Crop diversification positively alter the intensity of soil-plant interactions in intensive agrosystems giving clues for agroecological transition

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Abstract

Crop diversification (Eisenhauer, 2016) and crop rotation (King & Blesh, 2018) could modify rhizosphere functioning by altering the potential reservoir recruitable by plants (Benitez et al., 2017) Consequences are modifications of the plant performances through modifications of ecological functions fulfilled by rhizosphere microorganisms as disease suppressiveness (Peralta et al., 2018) or SOM turnover (Coskun et al., 2017 ; Hinsinger, 2001). Our aim is to estimate at the field scale and along a crop cycle if "rhizosphere effect" can be estimated in order to qualify the potential of plant-soil interactions in order to replace synthetic inputs by ecological regulations. We hypothesized that (i) a Rhizosphere Effect Index (REI) can be estimated (ii) and, the value of the REI will describe a gradient of crop diversification. Accordingly, we monitored a wheat field (*Triticum aestivum*) in 3 farms located in North differing by their crop diversity index (*sensu* Tiemann et al., 2015). Plant variables (diseases damages, development stages and aerial biomass) and soil variables (enzymatic activities, nitrate and phosphate fluxes, microbial diversity) in both rhizosphere and bulk soil were determined to calculate the REI. The suggested REI discriminate the rhizosphere soil compared to bulk soils with systematically lower REI value for the less diversified farm. Our results showed significant differences ($p < 0{,}05$) between rhizosphere and bulk soils, but some variables as enzymatic activities better defined the rhizosphere effect. Interestingly, temporal patterns can be analysed with the REI. Based on these results, we can consider that the crop diversification, even in intensive farms influence the rhizosphere effect, which is exacerbated in high diversification farms, suggesting limitations for agroecological transitions in the lower diversification farm. However, further developments of the REI are needed to determine correlations with plant performances and quantify causal links with inherent soil properties and practices.

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