

Role of Micronutrients in Plant Growth

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SUMMARY

Nutrients are the essential elemental components of soil required for plant growth. Deficiency of these elements creates certain identifiable symptoms. Commonly, these elements are found in soil in the form of their respective salts. There are total 18 essential Nutrients, out of that 9 are classified under Macronutrients and remaining 8 are called micronutrients. The micronutrients are required in small quantity as compare to macronutrients so these nutrients are called micronutrients or oligoelements. Out of 18 essential nutrients Fe, Mn, Zn, Cu, Mo, B, Cl and Ni are known as Micronutrients. These nutrients are required for completing the life cycle of the plant.

INTRODUCTION

Essential plant nutrients play a crucial role in plant growth, development, and overall health by participating in various physiological processes. These nutrients, categorized as macronutrients and micronutrients, are vital for enzyme activation, protein synthesis, energy transfer, and maintaining cell structure. Micronutrients play pivotal roles in maintaining the overall health and vitality of plants. They are involved in various physiological and biochemical processes, each contributing uniquely to plant health and productivity. Micronutrients have a profound influence on the reproductive phases of plants. Their presence at optimal levels during the flowering period can significantly influence both the quantity and quality of seeds produced.

Functions of Micronutrients and their deficiency symptoms

1. Iron

Iron is a constituent of two groups of proteins viz. (a) Heme proteins containing Fe porphyrin complex as a prosthetic group cytochrome oxidase, catalase, peroxidase, leg hemoglobin and (b) Fe-S proteins in which Fe is coordinated to the thiol group of cysteine or to inorganic S ferredoxin. It plays an essential role in the nucleic acid metabolism. It is necessary for synthesis and maintenance of chlorophyll in plants. Iron is an essential micronutrient for almost all living organisms because of it plays critical role in metabolic processes such as DNA synthesis, respiration, and photosynthesis.

Deficiency

Iron deficiency in plants, also known as iron chlorosis, is a common micronutrient disorder that manifests as yellowing (chlorosis) of the leaves, particularly the younger leaves. Plants having less than 50 ppm of Fe are usually classified as iron deficient. Yellowing of young leaves: the most common and noticeable symptoms, while veins remain green – interveinal chlorosis, stunted growth, as the plant struggles to produce sufficient chlorophyll – essential for photosynthesis. Leaf drop, in severe cases, affected leaves may drop prematurely. Poor flower (and fruit) development.

2. Manganese

Mn is an integral component of the water splitting enzyme associated with photosystem II. Because of this role Mn deficiency is associated with adverse effects on photosynthesis and O₂ evolution. Manganese is involved in nitrogen metabolism, particularly in the urea cycle, where it plays a role in the conversion of ammonia to urea. It influences the assimilation and utilization of nitrogen in plants, a crucial element for their growth and development. Manganese affects carbohydrate metabolism by playing a role in enzyme activation related to sugar and starch metabolism. It influences the breakdown and synthesis of carbohydrates, which are essential for energy production and storage.

Deficiency

Mn deficient plant contain less than 25 ppm Mn. Deficiency symptoms of Mn are more severe on middle leaves than on the younger once because Mn is preferentially translocated to the younger tissues. Interveinal

chlorosis in dicotyledonous plants is characterized by the appearance of chlorotic and necrotic spots in the interveinal areas. Pahala blight of sugarcane disease is caused due to the deficiency of Mn.

3. Zinc

Zinc is an essential micronutrient for plant growth, playing a crucial role in various physiological and biochemical processes. It acts as a cofactor for enzymes involved in protein synthesis, carbohydrate metabolism, and hormone (auxin) production, ultimately influencing plant development and productivity. Zinc is essential for protein synthesis, influencing the production of enzymes and structural proteins. It affects amino acid metabolism and helps in the formation of essential amino acids, which are the building blocks of proteins. Zinc is necessary for root development, promoting root elongation and branching, which enhances nutrient and water uptake. It facilitates the absorption and transportation of other essential nutrients, supporting overall plant nutrition.

Deficiency

Zinc deficiency in plants typically manifests as interveinal chlorosis (yellowing between leaf veins), stunted growth, and leaf deformities. Affected plants may also exhibit delayed maturity, reduced yield, and bronzing or purpling of leaves.

4. Copper

Copper (Cu) is an essential micronutrient for plants, playing a vital role in various physiological and biochemical processes. It acts as a cofactor for many enzymes, impacting photosynthesis, respiration, and antioxidant defense systems. It is important in imparting disease resistance to the plants.

Deficiency

Copper is immobile, meaning its deficiency symptoms occur in the newer leaves. Symptoms vary depending on the crop. Typically, the symptoms start as cupping and a slight chlorosis of either the whole leaf or between the veins of the new leaves. Within the chlorotic areas of the leaf, small necrotic spots may form, especially on the leaf margins. As the symptoms progress, the newest leaves are smaller in size, lose their sheen and in some cases, the leaves may wilt.

5. Boron

Boron is an essential micronutrient for plant growth, playing a vital role in cell wall development, cell division, and sugar transport. It also influences hormone development, pollination, and fruit and seed development.

Deficiency

Boron deficiency can lead to stunted root and shoot growth, poor pollination, and reduced yields. Deficiency can inhibit root elongation and lead to the cessation of cell division in the apical meristem.

6. Molybdenum

Molybdenum is an essential micronutrient for plants, playing a vital role in nitrogen metabolism, specifically in the conversion of nitrate to ammonia. It functions in *converting nitrates (NO₃) into amino acids within the plant*. It is essential to the symbiotic nitrogen fixing bacteria in legumes.

7. Chlorine

It plays a major role in osmoregulation (cell elongation, stomata opening) and charge compensation in higher plants. It acts as a cofactor in Mn-containing water splitting enzyme of Photosystem II.

Deficiency

Plants having less than 100 ppm Cl are usually designated as deficient. Deficiency symptoms of chlorine (that include wilting of leaves, curling of leaflets and chlorosis) are similar to that of Mn deficiency.

8. Nickel

Nickel is associated with nitrogen metabolism by way of influencing urease activity. In systems where urea is used as the sole N Fertilizer for foliar spray and Ni – supply is poor, lower urease activity causes urea toxicity to the foliage and leads to severe necrosis of the Root tips. It facilitates transport of nutrients to the seeds or grains.

CONCLUSION

Micronutrients are very important in relation to plant growth because it plays a vital role in plant metabolism. Without these nutrients, a plant cannot complete its life cycle. Deficiency of micronutrients may lead to diseases in a plant.

REFERENCES

Yawalkar K. S, Agarwal J.P and Bokde S (2011) Manures and Fertilizers.

V. K.Nayyar and K. Sudhir Soil fertility Management Chapter No. (26) Fundamental of soil science (2009). Indian Society of Soil Science.