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# Disentangling the effect of soil organic C input and mineralization alteration by management on SOC stabilization in oil palm plantations

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Increasing soil organic carbon (SOC) in agroecosystems is necessary to mitigate climate change and to improve soil fertility. Management practices designed to reach this goal call for a deeper understanding of the processes and drivers of carbon input localization and stabilization. Predicting impacts of land-use change and land management on SOC dynamics and its stabilization faces major difficulties as many factors affect both SOC stabilization and mineralization processes. Here, we identify main drivers of SOC stabilization in oil palm plantations using the well-defined spatial patterns of nutrients and litter application resulting from the usual management scheme. The stabilization of oil palm-derived SOC (OP-SOC) was quantified from a shift of C4 (savanna) to C3 (oil palm) vegetations and related to oil palm fine root biomass. Fertilization and frond stacking influenced the stabilization of OP-SOC stocks, which already reached after nine years up to 45 % of the total SOC stocks in the top 10 cm, but had no effects on the decomposition of savanna-derived SOC. Depending on management zones, OP-SOC stocks equalled up to 27% of the fine root biomass accumulated during 9 years. This proportion was not affected by the presence of frond pile in zones where mineral fertilization is identical, indicating that carbon inputs from dead fronds did not stabilize in SOC. SOC mineralization was proportional to SOC content and was independent on phosphorus availability. A path analysis confirmed that the OP-SOC distribution was largely explained by the distribution of oil palm fine roots, which itself is influenced by management practices. We conclude that SOC stabilization was driven by C inputs from fine roots and not by an alteration of SOC mineralization due to management.