

Orange Peel Powder Increases Growth Promotion of Peanut by *Bacillus velezensis* PGPR Strains and Nodulation by Indigenous Rhizobia

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Greenhouse experiments were performed to determine the effects of orange peel powder (OPP) amendments by *B. velezensis* (Bv) plant growth-promoting rhizobacteria (PGPR) strains on the growth and nodulation of peanut by indigenous *Bradyrhizobium*. We hypothesized that OPP amendments will enhance *B. velezensis*-mediated plant growth promotion of peanut. The experimental design included untreated peanut seeds (GA 09B) planted in field soil that contained Bv PGPR strains with or without 1.0 or 10.0 mg exogenous OPP, along with a nontreated control. The field soil used was from a history of peanut planting and therefore contained indigenous *Bradyrhizobium*. Bv PGPR spores (1.0×10^6 CFU spores/ml) and OPP doses were applied separately on the peanut seeds and incubated for 24 h at room temperature. At 35 days after planting (DAP), the peanut plants were removed from pots, washed, and analyzed for significant treatment effects. An *in vitro* growth assay and LC-MS analysis were performed to assess the PGPR growth and identify the secreted secondary metabolites of Bv strains amended with OP. In the field soil, Bv PGPR strain AP193 with OPP at 10 mg significantly enhanced root length compared to the same PGPR strains without OPP amendments and untreated control. Bv PGPR strain AP203 amended with 1.0 or 10.0 mg OPP significantly increased root length compared to the other strains. The dry root and nodule weights of peanut also significantly increased by Bv PGPR strain AP203 with 10.0 mg OPP amendment compared to Bv strain alone and the untreated control. PGPR strain AP193 increased and expressed two bioactive compounds *in vitro* test in the presence of OP amendment compared to the OP without AP193 strain. This study indicates that co-application of OPP with Bv PGPR strains can enhance peanut growth and nodulation.