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Carbon distribution between density and particle size classes of differently managed soils in a 40-year agronomic long-term trial

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Soils contain more carbon (C) in the form of organic matter (soil organic matter = SOM) than the entire atmosphere and global vegetation combined. They are a central component of the global C cycle and its largest dynamic reservoir. Smart agricultural practices are discussed, on the one hand, as a way to mitigate climate change because they can increase the amount of SOM and thus actively remove C from the atmosphere. On the other hand, all intensively used soils lose C in the long term. The scientific key questions in this context revolve around the extent and dynamics of C storage, as well as the associated stabilization mechanisms involved and effects of agricultural use on the C budget.

The DOK experiment is a long-term agronomic field trial near Basel (Switzerland) that compares biodynamic, organic and conventional management systems since 40 years. Within the "DynaCarb" project, we investigate how the management systems affect SOM fractions during the 40-year experimental period. We compare the unfertilized control to a purely mineral, a purely organic, and a combined fertilized, mineral-organic variant (four field replicates each) during six crop rotation cycles. By using a combined density and particle size fractionation, the SOM is separated into particulate and mineral-associated fractions and their development is quantitatively investigated in archived samples from 1982, 1989, 1996, 2003, 2010, and 2017.

"DynaCarb" investigates the medium- and long-term effects of different agricultural systems on SOM. These results are of great importance for the evaluation of the C sequestration potential of agricultural soils and for the identification of suitable management and fertilization strategies.