

# CROPPING SYSTEMS ON PERMANENT SOIL COVER FOR MADAGASCAR HIGHLANDS



Michellon R. <sup>1</sup>, Rakotondralambo P. <sup>2</sup>, Razanamparany C. <sup>2</sup>, Moussa N. <sup>2</sup> and Séguy L. <sup>3</sup>

<sup>1</sup> CIRAD, Madagascar <sup>2</sup> TAFE, Madagascar <sup>3</sup> CIRAD, Brazil

Corresponding author. E-mail: [roger.michellon@cirad.fr](mailto:roger.michellon@cirad.fr)



Soil smouldering in Andranomanelatra farm.

In Madagascar Highlands, population pressure and intensive rice cultivation in the lowlands has led to cultivation on the fragile, low fertility soils of the hillsides. 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) have been conducted since 1991 in the Andranomanelatra farm and since 1994 in farmers' fields, covering a wide range of biophysical and socio-economic situations.

## Cropping systems under investigations

Traditional cropping practices (with ploughing) are compared with systems that allow 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.),
- Association of the main crop with perennial species (maize grown on *Desmodium uncinatum* or *Trifolium semipilosum*, soybean or green bean on kikuyu grass - *Pennisetum clandestinum* - etc...).

Several fertilisation levels (adapted to soil types and cultivated species) are compared to soil smouldering, a traditional technique in high altitude areas, involving slow burning in trenches of organic material (*Aristida sp.*, *Acacia mearnsii*, etc...) covered with soil.

## Main results



Maize on *Desmodium uncinatum*.

### Maize

- Maize yield increases with time under DPPSC and decreases when soil is ploughed.
- Tremendous impact of soil smouldering (performed only once, in 1996) leading to yields similar to those achieved with a high fertilisation level which farmers can not afford.
- Lower effect of mineral fertilisation with DPPSC than with ploughing.
- Lower sensitivity of DPPSC to climatic hazards.

F1: 5t /ha manure

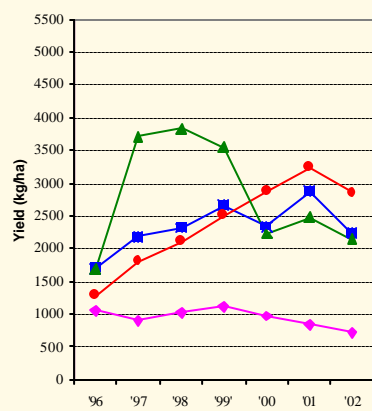
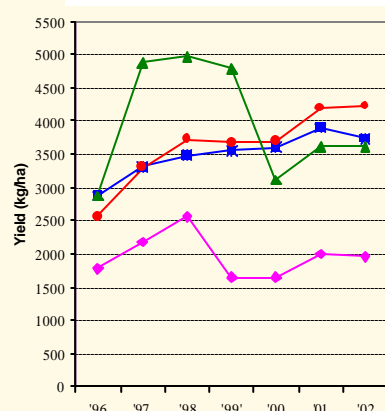


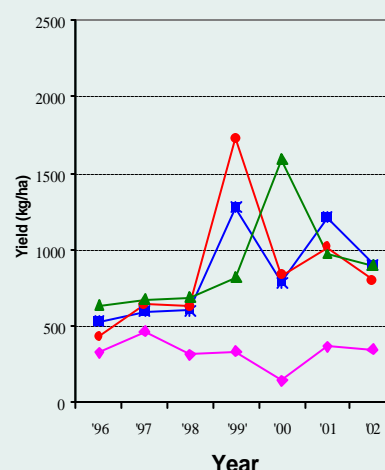
Fig. 1.: Trends in maize yield (kg/ha), according to soil and crops management. Ferrallitic soils, Andranomanelatra farm.

F2: 5t/ha Manure + 500kg/ha/year Dolomia + 100 N + 30 P + 40 K/ha/year.



Legend for Fig. 1 and Fig. 2:  
 ■ DPPSC, ass. with legumes  
 ● DPPSC, rotation with soybean  
 ▲ DPPSC, ass. with legumes, soil smouldering in 1996  
 ◆ Ploughing, maize monocropping

F1: 5t /ha manure



F2: 5t/ha Manure + 500kg/ha/year Dolomia + 30 N + 30 P + 40 K/ha/year.

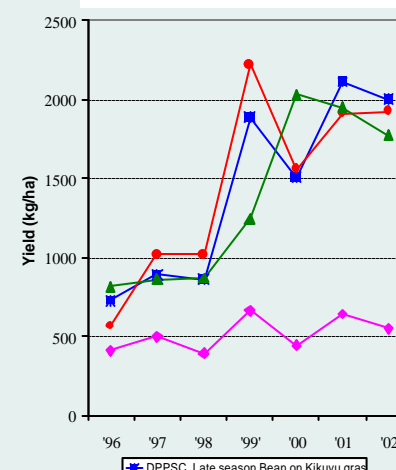


Fig. 2: Trends in green bean yield (kg/ha), according to soil and crops management. Ferrallitic soils, Andranomanelatra farm.

### Green bean

- Reduction in disease pressure (healthy plants).
- Increase in bean yield, profit and labour productivity.



Green bean on oats residues



Centre de coopération internationale en recherche agronomique pour le développement

Avenue Agropolis  
TA 74/09  
34398 Montpellier  
Cedex 5  
☎ 0467615643

TAFE

ONG "TAFE"  
Tany sy Fampandrosoana

BP 319  
Antsirabe 110  
Madagascar  
[Roger.michellon@cirad.fr](mailto:Roger.michellon@cirad.fr)

LaBas

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## Conclusions

These systems, which require minimal investment, have been adopted by over one thousand small farmers in Madagascar highlands. TAFE efforts now concentrate on training of extension staffs / executives and on support to extension. A similar creation-diffusion approach is being developed for various agro-ecological zones of Madagascar. It should lead to sustainable improvement of agricultural production.