

Upland cropping systems to produce staple food and milk on the Malagasy highlands

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Introduction

In Malagasy highlands, increasing demand for rice led to the improvement of upland rice in the hilly areas due to increasing land pressure in the lowland areas. To tackle the problem of sustainable upland crop production systems, CIRAD (IGO) and TAFE (NGO) have developed Direct-seeding Mulch-based Cropping systems (DMC), which conserves soil from erosion. In the highlands, livestock for the dairy production is growing very rapidly with the main constraints of limited availability of the forage resources. During last years, agriculture extension agencies have developed an approach aiming to **integrate agriculture and livestock**. In this context, studies were undertaken on some grasses and legumes for their **multiple uses as cover-crop and forage** for dairy livestock. To technically support these studies, further work has been conducted with the objective to develop **sustainable upland crop production system based on rice, maize, and forage**.

Materials and methods



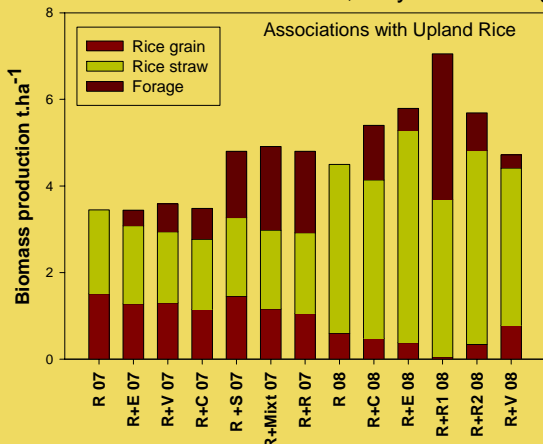
Rice with *Cajanus*

For this study, upland rice and maize were cropped (in double lines for rice) in association with *Eleusine coracana* (E), *Cajanus cajan* (C), *Raphanus sativus* (R, 2 dates), *Vicia villosa* (V) *Crotalaria grahamiana* (Crg), *Crotalaria spectabilis* (Crs), *Lupinus sp.* (L, 2 dates), *Stylosanthes guianensis* (S), *Brachiaria ruziziensis* (B) and with the mixtures of forage crops. These systems are compared for the competition and complementarities between crops in terms of grain yield of rice and maize, and biomass production, during 2 seasons 2007 and 2008.

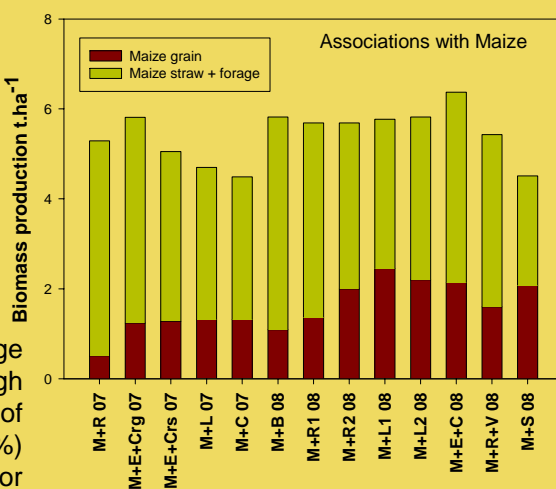


Rice with *Eleusine*

Results In 2007, rice cultivar sensitive to the pyricularia was used for the experiment to observe the effect under normal incidence of the disease. The best rice yield was obtained in pure culture and in association with *S. guianensis*, the highest total biomass was observed in the associations with *S. guianensis*, *R. sativus* and the mixture of forage crop. In case of maize, the associations with *E. coracana* and *Crotalaria sp.* were found most effective for production of both grain and the biomass. In 2008, a cyclone during



flowering stage induced high percentage of sterility (74%) and very poor rice grain yield.



The associations with *C. cajan* and *E. coracana* were the most effective in term of rice grain yield and biomass production. The highest maize grain yield was observed in association with *Lupinus sp.* sowed simultaneously. Whereas, the lowest maize grain yield was observed in association with *B. ruziziensis*. As for rice, the highest biomass production of the associated crop is linked with the lowest grain yield.

Conclusion

These preliminary results help to estimate the quantities of biomass produced under the stringent condition of Malagasy highland (rainfall and temperature). Further experiment will be conducted to estimate the balance between amount of biomass needed for mulching the field and the potential biomass that can be used for cattle feeding.