Geophysical Research Abstracts
Vol. 20, EGU2018-15897, 2018
EGU General Assembly 2018


# Soil organic carbon cycling in a long-term agricultural experiment, Switzerland

Marcel Bliedtner (1,2), Tobias Stalder (2), Paul Mäder (3), Andreas Fließbach (3), Gary Salazar (4), Sönke Szidat (4), Roland Zech (1,2)

(1) Institute of Geography, University of Jena, Germany (marcel.bliedtner@uni-jena.de), (2) Institute of Geography and Oeschger Centre for Climate Change Research, University of Bern, Switzerland, (3) Research Institute of Organic Agriculture (FiBL), Switzerland, (4) Department of Chemistry and Biochemistry & Oeschger Centre for Climate Change Research, University of Bern, Switzerland

Soils are one of the largest organic carbon pools and changes in the carbon release from soils has considerable impact on the composition of atmospheric $CO_2$. Alongside the accelerated carbon release from soils by anthropogenic warming (Crowther et al., 2016), agricultural use strongly affects soil organic carbon (SOC) (Johnston et al., 2009). Conversion from conventional to organic farming has been suggested a valuable contribution to sequester SOC providing a great mitigation potential within agricultural practices (Smith et al., 2008).

Here we present SOC contents and 14C activity under two different farming practices in the long-term agricultural DOK trial at Therwil, Switzerland (Mäder et al., 2002). In this long-lasting agricultural experiment, we compare biodynamic farming (biodyn), which receives manure and biodynamic preparations, with conventional farming (conmin), which receives only mineral fertilizers. We analyzed functional SOC fractions from both farming practices for SOC concentration and radiocarbon ($\Delta$14C) in two soil layers (0-20 cm and 20-50 cm). Three SOC fractions were obtained by density and particle size fractionation: particular organic matter (POM, labile pool), mineral-associated organic matter <20 $\mu$m (MOM <20 $\mu$m, stable pool) and mineral-associated organic matter >20 $\mu$m (MOM >20 $\mu$m, labile pool).

Our results clearly show higher SOC concentrations for biodyn compared to conmin in all SOC fractions in the upper soil layer (0-20 cm). In the subsoil (20-50 cm) we found a negligible influence of farming practices with depth. High $\Delta$14C values in the POM and >20 $\mu$m fraction indicated that they are a more labile and fast cycling carbon pool, whereas lower $\Delta$14C values in the <20 $\mu$m fraction indicate that this fraction represents a stable and slowly cycling carbon pool. $\Delta$14C differences between biodyn and conmin occurred in the POM and >20 $\mu$m fraction, with higher $\Delta$14C values in the biodyn system suggesting greater input of fresh plant material with a faster turnover.

Reference:

Crowther, T.W. et al., 2016. Quantifying global soil carbon losses in response to warming. Nature 540(7631), 104–108.

Johnston, A.E., Poulton, P.R., Coleman, K., 2009. Chapter 1 Soil Organic Matter. In: Elsevier, pp. 1–57.

Mäder, P., Fließbach, A., Dubois, D., Gunst, L., Fried, P., Niggli, U., 2002. Soil fertility and biodiver-sity in organic farming. Science 296, 1694-1697.

Smith, P. et al., 2008. Greenhouse gas mitigation in agriculture. Philosophical transactions of the Royal Society of London. Series B, Biological sciences 363(1492), 789–813.