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Root Associated Bacteria Suppress Symptoms of Iron Toxicity in Lowland Rice

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Abstract

The beneficial effects of root-associated bacteria in biologically controlling soilborne pathogens have been well established. Conversely, little is known about how these beneficial microorganisms affect responses of plants to abiotic stresses. An investigation was thus undertaken to evaluate whether root-associated bacteria endemic to rice could be used to mitigate the effects of iron toxicity symptoms in lowland rice. To date no bacteria strain is known to positively affect plant responses to iron toxicity. We isolated several strains of *Bacillus* from surface sterilized seeds of lowland rice and maintained them at -18 °C. In a hydroponic system, four of those, *B. megaterium*, *B. pumilus*, and two isolates of Bacillus not yet identified to species level, were used to inoculate root systems of 3-week-old seedlings of six rice varieties differing in iron toxicity tolerance. Seven days after inoculation the rice seedlings were subjected to two concentrations of FeII (0 and 1000ppm). Five days after the onset of the treatments the rice varieties were visually assessed for toxicity symptoms and compared with two controls that were not inoculated with any bacteria. Typical symptoms of iron toxicity were brown spots on the leaves and the brown-orange colouring of the leaves known as broncing. Under non-toxic conditions, inoculates generally promoted growth and in one case (*B. megaterium*) promoted internodial elongation as compared to non-inoculated controls. Three of the inoculates significantly reduced symptoms of iron toxicity in all tested varieties, whereas one (*Bacillus* sp.) significantly aggravated the symptoms. Analyses of iron uptake and distribution for the six rice varieties (ongoing) will elucidate the underlying mechanisms of bacterial effects on iron toxicity tolerance in rice. Possibilities for practical applications will be discussed.

Keywords: *Bacillus* sp., hydroponics, iron toxicity, rice, root-associated micro-organisms

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