07. **MINERAL NUTRITION**

The term, *mineral nutrient* is generally used to refer to an inorganic ion obtained from the soil and required for plant growth. The chemical form in which elements are applied to plants is called as *nutrient*. Nutrition may be defined as the supply and absorption of chemical compounds needed for plant growth and metabolism

The nutrients indispensable for the growth and development of higher plants are obtained from three sources viz., atmosphere, water and soil. The atmosphere provides carbon and oxygen as carbon dioxide. Carbon is reduced during photosynthesis and oxygen is utilized during aerobic respiration. Soil provides the mineral ions.

Essential elements

The term essential mineral element was proposed by Arnon and Stout (1939). These are the composition of both macro and microelements, in the absence of any one of these elements the plant cannot maintain its normal growth and develops deficiency symptoms, affects metabolism and die prematurely. Of the many elements that have been detected in plant tissues, only 16 are essential for all higher plants. They are C, H, O, N, P, K, Ca, Mg, S, Zn, Cu, Fe, Mn, B, Cl and Mo. In the absence of each of the essential elements, plants develop deficiency symptoms characteristic of the deficient element and die prematurely.

Macronutrients

The nutrient elements which are required for the growth of plants relatively in larger quantities are called as *major nutrients* or *macronutrients*. The major elements required for growth of plants are C, H, O, N, P, K, Ca, Mg and S. Among these nutrients, C, H and O are taken up by the plants from the atmosphere and water. The N, P, K, Ca, Mg and S are taken up by the plants from the soil and they are applied in the form of chemical fertilizers either through the soil or foliage.

Micronutrients

The nutrient elements which are required comparatively in small quantities are called as *minor* or *micro nutrients* or trace elements. The micronutrients required for the plant growth are Zn, Cu, Fe, Mn, Mo, B and Cl.

Tracer elements or labeled elements

The nutrient elements that are required for plants are some times labeled and used to study their movement or tracing out the involvement of such nutrients in metabolism in different organs of plants, are called as *tracer elements*. They may either be stable or radio active types and they are also called as *isotopic elements.*

E.g. Stable isotopes: ^{15}N, ^{12}C, ^{31}P

Radio active : ^{14}C, ^{32}P, ^{65}Zn, ^{56}Fe, ^{60}Co, etc.

Hidden hunger

When the plants are not able to meet their requirement either one or more of these essential elements, the plants will undergo starvation for such elements. At the initial stage of deficiency of such elements plants will not show any characteristic symptoms which could be exhibited morphologically and due to want of those elements some activities of plants would rather be affected and the internal deficiency is called as *Hidden hunger.*

General role of essential elements

In general, an element is essential to the life of a higher green plant for one or more of the following three reasons.

1. It may perform a nutritive role by being a component of one or more of the major classes of plant constituents.
2. It may be a catalytic role either as an action for of an enzyme or as an integral component of an enzyme.
3. It may function as a free ion and thereby exert a balancing role in maintaining electro-neutrality within plant cells (e.g. Potassium).

Criteria for essentiality of elements

The demonstration of the essentially several elements (macro and micronutrients), especially, micronutrients is rather very difficult. In view of the technical difficulties associated with demonstrating the essentiality of elements required in very small amounts, Arnon and Stout (1939) suggested the adoption of the following three criteria of essentiality for judging the exact status of a mineral in the nutrient of a plant.

1. The element must be essential for normal growth or reproduction and the plant processes cannot proceed without it.
2. The element cannot be replaced by another element.
3. The requirement must be direct i.e., not the result of some indirect effect such as relieving toxicity caused by some other substance.

Another recent suggestion to the criteria of essentiality is that some elements might better be called *functional or metabolic elements* rather than essential elements. This is intended to indicate that an element that is metabolically active, functional or metabolic may or may not be essential. For example in chlorine-bromine, chlorine is designated as a functional element rather than an essential element as chlorine can be substituted with bromine.

Based on the mobility in phloem, elements are also classified into three types.

1. Mobile elements : N, K, P, S and Mg
2. Immobile elements : Ca, Fe and B
3. Intermediate : Zn, Mn, Cu, Mo

Functions of elements

Protoplasmic elements : N, P, S

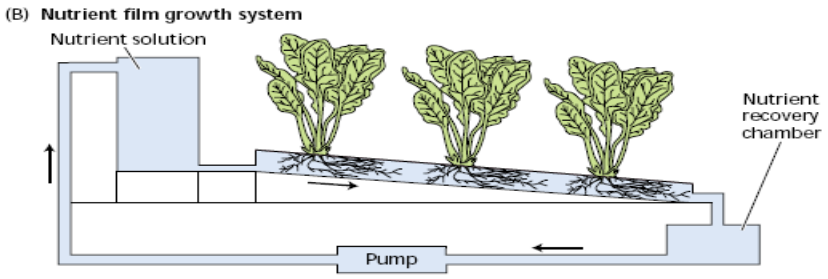
Balancing elements : Ca, Mg, K – counteract to toxic effects of other minerals by causing ionic balance.

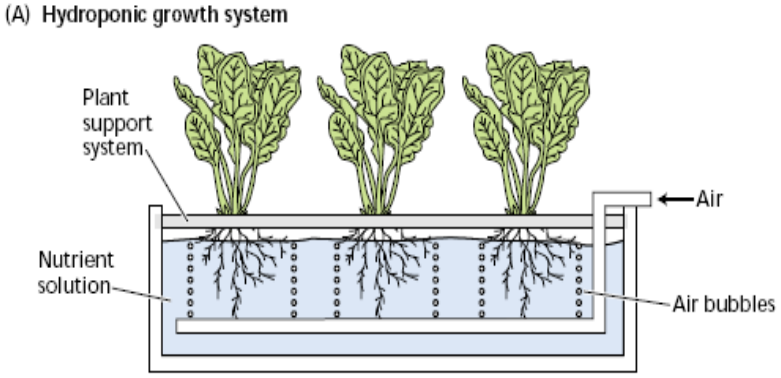
Frame work elements : C, H_2O – as they are the constituents of carbohydrates that form cell walls.

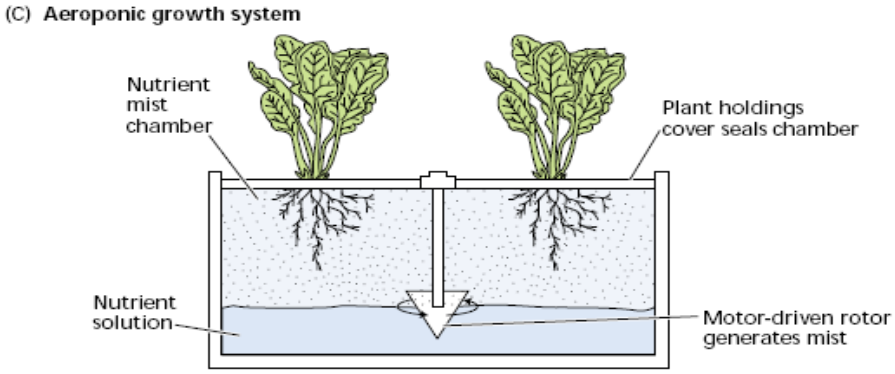
Catalytic elements : Mn, Cu, Mg, etc.

SOIL LESS GROWTH OR HYDROPONICS

The practice of growing plants in nutrient enriched water without soil is called as soil less growth or hydroponics. However, the term hydroponics is now being applied to plants rooted in sand, gravel or other similar matter which is soaked with a recycling flow of nutrient – enriched water.







According to a recent limited nations report on hydroponics: In area of tropics, where the water deficiency is the limiting factor in crop production, the soil less methods hold out much promise because of the more economical use of water.

The report also indicated that in some areas, lack of fertile soil or very thin soil layers may also move soil less methods worth serious consideration.

Besides these the other advantages of growing cucumbers, egg plants, peppers, lettuces, spinach and other vegetables hydroponically under controlled environment are

1. The regulation of nutrients

2. Control of pets and diseases
3. Reduction of labour cost
4. Sometimes quicker yield

But there is two main drawbacks of hydroponics farming.

1. Firstly the cost of settling up the system is very high
2. Secondly it requires skills and knowledge its operation