UNIVERSITY OF HOHENHEIM

Institute of Agricultural Sciences in the Tropics (Hans-Ruthenberg-Institute) (490)

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Bacillus-mediated Changes in Iron Partitioning in Lowland Rice under Iron Toxic Conditions

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Introduction

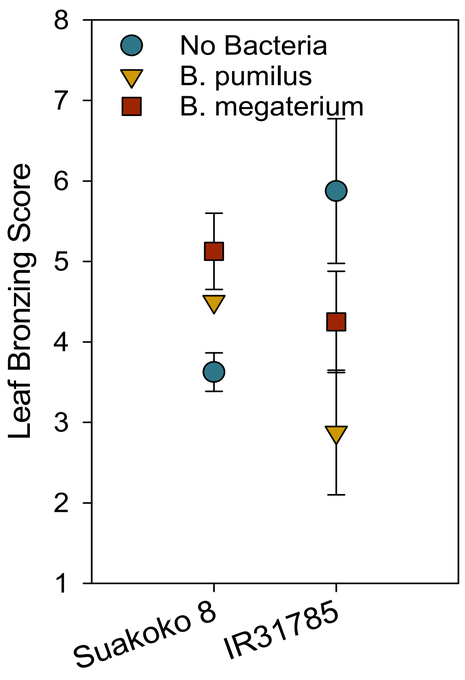
Iron toxicity is the result of large concentrations of reduced iron (Fe II) in the soil solution and constitutes a severe stress in lowland rice cultivation. Despite the widespread occurrence of iron toxicity in many rice producing areas, little is known about the impact of rhizobacteria on rice genotypic responses.

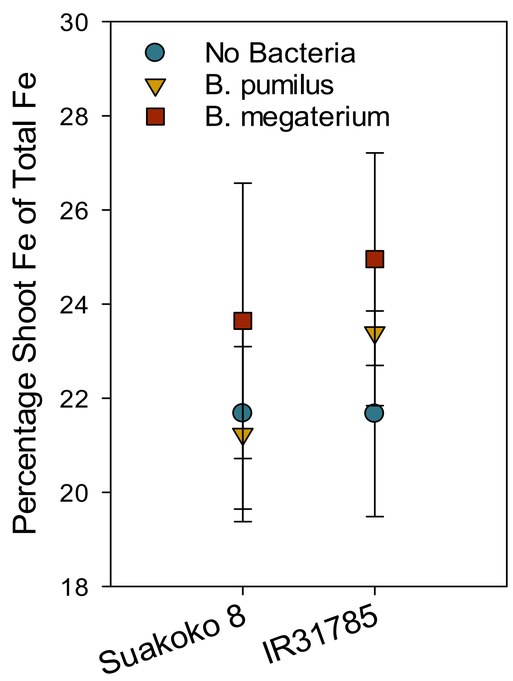
Rice cultivars tolerant to iron toxicity have been shown to employ different tolerance strategies and we hypothesize that the extent of iron toxicity symptom mitigation or aggravation upon Bacillus spp. inoculation is partly dependent on the genotypic adaptation mechanism. This study investigates Bacillus-mediated changes in iron partitioning in lowland rice and their impact on the expression of iron toxicity symptoms.

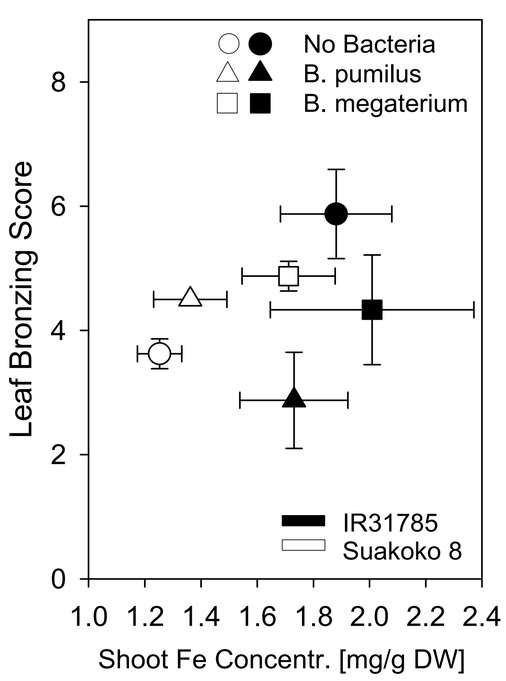
Conclusions

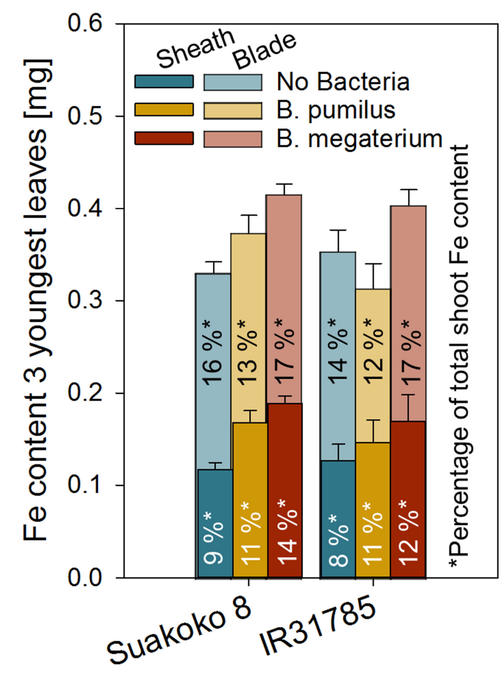
- Inoculation with *B. pumilus* and *B. megaterium* isolates can lead to contrary responses to iron toxicity in different lowland rice cultivars
- Shoot iron concentration does not correlate with leaf bronzing score
- Iron storage in sheaths can improve tolerance to iron toxicity
- Iron content in leaf blade does not correlate with leaf symptoms
- Impact of Bacillus inoculation on ROS scavenger enzyme activity will be investigated

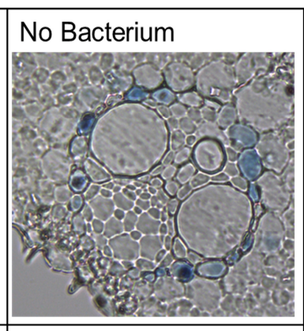
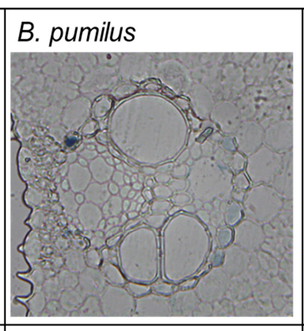
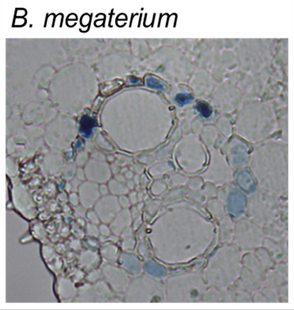
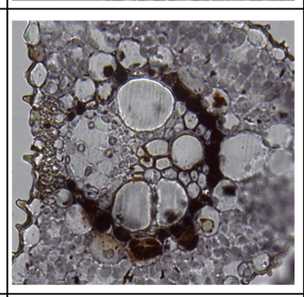
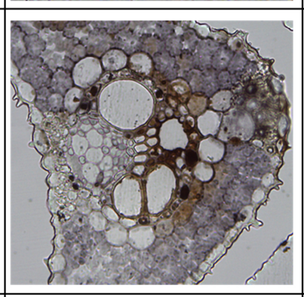
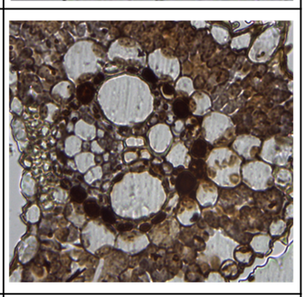
Preliminary Results and Discussion



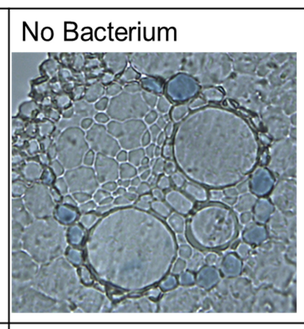
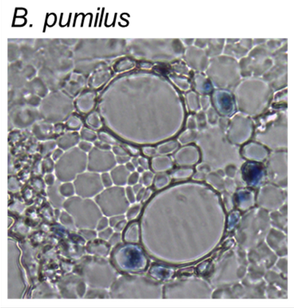
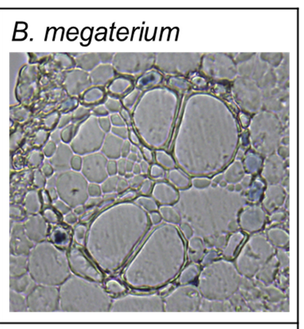
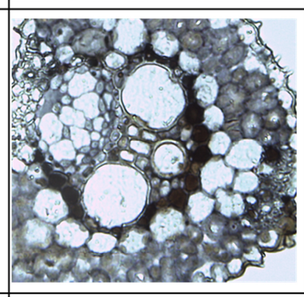
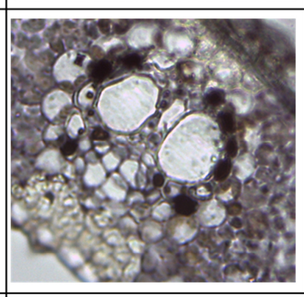
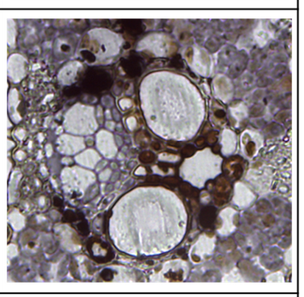






IR31785	No Bacterium	*B. pumilus*	*B. megaterium*
Perls staining			
Perls DAB staining			
Leaf Score	6	3.5	3

- Bacillus inoculation has effect on leaf score
- Only small effect on shoot share of total plant Fe
- No correlation between shoot iron concentration and leaf bronzing score

Suakoko 8	No Bacterium	*B. pumilus*	*B. megaterium*
Perls staining			
Perls DAB staining			
Leaf Score	3	3	3.5

- More Fe storage in sheaths compared to leaf blades of inoculated plants
- No correlation of staining intensity and leaf symptom / bronzing score

Notes on Materials and Methods

Plants were grown in hydroponic solution under greenhouse conditions with 12h light/dark period for three weeks before they were inoculated with Bacillus isolates. Nutrient solution containing the bacteria was removed after 7 days, prior to iron treatment. Iron was applied in the form of Fe (II) ($FeSO_4 \cdot 7H_2O$) to a concentration of 1,000 ppm Fe (II) for 7 days. Hypoxic conditions to prevent iron oxidation in the root zone were induced by N_2 gas diffusion for 15 minutes every two hours and O_2 content monitored.

Leaf bronzing was assessed visually on fully expanded leaves for the entire plant (Asch et al. 2005).

Iron content was measured photometrically in single organs (Hartmann and Asch, 2018). For shoot iron content, values of all above ground organs were added. For blade/sheath ratio, values of the 3 youngest fully expanded leaves were used. For microscopy, samples were taken 1 cm away from the tip of the 3rd youngest fully expanded leaf, embedded in Technovit 7100 and cut into 3µm sections. Perls and Perls DAB staining was performed according to Roschzttardtz et al. 2009.

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