Discussion Questions for Ch. 12 Nutrients(2): P, K, Ca, Mg, & Micro

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1. What is the role of phosphorus in plant growth?

2. Would potassium deficiency be a larger issue for younger or older parts of leaves? Why?

3. What are some symptoms of Phosphorus deficiency in plants?

4. In what form is P in the soil? How is P chemically fixed?

5. What are some methods used by plants to increase their uptake of Phosphorus?

6. What are some consequences of excess P fertilizer use?

7. Why do plants need potassium (K)?

8. How is potassium made available to plants in the soil?

Proposed Answers

1. - Essential component of ATP that drives biological processes and needed to make cell membranes and nucleic acids
   - Important for the development of roots
   - Enhances the fundamental processes of photosynthesis, flowering, fruiting, and maturation

2. Older parts of leaves, because potassium is highly mobile and will translocate to older tissues when there is no longer a sufficient supply of potassium in younger leaves.

3. Symptoms of P deficiency may include: Severe stunting, reduction in carbohydrate storage of roots, red or purple color on leaf sheaths and the underside of older leaves.

4. P is always in phosphate form. P is fixed by chemical reactions with certain cations such as: Ca2+, Mg2+, Fe2+, etc. An example of P-fixation is a calcium phosphate ion.
5. There are six specific strategies that plants can employ to uptake more P:
   a. Increase root absorptive area
   b. Chelate iron or aluminum to release P.
   c. Dissolve calcium-phosphate compounds with acid exudates.
   d. Exude phosphatase enzymes to release P from organic compounds.
   e. Exude substances to stimulate P-solubilizing rhizobacteria.
   f. Encourage colonization by mycorrhizal fungi that help plants take up P.

6. Due to the incomplete global cycle of Phosphorus, it is solely released by weathering or through human mining efforts, and the global supply is rapidly reaching a maximum. In addition to this depleted supply, P runoff from industrial agriculture is a key cause of Eutrophication, which leads to excess growth of algae and cyanobacteria. Once these organisms die, the level of increased decomposition by bacteria depletes oxygen in the water, which causes many of the organisms affected to die-- “the dead zone.”

7. It is an essential metal ion for over 60 different enzymes

8. Potassium is made available through rock weathering as well as the wetting/drying process of clay soils due to their cation exchange capacity. The bulk of soil K is held in primary and secondary minerals and is slowly released via the weathering process.