

EGU2020-19887

<https://doi.org/10.5194/egusphere-egu2020-19887>

EGU General Assembly 2020

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The impact of fertilization regime and land use change on the SOM after 60 years of maize cropping

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The top metre of the soil is one of the largest terrestrial carbon reservoirs. More than 50% of the soil carbon is stored as soil organic matter (SOM). Several papers report about the SOM losses due to tillage and land-use change. On the other hand, a huge amount of papers focus on the environmental potential of various min-till, no-till and other techniques for regenerative agriculture. The change of the fertilization regime also has an influence on SOM so it also can influence the humus status of the soils. This presentation focuses on the effects of different kinds of fertilization and abandonment of arable lands on the quantity and quality of the SOM.

The present study is based on Martonvásár Experimental Station (Hungary) which was established in 1958. The research focused on maize monoculture with the following treatments: (a) no fertilization, (b) NPK, (c) NPK with manure addition. The soil of the plots is Chernozem. Two controls were selected: (a) a natural Grassland and a secondary grassland. The secondary grassland was an arable land until 1990. Five repetitions of soil samples were taken from each plot and times. Soils were fractionated to silt and clay associated OM (s+c), aggregate associated OM (S+A), dissolved organic matter (DOM) and particulate organic matter (POM) according to Zimmermann's method (4). Quality parameters of the DOM were studied by CN analyser, UV-Vis spectrometer, spectrofluorometer, zetasizer and size exclusion chromatograph. Solid SOM fractions were studied by CHNS analyser, ATR-FTIR and DRIFT FTIR. The V3-V4 regions of the 16S rRNA gene obtained from the soil samples were sequenced on the Illumina platform for the description of microbial diversity.

Twenty years were enough to restore the natural SOM content of the soils (land-use change from arable land to grassland). Labile fractions of the SOM were higher in case of secondary than the primary grasslands. We have found differences in weight ratios of SOM fractions between fertilization regimes, as well. The proportion of microbial contribution to SOM were higher in the arable soils than the grasslands based on the C:N ratios of the SOM. However, the predominance of phyla Proteobacteria, Acidobacteria, Bacteroidetes, Actinobacteria and Verrucomicrobia in all

studied soils, microbial diversity is generally higher in the grasslands than in the arable plots. The DOM of different fertilization regimes and land uses have shown the most characteristic differences. The difference between arable plots (with various fertilization regimes) and grasslands can be characterized by humic substances (HS) with higher condensation degree and molecular mass. The application of manure has result same proportion of peptide-like components and HS with lower molecular as the DOM of grassland soils.

The microbial diversity of abandoned arable land remained similar to that of the arable lands over twenty years. The major part of the growth of SOM occurred in the labile fractions. The change of the fertilization regime also has limited potential to grow a total mass of SOM.

Support of the GINOP 2.3.2-15-2016-00056 and National Research, Development and Innovation Office under contracts K123953 are gratefully acknowledged.