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Response time of soil organic matter alteration triggered by land use changes

Gergely Jakab (1,2), Ádám Rieder (3), Balázs Madarász (1), Dóra Zacháry (1), Judit Szabó (1), Anna Vancsik (1), Marianna Ringer (1,2), Zoltán Szalai (1,2)

(1) Research Centre for Astronomy and Earth Sciences, Hungarian Academy of Sciences, Geographical Institute, (2) Eötvös Loránt University, Faculty of Sciences, (3) University of Leeds, Earth Surface Science Institute

Soil organic matter (SOM) content and composition are basic properties of the soil affecting most physical, chemical and fertility associated features. The SOM reflects to the former and actual inputs (plant residuals) and outputs (mineralization by microorganisms), therefore its chemical composition is hardly measurable. Some more degraded constituents are attached to the mineral phase that protects them against mineralization while others can be chemically more stable individual fractions. Changes in land use and even in agrotechnics modify SOM transformations, however the response time of several sub processes is still unknown in details. Present study aims to quantify SOM changes following forest conversion to arable field and due to the introduction of conservation tillage fifteen years ago.

Samples from the potentially tilled layers (0-18 cm) of a native forest (NT), a continuously ploughed field (PT) and a conservation tillage (CT) field were compared. Bulk soils were fractionated according to Zimmermann (2007) to separate silt and clay associated SOM; sand and aggregates associated SOM; particulate organic matter; resistant SOM and water dissolved SOM. Total organic carbon content, total bound nitrogen, and photometric indices derived from 0.1 M NaOH extractions were determined to predict SOM properties of these various soil fractions. Moreover, molecular size distribution was also measured using photon correlation spectroscopy.

Intensive ploughing significantly decreased the SOM content both in the aggregate and fine particles fractions compared to the forest soil. Moreover, the volume of macro-aggregates was also diminished due to ploughing. On the other hand, fifteen years of CT increased SOM in both above mentioned fractions whereas the volume of the finest fraction associated with resistant SOM increased the most and has reached the original value belongs to NF. In general, SOM molecules were increased in size both in the aggregates and in the fine fraction due to the long term ploughing whereas conversion to CT decreased only the molecular size of the fine fraction during the last fifteen years. This suggests that silt and clay associated SOM can considerably changes within decades. Water dissolved SOM was found to be consist of large and middle sized molecules mainly resulted by macro-aggregate brake down. Even if aggregation did not increase due to change to CT the content of larger molecular sized SOM increased in this short time.

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