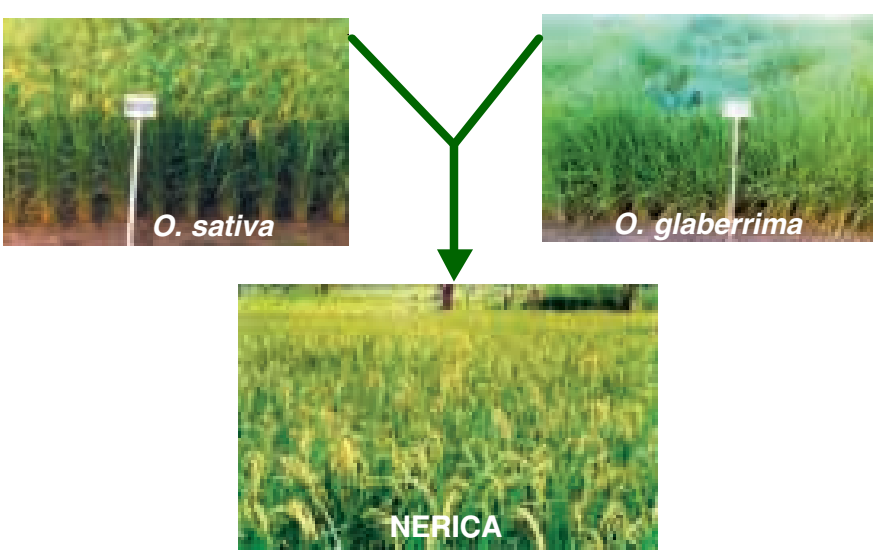
3. NERICAs: New Germplasm, New Opportunities

Technical change within agriculture is by its very nature an extremely complex process. Decades of experience in Africa and many bitter disappointments highlight the fact that there are no simple, single or general solutions. There are no 'silver bullets.' Even with adequate funding, partnership and participation, improving the productivity, profitability and sustainability of small-scale farming systems can be a slow, tedious and context-specific endeavor.

When TAC (2000) called on "... efforts to the development of improved rice genepools and integrated crop management ... and to broaden the genetic base by introgression of genes from diverse sources," WARDA had already opened new doors, providing enhanced opportunities for positive change. The key word here is opportunities. These new doors do not in themselves represent change or impact. Rather, they only help to set the stage for further action on the part of researchers, farmers and others, working within a production–consumption chain. The development of the NERICA rice germplasm is one such open door.

NERICA refers to germplasm derived from interspecific crosses of *Oryza sativa* (Asian rice) and *Oryza glaberrima* (African cultivated rice). As with all wide-crossing programs, the objective is to gain access to new genetic combinations, combinations which bring together the best characteristics from each parent. The actual contribution of *O. glaberrima* to West African rice farming systems and its potential contribution to modern rice breeding has been recognized for many years. Indeed, there were a number of earlier attempts to access the *O. glaberrima* genome through interspecific crossing. However, most of these attempts floundered because of sterility and stability problems in the interspecific progeny.

WARDA's contribution was to use anther-culture and embryo-rescue to circumvent the sterility problems, thus unlocking an exciting new



source of genetic variation. The basic objective has been to combine the yield potential of *O. sativa* parents with the local adaptation of *O. glaberrima*. The particular characteristics of interest from *O. glaberrima* are a shorter growth cycle, a growth habit associated with weed competitiveness, and drought and pest tolerance. In addition, *O. glaberrima* brings desirable eating qualities. Using backcrossing to the *O. sativa* parent to reduce the number and any undesirable effects of the *O. glaberrima* alleles, fully fertile, fixed lines containing around 12% *O. glaberrima* alleles can be obtained. It is fixed lines such as these that are referred to as NERICAs. NERICA development, testing and dissemination is most advanced for the rainfed uplands, although a similar strategy is now being used in the rainfed-lowland and irrigated breeding programs, and lines are now available for wider testing.

Results to date are very encouraging. In the rainfed uplands, some NERICA lines outperform the best *O. sativa* lines. Farmers have shown particular interest in the fact that the shorter growth cycle allows an extra measure of flexibility (in terms of, for example, drought avoidance and potential double-cropping). NERICA lines have already been officially released in Côte d'Ivoire, Nigeria and Uganda, and through the activities of ROCARIZ, INGER-Africa and other partners, NERICA breeding lines are being used and evaluated in rice-improvement programs throughout Africa and the world. In addition to formally released varieties, many farmers have had an opportunity to evaluate NERICA material for themselves through participatory varietal selection (PVS, *see* Appendix 8).

It is in Guinea where NERICA varieties have had their greatest impact to date. Following concerted effort by the Government and NGOs such as Sasakawa Global 2000, significant levels of NERICA adoption have been reported. The marked preference for local rice in Guinea is probably one important factor in stimulating rapid adoption.

Sahels, WABs and WITAs: Other Successful WARDA Lines

WARDA has had more success in the field of variety development than just the NERICAs. In the mid-1990s, both Senegal and Mauritania released three lines from the Sahel breeding program, which were designated Sahel 108, Sahel 201 and Sahel 202. All three proved popular, but Sahel 108 in particular was rapidly adopted and came to dominate rice cultivation in the Senegal River valley within a few years. Much of the success of this variety may be attributed to its short growth cycle, with consequent reduced water demand, while maintaining high productivity. These lines have also been variously released in Burkina Faso, Cameroon, Ghana and Nigeria.

In 1998, Côte d'Ivoire released four lines for rainfed uplands from WARDA's earlier WAB (WARDA/ADRAO-Bouaké) breeding program. At the same time, another WAB was released for the rainfed lowlands, and five WITAs (WARDA at IITA) for rainfed and irrigated lowlands. Again, several of these lines have also been released in other countries of the sub-region. Meanwhile, Cisadane from the lowland breeding program was released in Nigeria for its resistance to African rice gall midge, which devastates rice crops in the southeast of the country.

It should also be noted that it is not only NERICAs that have proved popular in PVS activities. Several high-yielding *sativas* from the WAB series have proven popular among rainfed-upland farmers, where yield, quality and disease resistance are important attributes. In the rainfed-lowland PVS, newer WITAs have proved popular, particularly those with tolerance to iron toxicity or rice yellow mottle virus.

In summary, NERICA germplasm offers real hope for improving the productivity, profitability and sustainability of rice farming in WCA. To move from hope to impact, however, these varieties must be brought together with a number of complementary technologies in more integrated crop management systems. In turn, these systems must sit within more enabling policy and market environments. This kind of integrated approach is at the heart of the African Rice Initiative within which NERICAs will play a central role (*see* Appendix 15).

There is still much work to be done.

Further reading

Jones, M.P., M. Dingkuhn, G.K. Aluko and M. Semon, 1997. Interspecific *Oryza sativa* L. × *O. glaberrima* Steud. progenies in upland rice improvement. *Euphytica* 92: 237–246.

Dingkuhn, M., M.P. Jones, D.E. Johnson and A. Sow, 1998. Growth and yield potential of *Oryza sativa* and *O. glaberrima* upland rice cultivars and their interspecific progenies. *Field Crops Research* 57: 57–69.

Dingkuhn M. and F. Asch, 1999. Phenological responses of *Oryza sativa*, *O. glaberrima* and inter-specific rice cultivars on a toposequence in West Africa. *Euphytica* 110: 109–126.

TAC Secretariat, 2000. CGIAR priorities and strategies for resource allocation during 1998-2000, and Center proposals and TAC recommendations. TAC, FAO, 86 p. plus appendices.

Acknowledgements

WARDA's work on interspecific hybridization and NERICA development, testing and dissemination has been generously supported by Japan (Ministry of Foreign Affairs), UNDP Technical Cooperation among Developing Countries (TCDC), Rockefeller Foundation, Gatsby Foundation, USAID, The World Bank and the CGIAR System-wide Program on Participatory Research and Gender Analysis for Technology Development and Institutional Innovation (PRGA).

In addition to WARDA's partners throughout WCA, the following institutions have contributed to the interspecific hybridization work: International Center for Tropical Agriculture (CIAT), *Centre de coopération internationale en recherche agronomique pour le développement* (CIRAD, France), Cornell University (USA), *Institut de recherche pour le développement* (IRD, France), International Rice Research Institute (IRRI), Japan International Research Center for Agricultural Sciences (JIRCAS), Ministry of Agriculture, Forestry and Fisheries (MAFF, Japan), Natural Resources Institute (NRI, UK), University of Tokyo (Japan), UN Volunteers, and Yunnan Academy of Agricultural Sciences (China).