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REGULAR ARTICLE

Interactive effects of plants and earthworms on the physical stabilization of soil organic matter in aggregates

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Abstract
Background and Aims Plants and earthworms are key ecosystem engineers and important regulators of soil aggregation and C dynamics, yet research to date has mainly considered their impacts in isolation thereby ignoring potential interactions between these organisms.
Methods We conducted a microcosm experiment under greenhouse conditions to assess the impacts of plants (*Brachiaria decumbens*) and earthworms (*Pontoscolex corethrurus*) on soil structure and C stabilization. Aggregate stability was assessed by wet-sieving. Large macroaggregates (>2 mm) were also visually separated according to origin (e.g., earthworms, roots) and then further fractionated into particle size fractions to assess aggregate composition and C distribution.
Results Earthworms increased aboveground biomass of *B. decumbens* by nearly 30 %. The presence of plant roots increased aggregate stability (mean weight diameter) by 2.6 %. While earthworms alone had no simple impacts on aggregation, a significant interaction revealed that earthworms increased aggregate stability in the presence of roots by 6 % when compared to microcosms without plants. Additionally, the presence of roots increased the C concentration of coarse particulate organic matter in earthworm casts, while earthworms increased C storage in microaggregates and the silt and clay fraction within root-derived aggregates.
Conclusions These findings suggest that plants and earthworms are intimately linked in soil aggregate formation and that both organisms need be considered simultaneously for proper management of soils.

Keywords *Brachiaria decumbens* · Ecosystem engineers · *Pontoscolex corethrurus* · Soil aggregation · Tropical pastures

Abbreviations

SOM	soil organic matter
CAST	earthworm casts
RHIZ	soil aggregates associated with rhizosphere
PHYS	aggregates formed by physiochemical and/or microbial processes
NON	non-macroaggregated soil
cPOM	coarse particulate organic matter

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