

Functional soil biodiversity; The contribution of reduced tillage systems to ecosystem services and sustainable farming

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Abstract:

Implementation of reduced tillage systems is targeted at increased soil organic matter contents and soil biodiversity, reduced soil erosion and enhanced climate resilience of agroecosystems. Enhanced soil biodiversity has been related to a range of soil functions and ecosystem services, e.g. nutrient delivery, soil structure and water storage, disease control and crop yields. However, development of reduced tillage approaches and optimization of overall system performance requires adaptation of basic principles to the agroecological and social context, as well as farming objectives (e.g. conventional vs. organic). Therefore we aimed to 1) document reduced tillage practices within different agroecological contexts in NW Europe; 2) evaluate the effects of the reduced tillage systems on soil biodiversity and soil functions; 3) develop approaches to integrate data, extract proxies for ecosystem services and evaluate overall agroecosystem sustainability, and 4) increase understanding of agroecological factors that determine potential benefits and trade-offs.

Earthworm and nematode taxa were selected as indicator organisms to be studied for their known response to soil management and effects on soil functions. Additionally soil organic matter, physical soil parameters and processes, and crop yields have been measured across a range of sites. Data have been collected over multiple cropping seasons in long term field experiments and farmers field sites in France (Brittanny) and the Netherlands (Flevopolder, Hoeksche Waard and Southern Limburg). Through international and interdisciplinary collaboration the observed diversity in earthworm communities in terms of species, abundance, and trait diversity could be related to soil quality and soil functioning. Data integration further allows for the evaluation of the impact of reduced tillage systems on the provision of ecosystem services via proxies such as crop biomass yields, soil organic matter, aggregate stability and water infiltration rate.

The paper will present forthcoming results of this collaborative work, thereby shedding light on the benefits and trade-offs related to reduced tillage systems in NW Europe, and the role of soil organism groups for improved soil functioning and crop performance. Recommendations are provided for soil sustainable management aiming at ecological intensification of agricultural land.

Keywords: *reduced tillage systems, arable cropping systems, organic farming, France, The Netherlands, soil biological and physical quality, ecosystem services*

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