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Micronutrients: Function, Deficiency Symptoms and its Control Measures

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SUMMARY

Micronutrients are essential elements that are used by plants in small quantities. In spite of this low requirement, critical plant functions are limited if micronutrients are unavailable, resulting in plant abnormalities, reduced growth and lower yield.

INTRODUCTION

Plants require food for growth and development. This food composed of certain chemical elements often referred to as plant nutrients of plant- food elements. In the absence of the nutrients plant is unable to complete a normal life cycle or that the element is part of some essential plant constituent or metabolite. There are seventeen most important nutrients for plants. Plants must obtain the mineral nutrients from their growing medium.

Micronutrients:

These nutrients include minerals and vitamins. Unlike macronutrients, these are required in very minute amounts. There are 8 micro nutrients which are essential for plant growth as follows: Iron (Fe), Boron (B), Chlorine (Cl), Manganese (Mn), Zinc (Zn), Copper (Cu), Molybdenum (Mo), Nickel (Ni).

Functions of micronutrients in plants:

1. Iron:

Functions: Helps in chlorophyll formation. Acts as oxygen-carrier in oxidation-reduction reaction and helps in protein synthesis and several metabolic reactions.

Deficiency Symptoms: The new leaves show chlorosis in between veins and the veins remain green.

Control of Deficiency: Spraying of ferrous sulphate on foliage is an effective method in controlling its deficiency. Iron is trans-located very slowly, as a result, after spraying chlorotic-spots may still be in evidence in places which did not receive iron spray. On alkaline soils where iron chlorosis is common, application of iron compounds to the soil have not been very successful because iron is soon rendered insoluble.

2. Manganese:

Functions: Acts as a catalyst in oxidation-reduction reaction and activator of many enzymes and helps in chlorophyll synthesis.

Deficiency Symptoms: Plants having less than 25 ppm Mn content show Mn deficiency symptoms. Deficiency symptoms of Mn are more severe on middle leaves than younger leaves because Mn is preferentially trans located to younger tissues. In Dicotyledons –Internal chlorosis characterized by chlorotic and necrotic spots in the interveinal areas. Cereals / Mono cotyledonous plants –Mn deficiency appear as greenish Grey spots, flecks and stripes on basal leaves. Chlorotic areas become necrotic and turn red, reddish brown or brown.

Control of Deficiency:

Soil application of manganese sulphate was found effective. Spraying is economical since much smaller amount can be employed. The concentration used is 0.2-0.5 per cent manganese sulphate solution at the rate of 500-1000 litre of water per hectare-. Manganese chloride solution may also be used in correcting the deficiency.

3. Boron:

Functions: Helps in the uptake of calcium. Encourages efficient utilization of calcium in plant. Helps in protein synthesis.

Deficiency Symptoms: The leaves thicken and margins roll upward. The leaf tip and margin of older leaves die prematurely. Terminal bud dies. The younger leaves are dwarfed. Diseases due to boron deficiency are: top rot of tobacco, heart rot of sugar beet, lack of head formation in cauliflower.

Control of Deficiency: Boric acid or borax (sodium tetra borate) is used as a foliar spray. Boron is also satisfactorily applied to the soil, either alone or in mixed fertilizers.

4. Copper:
Functions: Helps oxidation-reduction reaction and it is a constituent of certain protein.

Deficiency Symptoms: Plants having less than 5 ppm Cu are regarded as Cu deficient. Chlorosis of younger shoot tissues, white tips, reclamation disease, necrosis, leaf distortion and die-back are the characteristics of Cu deficiency. Male flower sterility, delayed flowering and senescence are most important deficient symptoms of copper.

Control of Deficiency: Copper sulphate is commonly used for the correction of deficiency of copper. It may be applied in soil or used as foliar spray. Solution of copper sulphate and calcium hydroxide is prepared in water for spraying. Without the calcium hydroxide, the copper sulphate injures the foliage

5. Molybdenum:
Functions: Helps in the fixation of atmospheric nitrogen in the roots of legume by nodule bacteria and helps in protein synthesis

Deficiency Symptoms: Curling of leaves and petiole of leaves remain intact but shedding of margin and other parts of leaves.

Control of Deficiency: Sodium molybedate, ammonium molybedate are used in soil and spray application. Its translocation in plant is slow

6. Zinc:
Functions: It is a constituent of a number of enzymes e.g. Carbonic anhydrase, alcohol dehydrogenase, and various peptidases. Helps in the formation of growth hormones (auxines). Enhances heat and frost resistance of plant. Affects the uptake of phosphorus by plants. Acts as a catalyst in chlorophyll formation. Deficiency of zinc in plant leads to reducing sucrose and starch content, decreasing auxin, upsetting protein synthesis and increasing organic acid content.

Deficiency Symptoms: Plants containing less than 15 ppm Zn are regarded as deficient in Zn. Interveinal chlorosis, first appearing on the young leaves, reduction in the size of young leaves, which are often clustered or borne very closely. Bronzing and purple, violet-reddish brown or brown colouration of the foliage.
Rice: Light yellow spots appear which turn to deep brown commonly known as Khaira disease of rice.
Maize: Leaves show white patches which turn to bluish red commonly known as White bud.
Wheat: Leaves show whites to yellow patches, which turn to brown. Earing and maturity delayed.
Dicotyledonous Plants: Short internodes (Rosetting) and decrease in leaf expansion (little Leaf).
Citrus: Little leaf –mottle of leaf or Frenching of citrus.
Cotton: Little Leaf.

Control of Deficiency: In case of soil application method, 20 to 25 kg zinc sulphate per hectare is applied at the time of final land preparation. Its residual effect remains in the soil for 3-4 years. Zinc sulphate is also applied in liquid form on foliage 5 kg zinc sulphate and 2.5 kg lime (calcium hydroxide) are dissolved in 1000 litre of water and spraying of this solution is done over standing crops. Addition of organic matter to soil or growing green manure crops frequently improves crops subject to zinc deficiency.

7. Chlorine

Functions: Chlorine is important for plant photosynthesis as it is involved in the opening and closing of stomata (pores in leaves that enable plants to take in and release carbon dioxide, oxygen and other gases as required. It also helps ensure leaves are firm.

Deficiency Symptoms: Chlorotic leaves, leaf spots, brown edges, restricted and highly branched root system, as well as wilting of leaves at margins and leaf mottling, may occur.

Control of Deficiency: Plants require 1 kg of chlorine for each 4000 kg of dry matter which they produce. Cl-containing fertilizers that may be supplied to plants are those of KCl (47% Cl), $MgCl_2$ and $CaCl_2$ (64% Cl).

8. Nickel

Functions: Nickel is a component of some plant enzymes, most notably urease, which metabolizes urea nitrogen into useable ammonia within the plant. Without nickel, toxic levels of urea can accumulate within the tissue forming necrotic legions on the leaf tips.

Deficiency Symptoms: Nickel deficiency displays no visual symptoms, but can reduce growth and yield of plants.

CONCLUSION

Micronutrients are indispensable like any other essential nutrient. Deficiency or toxicity of these elements in soil adversely affects the growth and development of crops. High crop production per unit area has resulted in greater depletion of available micronutrients.

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