Global change induced SOM changes and erosion

Albrecht Alain

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

Global change induced SOM changes

Elevalion of atmospheric C02 and climate changes (specially elevation of temperature) can, theorically, act onc carbon cycle alnd so, on soil organic matter dynamics. It exits only few references on this subject and their conclusions are not really effective. Laboratory experiments; on the effects of elevation of atmospheric C02 have showed that organic matter produced under high concentration of carbon dioxide had higher C/N ratios. Carbon cycle models under different scenarii of climate changes in the intetropical 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 suirface soil after long-term annual plants cultivation

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

The Martinique, in thc Caribbean, is a tropical mountainous volcanic small-sized island. In the South East of the island, vertisols are developped on compact volcanic rocks under 1300 mm rainfall per annuum 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 Gropping, different situations of crop rotations or pastures would differenciate the SOM status of these vertisols. Nine siluations, from a field station, with these different land uses are studied; the variation of SOM content in the surface soil (0-5cm layer) was tro 1,5 to 4,0 gC/IOOg 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: herbaccous, bare, hand-ploughed (seedbed type).

The main results of this study are;

- Soil surface type is the most important element regulaling soil detachment exprimed 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 SOIM 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 detachement for the situations under hand-ploughed surface and particularly those Wilh less SOM.

GC TE

GLOBAL CHANGE & TERRESTRIAL ECOSYSTEMS

CENTRE NATIONAL
DE LA RECHERCHE
SCIENTIFIQUE
"Programme environnement"

SOIL EROSION UNDER GLOBAL CHANGE

29 - 30 - 31 March 1994 Paris

PLACE
The workshop on
"Erosion under Global Change"

ORSTOM
Center of Ile de France

72, route d'Aulnay - 93143 Bondy cedex
Phone: (33.1) 48 02 55 00, Fax: (33.1) 48 47 30 88