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Co-inoculation Effects of Phosphate Solubilizing Microorganisms and *Glomus fasciculatum* on Green Gram-Bradyrhizobium Symbiosis

Almas ZAIDI, Mohammad Saghir KHAN

Department of Agricultural Microbiology, Faculty of Agricultural Sciences,
Aligarh Muslim University, Aligarh 202002, Uttar Pradesh, INDIA

 [Keywords](#)
 [Authors](#)



agric@tubitak.gov.tr

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Abstract: Experiments were conducted to evaluate the effects of nitrogen fixing (*Bradyrhizobium* sp. (*Vigna*)), phosphate solubilizing bacterium (*Bacillus subtilis*), phosphate solubilizing fungus (*Aspergillus awamori*) and AM fungus (*Glomus fasciculatum*) on the growth, chlorophyll content, seed yield, nodulation, grain protein, and N and P uptake of green gram plants grown in phosphorus-deficient soils. The triple inoculation of AM fungus, *Bradyrhizobium* sp. (*Vigna*) and *B. subtilis* significantly increased dry matter yield, chlorophyll content in foliage and N and P uptake of green gram plants. Seed yield was enhanced by 24% following triple inoculation of *Bradyrhizobium* + *G. fasciculatum* + *B. subtilis*, relative to the control. Nodule occupancy, determined by indirect enzyme linked immunosorbent assay (ELISA), ranged between 77% (*Bradyrhizobium* + *A. awamori*) and 96% (*Bradyrhizobium* + *G. fasciculatum* + *B. subtilis*) at flowering (45 DAS), decreasing at the pod-fill (60 DAS) stage with each treatment. Replica immunoblot assay (RIBA) revealed a greater variation in the rhizobial populations within nodules and the correlation between nodule occupancy and immunoblot counts was highly significant at 45 ($r = 0.95$) and at 60 DAS ($r = 0.96$). There was a negative effect on some of the measured parameters when *A. awamori* was used alone or added to the combination treatments. The present findings showed that rhizospheric microorganisms can interact positively in promoting plant growth, as well as N and P uptake of green gram plants, leading to improved yield.

Key Words: AM fungi, ELISA, green gram, N uptake

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