



Multi-year dynamics of soil structural stability under contrasting farming practices in a belgian organic field experiment

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At the heart of agro-ecosystems lie soils, essential components profoundly affected by intensive farming practices and global changes across various regions in Europe. This impact manifests as a loss of biodiversity, a decline in organic matter content, and heightened susceptibility to erosion. Recognizing these challenges, certain farmers are embracing innovative approaches to enhance soil quality, such as conservation farming and organic farming. These two systems differ significantly in their weed management practices, with conservation farming relying on synthetic herbicides and reduced tillage, while organic farming predominantly employs tillage.

To assess soil structural stability, we developed a new measurement protocol, the QuantiSlakeTest. This low-tech method operates on the principle of continuous quantitative measurement, evaluating the disintegration of a soil sample submerged in water. The resulting curves are normalized, and synthetic indicators, including relative weights at stabilization, time to reach maximum relative weight post-immersion, diverse slopes, and area under the curve, facilitate the comparison of various treatments.

Building on previous research demonstrating the relevance of this approach and the influence of tillage on soil structural stability (Vanwindekens & Hardy, 2023), our study employed the QuantiSlakeTest to highlight the annual evolution of soil structure stability over three years following the implementation of an organic cropping system trial in Gembloux (Wallonia, Belgium). Initiated in 2019, the trial involved converting a conventional 6 ha field to a seven-year rotation of organic farming. The three compared cropping systems differed in weed control, fertilization, and tillage practices. Soil samples were collected in early spring of 2020, 2021, and 2022 from various crops in the trial, including winter cereals, spring cereals, legumes, and maize, with cover crops or even uncovered after a winter ploughing.

Our main findings reveal a gradual differentiation of soil structural stability indicators during the first three years of cultivation. Cropping systems based on reduced tillage practices demonstrated a positive impact on soil structural stability, particularly in the third studied year (2022), while reference systems exhibited lower rates. These results confirm previous studies. We also detect a slight positive impact of legumes, cover crops, and/or crop associations, even in the two cropping systems with ploughing (2022). Further analyses, to be conducted over the seven years rotation will shed additional light on the dynamics of soil structural stability.

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