

# On-farm and Community Management of Rice Biodiversity

For some years, there has been growing concern about the potential loss of biodiversity as research world-wide generates more and more crop varieties, each one reportedly better than the last. WARDA has, therefore, been assessing farmers’ management of their rice biodiversity and the impact of modern varieties in Côte d’Ivoire.

“Talk to any rice farmer in west-central or western Côte d’Ivoire, and he (or she) will most likely tell you that he/she grows between five and ten rice varieties in any one year,” says Head of WARDA’s Genetic Resources Unit, Gouantoueu Guei. “But how do farmers decide which varieties they are going to grow this year, and how do they ensure that the varieties they choose not to grow will still be available next year should they decide to go back to them? How and why are landraces—or old varieties—kept from generation to generation by farmers and what determines farmers’ choice of varieties to grow?”

To answer these questions, WARDA conducted surveys over two growing seasons in four areas of Côte d’Ivoire—Danané and Gagnoa in the forest zone, and Boundiali and Touba in the savanna zone. “We visited farmers’ fields and their seed stores,” explains Yoboué N’guéssan, former Visiting Scientist at WARDA, who conducted the surveys with Guei, “to collect seeds of each variety identified by the farmer, along with details on location, origin of seed, why the farmer uses that particular variety, and so on.” At the end of two seasons, the team had plenty to work on—1673 seed samples from 306 farmers in 57 villages, and all the related data!

## The value of varieties

“Farmers’ handling of rice varieties is a complex issue,” Guei says, “but essentially it seems that individual farmers manage biodiversity and conserve varieties in the short term, while the community—either by conscious collective effort or simply as the sum of individuals’ actions—does the same over the long term.” After analysis of the survey results, Guei developed a model of rice biodiversity management at the community level (Fig. 10), which shows farmers

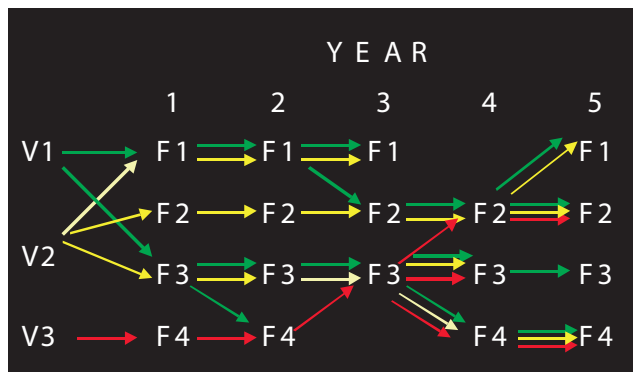


Figure 10. Model of rice biodiversity management at the community level

making deliberate decisions about which varieties to continue growing and which they want preserved within the community for future use. “Not every variety is grown by every farmer,” explains Guei. “So if, for example, a farmer has to travel during a season and is not going to be growing rice that year; if that farmer has a variety that he, or she, wants to keep, but that is not commonly grown by anyone else in the community, he (or she) may give some seed to a neighbor and ask them to grow it for that season, so that they will have seed for the next season. A variety may be abandoned in a village for some reason, but will not suddenly disappear in the farming community as farmers in neighboring villages may still keep it for other reasons.”

Individual varieties ‘mean’ different things to different farmers. There is of course the scientific—or rather, economic—value, which may be measured in terms of variety characteristics, such as yield, grain quality, cooking quality and processing quality, in other words, those things that breeders generally look at. However, there are also social and cultural values attached to specific varieties. For example, a variety may be part of a family’s heritage, because they have grown it over several generations of the family. Another variety might be valued for medicinal properties, like being good when someone has stomach problems. Yet another might carry a certain amount of prestige, as it is the traditional, or favored, variety at certain types of ceremony. “On top of all of these,” concludes Guei, “some varieties appear to have a certain mystic-spiritual value in certain communities.”

Related to the whole issue of value, is the farmers’ naming system for varieties. “What we found,” says N’guéssan, “is that farmers use a single name for what we might recognize as more than one variety; however, the name clusters varieties that have specific characteristics that the farmer is interested in.” Thus, the surveys found *Mlitti* and *Lognini*, both names for dark-grained rice; *Totoman*, which can be eaten without sauce; *Mlinkin*, for long-, fine-grained rice; *Guissi* for varieties that produce lots of tillers; *Mokossi* for tall,

vigorous varieties that suppress weeds; and, *Gaman* (Cowboy) for high-yielding, weed-suppressing varieties. Other typical naming systems are to adopt the name of the person who provided the farmer with the original seed, or the name of the village where the farmer discovered the variety.

“Farmers are opportunists,” Guei says, “always on the lookout for something new that might prove to be of interest.” It is not surprising, therefore, that each farmer has potential sources of seed. The most obvious source, perhaps, is the farmer’s own field, from which he (or she) may save the best grains as seed for next-year’s crop. In addition, seed may be bought on the local market, may be given as a gift, may be exchanged between farmers, may constitute payment (for example, for labor), or may come direct from research or extension services.

### Scientific assessment of biodiversity

As we have seen, what farmers call a ‘variety’ does not coincide exactly with what science calls a variety. If we want to know about the real state of rice biodiversity, we need to separate variety from ‘variety.’

“Crop varieties are recognized by their characteristics,” explains Guei, “primarily morphological—what they look like—and agronomic—how they grow. For most crops, descriptors have been identified that, when taken in combination, give a good picture of any particular variety.” The team used 29 of the descriptors for rice published by the International Plant Genetic Resources Institute (IPGRI). “In order to have plants to characterize, we grew all the ‘varieties’ in irrigated lowland at WARDA’s research farm at M’Bé in 2001 to generate enough seed for further study. We then conducted a simple laboratory test to differentiate upland (*japonica*) varieties from lowland (*indica*) varieties. The following year, we re-grew the *japonica* varieties in upland at M’Bé, and the *indica* varieties in Danané.” These plants grown in their ‘correct’ habitat were duly scored for the 29 descriptors.

A rather complex statistical technique (known as ‘principal component analysis’) was then used to generate two-dimensional graphs of diversity within the samples. Figure 11 shows one such graph. Major findings were as follows.

- Across Côte d’Ivoire, *indicas* are more diverse than *japonicas*, both in terms of number of groups (3 v. 2) and relatedness within the identified groups.
- Within the *indicas*, diversity is most marked in plant height, cycle length, number of fertile tillers, and resistance to lodging.
- Most *indicas* from the savanna are short-to-medium duration and short-to-medium stature, while those from Gagnoa in the forest are mostly short duration and short stature. However, *indicas* from Danané (forest) are more diverse

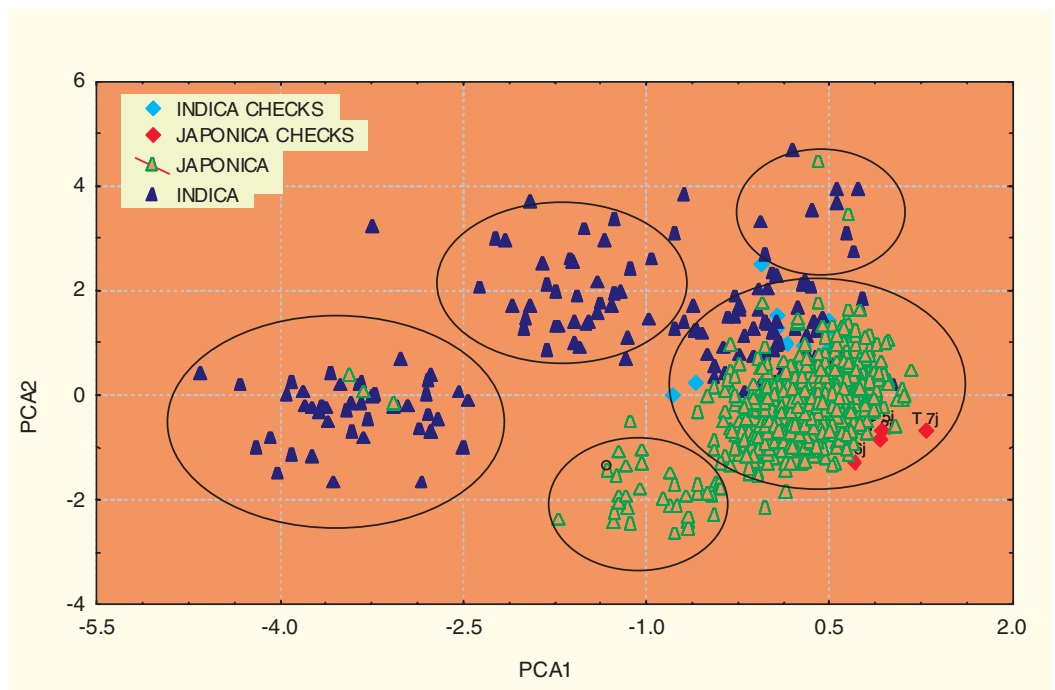
in both cycle and stature. It is suggested that growing rice in the short rainy season in Gagnoa has favored short-cycle types, while the single long rainy season in Danané allows time for long-duration types to mature.

- Most of the diversity in the *japonicas* is expressed in cycle length, plant height and leaf-width. All of the *japonicas* are medium-to-long duration, and tall.

“The next step in the process is molecular characterization,” explains Guei. “With biotechnology tools, it is possible to assess diversity at the gene level, and so really determine which samples are valid varieties and which duplicates.”

The WARDA genetic-resources team also wants to be able to offer breeders more options for traits like yield potential, grain quality and disease resistance.

**Figure 11.** ‘Principal component analysis’ graph of rice biodiversity in Côte d’Ivoire



“Some of the traits that our breeders are interested in are not included in the IPGRI characters,” says Guei, “so we will have to conduct more specific experiments targeting these traits.” The results reported here are only from Côte d’Ivoire; with 17 member states alone, there is plenty of scope for diversity studies in rice on a much broader scale.

“The value that we place on genetic resources was shown in the establishment of the Genetic Resources Unit in 1998,” concludes Director General Kanayo F. Nwanze. “With the appointment of Dr Guei as the head of that unit in 2003, we hope to see a growing contribution to WARDA’s activities, especially in plant breeding.”