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Effects of farming system and simulated drought on biodiversity, food webs and ecosystem functions in the DOK trial

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Organic agriculture promotes overall biodiversity in arable fields, with well-documented positive effects on plant and pollinator diversity and abundance. Responses of soil-living decomposers, aboveground herbivores and predators to organic farming are less uniform and not equally well understood. The DOK trial offers ideal conditions to assess the long-term effects of organic compared to conventional farming practices on these above- and belowground invertebrate communities. Organic treatments in the DOK trial have a pronounced effect on abundances, diversity and species composition across taxonomic borders. Application of farmyard manure promotes nematode and earthworm numbers, whereas mineral fertilizers detrimentally affected potworm and fly larvae numbers. Aboveground predators are more abundant under organic agriculture and herbivores show an opposite response. However, effects go beyond simple numeric responses as organic agriculture alters the species composition of local communities significantly.

These changes in taxonomic composition are of particular importance for system comparisons, as they may have pronounced consequences for trophic interactions and levels of ecosystem functions and services. Nutrient mineralization, pest infestation and biological control levels substantially differ between treatments with and without farmyard manure or mineral fertilizer application. The link between the observed natural enemy and pest numbers in organic treatments is not exclusively a consequence of higher predator abundances in organic treatments. Stable isotope analysis of samples from the DOK trial rather indicate, that the observed patterns also partly stem from altered predator-prey interactions under organic agriculture.

Finally, climate change holds the potential to alter the observed effects of organic agriculture on biotic communities and associated ecosystem functions. A recent BiodivERsA EU project (SOILCLIM) simulated severe drought conditions in the DOK trial. Amongst other biotic groups, below- and aboveground arthropods and associated ecosystem functions responded to climatic conditions and organic agriculture. This synthesis summarizes existing results from research on invertebrate communities and associated ecosystem functions in the DOK trial, emphasizing the need for long-term studies and the joint consideration of management and climate effects on biodiversity and ecosystem functions.