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Tillage-induced changes in dissolved organic matter composition of soil porewater and runoff

Gergely Jakab (1,2,3), Anna Viktória Vancsik (1), Lili Szabó (1), Balázs Madarász (1), Tibor Filep (1), Zoltán Szalai (1,3)

(1) Geographical Institute, Research Centre for Astronomy and Earth Sciences Hungarian Academy of Sciences, Budapest, Hungary (jakabg@mtafki.hu), (2) Institute of Geography and Geoinformatics, University of Miskolc, Miskolc, Hungary, (3) Department of Environmental and Landscape Geography, ELTE University, Budapest, Hungry

Water dissolved organic matter (DOM) takes only a minor part of soil organic matter (SOM), therefore its investigation to estimate SOM properties as a whole is rare. Most studies focus on isolated fulvic or humic acids those take only a minor fraction of SOM and are regarded as highly artificial (alkali solubility) categories. Contrarily, DOM represents the more reactive part of SOM and among natural circumstances reflexes to the natural organic matter decomposition and transformation processes. This study aims to compare dissolved organic carbon and total nitrogen content and DOM properties of porewater and surface runoff generated by a natural rainfall event. The hypothesis is that different tillage systems trigger differences in DOM content and composition. To analyze DOM, porewater and runoff samples were taken (04/07/2018) from Szentgyörgyvár research station Hungary, where plowing tillage (PT) and conservation tillage (CT) are compared since 2003. DOC and TN were measured using dry combustion, DOM was characterized by fluorescent spectroscopy indexes and emission-extension matrix. DOM was also investigated applying reverse high-performance liquid chromatography. Precipitation had 19.2 mg L-1 DOC concentration, which did not change in surface runoff under CT and slightly decreased under PT (14.2-15.8 mg L-1). In the porewater, TOC doubled (41.5-53.5 mg L-1) independently from tillage. Contrarily, dissolved N was higher in PT porewater (9.8-12.6 mg L-1) compared to that of CT (8.2-9.2 mg L-1). The fluorescent index indicated higher aromaticity under the CT. There was no relevant difference concerning biological index values (0.61-0.66) of the pore water and runoff, nevertheless, the precipitation itself had a lower value (0.53). This indicates that additional SOM solution to the precipitation water is microbially originated. The humification index value of the precipitation (0.67) was considerably increased due to soil contact and differed between surface runoff from CT (0.85-0.87) and PT (0.84-0.85) plots, which may indicate more degraded SOM under the latter one. A significant increase was detected concerning the porewater values, while the difference between the tillage systems was not relevant (0.94, 0.95 respectively). Humic-like Coble peaks were the highest in porewaters of CT and PT, however, under the latter one, the values were a bit lower. In the surface runoff, these peak values are doubled on precipitation basis but were much lower compared to the porewater samples. In the runoff, no difference was found between tillage systems concerning the humic-like Coble peaks. Regarding the HPLC results, spatial sample repetitions provided the very same curve, whereas the surface runoff samples were found to be more hydrophobic than porewater samples independently from tillage. To conclude, fifteen years of CT hanged the DOM composition of the porewater, but not the surface runoff. Nevertheless, the Coble peaks, fluorescent indexes, and the HPLC spectra do not provide univocal results, tendencies exist, those need to be proved by measurements on additional precipitation events. The study was supported by the Hungarian National Research and Innovation Office (NKFIH) K-123953.