Rehabilitation of rice fields in the acid sulphate soils of Lower Casamance, Senegal

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Abstract

The Casamance region in the south of Senegal is historically a region of rice production for home supply. Since the recent drought, the production stagnated while an increased population demands more and more rice imports.

Since the seventies, the government has taken measures to increase the degree of self-sufficiency in rice. Among these, the development of 'mangrove rice' production with the construction of dams is one of the most important. During the very dry years in the beginning of the eighties, the main objectives were to protect the ricefields from salinization and to rehabilitate the areas of acid sulphate soils. The anti-salt dams did not increase rice production.

A 150 ha polder in the small valley of Djiguinoum, directly in connection to the Casamance river, was chosen to try a new water management system. Sluices allow drainage of salts and acids at the beginning of the rainy season and, also, maintain water for rice culture.

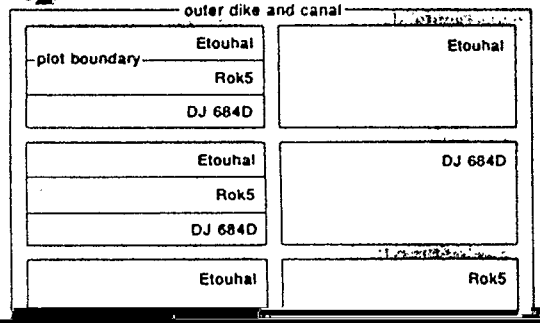
Three fields on a degraded area (about 1 ha) were equipped with an outer dike and a drainage network connected to the main river. Traditional techniques, used by the farmers, were applied for the rice cultivation. During two consecutive years a significant increase in yield was obtained. In the first year, salt movement in the soil was controlled by the dam. In the second year ploughing, tolerant varieties and fertilization were also tested.

A social inquiry was held, investigating whether the rice culture actually had any chance to become again a main interest for the population.

Introduction

The effects of the recent droughts are now well known in lower Casamance, especially in the mangrove environment (Marius 1979, Marius et al. 1986; Boivin et al. 1986, Loyer et al. 1988, Pages and Debenay 1987, Pages et al. 1987, Le Brusq et al. 1987, Dacosta 1989, Montoroi 1990, Mougenot et al. 1990). The principal consequences are:

- Decrease and destruction of the mangrove vegetation;
- Increasing salinity in coastal waters;
- Chemical degradation of lowland soils;
- Decreasing rice production, increasing activities in the uplands;
- Increased erosion in the uplands;
- Migration to the cities.


outer dike and canal
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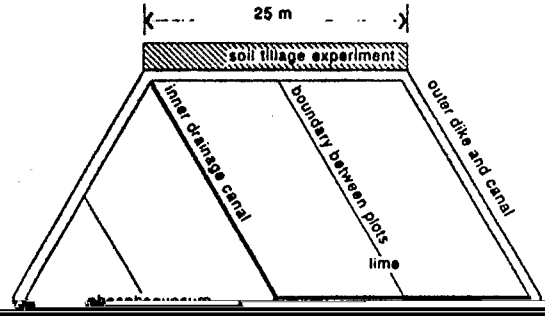
25 m
soil tillage experiment
inner drainage canal
boundary between plots
outer dike and canal
lime

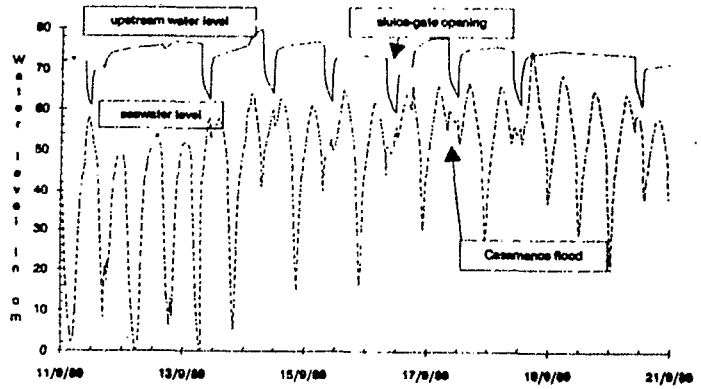

Figure 5 Upstream and downstream water levels at the anti-salt dam of Djilakoun in September 1989

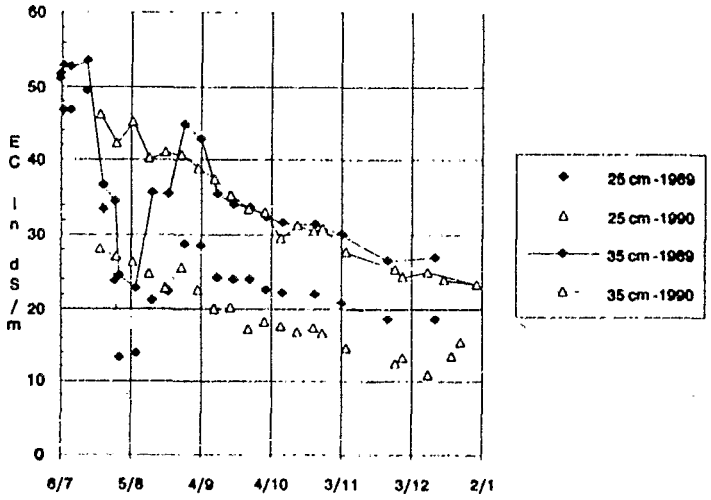

Figure 6 Effect of water management on the electrical conductivity (EC, in dS m $^{-1}$) of a cultivated acid sulphate soil in the Djiguinoum valley over two rainy seasons

3 dS m $^{-1}$ (Table 1). Rice roots grow only in the upper few centimetres, being unable to tolerate the salinity below.

Redistribution of salts

Tillage helps to decrease the salt content in the surface soil (Figure 7). On bare soil, the rainfall runs off, a salt crust is formed after each shower and infiltration is not effective.

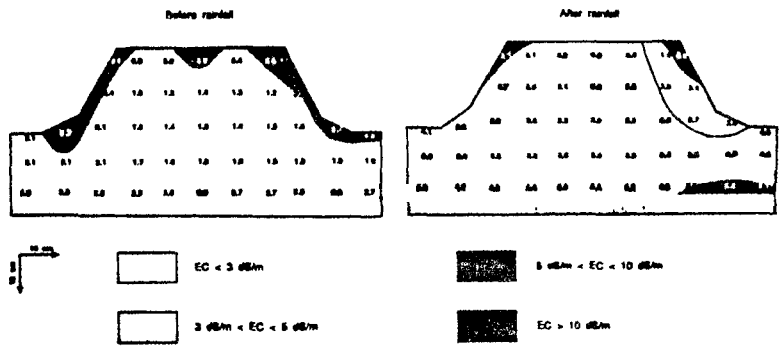

Figure 7 Redistribution of salts in a cross-section of a tilled plot after three simulated rainshowers (60 mm during one hour for each shower)

Rice production

The yields obtained in 1989 and 1990 were higher than the average yield of the Casamance region (about 1 t ha $^{-1}$). The results for the traditional rice field were better in 1989 than in 1990 (Table 2). The rainy season pattern was different and the water management had to be adapted. The salinity decrease was less effective. The lower yields obtained in the hexagonal rice field (Table 3) may be explained by a different planting density (125 000 plants per ha against 200 000 for the traditional rice field).

Table 1 Chemical composition of the surface water on 16 September 1989 (Brunet and Zante 1990)

pH	EC (dS/m)	Soluble ions, mmol per litre								
		Na	K	Ca	Mg	Cl	SO4	Al	Fe	Si
3.6	3.1	2.1	0.7	0.85	2.25	21	3.65	0.2	0.001	0.07

Table 2 Average paddy rice yield (in t/ha) for different, salt-tolerant varieties of rice and tillage in the traditional rice field (Brunet and Zante 1990, Brunet et al. 1991)

	Rice variety	1989	1990
Tillage	ROCK 5	2.8	2.8
	DJ 684 D	2.6	1.0
	ETHOUHAL	2.8	1.9
No tillage	ROCK 5		2.2
	DJ 684 D		0.8
	ETHOUHAL		2.1

Table 3 average paddy rice yield (in t ha $^{-1}$) for different type of fertilizers in the hexagonal ricefield (Dobos et al. 1991)

Treatment plot	Yield
A lime	1.0
B lime + phosphate	1.2
C phosphate + gypsum	0.7
Reference	0.5

Conclusion

The levels of rice production obtained in the experimental plots must be regarded with some caution. Several problems must be solved before regional extension can be advocated. Two successful years is a good basis but, in Casamance, each valley has a particular configuration and the techniques must be adapted to each case. Knowledge of the environmental conditions is required: for example, a hydrological study is needed as a basis for dam design and construction.

A major problem of water management is that all users depend on the water level control at the dam. The risk of conflicts between users is high because they cannot regulate individually, and users must be trained in the operation and maintainance of the dam. New management schemes will be needed to reclaim all the fields in a valley, for example with intermediate sluices.

The field experiment in the Djiguinoum valley has stimulated the local population to struggle against the effects of the drought on their fields. They want to come back to the valley with the desire to copy the management model used by the project (Sall

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