

Co-application of Rock Phosphate and Zeolite Can Mitigate Phosphorus Deficiency in Soils

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Important plant nutrient next to nitrogen is phosphorus (P). Phosphorus deficiency is widely noticed in soils with low pH or high concentrations of aluminium and iron. It has been found that nearly 30-40% of the cultivated lands in the world is challenged by P deficiency. The extent of P deficiency is found to be high in tropical and subtropical areas. In India, the extent of P deficiency is 49.3%. Moreover, P fertilizers are found to be costly as the raw material is imported from other countries. The raw material is rock phosphate, Yet, high grade rock phosphate is required for manufacture of P fertilizers. According to FAO, it is estimated that about 260 million tonnes (Mt) of RP deposits are available in India and only a fraction of it (about 5.27 Mt) meets the specification of the fertilizer industry because of their low P content (low-grade). Thus, only 10% of native available RP is suitable to produce P fertilizer in India. Recently, ministry of chemicals and fertilizers reported that India can become Aatmanirbhar in phosphatic fertilizers. The Government of India (GOI) has taken an action plan to make use of indigenous rock phosphate for manufacturing P fertilizers.

Low grade RP can be used a source of P fertilizer in phosphorus deficient soils as being a cheap and rich source of phosphorus. However, use of RP is found limited due to its low inherent reactivity that limits the release of adequate quantities of P into the soil solution. It can be a best P fertilizer for acidic soils where it is recommended for direct application. Research studies focused on improving the solubility of RP by using FYM and compost. And found that the application of RP along with organic manure, compost or with phosphorus solubilizing organisms enhances the dissolution of RP in the soil and thus increases the plant availability of P. Organic acids produced during the process of composting can lower the pH and increase the RP dissolution Even employed

techniques such as partial acidification process and dry compaction with water soluble P fertilizers can increase the solubility of RP. These techniques are bit expensive. Although organic matter (FYM/compost) is effective in solubilizing the RP. Its availability is a challenge to farmers. In this context, zeolite is found to be an excellent soil amendment to remediate P fixation in soils. Zeolites are porous crystalline, hydrated alumino-silicate minerals that form in nature as a result of a chemical reaction between volcanic lava and saline water. They are thermally stable at temperatures of up to 700-750°C. Once the zeolites are applied to soil, they do not easily break down over time and therefore, they remain in the soil aiding nutrients retention for long run. Zeolites application leads to less P being fixed by metal oxyhydroxides. Their application along with RP trigger induce-exchange dissolution mechanisms that release P and enhance the P availability as per crop demand. Thus, application of RP along with zeolite can be an effective solution to mitigate the P deficiency in soils. This is found to be cost effective, environment friendly and sustainable solution to address P deficiency in divergent soil types.

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