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Miscanthus-derived SOC: numerically declining over soil depths

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Miscanthus is one of the most efficient perennial bioenergy crops for wide establishment and distribution. Most of the previous reports had shown the benefits of Miscanthus cultivation in soil organic carbon (SOC) sequestration and greenhouse gas emissions (GHG) mitigation. However, some other papers pointed out that the Miscanthus-derived SOC is mainly of particulate organic matter and the labile quality of particulate organic matter may bear great uncertainties in GHGs emissions. This urges the necessity to investigate the quality and mineralization potential of Miscanthus-derived SOC.

This study investigated soil profiles deep to 1 m from 20 yr Miscanthus fields in France and Switzerland. Soil organic carbon (SOC) concentration and δ13C compositions of all the soil layers (0-10, 10-40, 40-70 and 70-100 cm) were determined. Our results show that: 1) Miscanthus cultivation can in general increase the SOC stocks compared to the Grassland, while the benefits of SOC sequestration may only constrain to the surface soil. Isotopically, the Miscanthus-derived SOC ranged from 69% the top 10 cm soil down to only 7% in the 70 to 100 cm layer, cautioning the use of SOC stocks on the surface soil to estimate the total net benefits of Miscanthus cultivation in terms of sequestrating atmospheric CO_2. 2) Compared to the Grassland soils, the surface soils on the Miscanthus fields tended to have a risk of acidification (pH values down to 6) and exceeded contents of P and K, adding another precaution to the environmental impacts of Miscanthus cultivation in the entire Upper Rhine Region. Overall, changes of soil characteristics must be included into Life Cycle Assessment to fully evaluate the environmental impacts of long-term Miscanthus cultivation.