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The soil carbon dilemma in the humid tropics: cannot hoard it!?

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As Albrecht (1938) wrote some 70 years ago: "[Soil] Organic matter functions mainly as it is decayed and destroyed. Its value lies in its dynamic nature." Thus, by merely hoarding rather than using soil organic matter (SOM; compare also Janzen, 2006) with the aim to sequester carbon (C) in soils, we risk neglecting the crucial aspect that decomposing SOM and the release of nutrients (and concurrently CO_2) is the basis for a healthy crop, decent yields and thus food security. This is even more true so in the tropics, where the majority of soils have low intrinsic fertility. In the absence of sufficient nutrient inputs through fertilizers in smallholder subsistence agriculture predominating e.g. in sub-Saharan Africa (SSA), SOM turnover is the key driver of crop productivity. On the other hand, humid tropical conditions – high temperatures and long periods of moist conditions – are very conducive to SOM decay. Therefore, maintaining SOM levels requires the constant input of significant amounts of organic matter; material that is often in low supply while then first of all used as animal feed in SSA mixed-crop livestock systems.
In this context it is not surprising that for SSA very few studies so far have been published that showcased viable agronomic management systems that did also sequester notable C in the soil. The two long-term trials of the International Center for Tropical Agriculture (CIAT) in Western Kenya are no exception. Neither Conservation Agriculture (CA) nor Integrated Soil Fertility Management (ISFM) management practices over a period of 12 years could prevent the topsoil from losing C. But, these two practices could significantly slow down C losses in comparison to treatments representing common farmer practice. Also in comparison to the latter, yields of CA and ISFM plots were 2-4 time higher. This example shows that hoarding SOM in soils under humid tropical conditions is a challenge, and to attain amounts required to come even close to the 4p1000 C-sequestration targets are (yet?) make-believe. However, using SOM, while replenishing losses as much as possible, provides for a notable increase in soil fertility and crop yields while – as a co-benefit – reducing carbon emissions from these systems.
The presentation will discuss this dilemma and elaborate on the pros and cons of alternatively using soil organic carbon emission intensities – analogous to the concept of greenhouse gas emissions intensities from livestock, which could be a smarter way of assessing the climate footprint of smallholder agricultural systems in the tropics.

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Janzen, H.H. 2006. The soil carbon dilemma: Shall we hoard it or use it? Soil Biology & Biochemistry 38, 419–424.