

HAFL Master's Thesis Abstract

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English Title: **Evaluation of soil fertility through sustainable management of soil organic carbon in permanent grassland systems**

English Summary: The largest mass of organic carbon on Earth is present into soils, and surpasses the combination of the mass present in the atmosphere and in the living biomass. Changes in soil carbon have a direct impact on the concentration of CO₂ in the atmosphere and thus on climate change. Soils are getting degraded by intensive agricultural practices to a degree at which certain soil functions and services cannot be fulfilled anymore. In the present study, soil samples were taken from sixteen farms in various locations of Solothurn canton (Switzerland), both from permanent grasslands and neighbouring cultivated lands following a paired sampling strategy. These soil samples were analyzed for their content in soil organic carbon (SOC) and clay, for physical properties such as the soil density and pH. In addition, spade tests were performed to visualize the structure of selected soil samples. Paired samples taken at the same location were thought to display the same soil properties, which allowed us to measure the effects of land management on SOC. The SOC content of permanent grasslands was estimated on average at 2,38 %, a value substantially higher than that of cultivated lands (1,89 %). Evaluation of soil density and aggregate stability indicated that the soil structure of cultivated lands was degraded. Statistical analyses on the dataset obtained in the present work and data from the *Ressourcenprogramm Humus* (Solothurn canton) revealed strong correlations between the SOC content and several soil factors (clay content, soil density and geographic unit). While the clay content in soil participates to the stabilization of SOC, the SOC/clay ratio only followed a linear trend for samples with clay content below 30 %. As expected, the soil density decreases with increase in both SOC and clay contents, indicating that the soil density should be experimentally determined. It was also shown that at the farm scale, land management influences the SOC content and that at regional scale, the geographic unit, including notably the soil type, must be added as factor influencing the SOC content. Taken together, these important factors should be integrated into the calculation of humus balance. Taking advantage of the paired samples at the farm level, the SOC content measured in the permanent grasslands of a given farm can be considered as a target value for farmers to be achieved in their corresponding cultivated lands. This invites to establish SOC content target values at a local scale, instead of using a unique national reference value.

Keywords: Soil organic content (SOC), permanent grasslands, clay content, soil density, humus balance

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