New rice varieties and cropping systems for paddy fields with poor water control in Madagascar

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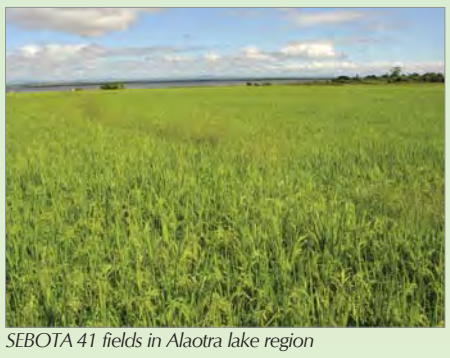

SEBOTA 41 fields in Alaotra lake region

Developing and maintaining water control in paddy fields is difficult, costly and requires sufficient water reserves. Thus, even in the main rice growing area of Madagascar, the Alaotra lake region (800 metres above sea level), only 30 000 ha of paddy fields can be properly irrigated when over 70 000 ha will remain under poor water control.

In these fields, traditional techniques based on irrigated cropping practices are very unreliable: late transplanting (which can be done only when sufficient water is available) and occurence of dry conditions at the end of the plant cycle lead to usually low yields (0.8 to 1 t/ha on average) and production is very unreliable (from nil, during the dry years to 3t/ha when rains are favourable), which makes crop intensification very hazardous.

For such situations, a change in paradigm is proposed: abandoning irrigated practice and making the choice of growing upland or "poly-aptitude" rice varieties (SEBOTA) with agro-ecological practices adapted to the specific field water regime.

Material and method

From 2001/2002, TAFA and CIRAD introduced in Madagascar some SEBOTA varieties and tested with farmers new cropping practices for paddy fields with poor water control in the Alaotra region (1 ha in 2002/2003, 7 ha in 2003/2004, a very dry year with 600-800 mm rain). In 2004/2005, extension of these varieties/practices over 300 hectares (400 farmers) was conducted in this region by SDMad, BRL Madagascar, TAFA and ANAE, four members of the Direct Seeding Group of Madagascar (GSDM).

Results presented here have been obtained from 148 fields (90.2 ha) monitored by BRL and SDMad and 134 fields (32.3 ha) monitored by TAFA during the 2004/2005 cropping season, with very difficult climatic conditions: late occurence of the first rain, followed by intense rains and fields submersion.

Results

Rice yield

The average yield was 3.46 t/ha in fields monitored by BRL/SD Mad and 3.55 t/ha in fields monitored by TAFA.

85 % and 91 % (for respectively BRL/SD Mad and TAFA) of the fields produced more than 2 t/ha, with a positive net margin and an interesting valorisation of the labour.

10 % and 15 % (for respectively BRL/SD Mad and TAFA) of the fields produced more than 5 t/ha with a high average margin of 750 000 Ariary (300 Euros)/ha and an excellent valorisation of the labour.

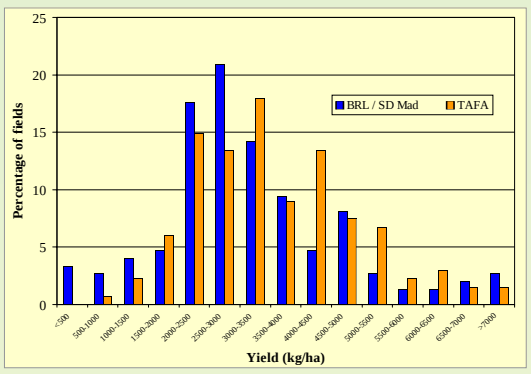

Figure 1: Distribution of yield classes for 148 fields monitored by BRL/SDMad and 134 fields monitored by TAFA in the Alaotra region.

B22 and SEBOTA 65 in Alaotra.

Effects of soil type and water regime

In fields monitored by TAFA, best yields are obtained on alluvial soils (5.87 t/ha on average for 6 fields), the lowest one in paddy fields at high elevation (2.43 t/ha for 9 fields), usually grown with upland rice varieties. Yield in clayey paddy fields (n = 25) or in organic paddy fields (n = 43) are similar (3.52 t/ha on average) and very similar to yield obtained on "baiboho" (recent alluvial soils, usually at high elevation but with capillary rise), with 3.49 t/ha (n = 51).

This trend is confirmed by BRL/ SD Mad results: Yield in alluvial soils is on average 740 kg/ha higher than on organic soil, although only urea (80 N) was applied on alluvial soils when organic soils received an additional 60 units of P2O5.

Impacts of cropping practices in relation to water regime

The highest yields are obtained with direct planting (no tillage) when vegetation and water conditions allow it: 3.7 t/ha on average in fields monitored by TAFA (n = 32). However, this requires use of herbicides and pesticides, which are not needed when transplanting young seedling after land preparation (possible only when water is available early), with a similar yield: 3.65 t/ha (n = 11).

Sowing rice in dry conditions after land preparation (using herbicides and pesticides) is the most commonly applied technique, with an intersting average yield of 3.51 t/ha (n= 78).

Finally, planting pregerminated rice seeds in mud after land preparation (when hydric conditions requires it), can be done, but with an average yield lower than with other techniques (3.24 t/ha, although yield can be up to 6.45 t/ha), and requires use of insecticides against *Heteronycus sp.*.

Variety	Number of fields	Area (ha)	Average yield (t/ha)	Cycle in Alaotra region (days)	Aptitude
FOFIFA 154	28	6.45	3.17	105	Upland
B22	37	9.75	3.36	110	Upland
SEBOTA 147	3	0.7	2.99	110	Poly-aptitude
SEBOTA 281	10	3.0	3.35	115	Poly-aptitude
SEBOTA 33	7	0.8	4.23	118	Poly-aptitude
SEBOTA 41	35	9.8	3.93	120	Poly-aptitude
SEBOTA 65	10	1.7	3.83	120	Poly-aptitude

Table 1: Rice yield according to variety (130 fields monitored by TAFA)

Varieties

SEBOTA 41, 65 and 281 have been identified as the best varieties available in 2004/2005 and are grown by farmers on large areas (Table 1).

The area under SEBOTA 33 (highest yield) was limited by seeds availability.

Recently introduced varieties (as SEBOTA 68 and 70) with very short cycle and high tillering capacity yielded respectively 5.8 and 7.6 t/ha in TAFA experiments (less than 0.1 ha) and will be released for extension in 2005/06.

Conclusions

Two very contrasted climatic years (dry in 2003/2004 and very high rainfall in 2004/2005) demonstrated the excellent performances of SEBOTA varieties and the new practices they made possible: a high yield (with excellent grain quality) can be securely achieved in all conditions, which makes intensification possible.

It is expected that a rapid extension of these varieties (3000 ha scheduled for 2005/2006), together with the cropping systems adapted to specific fields conditions will allow to rapidly reach self sufficiency in Madagascar, within a few years.

SEBOTA 68, introduced in Madagascar in 2004

New cropping practices made possible by SEBOTA varieties

SEBOTA (named after their French creators in Brazil: L. Séguy, S. Bouzinac and J. Taillebois) are "poly-aptitude" varieties which have the ability to grow either in rainfed or in irrigated conditions and have a good grain quality. Thus, they can be used (Séguy, L., Personal communication; Chabaud and Charpentier, 2004):

1. In paddy fields in which water is available late in the season, planting rice in rainfed conditions at the beginning of the rainy season, followed by a legume cover crop (*Dolichos lab lab, Vicia vilosa,* etc.) which will be used as mulch for very early direct planting (without tillage) of the next rice crop.
2. For planting pre-germinated seeds in mud, in paddy fields in which water is sufficient at the beginning of the rainy season for land preparation but in which a water layer can not be kept.
3. In paddy fields in which irrigation water is available at the beginning of the rainy season but not always at the end. These varieties can be sown or transplanted as for irrigated paddy fields, but they will not suffer from "dry" conditions when irrigation water stops.

Another possibility, used with success in the Alaotra region, is to grow rice in the dry season, planting it in water in fields along the lake shore and taping water using capillary rise when the lake water has receded. With such systems, harvesting is done at the beginning of the rainy season, when rice prices are high.

Introduction of new varieties (SEBOTA 68 and 70), with shorter plant cycle (101-103 days in the Alaotra region) will allow to also propose extension of these practices to the highlands (above 1200 m.a.s.l.), where paddy field with poor water control cover hundreds thousands hectares.

Also, the same principles can be adapted for the humid eastern coast, where drainage of the lowlands and use of these varieties in upland conditions with a very early planting make it possible to avoid iron toxicity, reduce the risk of damages by cyclones and allow very early harvesting in January, when rice is sold at its highest price.

Finally, these varieties, as they respond very well to high fertilisation level (although they also perform rather well with limited fertilisation), can be used for intensive production in well irrigated paddy fields (with yield above 10-12 t/ha in the best conditions).

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TAFA — TAny sy FAmpandrosoana Terre et Développement

SD mad — Semis Direct de Madagascar

BRL Madagascar

ANAE

GSDM — Groupement Semis Direct de Madagascar

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