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Composition of stable soil organic matter fraction related to polyvalent cations

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Polyvalent cations and clay minerals contribute to the stabilisation of soil organic matter (SOM). Mainly the C=O functional groups in SOM are interacting with polyvalent cations and mineral surfaces. It is, however, unclear whether in the long-term, different types of fertilization via the content of polyvalent cations in soil may affect the C=O content of the relatively stable fraction OM(PY). The objective of this study was to analyze the relation between the relative C=O group content of OM(PY) and the content of soluble calcium (Ca) and iron (Fe) ions for two arable soils for better explaining the composition of OM(PY). The OM(PY) fractions were obtained from loamy and sandy topsoils of long-term field experiments at Bad Lauchstädt and Halle by sequential extraction and analyzed by FTIR. Relative C=O content were determined from absorption bands at 1640 and 1720 cm-1 in FTIR spectra of OM(PY).

The C=O content of OM(PY) from the studied soil was not directly related to the content of oxalate soluble Fe. However a weak relation between C=O content of OM(PY) and exchangeable Ca was found: For soil samples with soluble amounts of calcium C=O content of OM(PY) increases with increasing amount of extractable Ca. If both, the amount of exchangeable Ca and of oxalate soluble Fe were considered this relation could be improved, especially, if relation between C=O content of OM(PY) was weighted according to the presence of soluble Ca in the studied soils. It seems as if OM composition was more affected by different mineral applications than by differences in organic and plant residues. Much weaker relations were found for the case of fertilization with farmyard manure, where OM of different stages of decomposition and complexed to polyvalent cations were directly added to the soil.