Does conversion to conservation tillage really increase soil organic carbon stocks in organic arable farming?

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Aggravation of weather extremes increases awareness of climate change consequences. Mitigation options are in demand which aim to reduce the atmospheric concentration of greenhouse gases. Amongst others, conversion from ploughing to conservation tillage is argued to increase soil organic carbon (SOC) stocks. Yet, main findings of reviews and meta-analyses comparing SOC stocks between tillage systems show different results: from a significant increase of SOC stocks to the question if there is any effect at all. Reasons are a sampling bias as in many campaigns only topsoil layers are assessed and horizons thickness is not considered adequately, different methods for SOC and bulk density determination, and the comparison of SOC stocks based on equivalent soil masses instead of equal sampling depths.

In order to address these limitations, we initiated the SOCORT consortium (Soil Organic Carbon in Organic Reduced Tillage) – an international network of nine agronomical long-term trials. All trials represent common mixed organic farming systems of the respective region with organic fertilisation and crop rotations including leys. Climatic conditions are similar, but age and soil texture vary (7 to 21 years and sandy to clayey soils). A common sampling campaign was consequently elaborated to answer the question if the combination of conservation tillage and organic farming can really increase SOC stocks. Undisturbed soil cores were taken with driving hammer probes (8 cm in diameter) to a maximum depth of 100 cm. Each core was divided in the increments 0-30, 30-50, 50-70, 70-100 cm. The topsoil layer (0-30 cm) was further divided into the different tillage depths of the respective trial. All samples were analysed in the same laboratory for bulk density, organic carbon content, pH and texture. We compiled the yields for each trial to assess carbon inputs. The SOCORT consortium in combination with the common sampling campaign will entangle the driving factors of carbon sequestration through reduced tillage and add important knowledge on carbon dynamics in agro-ecosystems.