Effects of Rhizobacteria on iron uptake in lowland rice under conditions of iron toxicity

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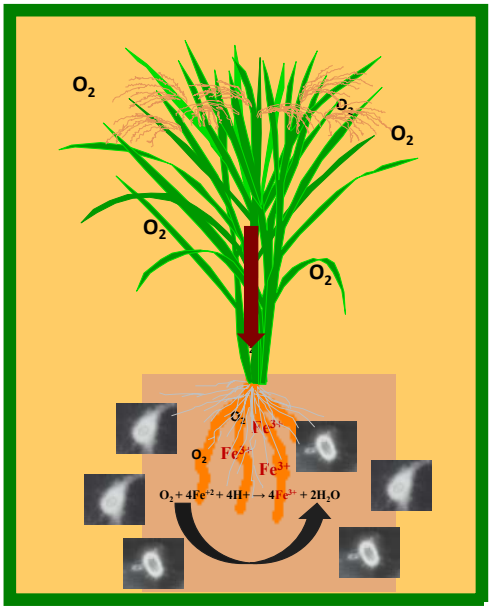
MOTIVATION

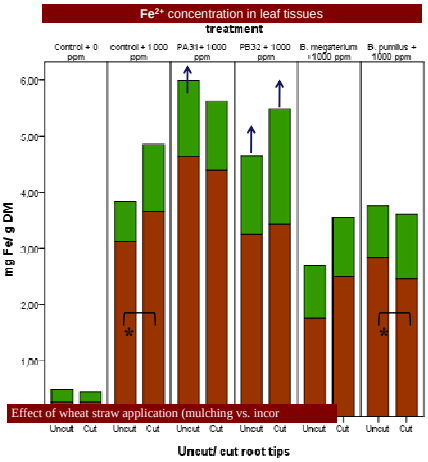
Plants take iron as Fe^{2+}. The ions are acropetally transported through the xylem to the leaves. In acidic-anaerobic conditions, Fe^{3+} is reduced to Fe^{2+} and plants take it excessively. In lowland rice, the oxygen sent to the roots through the aerenchym oxidizes part of the Fe^{2+} on the root surface, but it is not enough to prevent harvest losses of up to 30%. Some rhizobacteria are used in phytoremediaton by their capacity to ameliorate metal toxicities by oxidation of the ions. Here we have studied if root-associated bacteria endemic to rice with bio-control capacities, could enhance the iron oxidation.



CONCLUSSION

- **The bacterial isolate PA31 could play a role in the iron partitioning.**
- **Application of PB32 to the media resulted in an increased ferrous iron concentration in the plant and stronger iron toxicity symptoms.**
- ***B. megaterium* could be used to help plants dealing with iron toxicity since its addition to the media improved plant height and reduced the ferrous iron concentration in the plant possibly by oxidation Fe^{2+} of in the tissues.**

RESULTS

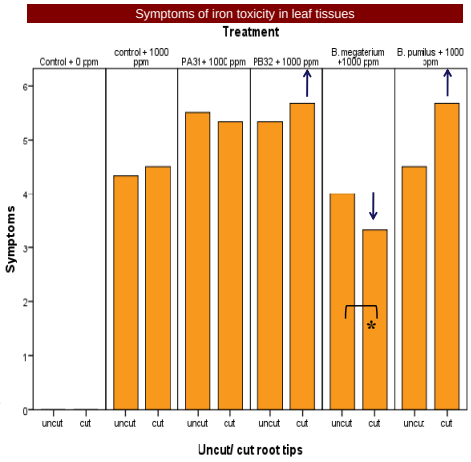


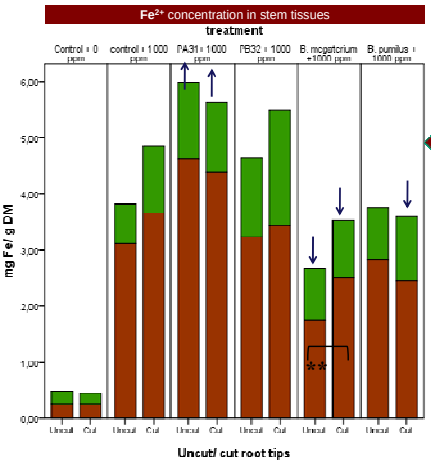
Inoculation with strain PB32 increased leaf Fe^{2+} concentration

Strains PB32 and *B. pumilus* increased toxicity symptoms in leaves

Inoculation with PA31 increased Fe(II) concentration in leaves

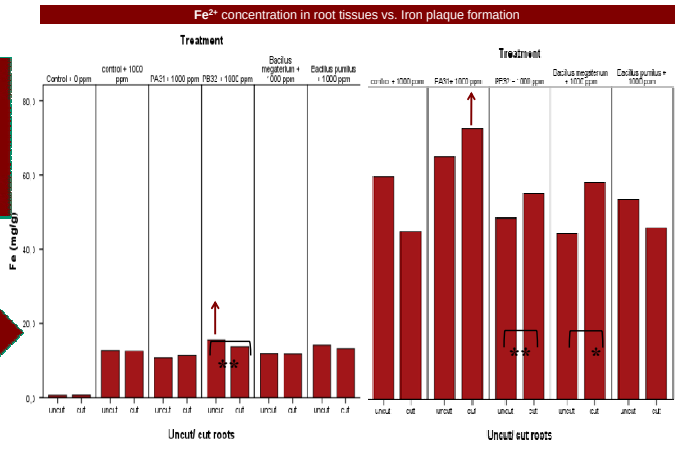
In plants with cut roots, *B. megaterium* reduced toxicity symptoms in leaves





Fe(II) concentration in stems was increased by PA31 and reduced by Bacillus *megaterium*

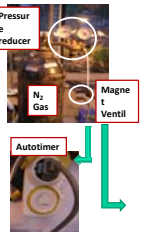
PB32 increased Fe(II) concentration in roots: PA31 increased Fe(III) plaque on roots



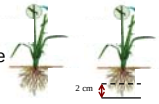
Duncan Multiple Range Test; bars marked by arrows are statistically different from the respective control in the indicated direction at p<0.05.
Uncut vs cut: two-sided t-test ;* and ** significantly different from uncut control at p<0.1 and p<0.05

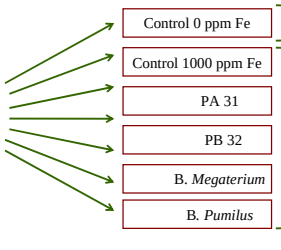
MATERIALS AND METHODS

- Plantlets of lowland rice genotype I Kong Pao sensitive to iron toxicity were grown hydroponically in Yoshida solution for 33 days
- Bacteria were applied for five days. 4 species of *Bacillus* were used; isolate PA31, isolate PB32, B. *megaterium* and B. *pumilus*
- Root tips (around 2 cm) of half of the plants were cut just before applying the bacteria to study a possible better penetration in the plant
- The bacterial solution was replaced by a solution containing 1000 ppm of Fe for 6 days.



- Plant tissues were sampled and roots were washed in a solution of HCl 0.5M to assess iron plaque formation
- Leaf, stem and root tissues were analyzed with the Dipyridil method





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