

Lowland rice can only get better



One of the first of the new Lowland NERICAs to gain release in Mali and Burkina Faso.

When are we going to get the lowland NERICAs? That was the question on everyone's lips as the success of the original NERICA varieties for the uplands grew to take in country after country in sub-Saharan Africa, and word spread to the lowlands of how yields were being transformed.

Even with the startling success of the upland NERICAs as proof of what sceptics said could not be done, Africa Rice Center's breeders still wanted to deploy the traditional caution of the scientist before unveiling the new generation of rice varieties that could bring hope to resource-poor farmers cultivating in the lowland ecology.

Of course, WARDA's insistence in involving the NARS and other partners in research projects meant that the word was already out that lowland types were already under development long before the first official lowland NERICAs were released in Mali (2) and Burkina Faso (4) in 2005.

In fact, about 60 of the new varieties for the lowlands have already received the stamp of approval from farmers in several African countries through the participatory varietal selection (PVS) process – an approach that was used successfully in accelerating the dissemination of the upland NERICAs. Scaling-up took place in both 2004 and 2005 to ensure that farmers get the seeds for which they have been clamoring since Dr Monty Jones' first NERICAs unleashed the potential of the uplands five years earlier.

Another scientific breakthrough for the Africa Rice Center, with yield potential of 6-7 tonnes per ha and good resistance to major lowland stresses, the lowland NERICA varieties have been developed for the African lowlands, one of the most complex rice ecologies in the world. Eventual impact is expected to be even greater than for the upland NERICA varieties that are vastly outyielding the disease- and pest-susceptible local varieties previously grown.

From the outset, the scientists involved – including Sahel Station team leader Dr Kouamé Miézan and Dr Moussa Sié (then a visiting scientist with WARDA in St-Louis but now WARDA’s lowland rice breeder) – wanted to ensure selections were carried out in countries other than Senegal where many of the early crosses were made.

The search for new varieties of rice adapted to the lowland ecology is necessary because of the multiple constraints that slow down the development of rice cultivation in this environment, says Dr Sié. To get suitable varieties quickly, a program of varietal selection was initiated with intra- and interspecific crosses available in the WARDA germplasm collection. Initial NARS partners were INERA in Burkina Faso for early identification of promising material, then Togo’s ITRA, with Mali’s IER and the ARI coordinator coming on-board for collaborative selection of promising lines in visits to each other’s countries.

A study at the Banfora Research Station in Burkina Faso – to which Dr Sié had returned as head of INERA’s rice improvement division – identified ideotypes suitable for lowland conditions, starting with the agromorphological characterization of more than 400 interspecific lines (*O. glaberrima* x *O. sativa*) or NERICAs. They were tested in valley bottom conditions in the Banfora lowland during the 2000 and 2001 wet seasons. From the first year trial, 96 lines were retained (14 intraspecifics and 77 interspecifics) for assessment under the same conditions in the 2001 wet season. Actual selection was carried out over two years following a collaborative approach in the first year and a multi-site approach in the second year in the ‘Plateau’ area in the west of Togo and in Burkina Faso.

“In Togo, we started in 2002 with 205 descendants and selected 29 lines with characteristics of interest for lowland rice cultivation,” adds Dr Sié.

PCR analysis with 10 variables gave an agromorphological evaluation of the material. Two types of lines were identified: the strictly upland type (*O. glaberrima* x *O. sativa japonica* or upland NERICA) and the rainfed lowland type (*O. glaberrima* x *O. sativa indica* or lowland NERICA and *O. sativa* x *O. sativa*).

Getting quality traits right in the new Lowland NERICAs will be particularly important for women who are dominant in post-harvest handling.



The lines showed the low susceptibility to disease and insect attack, which is vital if they are to succeed in the hard-pressed lowland ecology. The scores obtained in the 2000 wet season at Banfora for the lines were mostly lower than 5 for leaf blast and yellow mottle virus on a 1–9 scale.

The new NERICAs exhibited less than 2% damage from insects (onion tubes, dead hearts and white panicles) for the two sites (valley fringe and valley bottom). Although the interspecific *O. glaberrima* x *O. sativa indica* crosses proved to provide the best Lowland NERICAs suited to irrigated or lowland conditions, they also seemed to be more susceptible to some pest attacks (more than 2% of attack for silver shoot) but still at much improved levels over varieties currently in use in these environments.

The potential of these new crosses was not lost on the NARS partners, whose breeders took part in the selections that led to the official release of two lowland varieties (WAS 161-IDSA-1-WAS-B-FKR-B-IER-2-4 as N1, WAS 122-IDSA-1-WAS-B-FKR-B-IER-18-B as N2) in Mali, and four varieties in Burkina Faso (WAS 122-IDSA-1-WAS-B-FKR-1 as FKR 60N2, WAS 122-IDSA-1-WAS-6-1-FKR-B-1 as FKR 62N3, WAS 161-B-9-3 as FKR 56N4, and WAS-191-9-3-FKR-1 as FKR 58N0).

Of course, this is only the beginning of the Lowland NERICA story, says Dr Sié whose detailed studies into what makes the Lowland NERICAs tick are continuing at the same time as PVS involving farmers speeds the introduction of the new types in a number of countries. The typology of the new lines was examined in 2003 and 2004 with a study of 61 interspecific (*O. sativa glaberrima* x *O. sativa indica*) and nine intraspecific (*O. sativa indica* x *O. sativa indica*) lines. All were multiplied in the 2003 wet season at Banfora and planted in the 2004 wet season in nine countries (Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali, Niger, Nigeria, Senegal and Togo). Depending on the country, the lines were planted in a range of environments (valley slope, valley bottom and irrigated).

In the analysis of the results from this study, the varieties were placed in three groups according to their performance. This demonstrated clearly that the interspecific crosses of the African glaberrima rice with Asian japonica rice far outstripped the intraspecifics in their earliness, tillering, yield and better height characteristics.

Dr Sié explains there is much more to do as the Lowland NERICAs extend into WARDA member countries and others in Eastern, Central and Southern Africa. This includes evaluating the interspecifics for different water regimes, in different integrated crop management scenarios, characterizing more glaberrima germplasm in lowland ecosystems to allow better 'targeted' crosses, and molecular characterization of elite and promising characteristics.

"We must place the accent on quality traits because we should never forget that glaberrima is an African rice, appreciated for its quality, and no progress can be made if we lose that quality as a result of our varietal creations," he adds. Concentrating on post-harvest quality for the new rices will direct the benefits of improved varieties towards women who are key participants in the post-harvest markets. It is also important to enlarge the genetic base of new varieties by using more glaberrima and sativa parents and by bringing in other African rice species such as *O. barthii* and *O. longistaminata*.