Quadrant II

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Unit: 2

Module Name: Essential Elements and Criteria of Essentiality

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Notes

Unit -2 Mineral Nutrition in plants

Introduction

- Plants use inorganic minerals for nutrition. Complex interactions involving weathering of rock minerals, decaying organic matter, animals, and microbes take place to form inorganic minerals in soil.
- Minerals are vital elements necessary for the growth and development in plants.
- Roots absorb mineral nutrients as ions in soil water.

For example, Zinc is necessary for the manufacture of protein and for cell division**.**

What is Mineral Nutrition?

Mineral Nutrition is defined as the naturally occurring inorganic nutrient found in the soil and food that is essential for the proper functioning of animal and plant body.

Types of Mineral Nutrients

- Chemical analysis of the plant ash has shown that plants contain 60 different elements.
- Some of them are indispensable or necessary for the normal growth and development of the plants and are called as **essential elements**.
- Rest of the elements are called **non-essential elements.**
- It is known that the following 17 elements are essential for majority of the plants: C, H, O, N, P, K, Ca, S,Mg, Fe, Mn, Zn, B, Cu, Ni, Cl, and Mo.
- Besides these, Al, Si, Se, Na, Co, V and Ga may be essential for plants

Major Elements (Macronutrients)

- The essential elements which are required by the plants in comparatively large amounts (1000 mg/kg of dry matter) are called as major elements or Macronutrients. They are: C, H, O, N, P, K, Ca, S, Mg.

Minor Elements (Micronutrients)

The essential elements which are required in very small amounts (less than 100 mg/kg of dry matter) **or traces** by the plants are called as **Minor Elements** or **Micronutrients.**

They are:Fe, Mn, Zn, B, Cu, Ni, Cl and Mo

General Role of Nutrients

- **Balancing function:** Some salts or minerals act against the harmful effects of the other nutrients thus balancing each other.
- **Maintenance of osmotic pressure:** Several minerals cell sap is present in organic or inorganic form to regulate the organic pressure of the cell.
- **Influencing the pH of the cell sap:** Different anions and cations has an influence on the pH of the cell sap.
- **Construction of the plant body:** Carbon, Hydrogen, and Oxygen are elements that help to construct the plant body by entering protoplasm and constitution of the wall.
- **Catalysis of the biochemical reaction:** Certain elements like zinc, magnesium, calcium and copper act as metallic catalysts in biochemical reactions.
- **Effects of Toxicity:** Certain minerals like arsenic and copper has a toxic effect on the protoplasm under specific conditions.

Criteria for Essentiality

The criteria for essentiality of an element are given below:

(a) The element must be absolutely necessary for supporting normal growth and reproduction. In the absence of the element the plants do not complete their life cycle or set the seeds.

(b) The requirement of the element must be specific and not replaceable by another element. In other words, deficiency of any one element cannot be met by supplying some other element.

(c) The element must be directly involved in the metabolism of the plant.

According to Epstein (1972), there are two main criteria to judge essentiality of an element for plant,

- “an element is essential if the plant cannot complete its life cycle (i.e, form viable seeds) in the absence of that element.”
- “an element is essential if it forms part of any molecule or constituent of the plant that is itself essential for the plant”.