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Interactions between SOM composition, polyvalent cations and clay content investigated by using FTIR

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Mobility, stability and biogeochemical properties of soil organic matter (SOM) depend largely on nature and strength of interactions, in particular, between the C=O functional groups in SOM, polyvalent cations and soil mineral surfaces. Mineral properties are mainly site specific. It is, however, unclear if long-term differences in soil and fertilization significantly affects the composition also of the relatively stable pyrophosphate soluble SOM fraction OM(PY). The objective of this study was to analyze the effect of the content of polyvalent cations on the relative C=O group content of OM(PY) for soils from long-term field experiments. The OM(PY) fractions were extracted sequentially from loamy and sandy topsoils of long-term field experiments at Bad Lauchstädt, Halle and Rotthalmünster and analyzed by FTIR. Relative C=O content, determined at 1640 and 1720 cm-1 in FTIR spectra, increases with amount of soluble Ca, but is not directly related to the content of oxalate soluble Al or Fe. The relation could be improved considering additionally the amounts of exchangeable Ca and poorly crystalline oxides weighted according to the binding status of the corresponding cations. However, relations were stronger for soils from control, PK and NPK plots, but not detectable in soils of farmyard manure plots. The homogenizing effect of farmyard manure in terms of SOM composition may be explained by addition of OM that is already composed of more stabilized fractions and that is partly complexed to polyvalent cations. Differences in SOM composition need to be considered when studying sorption processes in soil. And interaction of chemical species with soil organo- mineral surface depends on small-scale distribution of SOM. Currently, SOM composition is mostly analyzed using disturbed soil samples. Investigations on undisturbed particle or structural soil surfaces for better understanding of interactions between SOM and surfaces require development of adopted methods.