P-cycling and N fixing bacteria of rice root compartments are affected by reduced P fertilization

Authors: C. Valli, S. Zecchin, L. Cavalca

The demand for rice (*Oryza sativa*, L.) production is continuously increasing, following the world population size (FAO 2021). Since phosphorus (P) is not a limiting factor for plants in rice paddy soils, environmental and economic issues ask for tailoring mineral phosphate inputs.

Due to the role of soil microbial communities in element cycling, this study was aimed to assess the impact of P fertilization on microbial communities in rhizosphere compartments (soil, rhizoplane, endosphere) of rice plants cultivated under continuous flooding in the presence (50 kg ha^{-1} P_2O_5) and in the absence of P fertilization. Illumina-MiSeq sequencing of bacterial and archaeal 16S rRNA genes and fungal ITS, demonstrated that different levels of P fertilization caused a significant (PERMANOVA, $p<0.01$) differentiation of bacterial and archaeal communities of root compartments, particularly of the endosphere. P fertilization increased the microbial functionality related to phosphate solubilization/mineralization and nitrogen fixation as assessed by Real-Time quantitative PCR and inferred functional profiling. The reduction of P fertilization needs to be further investigated, since the initial response of microbial community to the absence of a boost of nutrient was a decrease of P cycling and nitrogen-fixing bacteria in the proximity of rice roots.

Acknowledgement: Regione Lombardia (P-RICE, n. 23, d.d.s. 4403-28/03/2018).