



Integration of genomic tools with conventional screening For developing NERICA rice cultivars for West Africa



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Introduction

The Asian rice (*Oryza sativa* subspecies *indica* and *japonica*) and African rice (*O. glaberrima*) are the two cultivated rice species. In the history of rice breeding, it is notable that it was at WARDA that high yielding rice varieties were bred between *O. glaberrima* and *O. sativa* for the first time. The new rice varieties are called NERICA (NEW Rice for Africa) and they are interspecific that bridge the genetic gap between two cultivated rice species. NERICAs combine the superior traits from both parents but the development of new NERICAs with drought tolerance and tolerance/resistance to several other constraints in west and central Africa is still a top priority in the region.

IER scientists, with the support of the Rockefeller Foundation, have recently collected 121 *O. glaberrima* accessions from Northern Mali. These accessions are called Riz Africain du Mali (RAM), and eighteen RAMs were screened for drought tolerance in 2004 in Mali and 2005 in Benin. Some of the accessions have shown very good recovery ability after 35 days of water shortage (Fouyssen Cisse, pers. comm.) but detailed drought screening in multiple environments remains to be done. Some of the most promising RAMs were also used as donor parents to develop interspecific lines (*O. sativa* x *O. glaberrima*) that segregate for drought tolerance but detailed screening of these interspecific lines for drought tolerance remains to be done.

Many research groups have used microsatellite markers for rice genotyping studies but very little is known on RAM accessions collected from Mali. In rice, a number of genes for resistance to bacterial leaf blight, rice yellow mottle virus (rymv-1) have been cloned. These genes provide candidate loci to focus the high-resolution marker genotyping to small target regions. Although these genomic tools have not yet been utilized in Africa by breeders and geneticists from national agricultural institutes, it is now essential to enhance rice improvement by combining the new knowledge and traditional breeding methods

Objectives

The major objective of this project is to develop new rice for West Africa by combining the power of genomic technology with a conventional phenotypic approach.

The specific objectives of the project are:

- (1) To characterize *O. glaberrima* accessions and new interspecific lines for drought related traits, especially recovery ability and its association with yield, as well as traits for two major diseases (Rice Yellow Mottle Virus and Bacterial Leaf Blight) prevalent in rainfed environments
- (2) To use genomic tools to identify useful natural variation and search for new favorable alleles in *glaberrima* accessions and new interspecific lines for the future development of new NERICA lines
- (3) To select the best interspecific lines for on-farm testing and dissemination in the region

Expected outputs

- (1) Drought tolerant *O. glaberrima* accessions and new interspecific breeding lines identified
- (2) Interspecific lines and *O. glaberrima* accessions resistant to BLB and RYMV identified.
- (3) Microsatellite markers associated with drought tolerance to *glaberrima* accessions and/or interspecific lines identified
- (4) Markers for BLB validated on interspecific lines and accessions
- (5) New NERICA lines for West Africa selected and available for distribution regionally



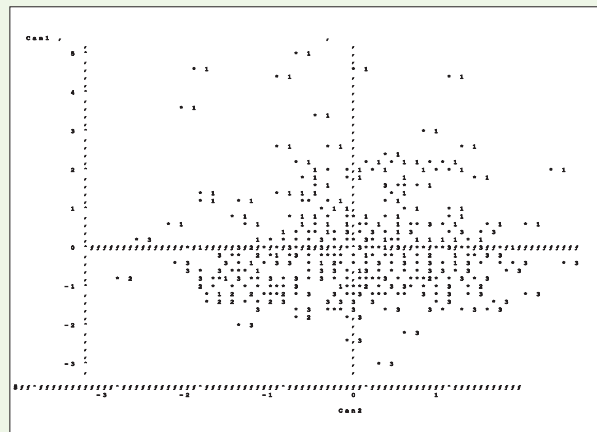
Screening for yield-related traits under drought

Materials and methods

A field trial was conducted in Cotonou, Benin to characterize *O. glaberrima* accessions and new interspecific lines for drought tolerance traits. 372 rice accessions comprising 225 *O. glaberrima*, 22 *O. sativa* and 125 interspecifics were subjected to drought stress treatments lasting 21 days starting either at 35 or 45 days after sowing (DAS) and the third treatment was a control which was continuously irrigated throughout the trial.

Results

Significant genetic variation was exhibited for vegetative stage vigor before the onset of drought and plant height during and after drought stress and tiller number after stress in both stress treatments. Cluster analysis revealed that for these traits *glaberrimas* were significantly different from *sativas* and interspecifics under stress at 35 DAS but these latter two groups of rice behaved similarly for these traits in this stress condition. Under stress at 45 DAS, however, all three groups were significantly different although the difference between *glaberrimas* and *sativas* and interspecifics was larger than the difference between *sativas* and interspecifics. *Glaberrimas* and interspecifics were more vigorous at the vegetative stage than *sativas* before drought stress. In addition, *glaberrimas* were taller and had higher tiller numbers than *sativas* and interspecifics under both stresses. Among these traits, tiller number after drought stress was the most discriminating parameter between the different groups of rice under both stress treatments.



O. glaberrimas (1) were generally more vigorous, taller and had more tillers under drought stress than *O. sativas* (2) and interspecifics (3)

Future Prospect

- 1) Continue the characterization *O. glaberrima* accessions and new interspecific lines for drought related traits, especially recovery ability and its association with yield, as well as traits for two major diseases (Rice Yellow Mottle Virus and Bacterial Leaf Blight) prevalent in rainfed environments
- 2) Use genomic tools to identify useful natural variation and search for new favorable alleles in *glaberrima* accessions and new interspecific lines for the future development of new NERICA lines

