

Field Visit to the West Africa Rice Development Association: 20-23/02/2000.

Background

A visit to WARDA was arranged as part of the Multi-Agency Partnerships for Technical Change in West African Agriculture (MAPs) research project. The ODI research team arranged the visit with Dr. Amir Kassam, Deputy Director General for Programs, to meet with WARDA scientists who are developing and promoting new rice varieties throughout West Africa. Dr. Blench and Robert Chapman attended from the ODI together with the MAPs research partner, the Head of the Faculty of Agriculture at the University of Development Studies, Tamale (Northern Ghana).

WARDA is located 30km North of Bouaké, Côte d'Ivoire where it occupies a site of 700 ha having moved from Liberia in 1988. The site is divided into four areas as follows:

Table:1	WARDA site.
Area(ha)	Crop Type
50	Lowland Irrigated rice
200	Mixed valley rice
400	Upland rice
50	Administration/Laboratory buildings.

There is a 5m m³ dam which provides water for the lowland experimental plots through canals and underground pipes and water can also be pumped to the upland irrigated areas. There are approximately 350 permanent staff and a further 150 to 400 are employed on a daily basis. Three different levels of management are used for the experimental plots to reflect different levels of input under each cropping regime.

Table:2	Input levels
Low Input	Threshold levels for soil clearing, inputs are at the same level as small-scale farmers: no fertilizer, use of hand-hoes and burn the undergrowth.
Medium Input	5mm tillage by power-tillers or animal traction. 80kg/m chemical input and some spraying of herbicides.
High Input	Can use deep tillage, deep ploughing, irrigation and fertilizers. Land is cleared and leveled.

The site area has an average annual rainfall of 1060mm (based on 30 years data) which is bimodal falling between May and June then between August and September, although the gap between the rains has been increasing.

Following the site visit of the WARDA operations a round table meeting was convened to introduce the MAPs project to the scientists identified for collaboration by the Deputy Director. These include Dr. Frederic Lançon (economist), Dr. Monty Jones (rice breeder), Dr. Amadou Beye (breeder/agronomist), Dr. Marco Wopereis (agronomist), Dr. David Johnson (weed scientist) and Dr. Rachel Kent (weed scientist). A series of meetings were held following the round-table meeting to discuss with the individuals the areas of their research that are appropriate for collaboration with the MAPs field research of rice farmers' production and marketing strategies which is being carried out in Mali, Ghana and Nigeria.

Participatory Varietal Selection (PVS) and the Community-based Seed Production System(CBSPS).

MAPs research collaboration meetings at WARDA:

Dr. Monty Jones- Rainfed Program Leader/ Rice Breeder - *meeting 21/02/2000*
Dr. Amadou M. Beye- Breeder/Agronomist, Technology Transfer - *meeting 21/02/2000*
Dr. David Johnson- Weed Scientist- *meeting 22/02/2000*
Dr. Rachel Kent- Weed Scientist- *meeting 22/02/2000*
Dr. Frédéric Lançon – Economiste- *meeting 22/02/2000*
Dr. Marco Wopereis – Economist - *meeting 23/02/2000*
Dr. Alain Audebert – Plant physiologist – *22/02/2000*
Dr. Wilfried Hundertmark – Water Management Specialist – *meeting 22/02/2000*
Dr. Amir Kassam- Deputy Director for Programs- *21&22/02/2000.*

Dr Jones is the Rainfed Program Leader and Rice Breeder at WARDA who has been at the forefront of the rice interspecific hybridization project. His team has successfully created a new rice variety combining resistant characteristics of African rice varieties (*Oryza glaberrima*) with the higher yielding characteristics of the Asian rice varieties (*Oryza sativa*). In the past new varieties have been presented by WARDA to farmers as a completed rice variety which can then be tried and adopted. This top-down method of technology transfer does not facilitate the inclusion of farmers' comments and experiences in the breeding process and therefore a new system of 'Participatory Varietal Selection'(PVS) has been developed. The PVS enables farmers to interact with the rice breeders through a process of selecting from a number of varieties on offer. Farmers are invited to take part in a PVS on a regional basis and provide the feedback on the varieties that they choose at the initial stage, the maturing stage and after harvesting. Farmer preferences and their reasons for choosing different varieties are then used by the WARDA rice breeders to develop further

varieties with the most popular characteristics. The rice breeders can then use the information regarding farmer's decision making processes to develop more appropriate varieties. Farmer's are allowed to choose 5 new varieties to grow during the PVS which are compared to each other and to two older varieties throughout the cropping season. The characteristics of each variety are assessed at each stage to establish what aspects of each variety are valued most by farmer's and can be most usefully replicated in new varieties.

WARDA introduced the PVS together with Task Force (TF) mechanisms in order to ensure 'early and broad dissemination' of new varieties throughout West Africa. Although the PVS centers around farmers' choices, the process also involves development agencies, NGOs and the national agricultural research and extension systems (NARES). Approximately 2000 farmers in seven countries selected new rice varieties in 1998 and a further seven countries were added in 1999. The extension of the PVS includes training of a plant breeder or agronomist and a social scientist or an extension specialist from each country together with United Nations Volunteers (UNVs), NGO staff working at the grassroots level and extension agents.

A new seed supply system has also been developed to utilise the indigenous knowledge and networking of local farmers called the 'Community-based Seed Production System'(CBSPS). The National Seed Service (NSS) only certifies the foundation seed and small quantities are made available through extension agents. The informal seed growers are from NGOs, farmers' cooperatives and private seed producers who produce non-certified seed for their communities. WARDA estimates that seeds can spread to some farmers within 4 years of a variety's release which is 3 years earlier than through the 'formal' seed certification process. Farmer's need to be trained in seed production techniques to ensure the quality of the seed being produced at community level is of a sufficiently high quality. Dr Amadou Beye is an agronomist and breeder at WARDA who specialises in technology transfer. In order to ensure high quality seed production outside the formal national seed supply systems training is arranged using senior technicians and extension workers. The extension workers attend workshops and training which is then disseminated at village level using NGOs. The multiplication scheme benefits from the experimental nature of West African farmers who already trade in seed varieties that have not been officially released. Farmers in Guinea have been found to be particularly experimental by WARDA scientists and through the multiplication scheme 33 growers produced over 480 kg of seed in 1999 on 8.1 hectares of land.

Analysis of rice collections.

Samples of different rice varieties will be collected throughout the MAPs research program by the in-country researchers for Mali, Ghana and Nigeria. Analysis of these varieties at WARDA's facility in Bouaké will help to identify which of the varieties that are being grown are local and which are new. A sample of a known variety can easily be identified by comparison with the germplasm collection which holds 16 000 accessions in cold storage at WARDA. Any unknown varieties will be grown on test plots to check the characteristics before being added to the collection and further samples can be taken to

verify its location. The surveys of rice farmers in Nigeria, Mali and Ghana will also list all the varieties of rice that are grown by each community through a village level questionnaire. Farmers will be asked individually which varieties they are currently growing and what characteristics they would like to be improved. The MAPs research will provide additional farmer profiles to those identified by the PVS which can be used both to scale-up existing technology transfer and to incorporate more data on farmers' choices into the development of new varieties.

The rice breeding process

The rice breeding process now incorporates the testing during the PVS of new varieties by farmers and then incorporates the results into the final breeding stage. The initial rice varieties are grown on test plots at WARDA over a period of 18 months under low, medium and high management conditions. New varieties are bred for a variety of different conditions in West Africa and the interspecific hybrids between *O.Sativa* and *O.Glaberrima* have been bred to combine the hardiness of African rice with the productiveness of Asian rice. The new varieties that are bred following the PVS represent both the most popular varieties of those that were tested and those characteristics that were most popular in all the varieties. It takes 5 years from leaving the fixed line trials at WARDA for a variety to be tested in the field and new breeding to take place before a new variety is complete. The first time this process will complete a full cycle is this year in Côte d'Ivoire where the Ministry of Agriculture is growing 20 tons of the two most popular varieties from the PVS to sell to farmers. It is the farmers apparent willingness to pay for new rice seed that illustrates the demand for new technologies and improved crops. Dr. Jones also emphasises the importance of maintaining genetic diversity by ensuring that as wide a selection of new varieties as possible should be made available to farmers in different areas to avoid an increased risk of disease and pest damage in the longer term. Sasakawa Global 2000 have introduced a package of new rice varieties in Guinea which includes fertiliser to achieve the highest yields possible. However, many varieties are now bred to reflect low input conditions which are more common amongst West African rice farmers with various characteristics to improve the plant's survival rate. Some of the problems that the WARDA rice breeders have been addressing in particular are as follows:

- Mildly Acidic and phosphorous deficient upland conditions.
- Drought prone areas.
- Competition with weeds.
- Low yields.
- Diseases and pests.
- Nutritional Value.

Dr. David Johnson is a weed scientist who is working at WARDA on a DFID funded project to help identify the problems rice farmers are experiencing with weeds in West Africa and develop methods for reducing their losses. Weed competition varies widely due to the large number of different species involved. A number of the interspecific hybrid rice varieties bred at WARDA are tested for their weed competitiveness under

low, medium and high input conditions. Field plots are also used throughout Côte d'Ivoire to test weed competitiveness in varying topographical and hydrological conditions. Dr. Johnson and Dr. Kent are researching ways to reduce the yield gap between lowland and upland rice crops. *O.Glaberrima* cultivars produce higher leaf areas than *O.Sativa* which help them to compete with weeds and these characteristics are being used to improve the rice varieties that are grown in upland areas. The upland rice varieties are farmed less intensively than the lowland varieties and therefore crop management techniques such as increased nitrogen levels are also being developed to reduce the yield gap. The MAPs research in Mali, Ghana and Nigeria will identify the different cropping systems of farmers and the level of inputs used. In establishing which rice varieties and crop management methods are used in different areas the MAPs in-country studies will collect data on the problems, such as weeds, that farmers are most concerned about within their local environment. The research findings will be available to WARDA researchers through an open collaboration to enable data on areas that are not covered by field plots to be examined and improved crop management solutions to be developed.

Technology development and transfer.

Dr Marco Wopereis has been working on improved crop management at the WARDA research station in St.Louis, Senegal. Yields have been improved in the Senegal River Valley through the *Irrigated Rice Program* which has combined research on varietal selection, the preservation of soil quality under irrigation, fertiliser use, the management of cropping calendars and farmers' constraints with technology development and transfer. Dr. Wopereis has been involved in developing partnerships with rice farmers in Senegal in order to develop and transfer appropriate technology such as a new thresher-cleaner. The development of a thresher-cleaner suitable for rice farmers in Senegal followed the results of farmer surveys which identified harvest and post-harvest costs as important constraints to the profitability of irrigated rice production. The thresher-cleaner that was developed by WARDA, IRRI and Senegalese researchers was able to clean 6 tons per day compared to manual production of 4.5 tons. The separation recovery rate was 99 per cent reducing the need to sift the straw for non-threshed rice or for winnowing. The private sector and the NARS are building local prototypes for reproduction of the new thresher in Mali, Burkina Faso and Mauritania with technical assistance from WARDA. The thresher-cleaner is an example of technology development resulting directly from a partnership with farmers to achieve an understanding of their needs and constraints. In this case the benefits of the technology transfer are not only in the improved efficiency of the threshing process but also the reduction in the postharvest grain losses that arise from delays and loss of humidity. The MAPs research will identify constraints experienced by rice farmers in both irrigated and non-irrigated production systems which could benefit from the technologies being developed through WARDA's research. Research areas for the development of new technologies will also be highlighted together with opportunities for scaling up the use of existing technologies that are being successfully employed by rice farmers in Mali, Ghana and Nigeria.

Research collaboration opportunities between WARDA and the MAPs programme.

- Establish an open dialogue throughout the duration of the MAPs research (until 09/2001) between the relevant researchers at WARDA and the MAPs researchers both from the ODI and the three research partners in the study countries of Mali, Ghana and Nigeria.
- Identify WARDA activities of direct relevance to the MAPs research to maximise coordination and knowledge transfer between researchers. The PVS was identified as an activity which MAPs partners could benefit from attending and/or from maintaining links with the process when it is introduced in their study area.
- The identification of rice samples that are collected in the field can be checked against the germplasm collection at WARDA. This will enable a more comprehensive map of rice variety use to be made of the study areas and could provide additional varieties for the WARDA database. It will also help verify the data collected on farmer preferences and their ability to access new varieties.
- The MAPs farmer surveys and village questionnaires may help identify appropriate locations for further research into specific constraints, such as weed competition, and can provide additional data for the rice breeders to that collected through the PVS.
- The West Africa Rice Information System (WARIS) will provide MAPs researchers with scientific and technical information to support their research throughout the programme.
- Research areas for the development of new technologies will be highlighted together with opportunities for scaling up the successful use of existing technologies.