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BOOK OF ABSTRACTS

Effects of long-term soil organic matter decline on soil nutrient status and organic matter composition in organically managed grass-clover ley and permanent pasture in Norway

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Grasslands are often seen as a beneficial measure to increase soil organic matter (SOM) content in (former) croplands and reduce GHG emissions. In permanent grassland the continuous ground cover and the high root density protect the soil against erosion, leading to an accumulation of organic matter. In cultivated grasslands, such as grass-clover leys, the nutrient cycle encompasses an accumulation phase during the ley period, followed by a rapid decomposition after ley termination. Upon ploughing the grass-clover ley, there is an increased mineralization of nutrients, contributing to the buildup soil fertility. As part of the global C-arouNd project consortium, which aims to investigate how short and long-term agricultural management practices affect SOM persistence in the soil profile, we want to investigate how SOM decline affect the soil nutrient status and organic matter composition in the long term, in a permanent and cultivated grassland in West Norway.

At Tingvoll gård experimental farm, organic milk production was established in 1986, replacing the previous conventional sheep farming. Records of bought additional feed and sold products have been kept, allowing to calculate a farm nutrient budget. Since 1990, soil samples (0-20 cm depth) have been taken every 5–7 year for determination of SOM and soil fertility status. In addition grass-clover yields have been annually measured since 1991. Preliminary analyses of the historical data show a decline on the SOM concentration (ignition loss) in the 0-20 cm top layer over 30-y period. On average in the cultivated grassland, SOM concentration declined from 14.0 % and 7.9 % in 1990 to 7.4 % and 6.4 % in 2021. In the permanent pasture, where the soil is not ploughed every 4 years, the losses of SOM content were smaller, on average SOM decreased from 10.2 % to 8.0 %.

We hypothesize that soil from fields with the largest decline in SOM over the past decades will contain relative more stable carbon components while also being richer for most macronutrients. Analysing the farm nutrient budget, i.e. the in- and output of nutrients from the farm system, will give further

insight in potentially deficient nutrients in soil and help establish a more durable soil management. Soil nutrient imbalances can lead to higher SOM turnover and a further decrease in SOM content can be expected. To test these hypotheses, soil samples will be taken in autumn 2024 to study the macronutrients and SOM composition in more detail. C, N and S will be measured by dry combustion, available P by the Bray-1 Method and exchangeable Ca, K and Mg using ammonium acetate extraction. SOM composition will be examined using a thermal fractionation method on the different size fractions (fPOM, oPOM & MAOM) of the soil.

Keywords: Grasslands, SOM decline, Nutrient mining