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ROOT GROWTH AND AM COLONIZATION DYNAMICS IN RICE PLANTS UNDER FLOODING AND DRY CONDITIONS

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As one of the most important food source for humans, rice has a relevant social and economic role worldwide. Understanding rice responses to the interaction with arbuscular mycorrhizal (AM) fungi has gained increasing importance in order to enhance plant yield. While it is known that AM fungi do not preferentially colonize flooded roots, the mechanisms which control this phenomenon remain largely unknown. The goal of our work is to elucidate, through morphological and molecular approaches, the factors which control colonization dynamics of rice roots by AM fungi in different water regimes such as flooding and dry conditions.

Using controlled growth systems, two sets of mycorrhizal and control rice plants were grown in both water regimes, considering also the transfer from water to dry and viceversa. Roots from all biological conditions were sampled at different time points, starting from 7 dpi (days after inoculation with *Glomus intraradices*) to 35 dpi. We evaluated both morphological and molecular parameters, such as root branching (the ratio between the number of large lateral roots and the crown ones), the mycorrhizal colonization level, and the expression of plant and fungal functional marker genes. As expected, mycorrhizal colonization decreased with flooding, while differences on root anatomy between dry and flooding conditions started from 7 dpi, leading to a more important branching under dry conditions. In mycorrhizal plants, root branching was significantly higher as a consequence of the fungal presence added to the effect of the dry soil. In addition, the root apparatus of plants shifted from the water condition to the dry rapidly adapted to the new condition revealing a high organ plasticity. Quantitative real time PCRs performed on plant and fungal P and N transporters revealed that symbiosis functionality was directly linked to the root anatomy and the success of mycorrhizal colonization. However, even if reduced, the expression of fungal P and N transporters was maintained also in the flooding condition.

In conclusion, our experiments demonstrate that the water regime influences the fungal colonization, and therefore the expression of symbiosis marker genes, first modifying root morphology.