

**Rice Breeders Technical Exchange Network Meeting**  
**Kampala, Uganda**  
**April 21-23 2008**

This is was the first African rice breeders' network meeting organized by AGRA's Program for Africa's Seed Systems (PASS). It was attended by breeders from 9 African countries (Uganda, Kenya, Tanzania, Mozambique, Malawi, Nigeria, Ghana, Rwanda and Mali). The meeting was also attended by scientists from the International Rice Research Institute (IRRI), The Africa Rice Center (WARDA), Seed Companies and Farmers. The meeting was officially opened by Dr Dennis Kyetere, the Director General of NARO. In attendance was the Director of PASS, Dr Joseph DeVries.

**Rice production in Africa-Remarks by Dr. Joseph DeVries**

Rice is an African staple crop and many African countries undertake costly imports from Asia and the Americas to meet their deficits. The increasing world demand for food and the high prices coupled with Africa's accelerated urbanization, require increased on-farm production of rice. According to Dr Devries, "African farmers need new rice production technologies in order to competitively produce and supply the local and world markets". This objective can be met through use of current technologies to develop and release new improved rice varieties, getting them commercialized and adopted by farmers. Dr. DeVries quoted a successful case study of the Nerica rice being grown in Uganda today. The introduction of NERICA upland and lowland rice varieties in Africa has a great potential. NERICA rice varieties have specific attributes like tolerance to drought, are early in maturity and are high yielding. WARDA has distributed over 18 upland and 11 lowland varieties in sub-Saharan Africa. In Uganda alone, 5 upland varieties three of which are NERICAs are released and with farmers.

Rice as a farmer's crop faces specific constraints most of which can be solved by breeding. Lowland rain-fed rice has problems of diseases like the rice yellow mottle virus (RYMV). In Tanzania rice production is threatened by RYMV which can cause up to 100% yield loss. Today in Kenya, almost 60% of the crop is hit by rice blast. Because of these frequent challenges many farms are faced with declining yields which currently stand at with an average of less than 2 t/ha. Farmers need new crop varieties, access high quality rice seed and favorable policies to increase productivity.

**Key challenges: Rice sector in Africa**

- Lack of adapted varieties
- Labor intensive
- Planting difficulties - timing
- Weeding
- Birds
- Drying
- Processing and marketing
- Challenges in seed multiplication
- Takes up to 5 years to release a new variety

**Key challenges: Private sector involvement in rice improvement**

- Limited financial and physical resources
- Short technical and business skills
- Policy and regulatory constraints
- Inadequate certification
- Poor variety maintenance
- Small seed market that is fragile
- Agro-ecological constraints
- Political instability

**The Rice Situation in Uganda-**

**Remarks by Dr. Dennis Kyetere-Director General NARO-Uganda**

Dr. Kyetere main points were that: There is no better opportune time to focus on rice in Africa as now because there is less rice being exported by the rice producing countries. Only 7% of rice produced enters the international market, the rest is left for domestic consumption. Therefore the benefits of using adapted varieties have is now evident because of the high yields farmers are getting on their farms in Uganda since the introduction of the NERICA varieties. He said that Uganda needs to increase the on-farm production for rice especially now. This is necessitated by the growing population which now is mainly young with 51 percent of the population made up of children under the age of 14 years. An increase in the number of rice farmers in Uganda and accelerated dissemination of upland varieties through a national program supported by the Head of state. Uganda has reduced rice imports by 35% between 2004 and 2007, saving the country an import bill of USD 30 million. The number of rice farmers has also grown from 4,000 in 2004 to over 35,000 farmers by 2007,

while the rice acreage has been going up ever since the first NERICA was released in 2002 at 6,000 ha to 40,000 ha in 2008.

There is a growing demand for rice in Uganda as the rice sector provides an opportunity to generate income and employment and thereby revitalize local economies. As a result, a steering committee has been formed to oversee and provide policy guidance for the development of Rice Industry in Uganda. In October, 2007, Uganda joined WARDA as a member to further benefit from various technologies the Center has.

### **Brief on the Objectives of the meeting**

The purpose of the meeting was to enrich national program breeders on the best opportunities available for breeding and delivery of improved rice varieties to farmers in sub-Saharan Africa. The main objective for the network meeting was to provide an interactive forum between private and public rice breeders in different countries in Africa and also to share experiences that will promote the development and access of improved varieties to farmers in varying ecological zones. The meeting also discussed challenges faced in commercialization of rice in Africa.

### **Constraints to increased rice production in Africa**

Rice production constraints faced by farmers include:

- Incidences of diseases especially rice rust, bacterial blight, sheath rot, rice blast and rice yellow mottle virus (in low land rain-fed areas)
- poor seed delivery systems with limited involvement of private seed producers
- limited national breeding capacities
- little private sector seed involvement in seed production and distribution
- Late maturity and poor adaptability of new varieties
- drought, weeds, floods and poor water management
- soil fertility challenges exacerbated by limited access to and use of inputs

- soil salinity, erosion, iron toxicity
- lodging
- low temperatures and changing weather patterns
- high cost of production
- restrictive bilateral agreements by African states on rice imports

The main breeding activities being undertaken by rice breeders to resolve constraints in rice production include

- selecting for drought tolerance
- improving lodging, threshability, grain quality, cooking attributes, aroma and other farmer attributes
- characterizing RYMV strains
- breeding for disease resistance e.g. RYMV and blast
- reduced plant height and crop cycle of cultivars with high yielding and early maturing
- dissemination and delivery of improved seed to farmers
- Testing NERICA for adaptation to local conditions
- capacity building for extension, seed producers and farmers

### **Important results from on-going work**

- in Tanzania, 80 rice lines identified to be resistant to RYMV using marker assisted selection
- In West Africa recent results show that new varieties are higher yielding with differences in yields from the normal 1.5 t/ha to 3.5 t/ha for upland varieties on farmers fields. With the new interspecific crosses even higher yields are recorded of between 9 t/ha for lowland and 11 t/ha for irrigated varieties in various countries
- In Uganda five new rice varieties have been released in the last five years for various ecologies and several other varieties are undergoing national performance trials in Kenya
- There are emerging linkages between private sector, farmers' associations

- WARDA and IRRI have new superior materials to share with NARS
- Some NARS have started their own breeding programs and have useful breeding materials being channeled out.

## **Opportunities to improve rice breeding and production in Africa**

1. **Support to Breeding Activities:** AGRA will support rice breeders to develop improved varieties and facilitate their dissemination to farmers through partnerships with private sector enterprises and farmers based seed production groups. One of the goals of AGRA is to increase the capacity of national programs to breed new crops by training breeders and crop technicians. In order to increase awareness on the role of improved seed for agricultural development among farmers, policymakers and regular meetings and forums for interaction are organized. AGRA also supports promotion activities. With emerging challenges to rice production in Africa now evident as in the case of the recent outbreak of the devastating rice blast disease which has resulted in losses of large acreages of rice in Kenya.

2. **Support to Private Sector:** Private sector organizations will be assisted to improve their seed production and delivery activities and also with funding (in form of grants and loans). Interested companies must meet certain criteria for seed production, distribution and dissemination activities. AGRA will also strengthen business training in SMEs, support breeders to produce breeder and foundation seed, and national seed associations and community seed producers.

3. It was reported that seed companies are now more able to access improved varieties from breeders. Also community seed producers are playing a significant role in production of standard seed.

4. **Networking and information sharing:** The rice scientists have the opportunity to learn from experiences and new initiatives of international

institutes like IRRI which has established activities in six countries in Eastern and Southern Africa. The strength of IRRI is in the germplasm gene pool. IRRI have also developed technologies to mechanize rice production by use of 2-wheel portable tractors, portable threshers and shellers. Also the African Rice Center, IRRI and CIAT have many sources of new breeding materials for national scientists involved in rice breeding in Africa.

There was a presentation from ASARECA on finalizing its programs on staple food crops to strengthen activities in eastern and southern Africa. A recently established forum - Eastern, Central Africa Rice Researchers Network (ECARRN), has the potential to promote information exchange, development and dissemination of rice technologies, as well as improve regional capacities for rice improvement

To enhance greater sharing of information, AGRA has developed and deployed a web-based Breeders Information System. Breeders will be able to quickly learn and share information on rice improvement activities from colleagues in other countries and also monitor performance of the released varieties. The database is restricted to AGRA-supported breeders and can be accessed at [www.africancrops.net](http://www.africancrops.net) website.

### **Proposed strategies to increase improvement and delivery of new rice varieties**

There is need for increased germplasm exchange to enhance the process of breeding otherwise Africa's opportunity to realize improved food security is threatened.

Greater participation of farmers from early stages of variety development and testing is recommended. Breeders must also engage in market driven research.

Decentralized research programs to various ecological zones may accelerate rice breeding efforts.

The core factors promoting African food crisis need to be well understood. There is need for technological transformation of African agriculture including improved access, value addition and adoption with more emphasis on adaptable seed varieties delivered through public-private partnerships.

More emphasis must be laid upon development and dissemination of upland rice varieties. Rice is considered crucial to eradicate poverty as it can be grown for two seasons in many countries and three times under irrigation.

To enhance rice production the qualities of local varieties need to be improved compared to imported varieties.

Stronger linkages among stakeholders in rice industry are important for increased production and need to be enhanced.

Capacity building for extension, seed producers, farmers and farmer-organizations is required in order to increase dissemination, adoption and land under rice cultivation. The following areas need special consideration:

### **1. Access to germplasm**

There are now clear emerging challenges and constraints that limit the increase in rice production. The special cases are the rice yellow mottle virus menace in Tanzania, rice blast in Kenya and drought which affects many African rice growing environments. These needs dictate the necessity to breed locally adapted varieties. It is important to use both local and exotic germplasm. Therefore there is need to strengthen linkages and access of traits like those found in the NERICA rice varieties. Farmers need particular traits or quality in a variety. For example NERICA 10 released in Uganda gives high yields and has short maturity period but lacks the exact cooking qualities that farmers desire

like 'aroma'. Germplasm for unique traits is available from IRRI, INGER and WARDA. Several options were floated that could facilitate breeders access germplasm. One proposal to solve the problem of germplasm access is to have collective regional nurseries where scientists meet together in a common field with nurseries and select lines with particular attributes that they like. The breeder then requests for seed of this particular line. For rice these nurseries are organized by IRRI. This activity can also be complemented with a regional travelling workshop. In 2008, IRRI has organized such a nursery evaluation in Mozambique. Therefore to in order to improve access to germplasm for diverse farmer preferences

- Breeders need to identify adapted lines and varieties for their local farming systems
- Long-term training is needed for extension staff and farmers to detect threats such as diseases and pests early enough and before major outbreaks occur
- A Rice Monitoring Team should be formed to provide information and organize quick response to outbreaks and early detection of threats to production. AGRA should coordinate this
- Opportunities offered by INGER-Africa and also the IRRI-WARDA projects in Mozambique in germplasm exchange need to be exploited by breeders and seed companies
- It may be important for NARES to establish regional research nurseries for variety evaluation in order to improve access to breeding materials.
- National breeders are encouraged to regularly request finished materials directly from IARCs for their breeding work.
- National breeders with improved materials should share them with their counterparts in other countries. Mali was very willing to share their germplasm

2. **Rapid release of new varieties to farmers:** In a number of countries the time required to release new varieties is too long. It takes 3-5 years to release a new rice variety and this may be slowing down the access of new rice

varieties by farmers. Variety release depends on the country. However the t breeders and regulators have a critical role to play. Besides a good government policy is needed to facilitate speedy variety release. The use of new tools like the farmer participatory evaluation and political good will enhance adoption of new crop varieties. Thus

- Breeders are encouraged to use participatory variety selection involving farmers, and to involve seed companies, regulators and policy makers early enough
- Harmonization of variety release laws at regional level may be useful but not required. Some efforts have been initiated by regional groups like ASARECA, FARA to harmonize the regulations
- A focus on Ecosystem breeding for specific ecologies will improve adaptation and take up of new varieties. this should pay attention to farmer attributes during breeding in order to guarantee greater uptake of new technologies
- Building local capacities by increasing the number of breeders through long and short term training is needed.
- There is need for traveling workshops for breeders to encourage the r direct interactions and discussion for specific needs in different ecologies. The on-spot discussions facilitate the sharing of experience and responses d to challenges to rice breeding and dissemination
- Financial support is required for national breeders to produce breeder and foundation seed production.
- Breeders need to interact with seed companies to facilitate better access to breeders seed
- AGRA will fund breeders seed production by breeders and seed companies

### **3. Rice Seed Delivery Systems:**

In many countries, quality rice seed is not readily available and farmers have no alternative other than recycling seed of old varieties. This is partly because rice is a self pollinated crop seed companies tend to show little interest in rice seed.

Seed recycling by farmers for self-pollinated crops like rice are considered constraints to the participation of private sector in production and marketing of rice seeds. In some countries the use of 'Standard' and 'Quality Declared Seed' is common where this is acceptable. In West Africa the challenge is even greater because there are so few seed companies in operation. The present challenges in seed delivery systems are related to rice policy issues and output markets that will give farmers incentives to buy high quality seed and also scale-up the involvement of private sector. The mechanization of rice production may also result in an increase the rice production. Some of the mechanization options are the use of a two wheeled tractor, thresher and harvester. The use of mechanized equipment is welcome advance in Africa because labor is very expensive now and is becoming unavailable even in the rural areas. However issues of cost of equipment and health issues associated with mechanization must be considered. To enhance adoption, governments would also need to be advised to wave taxes on these tools and inputs to make them affordable by smallholder farmers. Thus we need to look at the options of appropriate mechanization for the region.

**Improving seed delivery systems will entail:**

- greater involvement of governments to accelerate dissemination and uptake of upland rice varieties
- Recognition of the role of cooperatives as this important in farmer training for production of quality seed and their capacities must be strengthened through training and other support
- There is urgent need to increase and sustain the interest of the private sector rice seed production and marketing given the guaranteed output markets. Private investors can also invest in processing machines and equipment.
- Breeders need to create awareness of their improved varieties through close collaboration with various stakeholders particularly seed companies and farmers.

**4. Training and capacity building:** A lot of training to increase the capacity of farmers to increase the on-farm production of rice is needed.. The training needs to be extended to the extension officers also by use of various techniques including videos, booklets and radio programs. The group recommended a coordination of all the rice training programs and an upgrading of the rice training institute at Kilimanjaro. The facility is being constructed upgraded by IRRI. Thus

- Breeders and seed companies need to conduct training of trainers (TOTs) for farmers and extension staff in order to increase rice variety adoption

Expanded training for technicians and breeders (for both masters and Ph.D) is required given the shortage of rice breeders in Africa. The training can be extended to include the use of short online training courses

- Regional training programs needs to be established for synergy and greater exposure for breeders and extension staff. AGRA should coordinate this.
- Preparation of training videos and radio shows for farmers and small seed companies on rice production will improve adoption.
- The NERICA Rice Production Compendium need to be widely distributed in Africa
- Based on their previous experience, WARDA and IRRI are in a position to support short term training for rice breeders and field in west Africa

**5. Fertilizer dosage for rice:** Fertilizer usage and dosage are a site specific issue. The fertilizer needs and doses differ from country to country. As regards to dosage it is difficult to establish a blanket dosage for the whole region. Particular countries would have to test the right fertilizer recommendation for their production systems of rice. This meeting strongly supports the government moves to reduce fertilizer prices, and this is an area AGRA must pursue further.

**Fertilizer application rates on rice also have an implication on disease resistance. Therefore;**

- Rice improvement requires multi-disciplinary approaches that involve natural resource scientists to guide development and use of safe application rates
- There is need to develop databases, case studies and success stories on application rates and disseminate them widely
- Farmers will need to be trained on fertilizer use and encourage on-farm self-experimentation

**6. Plant Variety Database:** the rice breeders agreed that they are willing to share data but urged PASS to coordinate the standardization and the custody of the data. In the naming of crop varieties it was also agreed that even if the naming differs it should be possible to track same varieties especially the NERICA. WARDA always keeps track of all their materials because they would want to trace it. Thus **Information and database require**

- Rice breeders are encouraged to share their trials data through the AGRA's web-based Crop Variety Information System. Scientists are encouraged to use varieties in a way the crop pedigree can be tracked while sharing information through the database
- Breeders are encouraged to utilize the web-based IRRI Rice Knowledge Databank.

**7. In responding to challenges in shifting from irrigated to upland rice given diverse ecosystems in Africa, it was noted that**

- There is a need to promote among farmers the change from the culture of farming irrigated rice and to explore production of upland rice. Breeders need to work closely with all groups and in order to realize successful dissemination and adoption of upland rice.
- Improved access to rice processing equipment may encourage production

The meeting ended on a positive note with breeders agreeing to keep exchanging information, germplasm, making use of local germplasm to develop new varieties to suit farmers' preferences. On the other hand, IRRI and WARDA showed renewed interest to continue working with national NARS. RYMV and blast are the two major disease constraints and breeders will continue to address them in their breeding programs.