NCERT Solutions for Class 11

Biology

Chapter 12 – Mineral Nutrition

1. **Comment on the statement that 'All elements that are present in plant need not be essential to its survival'.**

Ans: All elements are not directly involved in the composition of the plant's body that's why they are essential to its survival. If the micronutrients concentration such as Zn, Cl, Fe, Mn, Cu etc., rise above their critical values, they appear to be toxic for the plant.

2. **In the mineral nutrition studies using hydroponics why is the purification of water and nutrient salts plays important role?**

Ans: Hydroponics is a method of growing plants in the absence of soil in a nutrient solution. Since the amount of solution is limited, there are chances of depletion of oxygen and mineral levels in the solution. Hence, the purification of water and nutrient salts is important to maintain optimum growth in the plants.

3. **Give some examples of macronutrients, micronutrients, beneficial nutrients, toxic elements and essential elements.**

Ans: The examples of the said nutrient types in the question are given below:

- The nutrients such as carbon, hydrogen, oxygen, nitrogen, phosphorus, sulphur, potassium, calcium and magnesium are needed in large amounts by the body and are known as macronutrients.
- The nutrients such as iron, manganese, copper, molybdenum, zinc, boron, chlorine and nickel are known as micronutrients.
- Any mineral ion is considered as a toxic element concentration if it reduces the dry weight of tissues by about 10%. For example, the absorption of other elements can be inhibited by manganese concentration.
- The plant nutrients that may not be essential, but are beneficial to plants are known as beneficial nutrients such as sodium, silicon, cobalt and selenium are beneficial to higher plants.

- The macronutrients including carbon, hydrogen, oxygen, nitrogen, phosphorous, sulphur, potassium, calcium and magnesium are required directly for the growth and metabolism of the plants and their deficiency can cause certain symptoms in the plants.

4. Give five deficiency symptoms that occur in plants and describe them with the concerned mineral deficiency.

Ans: The necrosis, stunted plant growth, premature fall of leaves and buds, and inhibition of cell division are some deficiency symptoms in plants.

- The loss of chlorophyll leading to yellowing in leaves is known as Chlorosis. The elements such as N, K, Mg, S, Fe, Mn, Zn and Mo can cause this deficiency.
- The deficiency of certain elements such as Ca, Mg, Cu, K can cause necrosis or death of tissue, particularly leaf tissue.
- Inhibition of cell division can be caused due to lack or low levels of N, K, S, and Mo.
- If the concentration of some elements like N, S, and Mo occur they can delay flowering in plants.
- The deficiencies of Cu and S cause stunted plant growth.

5. How would you find out experimentally that a plant shows a deficiency symptom due to one or more than one nutrient, the real deficient mineral element?

Ans: To find out experimentally that a plant shows a deficiency symptom due to one or more than one nutrient or the real deficient mineral element following experiment can be done.

- Every element shows certain characteristic deficiency symptoms in the plants. If an experimental set-up is prepared where several nutrient media is prepared where only one of the essential minerals is missing.
- Also, one control medium is prepared where all the nutrients are present.
- Now, we place a plant in each medium and record the deficiency symptoms according to the missing mineral element.
- This tabular form will work as the standard information regarding the identification of deficiency symptoms.

- Now we have to note down all the symptoms shown by any specific plant and match them with this standard data.
- The similarities found will let us know which is the real mineral nutrient the plant is missing.

6. Why is that in certain plants deficiency symptoms appear first in younger parts of the plant, while in other they do so in mature organs?

Ans: The older tissues show deficiency symptoms when the elements that are actively mobilised are exported to the young part. For example, the senescent leaves show the deficiency symptoms of nitrogen, potassium and magnesium.
In the older leaves, these elements are available for mobilising to younger leave due to the breakdown of biomolecules containing these elements. When the elements are relatively immobile from the older parts, the young tissues show deficiency symptoms. For example, the structural component of the cell that contains elements like sulphur and calcium does not easily mobilise to the younger tissues.

7. How the absorption of minerals occurs in the plants?

Ans: The mechanism of absorption of minerals can occur in two main phases.

i. In the first phase, the apoplast is passive and uptake of ions into the 'free space' or 'outer space' of cells occurs.
ii. The ions are taken in slowly into the 'inner space' the symplast of the cells in the second phase.

The ion channels, the transmembrane proteins that function as selective pores help in the passive movement. The expenditure of metabolic energy is required for the entry or exit of ions to and from the symplast. The inward movement of molecules into the cells is influx and the outward movement is efflux.

8. In what conditions atmospheric nitrogen can be fixed by Rhizobium and explain their role in Nitrogen-fixation?

Ans: The first essential condition for nitrogen fixation is the legume-bacteria relationship. The enzymes necessary for nitrogen fixation are present in root nodules and thus enable rhizobium to fix nitrogen. The conversion of nitrogen

into ammonia is facilitated by the enzyme nitrogenase which is the first stable product of nitrogen fixation. Ammonia is then converted into glutamic acid. The plants utilize glutamic acid and make amino acids; which are then utilised to make protein.

9. In the formation of a root nodule, what are the steps involved?

Ans: The nodule formation involves many steps and a sequence of multiple interactions between Rhizobium and the roots of the host plant. The nodule formation steps are:

- Firstly, the Rhizobia multiply and colonise the surroundings of roots and epidermal and root hair cells get attached to it. The bacteria invade when the root-hair curls.
- The bacteria are carried into the cortex of the root when an infection thread is produced, where the nodule formation in the cortex of the root is initiated.
- From the thread, the bacteria are released into the cells which lead to the differentiation of specialized cells for nitrogen fixation.
- A direct vascular connection is formed with the host with the help of nodules which help in the exchange of nutrients.

10. Which of the following statements are true? If false, correct them.

i. Boron deficiency leads to stout axis.

Ans: True

ii. Cell needs every mineral element that is present in it.

Ans: False

Correct statement: Out of all the mineral elements, only ^{17} are considered essential elements.

iii. Nitrogen is highly immobile in the plants in the form of nutrient element.

Ans: False.

Correct statement: Nitrogen is very much mobile in plants, as nitrogen is shifted from older parts to younger tissues.

iv. The micronutrients are required only in trace quantities so it is very easy to establish their essentiality.

Ans: True