Global change induced SOM changes and erosion

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This paper will present (i) a quick review about Global change induced SOM changes and (ii) results of an experimental programme in Martinique about relationships between SOM and soil detachment.

Global change induced SOM changes

Elevation of atmospheric CO₂ and climate changes (specially elevation of temperature) can, theoretically, act on carbon cycle and soil organic matter dynamics. It exists only few references on this subject and their conclusions are not really effective. Laboratory experiments, on the effects of elevation of atmospheric CO₂ have showed that organic matter produced under high concentration of carbon dioxide had higher C/N ratios. Carbon cycle models under different scenarios of climate changes in the intertropical areas showed that the variation of soil organic matter (SOM) storage was very low and that this variation could be positive or negative. That is no comparison with SOM stock variations under different land uses. It is usual to note a decrease of 40% of SOM stocks for the surface soil after long-term annual plants cultivation.

Land use, SOM, soil aggregation and soil detachment: an example in Martinique (F.W.I.) on lithomorphic vertisols

The Martinique, in the Caribbean, is a tropical mountainous volcanic small-sized island. In the South East of the island, vertisols are developed on compact volcanic rocks under 1300 mm rainfall per annum with a dry season (4/5 months). Land uses on these soils can be divided into two main categories: pastures (planted with Digitaria decumbens) and long-term market-gardening or food crop cultivation.

Long-term cropping, different situations of crop rotations or pastures would differentiate the SOM status of these vertisols. Nine situations, from a field station, with these different land uses are studied: the variation of SOM content in the surface soil (0-5cm layer) was from 1.5 to 4.0 gC/100g soil. Soil aggregation, characterized by the MWD (mean weight diameter) after head-over-head agitation in water, is related to SOM.

Using a small field rainfall simulator, it is possible to characterized soil detachment under different rainfall intensities and different types of soil surface for the nine studied situations. All the field experimentations are done in wet soil conditions; so because vertisols have the property of swelling, it is possible to work in the same conditions of water erosion: same rainfall intensity and same runoff intensity. Three soil surfaces are tested for all the situations: herbaceous, bare, hand-ploughed (seedbed type).

The main results of this study are:

- Soil surface type is the most important element regulating soil detachment expressed by the runoff water turbidity.
- SOM influences soil detachment only in the case of the most credible soil surface situation (hand-ploughed).
- Organic carbon in the runoff water turbidity is in higher concentration as SOM for all the soil surface situations except hand-ploughed and C/N ratios are systematically lower that SOM C/N ratios.
- Organic carbon and nitrogen exportations are not related to SOM.
- Rainfall intensity increasing acts a factor of an increasing of soil detachment for the situations under hand-ploughed surface and particularly those with less SOM.
SOIL EROSION UNDER GLOBAL CHANGE

29 - 30 - 31 March 1994 Paris

PLACE
The workshop on
"Erosion under Global Change"

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