

Does the chemical composition of organic waste products applied on soil impact the dissolved organic carbon concentration along the soil profile ?

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Organic waste products (OWP) application and cover crops are agronomic levers to improve soil health. OWP can be valorized by anaerobic digestion to produce biogas. The chemical composition of digestate differs from that of its source material. Labile fraction being partly consumed by microorganisms, recalcitrant molecules accumulate in digestate. Studies on transfer of DOM (dissolved organic matter) towards the subsoil in soil receiving digestate are scarce. In a previous lysimeter study over 9 years, higher topsoil-DOC (dissolved organic carbon) concentrations under digestate were observed every year compared to its original slurry and associated with different winter crops, probably in relation to the root development of the crop. The extra-DOC could come from a higher production of root exudates due to a potential auxin effect of the digestate and/or a solubilization of the recalcitrant organic matter from digestate via the alkalization of rhizosphere. To check this hypothesis, the evolution of DOM chemical composition after digestate application (i) associated with different winter crops, (ii) during the drainage season and (iii) between the topsoil and the subsoil was studied. Lysimeters at 40 cm (topsoil) and 90 cm (subsoil) depths were monitored in 2018-2019 (wheat) and 2020-2021 (mustard), from November to March under pig slurry (PS) and digestate from PS (PS-DIG). The DOM composition of lysimeters samples and water extracts from PS and PS-DIG (WEOM) were analyzed by thermochemolysis coupled to gas chromatography and mass spectrometry (THM-GC-MS). A higher proportion in phenols and dicarboxylic acids was measured in WEOM from PS-DIG compared to PS. Under mustard, the DOM composition of the PS-DIG modality at the beginning of the drainage season was close to the one of WEOM of PS-DIG. Under wheat, the DOM composition of the PS-DIG modality in the middle of the drainage season seemed only partly influenced by the PS-DIG application, with a higher proportion of dicarboxylic acids but no difference in phenols proportion compared to PS.

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