# Root dynamics of phosphorus and iron interaction in rice under variable phosphorus availability

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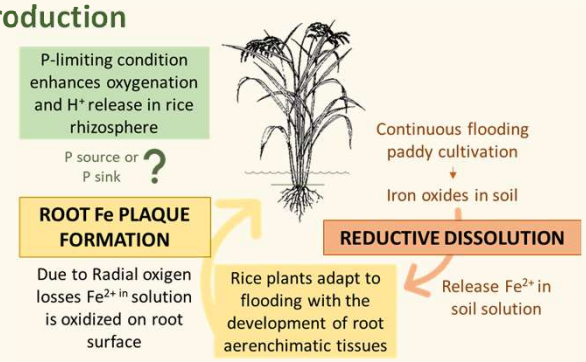
## Introduction

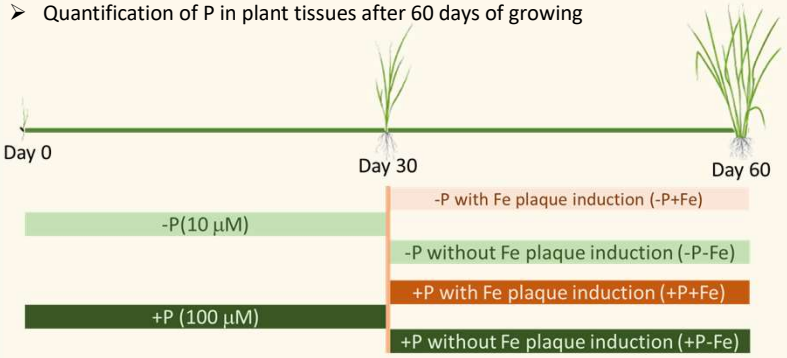



Research questions

1) Is the **higher rhizosphere oxygenation** under P deficiency related to a **higher Fe plaque formation**?
2) Is the **higher H⁺ release** responsible of the **P-source function** of Fe plaque **under P limited conditions**?

## Materials and Methods

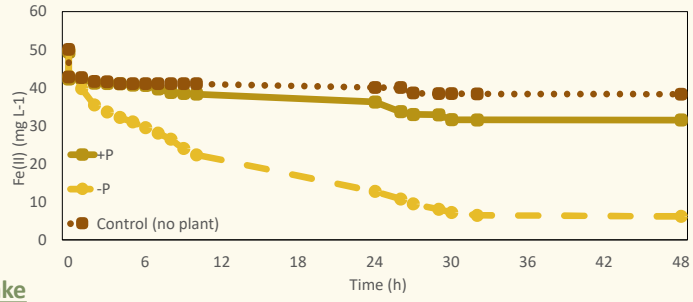
- 60 days hydroponic experiment with two levels of P in solution
- Daily measurement of nutrient solution pH
- Fe plaques induction at 30 and 45 days of plant growing
- Quantification of Fe plaque (oxalate extraction)
- Quantification of P in plant tissues after 60 days of growing




## Results & Disussion

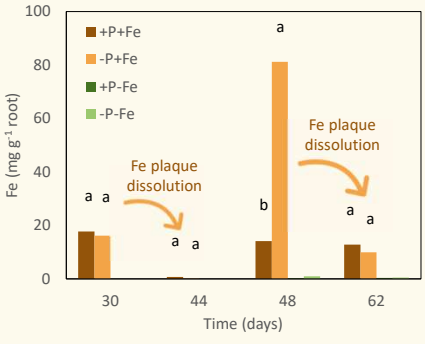
### Effect of P availaibilty on Fe plaque formation

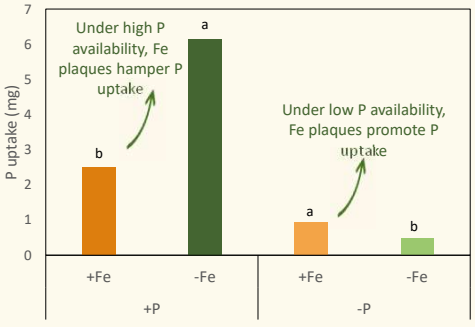
During Fe-plaque induction, –P plants showed a faster oxidation of Fe(II) than +P plants, confirming that **P availability influences Fe plaque formation on rice roots**. The higher $O_2$ release reported under P starvation could explain the **higher oxidation rates** of Fe(II). Despite no significant differences were observed in root biomass, –P plants showed a **root surface area that was double** than in +P plants, possibly increasing the root area for Fe plaque formation.

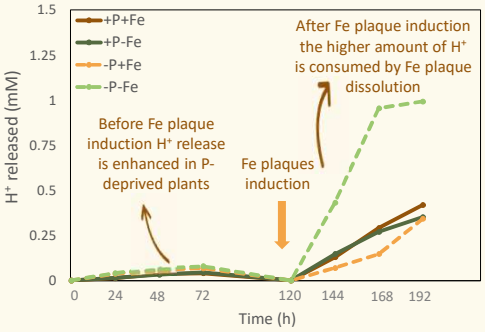



### Effect of P availaibilty on the function of Fe plaque in plant P uptake

Variations in the amount of root-associated Fe plaque with time confirmed their dynamic nature. Despite –P plants had more Fe plaque than +P plants, particularly during the fast vegetative growth phase, **no significant differences were observed 15 days after induction**, probably due to the higher rate of H⁺ released by P deficient rice plants. Acidification of the rhizosphere by P deficient plants could in fact favour the **dissolution of Fe plaque** releasing bound P for plant uptake. The values of plant P uptake confirmed that **P availaibility cannot only influence Fe plaque formation but also their role as a source of P for plant nutrition**. Under P-deprived conditions Fe plaque could represent a source of P for plant uptake, while at high P availability Fe plaque could act as a sink of P.




## Conclusions

✓ Phosphorus availability could influence the dynamics of Fe plaques on the root surface.
✓ The higher oxidation caused by P deficiency increased Fe plaque formation.
✓ Proton exudation induced by P deficiency caused the dissolution of Fe plaque, releasing P available for plant uptake.
✓ The debated role of Fe plaque in plant P nutrition is shown to be strongly influenced by P availability itself.

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