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Repeated applications of compost and manure mainly affect the size and chemical nature of particulate organic matter in a loamy soil after 8 years

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Land application of exogenous organic matter (EOM) of residual origin can help to maintain or increase soil organic carbon (SOC) stocks. However, it remains necessary to quantify and predict the soil C accumulation and to determine under which form the C accumulates. Changes to the chemical composition of soil organic matter (SOM) after repeated applications of composts and farmyard manure were investigated in a field experiment (Qualiagro experiment, Île-de-France) after 8 years of applications of green waste and sludge compost (GWS), municipal solid waste compost (MSW), biowaste compost (BIOW) or farmyard manure (FYM). The soil was fractionated into particulate organic matter >50 μm (POM), a heavy fraction >50 μm and a 0-50 μm fraction demineralized with hydrofluoric acid (HF). Repeated EOM applications significantly increased total SOC stocks, the C amount in the POM fraction and to a less extent in the 0-50 μm fraction compared to the reference treatment. Compost applications accumulated C preferentially under the form of coarse organic matter of size >50 μm, whereas the FYM accumulated similar C proportions of size >50 μm and 0-50 μm, which was attributed to the presence in the FYM of a fraction of labile C stimulating microbial activity and producing humified by-products together with a fraction of stabilized C directly alimenting the humified fraction of SOC.
Pyrolysis-GC/MS and DRIFT spectroscopy revealed enrichment in lignin in the POM fractions of amended soils with GWS, BIOW and FYM. In the soil receiving MSW compost, the pyrolysate of the POM fraction revealed the presence of plastics originating from the MSW compost. A lower C mineralization during laboratory incubation was found for the POM fractions of amended soils compared with the POM from reference soil. This feature was related to a lower ratio of (furfural+acetic acid) / pyrole pyrolysis products in POM of amended vs. reference plots, indicating a higher degree of recalcitrance.. The POM from amended soils also featured greater thermal stability during thermal analysis compared with POM from reference soil. Higher proportions of N-containing pyrolysis compounds in the POM fraction, and of benzene pyrolysis products in the 0-50 μm fraction, were found in the soil amended with BIOW compost, probably originating from the humified OM of the compost. DRIFT spectroscopy showed relative enrichment in aliphatic compounds of the 0-50 μm fractions from amended plots when compared to reference plots.