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Microbial Solubilization of Rock Phosphate to Use in Sustainable Agriculture

Jayawardhane S.G.R. and Yapa P.N.*

Rajarata University of Sri Lanka

*pnyapa40@yahoo.co.uk

Abstract

Microbial solubilization is more environmentally sound method of modifying rock phosphate to use in sustainable agriculture as an alternative to chemical acidulation. Therefore, the present study was carried out to find the strategies for microbial solubilization of Eppawala rock phosphate with using biochar and microbial inoculants and effect of these on maize (*Zea mays* L.) growth and yield. A pot experiment was carried out in the plant house at Faculty of Applied Sciences, Rajarata University of Sri Lanka, Mihintale, during July to December 2015. After searching the literature the following ratios of biochar and RP were selected assuming that the better comparison obtained in different treatments. Treatments were comprised of T₁: soil only, T₂: sterilized soil and 3% RP, T₃: soil and 3% RP, T₄: soil, 20% biochar and 3% RP, T₅: soil, mycorrhizae and 3% RP, T₆: soil, *Pseudomonas fluorescens* and 3% RP, T₇: soil, 20% biochar, mycorrhizae and 3% RP, T₈: soil, 20% biochar, *P. fluorescens* and 3% RP, T₉: soil, mycorrhizae, *P. fluorescens* and 3% RP, and T₁₀: soil, 20% biochar, mycorrhizae, *P. fluorescens* and 3% RP. The treatments were arranged in a Completely Randomized Block Design (CRBD) with eight replicates. Maize was grown as a test plant. Growth parameters were recorded in four weeks intervals and relative growth rate was estimated. After 120 days of seeding, chemical characteristics and yield parameters were also measured. Results indicated that there was a significant difference among treatments ($p < 0.05$) in all measured parameters over control. The highest available soil phosphorus was observed in biochar, mycorrhizae and *P. fluorescens* addition with 3% RP (T₁₀) and highest leaf phosphorus was observed in biochar and mycorrhizae with 3% RP (T₇). Significantly high ($p < 0.05$) relative growth rate, numbers of leaves, length of leaves, shoot and root dry weights were observed in sterilized soil with 3% RP (T₂). This higher growth and yield parameters of T₂ may due to soil heating which increases certain soluble mineral nutrients availability. However, growth rate and yield were shown lower in biochar added treatments (T₄, T₇, T₈ and T₁₀). Short term influence of high amount of (20% v/v) biochar alone in plant growth and yield is less. It can be concluded that biochar, mycorrhizae and *P. fluorescens* are effective in solubilizing the high grade Eppawala rock phosphate. Further, microbial inoculants such as mycorrhizae and *P. fluorescens* increased the soil P availability and increased P nutrition, growth and yield of maize plants.

Keywords: Rock phosphate, biochar, mycorrhizae, *Pseudomonas fluorescens*, phosphorus availability