

## **Assessment of plant growth-promoting rhizobacteria (PGPR) and rhizobia as multi-strain biofertilizer on growth and N<sub>2</sub> fixation of rice plant**

### **ABSTRACT**

Recently, there has been much interest on the application of PGPR-rhizobia multi-strain biofertilizer to enhance growth and yield of agricultural crops. A glasshouse experiment on rice plants was conducted to quantify the uptake of N derived from N<sub>2</sub> fixation by multi-strain inocula consisting of a locally isolated PGPR, UPMB19 ('*Lysinibacillus*' xylanilyticus), and an indigenous rhizobia, UPMR30 ('*Bradyrhizobium japonicum*'). <sup>15</sup>N isotope dilution technique was used to elucidate the N<sub>2</sub>-fixing and plant growth-promoting efficiency of the inocula through single and mixed applications. The mixed inocula significantly promoted plant and root growth, tiller numbers, plant dry weight, nutrient accumulations and produced a lower <sup>15</sup>N enrichment than uninoculated control that received similar N-fertilizer (33% N). The lower <sup>15</sup>N enrichment indicates the occurrence of biological N<sub>2</sub> fixation. The proportion of N uptake from atmosphere was estimated at 22%. The single inoculation of UPMB19, UPMR30 and the mixed inocula could fix N up to an extrapolated 43, 56, 63 kg ha<sup>-1</sup>, respectively, within the 65-day period. The combined inocula consistently performed better than single inoculum (15-30% higher root average diameter, 15% more tillers, 9-13% higher P in tissue, 9-16% higher Ca in tissue, 2-4% higher Mg in soil), on the rice plants, thus providing evidence that this treatment stimulated synergistic activities which enhanced the combined performance and cumulative beneficial effects of the respective strains. These beneficial effects were achieved with a minimal usage of N-fertilizer application. The study revealed a possible new and beneficial biofertilizer formulation to promote growth and yield of rice plants at reduced chemical N-fertilizer input in a sustainable and environmental-friendly agricultural system.

**Keyword:** Biological N<sub>2</sub> fixation; Multi-strain biofertilizer; <sup>15</sup>N isotope dilution; *Oryza sativa* cv. MR219; PGPR; Rhizobia