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Assessment of the Phosphate Solubilization Ability of Nitrogen Fixing Rhizobia (*Bradyrhizobium japonicum*)

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Symbiotic association between soybean (*Glycine max* L.) and *Bradyrhizobium japonicum* is of agricultural and ecological importance due to its contribution to soil nitrogen (N) fertility. The symbiotic nitrogen fixation and its benefits in legume-based cropping systems are well studied and understood. Co-inoculation of the widely used N biofertilizer and *B. japonicum* with other plant growth promoting rhizobia such as phosphate solubilizers has reported a significant increase in crop yield. Solubilization of inorganic phosphate by gluconic acid, produced through the direct oxidation of glucose via glucose dehydrogenase (GDH) enzyme whose prosthetic group is pyrroloquinoline quinone (PQQ) is the major mechanism employed by most phosphate solubilizing bacteria. This study aimed to investigate the potential use of *B. japonicum* as a phosphorous (P) biofertilizer. Its GDH activity, PQQ production, and phosphate solubilization ability were studied. *B. japonicum* USDA110 showed inorganic phosphate solubilization ability by dissolving $Ca_3(PO_4)_2$ up to 69.56 µg/ml of PO_4^{3-}. The pH of the growth medium gradually dropped to the final pH of 5.29 with increased solubilization of phosphate showing that the medium became acidic. Adding exogenous PQQ did not have a significant effect on its phosphate solubilization ability. Reconstituted GDH enzyme activity showed that *B. japonicum* produces PQQ and its production is regulated by P availability and carbon source. Thus, the current study indicates that *B. japonicum* is a potential candidate to be used as a dual function biofertilizer with N fixation and P solubilization abilities.

Keywords: *Rhizobia, phosphate solubilization, PQQ*