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Bio solubilization of Eppawala Rock Phosphate (ERP) by fungal-bacterial biofilms and its impact on crop enhancement of potatoes (*Solanum tuberosum* L)

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Abstract: Eppawala rock phosphate (ERP) in Sri Lanka shows promise as an alternative to Triple Super Phosphate (TSP), though its low solubility hinders its use. Recent researches indicate that fungal-bacterial biofilms (FBBs) could enhance the effectiveness of ERP by enhancing its solubility. This study evaluated the effectiveness of ERP solubilized by FBBs and their impact on soil properties and potato crop performance. Fungi and bacteria were isolated, screened for phosphate-solubilization, and developed into FBBs. These FBBs were tested with ERP (< 20 µm), and the most effective FBBs were evaluated under field experiments for their influence on soil properties and potato crop performance. The FBB-treated and untreated ERP were analyzed using scanning electron microscopy (SEM) and spectrophotometry. The FBB composed of *Bacillus subtilis*, *Brevibacillus brevis*, and *Penicillium polonicum* demonstrated the highest significant ($P < 0.05$), phosphate solubilization and the lowest medium pH. Molecular analysis confirmed the involvement of microorganisms in biofilm formation. Spectrophotometric analysis showed changes in phosphate bands, and SEM images revealed surface deformation in biofilm-treated ERP, indicating successful phosphate solubilization. Using FBBs with ERP, particularly when pretreated, enhanced leaf chlorophyll content, fresh weight, and tuber number in potatoes, though not significantly different from TSP treatment. Additionally, biofilm-enriched ERP resulted in the highest soil available phosphorus and the lowest soil pH. Thus, biofilm-enriched ERP outperforms the recommended TSP dosage in potato cultivation under field conditions.

Keywords: Eppawala rock phosphate, Solubilization, Biofilms

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