Towards more African Rice to Fight Poverty in Sub-Saharan Africa

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THE YEAR 2000 was a very busy, but successful one for WARDA, with its highlight in the presentation of the CGIAR King Baudouin Award to WARDA for the development of the 'New Rice for Africa' (NERICA). NERICAs are now a key component of WARDA's research strategy to tackle poverty, food security and environmental protection in West and Central Africa. WARDA is developing a range of germplasm, profiting from the African rice gene pool, to address the diversity of African rice-growing environments. Combined with natural-resources management techniques, this provides a basket of options for farmers, with great potential to increase local rice production, reduce rice imports and improve the livelihoods of farm households, while conserving natural resources and biodiversity.

Given the growing intensity of upland use and its inherent fragility, potential production gains in upland rice-based systems are modest. WARDA's applied research aims at sustaining productivity gains while stabilizing environmental equilibria in watershed production systems undergoing intensification. Our strategy has two components: (i) the stabilization of upland systems through improved land and crop management, and (ii) relieving pressure on uplands by making the cultivation of adjacent lowlands more attractive and sustainable. Our technology-development research targets various stages in the transition from extensive to intensive cropping systems. Since limited labor availability remains an important constraint during early stages in the transition from land-using to land-saving production systems, our research focuses on developing labor-saving and environmentally compatible technical solutions. That uplands can be intensified in a sustainable way is shown in Guinea, where NERICA lines are making rapid headway, providing scope for farmers to grow leguminous crops in the same season because of their shorter growth cycle compared with traditional cultivars. The success of the NERICAs in Guinea is based on a combination of participatory varietal selection (PVS) and community-based seed systems (CBSS), highly motivated farmers and solid Governmental support. The Guinea experience shows that an enabling environment is essential. This may require policy interventions to address institutional constraints or the development of improved rice processing, marketing and distribution systems. CBSS is clearly an answer to address weak national seed multiplication systems for rainfed-rice farmers.

The research strategy for inland valley lowlands recognizes that intensification is only sustainable if it maintains the natural-resource base, including crop and ecosystem biodiversity. The technical approaches to intensification, however, must be different for rural, labor-limited production systems on the one hand, and land-limited systems—such as peri-urban lowlands—on the other. For rural areas, we are developing low-management rice varieties with multiple biotic

and abiotic stress resistance derived from diverse genetic sources, as well as affordable water and soil-fertility management practices that, when combined, will make swamp rice cultivation an environmentally safe and economically attractive enterprise. This will also allow resource-poor farmers to gradually shift from fragile uplands to the more robust lowlands.

Research on land-limited, high-input lowland systems, however, will not necessarily aim at further intensification. Instead, we seek greater diversification by developing economically attractive crop rotations and soil–crop management systems that protect the environment and improve input-use efficiency. Farmer-participatory approaches are central to our strategy to ensure a good local fit and acceptance of the resulting technologies. The strategy is, therefore, to develop lowland cultivation methods that are profitable, safe for human health, provide local food and income security, require minimal initial investment, and allow for sufficiently flexible individual calendars for labor use. These systems must build on varieties that have horizontal (i.e. broad-based) resistance to the major local biotic stresses.

The development of rice-based vegetable production provides important opportunities in terms of diversification (income generation, food consumption) and intensification (optimization of resource use) in WARDA's target area, particularly in peri-urban lowlands. WARDA's investments in trying to initiate complementary vegetable research in the region are now starting to pay-off. By end of 2000, three new restricted-fund projects became operational. These projects include the recruitment of a visiting scientist and a vegetable specialist.

Complementary to the rice-based vegetable production projects, WARDA initiated a new peri-urban project in 2000, again with restricted funding. The project is entitled 'The evolution of agricultural systems in the peri-urban lowlands of West Africa and the development of policy and technologies for their sustainable intensified use.' It aims to sustainably intensify peri-urban lowlands, by (1) identifying areas and conditions that favor lowland intensification, diversification or both; (2) developing technologies and decision aids that reduce tradeoffs between economic performance and environment risks; and (3) providing options for currently less exploited lowlands along the rural to peri-urban gradient.

Regional capacity building on the design, planning and implementation of rice research have implications not only for improving the delivery and impact of research, but also for wider human and social capital formation among the actors as well as in the targeted communities. Our training activities include a series of specific training efforts and events that include: international workshops and hands-on work as visiting scientists or fellows at WARDA; developing regional capacity in the form of trainers; international conferences and symposia; developing and disseminating training materials; and producing guidelines, state-of-the-art studies and reports of rice research experiences. Over 100 rice scientists from West and Central Africa attended the first Regional Rice Research Review for West and Central Africa in April 2000. A large number of quality papers was presented, soon to be published in a proceedings.

Beyond the accomplishments that are featured in this Annual Report, there were several others that deserve mention. WARDA continued widening the genetic base of the West African rice germplasm by successfully introgressing useful genes from the indigenous *Oryza glaberrima* into *O. sativa.* We are continuing to develop interspecific progenies that show higher levels of tolerance and resistance to major yield-limiting stresses in West Africa, including drought, rice yellow mottle virus (RYMV) and acidity, together with good grain quality and stable high yields under low- and high-input conditions—these are being adopted by farmers.

Participatory approaches to technology development and dissemination are being adopted and adapted in 17 countries in West and Central Africa by WARDA and its national partners to facilitate farmers' involvement in the processes. These studies allow for accelerated diffusion of new technologies, as farmers themselves take the lead in

selecting acceptable materials using their own criteria. The approach has provided feedback to WARDA's technology-development programs. It has also provided direct information on technology dissemination processes, highlighting promising technologies that address the needs of rural agricultural populations in West and Central Africa. The approach has already paid handsome dividends, for besides speeding up the development of new varieties, it is helping to gauge the acceptability of available materials as well as stimulating demand for new varieties.

Our research on crop and natural resource management (C&NRM) in the upland systems showed the potential of the use of leguminous cover crops and the benefits of rock-phosphate on poor upland soils. These technologies, in combination with weed-competitive and acid-soil adapted interspecific rice varieties, will enable resource-poor farmers to stabilize upland rice cultivation, concentrating their farming on limited areas, thereby reducing destructive slash-and-burn practices. Yields will be stabilized, while labor productivity will be increased.

Water control and access to markets are key factors influencing the possibilities for cropping intensification and diversification in rainfed lowland systems. Given the extent of the lowland valleys, i.e. 20 million ha in West Africa alone, potential impact of improved C&NRM practices on food security in West Africa is tremendous. Options include dry-season cultivation of legumes, vegetables and root crops, and double-cropping of rice. Retaining and recycling upland soil nitrogen (N) *in situ* through deep-rooting crops (e.g. pigeon-pea), capturing loss-prone N in the hydromorphic fringe or during the pre-rice cropping niche in lowlands may reduce N losses to the atmosphere. Nutrient management through the use of N, phosphorus, potassium and zinc nutrients, along with the use of iron-tolerant lowland rice varieties, provides technology for increasing the productivity and production of rice in the wetlands where iron toxicity is present. Use of tolerant cultivars with proper water and nutrient management for reducing iron toxicity will help extend wetland rice cultivation in the inland valley systems.

Crop and fallow management and crop rotations have a profound impact on weed growth and form important components of integrated management strategies. Management practices have been identified that substantially reduce weed growth in the differing positions of the toposequence in the humid zone and in the irrigated ecologies of the Sahel. In the latter, it has been shown that improving the timing of application of inputs, rather than quantity, can lead to a 50% increase in yield—half of which is due to improved weed control.

A substantial proportion of the weed research has been conducted in support of the varietal improvement activities to develop weed-competitive plant types. Methodologies have been developed that enable the mass screening of rice cultivars for their competitive ability with weeds, enabling weed-competitive lines to be selected from the large numbers of interspecific progenies at an early stage.

We believe that these studies will contribute significantly to the expected boom in regional rice production, which is likely to draw from diverse hydrological environments and water management systems. New technologies from these studies will provide farmers with low-cost water management technologies and low-management plant types, as an incentive to increase and intensify the cultivation of lowlands. In the uplands, low-management (e.g. weed-competitive) but input-responsive interspecific rice varieties are now available and are being evaluated with farmers in participatory research. This will improve yield stability and create incentives for resource-poor farmers to replace nutrients extracted from the soil in short-fallow systems. The long-term recovery of destabilized upland systems would also require more substantial investments in resource-base quality. The major challenge will be to ensure the dissemination of these technologies to poor farmers, national agricultural research and extension systems (NARES), advanced research institutions (ARIs) and non-governmental organizations (NGOs) in a way that they can adopt and adapt them to their needs. Our PVS and CBSS work is a first step in the right direction. The integrated crop management (ICM) approach

for irrigated systems featured prominently in this report is another. However, such activities require an enabling environment, and this is the focus of our policy research—to provide options that foster enabling environments, including raising awareness among decision-makers on the potential benefits of rice technologies for poverty alleviation and rural development. This in turn should lead to renewed action to alleviate socio-economic constraints to rice development.

In conclusion, the year 2000 was successful, but a lot remains to be done to produce more NERICAs and complementary technologies to fight poverty in Africa. As indicated elsewhere in this Report (*see* pages 1 and 58), the potential for success is high—for example, 25% adoption of NERICAs in three countries (Côte d'Ivoire, Guinea and Sierra Leone) by 2004 would add US$ 20 million per year to the economy in these countries. We wish to thank all our partners, 'upstream and downstream,' for their efforts. We look forward to strengthening our collaborative activities with you in the years ahead.