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## Plant growth-promoting Rhizobacteria (PGPR) and Rhizobia as multi-strain biofertilizers for improved growth and yield of rice

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Recently, there has been much interest on the application of PGPR and rhizobia as multi-strain biofertilizer for crops to benefit from the consortium of biochemical characteristics. Several laboratory and glasshouse studies were conducted to assess the beneficial effects of locally isolated PGPR and rhizobia on Malaysian rice variety, MR219. Based on 16S rDNA gene sequencing, these bacterial strains were identified as *Lysinibacillus xylanilyticus*, *Alcaligenes faecalis*, *Bradyrhizobium japonicum*, *Rhizobium etli* and *Bacillus subtilis*. These isolates were selected as a potential strains in the development of multi-strain biofertilizer for having multiple beneficial abilities namely biological nitrogen fixation, solubilization of phosphate and potassium, production of phytohormone, hydrolyzing enzymes and iron siderophore. Laboratory study has demonstrated the effectiveness of these strains on early growth and vigor of rice seedlings under controlled condition. A subsequent glasshouse studies have showed a significant improvement of rice growth and yield with bacterial inoculations, particularly when supplied with minimal fertilizer-N rate (33% from the recommended rate). Single and multi-strain inoculations also 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% N<sub>d</sub>. 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.

### Biography

Ali Tan Kee Zuan has completed his PhD from Universiti Putra Malaysia. Currently, he is a senior Lecturer at Department of Land Management, Faculty of Agriculture, Universiti Putra Malaysia. He is the honorable Assistant Secretary of Malaysian Soil Science Society, a non-government organization aims to promote the study of Soil Science. He has won several academic awards and has published papers in international journals. His main research interest is Soil Microbiology, involving manipulation of beneficial soil microbes to benefit the crops.

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