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Increasing solubility of rock phosphate: Use of phosphobacteria as solubilizing agents

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Eppawala rock phosphate (ERP) is mainly used as the source of phosphorus in organic farming. Phosphorus solubilizing bacteria are reported to have potential use as bio-fertilizers to improve the available phosphate level in agricultural lands. This study was conducted using two bacterial cultures: *Bacillus megaterium* and *Pseudomonas fluorescence* as inocula (provided by Bio Power Lanka (Pvt) Ltd.), to assess their ability to increase the bioavailability of ERP, the persistence in the introduced environment and to ascertain the mechanisms of solubilisation. Bacteria alone and in different combinations were mixed with ERP, either supplemented with or without corn steep liquor and charcoal, as a carrier for the inoculum, and incubated for 30 days (n=3). Water-soluble phosphorus level (Murphy and Riley, 1962), total bacterial count (aerobic plate counts in nutrient agar medium) and phosphobacterial (PSB) count (aerobic plate count in Pikovskaya medium) were determined at 10, 20 and 30 days of the treatment. The change in pH and phosphatase activity (Tabatabai and Bremner, 1969) were evaluated using PVK liquid medium. The data was analysed statistically by analysis of variance (ANOVA) using general linear model with SAS 9.2 and one way ANOVA with Minitab 16 statistical software packages. Phosphate availability of high grade ERP improved ten-fold with microbial inoculations. As expected, the initial total bacterial count was significantly high ($p \leq 0.05$) in inoculated treatments and was 10^{12} cfu/g with a dramatic decline by day 10 (10^5 cfu/g). The rest of the treatments recorded a total count of 10^5 cfu/g. Initial PSB counts of the inoculated treatment were 10^{10} cfu/g which decreased significantly to 10^5 cfu/g after 10 days and remained more or less at the same levels throughout the experimental period ($p \leq 0.05$). This indicates the ability of the two bacteria to persist in the added environment. Non inoculated ones did not record any PSB. A significant drop in medium pH and a high phosphatase activity were observed by day 3 in PVK liquid medium which corresponded well with the highest recorded soluble phosphate content. Hence, medium acidulation and production of phosphatase enzymes can be considered as possible mechanisms for solubilizing phosphorus by these inocula. *P. fluorescence* and *B. megaterium* can be utilized in increasing phosphate availability for ERP.

Keywords: Eppawala rock phosphate, phosphorus solubilizing bacteria, water-soluble phosphorus, phosphorus solubilisation