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Is it efficient to co-compost and co-vermicompost green waste with biochar and/or clay to reduce CO_2 emissions? A short-term laboratory experiment on (vermi)composts with additives.

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Intensive farming practices can lead to a depletion of soil organic matter, negatively impacting important soil properties such as structural stability, fertility and C storage. The addition of organic amendments such as compost and vermicompost, rich in carbon, helps maintaining soil organic matter levels or restoring degraded soils. Composting and vermicomposting are based on stabilization of organic matter through the mineralization of easily decomposable organic matter compounds, therefore releasing greenhouse gases, including CO_2.

The aim of this study was to evaluate the global potential reduction of such emissions by the use of additives (2:1 clay and/or biochar): during (vermi)composting processes and after use of the final products as soil amendments. We hypothesized that the interactions between the additives and organic matter may lead to carbon stabilization and that such interactions may be enhanced by the presence of worms (Eisenia). We added in different proportions clay (25% or 50%), biochar (10%) and a mixture of biochar (10%) with clay (25%) to pre-composted green waste. The CO_2 emissions of the composting and vermicomposting processes were measured during 21 days. After that, the amendments were added to a loamy cambisol soil and the CO_2 emissions were monitored during 30 days of a laboratory experiment.
The most efficient treatments in terms of reducing global CO_2 emissions were the co-vermicomposting process with 25% clay followed by co-composting with 50% clay and with 10% biochar plus 25% clay. In this treatment (vermicompost with 25% clay), the carbon emissions were decreased by up to 44% compared to regular compost. Addition of biochar reduced CO_2 emissions only during composting.

Co-composting with biochar could be a promising avenue to limit global CO_2 emissions whereas in presence of worms clay additions are better suited. These findings suggest that the presence of worms increased the formation of organo-mineral associations and thus C protection up to a certain clay/organic matter ratio. This strategy could be used to enhance the stability of organic amendments and increase soil carbon sequestration.