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Where is DNA preserved in soil organic matter?

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Deoxyribonucleic acid (DNA) consists of long chains of alternating sugar and phosphate residues twisted in the form of a helix. Upon decomposition of plant and animal debris, this nucleic acid is released into the soil, where its fate is still not completely understood. In fact, although DNA is one of the organic compounds from living cells that is apparently broken down rapidly in soils, it is also potentially capable of being incorporated in (or interact with) the precursors of humic molecules.

In order to track DNA occurrence in soil organic matter (SOM) fractions, an experiment was set up as a randomized complete block design with two factors, namely biochar addition and organic amendment. In particular, biochar (BC), applied at a rate of 20 t/ha, was combined with municipal solid waste compost (BC+MC) at a rate equivalent to 75 kg/ha of potentially available N, and with sewage sludge (BC+SS) at a rate equivalent to 75 kg/ha of potentially available N.

Using a physical fractionation method, free SOM located between aggregates (unprotected C pool; FR), SOM occluded within macroaggregates (C pool weakly protected by physical mechanisms; MA), SOM occluded within microaggregates (C pool strongly protected by physical mechanisms; MI), and SOM associated with the mineral fractions (chemically-protected C pool; MIN) were separated from soil samples. DNA was then isolated from each fraction of the two series, as well as from the unamended soil (C) and from the bulk soils (WS), using Powersoil DNA isolation kit (MoBio, CA, USA) with a modified protocol.

Data clearly show that the DNA survived the SOM fractionation, thus suggesting that physical fractionation methods create less artifacts compared to the chemical ones. Moreover, in both BC+MC and BC+SS series, most of the isolated DNA was present in the FR fraction, followed by the MA and the MI fractions. No DNA was recovered from the MIN fraction. This finding supports the idea that most of the DNA occurring in the SOM is unprotected or physically protected, with a short-to-medium mean residence time.

Finally, the DNA isolated showed, in all cases, an acceptable level of degradation that makes it suitable for further analyses by PCR.