

THE «SUDANO SAHELIAN GROVE» : A multi-scale ecological alternative face to climatic change

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1. GOAL

The problems of the 21st century in the sahelian to tropical zone, besides food sovereignty, are ecological and socio-ecological. The elaboration of new modes of environmental management has become a major priority of public policies. Some of ecological biotechniques have been largely used by peasants of all continents that control the runoff and valorize the runoff. Runoff is defined as « a natural irrigation, complementary and simultaneous to the rain that as generated it as a function of the evolutive states of surface and depth , with a transfer and sequestration of nutrients». (Valet, 1995). The goal of this study is the elaboration of the traditional and innovative biophysical techniques typology based on the runoff control and runoff valorization. This typology supply to Ecologists and agronomists the most biophysical techniques adequate to resolve the degradation problems:
A) techniques of total or partial control of the runoff (Ridges, mulch, RCW); B) techniques of sustain of a controlled non-erosive runoff (Quickhedge, rings of stones) and C) techniques of a total trapping of the runoff (1/2 moon, Zai).

3. RESULTS

A- Techniques of total or partial control of the runoff

Billons

ridges reduce dramatically the runoff but not totally

Kalifa & al., 2005; Rockström & Valentin, 1997

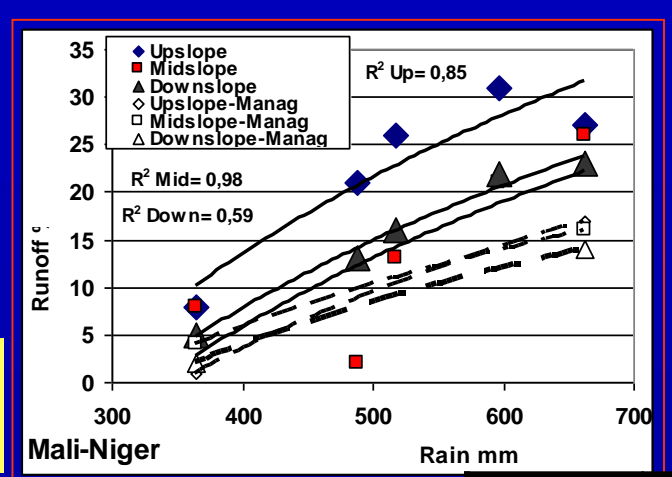
Ramial Chipped Wood

The Ramial Chipped Wood is the 5-7cm diameter branches of trees and brushes.

It spread 3cm thickness of RCW

Dodelin & Valet, 2007

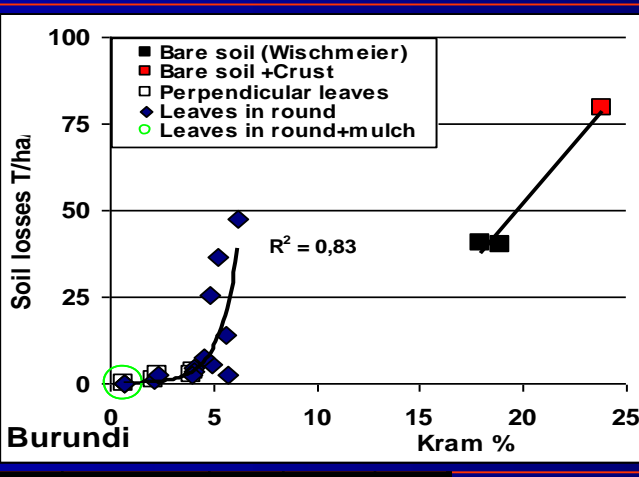
1. Ridges effect on runoff



2. Perpendicular mulch effect on soil losses

Leaves around Banana with mulch are the best to limite strongly OC, Nutrients and soil losses

Quansah and al., 1999

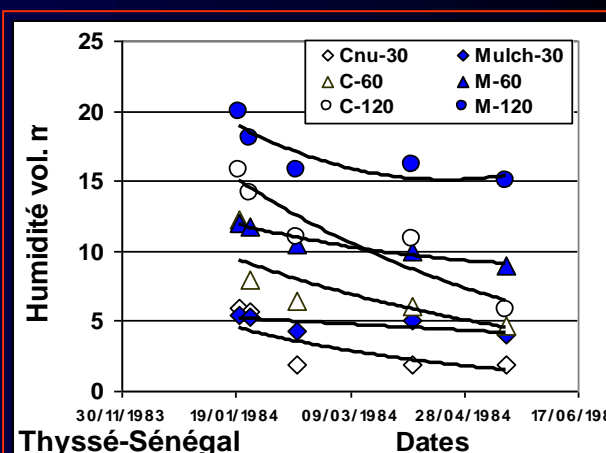


3. Mulch effect on water soil storage at three depths

With mulch, the water loss is about 15% during drought season & 60% for crusted soil .
= 56mm saving

Valet & al., 2008

Each water mm = 7 to 11kg ha⁻¹ for millet grain.



RCWs	Fungi*	Yield	Qx ha ¹	ROOT	SOIL			
pecies	Attack %*	Grain	Straw	Ms%	Humus	N	P	K
TEST	78	12	27.8	91.4	1.91	72	102	80
Betula V.	63	14.9	30.4	92.6	2.75	73	106	85
Salix a.	88	14.5	30.6	92.2	2.92	73	104	74

RCW increases bacteries & mycellia quantity & kinds and their efficacy

RCW effect on soil aggradation (humus, N, P) & rye biomasse (root, straw, grain) increasing.

Chervonyl, 1999; Domenech & al., 2008

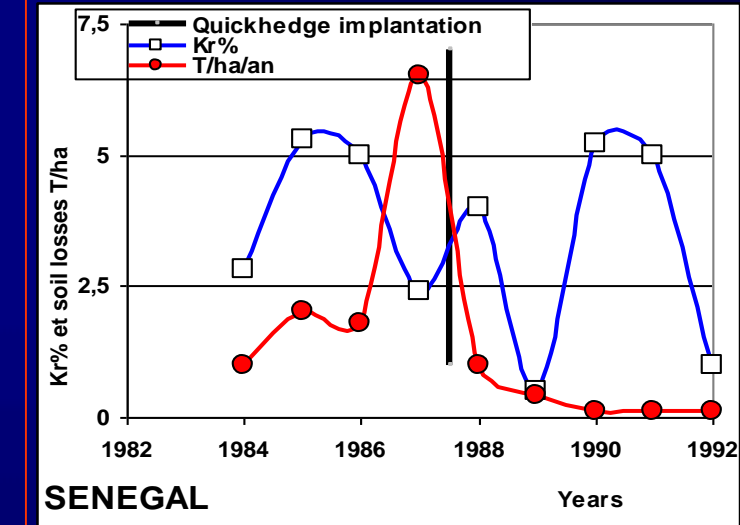
B- Techniques of sustain of a controlled non-erosive runoff

1. Traditional quickhedge in West Cameroon

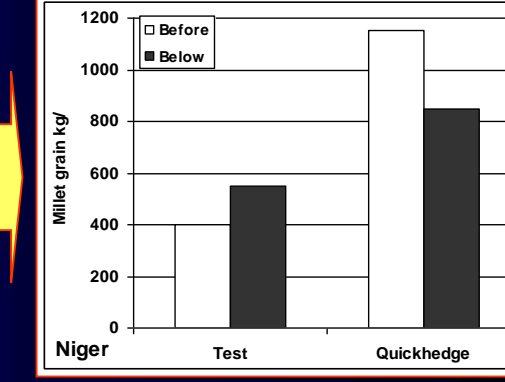


- reduces considerably the erosion;
- sustains of a non-erosive runoff;
- maintains a runoff;
- stops the transfer of eroded sediments up to 95%;
- amelioration of fertility and yield by uptake of nutrients;
- increases biomass yield. (Valet., 1999)

2. Sudan Sahelian zone: Soil losse decreasing and runoff maintaining



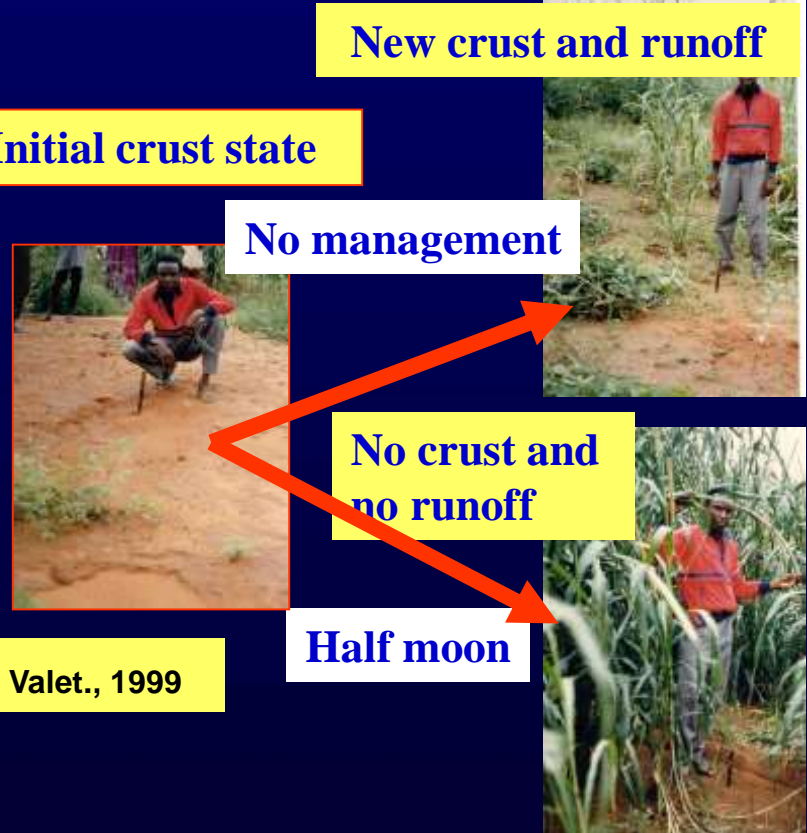
Millet yield increasing



Valet., 2004

C- Techniques of total trapping of the runoff

Half moon



Valet., 1999

Zougmore & al., 1999

Treatments	Soil C%0	Cam/l	Grain 1998	Grain 1999	Straw 1998	Straw 1999
Test	5.1	1.44	0	0	0	0
1/2 moon	4.6	1.54	0.83	1.46	3.02	5.1
1/2 moon+compost	4.6	2	9.3	11	27.3	25
1/2 moon+manure	5.4	2.48	16.1	11.1	42.9	25.4

**BP: natural phosphate of Burkina.; 1/2 moon : 14,6 Tha-1 of Manure et de compost.

« zai » or « Tassela »

Treatments	Soil C%0	Cam/l	Grain 1998	Grain 1999	Straw 1998	Straw 1999
Test	6.4	1.44	0	0	0	0
Z. Tradit.	9.2	2.23	3.75	2.06	21.3	0,73
Z+staw	7.5	1.73	4.38	1.8	24	7.4
Z.+staw+BP	9.9	2.54	7.08	6.94	39.1	16.2

**BP: phosphate naturel du Burkina. Zai : 9,5 Tha-1 de manure (ox).

The complete runoff infiltration ensures a better water satisfaction and limits the development of crusts

So, Half-Moon and Zai ensure a significant and stable production of sorghum (IRAT 204 of 90 days duration) because of a significant increasing of Ca⁺⁺, P₂O₅, OC and water.

For a long time the effect of these two techniques may be the same on the soil aggradation and biomass production

3. CONCLUSION

The main results of this study showed the necessity of this traditional and innovating biotechniques typology based on the runoff control and the runoff agroforestry valorization because of the drought increasing.

Face to climatic change it will be more and more important to know the agroecosystems hydrological functioning to choose the best traditional and innovating biotechniques to ensure an ecological