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Analysis of microelements in the forest soil of the mahadevpur reserve forests of karimnagar east division, karimnagar district, telangana, India

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ABSTRACT

Mineral elements that are needed by plants in only trace amounts are known as micro-elements or micro-metals or trace elements or micro-nutrients. These elements are as important to the plant's health as macro-elements, but needed in lower quantities. Many of the microelements are enzyme co-factors, which are easily supplied to the plants through the soil. These microelements are Iron (Fe), Copper (Cu), Manganese (Mn), Boron (B), Molybdenum (Mo), Zink (Zn) and Chlorine (Cl).

The forest ecosystems are dominant ecosystems in the sheltered tropical forests of Mahadevpur Reserve Forests of Karimnagar East Division, Karimnagar District of Telangana, India. The various bio-geo-chemical processes that the trace elements undergo during their residence times in the forest ecosystem, ultimately determine their distribution in the forest environment. Different factors such as sediment characteristics, grain size, distribution, mineral composition and organic content may control the partitioning and also the bioavailability of the microelements in the soil.

In the present studies, it provides the information on the distribution of trace metals in the forest ecosystem of Mahadepur Reserve Forests in relation with the sediment organic carbon and their texture. Bimonthly collections of soil sediments are made from January 2014 to June 2014. Hydrographical parameters such as pH, salinity and dissolved oxygen were noted. The oven dried samples were subjected to the textural study by sieving and pipette method followed the Krumbein Pettijohn were analyzed and determined the microelements.

INTRODUCTION

Plants require air, water, light, temperature, soil and more than 40 elements to grow well. Out of this large number of elements 9 macroelements such as are Oxygen (O). Hydrogen (H), Carbon (C), Nitrogen (N), Phosphorus (P), Potassium (K), Calcium (Ca), Magnesium (Mg), Sulphur (S) and 7 microelements such as Iron (Fe), Copper (Cu), Manganese (Mn), Boron (B), Molybdenum (Mo), Zink (Zn) and Chlorine (Cl) respectively are detected as essential for the growth and development of the plants.

As the science of chemistry progresses and the analytical techniques improved, as such the TABLE-

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TABLE 1 : Discovery of microelements for the best green belt

Microelement	Year of discovery	Discovered by
Iron (Fe)	1860	J. Sachs
Manganese (Mn)	1922	J. S. McHague
Boro (B)	1923	K. Warington
Zink (Zn)	1926	A. L. Somner & C. B. Lipman
Copper (Cu)	1931	C. B. Lipman & Mackinney
Molybdenum (Mo)	1938	D. I. Arnon & P. R. Stout
Chlorine (Cl)	1954	T. C. broyer *et al.*

1, had extended to include the microelements that are essential in low concentrations (ppb).

As the social forestation and the green revolution had developed with the increasing demand for higher yields in quantity and quality as such it resulted an increasing demand for the microelements. Also the plant productivity has increased along the years due to genetic development and selection of high yielding cultivars. These cultivars with intensive cultivation methods were found to remove higher quantities of microelements from the soil, leading to deficiencies occurring in many soils.

Therefore, the importance of microelements in plants nutrition is high and they should not be neglected although they are needed in minor quantities. This understanding was developed by the German chemist-Freiherr Justus Von Leibig (1840), who made a major contribution to the biological chemistry. He determined the "Law of the Minimum", which describes the effect of individual nutrients on the plants.

The Leibig's Law of the Minimum, often simply called as the "Leibig's Law", is a principle developed in phytochemistry that states that if one of the nutritive elements is lacking or deficient, plant growth will be restricted when all the other elements are abundant. Any deficiency of the nutrient, no matter how small the amount needed, it will hold back the plant development. If the deficient element is supplied, growth will be increased up to the point, where the supply of that element is no longer the limiting factor. So also, the increasing the supply beyond this point will not be helpful is the criteria of microelements.

Therefore, we are herewith undertaken the analysis of microelements in the different soil samples of the Mahadevpur Reserve Forests of Karimnagar East Division, Karimnagar, Telangana, India, in terms of their importance and functions, through the Krumbein Pettijohn's sieving and pipette method (dichromate method)for total organic carbon.

MATERIALS AND METHODS

In all the soils the microelements are not always present in the solution and their availability is restricted due to several factors, such as oxidation-reduction reactions and pH value. The soil samples taken from Kaleshwaram, Mahadevpur and Prathapgiri areas of the Mahadevpur Reserve Forest Ecosystem are oven dried and subjected to the textural study by sieving and pipette method (dichromate method) followed the Krumbein Pettijohn were analyzed and reported the microelements in the form of TABLE-2.

TABLE-1 elucidates that the neutral soils hold the high concentration of the microelements where as the acidic soils hold moderate concentration and alkaline soils hold less concentration. In this present investigation Fe concentration is found highest Cl concentration found least in the total organic carbon.

RESULTS AND DISCUSSION

The gist of the important functions and deficiencies of the microelements is discussed in detail as follows here under.

Iron (Fe)

Iron is present in the neutral and alkaline soils. Iron is absorbed in the form of Fe++ ions from the

TABLE 2 : Analytical report of the microelements in various samples collected

Sample	pH value	Microelement in mg.
Kaleshwaram	10.0	Fe 72 mg/litre
		Mn 51 mg/litre
		Zn 76 mg/litre
		B 45 mg/litre
		Cu 36 mg/litre
		Mo 64 mg/litre
		Cl 38 mg/litre
Mahdevpur	7.0	Fe 82 mg/litre
		Mn 58 mg/litre
		Zn 80 mg/litre
		B 64 mg/litre
		Cu 47 mg/litre
		Mo 73 mg/litre
		Cl 41 mg/litre
Prathapgiri	4.0	Fe 67 mg/litre
		Mn 50 mg/litre
		Zn 71 mg/litre
		B 30 mg/litre
		Cu 34 mg/litre
		Mo 53 mg/litre
		Cl 28 mg/litre

soil solution. It is found in all most of all parts of the plant and protoplasm. It acts as catalytic agent in chlorophyll synthesis. It helps in the formation of respiratory enzymes and coenzymes like flavoprotein, iron porphyrin, cytochrome peroxidase and catalase. The deficiency symptoms of iron are chlorosis and stoppage of protein synthesis.

Manganese (Mn)

Manganese is present in all the natural soils. It is absorbed in the form of bi, tri and tetravalent ions from the soil solution. It is found in the leaves. It activates the enzymes of Krebs cycle like malic dehydrogenase and oxalosuccinic decarboxylase and the enzymes of nitrogen metabolism like nitrate reductase and hydroxylamine reductase. Also it acts as a cofactor in oxidative phosphorylation. It participates in the primary photochemical reactions of photosynthesis and helps in the formation of chlorophyll. The deficiency symptoms of manganese are retardation in the chlorophyll formation. Necrosis is also observed.

Zinc (Zn)

Zink is found in all types of the soils. It is observed in the form of divalent ions which are released by the weathering of minerals like magnetite, biotite and hornblende. It is highly found in the seeds. It is an important participant in the synthesis of tryptophan and Indol Acetic Acid and protein synthesis. It activates the metabolism of enzyme alcohol dehydrogenase. It enhances the production of cytochrome a and b and cytochrome oxidase. It involves in the formation of enzyme carbonic anhydrase. The deficiency symptom are internal chlorosis and depression in chlorophyll formation. The deficiency of zinc decreases the protein synthesis and creates hindrances in seed formation. The excess zinc promotes antibiotic production in *Fusarium*. It promotes the nicotin productin in in *Nictiana tobaccum.* L.

Boron (B)

Boron is found in all most of all soils. It is present in the form of calcium borate, calcium silicate, manganese borate, manganese silicate and bo-

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ric acid. It is absorbed by the plants in the form of borate ions. It is highly found in woods. Boron implicates various metabolic processes of plants, but especially helps in easy transport of sugars through phloem. Generally it helps in the metabolism of nitrogen, phosphorus, fats and hormones. Also, it plays vital role in the absorption of the salts in photosynthesis. The deficiency symptoms of the boron are causes root and shoot apex and checks flowering. Leaf veins become copper coloured. This deficiency causes "top sickness" disease in tobacco and retards the formation of root nodules in leguminous plants. Its deficiency leads the brittleness in the stem and leaf petioles as in *Vicia faba*.

Copper (Cu)

The source of the copper in the soil is chalcopyrite and copper sulphide. Plants absorb the copper in the form of divalent copper cations. It participates in the formation of phenolase lctase and ascorbic acid oxidase enzymes. It helps in the biosynthesis of chlorophyll and acts as catalyst in oxidation processes. Copper acts as the best fungicide to prevent various diseases like "late blight of potato" and imparts black pigmentation to the spores of *Aspergillus niger.* The deficiency of the copper produces necrotic spots on young leaves. The deficiency causes the diseases like "exanthema" and "moor sickness" in fruit trees and cereals.Molebdenum (Mo):

Molebdenum is found in the organic matter of the soil in the form of molebdenate ions. The chief role of molebdenum is to activate nitrate reductase enzymes during the nitrogen metabolism and carbohydrate metabolism processes. It imparts the middle lamella formation during the cell divisions. It involves in the accumulation of amino acids. It controls ascorbic acid synthesis and synthesis of pectic substances. The deficiency symptoms of molebdenum is chlorotic interveinal mottling of lower leaves followed by marginal necrosis and infolding of the tender leaves. The deficiency results "whiptail" disease in cauliflower.

Clorine (Cl)

Plants absorb the chlorine from the soil solution in the form of chloride ions. Chlorine is an essential in photophosphorylation. It plays the vital role in the transfer of electrons during the photosynthesis processes.

Methods to overcome the deficiency of Microelements: The dilute solutions of soil deficient microelements are prepared in the lab and then sprayed over the young leaves of the plants through foliar applications.

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