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Status of Micronutrients Uptake by Soil and Tomato Plants – An Analysis

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Abstract: ***Necessary tools to identify optimal concentrations of essential elements required for plant growth is analysis of soil[1, 2]. Some essential elements affects the fertility of soil are copper (Cu), manganese (Mn), zinc (Zn) and Iron (Fe) are known as micronutrients. The micronutrients [9, 10, 11] most commonly tested in laboratories. Crop responses to micronutrient fertilization are uncommon in the certain well-defined situations. This paper including the status of micronutrients in the soil and ash of tomato plants. In soil samples of tomato plant the concentration of Fe, Cu, and Mn was 3.016ppm, 0.365 ppm 16.75ppm and in tomato plant ash the concentration was 0.411ppm, 0.326ppm and 12.06ppm respectively.***

Keywords: Tools, micronutrients, plant ash, optimal concentration, essential elements

1. Introduction

The growth of plants and fertility of soil[3] were affected by the presence of some useful elements known as micronutrients. The concentration of nutrients in plant tissues can be measured in plant extract obtained from fresh plant material, (i.e., tissue analysis), as well as in whole dried plant material. Total plant analysis[4] is quantitative in nature and is more reliable and useful. These micronutrient are analyzed by atomic absorption spectroscopy[5,6]. Atomic absorption is the best technique for determination of the presence and concentrations of metals in liquid samples, Metals include Fe[7, 8], Cu, Mn, Zn and many more. Typical concentrations range in the low mg/L(ppm) range.

Iron (Fe) [7, 8,] - is necessary for the growth of plants, formation of chlorophyll used as micronutrient.The role of Iron in plant metabolism to reversible Fe^{3+}/Fe^{2+} oxidation state. Chloroplast, mitochondrial and peroxisomes are associated with Fe

In redox type reactions. It also found in plants in the formation of levulinic amino acid is play an important role as precursor in chlorophyll synthesis. Iron deficiency causes no. of disease in several parts of plants.

Manganese (Mn) – Mn activates some important enzymes involved in chlorophyll formation Mn is partially dependent on soil pH. The deficiency of Mn in soil inhibits growth of plants.
Copper (Cu) - It is a component of some enzymes and vitamin A.
Zinc (Zn) – Zinc participate in chlorophyll formation, and also activates many enzymes.

2. Materials & Methods

2.1 Sampling

As the purpose of this study was to investigate the percentage composition of some important element, essential for growth and development of plants thus The resultant weight percentage of micronutrients present in tomato plant and their respective soil samples ritae is obtained from following methods. Plant analysis by dry ashing is simple, non-hazardous and less expensive. All soil samples were dried in air for 4 days and then mesh, sieve with 200 µm a pore size. For the determination of micronutrients(Cu,Fe, Mn and Zn)[9] all chemical used were 'A' grade, analyzed by different techniques (chemicals, reagent, Atomic absorption spectrophotometer).

2.2 Determination of Micronutrients [9, 10, 11] (Mn, Fe, Cu, Zn)

Reagents - (A) DTPA extraction solution DTPA – (Diethylene triamine pentacetic acid weigh 1.97 gm DTPA and 1.1 gm $CaCl_2$ into a beaker, Dissolve with DI water and the transfer to 1-L volumetric flask. Into another beaker weight 14.92 gm or add (13.38 ml) Triethanolmine (TEA) transfer with DI water into the 1-L Volume and make up to about 900ml with DI water. Adjust the pH to exactly 7.3 with 6 N HCl and make to 1-L volume with DI water. The final extractant solution is 0.005m DTPA, 0.1 m TEA, 0.1 M $CaCl_2$

(B) Standard Stock Solution:
Prepare a series of standard solution for micronutrients in DTPA extraction solution.
Fe = 0, 1, 2, 3, 4, 5 ppm
Cu = 0, 1, 2, 3, 4, ppm
Zn = 0, 0.2, 0.4, 0.6, 0.8, 1.0 ppm
Mn = 0, 1.0, 1.5. 2.0, 2.5 ppm

3. Procedure

Weight 10 gm air dry soil (2mm) into a 125 ml erlenmeyer flask then Add 20 ml extraction solution, shake for 2 hours on a reciprocal shaker. Filter the suspension though a whatmann No. 42 paper then Measure Zn, Fe, Cu, and Mn directly is the filter by an atomic absorption spectro-photometer (AAS).

4. Results and Discussion

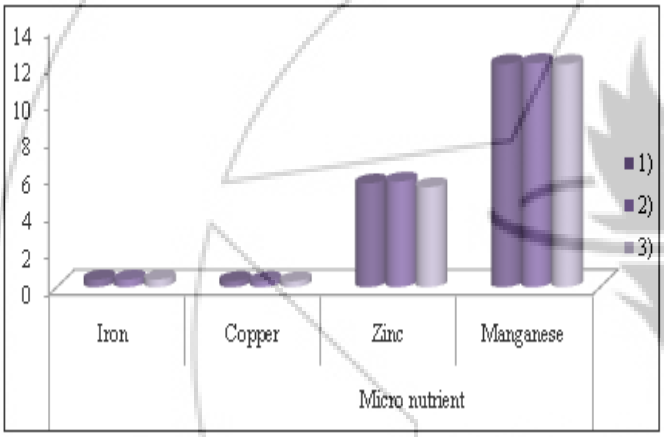
In collected soil samples of tomato plants and their respective plant ash were analyzed by atomic absorption Spectrophotometric method. The results obtained were

shown in Table 1 & 2 for tomato plant soil samples and tomato plant ash samples respectively. From all four micronutrients [9, 10, 11] the concentration of Zn was found in moderate amount.

- In soil samples of tomato plant the average concentration of Fe, Cu, and Mn was 3.063ppm, 0.347 ppm 16.78 ppm and in tomato plant ash the concentration was 0.4083ppm, 0.320ppm and 12.07ppm respectively.
- The concentration of Zn in soil sample of plant is less than that of plant ash The concentration of Zn in case of tomato plant soil samples(1,2&3) and plant ash(1,2&3) was 5.23, 5.99&5.98 ppm and 5.6, 5.4 & 5.7 ppm respectively.

Table 1: Micro nutrients of soil sample of tomato plant

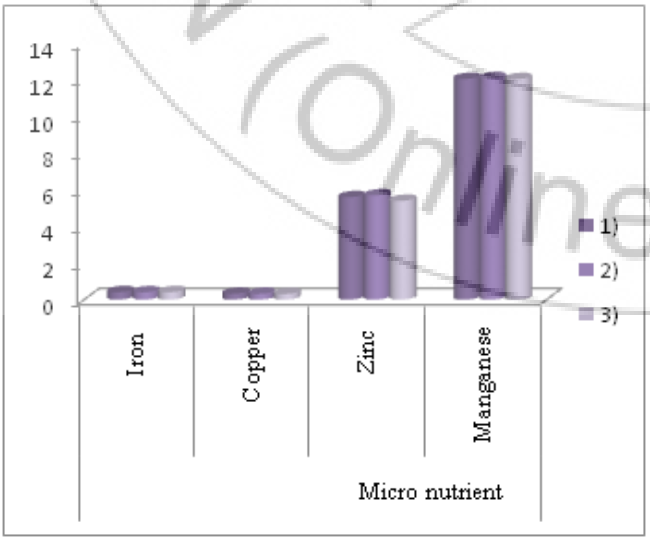
Sample no.	*Micro nutrients*			
	Iron (ppm)	*Copper*	*Zinc*	*Manganese*
1)	3.058	0.367	5.23	16.73
2)	3.061	0.321	5.99	16.86
3)	3.070	0.354	5.98	16.75



Graph 1: Micro nutrients of soil sample of tomato plant

Table 2: Micro Nutrients of Tomato Plant Ash

Sample no.	Micro nutrient			
	Iron	Copper	Zinc	Manganese
1)	0.4117	0.326	5.6	12.06
2)	0.4017	0.322	5.7	12.10
3)	0.4116	0.313	5.4	12.05



Graph 2: Micro nutrients of tomato plant ash

5. Conclusion

Among the all four micro nutrients available Fe, Cu, Mn were sufficiently present in all soil Samples. In those respective areas Zn was found to be marginal. Zn deficiency leads to wide spare nutritional disordered in tomato plants. in case of field crop soil application of ZnSO4 can be done before sowing or transplanting. Foliar spray of ZnSO4 is effective for crops .further application of zinc along with organic manures may enhance the availability and efficiency of native zinc through chelation.

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