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Organic amendments' dissolved organic carbon influences bioavailability of agricultural soil DOC

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Agricultural soils benefit from additions of organic amendments because they improve soil structure, are a source of plant nutrients, and increase concentrations of soil organic carbon (SOC). The latter fuels microbial processes important for plant growth, including nutrient mineralization and the suppression of plant diseases. However, these amendment additions range in quality and quantity of C and little is known about how their properties interact with native soil C and affect turnover. The dissolved pool of SOC (DOC) may be the most important C source for these processes as it is more biologically available and thus relatively easily turned over by the soil microbial biomass. Using a rapid-batch DOC fractionation procedure, we studied the composition of different organic amendments' DOC pools and measured how their additions change the quantity and turnover of soil DOC. Fractions isolated and quantified with this procedure include humic and fulvic acids, hydrophobic neutral and hydrophilic compounds. We hypothesized that these range from biologically recalcitrant to readily available, respectively. Amendments analysed included composts of different source materials and maturation stages collected from two different compost facilities in the Netherlands. Both total DOC concentrations and proportions of the aforementioned fractions ranged highly between composts. Composts cured for >10 days had a lower proportion of hydrophilic C compounds, suggesting that these are the most bioavailable and released as CO_2 via microbial activity during maturation. To measure the effects of compost DOC on soil DOC, we extracted the former and added it to a sandy soil in an incubation experiment. The amendment increased soil total DOC, CO_2 production from the soil, and the pools of humic and fulvic acids as a proportion of total DOC. Turnover of C from the incubated soil was measured by substrate-induced CO_2 production (an indicator of microbial activity) from a 96-well microplate (Microresp^{TM}) as well as photoacoustically from incubated headspace. Fractions of soil DOC were measured at 5 timepoints. Total DOC decreased throughout the incubation as well as, interestingly, pools of humic acids. We postulate that this is due to low aromaticity of the added C source. Composts with different hydrophilic proportions ranged in their effects on soil DOC pool sizes and turnover. This suggests that more knowledge about the nature of the amendment is needed before predicting the influence it will have on soil microbial activity when applied in the field.