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Cropping System to Limit Blast Disease in Upland Rice

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Cropping system is an essential aspect to take into account to manage blast disease (caused by the fungus *Magnaporthe oryzae*). In addition to the selection of resistant cultivars, studies report opportunities to limit blast incidence by managing mineral amendment (N, Si, P, etc.), cultivar mixtures or other cropping system adaptations. In Madagascar, rice is the staple crop and food. Farmers traditionally grow irrigated or rainfed lowland rice wherever possible. In the mid-1980s, CIRAD and FOFIFA launched a research program for the highlands to extend upland rice growing areas in high elevation areas of the tropics. This program was consolidated with research on cropping practices that ensure the sustainability of upland rice based cropping systems in this poor and fragile environment. New varieties where obtained, adapted for rainfed cropping up to 1800 m altitude (Dzido *et al.*, 2004). However, farmers had to face attacks of blast disease. Due to the small genetic basis of these varieties, the fungus quickly overcame resistant or tolerant lines selected by breeders.

The ways of management of blast disease are very limited in a country like Madagascar where efficient solutions are often not suitable for farmers. Observations of blast epidemics in different regions made us consider the soil as a key factor for rice susceptibility. In a first experiment, we measured the potential of our very susceptible varieties to tolerate blast when cropped in different soil conditions. During two years, we transported volcanic soil from a very fertile area close to the experimentation site and where blast pressure is much lower. We observed a decrease of blast symptoms on rice cropped on that soil compared to the soil of the experimental site, both on leaves and panicles. That decrease was bound to a significant yield increase, demonstrating the importance of plant nutrition on blast incidence. Such results confirm those obtained in 1981 by Seguy et al. Our aim was then to develop cropping systems that could influence blast incidence through an improvement of soil functions.

Direct seeded mulch based (DSMB) cropping systems were first used in Madagascar to limit erosion in upland areas. During 4 years, we compared blast epidemics between a traditional cropping system with ploughing each year and a DSMB cropping system, on a mid-susceptible variety specific of the highlands conditions. Two fertilisation levels were also tested in these systems: zebu manure only and manure plus additional mineral fertiliser. A significant difference between the two systems was observed, both at leaf and panicle stage. Blast incidence was reduced in DSMB cropping system and, on the contrary to the traditional cropping system, the mineral fertilisation had no effect on blast in DSMB.

N fertilisation is known for a long time as an essential factor in blast management. The fact that DSMB cropping system reduced the effect of N-fertilisation made us consider N as the determinant factor of the interaction between cropping system and blast incidence. The determinants of this interaction must then be explained to enable new and durable cropping systems to be developed to manage blast epidemics, in addition to cultivar improvement. This is the objectives of the starting project GARP (ANR-Systerra) which is conducted in Bolivia, Brazil, France, and Madagascar. Its aim is to quantify the interactions between cropping system, N-nutrition and blast resistance in upland rice. Hypotheses and preliminary results of the project will be presented.

Dzido, J.L. et al., 2004 : Fao Rice Conference, 2004/02/12-13, Rome, Italy.

Séguy, L. et al., 1985: Symposium sur la résistance du riz à la pyriculariose, 1981/03/18-21, Montpellier, France