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Characterizing soil organic matter differences among extracts and the solid phase – the role of conservation tillage

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Soil organic matter (SOM) is in the focus of research as it plays crucial role in soil fertility, carbon sequestration, and all adsorption related processes in the soil. Nevertheless, its compound and the methods to investigate it are rather diverse. Some approach prefers to define different theoretical carbon pools in the soil based on input and mineralization dynamics using mean residence times. Other studies apply physical and/or chemical fractionations of the soil to separate the various eg. mineral phase associated or aggregate occluded carbon pools to gain less heterogeneous material. However, in practice, these two approaches are hardly met each other. As a considerable part of SOM is strongly associated with the mineral colloid fraction or even cations its investigation reveals the question of extractions. Traditional methods aimed to extract pure SOM fractions such as fulvic and humic acids (FA; HA) and characterized the whole SOM based on them, even though these pure fractions represented only a small part of the total SOM and were not present under natural conditions. Recent methods try to characterize the SOM using in situ samples where the role of organic mineral complexes is still not fully understood. As a result, findings based on several approaches are hardly comparable with each other. The present study aims to characterize SOM based on parallel in situ solid-phase investigation FA separation, and water dissolved organic matter extraction. The study site is a haplic Luvisol under plowing and conservation tillage. Fourier transform infrared spectroscopy on the solid phase fractions resulted in an inverse proportion between organic carbon content and aromaticity independently from tillage. The aggregate occluded SOM was characterized by the lack of aliphatic components, whereas the fine fraction, and the bulk soil associated SOM seemed to be rich in them. The water-soluble SOM revealed molecular size increase in both the fine fraction related and the aggregate occluded organic matter owing to plowing, nonetheless, aggregates occluded the same sized OM molecules as those attached to the fine fraction. In general, FA fractions provided more humified organic matter, whereas water dissolved SOM showed a more intensive microbiome origin. The photometric properties of the FA fractions did not differ between the tillage systems, except for the SUVA254, which provided higher aromaticity under conservation tillage due to the lack of plowing. Also, the water-soluble part of SOM showed more humified composition and increased aromaticity under conservation tillage compared to plowing tillage. As a consequence, beneath the

fingerprint of recent microbial activity, DOM reflects soil organic matter composition as well, therefore it seems to be suitable as a direct SOM proxy. The present research was supported by the Hungarian National Research and Innovation Office (NKFIH) K-123953, which is kindly acknowledged.