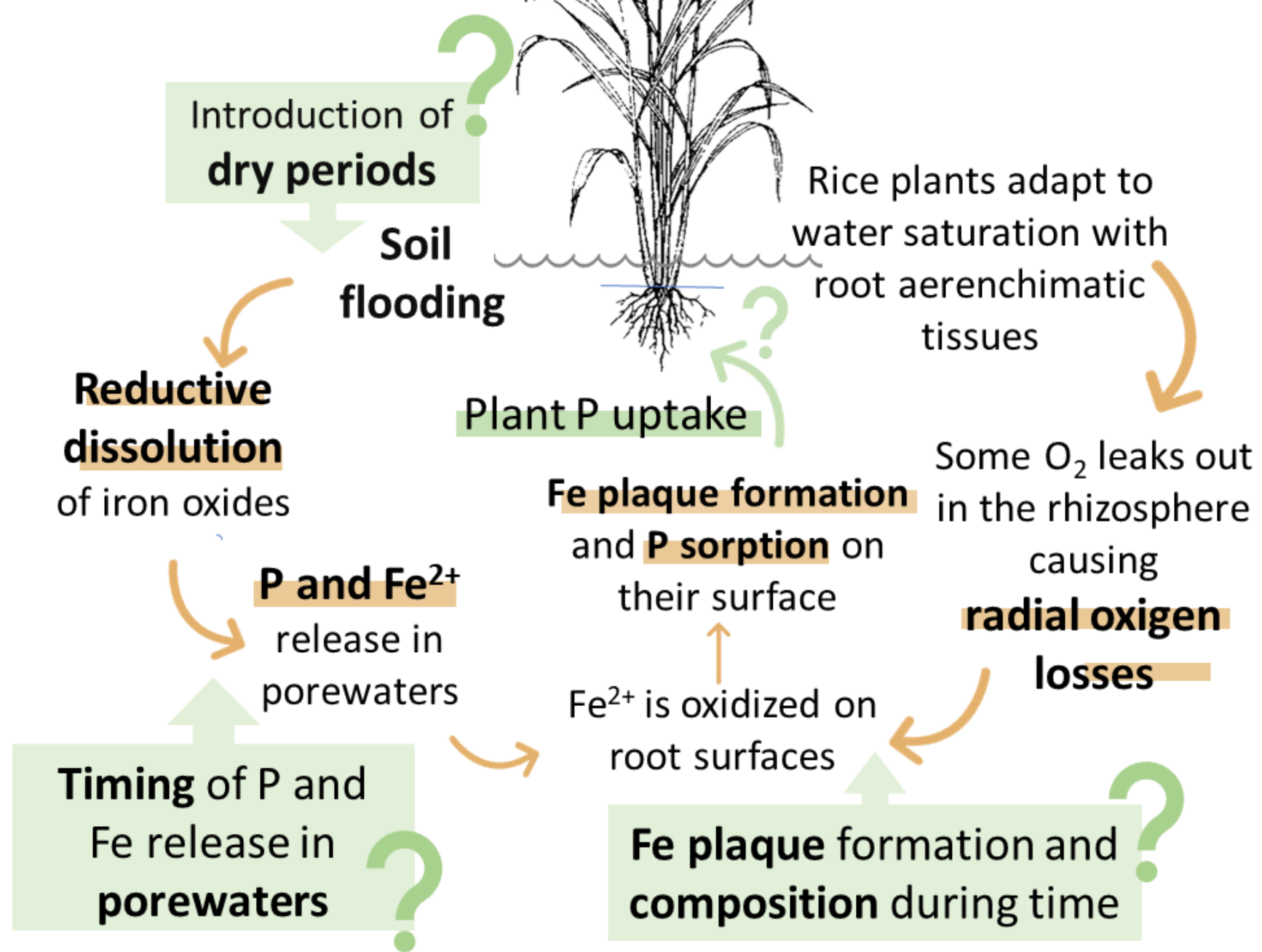
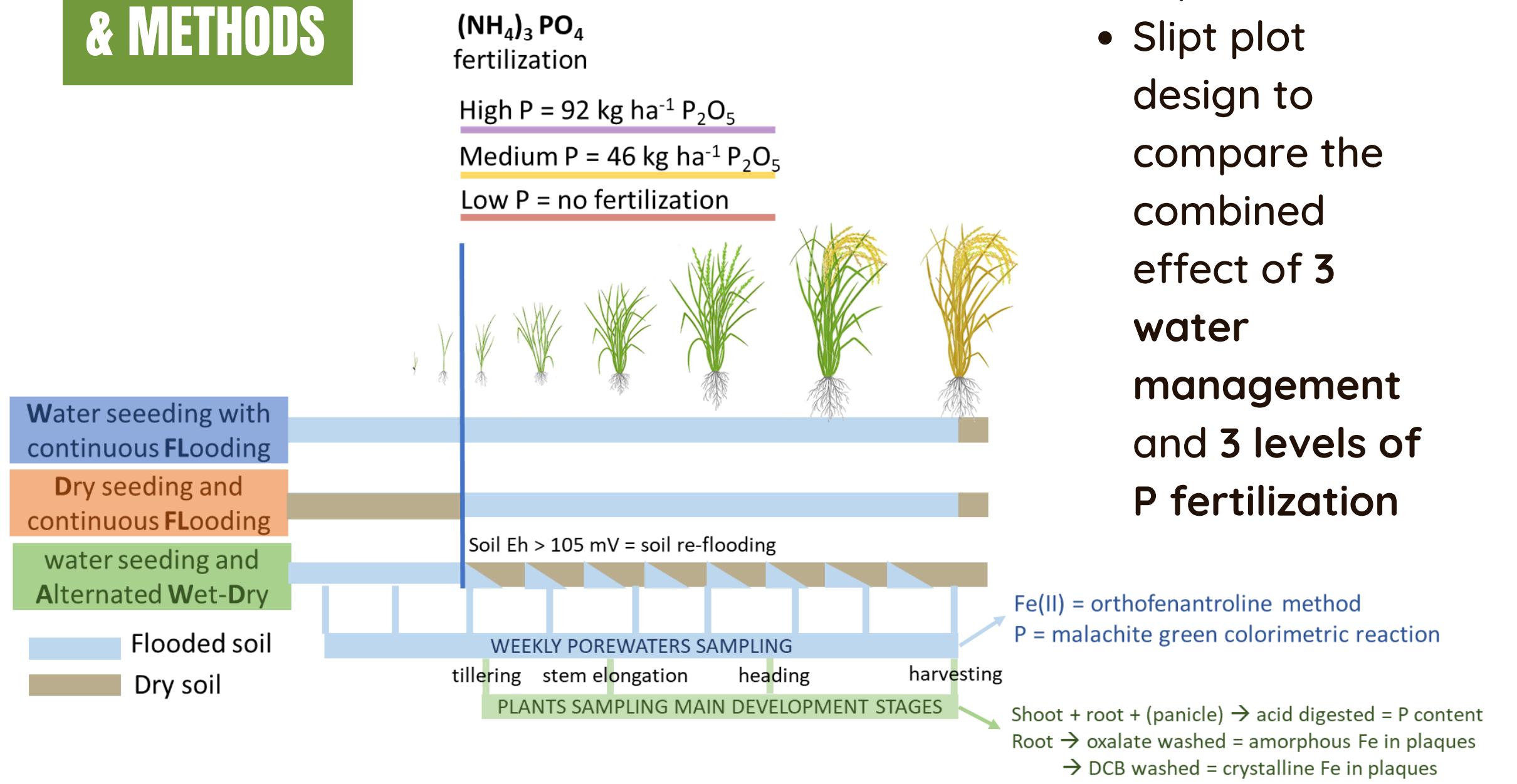


Influence of water management on iron-phosphorus interaction in rice rhizosphere

INTRODUCTION



MATERIALS & METHODS

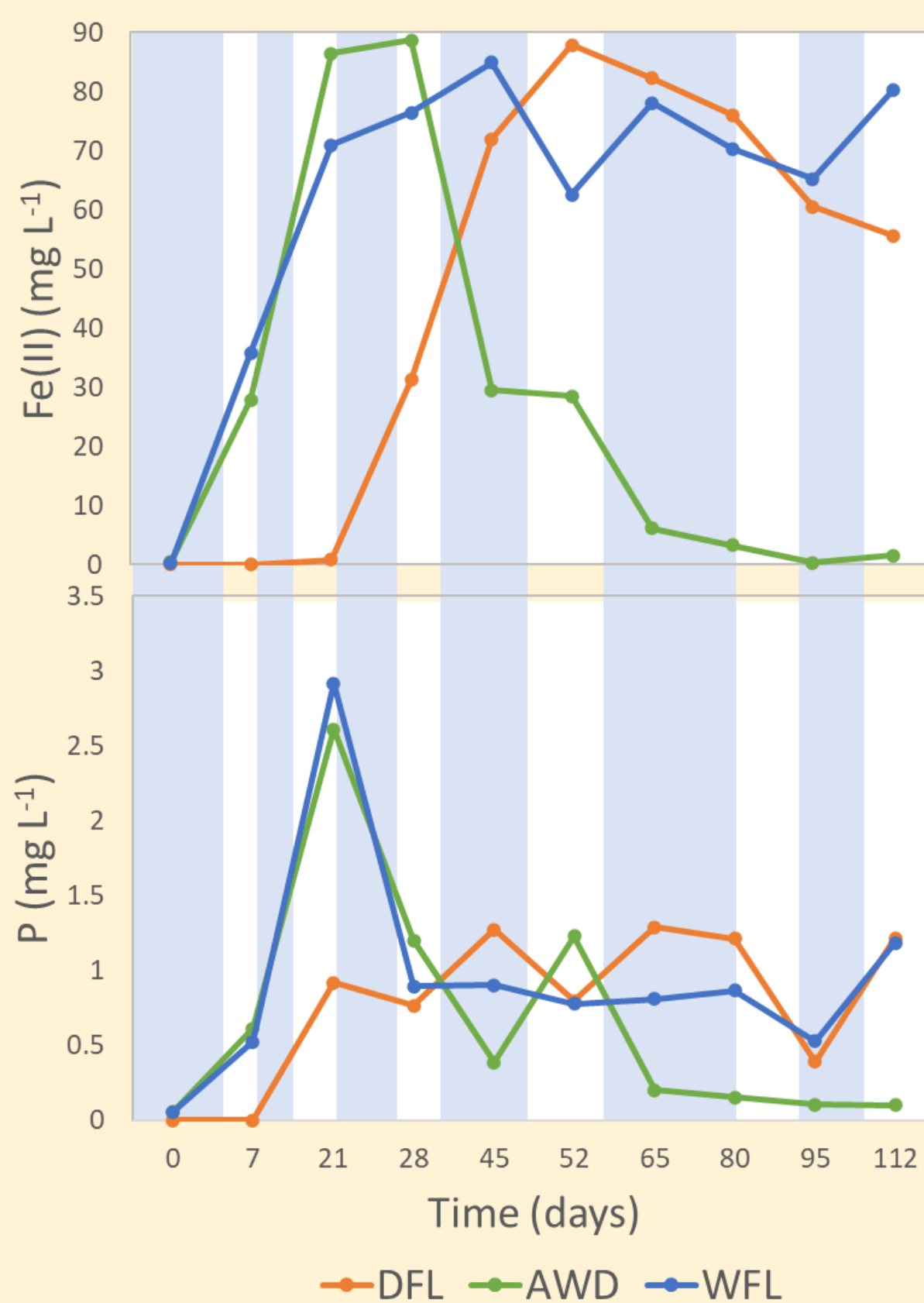


- Mesocosms experiment
- Split plot design to compare the combined effect of 3 water management and 3 levels of P fertilization

RESULTS AND DISCUSSION

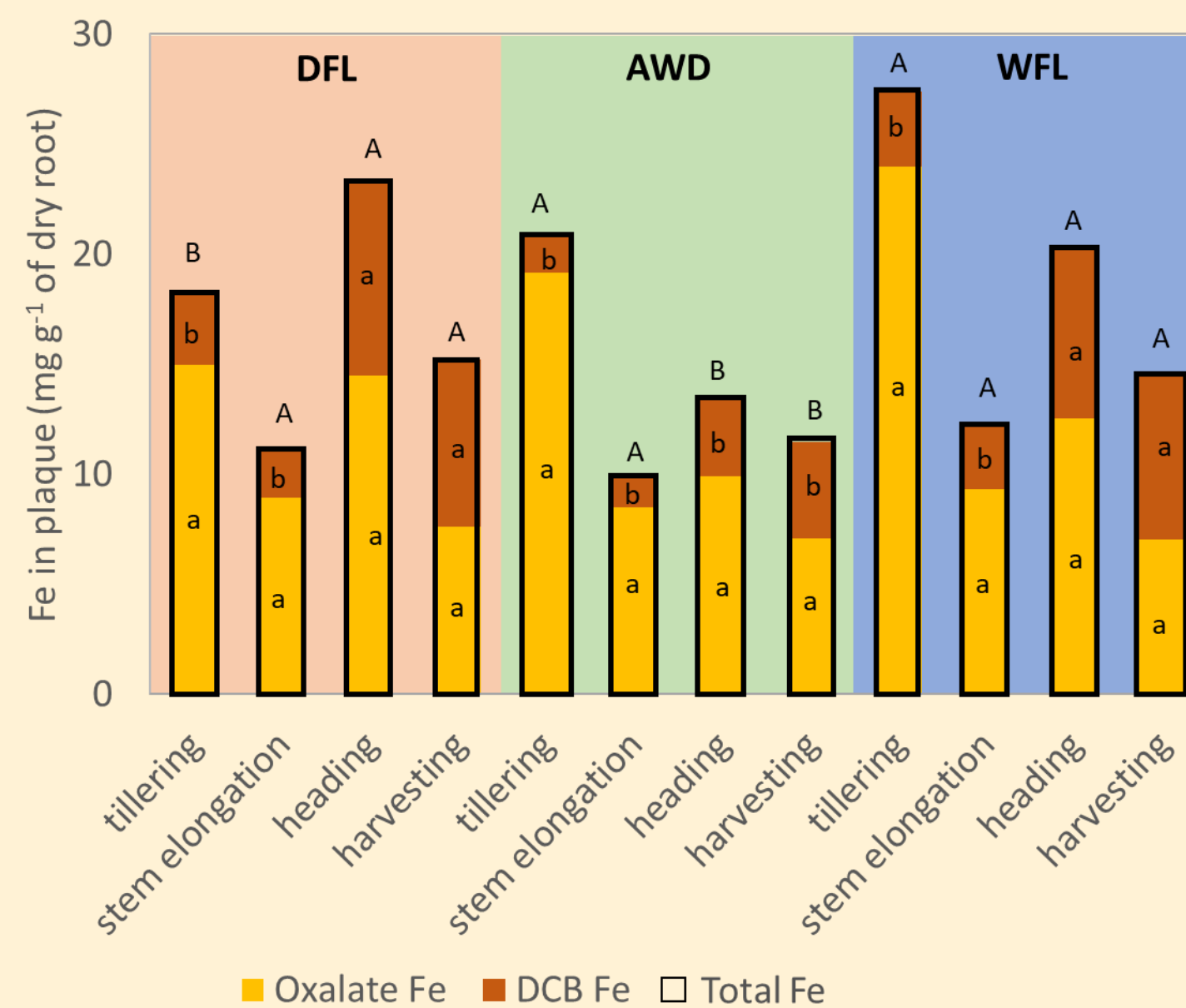
Fe(II) and P release in porewaters

The release of Fe(II) to the porewaters increases within 20 days after flooding. The earlier release observed in WFL and AWD compared to DFL was consistent with the delay in soil flooding. The P release is subsequent to Fe reductive dissolution only in AWD and WFL. In DFL the effect of P release after reductive dissolution was less evident, possibly because of the higher P demand by plants.



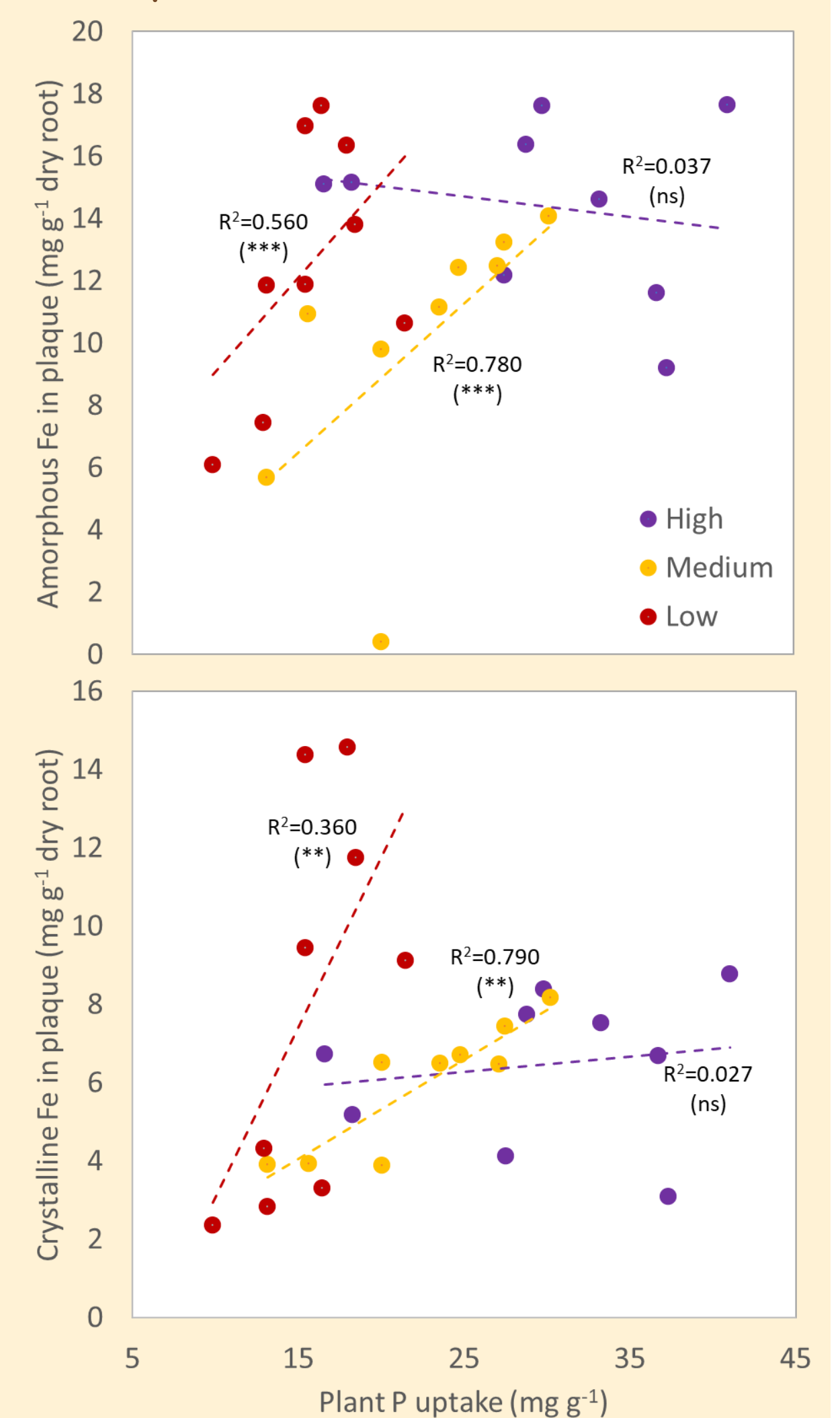
Fe plaque formation

In all the treatments Fe plaque formation was higher during the early vegetative stages, then decreased in the reproductive phases. At tillering DFL produced a lower amount of plaque than WFL and AWD, in line with the delay in Fe(II) release (upper-case letters). In the vegetative phases plaques were mainly composed of amorphous Fe (hydro)oxides. Conversely with plant development, crystalline forms started to appear (lower case letters). In AWD crystallization was less pronounced compared to DFL and WFL, according to the higher P:Fe molar ratio in porewaters. The pronounced decrease of Fe plaque during stem elongation could be attributed to the high P demand by plants. Thus, the plant strategies to acquire P may favor Fe plaque dissolution and the subsequent P release for plant uptake.



P uptake and Fe plaque

During the vegetative phase (stem elongation), the positive correlation between plant P uptake and amorphous Fe in plaque was more pronounced at medium and low P availability. The correlations with crystalline Fe in plaque were weaker, suggesting the primary role of amorphous Fe plaque in regulating plant P uptake.



CONCLUSIONS & FURTHER INVESTIGATIONS

- Soil flooding timing strongly impacted the temporal release of Fe and P in porewater. As a consequence Fe plaque formation was different in the tested water management techniques.
- The results from the wet chemical methods showed the relationship between plant P uptake and Fe plaque crystalline ratio.
- The determination of Fe plaque mineral composition could be the key point to better understand the role of this pool on P availability for rice plants.
- Further investigation may involve the application of synchrotron techniques.

