

Nutritional Requirements of Plants

1. Describe the ecological role of plants in transforming inorganic molecules into organic compounds.
2. Define the term essential nutrient.
3. Explain how hydroponic culture is used to determine which minerals are essential nutrients.
4. Distinguish between macronutrient and micronutrient.
5. Name the nine macronutrients required by plants.
6. List the eight micronutrients required by plants and explain why plants need only minute quantities of these elements.
7. Explain how a nutrient's role and mobility determine the symptoms of a mineral deficiency.

The Role of Soil in Plant Nutrition

8. Define soil texture and soil composition.
9. Explain how soil is formed.
10. Name the components of topsoil.
11. Describe the composition of loams and explain why they are the most fertile soils.
12. Explain how humus contributes to the texture and composition of soils.
13. Explain why plants cannot extract all of the water in soil.
14. Explain how the presence of clay in soil helps prevent the leaching of mineral cations.
15. Define cation exchange, explain why it is necessary for plant nutrition, and describe how plants can stimulate the process.
16. Explain why soil management is necessary in agricultural systems but not in natural ecosystems such as forests and grasslands. Describe an example of human mismanagement of soil.
17. List the three mineral elements that are most commonly deficient in agricultural soils.
18. Explain how soil pH determines the effectiveness of fertilizers and a plant's ability to absorb specific mineral nutrients.
19. Describe problems resulting from farm irrigation in arid regions.
20. Describe actions that can reduce loss of topsoil due to erosion.
21. Explain how phytoremediation can help detoxify polluted soil.

The Special Case of Nitrogen as a Plant Nutrient

22. Define nitrogen fixation and write an overall equation representing the conversion of gaseous nitrogen to ammonia.
23. Explain the importance of nitrogen-fixing bacteria to life on Earth.
24. Summarize the ecological role of each of the following groups of bacteria.
 - a. ammonifying bacteria
 - b. denitrifying bacteria
 - c. nitrogen-fixing bacteria
 - d. nitrifying bacteria
25. Explain why improving the protein yield of crops is a major goal of agricultural research.

Nutritional Adaptations: Symbiosis of Plants and Soil Microbes

26. Describe the development of a root nodule in a legume.
27. Explain how a legume protects its nitrogen-fixing bacteria from free oxygen, and explain why this protection is necessary.
28. Describe the basis for crop rotation.
29. Explain why a symbiosis between a legume and its nitrogen-fixing bacteria is considered to be mutualistic.
30. Explain why a symbiosis between a plant and a mycorrhizal fungus is considered to be mutualistic.
31. Distinguish between ectomycorrhizae and endomycorrhizae.

Nutritional Adaptations: Parasitism and Predation by Plants

32. Name one modification for nutrition in each of the following groups of plants:

- a. epiphytes
- b. parasitic plants
- c. carnivorous plants