

EGU22-1112

<https://doi.org/10.5194/egusphere-egu22-1112>

EGU General Assembly 2022

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Abundance and community composition of free-living nematodes as a function of soil structure under different vineyard managements

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Organic farming aims at improving soil fertility in vineyard soils through a combination of farming practices. We studied the effect of organic management on community traits of free-living nematodes as well as bulk and microstructure properties of soil by comparing them to conventional management, both within vine rows and in interrows. The objectives of this study were to: 1) identify differences between management systems in terms of nematode abundance and molecularly measured community composition, and 2) to scrutinize, whether these changes can be explained by microstructural properties measured with X-ray computed tomography (X-ray CT) of individual soil aggregates. Nematode abundance was mainly governed by habitat constraints, which was reflected in significant correlations with soil moisture and with porosity in the habitable size range of 20–220 μm obtained with X-ray CT. The lack of bioturbation by fine roots and the absence of irrigation reduced the abundance of water-filled, habitable pores, which resulted in the lowest nematode abundance in conventionally managed interrows without a grass cover. Community composition in terms of diversity and maturity, in turn, was not affected by habitat constraints but mainly governed by resource availability for the soil food web estimated by particulate and dissolved organic matter contents. The permanent grass cover and lack of tillage in interrows of the organic vineyard improved resource availability and promoted the build-up of omnivores and predators that are especially sensitive to disturbance. The organically managed interrows therefore had lower diversity and higher maturity than conventionally managed interrows. Differences between conventional and organic management were in general greater in interrows than within vine rows. These findings highlight the added value of pore structure investigations via X-ray CT in understanding trophic interactions of nematodes. At the same time, they stress the importance of exact sampling locations on nematode traits especially for perennial, woody crops.