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Effect of PGPR and *Rhizobium phaseoli* on Nitrogen Fixation of Mungbean (*Vigna radiata*) under Dryland Conditions

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Abstract

Today, food security has to be reached through a sustainability approach, where the farming systems in order to remain productive in the long term have to replenish the nutrients removed from soil. The need to develop sustainable practices and use resources efficiently, highlight the potential role of biological nitrogen fixation (BNF) as a primary N source in agriculture. Mungbean (*Vigna radiata*) has been suggested as a short-duration summer crop to be incorporated into the soil after harvesting the grain/pods. It is a crop well adapted to the dryland conditions of the tropics and subtropics. Due to the lack of summer rains or their erratic distribution, mungbeans are exposed to severe water deficits associated with salt stress, which results in lower grain yields and inefficient BNF. Plant growth promoting rhizobacteria (PGPR) showed the potential to diminish the negative effects caused by drought and salinity stress. This research work aims to identify the effects of three PGPR and their combination on mungbean N fixation under dryland conditions of Pakistan. In a field trial, two mungbean accessions were tested with five inoculation treatments: M9 (*Rhizobium phaseoli*), Mk20 (*Pseudomonas fluorescens*), Y16 (*Bacillus subtilis*), MIX (*R. phaseoli* + *P. fluorescens* + *B. subtilis*) and control (without bacterial inoculum). Plants were harvested at maturity to assess N fixation (%Ndfa), total N content and biomass accumulation. Chlorophyll content and proline content were assessed at flowering stage. MIX and Mk20 obtained the highest %Ndfa, while MIX and Y16 accumulated the highest total dry matter. In contrast, the controls always had the lowest chlorophyll content, total dry matter and %Ndfa. These results indicate that all tested bacterial inoculations increased biomass and chlorophyll content, but particularly their combination enhanced N fixation. Y16 accumulated the highest proline content. This is a response related to drought stress, suggesting that the best inoculation treatment to enhance BNF and yield is a combination of Mk20 and M9 only.

Keywords: Drought stress, drylands, nitrogen fixation, PGPR, *Rhizobium phaseoli*, *Vigna radiata*

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