



participatory varietal selection

## The Flame Spreads Into 2000



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# THE FLAME

## SPREADS INTO 2000

Proceedings of the  
Participatory Rice Improvement  
and  
Gender/User Analysis Workshop (PRIGA)  
17–21 April 2000  
WARDA Headquarters  
Bouaké, Côte d'Ivoire



West Africa Rice Development Association  
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2000

## ACKNOWLEDGMENTS

“On behalf of the world's poorest farmers—rice farmers of West and Central Africa—the West Africa Rice Development Association (WARDA) thanks the world community that supports Participatory Varietal Selection,” says Dr Monty Jones, Principal Rice Breeder at WARDA.

“We also speak for those at the forefront of the movement to increase rice production in the area that needs it most—the national agricultural scientists and extension specialists across the African continent,” Jones adds.

The invaluable support of our supporters and collaborators is gratefully acknowledged:

- the Japan Ministry of Foreign Affairs,
- the United Nations Development Programme (UNDP),
- the Systemwide Program on Participatory Research and Gender Analysis (SWP PRIGA) of the Consultative Group on International Agricultural Research (CGIAR),
- the UK's Department for International Development (DFID),
- the Rockefeller Foundation, and
- the 17 WARDA member countries: Benin, Burkina Faso, Cameroon, Chad, Côte d'Ivoire, The Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo (see map on page 83).

The PRIGA workshop was attended by representatives of major donors who support PVS. Below left: Dr Nina Lilja, Systemwide Program on Participatory Research and Gender Analysis of CGIAR; Dr Monty Jones, WARDA; Dr Ken Tatsuo Fujimura, UNDP; Dr David Harris, DFID/Plant Sciences; and Dr Joseph DeVries, Rockefeller Foundation.

Below right: UNDP is a key supporter of PVS. Dr Ken Tatsuo Fujimura, Senior Advisor on South-South Cooperation, presents rice seeds to Dr Adeyemi Joshua, agronomist and plant breeder with Premier Seed Mig. Ltd, Nigeria.



# INTRODUCTION





## “YOU OFFER THE SPARK THAT LIGHTS A FLAME”

Address to PVS participants from across  
West and Central Africa in 1999

West and Central Africa now import about 3.2 million tonnes of rice a year, at a staggering cost of US\$1 billion—a cruel strain on the region's economies. Thus, rice self-sufficiency, or at least a significant reduction in imports, is a vital priority.

A repeat of the Green Revolution in Asia is needed to feed the growing population of Sub-Saharan Africa. But the *African Green Revolution* must be different—it must avoid the pollution and environmental damage that often accompanied the rise in farm productivity in Asia. High production must be socially and environmentally sustainable.

WARDA, in partnership with scientists of national agricultural research systems, or NARS, develops and disseminates improved rice varieties and production technologies for farmers of West and Central Africa. Production has increased substantially in many regions. But adoption of better farming technology has been slow—or non-existent—in some ecologies, especially the harsh rainfed upland and rainfed lowland regions.

Scientists alone cannot genetically tailor and spread the new varieties and technologies needed

to trigger an African Green Revolution. To transfer the high yields on research stations to African farmers' fields, while protecting a fragile environment, requires teamwork.

The novel *participatory research approach* is proving to be a mechanism through which scientists, extension workers, and farmers can work together, as teams, to increase rice productivity.

A “silent revolution” began with the rapid adoption, through Participatory Varietal Selection, of the NERICAs (for *NEw RICES* for *AfriCA*) in Guinea and Côte d'Ivoire. The NERICAs are also sometimes called “interspecifics,” because they are progeny of wide crosses of *Oryza glaberrima*, the rugged African species of rice, with *Oryza sativa*, the more productive Asian species.

Participatory Rice Improvement and Gender Analysis (PRIGA) activities started in Guinea in 1997. By the year 2000, more than 20,000 Guinean farmers were growing the NERICA varieties on 5000 ha. Guinea imported 200,000 tonnes of rice in 1997. But importations are expected to decrease 25–50% by 2002, according to projections of the

Special Program for African Agricultural Research (SPAAR) and the World Bank Assistance Program. The government foresees self-sufficiency in rice production within 5 years.

Sixty-two PRIGA cooperators from 17 WARDA member countries attended the *Participatory Rice Improvement and Gender/User Analysis Workshop*, held 17–21 April 2000 at WARDA's Headquarters near Bouaké, Côte d'Ivoire. Sponsors were the Japan Ministry of Foreign Affairs, the United Nations Development Programme (UNDP), the Systemwide Program on Participatory Research and Gender Analysis (SWP PRIGA) of the Consultative Group on International Agricultural Research (CGIAR), and the UK's Department for International Development (DFID).

These workshop proceedings should serve as a reference and guide for all stakeholders in the collaborative effort, and an overall information source on participatory research.

The first section of the proceedings describes goals and objectives of PRIGA research. It is intended to help NARS partners in the participatory strategy learn and practice PRIGA components such as Participatory Varietal Selection (PVS), Participatory Rice Breeding (PRB), seed priming, and community-based seed multiplication.

Reports from NARS in the second section show how farmers themselves are selecting improved rice varieties, including the interspecifics or NERICAs, that are suited to their own biological, social, and economic conditions.

More important, perhaps, it shows that the "farmers first" approach is correct, and workable. Farmers are sharing rice-growing experience, passed down over the centuries, to guide breeders in the development of better rice varieties.

More than 3000 farmers participated in the PVS trials in 17 countries in 1999. Their frequent selection of the interspecific upland rice varieties to plant on their own farms next growing season is triggering an unprecedented demand for seed of the new varieties.

Common problems and issues that concern PVS stakeholders across the WARDA member countries are discussed in the third section of the proceedings.

Both the workshop and PRIGA activities were funded by UNDP, the Rockefeller Foundation, and DFID (UK).

Both the new rices for Africa, and the participatory research approach, are spreading rapidly in West and Central Africa. So is the hope that they bring. These workshop proceedings tell the story.

NETWORK  
DATABASE  
BIODIVERSITY  
SEED PRIMING  
SEED PRODUCTION

## SPECIAL TOPICS

Presented at the  
Participatory Rice Improvement and Gender/User Analysis Workshop





# NETWORK

## Regional Network for Participatory Varietal Selection: the Generation and Dissemination of Impact-Oriented and Demand-Driven Technology

Monty P. Jones, T.J. Dalton, N. Lilja, and D. Macaire

*Participatory rice varietal selection (PVS) trials are established by the West Africa Rice Development Association (WARDA) in collaboration with NARS scientists, extension agents, NGOs, and farmers. The purpose is to identify both varieties that are specifically suited to farmers' needs, and desirable plant and grain traits to integrate into breeding programs so that future varieties can be tailored for farmers. WARDA brought the approach to West Africa in 1996, with the initiation of PVS trials in Côte d'Ivoire. In 1997, WARDA and the NARS of Guinea initiated the region's second PVS trials. The regional Participatory Rice Improvement Network was initiated in 1998; it now covers 17 countries in West and Central Africa. In trials in Côte d'Ivoire, two interspecific lines, WAB 450-I-B-P-38-HB and WAB 450-11-1-P31-1-HB, have excelled in meeting farmer requirements for vegetative vigor and weed suppression, growth cycle, stature and height, yield, and grain quality. The impact of PVS has been widespread in Côte d'Ivoire and Guinea. More than 1000 farmers in 16 prefectures of Guinea participated in PVS trials in 1999. Regionally, more than 3500 farmers participated. We project exposure of almost 5000 farmers to improved upland rice varieties through PVS in 2000.*

### **Goal and Procedures**

The goal of PVS is to efficiently transfer improved rice technology to farmers. WARDA's PVS research is a 3-year program. In the first year, WARDA, along with local farmers and national scientists, identify centralized fields near villages, and plant 'rice garden' trials with about 60 upland varieties. The varieties range from traditional *O. sativas* that are popular across West and Central Africa, to interspecific hybrids, to African *O. glaberrimas*, to local checks. Men and women farmers are invited to visit the plot as often as possible, but farmers are brought as groups, for formal evaluation of the test varieties, at three key stages. Farmers are

asked to select which rices they like best at each stage. We compile the farmers' selection criteria, or traits they like and dislike about the varieties, through personal interviews.

The first visit is at *maximum tillering*, the most vigorous growth stage. The farmers compare traits such as how fast different rices grow, how well they shade out weeds. During the second visit, at the *maturity* stage, traits such as panicle type, plant height, growth cycle length, and other agronomic and morphologic traits are identified. The final visit, *post-harvest*, focuses on grain quality attributes such as size, shape, shattering, ease of threshing and husking, and palatability.

Each farmer's varietal selections are recorded at each of the three visits. At the season's end, the varietal choices, and the reasons given, are analyzed.

In the second year, each farmer receives as many as six of the varieties he or she selected as favorites in the first year, to grow on his or her own farm. Thus, new genetic diversity enters the communities.

Usually, five or six varieties are very popular across the group, and another 10–15 varieties selected only by a handful of farmers for particular “niches.”

During the second year, PVS observers visit participating farmers' fields to record performance and farmer appreciation of the selected varieties.

At the end of the second year, farmers evaluate threshability and palatability, to provide a 'full' view of the strengths and weaknesses of the selected varieties.

At the end of the season, farmers are asked to pay for seeds of the varieties they select—evidence of the value they place on them.

### **Findings in Côte d'Ivoire, 1997 and 1998**

#### *Farmers' evaluations at maximum tillering*

Farmers selected an average of three varieties, rather than the maximum of six specified by the guidelines, to grow on their own fields. Four groups of traits—those associated with plant height, tillering ability, yield potential, and growth cycle—accounted for 82% of the reasons that farmers gave for selection at this stage. A traditional *O. sativa*, LAC 23, along with the

*glaberrimas*, were often selected at maximum tillering because of their profuse tillering ability. Farmers also often selected three interspecifics, although not as often, because of tillering.

#### *Farmers' evaluations at maturity*

The interspecifics were the most frequently selected varieties at maturity. All farmers selected at least one interspecific to add to their portfolios of seeds, two-thirds selected two, and slightly less than a fourth selected three or more. More than two-thirds of all farmers selected WAB 450-11-1-P31-1-HB.

#### *Farmers' evaluations post-harvest*

The interspecific hybrids remained popular with farmers post-harvest. Women farmers tended to prefer a 'bold' grain—round and fat—at this stage. That trait is inherent in many improved *O. sativa*s, particularly IDSA 46. Men preferred a smaller grain type, like most of the interspecifics produce. Two interspecific varieties tied with IDSA 46 for the most popular variety. Men also liked varieties that performed well without fertilizer.

#### *Gender differences*

Men's and women's varietal choices differed statistically. In general, men and women selected the interspecifics about equally—but *different* interspecifics. That indicates that the hybridization program can serve the needs of men and women farmers equally, and that technology development does not favor one gender at the expense of the other.

## Regional PVS

Participatory research is technology generation and dissemination. The components involved are:

- *Participatory Varietal Selection (PVS)*, where farmers use their own criteria to make selections from “fixed” varieties (initially from a ‘rice garden’) for further evaluation, selection and adoption on their own farms.
- *Participatory Rice Breeding (PRB)*, where segregating populations are given to farmers, who select and move the populations back to breeders for further improvement.
- *Seed priming*, a process of soaking seeds for 12–18 hours, then shade-drying them before planting in the field. Seed priming improves crop establishment, and the ability of plants to tolerate environmental stresses.
- *Community-based seed multiplication*, where farmers are trained to produce seed of varieties for the use of other farmers.

# DATABASE

## Integrating PRIGA Data from 17 West and Central African Countries

Myra Wopereis-Pura, Monty P. Jones, Hla Myint

*WARDA is developing a database of information on participatory varietal selection, participatory plant breeding, and seed priming in 17 member countries. It will enable data analysis from individual countries, as well as comparative analysis from two or more countries. Each country provides information such as site descriptions, agronomic traits of varieties that farmers select, economic effects, and impact assessment. The database facilitates analysis and information-gathering on factors such as varietal selection criteria, area covered, number of farmers involved, and spread of varieties. NARS and WARDA scientists will have access to all PRIGA information.*

Activities of the Participatory Rice Improvement and Gender/User Analysis (PRIGA) program include participatory varietal selection, participatory plant breeding, and seed priming. All 17 WARDA member countries participate in one or two of these activities. Participating NARS researchers and NGOs in each country are responsible for data collection such as farmer surveys and records of preferred agronomic traits.

Standardization of data collection is essential for accurate analyses of data collected in the 17 diverse countries. Thus, WARDA is establishing a PRIGA database, with funding by the United Nations Development Programme (UNDP).

Information in the PRIGA database comes mostly from standardized survey forms that WARDA distributes to participants. Standardization facilitates data entry and simple statistical analysis. NARS scientists can access the database and

immediately access past, present, and future PRIGA activities. For example, scientists can request information on varieties that farmers select, the selection criteria that they use, spread of varieties, and gender differences in selecting varieties. Other information includes the area covered by PVS trials; the number of participating farmers, broken down by gender; and progress of PVS trials. The database will have two parts: country analysis and comparative analysis.

### **Country analysis**

Country analysis will include descriptions of area covered by PVS trials, number of farmers involved, participating villages, and selected varietal characteristics. The three components of country analysis are: agronomy, economics, and impact analysis.

*Agronomic data* include standard plant measurements such as plant height, density, percent

emergence, and yield. Damage to crops from insects, diseases, and other biotic and abiotic problems are also recorded.

*Agronomic analyses* include frequency and ranking of selected varieties, and varietal performance through the years. There could be comparative analysis of varieties in terms of yield, plant height, cycle, etc. in the second and third years.

*Economic data* will include descriptive material such as participating farmers, selection criteria, and farmers' willingness to pay for seeds. The histories of farms and farmers are recorded, including crops planted other than rice, crops planted 5 years before the study period, family roles in agriculture, ability to buy, cultural practices, farmers' comparisons of new versus local varieties.

*Basic analyses* will include criteria, gender differences, and farm and farmers' practices.

WARDA economists will help with comprehensive economic analyses.

Farm coordinates will be recorded to develop a GIS map of PRIGA activities. *Impact analyses* will include process and technology impact assessment during the third PVS year. Procedures will be finalized after arrival of the new impact assessment economist at WARDA.

### **Comparative analysis**

Comparative analysis will involve the same parameters as country analysis, but will allow the comparison of two countries. For example, Nigeria can compare its performance with that of Togo or Benin. Countries can identify and compare varieties that farmers prefer at sites in specific agro-ecologies.

Once developed and tested, the database will be open to all PRIGA cooperators.

# BIODIVERSITY

## Rice Biodiversity and PVS at the Community Level

R.G. Guei

*PVS trials introduce new higher-yielding and stress-tolerant varieties, including the interspecifics, into a farm community. Farmers' selections from PVS gardens of as many as 60 varieties can broaden local genetic diversity. As farmers adopt better varieties they may eventually abandon their local cultivars, which are sources of unique and useful genes. Thus, PVS activities should involve genetic resources scientists who inventory, collect, characterize, and conserve farmers' local varieties, including the *O. glaberrimas*.*

### **Introduction**

Both consumption of rice and the adoption of new rice varieties are increasing faster than any other food crop in many African countries. So are rice imports (Matlon et al., 1998). Considerable potential exists, however, to further expand the rice area and increase productivity.

Farmers have grown rice in Africa for centuries. Many African varieties have disappeared over time, but some have survived for decades, mainly because they are adapted to environmental stresses and possess preferred grain qualities.

Rapid genetic gains are being achieved through varietal improvement and innovative technology transfer approaches such as farmer participatory varietal selection (PVS). These approaches can increase genetic diversity—but can also accelerate the genetic erosion of local germplasm, as farmers abandon traditionally grown local varieties in favor of new ones.

Thus, farmers' germplasm management, before and after the introduction of new varieties through PVS, should be studied.

This paper aims to increase awareness among plant breeders and extension workers of the role of PVS in farmers' management of community genetic diversity, and to emphasize the importance of involving genetic resources scientists in PVS activities.

### **Genetic diversity at the community level**

Rice genetic diversity, at the farm-community level, includes wild rices as well as cultivated varieties of *Oryza glaberrima*, the African species, and *Oryza sativa*, the Asian species. Among the *O. sativas* are both landraces, or traditional varieties, and improved varieties.

The traditional upland rice varieties that farmers grow are usually well adapted to local environmental conditions. Most are tall, late maturing, and low yielding—but have good grain quality.

The local varieties are also useful sources of genes for stress tolerance. Each farmer might grow four or five local varieties and within a community, most farmers might grow one or two varieties in common.

### **Genetic erosion**

Natural factors such as drought, flood, and fire contribute to the gradual genetic erosion of rice varieties on African farms. Other factors include civil war, and community changes that come with the immigration of more progressive, educated, and market-oriented farmers who prefer modern varieties.

Several improved rice varieties released in Africa over the past decade are being adopted rapidly. Most are adapted to African farming systems and preferences. They grow well with few inputs, and compete well with weeds. Many have good grain quality, meeting local consumer preferences.

The adoption of new varieties means that the area planted to landraces, and the varieties themselves, are gradually disappearing.

But genetic materials becoming available to farmers can help restore genetic variability. In 1994, WARDA successfully crossed the *O. glaberrima* and *O. sativa* species, developing robust, stress-tolerant, and weed-competitive interspecific progenies. These new plant types are now being introduced to farmers, and should enrich genetic diversity at the community level.

Of the newly developed rice varieties, 91% of the mangrove varieties, 73% of the upland, and 91% of the rainfed lowland varieties were developed or

selected in Africa. In the irrigated ecology, however, only 30% of the varieties were developed or selected in Africa. The genetic base of these materials is fairly wide. These materials were made available to national scientists for on-farm evaluation, and are now part of the farm-level genetic diversity.

In a germplasm impact study of 7 of the 17 WARDA member countries, Dalton and Guei (in press) report that despite limited regional investment in varietal improvement, 197 improved varieties had been released. Seventy-six percent of the varieties were released from 1975 to 1994, an average of 7 varieties per year. The remaining 24% of the new varieties were released between 1995 and 1999, an average of 12 varieties per year.

Dalton and Guei (in press) project the release of 122 more new varieties from 2000 to 2004, an average of 30 varieties per year.

Thus, varieties developed at both the national and regional level have increased genetic diversity over the past 10 years. Moreover, West African scientists are developing better varieties for sustainable yield increase, yield stability, and stress tolerance.

Thus, genetic diversity is constantly being strengthened or reconstituted at the farm level.

### **Integration of PVS and genetic resources activities**

In the first year of each PVS trial, as many as 60 varieties of diverse genetic origin are grown in the rice gardens. Farmers' selections from the gardens broadens genetic diversity at the community level.

In the classical on-farm approach, by contrast, farmers can choose from only three or four varieties.

The success of the PVS and other technology transfer approaches can enhance farmer adoption of new varieties. But farmer adoption of only one or two introduced varieties could drastically decrease genetic diversity at the community level. Farmers may not immediately abandon their local varieties, but may eventually discard them, at least partially.

The following genetic resource activities, therefore, should be incorporated into PVS:

- farmers' varieties should be inventoried in PVS trial zones
- farmers' criteria for keeping their varieties should be cataloged
- seeds of farmers' traditional varieties should be collected, characterized, and preserved in genebanks

It is important to understand how farmers exchange and store seeds, and the role of traditional varieties in the adoption of new ones.

Farmers' varieties should be inventoried again, 5–10 years later, to determine how the adoption of modern varieties has affected on-farm biodiversity. Such information should be useful feedback for plant breeders.

### References

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# SEED PRIMING

## Participatory Testing of 'On-farm' Seed Priming for Direct-seeded Rice: a Suggested Approach for Farmer-implemented Trials

David Harris

### Background

Inexpensive, low-risk technologies that increase and stabilize yields can have a large impact on the livelihoods of poor farmers in the marginal environments of developing countries. Poor crop establishment has repeatedly been proven a widespread constraint to crop production in such environments.

Plant stands are often 'patchy' and yields low, often simply because there are too few plants in the field. Also, plants that eventually emerge often grow slowly and are highly susceptible to stresses such as drought, insects, diseases, and weeds. Anything that will increase the proportion of seeds that emerge, and their rate of emergence, will clearly help farmers.

'On-farm' seed priming has been developed and tested as an inexpensive, low-risk way to improve the performance of tropical crops through a combination of *in vitro*, on-station, and on-farm research. This research showed conclusively that priming, when guided by simple *in vitro* data on 'safe limits,' is a valuable and highly cost-effective technology for maize, wheat, chickpea, and direct-seeded upland rice in marginal areas (Harris et al., 1999, 2000).

### Pre-germination versus 'on-farm' seed priming

Distinction between pre-germination and 'on-farm' seed priming is important.

In *pre-germination*, seeds are allowed to absorb enough water to take the germination process beyond the 'point of no return.' Roots and shoots will emerge even if the seed is removed from water. Such seed will continue to germinate, and will probably die, if sown in dry soil.

In '*on-farm*' seed priming, seeds are allowed to absorb water, but only for a 'safe limit' of time. The seeds, when removed from the water and surface-dried, will not germinate unless they get more water, such as by sowing into moist soil. Seeds will not germinate if sown in dry soil to await the rains, for example. Seeds will dry out slowly, but will germinate when rain wets the soil.

Benefits of seed priming are greatest if seeds are sown into moist soil because they will have a 'head start.'

But if farmers *must* dry-seed the crop, the risk associated with priming should be minimal as long as the seed has not been pre-germinated. Figure 1 gives detailed instructions on seed priming.

## Experimental approach

Large amounts of relatively 'low grade' information can be gathered from a wide range of sites and management regimes through the participatory, on-farm approach advocated here. This is in contrast to 'high grade' data gathered at a limited number of sites through more conventional multi-site testing.

In the participatory approach, conditions in each trial are not well defined, but the large number of trials and the wide range of soils, varieties, weather conditions, and management levels sampled allow the technology to be evaluated for rice as a whole. For each paired-plot trial, it is possible to evaluate the effect of priming for those specific, local conditions. By using each farmer as a replicate, priming can be tested over a wide range of conditions found within a village, cluster of villages, or group of village clusters.

Group evaluation of all trials is suggested. Experience suggests that each group should include no more than 10–15 farmers. Each farmer in a group is given a quantity of seed, perhaps 2–4 kg. He or she is then asked to prime half of the seeds in water overnight, then surface-dry them. The farmers then sow the primed and non-primed seeds *simultaneously*, in two adjacent plots. For example, seven farmers in Bar village, Gujarat, India, were each given 2 kg seed of the rice variety Kalinga III and asked to follow this procedure in the 1998 *kharif*, or rainy season.

Yields from the two treatments can be compared by *measuring the area of the two plots accurately* (the researcher's responsibility) and *harvesting*

*and weighing grain from each plot separately*. Figure 2 shows results from the Gujarat yield trials.

## Farmers' perceptions

The gathering of farmers' perceptions is essential. Several methods can be used to facilitate the farmers' evaluation of their trials, and to elicit constructive feedback.

Two 'farm walks' through the fields should be arranged during each season to promote interest and discussion among the farmers about advantages and disadvantages of seed priming. The walks allow individual farmers to assess the technology at different stages of crop development, and over a range of sowing dates, soil types, varieties, and management levels in the group or village.

The first farm walk should be after crop emergence, focusing on aspects related to crop establishment. The second farm walk should be either immediately before or immediately after harvest, when farmers can compare, evaluate, and discuss factors such as plant growth, duration, and yield.

## Categories for assessment

Farm walks are usually followed by semi-structured focus group discussions (FGDs) in which farmers are asked to evaluate whether seed priming or their normal practices gave better results in a number of traits relating to agronomy, crop development, and yield.

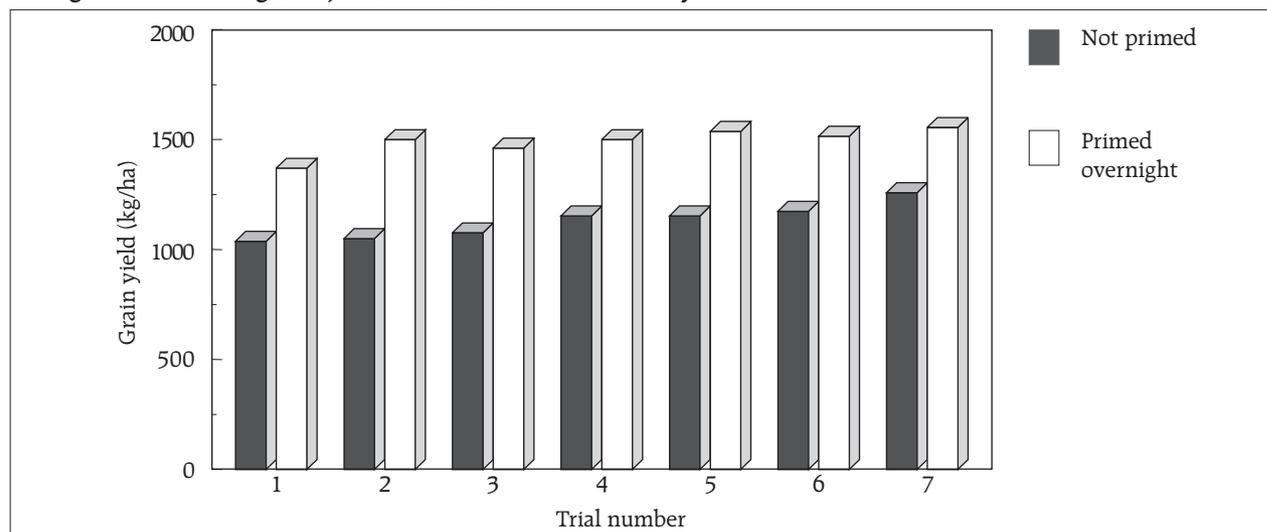
Preferably, data obtained from group discussions should be expressed as the number (or percentage) of farmers responding that the primed seed was

**Figure 1. How to prime seeds and evaluate trials.**

Take the seed lot and divide it into two equal portions, then treat in the following way.			
Time	Dry seed portion	Seed portion to be primed	Possible problems
Evening before sowing	Put aside	Put into a container and cover the seeds with a volume of clean water, double that of the volume of seeds	
Next morning: the day of sowing		Remove seed from water <sup>1</sup> after <i>12 hours of soaking</i> . Dry the surface of the seeds, either with a cloth or by spreading the seeds in the shade for 15 minutes	
When ready to sow	Sow seeds using normal practices	Sow seeds, using normal practices, in adjacent plots	If the planned sowing is not possible (for example, if heavy rain makes access to the field impossible), store the surface-dried seed in a cool, dry place. The seed quality will remain good for at least 3 days. Sow the dry and primed seeds in adjacent plots as soon as possible.

1. If farmers have treated the seed with a seed dressing such as thiram, they should be advised to dispose of the soaking water carefully. They should not pour the water into streams, and should wash the container thoroughly with clean water.

**Figure 2. Grain yield from seven paired-plot trials of 'on-farm' seed priming using the rice variety Kalinga III in Bar village, Gujarat, India, 1998 *kharif* or rainy season.**



better, the same, or worse (or if the farmers have no specific opinion), compared with the non-primed seed in the following categories:

- ease of sowing
- early germination
- better plant stand
- vigorous growth (tillering, branching, etc.)
- weed growth
- pest incidence or damage
- earlier flowering
- earlier maturity/harvest
- higher yield
- general impressions
- problems
- intention to prime again

The following format for recording plot data is suggested (depending on the availability of resources):

- village
- trial number
- farmer's name
- variety
- amount of seed primed (kg)
- amount of seed not primed (kg)
- area sown with primed seed (m<sup>2</sup>)
- area sown with non-primed seed (m<sup>2</sup>)
- date of sowing
- date of first heavy rain
- date of emergence of primed seed
- date of emergence of non-primed seed

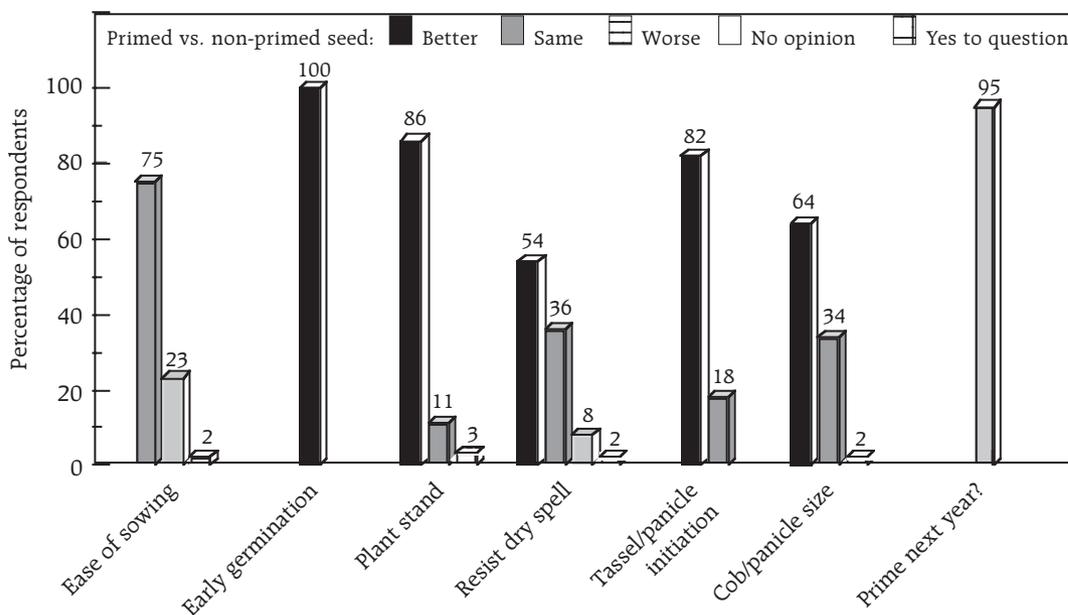


Figure 3. Farmers' perceptions of seed priming in maize and upland rice during the 1996 *kharif* or rainy season. Fifty-six farmers in four villages in Gujarat, Rajasthan, and Madhya Pradesh, India.

- plant population in 1 m<sup>2</sup> of primed plot (4 random samples per plot)
- plant population in 1 m<sup>2</sup> of non-primed plot (4 random samples per plot)
- yield from primed plot (kg) and area harvested (m<sup>2</sup>)
- yield from primed plot (kg) and area harvested (m<sup>2</sup>).

Figure 3 summarizes farmers' perceptions of the merits of seed priming in three areas of India.

### Statistical analysis

Paired t-tests can be used to compare yield data for each pair of non-primed and primed plots. Chi-square tests can determine if the mean response of a group of farmers for any category differs significantly from the expected response if there were no preferences.

### Possible problems

Following are possible problems that may affect seed priming trials:

- Rice grains stick together when wet, so farmers must be taught to spread out the wet seeds on a

dry surface, such as a piece of cloth or seed sack, to dry the surface so they can be sown easily. 'Rolling' the seeds along the cloth by hand will also help dry and separate the seeds.

- Sowing techniques often vary widely among farmers, so pay particular attention to recording the details of each farmer's sowing technique, and time of sowing in relation to rainfall and soil moisture.

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# SEED PRODUCTION

## Farmers Producing Seeds of Acceptable Quality for Farmers

A.M. Bèye

Seed production and distribution are notorious bottlenecks to the dissemination of new varieties within the sub-region of West and Central Africa.

National seed systems are market-oriented and are based on the production of certified seeds according to international standards. However, they are not efficient for small-holder farmers, are often under-resourced in terms of staff, equipment and funding, and therefore unable to meet production needs.

The consequence is that the use of improved seeds is low. In Côte d'Ivoire, for example, the use of certified seeds is less than 500 t per year, while the seed needs exceed 45,000 t per year. In 1999, only 84 t were sold.

Certified seeds are more commonly used for cash crops with the use of diverse inputs such as fertilizers, pesticides, and where there is good water control. For subsistence rice production, the situation is different. Farmers work in low-potential and heterogeneous agroecological areas where soils are mainly exposed to erosion as a result of primitive techniques and the short fallow period. Farmers do not have access to credit. Potential markets are too distant and practically non-existent.

Subsistence rice production relies on the management of natural processes such as rotation, crop combinations, natural predation, and so on. Subsistence agriculture is very complex and requires the management of a greater ecological and economic diversity. Farmers exploit their own technologies and local indigenous knowledge to face production needs.

### **Farmers' current system**

Most farmers in the sub-region use farm-saved seeds of local varieties. More than 90% of the seed production and distribution is controlled indirectly by farmers.

Rapid Rural Appraisals were organized in 1998 and 1999 to better understand farmers' methods in seed production, seed conservation and seed distribution. The results relate that farmers identify plants with preferred growth and grain type. During the harvest period, they select the best panicles with bold, heavy, undamaged and fully ripe grains that they harvest separately. These seeds are then cleaned and thoroughly dried in the sun and later stored in bundles in the kitchen or in the granary. Some farmers store in sacks, plastic bags or in containers—a large pottery pot or a wooden box.

Seeds are protected against insects with leaves of neem (*Azadirachta indica*), dried and ground red pepper, wood ash, or smoke from a wood fire. In all cases, seeds are dried in the sun 2–3 times, and this seems to be one of the major operations that farmers take seriously into account. These practices are well adapted to farmers' seed production systems. They are low cost, preserve the ecosystem, are easily accessible, and have low toxic levels.

### Formal systems

In formal seed production systems, once a variety has been released, the research institution provides *breeder seed* from which *foundation seed*, *registered seed* and *certified seed* are maintained, multiplied and distributed.

The seed system is usually organized by the Ministry of Agriculture, which controls each variety's genetic identity and purity during the whole process of seed multiplication. Extension agencies are responsible for the seed production and distribution to farmers. The system requires about 6 years from the release of a variety to produce sufficient seed for distribution to a large number of farmers (Fig. 1). Usually, it is only in the seventh year that any farmer who needs seeds can actually buy them!

### Improving farmers' seed production through the Community-Based Seed Production System

The Community-Based Seed Production System (CBSS) is suited to the African culture, because farmers have been growing and supplying seeds to other farmers for centuries. Rather than bring in a new system, the CBSS builds on the seed production

practices that farmers have passed down, from generation to generation, for centuries.

The program was developed by the Senegalese Agricultural Research Institute (ISRA) and WARDA, and is being implemented in Côte d'Ivoire and Guinea.

The CBSS teaches farmers how to produce better seeds for their own use, and to exchange or sell excess seed to other farmers. It shortens the time for seed to reach farmers.

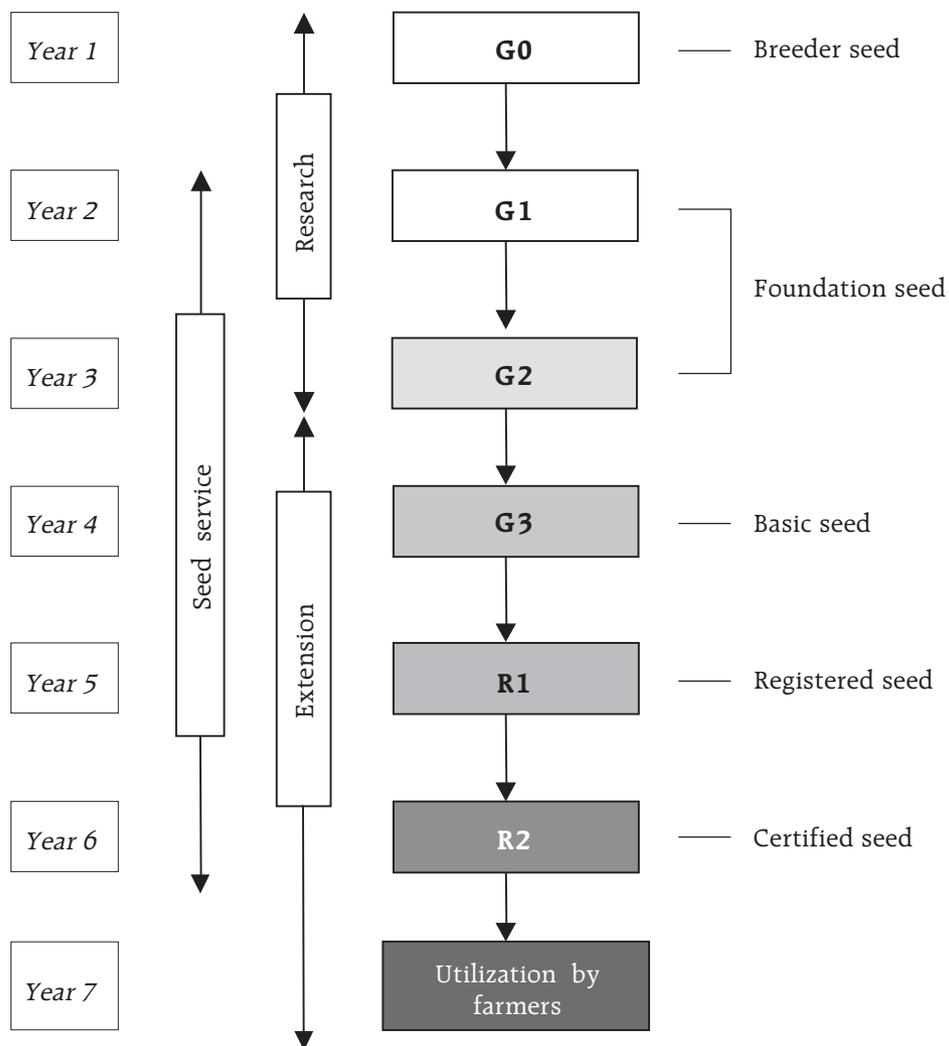
#### *How does the CBSS function?*

The CBSS is initiated when a variety is released. It is initiated by making small quantities of *foundation seed* available to various 'informal' *basic-seed* multipliers (Fig. 2).

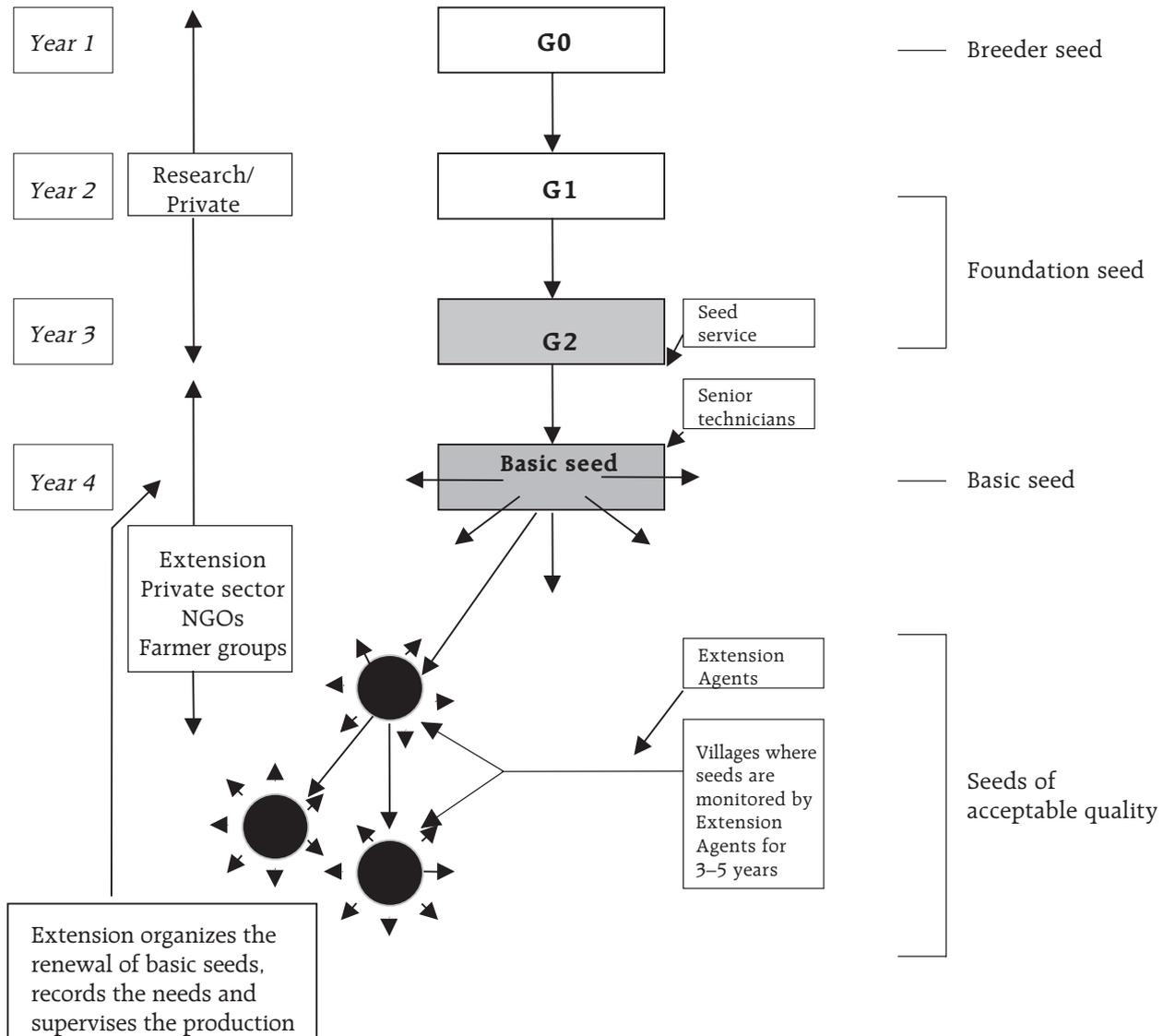
Basic-seed multipliers produce seeds for farmer-producers, who mainly produce seed for their communities. At the community level, seeds should be multiplied and distributed by using local practices. It is very important to respect local customs because, contrary to the general opinion, farmers buy seeds only if there is no other solution. In general, they prefer seed exchange, as a gift, or a loan.

Some simple guidance is given to help farmers maintain seed purity at the community level for 3–5 years. This advice covers seed purification by removing 'off-types'; choosing the best panicles with bold seeds and fully ripe grains before harvesting; careful handling of seeds during harvesting, threshing, winnowing, and storing; proper drying of seed; and germination testing of seed. Since rice is self-pollinated, farmers do not have to

**Figure 1. Conventional seed production scheme.**



**Figure 2. Community-Based Seed Production Scheme (CBSS).**



replace their seed stocks every season. The major concerns of deterioration of seed quality over time, reduced germination ability, and purity (mechanical mixture) are monitored at the farm level by the extension services.

### *Tools to implement CBSS*

The different tools used to implement CBSS are:

- rapid rural appraisals to identify the major constraints and opportunities by region and by community
- development of a national seed program
- organization of farmers' field workshops focusing on improvement of seed quality
- increasing awareness of the need to produce seeds of acceptable quality
- increasing awareness of the need to preserve local varieties, and
- feedback on seed stocks and seed demands by community

### **CBSS—a support for a second Green Revolution**

Two research and extension methodologies have been successfully tested with subsistence farmers in West and Central Africa. The new innovations offer, in combination with NERICA varieties, a hope for a new Green Revolution for the sub-region.

- *Participatory varietal selection (PVS)*, a 3-year program in which farmers are exposed to a range of promising cultivars for selection according to their own perceptions, comparison with local varieties, followed by adoption of improved locally adapted varieties.

- The *community-based seed production system*, based on the implementation of farmers' practices and indigenous knowledge in seed production and distribution.
- The *NERICAs*, or *NEw RICes* for Africa, developed by crossing the rugged African species of rice with the more productive Asian species. Some outstanding NERICA varieties that are suited for low-input farming systems have been identified through PVS trials in Côte d'Ivoire, Guinea, Nigeria and Togo. They include WAB 450-B-B-B-8-HB, WAB 450-I-B-P-20-HB, WAB 450-I-B-P-28-HB, WAB 450-I-B-P-91-HB, WAB 450-I-B-P-160-HB, and WAB 450-11-1-P31-1-HB.

The PADS Project (*Participatory Adaptation and Diffusion of technologies for rice-based Systems*) is working on how to create appropriate conditions for a full implementation of NERICA's advantages in low-input farmers' conditions in order to improve rice production and generate more income. It focuses on exploiting local techniques of improving soil fertility, rice processing (parboiling and milling), and increasing awareness of farmers to develop means to fully utilize rice products for self-consumption and for marketing.

### **Extending the NERICA coverage in West and Central Africa**

A regional workshop, scheduled for November 2000, can be a driving force to catalyze a *new* Green Revolution for Africa. Special emphasis will be given to recognizing and avoiding some environmental problems that followed in the wake of the Green Revolution in Asia.

# COUNTRY REPORTS

## PROGRESS IN PARTICIPATORY VARIETAL SELECTION

Presented at the  
Participatory Rice Improvement and Gender/User Analysis Workshop





## BENIN

### **Activity: Participatory Varietal Selection— Rainfed Upland**

Participatory varietal selection in Benin started in 1998, with 36 farmers participating, of which 15 were women.

In 1999, thirty farmers, including 8 women, participated in PVS trials in Dassa-Zoumé and Glazoué. Twenty PVS varieties were grown. Each farmer grew five varieties in his or her field from July to October.

Farmers direct-seeded in rows. Fertilizer (N-P-K: 28-46-28) was applied basally at 200 kg/ha. Nitrogen fertilizer (32% N) was then applied at flowering at 70 kg/ha. The 1999 annual rainfall was 1750 mm compared with normal rainfall of 1100 mm.

In Dassa-Zoumé, IDSA 85 was the first choice of all women, and of 67% of the men. The second choice of men and women was WAB 450-I-B-P-157-1-1, followed by WAB 450-I-B-P-160-HB, then IRAT 144.

Women chose IDSA 85 because of its high yield and short growth cycle.

In Glazoué, WAB 570-10-B-1-A2-6 was the first choice of all women, and of 62% of the men. Half of the participating men farmers named IR 47701-6-3-1 as their first choice.

Women chose WAB 570-10-B-1-A2-6 because of its short growth cycle and high yield. Men chose it because of high yield alone. Men chose IR 47701-6-3-1 because of its high yield, profuse tillering, short growth cycle, and weed competitiveness. These two varieties, and IDSA 85, were among the top four that farmers selected in 1998.

The quantity of rice produced on the small plots was not sufficient to conduct post-harvest evaluation.

A national workshop was held in January 2000. All participants were positive, and suggested PVS trials for maize, beans, and cassava.

## BURKINA FASO

Burkina Faso has three rice ecosystems. Eighty percent of the rice is rainfed lowland, 21% is irrigated, and 9% is rainfed upland. The average yield of rainfed rice is only 0.8–1.0 t/ha, although the yield potential is 2.0–2.5 t/ha. Irrigated rice yields 6–7 t/ha.

A rainfed upland participatory trial was planted at Diarabakoko, and irrigated trials were planted at Vallée de Kou and Bonam. A total of 205 farmers participated; 53 were women. Farmers' ages ranged from 30 to 60 years. The farmers visited the trials at maximum tillering, flowering, and harvest. Post-harvest palatability tests were conducted at all three sites.

### **Activity: Participatory Varietal Selection— Rainfed Upland Rice**

In Diarabakoko, 17 rainfed upland varieties were sown on 1 July. Thirty-three farmers participated in the selection; 11 were women. The farmers had 15–20 years of farming experience.

The Diarabakoko farmers selected 8 of the 17 varieties to grow on their fields next season. FKR 1, or Dourado, was the most popular variety, selected by 94% of the farmers. Next was FKR 35, selected by 76% of the farmers; FKR 41 was chosen by 73%; FKR 43 by 61%, and FKR 21 by 52%. Other popular varieties were FKR 33, FKR 39, WAB 224-8-HB.

Most of the selected varieties are similar to local varieties that the farmers are currently cultivating. Three varieties were not popular because of their long growth cycle: IDSA 6, IDSA 10, and WAB 570-10-1A2.6.

Farmers selected 20% of the varieties because of their adaptability; 18% because of short growth cycle, 17% because of yield, 16% because of panicle length, 16% for height, and 14% for profuse tillering.

FKR 5 yielded highest, with 2.7 t/ha, followed by FKR 41 with 2.4 t/ha. Interestingly, the most popular variety, FKR 1 or Dourado, yielded only 1.5 t/ha.

Men and women farmers used different selection criteria. Men wanted varietal homogeneity and short growth cycle; women were more concerned with ease in post-harvest work.

In a palatability test, FKR 1 (Dourado) received high ratings for color, aroma, and palatability (Table 1). FKR 21 also got high ratings. Every farmer rated FKR 41 high for its color.

Farmers did not like FKR 37 because it was difficult to dehull. Some varieties were rejected because, the farmers said, they resembled sorghum after cooking.

### **Activity: Participatory Varietal Selection— Irrigated Rice**

In Vallée de Kou, 20 irrigated varieties were sown on 16 July, and transplanted on 7 August. Of the 99 farmer participants, 32 were women. Farmers had an average of 25 years farming experience.

BW 293-2 was the most popular variety among the Vallée de Kou farmers with 61% of them selecting it. FKR 32 was selected by 58%, FKR 14 by 56%, FKR

**Table 1. Farmers' palatability preferences of rainfed upland rice varieties in Diarabakoko, Burkina Faso.**

Variety	Palatability preferences (%) of variety				
	Color	Smell	Consistency	Cohesiveness	Taste
FKR 1 (Dourado)	89	89	29	37	88
WAB 365 B1	89	74	35	65	73
FKR 5	7	42	41	76	31
ITA 150	26	67	58	70	54
FKR 21	89	81	25	74	84
WAB 224-8-HB	56	78	20	85	65
FKR 29	78	70	50	36	73
FKR 33	41	62	17	84	56
FKR 35	78	76	42	42	77
FKR 37	4	48	64	52	38
FKR 39	26	61	61	40	46
FKR 41	100	93	42	42	92
FKR 43	93	92	28	30	96

50 by 56%, and FKR 48 by 56%. The other popular varieties were FKR 28, IR 31785, and FKR 14 bis.

The farmers chose 33% of the varieties because they yielded well, 29% for tillering ability, and 19% each for good plant height and short growth cycle.

FKR 32 yielded highest, with 5.6 t/ha, followed by IR 32307 at 5.5 t/ha.

IR 32307 had the shortest growth cycle, maturing in 119 days.

Varieties rated high in a palatability test in Vallée de Kou were FKR 48, IR 2042, IR 32307, FKR 32, and FKR 19 (Table 2).

The women thought that the following varieties took too long to cook: IR 31785, WABIR 12979, TOX 3093, Chian Sen, IR 31851, MRC 2663, FKR

14, FKR 42, FKR 50, FKR 28, and FKR 14 bis. They also found that cooking the following varieties required too much water: CICA 8, ITA 306, WABIR 12979, TOX 3093, Chian Sen, and MRC 2663. Varieties rated low because they did not swell sufficiently during cooking were: IR 31785, BW 293-2, TOX 3093, IR 28128, Chian Sen, MRC 2663, and FKR 14 bis.

On the basis of the varieties' performance both in the field, and in the palatability test after the cropping season, farmers in Vallée de Kou selected the following nine varieties to grow on their fields the next season: FKR 48, IR 32307, FKR 32, BW 293-2, FKR 25, FKR 50, FKR 28, and FKR 14 bis.

In Bonam, 20 varieties were sown on 5 July and transplanted on 7 August. Of the 73 participating

**Table 2. Palatability preferences of irrigated rice varieties in Vallée de Kou, Burkina Faso.**

Variety	Palatability preferences (%) of variety				
	Color	Smell	Consistency	Cohesiveness	Taste
CICA 8	91	23	55	41	18
ITA 306	100	36	23	86	55
FKR 48	100	23	64	68	23
BW 293-2	73	23	24	64	45
IR 2042	55	50	24	59	50
WABIR 12979	86	23	49	50	36
TOX 3093-35	100	9	64	59	9
IR 28128215	82	18	14	64	50
Chian Sen	73	59	68	27	59
IR 32307	100	18	73	55	14
FKR 32	100	9	55	45	9
IR 3185196	59	23	73	32	9
MRC 2663	64	68	82	50	36
FKR 14	95	32	73	50	36
FKR 42	91	45	14	59	45
FKR 50	100	64	27	73	45
FKR 28	100	86	14	86	59
FKR 19	100	50	50	59	59
FKR 14 bis	95	77	36	64	45

farmers, 10 were women. They averaged only 10 years of farming experience.

The most popular varieties were FKR 28, FKR 48, ITA 306, TOX 3093, FKR 14, and FKR 19.

Bonam farmers immediately rejected four varieties—IR 317-85, IR 31851, IR 2042, and MRC 2663—as inferior to their local rices. Reasons cited for rejection were low emergence rate, low tillering, long growth cycle, few grains per area, short panicles, and short grains.

Palatability and cooking preferences of men and women were measured separately in Bonam. Men seemed more discriminating in palatability preferences (Table 3). This is consistent with past research findings. Women, who are responsible for feeding the family, often choose varieties on the basis of their yield, while men give higher value to palatability.

Farmers in Bonam chose only three varieties to grow on their fields next season: FKR 28, TOX 3093, and FKR 48.

**Table 3. Palatability preferences of irrigated varieties among men and women in Bonam, Burkina Faso.**

Variety	Palatability preferences (%) by gender									
	Color		Smell		Consistency		Cohesion		Taste	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
CICA 8	97	53	97	53	68	53	–	–	89	53
IR 317 85	–	–	53	–	–	–	–	53	–	–
ITA 306	97	–	94	–	97	–	57	–	80	–
FKR 48	45	–	79	53	53	53	–	–	59	53
BW 293-2	55	–	55	–	74	–	–	–	53	–
IR 2042	74	–	71	–	58	–	61	–	64	–
WABIR 12979	–	–	–	–	56	–	50	–	–	–
TOX 3093-35	92	53	84	53	–	53	–	–	104	53
IR 28128215	97	–	96	–	71	–	–	–	83	–
Chian Sen	53	–	73	–	83	–	72	53	62	–
IR 32307	–	–	50	–	76	–	75	–	58	–
FKR 32	–	–	–	–	–	–	–	–	–	–
IR 3185196	–	–	–	–	57	–	68	53	–	–
MRC 2663	–	–	–	–	–	–	97	53	–	–
FKR 14	88	–	82	53	86	53	–	78	–	–
FKR 42	–	–	53	–	–	–	–	53	–	–
FKR 50	–	–	–	–	56	–	–	50	–	–
FKR 28	66	53	76	–	79	–	–	–	79	53
FKR 19	–	–	–	–	89	–	88	–	–	–
FKR 14 bis	–	–	62	53	55	53	–	–	62	–

– = not available.

## CAMEROON

### **Activity: Participatory Varietal Selection— Upland Rice**

The Cameroon National Rice Program has introduced a series of high-yielding rice varieties with improved agronomic traits and resistance to local stresses. But only a few farmers have adopted them; most continue to grow low-yielding traditional varieties.

PVS trials were conducted at sites in Berore, Barombi Kang, and Tonga. Berore is about 4 km east of Manfe, in the low-lying humid rainforest near the Manfu River in southwestern Cameroon. The elevation is about 150 m. Barombi Kang, about 7 km from Kumba, is also in the rainforest. Tonga is in the medium-altitude zone of the western plain.

Farmers typically grow rainfed upland rice in these areas using traditional cultural practices, either as rice alone, or intercropped with other food crops.

The farmers visited the trial sites to select varieties, using their own criteria, at the maximum tillering, maturity, and post-harvest stages.

#### *Maximum tillering stage*

At maximum tillering, 26 farmers, including 9 women, evaluated rices at Berore. Seven farmers, including two women, participated at Barombi Kang.

The most popular varieties selected were WAB 450-I-B-P-163-4-1, WAB 450-24-2-3-B-P33-HB, WAB 56-50, and WAB 450-I-B-P-33-HB. The main selection

criteria were short growth cycle, high yield, and short plant height. Farmers at Berore also selected for seedling vigor and vigorous tillering. At Tonga, farmers selected for profuse tillering, large leaves, and early flowering.

#### *Maturity*

At maturity, 21 farmers, including 6 women, evaluated the PVS rices at Berore and 10 farmers, including 4 women, made evaluations at Barombi Kang.

Farmers selected WAB 450-I-B-P-33-HB, WAB 570-10-B-1A.2-6, WAB 515-B-16-A2.2, WAB 450-24-3-P-33-HB, Chinese Berore, WAB 450-I-B-P-163-4-1, and WAB 56-50. The main selection criteria were short growth cycle, grain color, short plant height, and large panicles.

#### *Post-harvest*

At post-harvest stage, 35 farmers, including 14 women, participated at Berore, and 12 farmers, including 4 women, at Barombi Kang.

At Tonga, 35 farmers, including 15 women, initially participated, but only 20 farmers, including 9 women, participated at the maximum tillering stage.

The most popular varieties selected were IRAT 144, IDSA 10, WAB 450-I-P33-HB, Madam, WAB 56-50, WAB 450-I-B-P-62-HB, WAB 450-I-B-P-24-HB, WAB 450-I-B-P-157-1-1, and Chinese Berore. The

main criteria for selection were grain color, yield, and bold grains.

Most of the improved varieties performed well without fertilizers. The farmers want to continue PVS and are willing to provide land for more trials. Most farmers who had abandoned rice to grow more profitable crops will return to rice if they have good varieties.

#### *Gender differences*

At maximum tillering, five varieties were selected by both men and women: WAB 450-I-B-P-163-4-1, WAB 450-I-B-P-33-HB, WAB 450-I-B-P-135-HB, WAB 450-I-B-P-157-1-1, and WAB 450-24-2-3-P-33-HB. Each of the women selected two or three interspecifics. The men selected four or five.

At maturity, WAB 450-24-2-3-B-P33-HB was the most popular among women and WAB 450-I-B-P-33-HB, among men. At Berore, only the men selected the local variety Chinese Berore.

More women participated in the evaluation at the post-harvest stage at Berore than at any other stage. Their main selection criteria were grain color and size. Both men and women selected IRAT 144 and IDSA 10. The women rejected WAB 450-I-B-P-33-HB, even though many preferred it at maturity. Women also preferred varieties with good grain swelling capacity and awns. Men selected WAB 450-I-B-P-33-HB, which they had also selected at maturity.

About 70% of the women and 50% of the men at Berore wanted to grow only interspecifics. No farmer was planting the new varieties at the time

of the evaluations, but several hectares will probably soon be planted to the new varieties.

#### **Activity: Seed Priming**

The response of rainfed rice to seed priming was evaluated, and the direct benefits of primed versus non-primed seeds were compared in a trial on an abandoned cocoa research site at the Institute of Agricultural Research for Development (IRAD), Kumba-Barombi Kang.

Plots were plowed by tractor, then planted by dibbling on 12 August. Plot size was 5 × 4 m.

Nine varieties were used in the trial: WITA 4, WAB 450-I-B-P-135-HB, WAB 96-1-1, WITA 9, Apapa Bombe (local check), WAB 515-B-16A2-2, IR 46, WAB 570-10-B-1A2.6, and IDSA 6.

Primed seeds of all nine varieties emerged 3–4 days earlier than dry seeds. The percentage emergence at 18 days after seeding was also higher, giving good crop establishment.

Primed seeds flowered 2–5 days earlier than non-primed seeds, and also matured earlier.

The grain and panicle yield for primed seeds, in all varieties, was higher than for non-primed seeds; the average gain was about 70%.

The local check variety Apapa Bombe yielded the lowest: 470 kg/ha with primed and 455 kg/ha with non-primed seeds. Apapa Bombe with primed seeds yielded only 3.2% more than with non-primed seeds. Pest damage and weed competition were worse in plots planted with non-primed seeds.

Fifteen farmers, including 10 women, evaluated the plots planted with primed versus non-primed seeds. All farmers agreed that plants from primed seeds germinated earlier, and had larger panicles and higher yields.

Ninety percent agreed that the primed plants reached 50% flowering earlier than non-primed

plants. Fifty-six percent thought the primed plots had less pest damage.

Half of the farmers saw no difference in ease of sowing for primed versus non-primed seeds, and 76% thought the two treatments competed with weeds about equally. All 15 farmers plan to use seed priming on their farms next year.

## CHAD

### **Activity: Participatory Varietal Selection— Rainfed Lowland**

Rice yields in southern Chad are less than 1 t/ha. The average annual rainfall is 1200 mm. Rainfed lowland rice receives supplemental water from river irrigation. Rice is farmed by both men and women.

A PVS trial was conducted at Tandjile, 400 km from N'Djamena, in collaboration with WARDA, the Chad National Office for Rural Development (ONDR), and World Vision.

The rice garden was grown in Mala village, using 48 varieties that had been tested by the Chad National Agricultural Research Institute. Each rice variety was dibbled at 20 × 20 cm spacing in fertilized and non-fertilized plots. Fertilizer (N-P-K: 15-15-15) was applied basally at 150 kg/ha at maximum tillering, and urea applied at 100 kg/ha at panicle initiation. The rice was weeded twice manually.

The ages of farmer participants ranged from 20 to 71 years; they had 5–40 years of rice farming experience. The farmers visited the rice garden three times: at maximum tillering, maturity, and post-harvest stages.

#### *Maximum tillering*

Seventy farmers, including 25 women, visited at maximum tillering. The most important criteria were profuse tillering and vigorous growth; 27% of the men and 38% of the women gave those traits as reasons for selection of varieties (Table 1).

Profuse tillering without fertilizer was the second most important criterion for men; it was a reason for selection of 18% of the varieties. The second criterion for women was weed competitiveness (13%). Other criteria given by men were weed competitiveness (15%) and good growth without fertilizer (11%). For women, profuse tillering without fertilizer was a criteria for 9% of the varieties selected, and good growth without fertilizer for 4% of the varieties selected.

Men selected the varieties RP 1045-25-2-1 (11%), RP 1746-111 (10%), IR 46 (7%), and CK 73 (6%). Women selected mostly locally grown varieties: Mahsuri (11%), Samaley (11%), TOX 4008-34-1-1-1 (11%), and Phalgana (11%).

#### *Maturity*

The visit at maturity drew 52 participants, including 20 women. Men and women used slightly

**Table 1. Selection criteria at maximum tillering, Tandjile, Chad.**

Criterion	Frequency of selection (%)	
	Men	Women
Profuse tillering	27	38
Vigorous growth	26	38
Profuse tillering without fertilizer	18	9
Weed competitiveness	15	13
Vigorous growth without fertilizer	11	4
Disease resistance	3	0
Insect resistance	1	0

different selection criteria. The main criteria for both men and women were filled panicles (23%), followed by high yield (18%) (Table 2).

Women were more concerned with grain quality (14%), while men looked for medium plant height and good yield without fertilizer (10–11% each). Women also wanted bold grains and medium plant height (11–12% each).

Men selected only two or three varieties each. Most popular were RP 1746-111 (chosen by 21% of the men), ITA 222 (18%), and BW 348-1 (11%).

Women selected three to six varieties. Most popular were RP 1746-111 (11%), ITA 222 (8%), TOX 728

(8%), CK 73 (8%), SIK 9-264-5-3-1 (6%), TN1/BD 83-1 (6%), and TN1/BD 83-11 (6%).

RP 1045-25-2-1 yielded highest: 7 t/ha with, and 2.3 t/ha without, fertilizer. ITA 222 followed, with 6 t/ha with fertilizer and 2.1 t/ha without fertilizer. Abaya, a local variety, yielded 5 t/ha with fertilizer and 2.1 t/ha without fertilizer.

#### *Post-harvest*

Fifty farmers—32 men and 18 women—visited post-harvest. Men and women used slightly different criteria for selection of varieties (Table 3). Men wanted bold grains (21%), filled panicles (18%), and numerous grains in the panicles (18%).

**Table 2. Selection criteria at maturity, Tandjile, Chad.**

Criterion	Frequency of selection (%)	
	Men	Women
Filled panicle	23	22
Yield	18	19
Medium plant height	11	11
High yield without fertilizer	10	5
Grain quality	9	14
Short growth cycle	6	3
Lodging resistance	5	1
Bold grains	4	12
Tall plant height	4	1
Long growth cycle	2	0
Large panicles	2	4
Disease resistance	2	2
Drought resistance	2	0
Long grains	1	7

**Table 3. Selection criteria at post-harvest stage, Tandjile, Chad.**

Criterion	Frequency of selection (%)	
	Men	Women
Bold grains	21	16
Small grains	2	2
Long grains	8	9
Grain color	3	10
Filled panicles	18	17
Large panicles	8	2
Numerous grains on the panicles	18	13
Well-filled grains	5	12
Bright-colored glume	1	0
Ease of husking	0	4
Grain whiteness	0	2
Good taste	0	3

Other selection criteria were large panicles, long grains, well-filled grains, small grains, and grain color.

Women cited well-filled panicles (17%), bold grains (16%), numerous grains in the panicles (13%), well-filled grains (12%), grain color (10%), and long grains (9%). Other criteria were ease of husking, taste, small grains, large panicles, and grain whiteness.

Men selected only two or three varieties each; their choices were almost the same as during the

first visit. Most popular were RP 1746-111 (16%), RP 1045-25-2-1 (8%), and Bouaké 189 (6%).

Women selected three to six varieties each. Their varietal choices changed from earlier visits. Most popular were Bouaké 189 (16%), ITA 222 (16%), BW 348-1 (10%), Suphanbouri (10%), IR 46 (7%), and RP 1746-111 (7%).

Each participating farmer selected two varieties to plant in his or her own field during the second year of PVS.

## CÔTE D'IVOIRE

### Participatory Varietal Selection—Irrigated Rice

A PVS trial was conducted at the Guiguidou Irrigation Scheme, 40 km from Divo, in the southwest forest zone. Two dams supply irrigation water for two cropping seasons in the Scheme, which covers 450 ha, including 17 villages with about 1000 farmers. Annual rainfall is 1500–2000 mm.

The average farmer's field size is from 0.5 to 1 ha. The main varieties currently grown in the area are Bouaké 189, which is recommended by ANADER, the national agricultural extension agency; WITA 9; and CC 9708, a Chinese variety.

Twenty varieties were tested, including 15 WARDA rices. Fertilizer was applied as follows: 200 kg N-P-K/ha at transplanting, 75 kg urea/ha at tillering, and 25 kg urea/ha at panicle initiation. Furadan® was sprayed at 20 kg/ha. The herbicide Rical® was applied; plots were also hand-weeded twice.

#### *Maximum tillering*

Twelve men and 17 women selected one or two varieties each at the maximum tillering stage. The most popular variety among men was CC 9704; 24% of the men selected it. Other varieties popular among men were TOX 3093 (16%) and Cheinurg-seri (16%).

MRC 2663 and IR 13240 were the women's favorite varieties; 25% chose each.

Profuse tillering was the farmers' main selection criterion, followed by bold grains and long panicles (Table 1).

#### *Maturity*

Men selected three or four varieties each at maturity. The most popular was CC 9704, selected by 17% of the men. Next were Cheinurg-Seri (14%), and TOX 3093 (14%).

Women selected two or three varieties each. MRC 2663 was the favorite; 30% of the women chose it. Next came ITA 306 (23%) and IR 13240 (16%).

The farmers' main selection criteria were profuse tillering (40%) and bold grains (22%). Other criteria were heavy panicles, short growth cycle, tall height, green leaves, short height, thick tillers, disease resistance, lodging resistance, small grains, and grain color.

Three varieties were never selected: CICA 8, because it was prone to lodging, and IR 28128 and WITA 7, because of their long growth cycles, small panicles, and insufficient tillering.

**Table 1. Selection criteria at the maximum tillering stage, Côte d'Ivoire.**

Criterion	Frequency of selection (%)
Profuse tillering	41
Bold grains	16
Large panicles	14
Green leaf color	8
Medium height	7
Tall height	6
Thick tillers	6
Short growth cycle	3

### Post-harvest

Thirty farmers participated; 20 were women. The most popular variety was IR 31785-58-1-2-3-3; it was selected by 13% of the men and 12% of the women.

Fourteen percent of the men selected WAB × IR 12979. BW 293-2, Bouaké 189, and WITA 7 were each chosen by 9% of the men.

Ten percent of the women selected ITA 306. Next came BW 293-2 (8%); IR 32307-107-2-3-3 (8%); MRC 2663 (8%); and IR 13240 (7%), CC 9704 (7%), and WITA 7 (7%).

Men and women used almost the same selection criteria (Table 2). The women were concerned with such post-harvest traits as ease of dehulling, cooking quality, and grain-swelling capacity. The men considered IR 28128 and TOX 3093 as very difficult to thresh. Women considered the following

varieties difficult to thresh: CICA 8, IR 28128, IR 31785, ITA 306, MRC 2663, and IR 13240.

The two highest-yielding varieties were BW 293-2, with a yield of 9.6 t/ha, and IR 32307, a short-cycle variety that yielded up to 9 t/ha. Table 3 lists varieties that farmers selected for the following season. Table 4 lists the frequency of selection criteria. IR 31785 and ITA 306 were the most popular, even though they did not yield the highest. Farmers selected short- and medium-cycle varieties that matured in 108–120 days.

WITA 7 and CC 9708 did not yield particularly high, but were popular because of their sweet taste, aroma, and grains that were not sticky after cooking.

Tall height was not a selection criterion. Farmers were enthusiastic about continuing PVS trials the next season.

**Table 2. Selection criteria that 30 farmers used during the post-harvest visit at Côte d'Ivoire.**

Criterion	Frequency of selection (%)	
	Men	Women
High yield	17	16
Taste	17	18
Non-sticky grain texture after cooking	17	16
Grain color	16	18
Grain color during cooking	16	15
Aroma	14	14
Sticky grain after cooking	2	2

**Table 3. Varieties selected for the second PVS year in Guiguidou, Côte d'Ivoire.**

Variety	Frequency of selection (%)
IR 31785-58-1-2-3-3	17
ITA 306	13
BW 293-2	12
WAB IR12979	11
WITA 7	11
MRC 2663	10
IR 32307-107-2-3-3	10
CC 9708	8
Bouaké 189	8

**Table 4. Frequency with which varieties were selected for various criteria during the second PVS year in Guiguidou, Côte d'Ivoire.**

Variety	Frequency of selection (%)						
	Grain color	Yield	Aroma	Rice color after cooking	Taste	Non-sticky	Sticky grain
IR 31785-58-1-2-3-3	24	0	2	25	20	0	29
ITA 306	5	0	5	21	34	0	34
BW 293-2	14	71	0	3	9	0	3
WABIR 12979	30	15	15	9	15	0	15
WITA 7	–	3	28	19	22	0	28
MRC 2663	72	10	7	3	0	0	7
IR 32307-107-2-3-3	7	45	14	14	14	0	7
CC 9708	–	4	29	13	25	29	0
Bouaké 189	30	17	4	22	17	0	9

– = not available.

## THE GAMBIA

### **Activity: Participatory Varietal Selection— Rainfed Upland Rice**

PVS trials were conducted at Tujereng, Gifanga, and at Ntoroba, in The Gambia.

Twenty-five varieties—20 improved rices from WARDA and five local varieties—were direct-seeded on  $5 \times 1$  m plots, with and without fertilizer. Management was by local farmers' practices. One-hundred-and-twenty-five farmers from 18 villages evaluated the rices at the maximum tillering, maturity, and post-harvest stages.

#### *Maximum tillering*

The selection criteria used by the farmers were, in order of preference: profuse tillering, short growth cycle, tall plants, high yield, and dark leaf color (Table 1). Plants in the fertilized plots generally grew taller.

#### *Maturity*

The farmers' selection criteria, in order of preference, were: profuse tillering, short growth cycle, and tall height. There were no yield responses to fertilizer application, but plants in fertilized plots had more panicles. Other traits for which farmers selected were large panicles, high yield, and large grains (Table 1).

#### *Post-harvest*

Favorite traits at post-harvest were high yield, large panicles, bold grains, long grains, grain swelling capacity, and length of stalk.

The overall results show that farmers' selections were influenced by fertilizer use.

The most popular WARDA varieties, selected by farmers at all growth stages were WAB 450-1-B-P-105-HB, WAB 56-50, WAB 377-B-16-L3-LB, and WAB 450-11-1-1-P31-HB (Table 2).

Breeders of rainfed upland rice, to be seeded by broadcasting, should give priority to the following traits: growth duration, height, yield, panicle size, and grain size.

### **Activity: Seed Priming**

Seed priming was evaluated to improve the emergence, establishment, and yield of upland rice on farmers' fields.

**Table 1. Selection criteria and their frequency distribution at maximum tillering and maturity stages, of 125 farmers from 18 villages in The Gambia.**

Trait	Frequency of selection (%) at	
	Maximum tillering	Maturity
Profuse tillering	80	50
Short growth cycle	60	50
Tall height	43	50
High yield	30	30
Dark leaf color	20	0
Medium height	10	15
Vigorous growth	10	10
Large panicles	0	40
Large grains	0	20

**Table 2. The most popular varieties selected by farmers at different growth stages in The Gambia.**

Variety	Frequency of selection (%) at		
	Maximum tillering	Maturity	Post-harvest
WAB 450-I-B-P-105-HB	12	22	25
WAB 56-50	12	14	22
WAB 377-B-16-L3-LB	–	20	26
WAB 450-11-1-1-P31-HB	–	18	0
Peking	32	14	–
ITA 150	15	14	–
Binta Sambou	12	14	–
IRAT 144	16	–	24
WAB 56-104	15	–	–
Befa Koyo	14	0	–
WAB 450-I-B-P-24-HB	12	–	10
WAB 450-I-B-P-62-HB	10	–	–
Aboulie Mano	–	14	0
WAB 365-B-1-H1-HB	–	14	0
WAB 365-B-2-HB-HB	–	–	38

– = not available.

Participating in the trial were 50 farmers from five villages: Bereding, Mbangkam, Faraba Sutu, Kafuta, and Tumannitenda. The variety Prasana was primed and planted by drilling or broadcasting at each site on 10 × 10 m plots, with a non-primed control.

The age of the farmers ranged from 45 to 85 years. A third of the farmers had formal education, 53% had non-formal education, and 14% had none. Sixty-three percent of the farmers had access to credit.

Ninety-two percent of the farmers had land of their own. Farm labor was both manual and draft; 65% of the farmers owned animals.

The farmers evaluated plots from the primed, and non-primed, seeds at the maximum tillering, maturity, and post-harvest stages.

Every farmer said that the primed seeds germinated first. Eighty percent reported that primed seeds gave better crop emergence and root establishment.

#### *Maximum tillering*

Sixty percent of the farmers reported that primed seeds gave better growth rate, crop vigor, and height.

#### *Maturity and post-harvest*

Farmers perceived healthier crops on plots planted to primed seeds. Eighty percent of the farmers felt that primed crops matured earlier; 60% felt that they yielded higher.

Eighty percent of the farmers preferred the crops planted to primed seeds.

## GHANA

### **Activity: Participatory Varietal Selection— Rainfed Upland Rice**

PVS trials were conducted in two regions that produce about 65% of Ghana's annual rice harvest.

One trial, for Ghana's guinea savanna zone, was in Nyankpala, a community 16 km east of Tamale, the zone's regional capital. The other trial, for the sudan savanna, was in its regional capital of Manga, 10 km west of Bawku. Farmers from five villages at each location evaluated the PVS trials.

Families in both areas grow about 1 ha of direct-seeded rice yearly, as monoculture, or intercropped with maize.

Plowing is usually by tractor in May. Farmers then seed rice when rainfall becomes adequate, from June to mid-July.

The PVS trials were seeded on upland hydro-morphic soils, using local farmers' practices, at the sudan savanna site on 26 June, and at the guinea savanna site on 7 July.

Twenty-five of 60 upland varieties selected from the previous year's trials were planted, including traditional and improved *Oryza sativas*, traditional African *Oryza glaberrimas*, and interspecifics. The trial was carried out under both high and low levels of inputs and management (fertilization, weeding, and land preparation). Fertilizer was applied at 60-60-30 kg N-P-K/ha for the high-input, and 30-30-15 kg N-P-K/ha for the low-input trials. The high-input trials were weeded twice and the low-input trials, once.

Sixty rice farmers, mostly men, were invited to visit the plot as often as possible. Formal crop evaluations were held at the maximum tillering, grain-filling, and post-harvest stages.

#### *Maximum tillering*

Farmers evaluated the trials at Manga in July and Nyankpala in August.

Each farmer selected three varieties, and also indicated a variety that he or she would not want to grow.

The most popular varieties were WAB 56-50, Kpukpula (the local check, an *O. glaberrima*), and the interspecifics WAB 450-I-B-P-160-HB and WAB 450-24-2-5-P4-HB.

Most of the criteria that farmers used to select varieties at this stage were agronomic traits such as profuse tillering, plant height, and leaf structure (the ability to suppress weeds). Farmers chose almost entirely medium-to-tall varieties; almost none wanted short varieties.

#### *Grain filling*

The second evaluation was in October when most of the varieties were approaching maturity. The number of farmers' selection criteria, especially agronomic traits, increased over the first visit.

Some varieties that were very popular in the first visit were not even selected. Most notable was the *O. glaberrima*, Kpukpula. The varieties that were

selected least generally had *O. glaberrima* traits: lodging, much grain shattering, and low yields.

The interspecifics were among the most frequently selected varieties. Farmers preferred their profuse tillering, intermediate height, and long panicles.

#### *Post-harvest*

At post-harvest stage, women farmers preferred varieties with large, bold grains, but men preferred grains that look attractive for marketing.

Surprisingly, Kpukpula was most popular with the farmers post-harvest.

#### *Discussion*

The PVS evaluations showed that potentially promising technologies can be taken directly to farmers, without going through conventional breeding systems.

Some interspecifics were among the most popular varieties at all three evaluation stages. The five most popular varieties were WAB 450-I-B-P-26-HB, WAB 450-I-B-P-133-HB, WAB 450-I-B-P-24-2-5-P4-HB, WAB 340-B-B-9-13-LI-LB, and IDSA 8.

Table 1 shows yields of the 10 most productive varieties, and the check.

At both low- and high-input levels, the top varieties yielded better than Kpukpula, the local check. WAB 638-1 (DR 2) yielded best even though, for some unknown reason, it did not respond to higher inputs.

**Table 1. Yields of the 10 most productive rice varieties at low- and high-input levels in Participatory Varietal Selection trials in Ghana.**

Variety	Yield (t/ha) at		
	Low input	High input	Mean yield
WAB 638-1 (DR 2)	3.5	3.5	3.5
TOX 3108-56-4-2-2-2	2.1	4.2	3.2
WAB 220-16-H-HB	1.6	3.6	2.7
SALUMPIKIT	1.7	3.3	2.5
WAB 340-B-B-9-13-LI-LB	1.6	3.3	2.5
IDSA 10 (IRAT 262)	1.9	2.9	2.4
WAB 126-18-H-HB	1.6	3.3	2.4
TGR 75	1.6	3.0	2.3
WAB 340-B-B10-HI	1.6	3.0	2.3
IDSA 85	1.4	3.0	2.2
Kpukpula ( <i>O. glaberrima</i> )	1.3	3.0	2.1

# GUINEA

## **Participatory Varietal Selection—Rainfed Upland Rice, Year 1**

Rice is Guinea's major cereal; consumption is about 100 kg/year per person. About 41% of the arable land is planted to rice. All of this is rainfed upland. Annual production of about 650,000 t meets only 61% of demand; 200,000 t of rice are imported yearly. Guinea's potential rice land is 1 million ha—enough to feed 7 million people.

PVS trials were conducted at two sites: Woloundou in the savanna zone, and Foubadou in the forest zone. In Woloundou, land is prepared with animals and rice is planted by broadcasting. In Foubadou, land preparation is by tractor, and rice is direct-seeded in rows.

Forty-six rice varieties were planted in mid-July. Basal fertilizer was applied at 150 kg N-P-K/ha. Urea was later applied twice at 25 kg/ha. The trials were weeded once, by hand. Harvest was in mid-October.

### *Maximum tillering*

At maximum tillering, 111 farmers, including 51 women, visited the trials. Selection criteria were high tillering ability, plant vigor, crop establishment, and leaf color.

Men and women differed in the varieties they selected. Preferences in the savanna and the forest zones also differed.

Women in the savanna chose from one to five varieties each, their favorite varieties being

Moroberekan, WAB 450-I-B-P-38-HB, WAB 450-24-2-3-P33-HB, Samaka, Nankin 6, and WAB 881-10-37-18-17-P2-HB.

Men in the savanna chose one to four varieties each, their favorites being WAB 450-I-B-P-38-HB, WAB 881-10-37-18-17-P2-HB, Nankin 6, WAB 450-24-2-3-P33-HB, IRAT 144, Samaka, and Moroberekan.

In the forest zone, the favorite varieties of women farmers were WAB 450-I-B-P-38-HB, WAB 181-18, WAB 56-125, WAB 56-50, and WAB 450-I-B-P-163-HB, WAB 450-I-B-P-62-HB, and WAB 450-I-B-P-105-HB.

Men in the forest zone chose WAB 450-I-B-P-38-HB, WAB 181-18, IRAT 144, WAB 56-50, and IDSA 10.

### *Maturity/post-harvest*

In an evaluation at maturity (including post-harvest traits), 143 farmers, including 60 women, visited the trials. They selected nine varieties, based on such criteria as: short growth cycle, large panicles, tall height, medium height, bold grains, profuse tillering, grain color, aroma, and yield. The most popular variety was WAB 181-18. The varieties chosen at maturity by the upland farmers are listed below, by zone.

### Varieties chosen in the savanna zone

- WAB 181-18
- WAB 450-I-B-P-62-HB
- WAB 450-I-B-P-163-4-1
- WAB 450-24-2-3-P38-HB

- WAB 450-11-1-1-P3-HB
- WAB 450-I-B-P-105-HB

Varieties chosen in the forest zone

- WAB 450-I-B-P-38-HB
- WAB 181-18
- WAB 450-11-1-1-P31-HB
- WAB 450-I-B-P-163-HB
- WAB 450-I-B-P-24-HB
- WAB 56-50

- IDSA 10
- WAB 450-11-1-2-P41-HB
- WAB 365-B-2-H3-HB

Farmers kept most of the varieties they had chosen in the first visit, especially those with profuse tillering ability, because they are considered good for weed suppression.

The farmers were enthusiastic about PVS, and will test 24 new varieties on their farms next year.

## GUINEA BISSAU

### Activity: Participatory Varietal Selection— Rainfed Upland Rice

A PVS trial was planted at the Contuboe Research Center—eastern Guinea Bissau. Average annual rainfall is 900–1500 mm. Both men and women farmers in the area grow rainfed upland rice, intercropped with maize and cassava, on fields that range in size from 0.3 to 3 ha. Most rice farmers in eastern Guinea Bissau are men; women farmers dominate in the south.

Fifteen varieties were seeded by broadcasting at 45–50 kg seed/ha. The plots were fertilized with N-P-K (12-24-12) at 75 kg/ha, and weeded manually twice.

Forty participating farmers, including 15 women, visited the trial at maturity, and 50 farmers, including 20 women, post-harvest. The farmers' ages ranged from 18 to 68 years, and they had 1–45 years of rice-growing experience.

### *Maturity*

Farmers selected 11 varieties at maturity. The most popular were WAB 450-I-B-P-163-4-1, WAB 450-11-1-2-P41-HB, and WAB 56-125 (Table 1). WAB 450-I-B-P-163-4-1 was selected mainly because of its large grains, large panicles, and high yield. WAB 450-11-1-2-P41-HB was chosen because of its high yield, profuse tillering, short cycle, and large panicles.

**Table 1. Varieties that 40 farmers selected from a PVS trial at the maturity growth stage, and their selection criteria, Contuboe Research Center, Guinea Bissau.**

Variety	Frequency (%)	Frequency of selection criteria (%)						
		Tillering	Short growth cycle	Large panicles	Large grains	High yield	Tall height	Medium height
WAB 450-I-B-P-163-4-1	22	12	11	16	33	18	5	6
WAB 450-11-1-2-P41-HB	17	17	17	17	13	19	11	6
WAB 56-125	17	12	11	25	19	18	9	7
WAB 450-11-1-P31-HB	10	12	12	12	21	27	6	9
WAB 450-I-B-P-135-HB	10	15	6	15	18	12	35	0
WAB 450-4-1-A16	7	17	25	17	13	17	4	8
WAB 56-50	6	13	13	4	13	17	4	8
WAB 450-I-B-P-153-HB	3	14	29	29	0	0	0	29
WAB 450-I-B-P-33-HB	3	57	0	14	0	29	0	0
WAB 96-1-1	3	67	0	0	0	0	33	0
WAB 450-24-2-3-P33-HB	3	33	17	0	33	0	0	17

Most women farmers selected three or four varieties; men selected four to six rices. The most popular varieties among women were WAB 450-I-B-P-163-4-1, WAB 450-11-1-2-P41-HB, WAB 56-125, WAB 56-50, and WAB 450-24-2-3-P33-HB. Men preferred WAB 450-I-B-P-163-4-1, WAB 450-11-1-2-P41-HB, WAB 56-50, WAB 450-I-B-P-153-HB, WAB 450-I-B-P-33-HB, and WAB 96-1-1.

#### *Post-harvest*

Farmers selected 13 varieties at post-harvest stage to grow in their own fields the next season. Yield ranged between 3.0 and 3.6 t/ha. The highest-yielding variety was WAB 450-I-B-P-163-4-1, and the least productive IRAT 144. The variety with the shortest growth cycle was WAB 96-1-1, which matured in 103 days. The longest cycle was the 122 days of WAB 450-I-B-P-153-HB.

Men and women used different selection criteria (Table 2). Men wanted medium-to-tall height, high yield, bold grains, and good response to low levels of fertilizer. Women preferred large panicles, weed suppression, aroma, high yield, and resistance to bird damage.

IDSA 6 and IRAT 144 were specifically chosen for drought resistance. No farmer selected WAB 450-I-

B-P-24-HB or WAB 450-I-B-P-105-HB because they were susceptible to local diseases.

The 11 varieties selected for the following season were: WAB 450-I-B-P-163-4-1, WAB 450-11-1-2-P41-HB, WAB 56-125, WAB 450-11-1-1-P31-HB, WAB 450-I-B-P-135-HB, WAB 450-4-1-A16, WAB 56-50, WAB 450-I-B-P-153-HB, WAB 450-I-B-P-33-HB, WAB 96-1-1, WAB 450-24-2-3-P33-HB.

**Table 2. Selection criteria of 50 farmers at the post-harvest growth stage, Contuboe Research Center, Guinea Bissau.**

Criterion	Frequency of selection (%)	
	Men	Women
High yield	16	12
Tall and medium height	16	9
Bold grains	15	9
Aroma	12	12
Good response to low fertilizer rates	12	0
Large panicles	7	14
Weed suppression	6	13
Drought tolerance	6	9
Good grain filling	4	1
Grain color	3	1
Cooking quality	1	0
Disease resistance	1	8
Bird damage resistance	0	11

## LIBERIA

### **Activity: Participatory Varietal Selection— Rainfed Upland Rice**

PVS trials were established at two sites, near the Central Agricultural Research Institute (CARI), near Gbarnga, the capital of Bong County, and at Massaquoi, south of CARI.

The region is in the humid forest zone, where 30–40% of all of Liberia's upland rice is grown. These sites were selected because they represent typical rice production areas in Liberia. Most households grow 2–4 ha of upland rice per year, intercropped with cassava and vegetables, on flat land and undulating slopes. Tillage and seeding are manual.

CARI is in a bimodal rainfall belt, averaging 1250–1800 mm annually, and 125 mm monthly. Massaquoi's rainfall is monomodal, averaging 2000–3000 mm annually, and 200 mm monthly. The growing season is 180 days or longer.

The soils of these areas are largely lateritic, sandy clay loam. They are somewhat acidic, and are deficient in soluble phosphorus. Land was prepared using the farmers' method of clearing brush, burning, and hoeing. Plots were weeded three times.

Trials were direct seeded by broadcasting in 3 × 5 m plots at CARI on 31 May, and at Massaquoi, on 9 June. Trials at CARI were harvested from 14 September to 3 October, and at Massaquoi from 11 September to 18 October. Of 40 upland varieties evaluated, 2 were traditional and 38 were improved *O. sativas* and interspecifics.

Ninety farmers—45 men and 45 women—evaluated the trial near CARI. Seventy farmers—35 men and 35 women—were involved at Massaquoi. Evaluations were at the maximum tillering, maturity, and post-harvest stages. Findings were similar at both locations.

#### *Maximum tillering*

Farmers' selection criteria were plant height, profuse tillering, weed suppression, seedling vigor, early maturity, and yield. Farmers preferred medium-tall varieties, because most of them harvest panicles.

#### *Maturity*

Farmers preferred varieties with high yield and short growth cycle. The favorite varieties were LAC 23, the interspecifics, and some improved *O. sativas*, especially WAB 96-1-1, IDSA 6, IDSA 10, and WAB 56-50. Farmers liked the interspecifics because they tillered profusely, matured early, and yielded well.

#### *Post-harvest*

The interspecifics remained popular at the post-harvest stage, with men and women selecting them equally. Women preferred the bold grains of the improved *O. sativas*, but men preferred the smaller grains of the interspecifics. Both men and women preferred grains with awns.

Three interspecific varieties were selected at all stages: WAB 450-I-B-P-135-HB, WAB 450-I-B-P-160-HB, and WAB 450-I-B-P-38-HB.

## MALI

### **Activity: Participatory Varietal Selection— Irrigated Rice**

The Longorola area is in the north guinea zone of southern Mali. It is 9 km from the town of Sikasso. Annual rainfall averages 1100 mm. The rainy season is from May to October. The Banifing and Bagot canals from the Babi River provide irrigation water to the low-lying areas during the rainy season.

Mali has two rice ecosystems: upland and rainfed lowland. Men usually farm upland rice and women, rainfed lowland. There are generally more male than female farmers. In both the upland and rainfed lowland systems, rice is direct-seeded in May and June, and transplanted in July and August. The average rice farm size is 0.2–3 ha. *Oryza sativa* varieties are the most popular ones.

Fifty-two varieties were sown by direct seeding in 11 villages on 26 June. Plots were 2 × 5 m, with no replications. They were grown with and without fertilizer application. Plots were weeded as needed. The INGER/IRRI Standard Evaluation System for Rice was used to evaluate the rices. Farmers visited the plots at maturity and post-harvest.

#### *Maturity*

The first visit, at maturity, was 20–21 September. Of the 81 participating farmers, 40 were women.

Participants selected two to four varieties each. The farmers chose a total of 20 varieties; 14 were interspecifics. Men and women ranked the varieties

differently (the most popular variety among women was not always the most popular with men), but both genders selected the same top five varieties.

The most popular three varieties at maturity were WAB 450-11-1-1-P31-HB, WAB 181-18, and WAB 450-24-2-3-P33-HB (Table 1).

Farmers based their selections mainly on high yield, tall plant height, profuse tillering, and size and weight of panicles. Other criteria that farmers cited were good yield without fertilizer, low input requirements, short growth duration, and grain quality (Table 2).

The presence of awns was particularly popular with women, because awns are thought to help prevent bird damage. Many women chose WAB 450-11-1-1-P31-HB because its grains have awns.

Farmers liked early-maturing varieties so that drought could be avoided at the end of the rainy season.

#### *Post-harvest*

The second visit was at post-harvest stage, on 5–6 November. Of the 68 participating farmers, 36 were women.

The farmers selected a total of 15 varieties; 11 were interspecifics. Four varieties were selected by about 88% of the farmers.

Men and women selected the same top three varieties—but ranked them differently. Men preferred WAB 450-11-1-1-P31-HB and WAB 181-18.

**Table 1. The top 10 varieties selected by farmers (both men and women) during visits at maturity and post-harvest.**

Variety	Frequency (%) at			
	Maturity		Post-harvest	
	Men	Women	Men	Women
WAB 181-18	19.1	12.3	13.6	10.0
WAB 450-11-1-1-P31-HB	17.6	22.4	13.6	12.1
WAB 450-24-2-3-P33-HB	16.2	14.5	10.4	19.3
WAB 450-24-3-4-P18-3-1	8.8	2.9	7.2	7.1
WAB 450-I-B-P-105-HB	7.4	5.8	7.2	7.1
WAB 450-I-B-P-160-HB	5.9	3.6	8.8	8.6
WAB 365-B-2-H3-HB	5.1	7.2	0.0	0.0
WAB 450-I-B-P-33-HB	2.9	6.5	6.4	9.3
WAB 56-125	2.9	6.5	9.6	6.4
WAB 450-11-1-1-P50-HB	2.2	1.4	10.4	8.6

**Table 2. Criteria by which farmers selected varieties at maturity.**

Criterion	Frequency (%)
Yield	12.6
Tall height	11.8
Profuse tillering	11.3
Large panicles	10.9
Low input requirements	7.6
Grain quality	7.1
Short cycle	7.1
Healthy plants	6.3
Weed competitiveness	5.9
Awns	5.9
Long grain	4.2
Bold grain	2.9
Medium height	2.9
Large leaves	2.5
Lodging resistance	0.8

Women named WAB 450-24-3-4-P18-3-1 as their first choice.

Some varieties that farmers chose at the first visit—maturity—were not chosen post-harvest. One example is WAB 365-B-2-H3-HB. Similarly, farmers almost ignored some varieties such as WAB 450-11-1-1-P50-HB at the first visit, but selected them as favorites post-harvest.

The criteria that farmers cited during the post-harvest visit included, in order of preference: yield, healthy plants, low input requirements, long panicles, and grain quality (Table 3).

#### *Agronomic observations*

At 63 days after sowing, agronomic traits were evaluated. Gall midge infected up to 20% of the

plants. The most susceptible varieties were WAB 450-11-1-2-P41-HB, WAB 450-I-B-P-157-2-1, WAB 450-I-B-P-32-HB, WAB 450-24-3-4-P18-3-1, WAB 450-I-B-P-62-HB, and IDSA 10. Resistant varieties were WAB 450-4-1-A16, SIK 48-46-5, SIK 48-62-5, SIK 48-91-5, and SIK 47-378-4-2.

Rice yellow mottle virus mainly affected SIK 49-62-5 and SIK 47-378-4-2.

Brown spot was observed during panicle initiation on about 60% of the plants. The most susceptible varieties were WAB 450-I-B-P-135-HB, WAB 450-I-B-P-24-HB, SIK 48-62-5, SIK 48-91-1, SIK 49-62-5 and SIK 47-378-4-2.

**Table 3. Criteria by which farmers selected rice varieties post-harvest.**

Criterion	Frequency (%)
Yield	20.9
Healthy plants	14.5
Low input requirements	12.2
Large panicles	12.2
Grain quality	11.0
Well-filled panicles	8.7
Awns	8.1
Short cycle	4.7
Bold grain	4.7
Long grain	2.9

Many plants in the fertilized plots were at least 10 cm taller than in the non-fertilized plots. The tallest varieties were WAB 450-I-B-P-105-HB and WAB 96-11 in fertilized plots.

Numbers of panicles were greater in the fertilized plots for all except WAB-450-I-B-P-38-HB and IDSA 6. IRAT 216 produced the most panicles, but did not yield highest.

Fertilized plots reached 50% flowering at 66–107 days. Flowering was 0–8 days later in the non-fertilized plots, except SIK 48-13-5, which was 24 days earlier, and IDSA 10 at 9 days earlier.

Growth duration was generally shorter in the interspecifics—a trait especially appreciated by farmers who plant potatoes after rice.

Neck blast was observed in WAB 450-I-B-P-51-1-1, WAB 365-B-2-H3-HB, and SIK 47-378-4-2.

The interspecifics yielded higher than the local checks, especially when fertilized. WAB 450-24-3-4-P18-3-1 yielded highest—83% more than the local check IRAT 216. Among the 18 varieties that outyielded IRAT 216, there were 16 interspecifics.

But in the non-fertilized plots, only two interspecifics—WAB 450-I-B-P-105-HB and WAB 450-I-B-P-160-HB—outyielded the highest-yielding local check, SIK 131.

## MAURITANIA

### **Activity: Participatory Varietal Selection— Irrigated Rice**

An irrigated PVS trial was conducted at two sites in the Gorgol Irrigation Scheme, which covers about 1000 ha. Farmers' fields in the area range from 0.5 to 2.0 ha in size. Annual rainfall is only 200–250 mm. Irrigated rice is grown in both the rainy and dry seasons.

Land preparation starts in mid-June and sowing, in early July. Farmers use both direct seeding and transplanting. Rice is usually transplanted 3–4 weeks after sowing. Farmers use urea and triple superphosphate fertilizers. Women are usually involved in transplanting, weeding, harvesting, and threshing.

Participating in the first visit, at maximum tillering, were 143 farmers; 16 were women. The second visit, at maturity, involved 133 farmers; 14 were women. Participants ranged in age from 23 to 65 years.

Rice was sown 25 July. Two plots of each variety were transplanted by

- the *recommended practice* with 1–2 plants per hill, spaced 20 × 20 cm at post-harvest
- the *farmers' practice*, with 3–4 plants per hill, and random spacing.

Ten varieties were used: BW 293-2, CICA 8 IR 2042-178-1, IR 13240-108 (Sahel 108), ITA 222, ITA 306, TOX 3093-35-2-3-3-1, WABIR 12979, 4418 × IR 6915-1-1, IR 28-128-45-3-3-2, MRC 2663-2483.

Fertilizer was applied in the *recommended practice* plots at 300 kg urea/ha and 177 kg triple superphosphate/ha, and in *farmers' practice* plots at 200 kg urea/ha.

#### *Maximum tillering stage*

At the maximum tillering stage, 20% of the farmers selected IR 28128-45; 18% chose TOX 3093-35-2-3-3-1; 17% chose WABIR 12979; 14% selected ITA 306; and 10% chose BW 293-2.

Tall and medium plant height were the farmers' most important criteria in selecting varieties. They preferred taller plants for weed competition and for ease of harvest and threshing (Table 1).

#### *Maturity*

Men and women differed in their selection of varieties during the second visit, at maturity. ITA 222 was a favorite of 29% of the women; 4418 × IR 6915-1-1, of 21%; TOX 3093-35-2-3-3-1, of 14%; BW 293-2, of 14%; and MRC 2663-2483, of 14%.

ITA 306 was the favorite of 23% of the men; TOX 3093-35-2-3-3-1, of 18%; BW 293-2, of 15%; CICA 8 and IR 2042-178-1, of 15%; and IR 28128-45-3-3-2, of 15% of the men.

ITA 306 and BW 293-2, which were popular with farmers, were recently released. But in general, farmers were conservative in their choice of varieties.

Table 2 shows the farmers' selection criteria.

**Table 1. Criteria by which 143 farmers selected varieties at the maximum tillering stage. Gorgol Irrigation Scheme, Mauritania.**

Trait	Farmers' reason(s)	Frequency (%)
Tall height	Shades weeds	20
Medium height	Easy to harvest and thresh	18
Vigorous growth	Good vegetation	17
Good tillering	High yield	14
Medium tillering	Average yield	11
Weak tillering	Low yield	8
Short growth cycle	Protection against famine, but low production	4
Medium growth cycle	Longer waiting time, but higher yield	3
Disease resistance	No disease	3
Long, erect leaves	Good panicle protection	1
Horizontal, semi-erect leaves	Panicles are less protected	1
Resistance to bird damage	Possible bird damage	1

**Table 2. Criteria by which 133 farmers selected varieties at maturity. Gorgol Irrigation Scheme, Mauritania.**

Trait	Farmers' comment(s)	Frequency (%)
Medium growth cycle	Best yield	20
Medium height	Needs only two weedings	20
Good fertilizer response	Maintains green leaves until maturity, which is good for livestock	15
Vigorous growth	Good tillering	13
Tall height	Susceptible to lodging at maturity	11
Compact panicles	High yield; panicle holds grains well	8
Loose panicles	Low yield, less grain	6
Bold grain	High milling recovery, good selling price	6
Slender grain	Good for local fish and rice dishes	5
Medium grain	Good for cooking	5

## NIGER

### **Participatory Varietal Selection—Irrigated Rice, Year 1**

Traditional varieties of rice have been grown in Niger since 1960. The crop is very dependent on the availability of water.

In 1970, the government established the Office des Produits Vivriers du Niger (OPVN) to help the country to become self-sufficient. The OPVN then established the AHA irrigation authority, which covers about 12,000 ha along the Niger River.

Rice is grown in the dry season, from November to May, and in the rainy season, June to November. The recommended varieties are D 52-37, IR 1529, IR 54, and BG 90-2. New varieties with resistance to pests and environmental stresses are needed.

A PVS trial was conducted in Sébéri village, 40 km from Niamey. Rice there is grown by men on fields that range from 0.25 to 0.5 ha. Current yields are 3.9 t/ha. Millet is the other major crop. Rainfall in 1999 was 558 mm.

Sixteen varieties were transplanted at 20 × 20 cm spacing. Fertilizer (N-P-K : 15-15-15) was applied after transplanting at 200 kg/ha. Urea was also applied at tillering at 200 kg/ha, and at panicle initiation at 50 kg/ha.

#### *Farmers' socioeconomic backgrounds*

The 10 farmers who participated were AHA members with 19–50 years of rice-growing experience. They were from six villages around Sébéri. Their

average age was 52; the youngest was 43 years old and the oldest, 76. They were all married, and had an average of seven children. Six of the farmers had no education; three had had Koranic lessons. One was a retired soldier.

Eight of the 10 were subsistence farmers. Incomes of the other two were meager. Only three of the participants could borrow money to buy agricultural inputs.

#### *Maximum tillering*

Farmers selected 12 varieties during the first visit (Table 1). IR 4418 × IR 6115-1-1-1 and Chiannung Sen-Yu, the most popular varieties, were selected mainly for their profuse tillering and good plant height. Minor traits were erect leaves and insect resistance. WABIR 12-979, ITA 306, and IR 2042-178-1 were selected for their tall height, erect leaves, and insect resistance. IR 31785-58-1-2-3-3, IR 31851-96-2-3-2-1, and IR 32307-107-3-2-2 were chosen for height and insect resistance.

Forty percent of the farmers did not like BW 293-2 at maximum tillering because of its short height, poor tillering, and yellow color.

#### *Maturity*

Again, IR 4418 × IR 6115-1-1-1 was popular (Table 1). Selection criteria were profuse tillering, panicle size, plant height, bold grain, number of spikelets, and insect resistance. IR 2042-178-1 was also popular because of its panicle size, number of spikelets,

profuse tillering, plant height, and bold grain. IR 31851-96-2-3-2-1 was the third most popular, because of its profuse tillering, panicle size, short growth cycle, number of spikelets, and bold grains. TOX 3093-35-2-3-3-1 was another newly selected variety during this visit.

#### *Post-harvest*

Farmers selected different varieties at post-harvest stage (Table 1). The most popular were ITA 306 and IR 28-128-45-3-3-2. Varieties that were retained—but that were not as popular as before—included Chiannung Sen-Yu, IR 32307-107-3-2-2, and TOX 3093-35-2-3-3-1. These varieties were chosen for their slender grain, absence of empty grains, long grain, bold and heavy grain, and seed purity.

The farmers selected five varieties to grow on their own fields the following year: IR 4418 × IR 6115-1-1-1, ITA 306, Chiannung Sen-Yu, IR 28128-45-3-3-2, and IR 2042-178-1.

#### *Discussion*

IR 2042-178-1 yielded highest, at 6 t/ha. IR 32307-107-3-2-2 had the shortest growth cycle: 113 days.

The most important selection criteria were agronomic: yield, profuse tillering, short growth cycle, and plant height. The second most important group of criteria were post-harvest traits: grain-swelling capacity, grain size, and taste. The other important criteria were insect and disease resistance, good yield without fertilizer, drought resistance, and ease of threshing and husking.

The new farmer-selected varieties can have a high impact on rice production within the AHA irrigation scheme, where the current average yield is 4.5–4.7 t/ha. Their introduction may increase yield by 700–900 kg/ha. Production on Sébéri farms is projected to increase by between 400 and 1500 kg/ha.

Seed multiplication should be initiated to satisfy demand.

**Table 1. Varieties that farmers selected at different growth stages in Niger.**

Varieties	Frequency of selection (%) at		
	Maximum tillering	Maturity	Post-harvest
IR 4418 × IR 6115-1-1-1	25	21	3
Chiannung Sen-Yu	19	6	13
WABIR 12 979	13	2	0
ITA 306	10	7	31
IR 28-128-45-3-3-2	10	0	26
IR 31851-96-2-3-2-1	8	13	0
IR 32307-107-3-2-2	6	6	10
IR 31785-58-1-2-3-3	4	3	5
CICA 8	3	0	0
IR 2042-178-1	3	20	0
TOX 3093-35-2-3-3-1	0	9	8
IR 1529	0	4	0
BG 90-2	0	0	5

## NIGERIA

### **Activity: Participatory Varietal Selection— Rainfed Upland**

Rice is grown on more than 1.7 million hectares in Nigeria. Annual production is about 3.7 million tonnes. Rice is grown across the country, and in all ecosystems. But rainfed upland rice accounts for about 35% of the total rice area.

PVS trials were conducted at two locations: at Maloko-Ashipa, in the humid forest of Ogun State, and Kuta, in the southern guinea savanna of Niger State. Maloko-Ashipa consists of five villages about 40 km south of Abeokuta, the Ogun State capital. Thirty-three men and two women farmers participated there.

Kuta is 78 km northeast of Minna, the Niger State capital. Thirty-three men and seven women participated there.

The PVS at Maloko-Ashipa was planted on 8 June, and the trial at Kuta, on 15 July. Planting at both sites was by dibbling in straight rows at 29 × 20 cm spacing. Both sites were fertilized with 60-30-30 N-P-K/ha; P and K were applied as basal; N was split, with half applied at seeding and the other half at panicle initiation.

The PVS was planted 2–3 weeks after farmers' planting time at Maloko-Ashipa. PVS planting coincided with farmers' planting time at Kuta.

Farmers from the villages harrowed the plots manually to ensure fine tilth, good germination, and good initial weed control.

### *Vegetative stage*

- *Maloko-Ashipa*. The farmers' criteria for selection of varieties were good weed competitiveness (cited in 20% of the selections), green leaves (10%), profuse tillering (10%), and moderate tillering (9%).

Some varieties were selected for early maturity, so they would fit into a double cropping system. They were WAB 56-50, WAB 450-I-B-P-153-HB, and WAB 450-I-B-P-33-HB. Others were: WAB 450-4-1-A16, WAB 450-I-B-P-160-HB, and WAB 450-I-B-P-24-HB.

- *Kuta*. The farmers' criteria were vigorous vegetative growth (cited in 19% of the selections), profuse tillering (15%) and leaf color (14%).

The varieties selected were WAB 365-B-2-H3, FARO 43, WAB 450-24-2-3-P33-H, WAB 365-B-1-H1-HB, FARO 46 (ITA 150), and WAB 450-I-B-P-135-HB.

### *Gender analysis*

Selection criteria at both sites tended to be the same, although women generally chose fewer varieties than men.

### *Discussion*

At the vegetative stage, Kuta farmers selected 16 varieties while their counterparts in Maloko-Ashipa selected 14. Three varieties were selected at both sites: FARO 43, WAB 450-I-B-P-24-HB, and WAB 450-I-B-P-160-HB.

**Table 1. PVS varieties that farmers selected at Maloko-Ashipa, Nigeria.**

Variety	Frequency of selection (%)
WAB 450-I-B-P-160-HB	36
WAB 450-I-B-P-24-HB	27
WAB 450-4-1-A16	27
WAB 56-50	18
WAB 96-1-1	18
WAB 35-2-Fx	18
FARO 43	18
ITA 321	18
LAC 23	18

Table 1 shows the most frequently selected varieties at Maloko-Ashipa.

#### *Maturity*

- *Maloko-Ashipa*. The selection criteria at maturity were tall plant height, profuse tillering, and bold grains.

The varieties selected were WAB 450-I-B-P-105-HB, WAB 450-I-B-P-160-HB, WAB 570-10-B-1-A2.6, ITA 321, and WAB 96-1-1.

- *Kuta*. The farmers' selection criteria were tall-to-medium plant height, profuse tillering, vigorous vegetative growth, early maturity, attractive grains, and high yield.

The varieties selected were WAB 450-I-B-P-163-4-1, WAB 515-B-16A2.2, WAB 365-B-2-H3-HB, WAB 570-10-B-1A2.6, and FARO 43.

#### *Gender analysis*

Both men and women agreed on the most popular five varieties at maturity.

“Smooth leaves” was a common criterion—but given only by women—for selecting the five most popular varieties.

Ten of the varieties were selected by both men and women; the other 12 selected by only men or only women.

#### *Discussion*

The characters that farmers want vary with growth stages. In the early growth stages, the most popular selection criteria were profuse tillering, vigorous growth, and green leaf color. At maturity, yield, grain type, grain quality, and profuse tillering became most important. Farmers in the humid forest zone prefer tall plants because they make ‘panicle harvesting’ easier.

Farmers correlated profuse tillering with high yield at Kuta, in the southern guinea savanna. The trait is also important because they use straw as animal fodder.

Farmers in both regions selected only one variety—WAB 450-I-B-P-160-HB—at both vegetative and maturity stages. Five other varieties were selected at maturity in both regions: WAB 570-10-B-1A2.6, WAB 515-B-16-A2, WAB 450-I-B-P-105-HB, IDSA 6, and WAB 96-1-1.

The three most popular varieties at Maloko-Ashipa were WAB 570-10-B-1-A2.6, WAB 450-I-B-P-160-HB, and WAB 450-I-B-P-105-HB.

Most popular at Kuta were WAB 450-I-B-P-163-4-1, WAB 365-B-2-H3-HB, and WAB 515-B-16A2-2.

### **Activity: Participatory Varietal Selection— Seed Priming**

A seed priming initiative was launched in Nigeria, The Gambia, and Sierra Leone in 1998. At the 1999 PRIGA workshop, a survey of adoption of seed priming by Nigerian farmers was approved.

A total of 131 farmers was surveyed by questionnaire in three zones of Kano State, in the sudan savanna of north-central Nigeria. Forty farmers were surveyed at Abeokuta, in Ogun State, in the humid forest of southwestern Nigeria.

Of the farmers surveyed, 37% in Kano State and 12% in Ogun State primed their rice seeds before planting.

Forty-five percent of the Kano farmers learned seed priming techniques from family members; 37% learned from extension agents; and 5% from other farmers and friends.

Fifty-one percent of the Kano farmers also primed maize seeds; 5% primed sorghum seeds; and 4% primed soybean. Other primed crops included garlic, millet, wheat, groundnut, okra, and cowpea.

Seventy percent of the farmers who primed had adopted the technique in the past 10 years. The

adopters were older farmers, from ages 41 to 50. Most preferred to soak seeds overnight. Priming is practised more in the uplands than in the lowlands.

### *Gender*

Of the 131 farmers interviewed in Kano, 8% were women; 80% of them primed their rice seeds before planting. Sixty-two percent primed overnight, and 37% primed for 2 days. Half of the women received information on seed priming from extension agents.

Seventy-five percent of the women who primed felt that the practice gave early seed germination; 100% felt that priming enhanced germination; and 25% felt that it increased yield.

But half of the women felt that priming is time-consuming, and sometimes results in seed rotting.

Twenty percent of the women who primed in Ogun State planted in the uplands; they felt that priming gave early seed germination.

### *Discussion*

The farmers had insufficient knowledge of seed priming techniques. Those who complained that primed seed had rotted may actually have practised seed pre-germination, and soaked the seeds too long.

## SENEGAL

Rice accounts for 34% of Senegal's cereal consumption (54% in cities and 24% in rural areas). Rice production is about 200,000 t per year, but does not meet demand.

Rice is grown in two regions: rainfed upland rice in the 'peanut basin' region, and irrigated rice in the Senegal River valley. Thus, PVS trials were held in the two regions.

### **Activity: Participatory Varietal Selection— Rainfed Upland Rice**

A PVS trial for rainfed upland rice was conducted in the peanut basin. Annual rainfall is 800–1000 mm. The main crops grown are millet, 39,000 ha; peanut, 38,000 ha; and beans, 14,000 ha. Rice is the fourth crop, grown mainly by women for home consumption.

Farmers sow rice at the onset of the rainy season, in June or July, and harvest in September or October. Because the growing season is short, farmers prefer early-maturing varieties. Women weed the crop manually. No chemical inputs are applied, and yields are only 1.5 t/ha.

Rice was widely grown in the area in the past, but little is grown now because of droughts. For the past two years, Japanese volunteers and women's groups have promoted increased rice production.

Rainfed upland PVS trials were grown at two sites, Kaolack and Fatick. The Kaolack trial was in Diamaguène, a farming village of 681 inhabitants.

The Fatick trial was in Niodor, a fishing village of 6000 where men grow rice along the river while women sell fish by-products.

The main local rice varieties are Maro Obale, a short-statured variety that matures in 3 months, and has black panicles; Massarinko, a tall variety that matures in only 2 months, and has long panicles; Omam Samaani, a short, 3-month variety with long panicles; and Opedio, a tall, 3-month variety with red grain. All local varieties yield less than 1 t/ha. No improved varieties were grown.

Rice is mainly women's work in the area. Seventy-four percent of the participants at Kaolack were women; 91% of those at Fatick were women.

Participants visited the trial at maximum tillering, maturity, harvest, and post-harvest stages. In Kaolack, the first visit drew 75 participants (40 women); the second visit, 77 (65 women); the third visit, 26 (24 women); and the fourth visit, 24 participants (22 women).

Varieties selected were different among the sites and genders. At Kaolack, women farmers selected ITA 150, WAB 56-50, and WAB 56-104 (Table 1). Men preferred WAB 450-I-B-P-163-HB and WAB 450-11-1-2-P41-HB.

At Fatick, both men and women preferred WAB 450-24-2-3-P33-HB.

The main selection criteria were short growth cycle and post-harvest traits such as ease of threshing, grain quality, grain color, and yield (Table 2).

**Table 1. Varieties selected in a rainfed upland rice PVS trial in Kaolack and Fatick villages, Senegal.**

Variety selected	Frequency of selection (%)		Growth cycle (days)	Yield (t/ha)
	Men	Women		
<b>At Kaolack</b>				
ITA 150	23	77	97	6.0
WAB 450-11-1-2-P41-HB	43	57	102	4.1
WAB 450-I-B-P-163-HB	48	52	102	5.2
WAB 56-50	26	74	103	5.0
WAB 56-104	26	74	103	5.1
<b>At Fatick</b>				
WAB 450-24-2-3-P33-HB	13	27	94	3.6
WAB 450-I-B-P-62-HB	2	20	97	1.4
ITA 150	0	22	97	0.8
WAB 876-6-32-1-21	1	13	96	1.8
WAB 224-8-HB	0	13	109	2.5
WAB 450-I-B-P-32-HB	0	12	94	1.2

### **Activity: Participatory Varietal Selection— Irrigated Rice**

PVS trials were conducted at two sites in the Senegal River valley: the delta and the Middle valley. Senegal River participants were mostly men, although women usually provide some manual labor for the rice crop. They had 15–35 years of farming experience.

Eighty-nine percent of Senegal's rice production comes from the Senegal River valley. Sixty-two percent is from rice schemes of 1000–2000 ha in the Senegal River delta.

Rice farming is highly mechanized and, compared with rainfed rice in Senegal, highly advanced. Rice production in this region is commercial; the rainfed rice in Fatick and Kaolack is for home

consumption. Seventy to 80% of the valley's rice is grown during the rainy season.

Participants at the two sites selected the same varieties, although they ranked them differently. Dagana farmers mostly preferred ITA 222; Guédé farmers preferred IR 31785-58-1-2-3-3 (Table 3).

Selection criteria in the valley differed from those of rainfed rice farmers at Kolack and Fatick (Tables 2, 3). That is probably because the valley's irrigated rice crop is commercial, with high investments and infrastructure, while the rainfed rice is for home consumption.

Seed purity should be considered throughout the PVS process. Next year's PVS trials will involve the same farmers, who will be given five or six varieties that they chose this year.

**Table 2. Selection criteria of farmers in rainfed upland and irrigated rice PVS trials in Senegal.**

Selection criterion	Frequency of selection (%)			
	For rainfed rice at		For irrigated rice at	
	Kaolack	Fatick	Delta	Middle Valley
Short growth cycle	34	30	40	30
Ease of threshing	25	14	0	0
Yield	15	12	45	40
Grain quality	12	14	10	20
Grain color	10	15	0	0
Plant height	3	5	0	0
Vigorous growth	0	10	0	0
Profuse tillering	0	0	3	5

**Table 3. Varieties selected and selection criteria for an irrigated rice PVS trial in the Senegal River valley of Senegal.**

Variety selected at	Frequency	Selection criteria
<b>Dagana</b>		
ITA 222	16	Long and slender grain, yield, short growth cycle
WABIR 12979	15	Long and slender grain, well-filled grains, yield, good panicles, short growth cycle
CICA 8	15	Yield, good panicles, short growth cycle
BW 293-2	14	Small reddish grain, yield
IR 31785-58-1-2-3-3	14	Well-filled grain, long and slender grain, yield, good panicles, short growth cycle
<b>Guédé</b>		
IR 31785-58-1-2-3-3	16	Numerous grains in the panicle, long and slender grain, good yield, short cycle
ITA 222	14	Bold and long grain, yield, grain color
WABIR 12979	13	Bold grain, short cycle, yield
IR 31851-96-2-3-2-1	10	Bold grain, short growth cycle, yield, grain color
IR 28128-45-3-3-2	9	Long and slender grain, yield, short growth cycle

## SIERRA LEONE

### **Activity: Participatory Varietal Selection— Rainfed Upland**

From 60 to 70% of Sierra Leone's rice area is rainfed upland. Productivity is low because of infertile soils and the lack of improved rice varieties suitable for low-input farming. Farmers continue to grow traditional varieties that produce 1 t/ha or less—but are highly adapted to local conditions, can tolerate low soil fertility, and have good eating qualities.

Small-holder farmers have not adopted many of the high-yielding upland varieties released in Sierra Leone because they cannot afford the associated inputs such as fertilizer.

To speed up the adoption of new interspecific and other promising upland rice varieties, a 3-year Participatory Varietal Selection and Gender Analysis program was initiated in upland areas and inland valley swamps in northwestern Sierra Leone in 1998. Activities in 1999 included:

- on-farm evaluation of upland rice varieties
- a rice garden, and
- on-farm seed priming

Trials were planted in the savannas at Kegbal, Mahum, Royeima, and Petifu in the Lokomassama chiefdom. The annual rainfall is about 2300 mm, mostly from June to September. Infertile soils and weeds are among the major constraints. Iron toxicity is also a problem in the inland valley swamps.

Land for the on-farm trial was prepared using standard farmers' practices. The trial was broadcast-seeded on 25-m<sup>2</sup> plots in June. Plots were weeded once, on 28–29 July. Harvest was in September.

The varieties used in the trial were WAB 450-11-1-1-P31-HB, WAB 450-I-B-P-38-HB, IRAT 144, WAB 450-I-B-P-160-HB, WAB 96-1-1, and ROK 3 (the local check).

A total of 120 farmers—60 men and 60 women—evaluated the trials at tillering and maturity.

The most popular varieties among farmers were WAB 450-I-B-P-160-HB and WAB 450-11-1-1-P31-HB.

The farmers' main selection criteria were yield, panicle size, height, and short growth duration.

### *Gender preferences*

Men and women farmers both preferred the interspecifics because of their yield. Women preferred tall plants because they are easier to harvest.

Men preferred WAB 450-11-1-1-P31-HB, followed by WAB 450-I-B-P-160-HB. Both were equally preferred by women.

The three interspecifics in the trial outyielded the local check by 12–28%.

### *Selection of varieties in the rice garden*

Sixteen upland varieties, including the 13 most popular varieties in the 1998 PVS, were direct-

**Table 1. Criteria that farmers used to select varieties in a rice garden in northwestern Sierra Leone.**

Variety	Selection criteria used by	
	Men	Women
WAB 450-I-B-P-160-HB	Short growth cycle, panicle size, tall height, clean white grains, long grains, profuse tillering.	Short growth cycle, height, weed suppression, leafiness, ease of threshing, grain size, grain color.
WAB 570-10-B-I-A2.6	Tall height, large panicles, profuse tillering, bold grains, weed suppression.	Large panicles, high yield, weed suppression.
WAB 515-1-B-16-A2.2	High yield, short growth cycle, height, large panicles, many grains, uniform maturity.	Weed suppression, medium height, short growth cycle, clean, white grain.
WAB 450-11-1-1-P31-HB	Awns, attractive husk color, large panicles, weed suppression, profuse tillering.	Awns, medium height, short growth cycle, high yield, weed suppression, long and clean grain, attractive husk color, uniform height.
IRAT 144	Short growth cycle, large panicles, medium height, easy threshability, large grains.	Large panicles, short growth cycle, medium height, long grains.
WAB 450-I-B-P-38-HB	Large panicles, high yield, profuse tillering, disease resistance, fine grains.	Short growth cycle, fine grains, large panicles, high yield, marketability, weed suppression.

seeded on 25-m<sup>2</sup> plots on 21 June. Eight were interspecifics; one was a local *O. glaberrima*. No fertilizer was applied.

Participating in a plant evaluation day at crop maturity were 120 farmers—60 men and 60 women—from three villages. Each farmer selected a maximum of five varieties. Table 1 gives the criteria by which farmers selected the six most popular varieties.

The most important agronomic traits used to select WAB 450-I-B-P-160-HB were its high yield

and large panicles. Most important for WAB 450-11-1-1-P31-HB was its grain type (even though farmers found it difficult to thresh).

#### *Seed priming*

A 100-m<sup>2</sup> plot was prepared using farmers' normal practices. Seeds of ROK 3, Dissikono, and Gbakinta were 'primed' by soaking in water for 12 hours, then surface-dried and sown in June.

Seventy-five farmers from Kegbal, Kokomassama, Mahum, Petifu, and Royeima in the chiefdom took

farm walks through the site and participated in group discussions in July, August, and September.

Farmers compared growth and other traits by scoring the primed treatment as better or worse than the unprimed treatment at 17 weeks after seeding.

Seed priming increased yields by between 27 and 60%, averaging 46%. Twenty-nine percent of the

farmers felt that seed priming helped prevent bird damage at seeding.

But 31% of the farmers reported that the primed seeds were difficult to broadcast.

Evaluation by farmers at 10 sites showed that seed priming reduced weed growth significantly. Many of the farmers decided to adopt seed priming on their farms.

## TOGO

### **Activity: Participatory Varietal Selection— Upland**

Most of southwest Togo's rice land is planted to traditional *Oryza glaberrima* varieties. Seventy-six percent of the region's rice farmers grow two successive crops of rice; 10% rotate beans–rice–beans, 10% rotate maize–rice–maize, and 4% grow okra–rice–okra. Many farmers are looking for crops to substitute for cotton production, which is becoming increasingly expensive.

Participatory trials were planted from 22 June to 20 July in three villages about 6 km from Amou in southwest Togo. Of the 21 participating farmers, 10 were women.

Each farmer was given two new varieties, which were planted on 5 × 10-m plots. Fertilization with N-P-K (15-15-15) was at 150 kg/ha at sowing, and with urea at 50 kg/ha at tillering and booting. Various planting methods were used: 14% of the new varieties and 38% of the local varieties were broadcast; and 76% of the new and 28% of the local varieties were planted by dibbling. Thirty percent of the plots were hand-weeded once; 60% were weeded twice, and 10% were weeded three times.

#### *Vegetative stage*

At the vegetative stage, 75% of the farmers selected varieties based on their weed competitiveness, tillering ability, and plant growth. Weed competi-

tiveness was especially appreciated. Farmers were equally divided on their varietal preferences: 47% chose the new varieties and 53%, local varieties.

#### *Maturity*

At maturity, farmers chose varieties for their grain quality, panicle shape, and yield. Fifty-two percent chose new varieties and 48%, local varieties.

#### *Post-harvest*

In the post-harvest visit, farmers selected varieties for ease of threshing, husking, cooking quality, color, smell, and taste. For these criteria, farmers did not differentiate between the new and local varieties.

Yields ranged from 0.9 to 2.4 t/ha. IRAT 112 yielded highest.

At the end of the season, 4 farmers chose only new varieties, 16 chose both local and new varieties, and one farmer chose only local varieties.

Most farmers observed that short-cycle varieties (100–108 days) have more potential to avoid drought than local varieties, which mature in 120–152 days.

PVS sped up the distribution of the new varieties. One concern is maintenance of seed purity. Scientists saw a need to train farmers in seed production.

# ISSUES OF CONCERN

Discussed at the  
Participatory Rice Improvement and Gender/User Analysis Workshop





## PVS Issues of Concern in the National Agricultural Research Systems

Participatory varietal selection is being accepted as a progressive and viable 'fast track' alternative to conventional breeding in West and Central Africa. The innovation is obviously catalyzing the generation and dissemination of improved rice technology.

Throughout the workshop, participants discussed common and inter-related issues concerning the general operation of PVS research across the region. Discussions of such issues are summarized below.

### **Standardization of reporting**

It was obvious from the reports that NARS scientists are modifying the PVS methodology to suit local needs and environments. All stakeholders at the workshop welcomed this development.

But there was also a strong consensus that the general approach and principles should remain standardized, and that reporting be uniform. All stakeholders should "speak the same language" for better communication and information flow.

Three inter-related issues generated considerable discussion—*varietal release*, *varietal naming*, and *seed multiplication*.

### **Varietal certification and release**

Some countries advocate that all varieties going into farmers' hands should pass through the established varietal release process. A few NARS scientists felt that the PVS process, to their

embarrassment, bypasses this procedure. That apprehension was generally defused. PVS is similar to on-station trials where farmers are invited to select varieties of their choice.

Technicians should encourage, and train, farmers in the production of seeds of acceptable quality from foundation seeds provided through the PVS trials. Further, it is advisable to include the major stakeholders in the varietal release system early in the PVS process to prevent bureaucracy from delaying the release of varieties that farmers want and need.

NARS scientists should recommend fairly flexible varietal release systems to their governments. But such flexibility should be accompanied by strict adherence to minimum standards, to avoid problems of varietal rejection in the future.

Such 'disciplined flexibility' has served countries such as Guinea, Senegal, and Sierra Leone well in both internal and international seed exchange.

In Sierra Leone, for example, NGOs bought most of the seeds for distribution in war-torn areas from farmers who were initially trained in seed production. PVS farmers, similarly, should be trained in seed production.

### **Naming of varieties**

Some NARS scientists who have given local or institutional names to PVS entries, used those names when presenting reports. Participants agreed that

scientists should retain the pedigree names that the originating institutions gave the entries when reporting on their performance to an international audience. But WARDA and NARS breeders were requested to simplify the pedigree names of materials sent out for PVS trials.

The naming of varieties for release to farmers should follow the varietal release procedures for each country.

### **Seed multiplication, pricing, and marketing**

The constant references to the multiplication, pricing, and marketing of seeds during the workshop emphasized the importance of linkages between the seed sector and the PVS trials. Although the primary goal of PVS is clearly to efficiently transfer improved rice technology to farmers, components such as community-based seed multiplication and seed priming are now integral PVS activities.

#### *Seed pricing*

Seed issues naturally enter the system in the second year of PVS, when farmers are provided seeds of their favorite varieties to compare with their own local varieties on their farms. This stage is similar to on-farm trials in conventional varietal improvement, the participants agreed, and farmers should receive seed for testing free of charge.

A good variety will naturally attract a fair price. In the third year, NARS should consider selling seed, at cost, of the varieties that farmers want, and are prepared to buy. Selling seeds at this stage can prevent accusations of 'forced adoption' of varieties.

#### *Seed multiplication*

As farmers become more aware of the potentials of the improved varieties, the question of scaling up the seed multiplication process arises. This is because the formal seed multiplication procedure in many countries has collapsed or become seriously neglected, particularly after introduction of privatization through the Structural Adjustment Program (SAP).

There were some genuine fears that seeds of varieties might mix if farmers keep more than two varieties in their seed portfolio. Dr Ahmoud Mustapha Bèye of WARDA summed this up with an African adage, "If you don't know where you are going, you should know where you are coming from."

As farmers have always been knowledgeable of their environment and their seed needs, they should be trusted to produce their own seeds.

Effective community-based seed multiplication and distribution systems require training. Key to the process is to train the major stakeholders—farmers and extension technicians—together, because they *must* work together for the common goal.

Both farmers and technicians should be exposed, for three to five seasons, to basic seed production techniques such as rouging and packaging. Simultaneously, farmers will use their own indigenous ways to spread the new varieties.

But maintenance of seed purity and standards is essential. Thus, production of the initial breeders seed and foundation seed in a community-based seed multiplication system should be left to the professionals.

Some countries may decide to work with individual farmers in seed multiplication, while others may work with farmer groups. Guinea has used both approaches with huge success. Other countries were encouraged to consider the Guinea example.

### *Seed marketing*

Farmers must eventually market seeds among themselves, if a community-based system is to work well. Both the 'formal' governmental and private seed sectors should support the community-based system from the start. The 'formal' system will thus be able to buy, and market in other areas, excess seeds produced by the community system. In a sustainable seed market, the community-based system will dominate short-term seed supply, and the governmental or private sector will supply long-term needs. The two sectors should complement one another.

NARS were advised to start planning for seed multiplication early in the PVS process. Without proper planning, NARS might have to multiply many varieties simultaneously, straining scarce resources.

NARS should also involve voluntary organizations such as the Japanese Overseas Voluntary Service and other NGOs in PVS. These organizations also work closely with farmers, and might help fund the 'scaling up' of activities.

### **Time of evaluation**

The large number of entries in a PVS garden may have advantages and disadvantages. Participants discussed the practicality of evaluating 60 rice

varieties in a PVS rice garden in a single day at a single growth stage. Some pointed out that such a wide varietal mix, including rices of early, medium, and late maturity, makes a large spread in agronomic traits inevitable. Thus, simultaneous evaluation may automatically bias against some varieties. Grouping the varieties by maturity at planting could partially overcome the problem—if the information is available.

The timing of evaluation will depend on the agroecological zone. The time of planting should coincide with the farmers' planting time so that during evaluation visits, farmers can better compare the PVS entries with their local varieties.

Cooking quality of PVS varieties should be evaluated three months after harvest, when the grains have reached equilibrium, or have 'rested.'

### **Feedback to research**

Feedback was discussed in detail. How should breeders use the wide array of PVS data that farmers provide them? What should breeders do when farmers identify traits that they want in their varieties? How will the farmers' messages influence the breeding process?

Breeders should strive to understand the messages that farmers pass to them. For example, what does a farmer want when he or she cites "greenness of leaves" as a criterion for choosing a variety? Further probing questions should be asked to identify specific agronomic or grain-quality traits.

Breeders should use farmers' criteria in future breeding programs so that succeeding PVS trials

should include varieties with traits that the farmers suggested earlier. PVS might be repeated in a given location every five years.

#### *Prioritization of criteria*

Rice breeders in West and Central Africa have looked for widely adapted varieties for the past three or four decades. More recently, specific niches in agroecological zones have been targeted. Scientists are now trying to target the interspecifics to specific ecosystems such as rainfed upland or lowland.

Neither WARDA nor NARS breeders can combine all of the farmers' selection criteria into varieties. Thus, they should concentrate on more finite traits. NARS were encouraged to 'sieve' and prioritize farmers' preferences to develop a 'blueprint,' or vision of plant type. NARS should begin to ask probing questions in the second year of PVS.

#### *Breeders' utilization of PVS data*

One challenge of PVS is to sieve breeding objectives from the large pool of selection criteria that farmers provide. Participants pointed out that two or sometimes three researchers—a breeder, an economist, and possibly, an agronomist—are normally involved in PVS trials.

The breeders and the agronomists should jointly gather, quantify, and prioritize the selection criteria. The breeder should then use that information in the breeding program, or pass it on to WARDA. This was the original concept, but it can be adjusted. Some NARS reported such modifications at the workshop.

NARS should therefore reflect the extent to which they are using data gathered in 1999 in their 2000 activity reports.

Further, participants welcomed a recommendation that the 5th Participatory Varietal Selection meeting, in 2002, be mainly for breeders. A major purpose would be to examine how previous data on selection criteria are being used in breeding programs.

Participants noted that PVS trials, initially designed for the uplands, are being conducted in other ecologies such as in irrigated areas in Côte d'Ivoire and the Sahel regions, and even mangrove swamps in Guinea Bissau.

The main purpose of PVS is to get as many of the best varieties as possible to farmers who need them, as quickly as possible. Each country can tailor its methodology to meet the specific needs of its farmers.

Secondly, the PVS approach does not specify that all varieties should be interspecifics; farmers should have access to the best varieties, regardless of origin.

#### *Breeders' versus farmers' selections*

Participants noted that farmers do not base selection criteria on yield alone. Nor do farmers and breeders necessarily agree on varietal traits that are needed most. Participants also noted the possibilities of bias in farmers' selections if procedures for selecting participating farmers are faulty. Breeders were urged to always give top priority to farmers' selection criteria.

### *Requested tables: varieties, criteria, and traits*

Participants noted that selection criteria often depend on the social, economic, and gender landscape of the PVS site. They suggested that WARDA provide a matrix table showing varieties selected or rejected, selection criteria, and gender differences in Association member countries.

Participants also requested tables showing full characterization—including reactions to weeds, insects, and diseases—of varieties nominated for PVS trials.

### **Seed priming**

The UK's Department for International Development (DFID) supports seed priming activities within PVS. A DFID representative evaluated reports on seed priming trials in upland rice in Cameroon, Sierra Leone, The Gambia, and Nigeria. These trials were a sub-component of an international network for seed priming research.

Some programs confuse seed priming with pre-germination, the DFID representative felt, so he clarified the process. Seed priming is soaking seed for 12–14 hours, then shade-drying it before planting. Seeds are not incubated.

Results on rice and other crops in Asia have shown that seed priming is inexpensive and simple, with low risks and intermediate-to-high rates of return. In India, the yield return has been 25–40%.

In West and Central Africa, seed priming generally increased yields by 5–70%. But in The Gambia, yields of plots planted with primed seeds were 6% lower than those with non-primed seeds.

### **National capacity**

NARS were advised to focus on projects that are sustainable and achievable with available resources. PVS, participants noted, should not be a one-time shot. It should be a synergistic process among researchers and farmers to accelerate the diffusion of new varieties. Breeders should continuously be developing, and moving into the PVS system, rice varieties with traits that farmers have identified through the selection process. Thus, farmers continuously evaluate and use newer and better materials.

### **Donors' comments and expectations**

*Department for International Development (DFID), UK*

DFID expects PVS to have a huge multiplier and catalytic effect in the adoption of new technology. Appropriate varieties are a basic, low-cost and low-risk agricultural technology, but the PVS system of farmer–scientist cooperation should broaden from field trials of varieties to the diffusion of a wider range of technology for agricultural development. The expansion of PVS trials to seed priming is an example.

*United Nations Development Programme/ Technical Cooperation among Developing Countries (UNDP/TCDC)*

UNDP/TCDC expects the PVS system to contribute significantly to food security in West and Central Africa by increasing rice production and consumption as a staple, and the number of households that benefit from it.

UNDP also advised NARS to consider the farmers' total needs and environment. Future planning should include seed multiplication and the utilization of by-products such as rice straw. TCDC also supports South–South cooperation, and is pleased that 17 countries are working together, with a common objective, in the PVS project. NARS should strive for the rapid progress and achievements made through PVS in Guinea and Côte d'Ivoire.

#### *Systemwide Program on Participatory Research and Gender Analysis*

NARS were advised to continue emphasizing gender and impact analysis. The representative said that NARS in West and Central Africa are ahead of other countries in extending the frontier of PVS research.

#### *The Rockefeller Foundation*

Rockefeller has been 'behind the scenes,' giving support to biotechnology research, including the development of the interspecifics, and NARS staff development. The Foundation expects technological breakthroughs for marginal areas, and stronger national capacity for research in the region. The representative commented that many had thought that Africa's *Green Revolution* would not be through plant breeding, as it was in Asia. But a rapid increase in rice yields and production seems to be on the horizon—as a result of plant breeding.

This is a tribute, he said, not only to WARDA, but also to a man who not only led in the development of the new interspecific rices, but also spearheaded their transfer to farmers: Dr Monty P. Jones.



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# WARDA MEMBER COUNTRIES



## ABOUT WARDA

The West Africa Rice Development Association (WARDA) is an autonomous intergovernmental research association with a mission to contribute to food security and poverty eradication in poor rural and urban populations, particularly in West and Central Africa, through research, partnerships, capacity strengthening and policy support on rice-based systems, and in ways that promote sustainable agricultural development based on environmentally sound management of natural resources.

In collaboration with the national agricultural research systems (NARS) of member states, academic institutions, international donors and other organizations, the work of WARDA ultimately benefits West and Central African farmers—mostly small-scale producers—who cultivate rice, as well as the millions of African families who eat rice as a staple food.

WARDA was constituted in 1970 by 11 West African countries with the assistance of the United Nations Development Programme (UNDP), the Food and Agriculture Organization of the United Nations (FAO), and the Economic Commission for Africa (ECA). It now comprises 17 member states: Benin, Burkina Faso, Cameroon, Chad, Côte d'Ivoire, The Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo.

WARDA is a member of the Consultative Group on International Agricultural Research (CGIAR), a network of 16 international research centers supported by more than 50 public- and private-sector donors.

Donors to WARDA in 1999 were: the African Development Bank, Canada, the Common Fund for Commodities (CFC), Côte d'Ivoire, Denmark, France, the Gatsby Foundation (UK), Germany, the International Development Research Centre (Canada), the International Fund for Agricultural Development, Japan, the Netherlands, Norway, the Rockefeller Foundation (USA), Sweden, the United Kingdom, UNDP, the United States of America, the World Bank and WARDA member states.

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