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Role of Phosphorous in Soil and Plant

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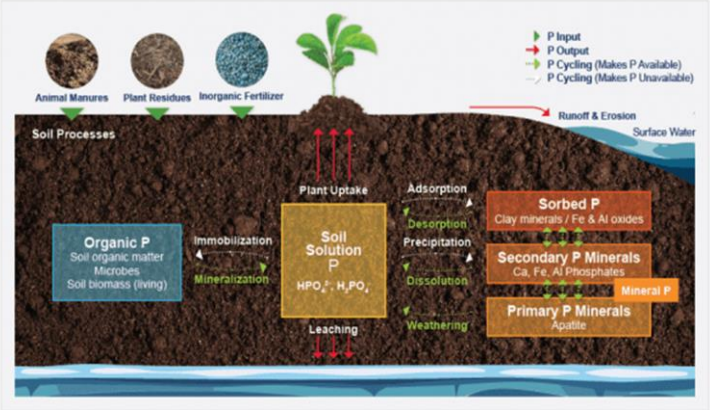
INTRODUCTION

Phosphorus is a macro-element that is necessary for plant nutrition. It is involved in metabolic processes such as energy transport, and degradation and carbohydrate synthesis. Phosphorus is found in organic compounds and minerals in the soil. However, as compared to the overall amount of phosphorus in the soil, the amount of readily available phosphorus is quite low. As a result, phosphorus fertilizers should be used in many circumstances to meet crop requirements.

PHOSPHORUS REACTIONS IN SOIL



Phosphorus is found in soils in both organic and inorganic (mineral) forms, with a low solubility. The phosphorus in the soil solution and the phosphorus in the solid phase of the soil are in equilibrium.

Plants can only take up phosphorus that is dissolved in the soil solution, and because most soil phosphorus is in stable chemical compounds, only a tiny quantity is available to the plant at any given moment.

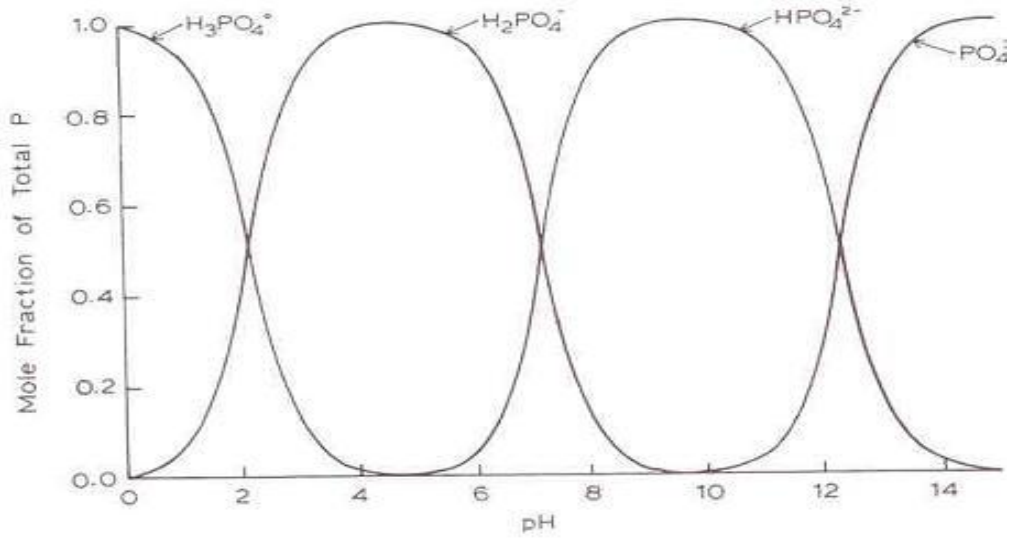
To maintain balance, some phosphorus adsorbed to the solid phase is released into the soil solution when plant roots extract phosphorus from the soil solution.

The sorts of phosphorus compounds found in soil are mostly determined by the pH of the soil as well as the type and amount of minerals present. Aluminium, iron, manganese, and calcium are commonly found in phosphorus mineral complexes.

Phosphorus prefers to react with aluminium, iron, and manganese in acidic soils, whereas calcium is the major fixer in alkaline soils. The pH range 6.0-7.0 is ideal for maximal phosphorus availability.

Decomposition of organic matter and agricultural residue contributes to the amount of phosphorus available in many soils

UPTAKE OF PHOSPHORUS BY PLANTS



Effect of pH on the distribution of orthophosphate ions in solution.

Plants take up phosphorus as the orthophosphate ion HPO4-2 or H2PO4- from the soil solution. The percentage of these two forms absorbed is governed by the soil pH, with higher soil pH resulting in more HPO4-2 absorption.

Because phosphorus mobility in soil is limited, plant roots can only absorb phosphorus from their immediate surroundings.

Plants mostly use active absorption against the concentration gradient because the concentration of phosphorus in the soil solution is low (i.e. concentration of phosphorus is higher in the roots compared with the soil solution).

Because active uptake requires energy, circumstances that restrict root activity, such as low temperatures or abundant water, also inhibit phosphorus uptake.

DEFICIENCY OF PHOSPHORUS

Stunted growth and the dark purple shade of older leaves are signs of phosphorus shortage, as is the suppression of root system development and flowering. When the phosphorus concentration in the leaves falls below 0.2 percent, these symptoms develop in most plants.

EXCESS OF PHOSPHORUS

Phosphorus excess mostly disrupts the absorption of other elements such as manganese, iron and zinc. Phosphorus overfertilization is prevalent, and many producers use excessive amounts of phosphorus fertilisers, especially when compound NPK fertilisers are utilized or irrigation water is acidified with phosphoric acid.