

CROPPING SYSTEMS ON PERMANENT SOIL COVER FOR MADAGASCAR HIGHLANDS

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Introduction

In Madagascar Highlands, population pressure and saturation of rice-cultivated lowlands speed up extension of cultivation on the fragile soils of the hillsides, with low fertility. Fertilisation being limited, yields remain low while erosion leads to paddy field silting-up and destruction of downstream infrastructures.

To overcome these problems, experiments on direct planting on permanent soil cover (DPPSC) are conducted since 1991 in the farm of Andranomanelatra (Rakotondralambo and Razanamparany, 1998). In 1994, the research activities were enlarged to references sites, located in farmers' field, which allowed to cover a large range of bio-physical and socio-economic situations.

Proposed systems

Traditional cropping practices (with ploughing) are compared, on technical and economical criteria, to systems allowing a better integration with animal raising, a major activity in Madagascar Highlands :

⟨ Direct planting on crop residues, with (eventually) relay cropping of forages (oats, etc.), or
⟨ association of the main crop with perennial species (maize grown on *Desmodium uncinatum* or *Trifolium semipilosum* , soybean or bean on kikuyu grass : *Pennisetum clandestinum*, etc.)

Several fertilisation levels (adapted to soil types and cultivated species) are applied :

⟨ F1 : Manure alone (farmers' practice)

⟨ F2 : Manure + recommended mineral fertilisation

⟨ F3 : Manure + high fertilisation level (no limitation to plant growth due to fertilisation)

They are compared to soil smouldering, a traditional technique in high altitude areas, consisting in a slow burning in trenches of dry organic material covered with soil (d'Aristida sp., *Acacia mearnsii* , etc).

Results

Maize yield decreases with time when soil is ploughed and manure only is applied, while it increases with DPPSC (Fig. 1.). Soil smouldering, performed only once in 1996, has a tremendous impact and leads to yields similar to those obtained with a high fertilisation level, which farmers can not afford (Michellon et al, 2001). Effect of mineral fertilisation is lower with DSPCV than with ploughing, the latter systems being more sensitive to climatic hazards.

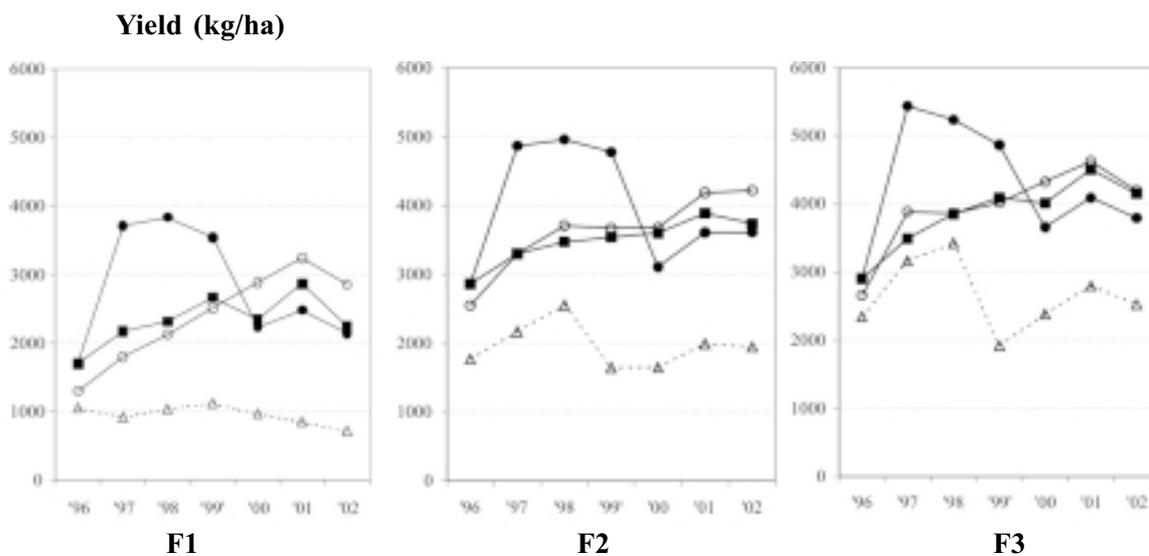


Figure 1. Trends in maize yield (kg/ha), according to soil and crops management, ferralitic soils, Andranomanelatra farm.

F1: 5t/ha Manure. F2: 5t/ha Manure + 500kg/ha/year Dolomia + 100 N + 30 P + 48 K₂O/ha/year.

F3: 5t/ha Manure + 2000kg/ha/ 3 year Dolomia + 130 N+59 P+96 K₂O/ha/year

■ : DPPSC, ass. with legumes ● : DPPSC, ass. with legumes, soil smouldering in 1996

m : DPPSC, rotation with soybean ▣ : Ploughing, maize monocropping

For bean, sanitary status is improved and yield increased by DPPSC (fig. 2). DPPSC increases profit and labour productivity, ploughing being abandoned and weeding time reduced.

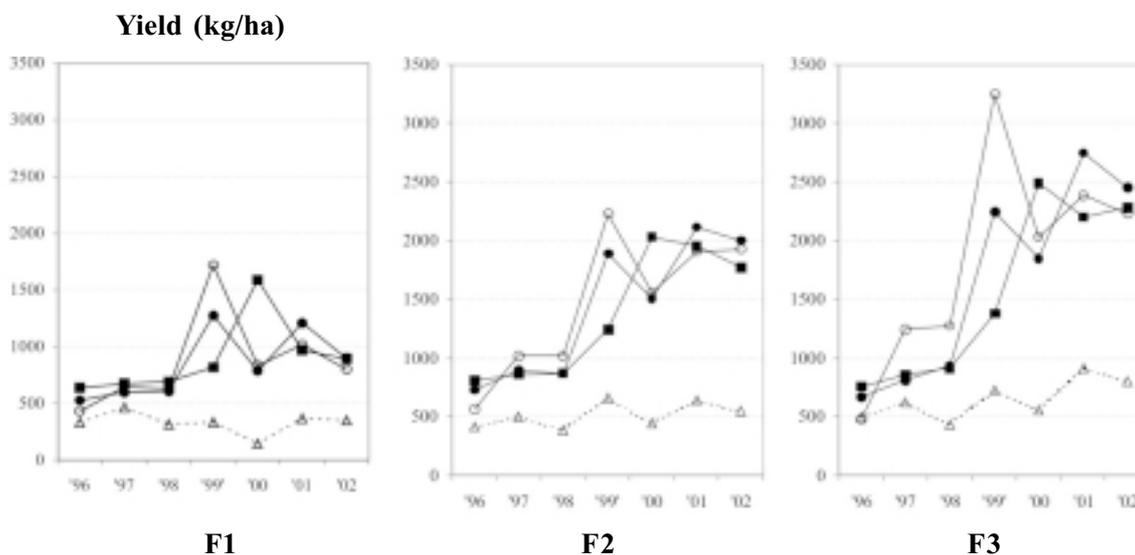


Figure 2. Trends in bean yield (kg/ha), according to soil and crops management, ferralitic soils, Andranomanelatra farm.

F1: 5t/ha Manure. F2: 5t/ha Manure + 500kg/ha/year Dolomia + 30 N + 30 P + 48 K₂O/ha/year.

F3: 5t/ha Manure + 2000kg/ha/ 3 year Dolomia + 60 N+59 P+96 K₂O/ha/year

■ : DPPSC, Succession Bean- Oats ● : DPPSC, Late season Bean on Kikuyu

m : DPPSC, Succession Oats- Bean ▣ : Ploughing, Late season Bean

Conclusions

Recent extension of DPPSC by GSDM members (Direct seeding group of Madagascar) already reached over one thousand farms in this region, with manual agriculture, very limited investment means and small fields (1000 m² on average).

TAFA efforts now concentrate on training of extension staffs and executives and on support to extension, especially with the development of a wide set of technico-economic references at village level.

A similar research and extension device is being developed in various agro-ecological zones of Madagascar. It should lead to sustainable improvement of agricultural production.

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