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Effects of organic amendments on natural organic matter in bulk soils from an italian agricultural area as assessed by Fast Field Cycling NMR relaxometry

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Losses of soil organic carbon often occur in soil because of intensive agricultural practices. This is due both to removal of organic carbon following harvest production and to insufficient inputs of organic amendments. Natural organic matter (NOM) can be a very appropriate material for enhancing organic carbon content in very stressed agricultural soils. In general, NOM plays an important role in environmental matrices due, for example, to its capacity in retaining water, in interacting with organic and inorganic pollutants, and in enhancing nutrient availability to plants. For this reason, the understanding of the mechanisms with which NOM interacts with other chemicals in the environment is of paramount importance.
Structural and conformational NOM characteristics can be analysed by high field (HF) nuclear magnetic resonance (NMR) spectroscopy either in the solid or in the liquid state. In both cases, information on the chemical nature of NOM can be achieved. Moreover, relaxometry studies can be also conducted to provide information on the molecular dynamics of natural organic matter. However, HF-NMR relaxometry limitations are related to the strength of the magnetic fields which limits the range of relaxation rates that can be investigated. In fact, high magnetic fields (e.g. $\geq$108 Hz) reduce the possibilities to observe molecular dynamics at very low frequencies such as those between 106 and 103 Hz. To this aim, nuclear magnetic resonance relaxometry at low fields and in the fast field cycling (FFC) setup is the most powerful way to retrieve information on the dynamics at low frequencies. Here, FFC-NMR relaxometry studies on soils subjected to different organic amendements are presented.
Two farms, in an important agricultural area of Campania Region, Italy, were selected in order to study the effect of different organic amendments on bulk soils. Namely, a compost from municipal solid wastes and wood-wastes (scraps of poplars pruning) were applied in different doses and ratios. After soil sampling, drying and sieving, the samples were analysed by FFC-NMR relaxometry. Results showed differences among the longitudinal relaxation time distributions of soils treated with different amendment practices, thereby revealing the nature of the interactions between the endogenous and exogenous organic matter.

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