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The Effect of Plant Growth Promoting Rhizobacteria on Barley Seedling Growth, Nutrient Uptake, Some Soil Properties, and Bacterial Counts

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Abstract: This study was conducted with barley in greenhouse conditions in order to investigate seed inoculation with 5 different N₂-fixing (*Bacillus licheniformis* RC02, *Rhodobacter capsulatus* RC04, *Paenibacillus polymyxa* RC05, *Pseudomonas putida* RC06, and *Bacillus OSU-142*) and 2 different phosphate-solubilising (*Bacillus megaterium* RC01 and *Bacillus M-13*) bacteria in comparison to control and mineral fertiliser (N and P) application. Among the strains used in the present study, 6 plant growth promoting rhizobacteria (PGPR) stimulated indole acetic acid (IAA) production and 3 of them stimulated phosphate solubilisation; all bacterial strains fixed N₂ and significantly increased the growth of barley. Available phosphate in soil was significantly increased by seed inoculation with *Bacillus M-13* and *B. megaterium* RC01. Maximum NO₃-N was found in soil after inoculation with N₂-fixing *Bacillus OSU-142*, followed by *P. polymyxa* RC05 and *R. capsulatus* RC04. Total culturable bacteria count increased in all treatments with time, whereas N₂-fixing bacteria decreased with time, except with *B. megaterium* RC01 inoculation. The data suggest that seed inoculation of barley with plant PGPR increased root weight by 17.9%-32.1% as compared to the control, and increased shoot weight by 28.8%-54.2%, depending on the species. N₂-fixing bacterial inoculation significantly increased uptake of N, Fe, Mn, and Zn by barley. The production of hormones is suggested to be one of the mechanisms by which PGPR stimulate barley growth. Effective *Bacillus* species, such as OSU-142, RC07, M-13, *P. polymyxa* RC05, *P. putida* RC06, and *R. capsulatus* RC04, may be used in agriculture.

Key Words: Plant growth-promoting bacteria, IAA, nitrogen fixation, phosphate solubilisation, barley

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