Functional agrobiodiversity: intercropping with legumes as the most promising tool for facilitating phosphorus availability in the Mediterranean cropping systems.

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Intercropping is proposed as one of the best practices within the agroecological approach based on functional agrobiodiversity. One of the most important functional crops that in intercropping facilitates phosphorus (P) uptake of the intercropped cereal are grain legumes [1]. Great attention is focused on their root interactions, which are mediated by root intermingling, and the role of the rhizosphere bacterial community. Considering the low availability of P in the soil for Mediterranean crops, the improvement of the P use efficiency is an interesting way to reduce external inputs to the agroecosystem.

To shed light on the mechanisms driving P facilitation in grain legume-wheat intercropping, a series of experiments using several grain legumes were carried out at the Department AGRARIA of the Mediterranean University of Reggio Calabria. The main results of these studies are presented and particularly focus on: i) the effect of soil P availability on root exudation and how it influences P uptake of intercropped wheat; ii) the effects of increasing grain legume density on facilitation and competition; iii) how the roots react to P availability in intercropping due to their phenotypic plasticity and whether it affects root intermingling; iv) how grain legumes shape their rhizosphere bacterial community due to P availability and whether it can help in using the sparingly available P fraction in intercropping. The most relevant outcomes suggested that a) intercropping always facilitated P uptake of wheat at low P availability; b) the P uptake response to each legume species was affected by its density, which modified root exudates in the wheat rhizosphere; c) the root intermingling was enhanced at low P availability, which can be explained by root proliferation near the neighbour roots; d) the rhizosphere bacterial communities of the legumes and intercropped wheat were enriched with phosphate solubilising bacteria (PSB) when P was less available.

[1] Tang, X., Zhang, C., Yu, Y., Shen, J., van der Werf W., Zhang, F. (2021) Intercropping legumes and cereals increases phosphorus use efficiency; a meta-analysis. Plant Soil 460:89–104. https://doi.org/10.1007/s11104-020-04768-x