EGU22-13352
https://doi.org/10.5194/egusphere-egu22-13352
EGU General Assembly 2022

Distinct patterns of change of organic matter in bulk soil or in earthworm casts during ageing

Katell Quenea[1], Naoise Nunan[2], Thomas Lerch[2], Claire Chenu[3], Emmanuel Aubry[1], Valerie Pouteau[3], Cedric Plessis[3], and Julie Leloup[2]

[1]Sorbonne Université, CNRS, EPHE, PSL, UMR METIS, F-75005 Paris, France
[2]Sorbonne Université, CNRS, IRD, INRA, P7, UPEC, Institute of Ecology and Environmental Sciences, Paris, France
[3]UMR Ecosys, INRAE AgroParisTech, Thiverval-Grignon, France

Earthworm activities in soil generate biogenic aggregates (casts), the mass of which can reach up to 30 - 50t/ha. The dynamics of organic matter (OM) is strongly constrained (accessibility, O_2 content, etc.) within these structures and they tend to have high OM contents. As a result of their large mass and high OM contents, these aggregates can have significant effects on OM dynamics and protection over distinct time scales: (i) over the short term, earthworms increase OM mineralization through their own metabolic processes and by stimulating soil microbial activity, the so-called priming effect; (ii) over longer terms, during cast ageing, a new equilibrium may be reached, leading to the protection of the incorporated OM. However few incubation studies have been conducted for more than three months. Consequently, the net influence of earthworm's casts on the OM dynamics is still poorly understood and remains to be determined.

Our objective was to estimate whether the incorporation of fresh OM into casts leads to its protection or to an enhanced degradation during the period of cast ageing. To do so, we compared the fate of ^{13}C labeled fresh OM added to bulk soil to the fate of fresh OM ingested by earthworms (*L. Terrestris*) in mesocosms, and monitored OM mineralization during one year. The incorporation of fresh OM into casts was also determined as were the microbial communities involved in the consumption of labelled OM (via ^{13}C-phospholipid fatty acid analysis). In addition, the OM stability was estimated as the proportion of mineral associated.

The results showed that fresh OM was largely incorporated into casts, with significant differences in the mineralization rates obtained for the OM incorporated into the soil, compared with that incorporated into the casts. This difference decreased over time, as the casts aged. Fungal activity was lower when OM was incorporated in casts. In conclusion, earthworms influence the fate of fresh OM in soil by delaying its mineralization but do not lead to long-term stabilization.