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GHG emissions and soil quality in differently tilled soils at an organic experimental field at ILVO (Merelbeke, Belgium)

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ABSTRACT: GHG emissions and soil quality in differently tilled soils at an organic experimental field at ILVO (Merelbeke, Belgium)

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A long term field experiment under organic management was established by the Institute for Agricultural and Fisheries Research (ILVO) at Merelbeke (BE) in 2012. Different soil tillage, green manure management, and application of soil-improving amendments are compared. The experiment has a split-plot design, with twelve treatments and four replicates. Tillage was carried out by conventional ploughing or reduced non-inversion tillage. In 2012, differences in timing of grass clover sward termination were assessed for nutrient availability on leek (Allium porrum). In the following year ensilaged grass-clover was applied (0, 10, 20 Mg ha-1) to create distinguishable nutrient and organic matter input for the celeriac crop (Apium graveolens var. Rapaceum). From 2013 onwards, soil-improving amendments were introduced as a new factor leading to a split-split-plot design. Farm compost (zero and 33 Mg ha-1 in 2013) and PRPSOL (PRP-technologies) (zero and 200 kg ha-1 in 2014) were applied on the sub-sub-plots before sowing of the main crop. Both tillage operations were carried out before sowing of spring wheat (Triticum aestivum) in 2014. Soil samples were taken for analysis of soil organic carbon (SOC) and total nitrogen contents (0-10 cm, 10-30 cm and 30- 60 cm) in early spring 2014. Since celeriac tuber harvest, repeated sampling of greenhouse gas emissions from the plant-soil system were carried out using the static ventilated chamber system (closed PVC chambers, diameter 30 cm). For this purpose, two chamber collars were initially placed in each non-compost sub-subplot (two collars in six treatments replicated four times (total 48)). The gas samples were analysed by optical feedback cavity-enhanced absorption spectrometry (OFCEAS) for CO_2, CH4 and N2O. GHG emission measurements were pursued during the tillage operation period and throughout the wheat crop growing season. Depending on results from spring 2014, collars were shifted to the compost treatments. Soil respiration (CO_2) was measured twice by a Li-Cor 8100A® apparatus during the period of tillage operations in spring (two collars per sub-sub plot in six treatments in two replicates (total 24)).

At the time of writing this abstract, the data has yet to be analysed. A Meta-analysis of soil samples originating from short and long term experiments on reduced tillage in organic agriculture within the TILMAN-ORG project (www.tilman-org.net) provided evidence that SOC in the upper soil layer is enhanced in reduced tillage plots as compared to the ploughed ones. Also crop yield and soil respiration were indeed affected by green manure application and/ or tillage type at the ILVO experiment in previous years. We expect that the organic matter stratification under reduced tillage in combination with soil amendments will directly affect nutrient availability, which will be measured through soil analysis, GHG emissions and biomass production. Emissions from plant and soil respectively, are thus expected to differ according to tillage operations and soil improvement amendments. The newly generated data will be presented at the conference.