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THE RUN OFF ON SUDAN-SAHELIAN ZONES : A salutary oxymore

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1. OBJECTIF

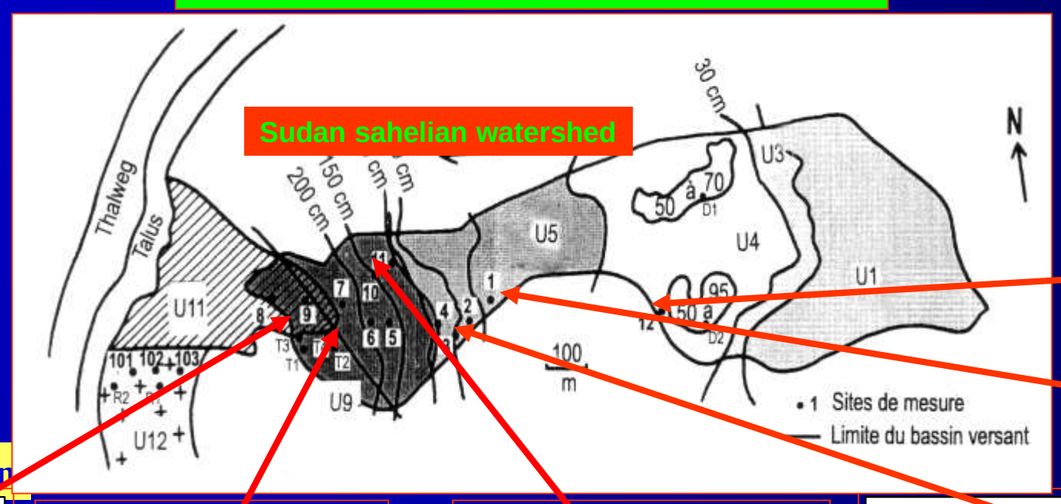
The food sovereignty decreases when agrosystems are under hydrological and nutritional stress generated by climatic change or the anthropogenic degradation of soils. Their degradation results of the runoff observed on all morphopedological units whatever their slope despite a good infiltration capacity of the soils. Moreover the runoff is the main agent responsible for erosion and the nutrients loss. It large spatio-temporal variability explains the variability of the millet yield on these formations. A good part of this runoff, the runon, at different scales, ensure a very rapid and important reconstitution of the water storage at the footslope along the hillslope and in the dunes. This runon is defined as *« a natural irrigation, complementary and simultaneous to the rain that has generated it according to the natural (topopographical, morphological, permeability, occurrence of a deep and dense horizon) and antropogenic (soil labour) conditions".* The goal is to: A) measure the existence of the variability of the runon; B) identify the transfer of nutrients and soil particles; C) evaluate the agropedological consequences.

2. RESULTS

The structural instability which increase toward the top of the hillslope, differently according to the unities, explain the higher risks of soil crusts and the increasing runon too.

The offered water increase along the slope because of increasing runon.

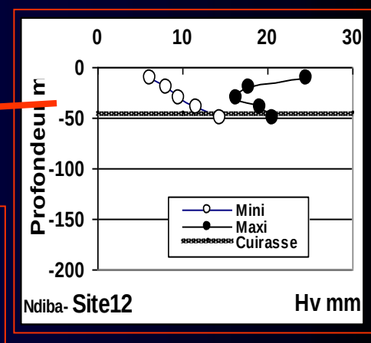
A- Variability of the runon

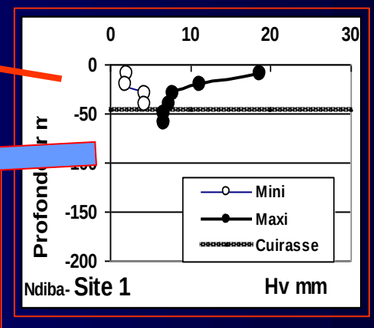


Drought year, Rainfall=382mm

2.1. Hillslope scale

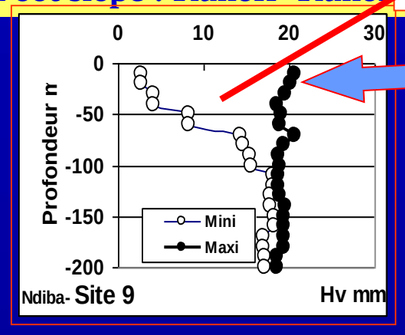
Toeslope: Runoff>Runon

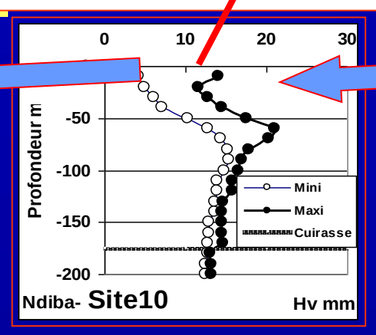


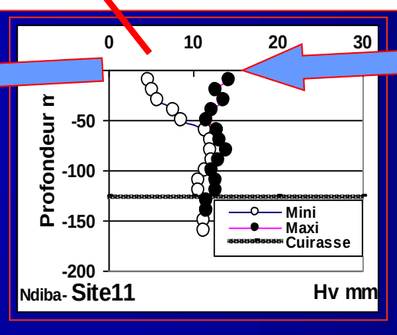


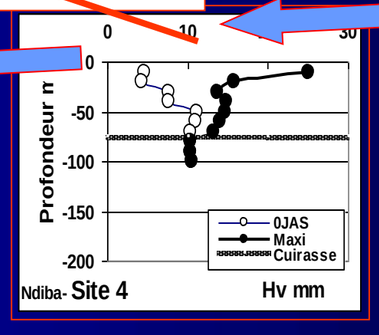
Runon

Foot slope : Runoff<Runon

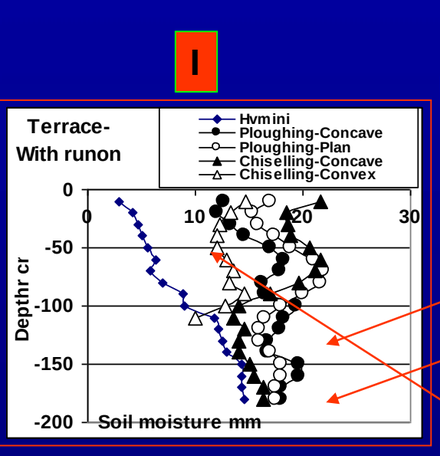


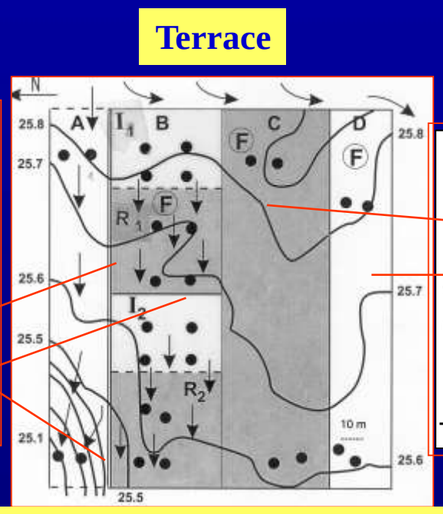


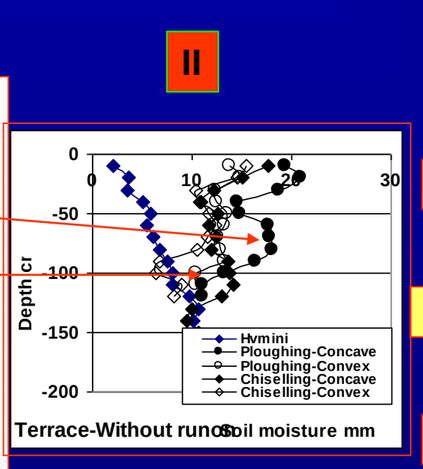




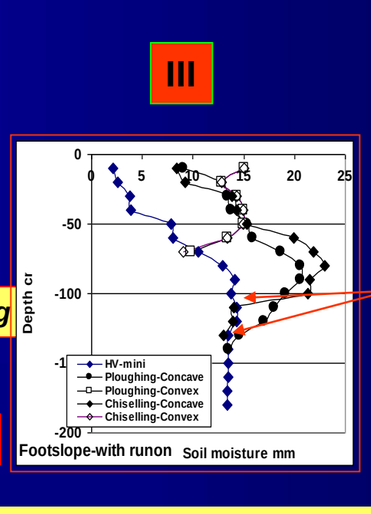
2.2. Field scale

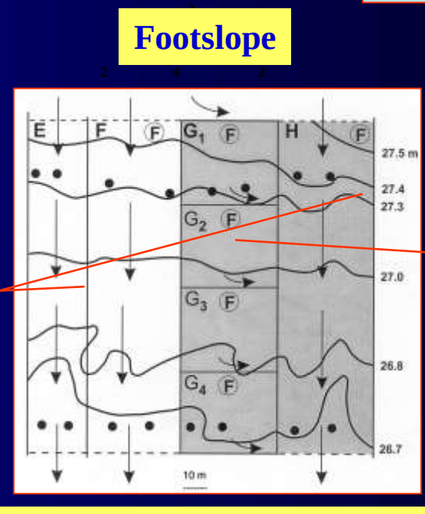


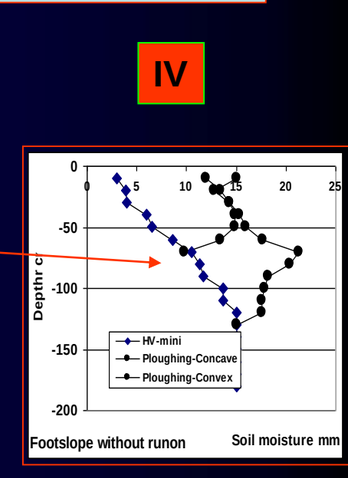




Fallow
Chiselling
Plough





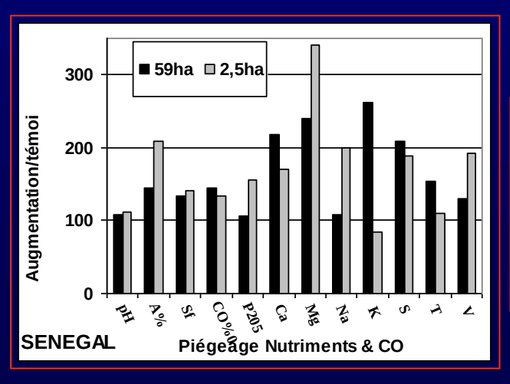


Runon effect is very importan between I & II, & plowing effect more higher without runon The almost same moisture content in III & IV point out the runoff > runon.

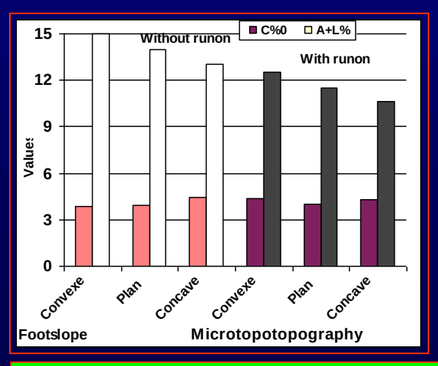
The concave micromodelling traps more water than convex form but the difference is higher in footslope because of more important runon

B- Nutrients & water transfer

A- Watershed



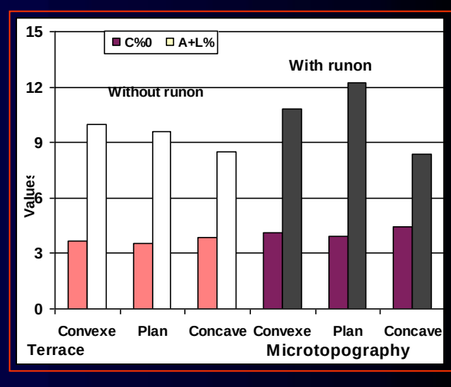
The nutrient & soil losses increase when surface watershed decrease from 59ha to 2.5ha.



B- Fields

OC increase with runon & in concave form in footslope & terrace.

Clay+silt decrease in concave form in footslope & terrace. But with runon it is higher in terrace because of small runoff.



C- Millet grain yield

UNITiES	RUNON	TILLAGE & FERTILIZATION	MEAN (Mini-Maxi)	MEDIAN	CV %
HILLSLOPE	YES	FO	318.8 (0-648)	326.5	51.2
FOOTSLOPE	YES	E- Chiselling- F0	328.1 (190-457	342.5	25.6
		F-Chiselling- F1	327.3 (132-495)	342	41.6
		H-Ploughing- F1	388.7 (232-807)	341.5	52.3
	NO	G-Ploughing- F1	450 (170-898)	372	76.9
TERRACE	YES	A- Chiselling- F0	527.4 (183-1136)	326.5	51.2
		B- Ploughing- F1	949.6 (502-1273)	1045	29.4
	NO	C- Ploughing- F1	158 (71-254)	145	42.8
		D- Chiselling- F1	141.6 (79-244)	129.5	48.7

On the footslope, the managed stripe (G) have the best yield. Maybe, if the breaking of crusts is carry out more, a good yield shall be obtained as it is possible (H: maxi yield=807kgha^{-1}) because of infiltration increasing.

On the terrace, some good yield (A: 1136kgha^{-1}) with important runon is explained beacuse Of the fertility transfer. The fertilization ensure maxi yield (B: 1273kgha^{-1}). Without runon, the yields (C:plough & D:chisel stripes) are very small with a little more for the ploughing.

The effect of fertilization is less important than the runon with it small nutrients brought down.

3. CONCLUSION

This study showed, in sudan-sahelian climate, during stern drought that the runon (Positive part of the runoff) with it fertility transfer generate millet yield higher than the pedoclimatic offer (Rainfall=382mm) because of water storage and nutrients increasing.
To maintain this runon without erosive capacity, it is necessary to choose the best biophysical techniques for each geopedological unity and to realize the sufficient number of crust breaking to maximize the water infiltration and storage to ensure the millet AET.