Impact of farming practices on soil biodiversity and functioning in vineyard landscapes

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Résumé

Agricultural practices are known to affect endogenous fauna and soil microorganisms, which are essential for soil functioning and organic matter recycling. In perennial crops such as vineyards, organic farming or reducing pesticide use are supposed to be beneficial for biodiversity conservation. To assess the responses of soil mesofauna and microorganisms to different management regimes, we measured the responses of springtails communities (abundance, diversity) and microbial activity (extracellular enzymatic activities, catabolic capacities) to farming practices in real-world fields. We investigated more precisely the impact of pesticide use, the intensity of soil management, and the inter-row management type (grassy and tilled inter-row) while taking in to account the soil physico-chemical properties. For springtails, we observed a drop in abundance and diversity in late spring, which could be associated with an increase of pesticide use. We also found that organic matter content and tillage intensity enhanced the functional and taxonomic diversity of springtails. The intensity of pesticide use, and particularly the number of different phytosanitary products used, is associated with a decrease of their diversity, but we found no effect of soil copper content contamination by copper on springtail communities. Regarding enzyme activities and physiological profiles of microbial communities, we found relatively low rates of substrate respiration and little contrast in the diversity of substrates respired between the different soil management practices as well as along the pesticide use gradient. However, we found that soil properties, such as organic matter content and pH, influenced soil microbial functioning, as they were both positively related to N and P related enzyme activities and nutrient availability in vineyard soils. Our results emphasize that the increase of soil organic matter content through, for example, the use of cover crops, manure or compost adding, may help at preserving diversity of endogenous fauna and their functions in soil.

Mots-Clés: Collembola, microorganisms, soil management, taxonomic diversity, functional diversity

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