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Effect of crop rotation and fertilization on soil organic matter composition of differently stable fractions for two long-term field experiments

M. Kaiser, R.H. Ellerbrock, H.H. Gerke

Leibniz-Centre for Agricultural Landscape Research (ZALF) e.V. Müncheberg, Institute of Soil Landscape Research, Eberswalder Str. 84, 15374 Müncheberg, Germany (mkaiser@zalf.de / Phone: +49-33432-82112)

Climatic conditions, soil properties, land use and management practices determine soil organic matter (SOM) composition by controlling the organic matter (OM) decomposition. Systematic analyzes of these mechanisms and their interactions are needed to understand their effects on SOM composition.

The objectives are (i) to identify functional groups in the soil organic matter of bulk soil samples (SOM(soil)), water soluble (OM(W)) and sequentially extracted Na-pyrophosphate soluble (OM(PY)) fractions, (ii) to analyze effects of fertilization and crop rotation on the composition of these three SOM fractions and (iii) to identify the fraction which reflects the effects of fertilization and crop rotation on SOM composition most distinctly.

Soil samples were taken from the long-term field experiments at Halle and Bad Lauchstädt. OM(W) and OM(PY) were isolated by a sequential extraction. The composition of SOM(soil), OM(W), and OM(PY) were analysed using FTIR spectroscopy. All FTIR spectra were analyzed at three absorption bands (C-H absorption bands: A, C=O absorption bands: B, C-OC absorption bands: C). Absorption band C is used as a reference to facilitate a quantitative comparison.

FTIR spectra of OM(PY) fractions from the PK fertilized Halle soils show always higher relative intensities of absorption band B than corresponding farm yard manure (FYM) and unfertilized soils with the same cropping. This could be explained by higher contents of oxalate soluble Fe or Mn in these soils caused by fertilization with

Thomas phosphate in the past. FTIR of OM(PY) from Bad Lauchstädt soil samples with R2 cropping (crop rotation with legumes) show lower intensities of absorption band B than those from soils with R1 cropping (crop rotation without legumes). This could be caused by additional nitrogen input via legumes in these soils.

Analysis of sequentially extracted OM(PY) fraction seem to be more applicable to detect to long-term fertilization/crop rotation effects than that of OM(W) or SOM(Soil). It could be concluded that analysis of OM(PY) allows the detection of fertilized and cropping effects on its composition.