

Soil properties are affected by management of pruned fronds in palm plantations of smallholders in western Africa

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Abstract

Carbon stock, some chemical parameters and microbial activities of soil were studied in smallholder oil palm plantations located in south-eastern Benin (2°30' – 2°45' E, 6°35' – 7°45' N). Two age groups (7–11 and 16–19 years old) of 12 palm plantations were chosen on a slightly desaturated and depleted Oxisol. They were characterised by two practices of pruned frond management on the soil: total recycling (TR) and no recycling (NR) of fronds. Three palm trees of each frond management practice were chosen per age group. The soil was sampled at 0–5, 5–10, 10–20, 20–30 and 30–50 cm for determination of carbon (C), nitrogen, calcium, magnesium and potassium content, pH, microbial biomass and carbon dioxide release. Bulk density was determined for calculation of C stock (650 kg/m²; ~0–50 cm) of soil. Frond recycling impacted soil properties in the mature plantations, corresponding to 10 years of recycling. TR increased soil C stock under frond piles by 70% compared with NR practices. Surprisingly, soil C stock did not decrease over time under NR. The significant increase of C stock after 10 years of TR (frond recycling) improved several soil parameters in the first 20 cm soil depth. The soil was enriched in organic matter (20 g C/kg) and nitrogen (1.5 g N/kg). The cationic exchange capacity reached average values (7 cmol⁺/kg); two times higher than in the case of NR practices. Microbial biomass was also increased under TR practices in the first 20 cm soil depth, whereas soil respiration was significantly increased at 0–5 cm.

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