

Effective soil organic carbon monitoring in perennial agriculture systems *Sampling protocol development and evaluation*

Perennial agriculture systems are gaining ground as a more sustainable alternative to conventional annual agriculture, partly for their potential to increase the soil organic carbon (SOC) content. Carbon farming is another hot topic for SOC sequestration, as it creates economic incentives for farmers. The main purpose of this study was to measure the baseline SOC stock for a larger research project, where the SOC balance of a field with the perennial grain Kernza™ will be compared to conventional annual crops grown on a control field during five years. The SOC stock of the test and a control plot in Alnarp, south Sweden has been determined to 136.76 Mg SOC ha⁻¹ for Kernza™ and 150.06 Mg SOC ha⁻¹ for the control, through extensive field sampling and laboratory analysis. When evaluating different sampling protocols regarding stratification and sample size, it was found that in order to accurately detect relevant changes in SOC over a short time frame, a large number of samples was required. In this study, stratification was not effective to reduce the required number of samples. This study implies that there is a need for robust SOC sampling designs for research and the carbon farming market alike.

Keywords: Physical geography, ecosystem science, soil organic carbon, soil sampling, perennial crops, carbon sequestration, carbon farming, Kernza™, SOC stock

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