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Influence of intra- and inter-specific plant biodiversity on soil functioning: soil response under the use of Evolutionary Populations in a rotation system

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Abstract:

Intense conventional crop production is characterized by a large use of inputs and are systems inducing a strong pressure on the environment through biodiversity loss or soil degradation. Moreover, climate change combined with the rise of extreme climatic events threaten crops yields. Therefore, there is a need to adopt sustainable agricultural practices that could reduce the agricultural impacts on the environment while enhancing its resilience.
Evolutionary Populations (EP) are plant populations presenting a high degree of within crop genetic diversity that usually show a lower input need than Mono-variety crops. As well, they often exhibit a higher buffering capacity in response to environmental stresses. They could be used as alternatives in areas where cultivation can be difficult such as in Mediterranean areas. An important aspect of the adaptation of EP in those environments remains in the relationship between root systems and soil microorganisms. The aim of this work is thus to investigate if EP crops lead to contrasting soil functioning.
We carried out a field experiment including conventional and evolutionary populations of wheat to investigate their effect on soil functioning. We aimed to understand if (1) EP can participate at modifying soil organic matter composition, (2) if they can participate at modulating soil microbial communities and (3) their activities. To this end, we analyzed soil MIRS signatures as well as microbial communities through EL-FAME extraction while assessing soil enzyme activities. We characterized bulk and rhizosphere soils from EP and conventional wheat after precessions of legumes or wheat at two Italian sites.
Our results highlighted that, after a year of cultivation, EP did not disturb soil microbial communities or their activities and neither modified soil organic matter composition. Co-inertia analysis demonstrated that soil organic matter was more correlated to enzymes activities than to microbial communities. Nevertheless, observed results were highly dependent on the sites and the type of rotation. Those results have to be investigated in a longer-term way and a monitoring of these crop systems on several years will be performed.