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Influence of Root Zone Bacteria on Root Iron Plaque Formation in Rice Subjected to Iron Toxicity

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Abstract

Iron is essential to both energy processes and growth in plants. It exists either as ferric iron (Fe3+), which precipitates in alkaline and oxidising soil conditions being unavailable to plants, or plant available as ferrous iron (Fe2+) under reducing or acidic conditions. Reduced, anaerobic conditions are predominant in lowland rice cultivation, in combination with high soil Fe concentrations causing iron toxicity via an excess of ferrous iron present in the soil due to the activity of rhizosphere microorganisms.. As oxidised polyphenols accumulate in the plant tissue, leaves turn orange in colour (bronzing) and brown spots appear on the leaves.

Some bacteria of the genus Bacillus that associate with roots, reduce the effects of abiotic stresses. Those bacteria, that can form endospores under unfavourable environmental conditions, have been shown to enhance growth in rice during drought periods. However, little is known about how they affect rice responses to iron toxicity.

Earlier work showed that, from 6 lowland rice varieties differing in iron toxicity tolerance, which were inoculated with 4 bacillus strains (*B. megaterium*, *B. pumilus*, and two isolates of *Bacillus* sp.), 3 of the strains helped mitigate leaf Fe toxicity symptoms. However, genotypes differed in their responses to bacteria/Fe toxicity treatments. One of the main differences seemed to be in the formation of root Fe plaque.

Presently, a new set of experiments is being run to quantify the effects of bacteria present in the root zone on both Fe plaque formation on the roots and on total uptake of Fe to the rice shoot. For this 2 concentrations of iron are applied (0 and 1000 ppm) to 6 lowland rice varieties, inoculated with the bacteria named above. After 4 weeks of growth, one week of inoculation and 1 week of Fe treatment, Fe plaque formation, Fe uptake and distribution, dry matter and Fe toxicity symptoms will be determined. The study will clarify the influence of the different bacteria on root Fe plaque formation allowing further detailed studies on the mechanisms of bacterial effects in the root zone of rice subjected to abiotic, toxicity stress conditions.

Keywords: Abiotic stresses, *Bacillus* sp., iron toxicity tolerance, iron uptake, lowland rice

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