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Nitrogen cycling and microbial communities within soil microenvironments in integrated organic farming systems in Switzerland

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Soil tilling is part of standard agricultural field preparation practices both in conventional and organic cropping systems. Although used mostly for weed control, it presents several drawbacks including increased soil erosion, soil structure disruption and high soil moisture loss. The use of fast-growing cover crops to overcome weed pressure, in combination with conservation tillage has been identified as a possible management strategy in organic systems, yet the mechanisms by which these practices affect nitrogen dynamics is mostly unknown. In this study we use an existing 4-year-old field experiment that combines the use of different tilling intensities and four different cover crop treatments and analyze overall N cycling using 15N stable isotope techniques, physical fractionation methods, and quantitative functional gene assays. Preliminary results suggest that reduced tillage may promote the formation of large macroaggregates in organic systems. Lower proportions of small macroaggregates and microaggregates went to the assembly of large macroaggregates when a cover crop was present. Macroaggregates constitute the majority of soil volume and consequently contribute the most to overall carbon and nitrogen soil content. There is a trend of higher carbon content across all soil fractions in the organic tillage treatments with mixed and brassica cover crop treatments, although the differences were not significant, added effects may be seen with time. Overall, treatment effects are more pronounced in the 0-6cm soil layer. Ongoing quantitative functional gene expression assays will shed light on the role of microorganisms and contribute to understanding nitrogen availability, stabilization and loss in integrated organic systems.