

Trace element or Micronutrient

By:

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Green plants are autotrophs. They require inorganic elements for their nutrition. These inorganic elements are supplied by minerals and so these elements are termed as **mineral nutrients** and subsequently the nutrition is referred as **mineral nutrition**.

Altogether 16 essential elements have been known so far in which C,H,O,N,P,S,K,Ca,Mg, and Fe were reported into major quantities while a careful analysis revealed that Mn,Zn,Cu,Mo,B,Cl are also essential though in a very little quantity. Since these elements are needed only in traces; they are termed as **Trace elements or Micronutrient**.

Sources of Trace elements :

Plants obtained the trace elements from soil, as well as water or both, but the ultimate source of trace element is soil.

Factors effecting uptake of Trace element:-

It may be possible that soil has sufficient trace elements but plant fails to absorb them Since their uptake depends upon several soil factors :-

- P^H of soil.
- Organic matter content of soil
- Moisture
- Pore space
- Proportion of clay and silt.
- Size and type of microbial life.

Role of Trace elements:

Although trace elements are present in very little quantity, they play a major and very important role in proper growth and development of plant and absolute lack of any one of these cause the plant to failure in achieving normal growth.

The role, function and symptom caused by deficiency of each trace element may be discussed as follows:-

(A)Manganese

(Occurs 5-1500 ppm of dry weight in plants)

Manganese is present in all plant tissue but is particularly concentrated in green leaves, shoots and seed.

Source :-

Manganese is present in soil in traces(7%).Oxides form of manganese is found in soil .Its solubility increases with the increased acidity and in acidic soils, it is frequently present in toxic concentration.

Function :-

- It is essential for photolysis of water during photochemical reaction.
- It is applicable as Co-factor in oxidative phosphorylation.
- It is utilized as activator in a no. of enzyme particularly dehydrogenase and decarboxylase in respiration and reduction in nitrogen metabolism.
- It function as an oxidizing agent by which conversion of Ferrous to Ferric is done. Abundance of manganese leads to iron deficiency. It plays role in synthesis of chlorophyll.

Deficiency symptom :

- Chlorosis of leaves.
- Necrosis may occur at several spots of leaf.
- Root system is poorly developed.
- Grain formation is reduced.

(B) Boron

(Occurs 2-75ppm of dry weight of plants)

Boron is accumulated in the leaves and reproductive organ and be found in roots and fruits.

Source:-

Boron is present in rocks and marine sediments. The inorganic form in which boron occurs are chiefly borate of Ca ,Mg, and Na. It favours the absorption of calcium.

Function :-

- It controls meristematic activity in leaf cell.
- It is necessary for transport of sugar from leaf cell to other parts.
- It regulates the water intake in the cell.
- It is involved in reproduction and germination of pollen.

Deficiency symptom :

- Leaves show appearance like white stripe, distortion like cupping and curling and reduced growth
- Stem shows abnormal tillering, curling.
- Flowers are produced in lesser number and sterile. Fruits when affected are severely deformed and useless.
- Hollow stem in cauliflower.
- Cracked stem of alfalfa.

(C) Zinc

(occurs 3-150 ppm of dry weight in plants)

Source :

It is present in all soil in minute quantity which is enough to satisfy the need of plants. It becomes less available to plant as P^H of soil increases.

Function :-

- It catalyzes the process of oxidation in plant cell.
- It is vital for transformation of carbohydrate.
- It regulates the consumption of sugar.
- It promotes absorption of water.
- It functions as Co-enzyme of enzyme carbonic anhydrase and several other dehydrogenase and phosphatase.
- It has great role in the formation of spores.

Deficiency symptom :

- Stunted vegetative growth and distorted leaves.
- Chlorosis at interveinal region.
- Suppression of seed formation and malformation of fruits.
- White bud of maize
- Tumour developed behind the growing tips in tobacco.

(D) Molybdenum

Source :

It is found in small amounts in soils and plants but relatively its higher concentration occurs in mineral oils.

Function:

- It is associated with fixation of Atmospheric nitrogen by Azotobacter.
- It helps in synthesis of protein.
- It is Co-factor in synthesis of vitamin 'C'.
- It acts as an activator of some dehydrogenases and phosphatases .

Deficiency symptom :-

- In acute cases necrosis of leaf tissue occurs.
- Inhibition of flower formation.
- Whiptail disease of cauliflower.

(E) Copper

Source:-

Soil is estimated to contain 5-50 ppm copper which is chiefly in the form of sulphate. The availability of copper to plant depend upon P^H value of soil and its humus components.

Function :-

- It is essential for formation of iron porphyrin, a precursor of chloroplast.
- It is a constituent of plastocyanin and thus work in electron transport in photosystem.

Deficiency symptom :

- Both vegetative and reproductive growth are reduced.
- The foliage may show burning of margin.
- Multiple bud formation may occur.
- Reclamation disease in cereals and legumes.

(F) CHLORINE

(Occurs 100-300 ppm of dry weight in plants.)

It is present in plant as water soluble chloride.

Source:-

Chlorine is present in soil as chloride of Na,K and NH_4 . Its availability to plant depends upon its solubility.

Function :

- It function as electron carrier during photosynthesis.
- It is important for normal formation of fruits.

Deficiency symptom :

- Root tips swell in absence of chlorine.
- In severe absence, wilting of leaf tip occur which is followed by chlorosis and finally necrosis.
- Plants fail to form fruit.

(G) IRON

(Occurs 10-15 ppm of dry weight in plants)

Source :-

The soil contain 2-5% iron in the form of ferric and ferrous compound. The ferric is soluble in P^{H} range 3 to above 5 the ferric and ferrous combine with humous to form humate which is soluble in all P^{H} readily available to plants.

Function :

- It is essential to synthesis of chlorophyll.
- It is constituent of cytochrome, ferredoxin, etc.

Deficiency symptom :

- Chlorosis of leaves occur. Young leaves are most affected.
- In extreme conditions scorching of leaf margins and tips may occur.

Some other trace elements :-

In recent years several elements were reported in traces after analysis of plants. Though their deficiencies does not cause any harmful effect, but their use is beneficial for more growth and yield. A brief account of these elements are as follows.:-

Cobalt

If cobalt is provided it favours the synthesis of serine in *Zea mays*. It is an essential element for Myxophyceae algae.

Silicon

It is present in appreciable amount in many plants e.g. *Equisetum*. Deficiency of silicon in rice plant lowers its resistance against diseases.

Conclusion :-

Trace elements are present in very low concentration, but their role in proper growth and development is well pronounced. Lack of any of these below the optimum level causes abnormalities in metabolic activities of plants. It is noted that in complete absence the growth is checked.

The deficiency of these elements may be removed by extra dosage in soil, but it is very difficult to identify the symptom of deficiencies of particular element, because sometimes the deficiency symptom of two elements is quite similar as well as different plant species may show different symptoms for same element.