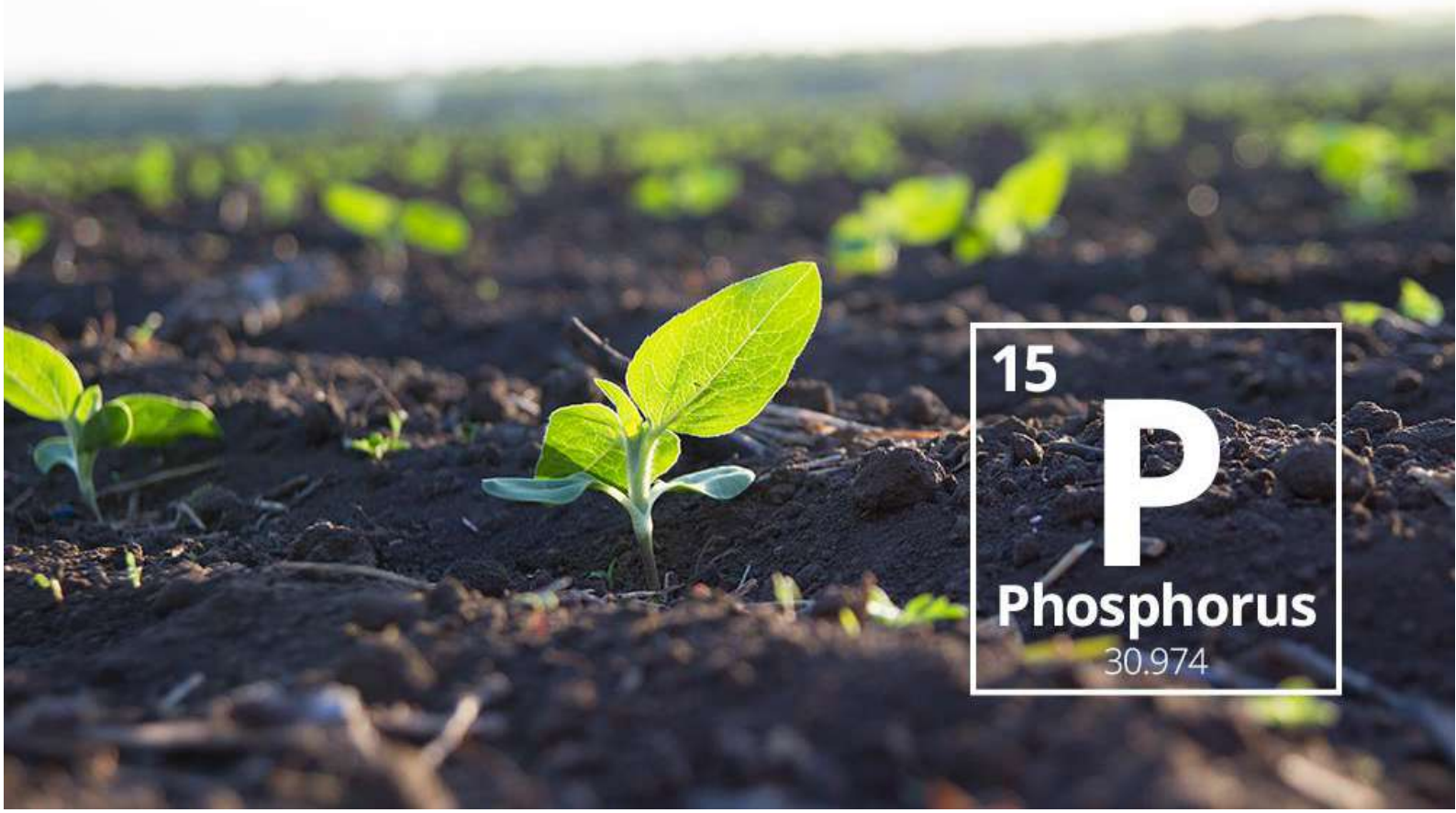

Phosphorus Management: Energy Booster for Seed Growth

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Introduction

Phosphorus (P) is the second most vital nutrient next to nitrogen which serves as building block of several physiological, biochemical and molecular processes in plant growth and development. The word phosphorus was derived from the Greek root 'phos' means light and 'phorus' means bringing and was first discovered by German alchemist, Hennig Brandt in 1669. Phosphorus plays a major role in biological nitrogen fixation, roots development, seed growth and production and resistance to soil-borne diseases in plants. Functioning of several critical metabolic processes such as photosynthesis, respiration, cellular oxidation etc., is directly linked with phosphorus contributing as energy currency for the plant cell. It catalyze several chemical reactions such as the transformation of sugars and starches, nutrient movement within the plant and transfer of genotypic characteristics from one generation to the subsequent generation; being the important component of nucleic acids. Though, P is important role in plant biological processes, its use efficiency is extremely low. Soil pH, temperature, organic matter, soil minerals etc. are the major factors affecting its fixation. So, its management is incredibly important to extending phosphorus use efficiency.

Ways to Increase Phosphorus Use Efficiency

1. Application of phosphatic fertilizers based on soil testing:

Based on the availability of P in soil, a recommended dose of phosphorus should be applied to the field. Several testing approaches discussed by Olsen (1954), Bray's (1945) can be used to test the available P in soil.

2. Method of fertilizer application:

Band placement of P fertilizer 5 cm below the seed and 5 cm away the seed rows with seed cum fertilizer drill is suggested as compared to broadcasting as band placement ensures better contact of fertilizer with roots of the plant.

Fig. Band Placement of Fertilizer

3. System-based approach:

a. In the rice-wheat cropping system, under resource constraints, more P should be applied in wheat crops and the residual effect can otherwise be exploited by rice

crops as it has better capacity to utilize the insoluble fixed forms of P like hydroxy phosphate of Fe, Al and Mn.

b. Use of pigeon pea crop in the cropping system. Pigeon pea releases some organic compounds viz. psidic acid and oxalic acid from its root system which dissolves the unavailable P to make it easily available for plants.

c. Use of Rock phosphate in acid soils and long-duration crops can improve P use efficiency.

4. Root dipping of seedlings in fertilizer slurry:

It can effectively increase P fertilizer use efficiency. Dipping of rice roots in a single super-phosphate (SSP)-soil slurry just before transplanting can increase phosphorus use efficiency by 40-60% of the recommended P dose applied in conventional practice.

5. Use of slow-release fertilizer phosphorus:

These consist of DAP or MAP with high charge density

polymer resulting in larger and longer P availability to the plant. In this context, nano clay-polymer composites (NCPCs) are one of the recent alternatives to current fertilizer deployment and may act as anew viable option in regulating efficient nutrient supply.

6. Use of phosphate solubilizing micro-organisms:

Phosphorus solubilizing micro-organism is one of the important means to extend P use efficiency. Different fungi and bacteria viz. Aspergillus sp., Penicillium sp., Bacillus sp., etc. are some major micro-organisms.

7. Use of Vesicular Arbuscular mycorrhiza (VAM):

It is the symbiotic association between plant roots and fungal hyphae. It is mainly an extension of the root system which is employed for phosphorus mobilization.

Fig: Root Extension with Vesicular Arbuscular Mycorrhizae (VAM)

Conclusion

Phosphorus management is a crucial agronomic practice due to its limited availability. Without proper management, environmental implications like eutrophication can happen which alters the aquatic environment and hampers the lives of aquatic plants and animals. Because of its high immobility and rapid fixation in soil on a wide range of soil pH resulting in low fertilizer use efficiency. Phosphorus management is considered the most complicated among the key nutrients. Fertilizer P use efficiency is often enhanced through its use based on the soil test value, timely application, right source of fertilizer, system-based application and its use under integrated nutrient management. Thus, it can be concluded that phosphorus management with the above-mentioned methods helps increase productivity and sustain soil health.