamine penta acetic acid (AB-DTPA) extractable Zn, Fe, Cu and Mn were determined using the method given by Havlin and Sultanpour (1981) [5]. 15 g soil were taken in 250 conical flask and shaken with 30 mL of AB-DTPA extracting solution for 15-20 minutes on reciprocal shaker. Then filtered the solution through “Watman No 42”. The filtrate was analyzed for iron, copper, zinc and manganese using atomic absorption spectrophotometer.

Soil Electrical Conductivity

Soil EC was determined in 1: 5 soil water suspensions. [4]

Soil pH

Soil pH was also determined in 1: 5 soil water suspensions.

Organic Matter

One g air dried soil was taken in a coeval flask and 10 mL of 0.5 N $K_2Cr_2O_7$ and 20 mL of Conc. H_2SO_4 was added to it. Allowed to stand for 30 min. to complete the reaction. 200 mL, of distilled water was added and suspension was filtered. Indicators, 2 – 3 drops of orthophenopthalein were added to the filtrate and titrate against 0.5 N $FeSO_4.7H_2O$ until the color changed to dark brown at last.

Lime Content

Lime content was determined by acid neutralization method. [4]

Results and Discussion

The analysis was aimed to evaluate the micronutrient status of some selected soils of Kowga, district Buner. The results of chemical properties of the soil samples are given in Table 1. Data regarding micronutrient status of the soil samples are presented in Table 2.

Soil pH

The data regarding the soil pH of the soil samples are given in the Table 1. Minimum and maximum values of soil pH $_{(1:5)}$ were determined from Mer Khane-2 and Damghar-3 respectively. The average values observed were 8.2. All the soil samples had pH value above 8.0. It showed that majority of the sites were

Table: 1.Soil pH, EC, O.M, Lime of surface soil at the depth of 0 – 30 cm.

Sites	Soil pH $_{(1:5)}$	EC (dS m^{-1})	O.M (%)	Lime (%)
Wach Khwar	8.24	0.40	0.15	12.18
Manizai	8.18	0.30	1.99	10.15
Yakhel	8.12	0.34	1.52	11.5
Shahida Abai	8.18	0.33	1.01	12.13
Kowga	8.26	0.38	2.12	17.5
Gul bela	8.25	0.32	1.94	12.48
Mer Khane-1	8.10	0.34	0.98	9.7
Mer Khane-2	8.35	0.34	0.98	12.9
Landi Sara	8.21	0.37	0.59	8.88
Dhand Mera	8.22	0.36	0.19	12.98
Akokhel	8.02	0.40	0.51	14.95
Baba Ziarat	8.26	0.33	0.33	13.25
Damghar-1	7.97	0.43	0.98	9.5
Damghar-2	8.15	0.41	0.80	7.43
Damghar-3	8.31	0.36	0.55	14.4
Damghar-4	8.21	0.38	0.59	11.15
Mean	8.2	0.36	0.95	11.94

Table: 2. Micronutrient Status (mg kg^{-1}) of surface soil at a depth of 0 – 30 cm

S.No	Zn	Fe	Cu	Mn
Wach Khwar	0.69	3.03	3.24	5.91
Manizai	0.70	3.73	3.70	7.39
Yakhel	0.61	3.51	3.99	7.66
Shahida Abai	0.95	4.02	3.69	8.57
Kowga	0.54	0.57	3.15	7.53
Gul bela	0.70	2.64	3.25	6.21
Mer Khane-1	0.68	6.60	2.88	9.98
Mer Khane-2	0.87	2.19	2.94	5.82
Landi Sara	0.62	2.77	2.42	4.66
Dhand Mera	0.51	2.47	3.37	6.22
Akokhel	0.55	2.42	3.17	6.23
Baba Ziarat	0.57	1.99	2.90	5.36
Damghar-1	0.65	3.11	2.92	9.31
Damghar-2	0.71	2.15	2.94	6.45
Damghar-3	0.42	2.02	2.77	5.45
Damghar-4	0.66	2.73	3.23	6.33
Mean	0.61	2.87	3.16	6.81

alkaline and render the micronutrients less soluble and less bioavailable [4].

Organic Matter

The data showing the organic matter content of the soil samples are given in the Table 1. The organic matter content ranged from 0.15 to 2.12%. The average value of organic matter content was 0.95 %. Minimum 0.15% organic matter content was recorded from Wach Khwar while the maximum 2.12% was recorded from Kowga site.

Lime ($CaCO_3$)

The results of the lime content of soil samples are given in Table 1. The lime content ranged from 7. 43 to 17.5 %. The average value observed was 11.94 %. Damghar-2 site had the minimum and Kowga site had the maximum lime content, which showed that the soils are slightly calcareous.

Electrical Conductivity (EC)

The values of the EC of soil samples are given in table 1. The EC ranged from 0.30 dS m^{-1} to 0.43 dS m^{-1}. The average value observed was 0.36 dS m^{-1}. Minimum EC was recorded from Manizai site while the maximum was recorded from Damghar-1 site.

Micronutrient Status of Soils

Zinc (Zn)

The AB-DTPA extractable Zn concentration of the soil samples are shown in Table 2. The AB-DTPA extractable Zn conc. ranged from 0.42 to 0.95 mg kg^{-1} with an average value of 0.61 mg kg^{-1}.

Minimum and maximum Zn contents were observed from Damghar-3(0.42) and Shahida Abai (0.95) respectively. According to criteria set by Rashid and Ahmad (1998), 15 samples were found deficient <0.9 mg kg^{-1}, while only one sample was in medium range (0.9 – 0.15 mg Zn kg^{-1}).

Iron (Fe)

The data regarding the AB-DTPA extractable Fe concentration is presented in Table 2. The AB-DTPA extractable Fe conc. ranged from 0.57 to 4.02 mg kg^{-1} with an average value of 2.87 mg kg^{-1}. The minimum and maximum Fe contents were observed from Kowga and Manizai sites respectively. According to criteria set by Patil, Y. M. and K. R. Sonar [6]. 10 soil samples collected were found low, 5 samples were in medium (3 – 5.0 mg Fe kg^{-1}) and 1 sample was in adequate (5.0 mg Fe kg^{-1}) Fe concentration.

Copper (Cu)

The extractable Cu concentrations of all the sites are presented in Table 2. The AB-DTPA extractable Cu conc. ranged from 2.42 to 3.99 mg kg^{-1} with an average value of 3.16 mg kg^{-1}. Minimum and maximum Cu concentration was found in Landi Sara and Yakhel sites respectively. According to criteria set by Patil, Y. M. and K. R. Sonar [6]. All the soil samples were found adequate in the AB-DTPA extractable Cu concentrations.

Manganese (Mn)

The AB-DTPA extractable Mn concentrations of the sampling sites are presented in Table 2. The AB-DTPA extractable Mn conc. ranged from 4.66 to 9.98 mg kg^{-1} with an average value of 6.81 mg kg^{-1}. Minimum and maximum Mn concentration was found in Landi Sara and Mer Khane-1 respectively. According to criteria set by Patil, Y. M. and K. R. Sonar [6]. All soil samples were found adequate in AB-DTPA extractable manganese concentration.

References

1. Brady NC and Weil RR (1999) The Nature and Properties of Soils. 9th Edition. Macmillan Publishing Company New York. 750 p
2. Black CA (1965) Methods of soil analysis-part-II. Soc.Agron. Inc. Publ. Madison.Wisconsin, USA
3. Perveen S, Tariq M, Farmanullah, Khattak JK and Hamid A (1993) Study of micronutrient status of some important sites of N.W.F.P., Pakistan. Sarhad Journal of Agriculture. 9(5): 467-473.
4. Yu-X and Bell PF (2002) Boron and lime effects on yield and deficiency symptoms of rice grown in greenhouse on acid Typic Glossaqualf. Journal of Plant Nutrition. 25(12): 2591-2602.
5. Havlin, JL and. Sultanpour PN (1981) Evaluation of the AB-DTPA soil test for iron and zinc. Soil. Sci. Am. J. 45:55-70.
6. Patil YM and. Sonar KR (1994) Status of major and micronutrients of swell shrink soils of Mahrashtra. J. Maharashtra. Agric. Univ. 1994, 19 (2): 169-172.