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THE INFLUENCE OF CULTIVATION ON THE STRUCTURAL INSTABILITY OF A FEW URUGUAYAN SOILS

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Uruguay is a flat country mesothermal climate (fig. 1), complex geology (fig. 2) and gramineous steppe vegetation. The recent development of agriculture has brought with it an increasing susceptibility to erosion. Because soils losses are probably related to the structural stability, we propose to study the variations in this parameter wih the variables connected to the soil or resulting from cultivation.

The soils chosen belong to groups that cover large areas, and which have been partially cultivated for the last 10 years. These are grumosols (vertisols), praderas negras (brunizems), praderas pardas (brown leached soils) and planosols (hydromorphic soils).

The instability index Is (HENIN, 1960) (fig. 3) increases from the onset of cultivation, but its variation within soil groups is as large as its variations between gorups.

Statistical analyses (Principal Component Analysis, Factor Analysis of Correspondences, Dynamic Cluster Analysis) and various common statistical treatments (fig. 4, 5 and 6) permit the following conclusions :

— There is no correlation between Is and the iron or aluminium content of the organic matter.

— Exchangeable calcium and magnesium promote the stability of aggregates.

— The structural instability decreases whit increasing contents of both clay and organic matter (carbon and nitrogen).

— The grumosols and praderas negras have a lower structural instability index than praderas pardas and planosols. These two latter classes of soils are more sensitive to erosion.

— Cultivation provokes a decrease of organic matter and thus an increase of structural instability index.

— The increase of structural instability caused by cultivation is higher for praderas pardas and planosols, impoverished in clay, than for grumosols and praderas negras where clay is generally high.

Finally, cultivation should preferentially be done on grumosols and praderas negras.

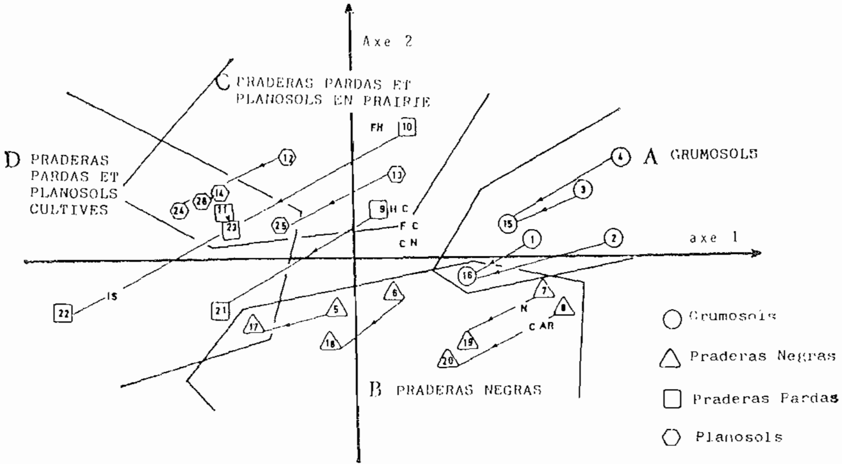

Figure 4 : Factor Analysis of Correspondence of general data : Simultaneous figuration of soils and variables in the two first factors space. Is : Structural instability ; C : total carbon ; N : total nitrogen ; CN : carbon-nitrogen ratio ; FC : fulvic acids - total carbon ratio ; HC : humin - total carbon ratio ; FH : fulvic acids - humic acids ratio ; AR : clay content.

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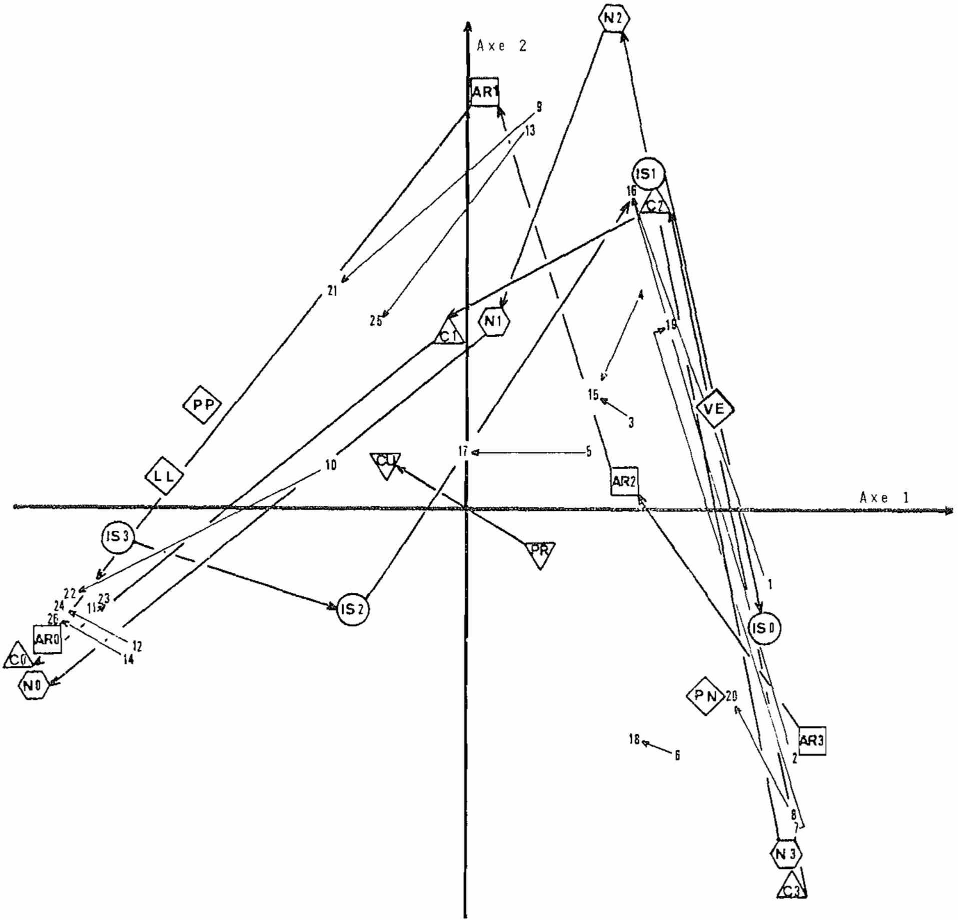

Figure 5 : Factor Analisis of Correspondances of the disjonctive binary data table obtained by quartiles : simultaneous figuration of soils and variables in the first two factors space.
IS0, IS1, IS2, IS3 : structural instability ; C0, C1, C2, C3 : carbon ; N0, N1, N2, N3 : nitrogen ; AR0, AR1, AR2, AR3 : clay content ; PR : mead soils ; CU : cultived soils ; G : grumosols ; PN : praderas negras ; PP : praderas pardas ; LL : planosols.

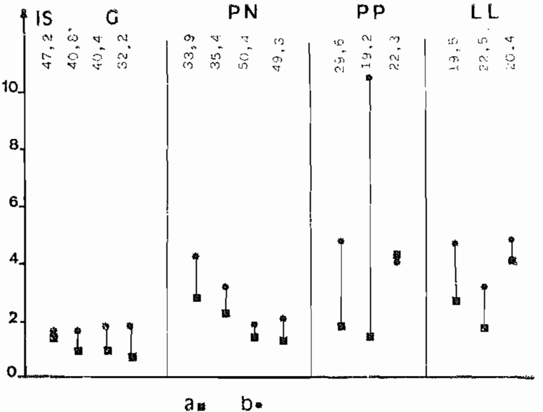

Figure 6 : Total carbon content variations according to the soil type.

a : mead soils
b : cultivated soils
G : grumosols
PN : praderas negras
PP : praderas pardas
LL : planosols