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# Agricultural practices that store organic carbon in soils: is it only a matter of inputs ?

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Increasing the world soils carbon stocks by a factor of 4 per mil annually would compensate the annual net increase of $CO_2$ concentration in the atmosphere. This statement is the core of an initiative launched by the French government at the recent COP21, followed by many countries and international bodies, which attracts political attention to the storage potential of C in soils. Compared to forest and pasture soils, agricultural soils have a higher C storage potential, because they are often characterized by low C contents, and increasing their C content is associated with benefits in terms of soil properties and ecosystem services.

Here we quantified, under temperate conditions, the additional C storage related to the implementation of two set of practices that are recognized to be in the framework of agroecology: conservation tillage on the one hand and agroforestry on the other hand. These studies were based on long-term experiments, a 16-years comparison on cropping systems on luvisols in the Paris area and a 18-year-old silvoarable agroforestry trial, on fluvisols in southern France, the main crops being cereals in both cases. C stocks were measured on an equivalent soil mass basis. Both systems allowed for a net storage of C in soils, which are, for the equivalent of the 0-30 cm tilled layer, of 0.55 $\pm$ 0.16 t ha$-$ 1 yr$-$ 1 for conservation agriculture (i.e. no tillage with permanent soil coverage with an associated plant, fescue or alfalfa) and of 0.25 $\pm$ 0.03 t ha-1 yr-1 for the agroforestry system.
These results are in line with estimates proposed in a recent French national assessment concerning the potential of agricultural practices to reduce greenhouse gas emissions. Compared to recent literature, they further show that practices that increase C inputs to soil through additional biomass production would be more effective to store C in soil (tree rows, cover crops in conservation agriculture) than practices, such as no-tillage, that are assumed to reduce soil organic matter mineralisation rates.

This questions our understanding of the stabilization processes of organic matter in soils and especially that of physical protection. The conditions and scale, both spatial and temporal, of physical protection of organic matter are discussed in light of recent literature.