JICA Seminar on

Promotion of Rice Production and Dissemination in Africa

February, 2004

AICAD, Nairobi, Kenya

Japan International Cooperation Agency

Overview of the Seminar

Purpose

The Tokyo International Conference on African Development Ⅲ(TICADⅢ) was held in September 2003. During the conference, wide-ranging discussions were held in order to embody the New Partnership for African Development (NEPAD), emphasizing the importance of agricultural development for alleviation of poverty through economic growth. Prior to TICADⅢ, at the World Summit on Sustainable Development (WSSD) in 2002, the Japanese government expressed its support for dissemination of New Rice for Africa (NERICA) to African nations where a shortage of food is a major concern.

On the other hand, in December 2003 the General Assembly (UN) designated 2004 as the Year of Rice for people to understand the important role of rice for food security and alleviation of poverty in line with Millennium Development Goals (MDGs).

In this connection, the necessity of assistance to Africa was stressed and it was urgently needed to discuss how to promote support for production of rice, particularly NERICA.

In the context stated above, JICA decided to hold a two-day seminar on "Promotion on Rice Production and Dissemination in Africa", at the African Institute for Capacity Development (AICAD), Nairobi, Kenya on 10 – 11, February in 2004 (See attached paper. In addition to JICA agricultural experts and their counterparts in African countries, JICA invited participants from authorities involved in NERICA-related countries, NGOs and International organizations. The seminar aimed to identify the current situation and problems on rice and to share ideas on rice development cooperation among the participating countries/organizations.

Direct Outcome

1. Information on the present condition of rice which covers regions from Eastern and Southern Africa to Western Africa was shared using many visual aids.
2. Information on "Good Practices", "Possible Approach" and Issues that should be addressed was shared through Q & A during each session and Round Table Discussion.
3. Information on Trends and Ideas in International Organizations, Development Partners for Rice Promotion in Africa was shared.
4. A network of the Seminar's participants (representing many different professions such as researchers and administrators from many countries) was established. The network is shown on the "Participants List".

Output for the future

Output will be generated by participant activities based on shared information and the human network.

Executive Summary

1. Objective of the Seminar

The seminar on promotion of rice production and dissemination in Africa was held on the 11th and 12th of February, 2004, at AICAD in Nairobi, KENYA. The seminar aimed at sharing various information on rice development among the participants.

2. Presentations

The seminar started with two opening remarks, followed by two keynote speeches, both of which suggested the direction of assistance in rice development. The main part of the seminar consisted of three sessions: (i) In session 1, three presentations regarding agricultural development and rice cultivation activities were made, (ii) in session 2, two JICA assisted on-going projects were presented and (iii) in session 3, five presentations in relation to NERICA development and dissemination activities were made.

Round table discussions were held, with participants divided into two groups sharing current situation and development issues on rice in each country, to elucidate possible approaches for rice development and promote and disseminate issues on NERICA.

3. Shared Information

(1) Current Situation and Development Issues on Rice in Africa

- African countries differ in the development stage of rice, and its position as a food varies from one of major importance to minor importance. The prime production purpose of rice, market structure and scale, dietary habits, consumption characteristics, etc. also differ among the countries.
- While rice is grown under various agro-ecological conditions, it is mainly grown under rain-fed lowland conditions.
- Rice demand has been increasing year by year in almost all countries. In many countries increased rice production has not kept up with demand, resulting in increased rice imports.
- Increased rice production in Africa has been realized mainly by area expansion.
- Imported rice is cheaper because of the low productivity and quality of domestic rice.
- To realize increased rice production, many issues must be overcome, including research and development, inputs supply, agricultural credit, extension and training, post-harvest and handling, marketing, and others.
- Human resources such as researchers and extension agents having skills in rice cultivation are in short supply.
- NERICA is expected to be a breakthrough in rice production although basic information and experience gained have not been shared among concerned countries.

(2) Activities of WARDA (West Africa Rice Development Association) and ARI (African Rice Initiative) in relation to NERICA

- WARDA initiated the development of new rice by crossing Asian rice (*Oryza sativa*) and African rice (*Oryza glaberrima*) in 1991, and succeeded in disseminating the new rice to farmers in Guinea by adopting PVS (participatory variety selection) and CBSS (community based seed production system) in 1997. These new strains of rice were named "NERICA (New Rice for Africa)" in 2000.
- ARI was launched in March 2002, in order to promote the dissemination of NERICA to other countries. ARI will be implemented through the NERICA Consortium for Food Security in Sub-Saharan Africa. ARI membership is open to any Sub-Saharan African country, but the initial focus was on the seven West African Pilot countries of Benin Côte d'Ivoire, Gambia, Guinea, Mali, Nigeria and Togo. In 2003 Ghana and Sierra Leone were added, bringing the total to nine countries. ARI's target is to expand the cultivated area under NERICA to 210,000 hectares and production to 744,000 tons by 2006.
- ARI has two main complementary Action Plans to achieve the above target: (a) Stakeholders' Platform with seven Action Plans: to determine goals and promote wide dissemination of NERICAs through seed production (PVS, CBSS, etc.) and complementary technologies; and (b) Research Network with five Action Plans: to continue the research process, especially integrating technologies and looking into bottlenecks to scaling up through close monitoring of the progress in socioeconomic and environment aspects. This network will also catalyze information exchange between research and stakeholders.
- Dissemination of NERICA has been in progress in eight countries (except Togo). The seed production target is likely to be attained though some delay is expected. However, the action plan as a whole has not made much progress as the donors have not yet made a significant commitment to supporting the research network.
- WARDA has been trying to develop new inter-specific varieties adaptable to lowland conditions. So far promising materials that are high yielding, early maturing and resistant to key lowland stresses have been available. These have been successfully tested in Burkina Faso, and will be extended to more NARS (National Agricultural Research Stations) in 2004.
- WARDA's other development efforts include research on water-soil fertility management to enhance yield, development of termite control methodology, and development of post-harvest and handling technologies to enhance market opportunities.

(3) Trend in Donors' Support to NERICA

- Initiation of ARI was supported by Japan, UNDP, Rockefeller Foundation, WB and AfDB. Dissemination of NERICA (PVS, CBSS, etc.) has been supported by Japan, UNDP, FAO, Rockefeller Foundation, Gatzby Foundation, SG2000 and AfDB.

- AfDB is the largest donor to assist in disseminating NERICA, including support to the ARI secretariat, support to seven pilot countries in establishing the national NERICA team and national upgrading strategy. AfDB will also start a five year NERICA dissemination project for seven countries (ARI pilot countries except Côte d'Ivoire and Togo).
- WB operates mostly at the country level through projects aiming at enhancing agricultural productivity. Opportunity exists in those projects to build in NERICA promotion activities in all sub-regions of the continent and in particular in Eastern African countries.
- At the regional level, WB is developing in close collaboration with FARA, a Multi Country funding mechanism, to support implementation of the agricultural productivity component of NEPAD's Comprehensive African Agricultural Development Program (CAADP). It is expected that a sizable budget will be earmarked for the implementation of the Program once completed and validated. NERICA would be a logical candidate eligible for funding.

(4) Recognition of NERICA

- Success in developing inter-specific varieties enabled expansion of the genetic base.
- NERICA has the prominent characteristics of a shorter growth duration, higher protein content, high yield, shorter plant height, and large panicle compared with many grains.
- The physiological features of each NERICA variety have not been fully clarified.
- The cultivation techniques for NERICA have not been fully established.
- Dissemination of NERICA to East and Southern African countries has not necessarily been carried out systematically.

(5) Future development issues on NERICA

- Promotion of further research on NERICA including characterization and cultivation techniques.
- Standardization of the research methodology on NERICA.
- Establishment of seed production and distribution system.
- Sharing information and experience on NERICA among the countries concerned.
- Strengthening of regional collaboration including East and Southern Africa on NERICA dissemination, centering on WARDA/ARI.

Contents

This report was edited by the Agricultural Development Cooperation Department of JICA.
In certain parts we have used other expressions without changing the point of the participant's presentation and the presentation contents.

Please be forewarned
Thank you.
Agricultural Development Cooperation Department
Japan International Cooperation Agency

Acronyms

AfDB : African Development Bank
AICAD : African Institute for Capacity Development
ARI : African Rice Initiatives
CAADP : Comprehensive African Agricultural Development Program
CBSS : Community Based Seed-multiplication System
FAO : United Nations Organization for Food and Agriculture
FARA : Forum for Agricultural Research of Africa
IFAD : International Fund for Agricultural Development
IRRI : International Rice Research Institute
JICA : Japan International Cooperation Agency
KATC : Kilimanjaro Agricultural Training Center
NARS : National Agricultural Research Systems
NEPAD : The New Partnership for Africa's Development
NERICA : New Rice for Africa
PVS : Participatory Varietal Selection
RYMV : Rice Yellow Mottle Virus
SG2000 : Sasakawa Global 2000 (an NGO)
SPFS : Special Program for Food Security
SUA : Sokoine University of Agriculture
SSIAPP : Small Scale Irrigated Agricultural Promotion Project
TICAD : Tokyo International Conference for African Development
UNDP : United Nations Development Program
UNGA : United Nations General Assembly
WAB : West Africa Boukē
WARDA : West Africa Rice Development Association
WCA : West and Central Area
WSSD : World Summit for Sustainable Development

Outline of the Seminar

Seminar on Promotion of Rice Production and Dissemination in Africa
10-11 February 2004
at African Institute for Capacity Development, Nairobi, Kenya

A two-day seminar on "Promotion of rice production and dissemination in Africa" was held under the sponsorship of the Japan International Cooperation Agency (JICA), on the 10th and 11th of February 2004, at the African Institute for Capacity Development (AICAD), Nairobi, Kenya. More than 100 participants from 20 countries attended the seminar.

The seminar started off with opening addresses by Mr. Masaaki Otsuka & Mr. Joseph K. Kinyua, followed by keynote speeches and three presentations on agricultural development and rice cultivation in Africa (Session 1). The following day, two presentations on agricultural development projects by JICA (Session 2) and five presentations in relation to NERICA (Session 3) were made. The round table discussions concerning the theme of the seminar were made by dividing the participants from various countries into two groups. The seminar was adjourned after the wrap-up session summarizing the results of the round table discussions as well as the seminar as a whole.

The contents of each speech, and questions and answers were summarized as follows:

Tuesday, 10 February 2004

1. Opening Address (14:00- 14:30)

Mr. Masaaki Otsuka Resident Representative, JICA Kenya Office, Kenya

Mr. Otsuka welcomed the participants to the seminar. He explained the background of the seminar, referring to the commitment to support dissemination of NERICA (New Rice for Africa) by the Government of Japan at WSSD (World Summit for Sustainable Development) in 2002, the importance of agricultural development for alleviation of poverty and economic growth as emphasized in TICAD III (Third Tokyo International Conference for African Development) in 2003, and the year 2004 designated as the International Year of Rice by UNGA (United Nations General Assembly). He also explained JICA's efforts to support rice development in Kenya, and JICA's intention to focus more on support for Africa in achieving increased food production, reduced poverty and creation of wealth, under its new status as an "Independent Administrative Institution" since October 2003.

Mr. Joseph K. Kinyua Permanent Secretary, Ministry of Agriculture, Government of Kenya

On behalf of the Kenyan government, Mr. Kinyua expressed his gratitude to organizers and participants of the seminar. Mr. Kinyua emphasized the importance of increasing food production in Sub-Saharan Africa citing the fact that the majority of the one billion people subject to food insecurity live in this region. He viewed the use of new high yielding varieties and modern technology as the ways to increase food production. He explained that rice in Kenya was positioned as the third most important cereal crop after maize and wheat while its consumption has been dramatically increasing.

Mr. Kinyua said that the potential area for rain-fed rice production in the western region was not yet fully developed. He listed several constraints which hamper increased rice production, such as inadequate funding in irrigation, poor research and development on seed for irrigated and rain-fed conditions, high production costs, and inadequate cooperative development in post-harvesting and marketing.

He presented Kenya's strategies for improving rice production, including rehabilitation of existing irrigation systems and promotion and dissemination of NERICA. He stated his expectations of NERICA's good characteristics which are expected to contribute to food security. He acknowledged that the UN has designated this year as the "International Year of Rice" with the goal of eradicating persistent poverty in the developing world. He also stressed the importance of international cooperation, adding that the Kenya Agricultural Research Institute should be involved in such international efforts to improve food security in Africa.

2. Keynote Speech (14:30-15:30)

Mr. Hisao Azuma Vice President, The Japanese Committee for International Year of Rice, Japan

Mr. Azuma covered several topics in his presentation. Firstly, he explained the objective and meaning of the International Year of Rice and the role of FAO as the leading organization for its implementation. Secondly, he presented the history of rice production in Japan and how Japan increased rice production after World War II. Thirdly, he explained the situation of rice in Sub-Saharan Africa including production trends, the ecological environment, and supply and demand, suggesting a yield increase through increased rice production in the area in the future. Fourthly, he presented several options to increase the rice yield such as the introduction of new varieties, better crop management including fertilizer application, use of agro-chemicals, mechanization, etc. Fifthly, he explained how increased rice productivity contributes to rural development and results in enhancement of farm household income. Sixthly, he explained Japan's recent cooperation on African development at the policy level. He concluded his speech by quoting the Governor of Hyogo Prefecture, "RICE IS LIFE", a reference to food assistance delivered from across Japan after the disastrous Kobe earthquake.

Dr. Elicio Perpétuo Guimarães Senior Officer, Cereal Crop Department, FAO, Italy

Dr. Guimarães explained the present situation of rice in Africa, constraints and opportunities to rice development, FAO's role in rice development and the way forward. First, he showed the past trends in area, production and yield of rice in African countries, and highlighted the feature that the main contributing factor to increased rice production in Sub-Saharan Africa in the past was area expansion, while increased yield was the main contributing factor for the rest of the world. He also showed that rain-fed lowlands and uplands are the major cropping systems of rice in Sub-Saharan Africa. Then, he presented the constraints on increased rice production from the viewpoints of cropping system, Asian varieties' adaptability to the African environment, and the political and socio-economic environment. He also presented the opportunities for increased rice production through dissemination of NERICA, referring to some outstanding features of NERICA and FAO's in support of NERICA under the umbrella of SPFS (Special Program for Food Security). He further presented the FAO's role in promoting rice in Africa, particularly the four major activities of information resources, technology transfer and training, promotion of crop research, and forum and advice inputs. Finally he listed the works to be done in the future to fulfill the mission, such as speeding up seed multiplication, promoting participatory approaches, developing NERICA varieties for other growing environments, establishing task forces to tackle specific problems, efficiently using existing networks, improving upland rice production over the short term and promoting small-scale irrigation schemes in over medium term.

3. Session 1 (16:00-18:00)

Dr. Ahura Luzi-Kihupi Senior Research Fellow, Department of Crop Science and Protection, Faculty of Agriculture Sokoine University of Agriculture (SUA), Tanzania

Dr. Luzi-Kihupi gave a brief description of the state of production and consumption of rice in Tanzania. She asserted that rice is one of the important cereal crops in Tanzania and is consumed by 60 percent of the population. She listed weed management, water management, insects and diseases, lack of improved varieties, and lack of adequate farm inputs as constraints in rice production in Tanzania. She provided a brief overview on rice research in Tanzania including the history and roles Sokoine University of Agriculture has played over the past 30 years. She outlined SUA's current research (activities of rice yellow mottle virus (RYMV)) as a field screening and integrated rice improvement project. She concluded that interdisciplinary research involving various institutions is a key to successful identification of appropriate farm practice for e productivity improvement.

Questions, Comments & Answers

Dr. R. Ikeda, Japan: I am very much interested in your findings on varieties resistant to RYMV. I think that the virus will be transmitted by some insect. In that case, which factors are the main contributors to such resistance; resistance to vector, resistance to virus or resistance to both of them?

Dr. Lusi-Kihupi: We were evaluating the varieties, we are not creating to see what is resistant or not. But the last time I participated in entomology co-work, which was done by Dr. Mbapila, we also had one PhD. Student who had done extensive work on insects which transmitted the disease.

Dr. George Bigirwa, Uganda: I just want to know how you screened RYMV?

Dr. Lusi-Kihupi: We did screen-house screening and field screening. We took some infected materials from the location (i.e., Kiera in Ndungu). We macerated the infected leaves, obtained inoculums and created the healthy plants. Then, we evaluated the materials. So we implemented it in the screen-houses several times and also in the field.

Mr. Christopher NDIRANGU, Kenya: Could you describe to us participatory breeding, please?

Dr. Lusi-Kihupi: The only activity which we did in participatory screening was for RYMV in Kiera. We were involving farmers to help us evaluate and select the resistant materials according to the plant type they wanted. But we have not yet started with the SUA. It depends very much on the cooperation with WARDA, as they are highly experienced in participatory breeding, to help us establish this program.

Mr. Albert Feefi SWATSON, Ghana: In your presentation, you recounted many constraints. And then, at the end of it, you called for a collaborative effort among all the research

institutions. I know in Tanzania, you have the Kilimanjaro Agricultural Training Center. I've did not hear them mentioned in your presentation or whether you have any collaborative effort with them in trying to look at the problems that you enumerated.

Dr. Lusi-Kihupi: I think I went very fast, but there was one slide which shows the JICA expert with the KATC staff who came to our university for this evaluation. So we have a lot of collaboration with KATC. Ndungu is very near KATC and it is also under JICA. The materials implemented by JICA are used here. So, we have a lot of collaboration with KATC and other institutions.

Mr. Tatsuo Fujimura Senior Advisor on South-south Cooperation, Special Unit for Technical Cooperation Among Developing Countries, UNDP, USA

Mr. Fujimura explained the brief history of development of NERICA, New Rice for Africa. He presented a set of targets to be achieved by 2006 defined by African Rice Initiatives (ARI), indicating (1) cultivated area of 210,000 hectares in West and Central Africa (WCA); (2) production of 744,000 tons/yr in WCA; (3) rice import substitution value of almost US$ 88 million; (4) 1.7 million African farmers exposed to NERICAs; (5) adoption rate among exposed farmers of 35-45 percent; and (6) adopting farmers allocating 15-20 percent of their rice land to NERICA. He gave additional targets set by the African Development Bank (AfDB). He provided some detailed schematics and funding arrangements for development and dissemination of NERICA coordinated by UNDP. An estimated budget of US$15,191 thousand is required while support of US$34,970 thousand is already promised by donors, including AfDB, FAO, UNDP, Japan, Rockefeller Foundation, Sasakawa Global 2000 (SG2000), etc. While extension and dissemination is already implemented in ARI pilot countries, the research network including information exchange, monitoring and evaluation, and development of new NERICA strains should be strengthened. He stressed the importance of international coordination through WARDA and African Rice Initiatives (ARI) for further dissemination of NERICA. He concluded his presentation by highlighting: (1) mobilizing resources for the research network; (2) enhancing participation of more donors in a coordinated manner; (3) expanding PVS in non-pilot countries; (4) systematizing the dissemination of NERICA in East and Southern Africa; and (5) systematizing the production and dissemination of foundation seed.

Questions, Comments & Answers

Mr. Ibrima Kunjo, Gambia: It has been mentioned in the ARI explanation that in the aggregation of these pilot countries, most have been based on either the successes of PVS, following the introduction of NERICAs, and other criteria. But my worry now is, what is the criteria for selectively outlining other countries for sourcing and additional support. For example, Gambia, has not been identified as a potential pilot country. Efforts are being made by JICA or other organisations, to source additional funding to support the programs. We are operating within the same kind of environment qualifying each of those countries as a

pilot country.

Mr. Fujimura: I think these criteria were set by WARDA when we were about to launch. Because resources were rather limited, we needed to select certain pilot countries to go ahead, with non-pilot countries to follow later. The most important criteria for selecting pilot countries was whether the country had already chosen strategically important NERICA rice varieties to disseminate within the country. Usually each country selects four or five varieties, so that once this is decided it is easy to go ahead. NERICA has over two hundred varieties available for dissemination, but we cannot disseminate all of them. Secondly, countries to which donors identify for CBSS support will be given priority. These are the two major criteria. As Gambia was supported by the World Bank at that time, finally Gambia was included as a pilot country. At present, there are nine pilot countries; Benin, Togo, Gambia, Ghana, Guinea, Mali, Nigeria, Sierra Leone, and Côte d'Ivoire. However, the African Development Bank does not provide loans to Togo and Côte d'Ivoire, because they do not yet meet the conditionality.

Dr. Akintayo Inusa, ARI: You mentioned something concerning the lowland NERICAs, which we are calling presently lowland interspecific lines. WARDA has gone very far in developing this material. We have excellent results. The materials have been tested in some countries and are already, very resistant and productive. I will mention all those to you tomorrow, and the door is open for collaboration with all countries. Especially after the report of Tanzania, I realized that you are having Rice Yellow Mottle Virus disease, and I can tell you that we have developed excellent varieties which are totally resistant to that disease. I think it will help to boost rice production on lowland ecology.

Mr. M. Bafode Drame, Senegal: Given the assistance by international donors, we would also like to promote NERICA. What would be a procedure of extending the support to Senegal? What is the possibility of working with ARI?

Mr. Fujimura: This criteria itself may not change but the review of the pilot and non-pilot countries can be made in the consortium management committee. Actually we had the second consortium management committee meeting in September 2003, and Guinea and Sierra Leone were recognized as pilot countries by the committee. So if you are ready by selecting certain priority NERICA varieties for the country's strategy for dissemination of NERICA, you need to submit the application to the ARI Secretariat for review. So that it can be tabled for discussion at the next consortium management committee meeting. But you have to select the country's strategically important variety in advance. So far the most important varieties WARDA has identified are NERICAs 1 to 7. But, Dr. Akintayo, do you also accept other than NERICAs 1 to 7? As I found there are many varieties of which countries prefer to choose. Do you have any particular comments on this?

Dr. Akintayo: At our last management committee meeting, we recognised that the criteria settled before for selection of the pilot countries is already obsolete. That ARI intend to increase the number of countries. This is why, for instance, Ghana and Sierra Leone have been added, and other countries can be added and joined to the team. There is no limitation. Regarding the number of varieties, presently or currently in the pipeline, WARDA is dealing

with 450 series of NERICA. Those are the ones which are disseminated. And now, we have 880 series which have been tested, and have demonstrated good results under upland conditions. Those will go in our PVS and CBSS activities starting from 2004. Many lines exist at present. Seven varieties were selected due to PVS activities conducted in those countries. There are many varieties which have not been named yet.

Dr. W.O. Kouko
Kenya Agriculture Research Institute, Kenya

Dr. Kouko explained about the current status of rice production in Kenya by citing recent statistics. He asserted that the current consumption of rice stands at 150,000 metric tons while the production of rice is limited to 60,000 metric tons. The irrigated rice area fluctuates between 8,000 and 11,000 hectares, while national potential is about 400,000 hectares. He provided information on an ongoing study on lowland and highland replicated yield trials including NERICA varieties, and current follow-up activities. Then he enumerated six broad priority research themes to develop in the future as a way forward, including (1) adapt high yielding NERICA varieties, (2) develop appropriate agricultural machinery and farm tools, (3) develop an integrated pest management system for NERICA rice, (4) integrate cropping and farming systems for NERICA, (5) establish procedures for technology transfer through PVS, CBSS, on-farm adoption verification and support activities, and (6) develop strong human resources capability at the National level. Finally he mentioned the meaning of rice research contributing to rural development from the viewpoints of socioeconomic development, food security, employment creation, natural resources management and wealth creation.

Questions, Comments & Answers

Mr. Tareke Berhe, SG2000, Guinea: I have two questions. When I see your table on early upland varieties, out of the WAB450 series, there is only one NERICA out of the seven NERICAs that has been selected. That is NERICA 6. Was this selection made by yourself from the earlier bigger set, or was this set sent to you by WARDA? This is my first question. The second question is that Kenya provides the second highland environment next to Ethiopia. In Ethiopia we had some problems with the early NERICAs due to altitude and night temperature. I wonder if you have observed or experienced anything, if not please be aware because you will be a good source of information for us. What happened in Ethiopia is practically for every 100 meters of altitude there was almost 10 days of difference in maturity. So the 90 day varieties are maturing at 100, 110, 120, and so on. I would like to have your contribution.

Dr. Kouko: NERICA 6 kits was given from WARDA. We planted them when they came.

For altitude, so far we are concentrating in the lowlands. As it were I don't see any problem but we may also want to learn more as we network together, so that we know how far this can also affect the maturity period. But I am sure that the areas we are working in the Lake region, particularly on the coast, the altitudes are very low compared to the highlands of Ethiopia.

Participant from Kenya: My question is concerned with the seed kits that the Kenyan Research got from WARDA. My understanding is that once new varieties especially rice is introduced to a new environment, we are required to do more work before you can do participatory research. I'd like you to introduce the farmers to appropriate research so that we may receive varieties which the farmers can then pick.

In addition I have another question. Kenya has the Coast, Central Region which houses Mwea, and the Western Bloc of the Lake region which has soils suitable for rice culture. When you receive these kits, is it a request that these varieties be tested under various environments? Long experience indicates that some varieties, especially IRRI which performed well at Mwea, did not necessarily perform well in places like Ahero and West Kano for obvious reasons. I am wondering whether this was taken into account in your study.

Dr. Kouko: How much time do we need for preparation? What we are emphasizing here is not really insisting on going to the farmers. What we want to do is to involve farmers in our trials and let them see which varieties they can select. This is the formal variety selection which we refer to as "participatory". There are some varieties which you may plant. They may be high-yielding, but they don't end up anywhere at the end of the day. So by involving farmers in our trials, we may expect a lot of adoption. This is where we need to move. Now at the same time, with these varieties, of course, we started doing a range of experiments from Matuga, Nyanza at Kibos, and some trials were conducted in Mwea. We may want to test these varieties as much as possible, that is, in as many places as funds allow. So we have chosen three sites to start with. But we lacked the finances for proper management in some places. So the results I am giving here are the Kibos ones. The Matuga ones unfortunately we missed due to some problems in the field, but we hope that we will get something from Mwea. So we want to go to many places, citing these materials to see which ones and what locations will turn out the best.

Wednesday, 11 February 2004

4. Session 2 (9:00-10:00)

Mr. Sammy M. Akagbor Director, Operation Department, SSIAPP, Ghana

Mr. Akagbor presented the status of rice in Ghanam stating that rice is one of the four major cereals followed by viz maize, millet and sorghum, locally produced and consumed in Ghana. Rice consumption significantly increased (10.9 percent annually) between 1983 and 1992. Average consumption in 2000 was 466,000 metric tons which is equal to 25 kg per capita. Rice consumption is far exceeding local production while self-sufficiency accounts for a mere 34 percent. Mr. Akagbor stated that rice is considered as both a cash and food crop for the majority of farmers in Ghana. He gave a brief explanation on the Ghana government's strategy for promoting rice farming and further explained the irrigation development and rice industry promotion currently being implemented. He addressed the issues of development of

rice component technology, verification trials, support system for sustainable farming, extension, and training. He then explained Ghana's endeavors to improve rice production. He gave details of ongoing preliminary evaluation of NERICA, and affirmed that preliminary trial's indicate that the NERICA variety is more suitable as a rain-fed crop and that yields were higher (7 tons/ha) under upland conditions than under lowland conditions (5 tons/ha).

Questions, Comments & Answers

Dr. Kouame Miezan, WARDA: This is a remark, not a question. In the last 2-3 slides I could see that you were using the NERICA varieties that you had more in the lowland environment. But I would like to draw attention to the fact that the WAB 450 series is not lowland. Therefore, you have to be very careful. In fact, you could see it in the last slide. You see stunted crops in the lowland. They don't really look like lowland fields. So you have to be careful of that. Some new lines are coming up, both inter-specific and intra-specific, which are much more adaptable to this lowland environment.

Mr. Akagbor: Anyway, you really saw what we simulated in the upland. We didn't produce this crop under irrigated conditions.

Mr. Tareke Berhe, SG2000, Guinea: Could we know what NERICA lines you had?

Mr. Akagbor: The lines are in my report, just like WAB.

Mr. R. J. Shayo
Principal, Kilimanjaro Agricultural Training Center, Tanzania

Dr. Shayo presented a brief history, justification and purpose of the Kilimanjaro Agricultural Training Center Phase II project. He stated that rice cultivation in Lower Moshi was one of the successful JICA projects in Africa, that the project was to extend JICA's experience in the past irrigation project to six different irrigation zones in Tanzania as well as to neighboring countries, and that the project was currently working to improve agricultural scheme management and the rice productivity of these irrigation areas. He said that the project has proceeded as planned and emphasized that increased rice productivity in the model site should not be taken as an end in itself, but as a means toward increased rice productivity in all irrigation schemes in Tanzania and beyond, and that therefore, the achievements in the model sites have to be disseminated to all other schemes starting from the schemes in the district where the project is currently located. To materialize this, he said that the district councils had to play significant roles in disseminating the technology and the KATC approach to other schemes even when KATC II was completed, using the model irrigation schemes as a basis of the technology to be disseminated.

Questions, Comments & Answers

Ms. Nicole Hery-Sora Rakotomalala, Madagascar: In your presentation, you said that you have three cropping seasons for rice in KATC. My question is what bridge crops do you have in those rice systems. In-between the three cropping seasons do you grow anything other than

rice in those schemes?
Mr. Shayo: In Lower Moshi, we have an acute water shortage; therefore, we are growing rice now in turn. So we don't grow rice in all schemes. We grow it in several areas in turn. In one season, one area grows rice, and the other areas which are not growing rice grow other crops like maize, beans; and during the next season they shift to another area to grow rice and other areas which are not growing rice grow other crops, and so on. This is a kind of shifting, to maximize the use of limited water resources in that area. So other crops include maize and beans.
Mr. Moses Changwony, Kenya: We have a group of farmers we are sponsoring through the Tana and Athi River Development Authority in the Tana River District. My question is if we want them to benefit from this training, what would be the requirement? What would be arrangements that make it possible to send them to your training course? Do you have subsidized training facilities? Or do we have to pay for these farmers to come down?
Mr. Shayo: In Kenya, we have one model site which is south-west Kano in Western Kenya, and we are hoping that the we will be able to use the model site as the center for dissemination of those technologies to other parts of Kenya with the assistance of the National Irrigation Board, and other concerned agencies in irrigation in Kenya. That is where JICA is assisting. We also have some other training which is not JICA assisted but those under the sponsorship of other organizations such as the World Bank, IFAD or FAO. They contact us and we negotiate how they could benefit by KATC training. So far, we have been receiving trainees within Tanzania, we have had contact from Malawi, there are a lot of irrigation schemes being assisted by IFAD, and they said they would like to contact us on how they could benefit more; apart from the Bwanje Valley scheme, they want farmers in other schemes to be trained at KATC. So after contacting KATC, we can negotiate on how we can assist. You are welcome to contact us and bring farmers to KATC or invite KATC trainers to your schemes, whatever it is.

Mr. Vincent Mkandawire, Malawi: Do you have any programs for training farmers on how to grow NERICA?
Mr. Shayo: As far as the NERICA varieties are concerned, we have been contacted by the National Rice Coordinator who is here, to collaborate with the National Rice Research Team to disseminate NERICA varieties in Tanzania. And we have corresponded with it positively. But so far, we have only received a few seeds, and are now trying to see their characteristics. We need more assistance from the research institute of KATRIN, to be able to manage this dissemination of NERICA in Tanzania. I think KATRIN at Ifakara will take the initiative, and we are ready to collaborate.

5. Session 3 (10:00-12:15)

Dr. Inussa Akintayo Coordinator, African Rice Initiative, WARDA, Mali

Dr. Akintayo presented the history of the development of NERICAs, the inter-specific

varieties of *Oryza sativa* having high yielding potential but susceptible to stresses, and *Oryza glaberrima* which are poor yielding in nature but highly resistant to various stresses, and their physiological traits of early maturing, high yielding, and wide adaptability to stressed conditions. He also presented the story of ARI creation in 2002.

He, then explained what has been done so far regarding NERICA dissemination, such as the varieties cultivated, progress of PVS (Participatory Variety Selection), CBSS (Community Based Seed-multiplication System) in the ARI member countries of Guinea (NERICAs 1, 2, 3, 4, and 6 cultivated), Côte d'Ivoire (NERICA 1 and 2), Nigeria (one NERICA variety released officially in 2003), Gambia (up to 4 NERICA varieties cultivated), Togo (NERICA 1, 2, 3 and 4 adopted), Ghana and Benin (adoption of 2 to 3 varieties reported), as well as outside West Africa. He insisted that the NERICA varieties available at this moment are for upland, and that new NERICAs under development are adaptable to lowland conditions.

He also presented the perspectives of NERICA development, such as the new series of NERICAs under development, complementary technology development to be made to enhance productivity and production such as soil and water management and termite control, post-harvest and processing to increase NERICA competitiveness (through producing cookies, for example), and extension of PVS and inter-specific varieties for the lowland (high yielding as well as early maturing).

Questions, Comments & Answers

Mr. Ahine Sileshi, Ethiopia: My question is about the institutional arrangement for rice in Africa. The presenter said that WARDA stands for African Rice Center. I am not clear on that. WARDA is the western sub-regional center for rice, but not the regional center. Just the clarification of this one point. Maybe my observation extends to other presenters. Are there coordinative role among FAO, ARI, WARDA, and JICA? Just say something about the central coordination role of these institutions in terms of information exchange, technology transfer, and other things? Which institution is the focal point for rice in Africa?

Dr. Akintayo: WARDA now has a new mandate to cover all the Sub-Saharan Africa, not only Western and Central Africa. The focal point in rice on research and extension belongs to WARDA. My colleague can give you more information.

Dr. Kouame Miezan, WARDA: WARDA was created as an association for West Africa. But after operating for over 30 years, most of the technologies that have been developed have been requested by East and Central Africa, in fact. Currently, a couple of WARDA materials have been tested in a number of countries in this region. Therefore, during the last meetings of council of ministers, because of the WARDA boards of trustees, WARDA council of ministers have been approached by a number of other countries to address most of the rice problems in the East and Central African region. The council ministers have agreed on WARDA as the African Rice Center, not to be able to interact officially as a national institution so far in the region. Having said that, WARDA is working actively itself; in fact, the essence of WARDA's approach is partnership. WARDA has been collaborating very closely with IRRI, as you know. IRRI has the global mandate. But the African mandate has been recognized to be taken care of by WARDA. WARDA has been assisted and supported very strongly by Japan through JICA, collaborating very efficiently, and WARDA has been

collaborating with and supported by FAO, so the issue of a focal point for rice is not a problem. I think the issue is how WARDA will be recognized as the African Rice Center, can collaborate or can have the support of all other institutions working on rice.
Dr. Taib Diouf, Senegal: (comment in French, introducing activities for disseminating rice including NERICA in Senegal)

Dr. I.O.Fatoba, Nigeria: I have two questions. I am in NERICA dissemination. What do you think of the stability of NERICA over time? Some of these upland NERICA varieties normally break down over some time. We are much afraid of that. The second is our experiences in the field with NERICA 4. Farmers have harvesting problems on threshing the variety. In Nigeria, most farmers use wood. They beat the rice straw on wood. You will find that we are still losing about 20 percent of the grains of the straw. The farmers beat and beat and beat and beat. I advised farmers to sprinkle some water on the straw and store it for about two days. So I would like to look at these questions.
Dr. Akintayo: (1) Concerning the break down of NERICA, this has been noticed in other countries. We think that this is because they do not renew their seeds. That is why in our program now, we have decided to help NARS to renew their seeds after two or three years. That is the problem because in some countries they are growing the same varieties for 5 to 6 years before renewing the seed, and even though rice is self-pollinating, there is some cross-pollination which can cause the problem you mentioned. So, frequent renewal of your seeds is essential. That is what we are doing. (2) Concerning threshing, yes. Even I read that in one of the documents of the other participants. You mentioned that it is difficult to thresh. On the other hand, some farmers are happy about that because they can leave their rice on the field and do nothing without losing it. But threshing is a problem. If you go to Guinea, we have very good threshers which have been developed with the support of Sasakawa Global 2000. Hand threshing is very difficult, so in our program we are planning to make small scale threshers available to farmers to solve this problem.

Mr. Duncan Mwanjila, Kenya: I was trying to talk something on bird control, particularly "quela" birds. It is a big problem here, particularly in the East African region, Kenya, Uganda and Tanzania. Previously there was cooperation between the three countries because the birds are migratory. I do not know what WARDA can do particularly in the control of the "quela" species. We have rice growing areas in lower Tana, and we are losing almost 40 percent in one season from "quela" birds migrating from Somalia, Ethiopia and Tanzania.
Dr. Akintayo: Birds control is very difficult.

Mr. Berhe, Guinea: Concerning the focal institution, I think there is no question that WARDA is the focal institution. Now within WARDA, if you are interested in germplasm, genetic material, or breeding material, etc., you can directly contact the Communications unit of WARDA. If the subject is transfer of technology, receiving developed varieties, NERICA training, Dr. Akintayo (ARI coordinator) is here at WARDA. So it's WARDA, and within WARDA that we have the African Rice Initiative.

Mr. Okou Zago, Côte d'Ivoire: (in French) We have a problem on dissemination of NERICA. We have not been supported by Japan or AfDB. Japan assisted phase 1 of CBSS only, and AfDB does not put priority on Côte d'Ivoire. How can you assist us?
Dr. Akintayo: Both JICA and AfDB will assist Côte d'Ivoire after the lifting of sanctions.

Mr. Moctar Toure
Lead Agriculture Services Specialist, African Region, World Bank, USA

Mr. Toure affirmed the World Bank's interest and commitment to continue to support the NERICA promotion and dissemination process. NERICA has gained a very high profile within the Bank and in particular in its African region. He asserts that the opportunity exists in these projects to build in NERICA promotion activities. At the regional level, the Bank is developing, in close collaboration with FARA, a Multi Country funding mechanism to support the implementation of the agricultural productivity component of NEPAD's Comprehensive African Agricultural Development Program (CAADP). NERICA would be a logical candidate eligible for funding. He concluded that three issues may influence the future of NERICA's promotion and dissemination effort: (i) the availability and accessibility of quality seeds; (ii) the consolidation and protection of the genetic attributes of the NERICA varieties. Effort should be made to anticipate genetic breakdown and lost of the attributes that make NERICAs unique. Therefore, more research is needed; and (iii) the continuous degradation of the natural resource base, in particular the loss of soil fertility, water scarcity and management issues.

Dr. Jun-Ichi Sakagami
Senior Researcher of Development Resources Division
Japan International Research Center for Agricultural Science (JIRCAS), Japan

Dr. J. Sakagami explained the activities of JIRCAS for improving rice productivity in West Africa. First, he overviewed the situation of rice production in Africa followed by the major factors which limit rice yield in Africa, such as drought, flood, weed, soil fertility, diseases and pests, salinity and iron toxicity. Secondly, he explained JIRCAS's research activities focusing on the features of the drought tolerant varieties including NERICA, conducted at WARDA in Côte d'Ivoire, and presented the conclusions of the research including the positive relation between root length and transpiration, the deep rooting ability of the rice plant as an indicator of drought tolerance and surviving strategy in the dry conditions, some of NERICAs' features of non-deep rooting and low transpiration rate under dry conditions, etc. Lastly after showing three prospective research themes for NERICAs, he presented JIRCAS's new project for improvement of rice productivity by the physio-genetic approach in West Africa and the research plan in 2004.

Questions, Comments & Answers

Mr. Evans Atera, Kenya: Since yesterday till this morning we have heard so many advantages of NERICA rice. Are there any disadvantages of NERICA rice?

Dr. Sakagami: In the presentation I already mentioned that early maturing traits of about 90 to 94 days are very useful economical traits, because, we have so many options with these kind of varieties. For example, rotation with leguminous makes it possible to cultivate two or even three crops a year. If you don't have any kind of problem like bird damage, and if you have water and fertilizer, it is possible. This is the first advantage of NERICA. The second advantage is the productivity of high potential, about four or five tons per hectare, by the announcement of WARDA. But still we have problems of the yield gap between the farmers' field and experimental field. So we have to develop new technology for NERICA to reduce the yield gap. For disadvantages, someone mentioned threshing, in particular NERICA 4, yes I agree. But we found that the most serious problem on developing NERICA is the lack of scientific data to evaluate NERICAs 1 to 7. So maybe JIRCAS will cooperate and work together with WARDA to evaluate NERICA and also new NERICA. In addition, your target and your eyes are always on the upland ecosystem. But the potentiality in the lowlands is very, very high. So I think the lowland ecosystem is necessary for improvement in terms of rice variety and rice production in Africa..

Mr. Tareke Berhe, Country Director for Guinea, Sasakawa Global 2000, Guinea

Mr. Berhe presented the NERICA's development experienced in Guinea. He first stated that NERICA had been introduced to Guinea in 1997 in cooperation with rice farmers through a farmers experiment unit. Then he listed several reasons for the success of NERICA dissemination in Guinea, including (i) the importance of rice as a main staple food in Guinea; (ii) the collaborative effort to among institutions; (iii) varietal adaptation and performance, (iv) well coordinated national programs; and (v) political will. He also mentioned the importance of accompanying post-harvest and agro-processing technology developments, specifically par-boiling, and threshing and polishing.

He presented the expected gains from NERICAs such as increased production due to their high yielding potential, increased family revenue, improved family nutrition due to high protein content, and protected environment. He also presented the pilot projects conducted in Guinea with the components of intensified production, farmer management, resources management, gender and development and farmer organization. He then listed problems on NERICA including (i) birds (NERICA matures before any other crops), (ii) drying (NERICA matures during the rainy season), (iii) threshing (some NERICA are hard to thresh manually), (iv) aroma (attracts rabbits and grass-cutters), (v) segregation (*O. glaberrima* like plants observed in the fields of NERICA), and (vi) stem borer (shoot fly; observed in some parts of the country). He presented ways forward including (i) complete and expand NERICA based agro-industry pilot project, (ii) carry out the ADB-financed ARI project, (iii) create a good data base by harmonizing the existing data available, (iv) start testing lowland paddy

NERICA because demand is high, (v) continue development and promotion of NERICA package consisting of provision of good seed, water management, soil management, and post-harvest handling, and (vi) establish a formal seed production system in Guinea. Finally he emphasized the importance of adoption of appropriate farming technology to realize a high yield of NERICA at the farm level.

Questions, Comments & Answers

Dr. I.O. Fatoba, Nigeria: You informed us that you don't have formal seed organizations in Guinea. We are aware that even from Nigeria we are expecting some seed of NERICA from you. How do you ensure the purity of seeds? Are the seeds you will send foundation or certified seeds?

Mr. Berhe: In the formal seed production system, you have breeder seeds, foundation seeds and certified seeds. You control at all those levels. In Guinea, we don't have a seed certification system. So we obtain breeder seeds and foundation seeds from WARDA. Multiplication of foundation seeds is done at the research centers. We provide funds so that those people ensure the purity of the seeds by isolating each variety by logging and what have you. Then we have trained seed producers that produce what we call quality acceptable seeds. There is no method of certification but they are equivalent to certified seeds. That's the way it's working right now. It only needs to be formalized. Otherwise the system is following the classical type of seed production.

Ms. Nicole Hery-Sora Rakotomalala, Madagascar: The paper we had before we went for the tea break gave us some information that the yields we get for research are different from the yields realized by farmers. In your presentation, you gave us figures on some of the NERICA varieties, which are very impressive, but then I could see the trend, the more fertilizer you use the more yield you get. Now you also mentioned that in the research you plan to promote rotation with some legumes. Could we have some figures on that because I have never been to Guinea. I do not believe that the Guinean farmers are that much different from what we have in East Africa. And the majority of our farmers may not be able to afford those fertilizer rates which we are trying to promote. So maybe those figures could help to solve my problems.

Mr. Berhe: For the second question, we have some figures. I said in general when we plant NERICAs after soybeans or cowpeas, the first year we get doubling of the yield. With Mucuna, I don't know whether you are familiar with Mucuna, we had three or four years where we rotated with maize and rice, and the result is the same. But you use rotation if you don't have any other means. We recommend that you use rotation, because you get organic matter and so on from the legumes, but you can't reduce your fertilizer use by half, and then get more yield. For the first one, please repeat your question.

Ms. Nicole Hery-Sora Rakotomalala, Madagascar: What sort of yields do you get? Because when you say you doubled the yield, you doubled it from what? Are you doubling it from one to two tons per hectare, or from where?

Mr. Berhe: We showed what we get in general, if we don't apply any fertilizer. It's from one

to two tons per hectare. If you are getting one ton, you plant cowpeas or you plant soybeans, and then you follow it with rice, you can get 1.5 tons to two tons.

Mr. Ryuzo Nishimaki Senior Researcher (Rural Development), JICA, Japan

Mr. R. Nishimaki presented JICA's cooperation for Africa in agriculture and rural development. He firstly explained JICA's role in the framework of Japanese ODA (Official Development Assistance), followed by the Japanese ODA policy. He put stresses on the importance of human resources development and "site" under the new JICA administration. He also showed JICA's expenditure by region and sector. Then he explained the aim of agricultural development and rural development under JICA's cooperation as well as their policies. Finally, he presented the support to NERICA so far extended by the Japanese Government including JICA, and JICA's policy and strategies for the future support to NERICA. He stressed that the strengthening of capacity-building of each country's researchers and extension entities would be the basic approach of supporting NERICA by JICA. He mentioned the concrete support programs of (i) dispatch of JICA experts to strategic countries to extend technical advice, provide small financial support and to establish a network among donors and relevant countries/entities, (ii) mobilization of NGOs and private sectors for extension, and (iii) provision of training in Japan and third countries.

6. Round Table Discussion (13:15 – 16:00)

Group A	(Côte d'Ivoire, Gambia, Ghana, Guinea, Madagascar, Mali, Niger, Nigeria and Senegal)
Group B	(Ethiopia, Kenya, Malawi, Mozambique, Tanzania, Uganda, Zambia and Zimbabwe)

Group A

Round Table Discussion of Group A, chaired by Dr. N. Nagayo, Leader of the JICA funded Small Scale Irrigated Agricultural Promotion Project (SSIAPP) in Ghana, convened in the auditorium of AICAD. The total number of participants was 24 from nine countries as well as the representatives of WARDA/ARI.

Prior to the discussion, Dr. Nagayo briefly explained to participants the objective and procedure of the discussion. Then, each representative from the participating countries presented the current situation of rice and constraints and issues on rice development, based on the formatted table they had filled in (refer to F. Round Table Discussion in this document).

1. Present Conditions and Constraints

As for the current situation of rice, the following three common aspects were recognized:

(i) Rice is a very important cereal crop for all countries;

(ii) Self-sufficiency rate of rice is less than 50 percent in many countries despite of its important position; and
(iii) Rice is produced mostly under rain-fed conditions.

As for the constraints on the development of rice, the followings were among others important factors.

(i) Inadequate research in such fields as variety improvement, post-harvest, package of production technologies, socio-economy, etc.;
(ii) Low quality of domestic rice (hence low price) which results in decreased competitiveness compared with imported rice;
(iii) Lack of credit system for farmers to procure inputs (high cost of inputs);
(iv) Weak farmers' organization;
(v) Inadequate post harvest processing; and
(vi) Lack of marketing channels.

Other constraints raised included external assistance not reaching to farmers (Nigeria), uncoordinated research and extension (Niger), and poor funding for rice sector (Côte d'Ivoire, Guinea and Gambia)

2. Issues

While Dr. Nagayo had asked participants to select priority issues to tackle, several countries including Côte d'Ivoire, Gambia, Ghana and Mali insisted that those constraints could not be separated or prioritized as they were related to each other, and emphasized the importance of integrated approaches to remove constraints. Other countries have put priority on specific issues, including assurance of supply of inputs like seeds, fertilizer, etc. (Madagascar, Niger and Nigeria) and strengthening of research (Senegal).

Meanwhile, the representative from WARDA emphasized that both the quality and productivity improvement of rice are necessary for all countries to compete with imported rice through research and technology development as well as the improvement of processing and marketing. He also mentioned that research should be focused on increased productivity and quality improvement, and that extension and training should link scientists, extension workers and farmers.

3. Possible approach

While several countries have experienced difficulty in competing with cheap imported rice under the globalization process, possible approaches to strengthening the competitiveness of domestic rice marketing included: low cost rice production technologies such as rotational cropping and the use of leguminous crops (Côte d'Ivoire), development of high value rice like aromatic rice (Senegal), supporting private sector to market high quality rice and productivity enhancement (Ghana), encouragement of individual farmers and farmers' groups in better processing (Nigeria) and variety improvement (Guinea).

Other possible approaches proposed to enhance productivity and improve quality included development of location specific packages for production technologies under different soil and water conditions (Nigeria), variety improvement based on needs, development of

integrated production technologies and commercialization extension (Senegal), and development of new varieties adaptable to lowlands and development of palatable rice (Ghana)

4. NERICA

As for issues to promote NERICA, it was found that each country was under its own stage of development.

Guinea has advanced with regards to NERICA dissemination and has already reached a certain level of yield. However, there is the serious problem of a fertilizer shortage. A credit system to procure fertilizer is necessary.

In Gambia, seed dissemination and the multiplication system should be formalized, and a seed bank is also required. In Nigeria, NERICA is still new. Two varieties of NERICA through testing have been officially released in 2003. Further information on varieties is required.

In Mali, a shortage of inputs like fertilizer poses a serious problem. So far only one variety has been selected. No farmers are organized. They lack a system for encouraging and training farmers who grow NERICA.

In Côte d'Ivoire, finance in disseminating seeds is a problem. They lack credit facilities.

In Senegal, production is still very small.

In Ghana, experiments on variety selection are still ongoing.

WARDA stated that NERICA is not well-known. For future development and promotion of NERICA, it presented three issues: (i) characterization of NERICA, (ii) establishment of seed production and distribution system, and (iii) development of a package of NERICA production technology.

Group B

Round Table Discussion in Group B, chaired by Mr. M. Tomitaka, Advisor to Agricultural Planning Department of Ministry of Agriculture, Animal Industry and Fisheries of Uganda, convened in seminar room #5 of AICAD. The total number of participants was 46 from eight countries as well as the representatives of Sasakawa Global 2000.

Prior to the discussion, Mr. Tomitaka provided a brief explanation of the objective and agendas of the discussion. Each representative from the participating countries presented the current conditions and five issues on rice development based on the formatted table they had filled in (refer to F. Round Table Discussion in this document).

1. Present Conditions

Based on the presentation from the participating countries, the following was identified as the common status of rice and rice production in the participating countries:

(i) Rice is important as a food crop and cash crop as its production is ranked 2nd or 3rd in important cereals in some countries;

(ii) While the consumption rate of rice is increasing, the self-sufficiency rate is low. Most

countries import rice from Asian countries; and

(iii)Rice is recognized as an important marketable crop.

2. Issues

- There is no fixed legal framework for administering cross-border technology transfer (Kenya, Uganda, Guinea, Malawi). For commercial use, cross-border technology transfer may be strictly controlled by the government (Uganda). An official registration system is not established yet in Guinea, while the private sector plays certain roles in maintaining the quality of seeds (Tomitaka).
- A major constraint is the price because domestic rice production suffers from price competition with imported rice in the market (Kenya, Tanzania).
- The quantity of NERICA seed initially provided was not high enough for many farmers to try. The limitation of the seed availability is a problem (Malawi).

3. Possible approaches

- It was stressed that some systematic arrangements for sharing information and useful experiences in the region needs to be established (Ethiopia, Malawi). Other approaches may include standardized research procedures and exchange of data system, etc. (Tamura, Tanzania).
- In Kenya, Basmati rice is a strong preference. The quality aspect should be addressed in order to challenge the price disadvantage relative to imported rice. The application of technology is also an important issue to address. Most Kenyans may have a will to pay farm inputs as long as a reasonable yield increase would be attained (Kenya).
- Introduction of new machinery and technology should be implemented after carefully assessing local capacity in order to ensure sustainability and technology adoptability (SG 2000).
- Marketing of rice including high quality post-harvest handling should be stressed for marketing purpose (Tomitaka). Polishing from and storing in the form of brown rice as is done in Japan are areas to explore (Kenya).
- In order to protect domestic rice production, WTO should allow developing countries to ban certain products from import as a restrictive measure to protect the local market from export subsidies by producing countries. One or two commodities can be excluded. This is being negotiation now in Geneva (Azuma). One suggestion that I can give is to consume locally available foods at all boarding schools, prisons, and other government institutions (Tomitaka).
- In order to compete against imported subsidized rice, overall production costs should be dramatically reduced by improving productivity and adjusting macro policy, such as subsidies to farm inputs, etc. (Kenya).
- UNDP has instantiated post harvesting handling. The donor directly supports the food processing industry and agro-based industry. Why do they support the processing industry? Development and dissemination of technology, in a comprehensive approach, are equally important. The whole discussion right now is from the supply side. But marketing is equally important (JIRCAS).

4. NERICA

- WARDA and ARI's role in the development and dissemination of NERICA should be reaffirmed in East and Southern Africa (Ethiopia). A stronger leadership is necessary if ARI extends its technical expertise in East and Southern Africa (Tomitaka).
- There should be a harmonized policy established to allow cross-border technology transfer for dissemination of NERICA in a more accelerated manner (Malawi).
- Better coordination and arrangements at national, regional and inter-regional levels will accelerate dissemination of NERICA in Africa (Kenya). AICAD has a role to play in terms of university-based cooperation (Tomitaka).
- Development of varieties with disease and draught resistant characteristics are a higher priority (Uganda), while other participants (Tanzania, Kenya) stressed storing and development of lowland NERICA (Kenya). We need strong bug resistant varieties. The selection process should be dramatically improved (Tanzania).
- NERICA varieties are still new. Work hard to multiply the seeds and anything you can do is valid.
- Status of adopting and developing NERCA is very different from country to country in East and Southern Africa (Uganda). Strengthened collaboration through information sharing is necessary. Also, we need to include consumers as important stakeholders (Kenya).
- If you receive the seeds from outside organizations such as WARDA or IRRI, go ahead and cultivate them. In some countries you can harvest up to three times a year under certain conditions. There has not been any countries that have sufficiently adopted NERICA. You can get any line from WARDA. Show them your interest to receive their support.
- Regional cooperation and collaboration needs to be much enhanced (Zimbabwe).
- Each country is in a different phase of disseminating (or developing) NERICA. Establishing standardized research methods along with providing funding would be a suggestion (Nozaka). A standardized research method already exists, is internationally recognized, and there is a basic manual. JICA is not in a position to provide support here because we are not a research institution, but JIRCAS may be. If necessary, we may organize say a one-week long workshop on such topics as NERICA research in the future (Tomitaka). From JICA's perspective, such technical cooperation may be possible (Sato).

7. Wrap up Session (17:15-17:45)

Dr. Narihide Nagayo Leader, Small Scale Irrigated Agricultural Promotion Project (SSIAPP), Ghana

Dr. Nagayo stated three major items to explain the present condition of rice in the countries of Group A: (i) its important position in cereal crops in general, (ii) low self-sufficiency rate in many countries and (iii) rain-fed condition as its major growing environment. He listed the constraints to promoting rice production and dissemination including inadequate research in

various fields, low quality of domestic rice which reduces the competitiveness with imported rice, difficulty in obtaining inputs (high cost and inadequate credit), weak farmers' organization, inadequate post harvest processing, and lack of marketing channels. He emphasized two issues in promoting rice production and dissemination: (i) integrated approach to remove constraints including research, extension and post-harvest handling, all of which are inter-related; and (ii) quality and productivity improvement. He finally highlighted the five main issues on promoting NERICA in the future: (i) establishment of a seed bank; (ii) Assurance of inputs (e.g., fertilizer) to farmers through credit; (iii) Development of a package of production technology; (iv) Characterization of NERICA; and (v) Establishment of seed production and distribution system.

Mr. Motonori Tomitaka
Advisor, Agricultural Planning Department, Ministry of Agriculture, Animal Industry and Fisheries, Uganda

Mr. Tomitaka explained first the present condition of rice in the countries of Group B, such as (i) varied position of rice in cereals, (ii) increasing consumption trend in many countries, (iii) rice imported in many countries, (iv) recognition of rice as an important marketable crop, etc. Then he enumerated the many constraints on the promotion of rice production, including (i) lack of high yielding varieties with high quality, (ii) unreliable rainfall, (iii) damage by pest, diseases, weed, animal, etc., (iv) inadequate land preparation, (v) high cost and unavailability of inputs, (vi) land degradation, (vii) competition with imported rice, (viii) inadequate post-harvest processing, and (ix) lack of training for key stakeholders. He also presented various donors which have given assistance in relation to rice promotion, and several examples of good practices made in respective countries. To promote rice production and dissemination, Mr. Tomitaka showed four possible approaches: (i) improvement of the quality of rice, (ii) improvement of management of the irrigation scheme through active participation of key-stakeholders, (iii) enhancement of the capacity of stakeholders to be integral partners, and (iv) exchange materials and experience across national borders. He explained the present situation of NERICA in concerned countries, which is still the initial stage of introduction, and presented a way forward for NERICA dissemination, such as (i) sharing information, variety, seeds and NERICA experience , (ii) release potential lines of NERICA suitable for lowland conditions, (iii) standardization of the research methods and training of stakeholders, and (iv) improvement of post-harvest handling.

Mr. Hideyuki Kanamori
Senior Advisor, Institute of International Cooperation, JICA

To wrap up the seminar as a whole, Mr. Kanamori first reminded everyone of the purpose of the seminar: "To share the current situation and problems on rice among participants". Then he briefly introduced all the presentations. In the key note speeches, Mr. H. Azuma and Dr.

Gimaraes made presentations defining the direction of approaches for assistance from the viewpoints of their respective organizations. In session 1, three speakers from the Sokoine University of Agriculture of Tanzania, UNDP, and Kenyan Agricultural Research Institute, respectively, described their activities on agricultural development and rice cultivation. In session 2, two ongoing JICA-supported technical cooperation projects— Small Scale Irrigated Agriculture Promotion Project in Ghana and Kilimanjaro Agricultural Training Center Project in Tanzania—were presented. In session 3, Presentations focusing on NERICA were made by several organizations actively carrying out activities on NERICA in the field, from which the constraints and opportunities of NERICA were recognizedNext, Mr. Kanamori summarized the outcome of the round table discussions, explaining (i) the number of countries that participated, (ii) present conditions of rice in terms of the rank of rice in cereal crops, self-sufficiency rate in rice and major growing environment, (iii) possible approaches to be taken for promoting rice production and dissemination, and (iv) issues to promote NERICA, which are shown below.

Group	A	B
No. of countries	9	8
Rice rank in cereal crops	1 to 4	2 to 8
Self-sufficiency rate in rice	Low	Low except 1
Major cultivation condition	Rainfed	Rain-fed/irrigated

Group	A	B
Possible Approach	1) Conduct integrated approach. 2) Improve quality and productivity.	1) Improve quality of rice 2) Improve irrigation scheme. 3) Enhance capacity. 4) Exchange material and experience
NERICA	1) Need seed bank. 2) Need credit for inputs. 3) Need a package of production tech. 4) Characterize NERICA. 5) Need seed production and distribution system.	1) Share information 2) Want NERICA lowland 3) Standardize the research 4) Improve post harvest.

A. Opening Address

1. Mr. Masaaki Otsuka: Resident Representative, JICA Kenya Office
2. Mr. Joseph K. Kinyua: PS, Ministry of Agriculture, Government of Kenya

Seminar on "Promotion of rice production and dissemination in Africa"
Speech by Resident Representative, JICA Kenya Office–10th Feb.2004

Mr. Joseph Kinyua, Permanent Secretary, Ministry of Agriculture,
Mr. Hisao Azuma, Vice. President, The Japanese Committee for International Year of Rice, former Vice President of JICA,
WARDA Representative,
Prof. Andrew Gidamis, Executive Secretary AICAD, colleagues,
Resource persons and the seminar participants, Ladies and Gentlemen.

On behalf of the JICA Kenya Office, I would like to take this opportunity to welcome you all to this international rice seminar. We appreciate the efforts made by you to avail yourselves from your busy schedules.

It was exactly one year ago that we had AICAD inauguration ceremony and an international seminar on Food and Water in Africa. We covered the linkages with TICAD III and 3 rd World Water Forum in Kyoto.
This is the second agricultural symposium organised by JICA. It is a great pleasure and honour that agricultural symposium is held regularly at AICAD in Nairobi and sending the message of JICA's strategy for agricultural development in Africa.

As you may know, JICA acquired a new status from the beginning of last October and attained a new status of "independent administrative institution" from the previous "special public institution". JICA's Mission Statement is "For a better tomorrow for all".

The reform within JICA implies closer attention paid to grassroots cooperation, peace building, cost effective performance, faster decision making and visibility.
Inline with this objectives and the leadership of JICA's new president Madam Sadako Ogata, JICA is more interested in and emphasise supporting Africa in achieving increased food production, reducing poverty and creating wealth.

As some of you are aware, TICAD (Tokyo International Conference for African Development) is a forum for discussions of development agenda for Africa. These discussions are held between the collaborating African countries, Japan and multilateral development organisations including the United Nations, UNDP, the Global Coalition for Africa (GCA) and the World Bank.

During TICAD II, held in 1998, a decision to establish AICAD (African Institute for Capacity Development) was made.

The AICAD's objective is to reduce poverty among the African countries through human resource development. Initially, the project will cover only the three East African countries including Tanzania, Uganda and Kenya. In future the project would expand to cover other countries in Sub-Saharan Africa.

In September 2003, during TICAD III, wide-ranging discussions were held in order to embrace the New Partnership for African Development (NEPAD). The forum emphasised the importance of agricultural development for poverty reduction and economic growth. Prior to TICAD III, at the World Summit on Sustainable Development (WSSD), in 2002, South Africa, the Japanese government expressed the support for dissemination of New Rice for Africa (NERICA) to African nations was of major concern.

In addition, the UN resolved at the General Assembly in December 2002, that this year is designated as the International Year of Rice, with the motto "rice is life". The aim is to create awareness on the importance of rice for food security and poverty reduction in line with the Millennium Development Goals (MDGs).

In this regard, it is necessary to emphasise the assistance to Africa urgently through discussions on how to promote rice production and intervene, particularly on NERICA.

Majority of Sub-Saharan African countries are faced with food deficit and experience high poverty levels. This could be changed through increased rice production and dissemination.

NERICA rice has advantages over other rice varieties including, tolerance to drought and water stress, can be grown under upland and lowland rain-fed conditions, tolerant to diseases and has short maturity period.

In Kenya, the agricultural sector contributes about 25 % towards the GDP and provides employment to about 75 % of employment in the rural areas. In this background, JICA has been active in supporting smallholder irrigation, rural development in Arid and Semi-Arid lands and support for horticultural production and marketing.

With regards to rice, JICA Kenya has previously supported rice production and research through a five-year collaboration with National Irrigation Board (NIB), at Mwea Irrigation Scheme.

Last year, JICA Kenya collaborated with KARI (Kenya Agricultural Research Institute), to carry out NERICA adaptability trials, under rain-fed condition, in Kisumu and Matuga. The result is encouraging. Currently, irrigated NERICA trial is going on at Mwea Irrigation Scheme through partnership between JICA, KARI and NIB.

This international rice seminar is a good opportunity for all the participants from different countries to exchange information and disseminate the appropriate technologies to respective countries.

Finally, may I wish you all a frank, open and successful seminar. I hope the various papers to be presented from different countries, would stimulate interesting and useful discussions, leading to pro-active rural development through rice production.
I wish you all a pleasant stay at AICAD.

Thank you for your attention!

SPEECH BY THE PERMANENT SECRETARY FOR AGRICULTURE, MR JOSEPH K. KINYUA, ON THE OCCASION OF THE INTERNATIONAL SEMINAR ON PROMOTION OF RICE PRODUCTION AND DISSEMINATION IN AFRICA ON FEBRUARY 10, 2004.

Mr. Masaaki Otsuka, Resident Representative, Jica Kenya Office
Mr. Hisao Azuma, President, Equine Cultural Affairs Foundation of Japan
Distinguished Guests
Ladies and Gentlemen

1. I am pleased to be here this afternoon to officiate the opening of this Seminar on **"Promotion of Rice Production and Dissemination in Africa".**

2. This Seminar is important to us as a Government for a number of reasons. First, the choice by the organizers to have Kenya host it is testimony to the confidence the international community has in the prudent and civilized manner our new Government is managing the economic and political affairs of this country. We are particularly grateful for that recognition. Second, and perhaps more important, is the recognition of the importance of agricultural development to the realization of a prosperous and hunger free continent of Africa.

3. **Ladies and Gentlemen**, available information shows that about **one billion** of the world's population is chronically **food insecure**. And majority of these people are in the sub-Saharan Africa. The situation in Kenya is not any better. Therefore, we all need to work hard to conquer this enemy, that is, **food insecurity**.

4. But the war against food insecurity cannot be worn unless we are ready to transform and modernize our agricultural sectors by embracing modern science and technology. We must adopt modern and efficient farming practices; we must adopt new and high yielding seed varieties. In other words, we must have **a green revolution in sub-Saharan Africa.**

5. The subject of this Seminar is therefore timely. As many of you may know, rice is the third most

important cereal crop in Kenya, after maize and wheat. It forms an important diet for a large proportion of our urban dwellers; and it is gaining popularity

among those living in the rural areas. Indeed, consumption of rice in Kenya has risen dramatically over the last fifteen years or so; it is now estimated to stand at 120,000 metric tons per annum. However, rice production over the last three years, has been far below our domestic consumption requirements, ranging between 45,000 to 50,000 metric tons per season. This means we have had to meet our consumption requirements through importation.

6. Most of the rice Kenya is grown under irrigation, mainly in four schemes; that is, **Mwea** in central Kenya, **Ahero** and **West Kano** in western Kenya. Rice grown in these schemes accounts for about 95% of total domestic production. The remaining 5% is grown under rain-fed conditions in coastal districts such as **Kwale**, **Kilifi** and **Tana River** Districts and in some parts of western Kenya. There is however, potential for expansion of rain-fed rice production in the Coast and western Kenya areas that is yet to be exploited.

7. **Ladies and Gentlemen**, there are a number of constraints that continue to hamper sustained growth in the production of rice in Kenya. **First** is inadequate funding to finance maintenance of irrigation facilities in order to provide adequate water for irrigation in the existing schemes and to finance investments in new rice schemes. The funding problem has been a major constraint and has also adversely affected research and development activities, thereby limiting the development of new rice varieties suitable for both irrigated and rain-fed conditions. Therefore, any strategy to promote agriculture must address the issues of funding or access to adequate and affordable credit by the farmers.

8. Another important constraint is the high cost of producing rice in the country. As we aim at expanding rice production in Kenya, the efficiency of production must be addressed to bring down its cost of production. Currently, locally produced rice cannot compete with imported rice. Yields of local varieties are low and the technologies for production do not favour realization of expected high yields. There is also need to improve the management of cooperative societies involved in milling of paddy and marketing of the milled rice, as this has led to almost a total collapse of the industry.

9. The need to address urgently these constraints in Kenya cannot be overemphasized. The 14,000 ha that is under rice production support almost 8,000 families, who depend on it as a source of livelihood. Improvement of this sub-sector will therefore benefit more Kenyans and will help us achieve our stated objectives of achieving national food security and reducing substantially overall poverty by year 2015.

10. We therefore, welcome the collaboration between the government of Japan and the government of Kenya in promoting rice production. This effort will go a long way in improving the livelihood of many Kenyans and assist us achieve our set objectives as stated earlier. In deed, this collaboration dates many years back and has had big impact in the rehabilitation of a number of our irrigation schemes.

11. I am told that the new type of rice known as **New Rice for Africa (NERICA)** has superior characteristics such as **short growth period**, **high disease and drought tolerance**, and **high yields**. It is therefore, expected to contribute significantly to the improvement of **food situation in Africa**. I am also told that it was developed with a major contribution by the Japanese government in terms of both human and financial resources. We in the continent of Africa are most grateful to the Japan Government.

12. **Ladies and Gentlemen**, the United Nations has declared Year 2004 as the "**Year of Rice**" in order to sensitize the importance of **rice for food security and poverty reduction in line with the millennium development goals**. There is no better way to celebrate this than for each one of us, to do whatever we can to support promotion of **NERICA rice** and any future activities involving development of rice.

13. I am happy to note that the Kenya Agricultural Research Institute (KARI) is already involved in the **adaptive research activities**, working closely with the JICA experts. Initial results of these research activities are encouraging. We should now expand this to cover a larger part of the country.

14. Let me at this point take this opportunity to thank JICA for organizing this Seminar and for bringing together participants from different regions of Africa, to share their experiences. I am confident this collaboration with JICA will bear good fruits for our Kenyan people and the people of the entire continent of Africa. I also wish to thank the Government and the people of Japan for the assistance given to support other areas of agricultural sector such as horticultural development.

15. In conclusion, I wish you all fruitful deliberations during the next two days. I also wish to encourage those of you who are **visiting** our country for the **first time**, to please find a moment to relax and enjoy the beauty of Kenya and the hospitality of our people.

16. With these remarks, it is now my pleasant duty to declare the **"International Seminar on Promotion of Rice Production and Dissemination in Africa"** officially open.

Thank you for your kind attention.

B. Keynote Speech

1. Title: “Promotion of Rice Production and Dissemination in Africa”
   Mr. Hisao Azuma: Vice President, The Japanese Committee for International Year of Rice
2. Title: “Rice in Africa Challenges /Opportunities”
   Dr. Elcio Guimaraes: Senior Officer, Cereal Crop Department, FAO

Presentation in JICA seminar on African Rice Production

By Hisao Azuma 2.5 1:00

(The International Year of Rice 2004)

1. This year was dedicated to the International Year of Rice by the General Assembly of the United Nations(UNGA). This dedication to a single crop was unprecedented in the history of UNGA. The theme or motto of the International Year of Rice is “Rice is life”. It reflects the importance of rice as a primary food source and is drawn from an understanding that rice-based production systems are essential for food security and poverty alleviation, which are the main objectives of the UN Millennium Development Goals (MDGs).

2. Rice is the staple food of over half of the world population and occupy more than one third of the world total grain production. In Asia, more than 2 billion people obtain 60 to 70 percent of their energy intake from rice, and it is the most rapidly growing food source in Africa. It is the predominant staple food for seventeen countries in Asia, and eight countries in Africa. It provides 20 percent of dietary energy supply in the world and 27 percent in all developing countries.

3. About 80 percent of rice in the world is grown by small-scale and low-income farmers and consumed locally in developing countries. Rice-based production systems, including post harvest operations, employ nearly one billion people in rural areas of developing countries. Therefore, efficient rice-based production systems are vital for economic development and for improving standard of life in developing countries. And improving the productivity of rice-based production would contribute to hunger eradication, poverty alleviation, and national food security.

4. The General Assembly of the United Nations nominated FAO as the leading organization to implement and to coordinate IYR activities. It also designated that the fundamental aim of IYR is to promote and guide the sustainable development of rice and rice-based production systems, now and in the future. In order to meet this goal, FAO established the IYR strategy focusing on the following activities;

1) increasing public awareness of the contributions that rice-based systems make to food security, better nutrition, poverty alleviation and livelihood improvement;
2) increasing public awareness of the diversity and complexity of rice-based systems, and challenges and opportunities for their sustainable development;
3) promoting and providing technical support to ensure the sustainable development of rice and rice-based systems at the global, regional, national and community levels;

4) promoting the conservation and enhancement of rice-based products in order to derive economic, social, cultural and health benefits for the world's human population.

5. FAO encouraged each country to organize its national committee on IYR. Responding to this request, Japan organized its national committee whose main roles are as follows;

1) reaffirming the importance of rice and rice production in Japanese society and culture,
2) promoting Japanese style diet with rice as the staple food for healthy life in Japan,
3) increasing public awareness of the world situation of rice and of the necessity of international cooperation in rice production.

Professor Kimura was appointed to the president of this committee and I myself was appointed to the vice president, and this seminar was positioned as one of Japan's international activities in IYR.

(Rice production increase in Japan)

1. In 1963, imminent food shortages and the threat of famine, especially in Asia, led FAO into Freedom from Hunger Campaign. A major contributor to the campaign in success was the introduction of high yielding rice varieties by the International Rice Research Institute (IRRI). This resulted in the Green Revolution in many rice producing countries in Asia. Rice production increased and hunger and poverty were reduced dramatically.

2. Prior to this Green Revolution, Japan succeeded in enhancing rice yield by using improved varieties, which are the parent varieties of IRRI's new varieties for Asian Green Revolution. After the conclusion of the World War Ⅱ, many Japanese nationals and soldiers were forced to return to their hometowns from Japan's occupied areas. This population influx resulted in a dramatic increase of domestic food consumption, while there was a stagnation of domestic food production and a limited ability to import food due to the country's shortage of foreign currency. With poverty and starvation pervading the country, the most important government's policy task was to feed the people in a sustainable and equitable manner. As it is well known, the staple food of Japanese is rice. Therefore, the government primarily devoted itself to increase rice production by encouraging to enlarging rice acreage and to enhancing rice yield. For this purpose, new rice varieties bred by the national agriculture research institutions had been introduced with appropriate technologies.

3. In Japan, the average-year-base rice yield in milled was 3.1 ton per hectare in 1945, just after the war, and reached 4 ton in 1965, just around the starting year of the Asian Green Revolution. It was mainly owing to the introduction of new varieties with fertilizers and pesticides. The mechanization of agriculture with realignment of arable land started in 1960s also stimulated to enhance rice yield to 4.5 ton in 1975. But in 1970 Japan faced the problem of overproduction of rice, and afterwards farmers have been shifting their efforts to get better quality rice rather than to get larger quantity. Until 1980 the tendency of increasing yield had been continued to be 4.74 ton, but after that the increase has been stagnating.

4. It is the time of Sub Sahara African countries to increase their rice production with new varieties such as “NERICA”. We know that NERICA is now the variety of upland rice, but it is a variety between African and Asian rice, and may open up new horizon to new varieties fit to African wetland. At the Johannesburg summit, our Prime Minister picked up “NERICA” as a possible seed to ignite the African Green Revolution. Japan has a dream that many Sub Sahara African countries may start their Green Revolution with “NERICA”.

5. “Why rice in Africa?” It is a question directed to Professor Kimura in a seminar of the Japan Committee on IYR. He answered that “Rice is the most productive grain in a unit of arable land in Africa. Rice is a crop to be able to harvest three times a year in most of African countries, and easy to be allocated in crop rotation properly. Rice is environmentally friendly crop and its production is sustainable. Rice is nutritionally rich with gluten and protein, and can contribute to improve malnutrition in Africa. Even in nations “new to rice”, production of rice introduce new cuisine with rich taste, and provide farmers with new sources of income”

(Rice in Sub Sahara Africa)

1. The world total rice production in paddy field is about 600 million ton in 2000, which is about three times more than the production in 1961. During the same period, in Sub Sahara Area, rice production had increased from 3 million to 11.3 million ton by more than 3.5 times. But the increase of rice yield shows a different picture. Although world average yield of rice increased by double, rice yield in Sub Sahara Area increased by only less than 40 percent, which has been stagnated after 1985. Under this situation, until 1990 Sub Sahara Area could increase its production mainly by increasing its acreage, but after that the production itself has been leveled off. This is the case of paddy rice, which provides almost 90 percent of total rice consumption in the world, but the increase of upland rice yield is worse. It is said that in West Africa, where is the

largest rice producing area in Africa, about 40 percent of total rice acreage is covered by upland rice.

2. On the other hand, the consumption of rice in African countries has been increasing very rapidly due to population growth and increase of consumption per person in urban areas. To cover the gap between rice production and consumption, rice imports of Sub Sahara African countries have expanded dramatically and reached 6.8 million ton in 2001. This figure is almost one third of their consumption and about 30 percent of total world traded rice. Rice tends to be consumed locally and the international rice market is thin, accounting for only 5 to 7 percent of world output. Moreover, it is segmented into varieties such as Indica or Japonica, and qualities such as aromatic or glutinous. It can be said that international rice market is rather tending to fluctuate easily by production conditions. Therefore, it is an anxiety not only of African countries but also of large importing countries in other areas whether African countries can increase their rice production domestically in the future.

3. The Expert Consultation on Yield Gap and Productivity Decline in Rice Production by FAO recognized that there is a sizable rice yield gap between attainable and actual farm yield. In many developing countries, yield of paddy rice in irrigated area is only 4 to 6 ton per hectare, while the potential yield of modern rice varieties is 10 to 11 ton under tropical humid conditions. In Sub Sahara Africa, rice yield is even worse with half of the world average, and there is a potentiality to improve rice yield considerably. Increasing rice yield and production requires not only genetic improvements for higher yield potential but also better management technologies and systems including institutions.

(Improvement of rice yield and production)

1. Concerning genetic improvements, there are several improved rice varieties introduced by IRRI for paddy field. And recently WARDA introduced high-yield potential seed named NERICA for upland field and is going to extend this crossing and breeding technology to paddy rice in Africa. The point is how to apply those new varieties to actual field under different environments. The national agriculture research institutes in individual country should play the main role in application tests including rotation with other crops like maize or leguminous whose improved seed would be supplied by CIMMYT or IITA.

2. Next step is the dissemination of those varieties with appropriate technologies. There are three types of rice production systems; wetland, rain-fed and upland. In wetland areas, rice base production systems are prevailing, and in rain-fed or upland

areas, integrated production systems are prevailing and rice should be placed properly in crop rotations. New varieties may require proper application of fertilizers and pesticides suited to different environments. Furthermore, those different conditions would impact on introduction of machines and crop management including water control for getting better results.

3. The goal of increased productivity can be best achieved by coupling the most appropriate available technologies. Research institutions should provide appropriate and location-specific technological packages. The extension services should ensure farmers use correctly and systematically recommended technical packages. A farmer's ability to adopt those technologies depends on the linkages among research institutions, extension services and farmers.

4. At the field level, yield differences among farmers in the same area are observed because of farmers' different ability of crop management. Due to the fact that in Sub Sahara Africa Area most of rice production, especially upland rice production, is shared by small-scale farmers, it is essential to provide participatory approaches under rural development programs for enhancing total production. Japan possesses several advantages when it comes to tackling issues related to small-scale farming. We can transfer farming technologies suited to small-scale farming with the aim of increasing productivity.

5. With regard to using fertilizers, relevant application of nitrogen fertilizers from productivity. seeding to harvesting, in terms of quantity and timing, will make significant contributions to increase rice yield while avoiding unnecessary losses of nitrogen, which increase cost of production. Farmers need adequate amount of fertilizers at right time, hence the provision of special mutual credit systems for small farmers can help them. With regard to pesticides, it is the most effective to spread them at the same time in whole area, and group collaboration for spreading is recommendable.

6. Concerning agricultural mechanization, at the beginning Japan tried to introduce big machines which were used in western countries to enhance rice productivity, but failed in dissemination of those machines because of predominant small-scale owner farmers who are not willing to retire from their farming activities and to let their fields unite. Therefore, Japan developed rather small machines fitting to small lots and started in realigning fields into rather small rectangular shape (100X30 meters) for the purpose of easy use of those machines. Those realigning works can be implemented easily under rural development programs and they also make groups use machines rather easily. Water supply control is another issue to be tackled in a rural community

as a whole. We have to use water, which is scarce resources, effectively under the control of local authorities. For African small farmers it may be more realistic to start in introducing rather small- scale irrigation systems suitable to their environments.

(Rice production in rural development)

1. Increased productivity of main crops such as rice makes small farmers to be able to provide enough food for their families, and whatever surplus they have, they can sell it to markets. Moreover, these farmers can utilize the surplus labor force, which they may gain through increased productivity in the limited acreage of their farms, in other areas of agricultural production, such as fruits and vegetables or livestock. This will provide them extra sources of income. It may also be expected that new agricultural products will generate new marketing or processing industries. Some farmers or their family members can work in these industries as part-time workers, and some of them can become full-time workers while still living in rural villages.

2. Increasing the income of farm households will stimulate economic activities in rural areas---for example retail, transportation, and other service businesses--- and farmers would be able to take advantages of other employment opportunities. It is also feasible that some enterprises would establish their factories close to rural areas so as to have easy access to surplus farm labor forces. Through this process, the income of farmers' and rural inhabitants' households can be improved as a whole with income not only from farming but also from other activities. Poverty can be alleviated in rural areas, and the income or living standard gap between rural areas and urban areas can be diminished. This will results in the well-balanced development of the country as well.

3. This is the process of Japan's agricultural and rural development in the course of its rapid economic growth from 1960 to 1990. An increasing reliance in non-farm related works to complement income generated from farming led to an increase in the ratio of the income of a farm household compared to that of a non-farm household from 75% in 1960, to about 110% in recent years, with about 85% of farmers' incomes coming from non-farming activities. Over the same period, however, the farming village population in Japan fell by only nine million, from 53 million in 1960 to 44 million in 1995, and the farming village community sustains and develops itself with agriculture as the base. Farmers either continue to farm or even suspend their farming activities while living in farming villages and looking for employment opportunities in other industries. This process of agricultural and rural development in Japan resulted in an alleviation of the income gap between rural and urban areas, in addition to bringing

about the current overall well-balanced development of the country. The same process is going on in other Asian countries as well, especially in China and Korea.

4. As Japan shares the same characteristic of agriculture with most African countries as “Small-scale Farming”, Japan can extend its technologies suitable for small farmers what it obtained in the course of its agricultural development. It also can extend its experience of rural development as a reference, even though we realize that each country has its own historical background, conditions and environments in terms of agriculture and rural societies. Japan can work together with African countries toward overall rural development based on agriculture, especially rice production, with the view to food security and poverty alleviation.

(Japan's cooperation)

1. The Millennium Summit of the United Nations in September 2000 delivered the resolution on African issues. It says, “We will support the consideration of democracy in Africa and assist Africans in their struggle for lasting peace, poverty eradication and sustainable development, thereby bringing Africa into the main stream of the world.” Thereafter, the summit of African countries formulated NEPAD(New Economic Program of African Development) by their own initiatives, responding to the resolution of TICAD(Tokyo International Conference of African Development)Ⅱ which indicates the importance of ownership of African countries. It was applauded and endorsed by the G-8 summit in Kananaski and WSSD(World Summit on Sustainable Development) in Johannesburg.

2. Based on NEPAD, Comprehensive African Agriculture Development Program(CAADP) was agreed among agriculture ministers in 2002, which was endorsed by the heads of African governments as an integral part of NEPAD. CAADP indicated that investments should be focused on the following four points.

1) Enlargement of arable land which can be managed well with appropriate water control systems,
2) Improvement of infrastructures in agricultural sector and enhancement of trade capability for market access,
3) Increase of food supply and reduction of malnutrition,
4) Enhancement of agricultural research and technical extension.

Moreover, the summit of the African Union which was held in Mozambique in July last year adopted and announced the declaration of pledge to increasing the budget for agricultural investment.

3. These continuous efforts of African countries were welcome by other

participant countries in TICAD Ⅲ held in Tokyo in September of last year. In its meetings the main issue was how to implement and realize NEPAD itself through TICAD process. The strong commitment of the government of Japan to African development based on NEPAD was highlighted in the speech of Prime Minister Koizumi in TICAD Ⅲ. Now, it is the obligation of Japan as a host country of TICAD to extend its cooperation for realizing NEPAD and for stimulating African development.

4. In TICAD Ⅲ, one of the main themes is how to advance agricultural development in Africa, and it is recognized that implementation of practical measures to enhance agricultural development is one of the priority matters for poverty eradication. Prior to TICADⅢ, in WSSD Japan's Prime Minister applauded the innovation of NERICA and expected African Green Revolution with it, resulting in the improvement of food security and eradication of poverty in Africa. It is my understanding that rice dissemination in western Africa is a strategically important program in NEPAD and that NERICA is dedicated to the favorable rice variety to be disseminated. NERICA is now a variety of upland rice, but it is a crossing variety between African and Asian rice, and this technology of crossing can be used to get new paddy rice varieties.

5. January 20th of this year, we held the first meeting of the Japan Committee on IRY and in its inaugural message Japan's Minister for agriculture, Mr. Kamei, told the audience, "When I attended an FAO meeting in Rome last November, I had a chance to see some pictures of rice production activities in different developing countries exhibited in the hall of FAO head quarter building, and I realized that Japan or Japanese would be expected to increase its cooperation in this field." Japan has already announced in various occasions that Japan would support the efforts of Sub Sahara countries to advance their agricultural development by providing its cooperation as one of the priority sectors.

6. It is JICA's mission to extend Japan's international cooperation in agriculture sector. JICA started its mission as a new organization from last October, even though it did not change its name in English(in Japanese its name was changed slightly). JICA got more flexibility to carry its business, but under the stringent government budget it is required to implement its mission more efficiently. It will continue to extend the same kind of cooperation as it did, but it is going to put more focus on "comprehensive program approach" and "regional approach". The new president of JICA is very concern about African development from her humanitarian viewpoint. She is very proud of being called by the name of "Mother of Africans". Therefore, I am sure that JICA is going to increase its cooperation to African countries.

(Concluding remarks)

7. I hereby would like to conclude my speech with quoting a comment delivered by the Governor of Hyogo Prefecture, where the city of Kobe located, just after the Kobe earthquake. “I felt we were well supported by all Japan and Japanese when I was given a rice ball by a salvation team from other prefecture. Rice is really life itself for me.”

The International Year of Rice

To promote and guide the sustainable development of rice and rice-based production systems, now and in the future

The IYR Strategy

- To increase public awareness of the contributions of rice-based systems
- To increase public awareness of the diversity and complexity of rice-based systems
- To promote and provide technical support to rice-based systems
- To promote the conservation and enhancement of rice-based products

Japan Committee on IYR

- Reaffirming the importance of rice and rice production
- Promoting Japanese style diet with rice as the staple food
- Increasing public awareness of the world rice situation and international cooperation in rice production

Rice production in Japan

	production(thou. ton)			yield(ton/ha.)	
	total	paddy	upland	paddy	upland
1965	12,409	12,181	228	4.02	1.72
70	12,689	12,528	161	4.29	1.84
75	13,165	13,085	80	4.50	1.79
80	9,751	9,692	59	4.74	2.15
85	11,662	11,613	49	4.82	2.06
90	10,499	10,463	36	4.94	1.89
95	10,748	10,724	24	4.99	2.09
2000	9,490	9,472	18	5.16	2.56
02	8,889	8,876	13	5.22	2.25

Why Rice in Africa

- The most productive grain in a unit of arable land in Africa
- A crop to be able to harvest three times a year in the most of African countries
- Environmentally friendly crop and sustainable
- Nutritionally rich

Grain consumption and yield in Sub Sahara
(per person kg/year, ton/ha.)

	rice	maize	sorghum	millet
1980 consumption	17.6	40.0	32.3	21.9
yield	1.35	1.14	0.86	0.66
1990 consumption	20.9	50.3	28.1	22.8
yield	1.65	1.19	0.73	0.67
2000 consumption	19.1	44.6	23.0	21.8
yield	1.66	1.28	0.83	0.66

Rice production and import

	Paddy rice production (thousand ton)		Paddy rice yield (ton/ha.)		Import (thousand ton)	
	world	South of Sahara	world	South of Sahara	world	South of Sahara
1961	215,654	3,149	1.87	1.18	6,607	462
1965	254,081	3,677	2.03	1.26	8,412	738
1970	316,384	4,677	2.38	1.33	8,856	707
1975	356,994	5,677	2.51	1.40	7,298	592
1980	396,868	6,194	2.74	1.36	12,815	2,277
1985	467,955	7,097	3.25	1.50	12,535	2,806
1990	518,221	9,171	3.53	1.64	12,288	2,714
1995	546,021	9,916	3.66	1.57	21,989	3,654
2000	602,605	11,329	3.91	1.67	22,742	5,032
2001	597,787	11,414	3.95	1.61	23,515	6,755

International agriculture research institutions

- IRRI(International Rice Research Institute)
- WARDA(West Africa Rice Development Association)
- CIMMYT(International Maize and Wheat Improvement Center)
- IITA(International Institute of Tropical Agriculture)
- ICARDA(International Center for Agriculture Research in the Dry Area)
- ICRISAT(International Crop Research Institute for the Semi-Arid Tropics)
- ILRI(International Livestock Research Institute)
- CIAT(International Center of Tropical Agriculture)
- IFPRI(International Food Policy Research Institute)
- IWMI(International Water Management Institute)
- ICRAF(World Agroforestry Center)

Rice production Technologies

- Application of fertilizers and pesticides
- Introduction of machines
- Crop management including water control

(Linkage among research centers, extension services and farmers)

Process of enhancing farm household income through rural development

- Increase of productivity of main crops (labor force surplus)
- Diversification of production (fruits, vegetables, livestock)
- Generation of processing and marketing industries (works for farmers and their families)

increase of farm household income

- Stimulate economic activities in rural area (other working opportunities for farmers and their families)

The UN Millennium Summit Resolution on African issues

- We will support the consideration of democracy in Africa and assist Africans in their struggle for lasting peace, poverty eradication and sustainable development, thereby bringing Africa into the main stream of the world.

CAADP Four Point

- Enlargement of arable land
- Improvement of infrastructures
- Increase of food supply and reduction of malnutrition
- Enhancement of agricultural research and technical extension

Minister Kamei's comment

"Japan and Japanese would be expected to increase its cooperation in rice production or rice-based systems"

Hyogo prefecture Governor's comment

"I felt we were well supported by all Japan and Japanese when I received a rice ball by a salvation team from other prefecture. Rice is really life itself for me."

Rice is Life

RICE IN AFRICA
CHALLENGES/OPPORTUNITIES

Elcio Perpétuo Guimarães
Senior Officer – Plant Breeder
FAO - AGPC

FEB-2004

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FAO's ROLE

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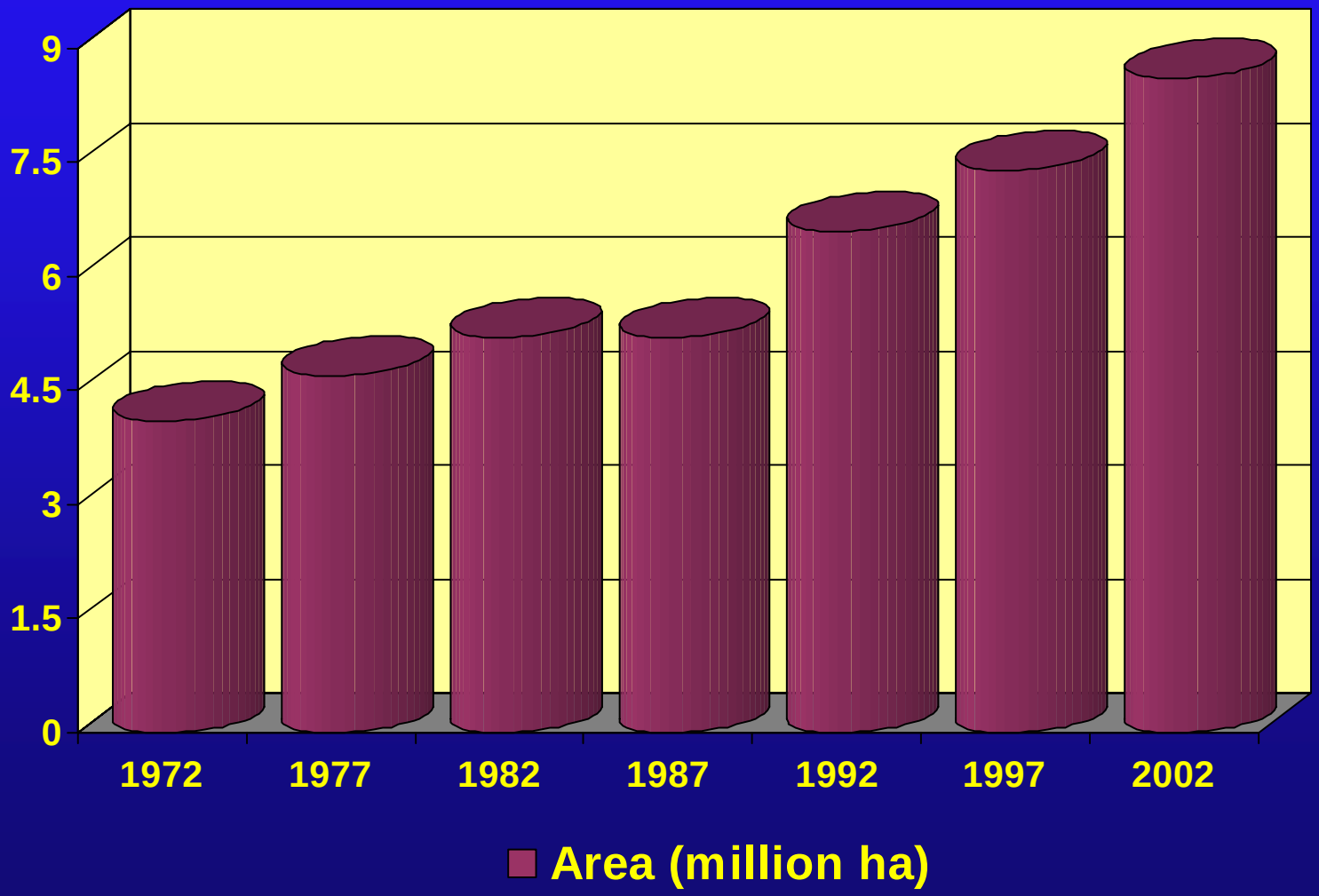
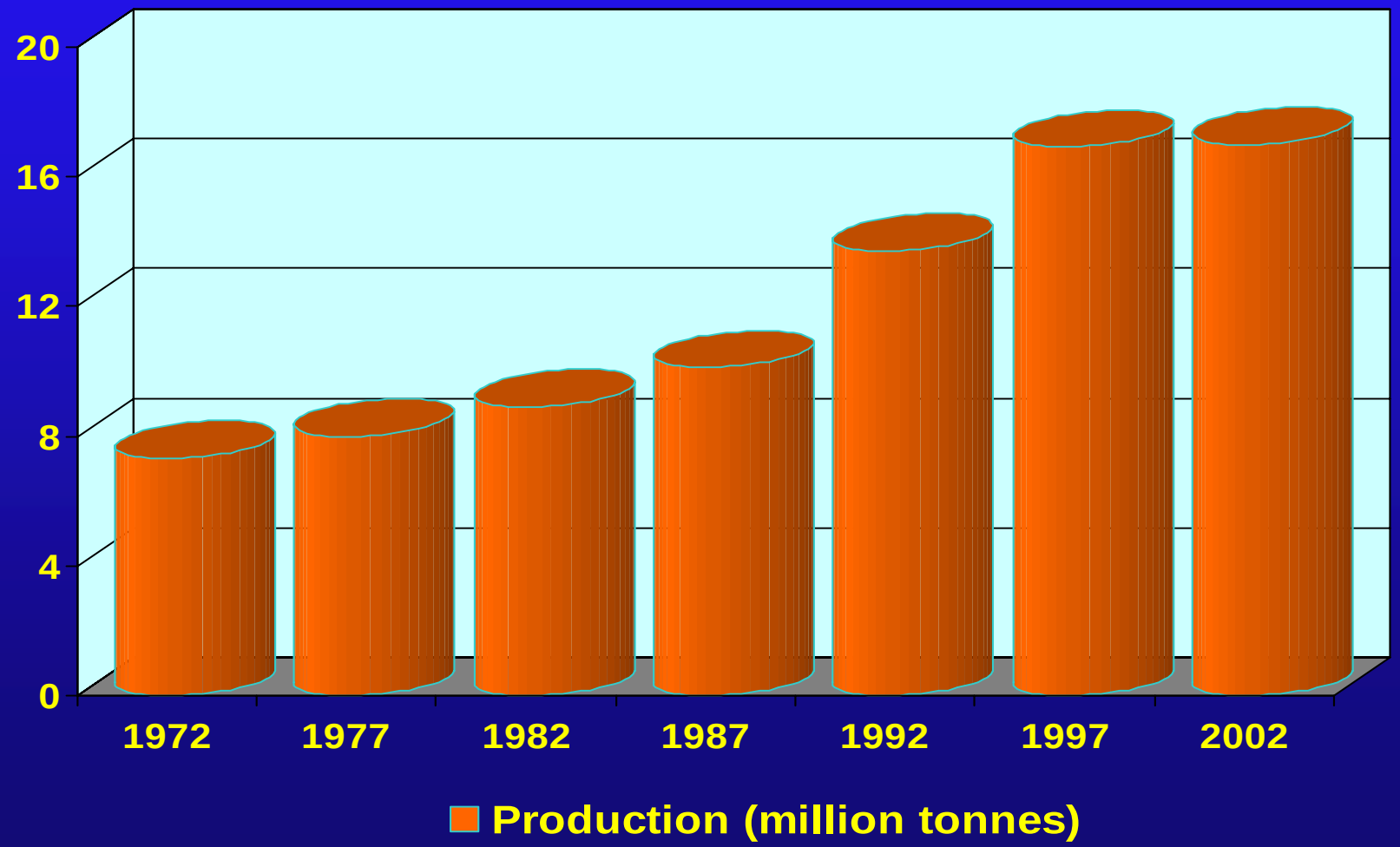
RICE AREA IN AFRICA



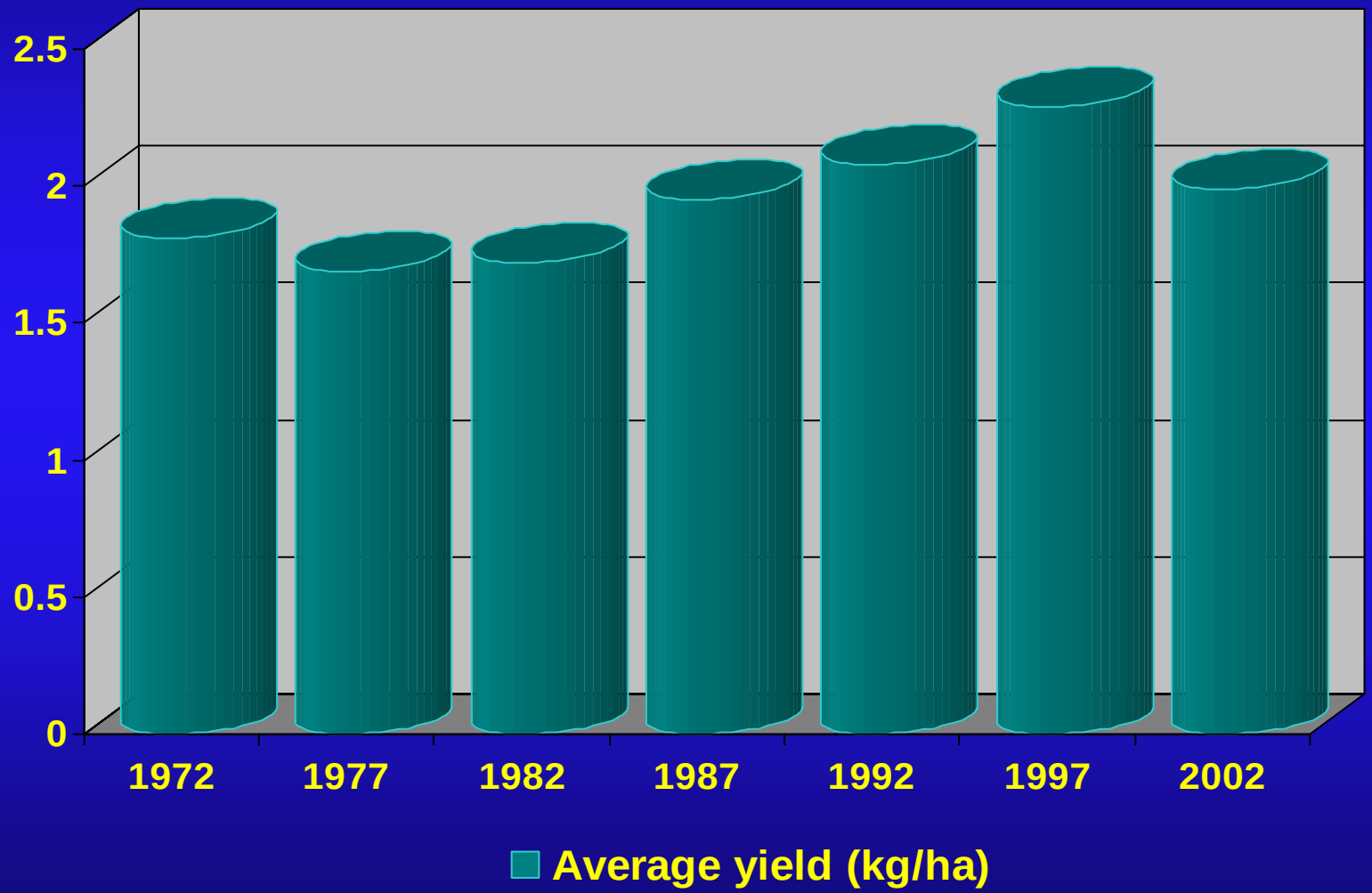
SOURCE: FAOSTAT (2004)

RICE PRODUCTION IN AFRICA



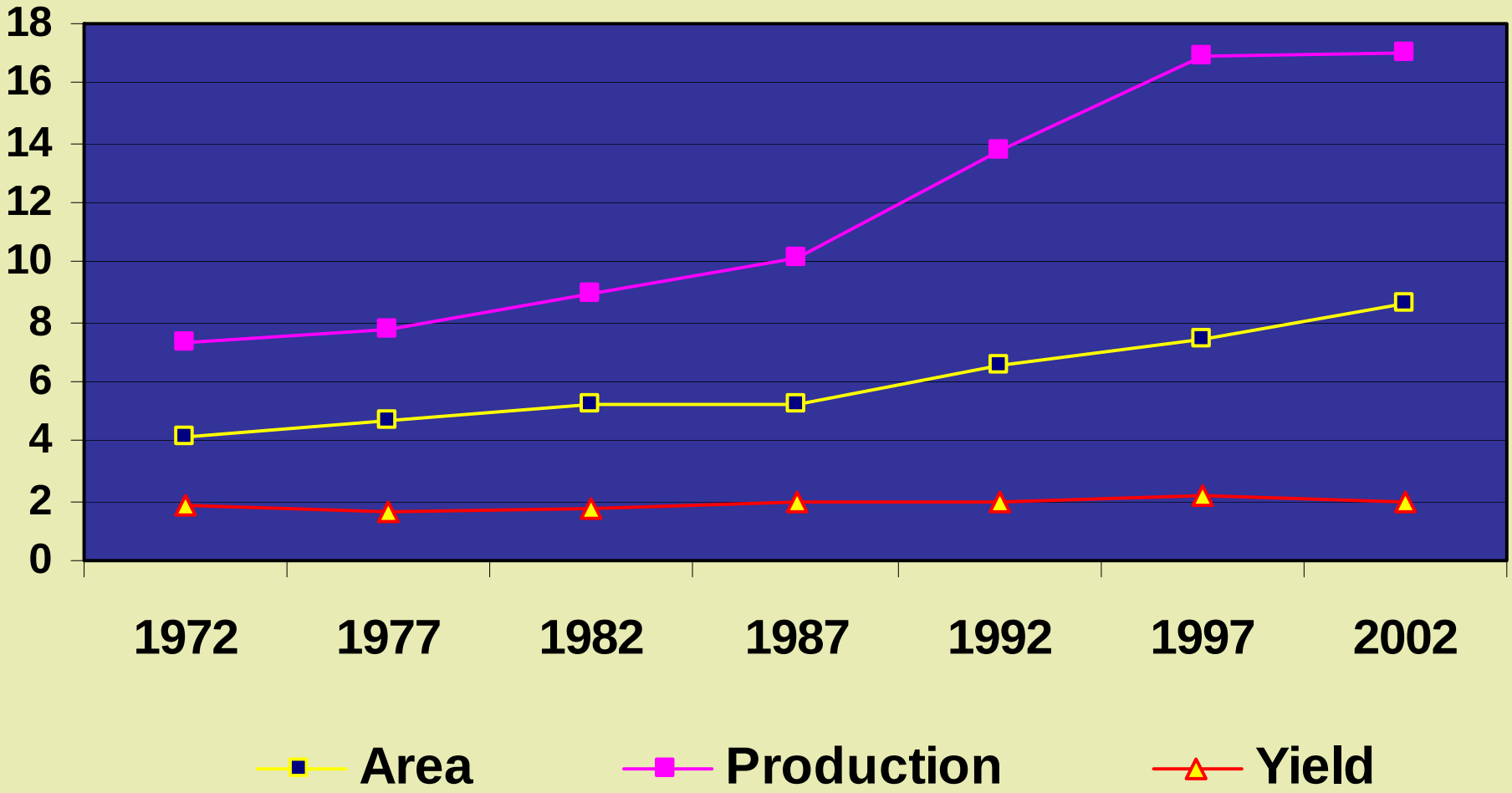
SOURCE: FAOSTAT (2004)

RICE YIELDS IN AFRICA



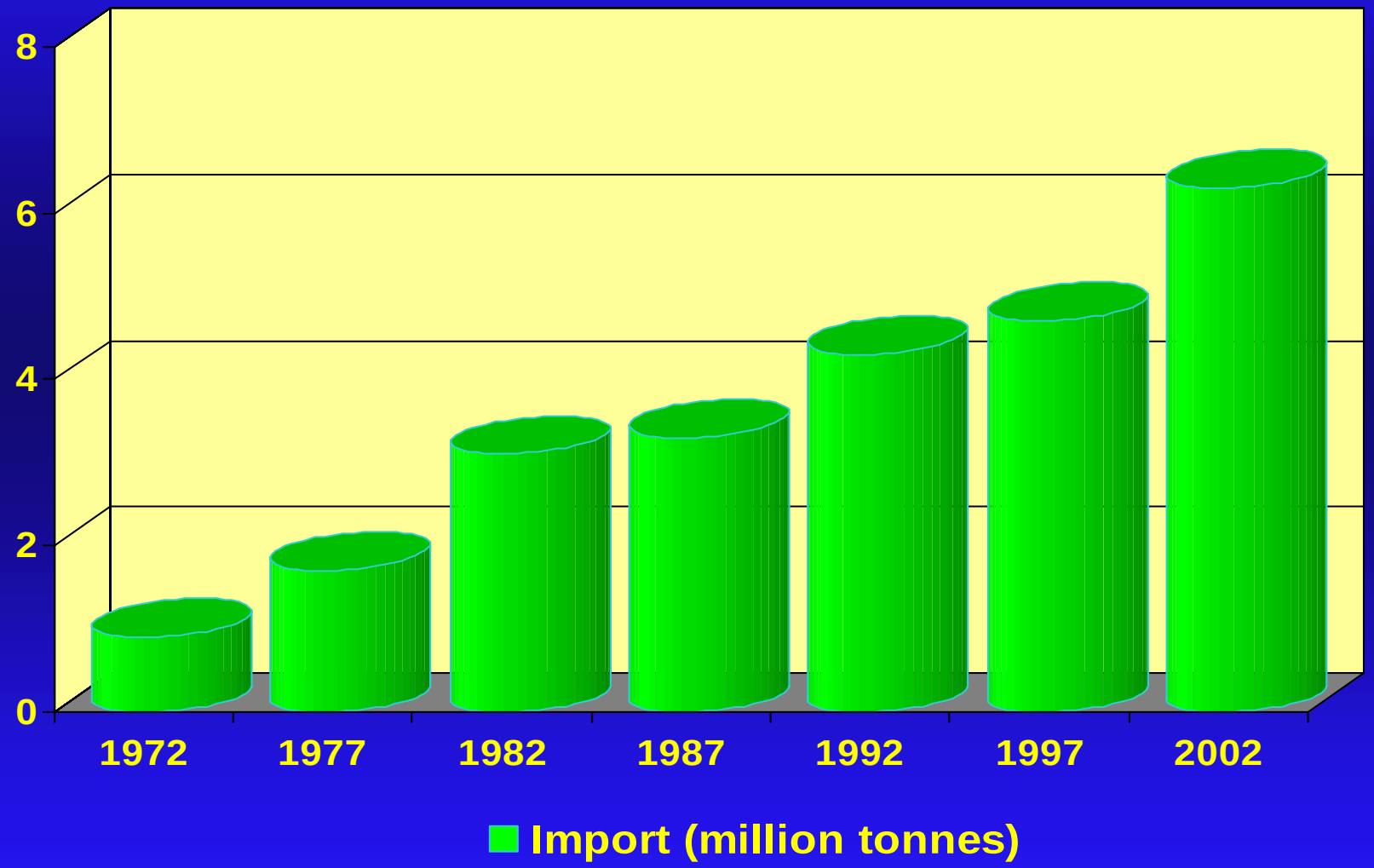
SOURCE: FAOSTAT (2004)

RICE AREA, PRODUCTION AND YIELD IN AFRICA (1972 TO 2002)



SOURCE: FAOSTAT (2004)

RICE IMPORT IN AFRICA



SOURCE: FAOSTAT (2004)

RICE IN SUB-SAHARAN AFRICA

(% CHANGES IN RELATION TO 1980 = 100)

Parameter	1985	1990	1995	2000
Harvested area	4	23	39	53
Production	14	48	60	87
Yield	10	20	15	22
Imports	25	27	69	111

RICE AREA IN SELECTED REGIONS

(% CHANGES IN RELATION TO 1980 = 100)

Region	1985	1990	1995	2000
East and South East Asia	3	4	13	20
South Asia	2	5	5	10
South America	-18	-27	-17	-25
Sub-Saharan Africa	4	23	39	53

Source: FAOSTAT (2003)

RICE PRODUCTION IN SELECTED REGIONS

(% CHANGES IN RELATION TO 1980 = 100)

Region	1985	1990	1995	2000
World	17	30	37	51
East and South East Asia	22	30	52	74
South Asia	16	35	39	66
South America	-1	-7	34	43
Sub-Saharan Africa	14	48	60	87

Source: FAOSTAT (2003)

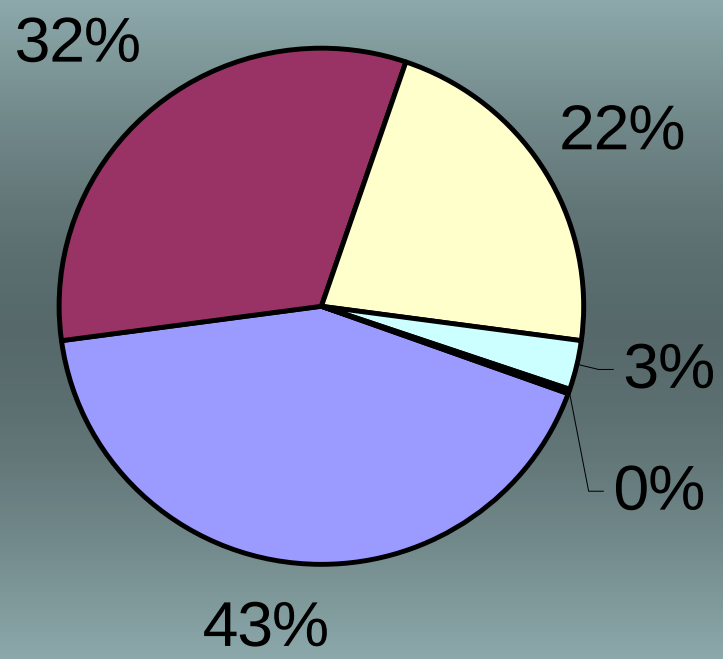
RICE YIELD IN SELECTED REGIONS

(% CHANGES IN RELATION TO 1980 = 100)

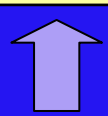
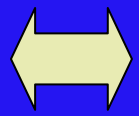
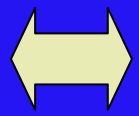
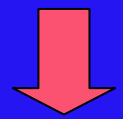
Region	1985	1990	1995	2000
East and South East Asia	18	25	33	44
South Asia	13	28	32	50
South America	21	27	60	90
Sub-Saharan Africa	10	20	15	22

Source: FAOSTAT (2003)

Regional Rice Production in Africa

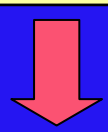


MAJOR RICE PRODUCING COUNTRIES IN AFRICA (AREA IN 1000 HA)

Country	1980	1990	2002	Trend
Nigeria	550	1208	3116	
Madagascar	1199	1165	1216	
Guinea	534	436	522	
Côte d'Ivore	360	572	510	
Mali	135	196	452	

Source: FAOSTAT (2004)

MAJOR RICE PRODUCING COUNTRIES IN AFRICA (YIELD IN KG/HA)

Country	1980	1990	2002	Trend
Nigeria	1982	2069	1024	
Madagascar	1759	2077	2196	
Guinea	899	971	1613	
Côte d'Ivore	1167	1155	1604	
Mali	973	1436	2046	

Source: FAOSTAT (2004)

HARVESTED RICE AREA IN SUB-SAHARAN AFRICA (YEAR 2000)

Cropping system	Area (%)
Rainfed lowland	42.6
Upland	37.1
Irrigated	13.9
Deepwater	4.8
Mangrove	1.6

Source: Nguyen and Tran (2002)

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UPLAND RICE CONSTRAINTS

Drought

Weeds

Diseases (blast)

Pests (birds, rats)

Competition with other crops

Low inputs

RAINFED LOWLAND RICE CONSTRAINTS

Iron toxicity

Floods

Insects (rice gall midge)

Diseases (rice yellow mottle virus, blast)

IRRIGATED RICE CONSTRAINTS

Diseases (virus)

Insects (gall midge)

Pests (birds, rats)

Weeds

Nutrient deficiency

Toxicity and acidity

High temperature

MAJOR CONSTRAINTS TO INCREASE RICE PRODUCTION

- **Poor adaptation of the Asian varieties to stresses**
  - **Severe drought**
  - **Iron toxicity**
  - **Low soil fertility**
  - **Weed competition**
  - **Diseases and pests**

MAJOR CONSTRAINTS TO INCREASE RICE PRODUCTION

- **Political and Socio-economic constraints**
  - **Land preparation**
  - **Inputs acquisition**
  - **Resource allocation**
  - **Crop priority**
  - **Weak research and extension support**
  - **Land tenure**
  - **Post harvest losses**
  - **Low rate of technology adoption**

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OPPORTUNITIES FOR RICE PRODUCTION INCREASE NERICA

Ability to suppress weeds
Strong stems
High number of grain per panicle
Resistance to rice diseases
Ability to grow well under stress
More protein
High and stable yields
Short growth cycle

FAO'S CONTRIBUTION TO THE DISSEMINATION OF NERICA

- FAO - NERICA - 1997
- FAO activities - umbrella of SPFS
  - Information dissemination
  - Forum for collaboration
  - Technical activities (varietal evaluation, seed production)
  - Project formulation

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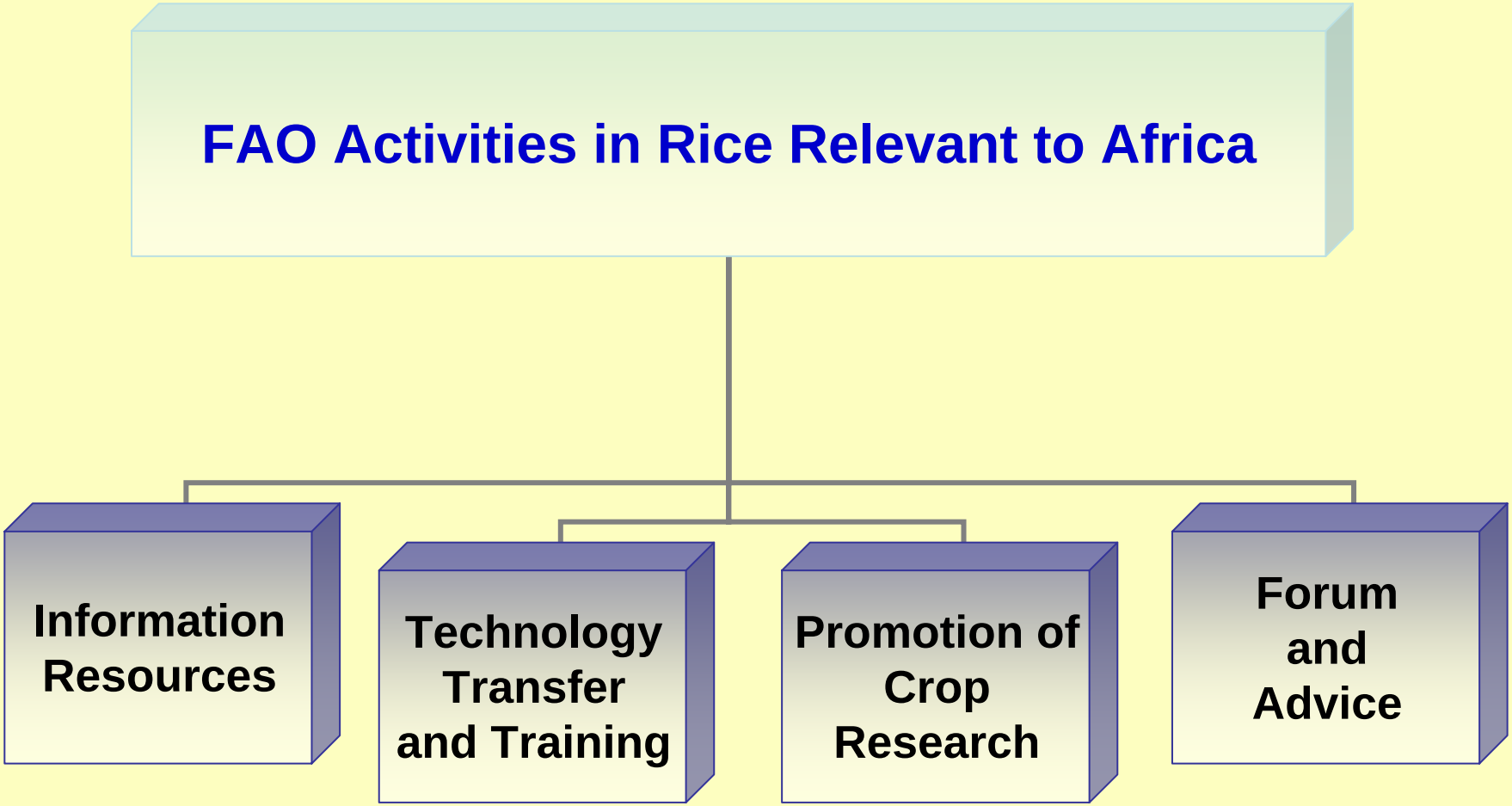
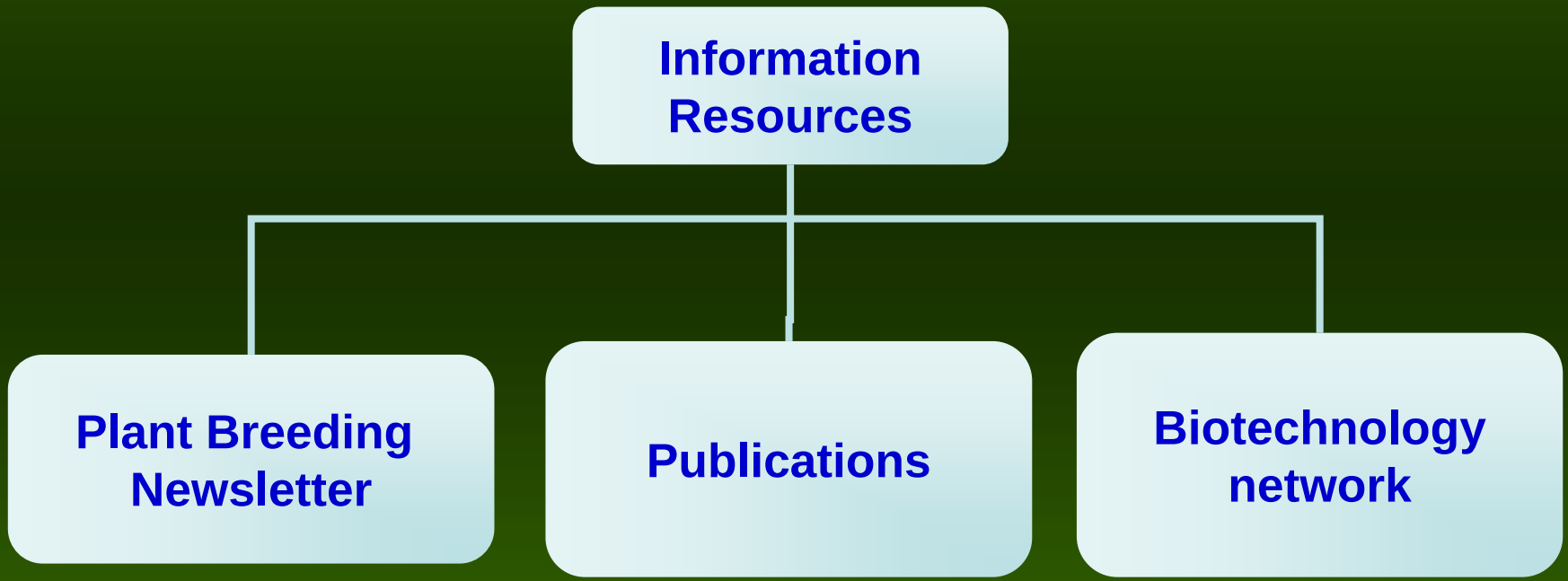
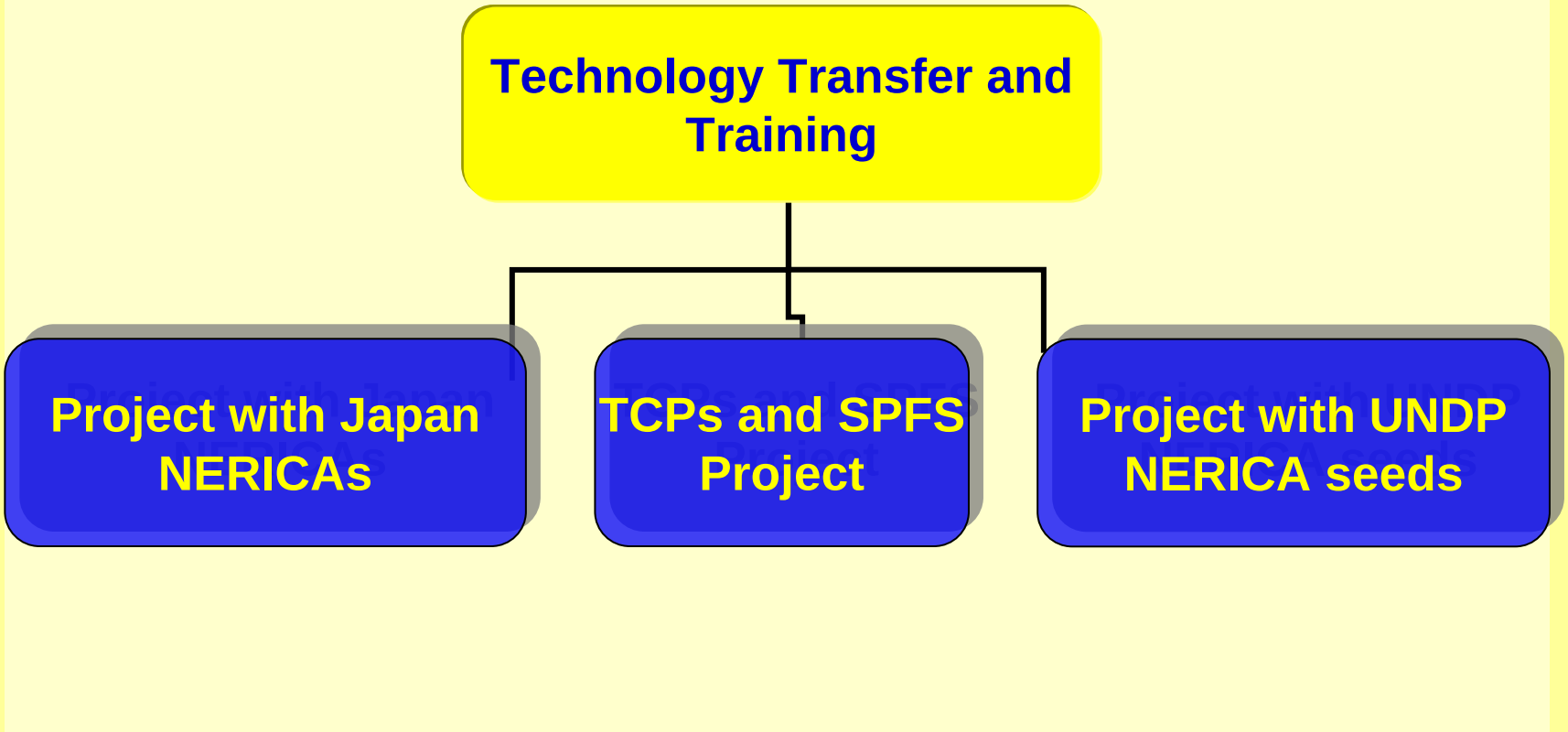
FAO Activities in Rice Relevant to Africa



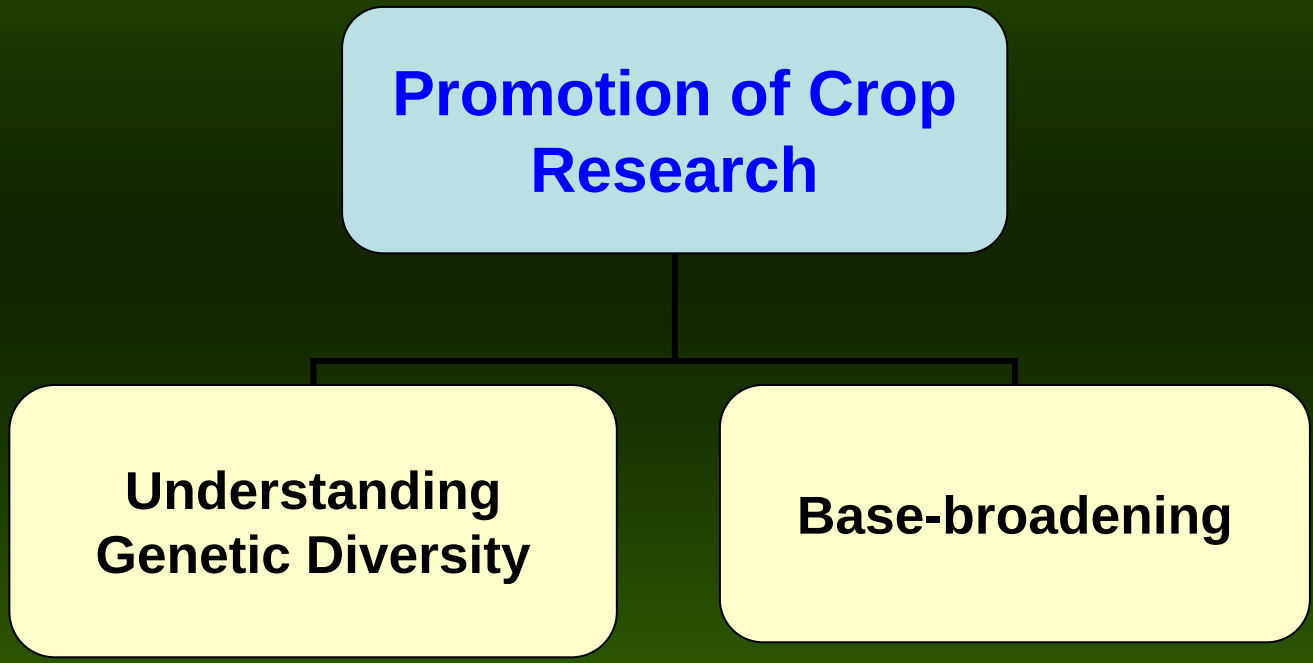
FAO ACTIVITIES IN AFRICA



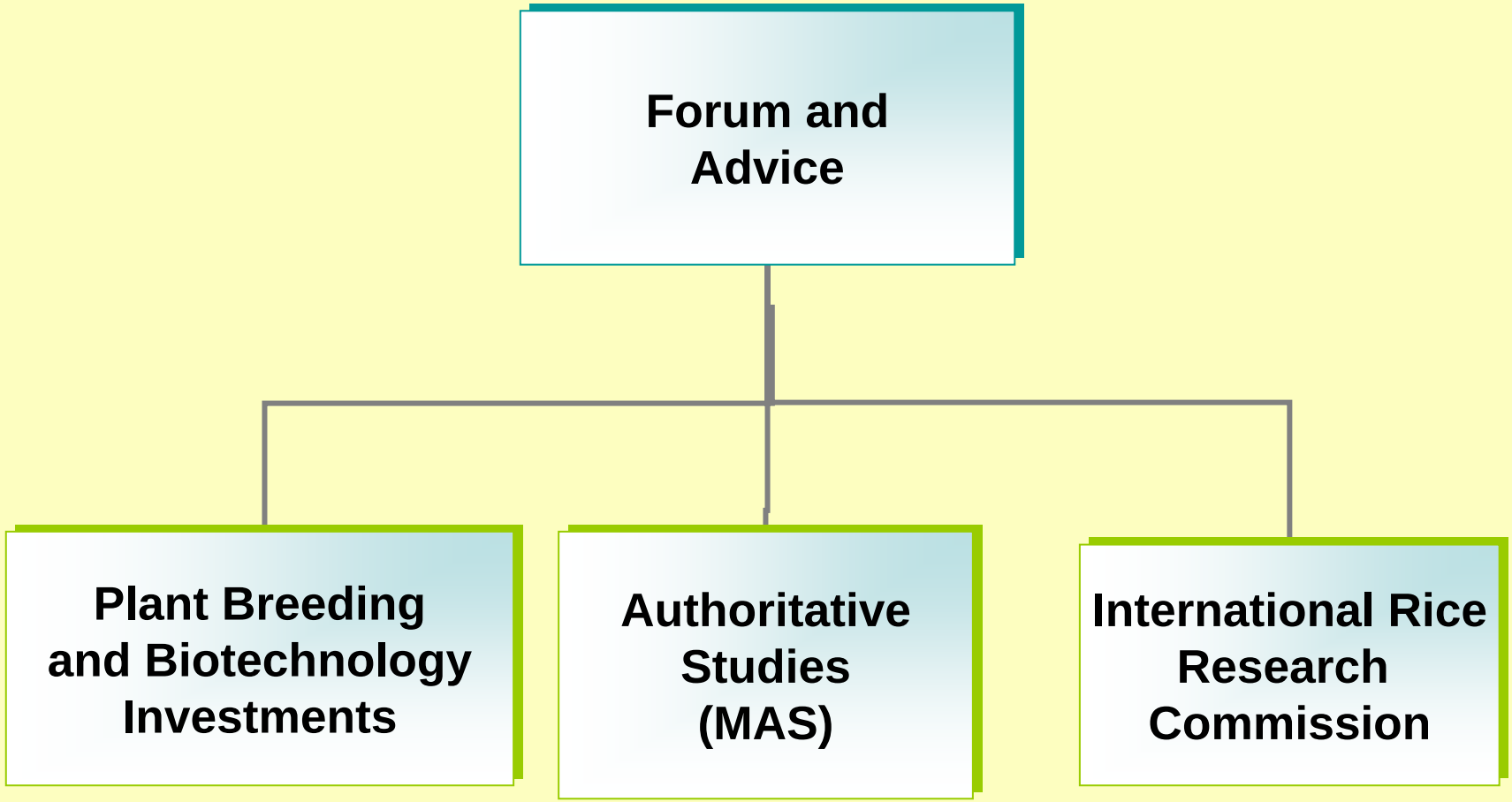
FAO ACTIVITIES IN AFRICA



FAO ACTIVITIES IN AFRICA



FAO ACTIVITIES IN AFRICA



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RICE IN AFRICA
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THE WORK FORWARD

- Speed up seed multiplication
- Participatory approaches (PVS)
- NERICA's varieties for other growing environments
- Task forces to tackle specific problems
- Efficient use of existing networks
- Short term - improve upland production
- Medium term - promote small-scale irrigation schemes (irrigated areas <0.2%)

C. Session 1
(Agricultural Development and Rice cultivation)

1. Title: “Rice Improvement and Production in Tanzania”
   Dr. Ashura LUZI-KIHUPI: Senior Research Fellow, Department of Crop Science and Protection, Faculty of Agriculture Sokoine University of Agriculture, The United Republic of Tanzania
2. Title: “Dissemination of NERICA under the African Rice Initiative”
   Mr. Tatsuo Fujimura: Senior Advisor on South-South Cooperation, Special Unit for Technical Cooperation among Developing Countries, UNDP
3. Title: “Preliminary Evaluation of NERICA in Kenya”
   Mr. W.O. Kouko: Kenya Agricultural Research Institute, The Republic of Kenya

RICE IMPROVEMENT AND PRODUCTION IN TANZANIA

Ashura Luzi-Kihupi and M. Tamura
Sokoine University of Agriculture
Morogoro, Tanzania

SUMMARY

Rice (*Oryza sativa* L.) is one of the most important cereals in the world. It is the staple food of approximately half of the world's population. It is one of the major food crops of sub-Saharan Africa with an estimated cultivated area of about 6.8 million hectares. Demand for rice in Tanzania is increasing as a result of dietary shift from conventional food brought about by urbanization and increase in population. The capita consumption of rice is estimated at 50kg/ year.

Rice is grown in all regions with varying levels of importance. Most of rice is grown under rainfed lowland conditions by small holder farmers accounting for 74% of the total area under rice. Upland rice comprises about 20% and irrigated rice constitutes 6% of the total rice area.

There has been a steady increase but fluctuating area under paddy production over the years. In 1998, an estimated 849,500 metric tones of rice was harvested from a total area of 654,500. This extra ordinary increase from 439,300 tones the previous year harvested from 439,300 hectares could be ascribed due to *El Niño* phenomenon. The current average yield estimated at 1.5 – 2.0 tones per hectare is however low when compared to that of other countries like Korea and Japan with average yield of above 6 tons/ha. Many factors are known to constrain rice production. These include weed management, varieties with acceptable grain qualities, inadequate land preparation and rare use of fertilizers and other inputs. Research has therefore a challenge to address major constraints to rice production so that farmers can raise their production per unit area in order to meet domestic demand.

This paper reviews the past and present production and research efforts to raise rice production in the country. It also puts forward future strategies especially taking into consideration the role of Sokoine University of Agriculture.

Rice Improvement and Production in Tanzania

[1]Dr. Ashura Luzi Kihupi, and [2]K. Tamura and [3]J.C. Mbapila

SOKOINE UNIVERSITY OF AGRICULTURE

[1]DEPARTMENT OF CROP SCIENCE & PRODUCTION,

[2]SUA CENTRE FOR SUSTAINABLE RURAL DEVELOPMENT.

1. Introduction

Rice (*Oryza sativa* L.) is one of the most important cereals in the world. It is the staple food of approximately half of the world's population. It is one of the major food crops of sub-Saharan Africa with an estimated cultivated area of about 6.8 million hectares. The total rice production in the region is about 10 million tonnes annually (Jones, 1999).

Demand for rice in sub-Saharan Africa is becoming increasingly higher as a result of dietary shift from conventional foods, brought about by urbanization and increase in population. Major producing areas in Sub-Saharan Africa are found in West Africa, Eastern Africa and Central Africa. In East, Central and Southern Africa (ECSA) region, Tanzania is the second largest producer after Malagasy (IRRI, 1994) (Table 1). The ECSA sub-region produces about 3.4 million metric tons, approximately 40% of the total rice produced in sub-Saharan Africa (Jones, 1999).

In Tanzania, rice is the third most important cereal crop coming after maize and sorghum. Rice is believed to have been introduced to East Africa by Arabs and Indian traders in early times (Monyo, 1974). The importance of rice in Tanzania is increasing. Currently, it is a food crop in the diet of 60 percent of the people in Tanzania whose population is growing at a rapid rate (2.8%) resulting in a continuous increase in demand for rice and continuous pressure to increase production (FAO, 1994).

Rice is grown in all regions of the country with varying levels of importance (Table 2). Most of rice is grown under rain fed lowland conditions by small holder farmers which accounts for 74% of the total area under rice (Kanyeka *et al*.,1997). Upland rice comprises about 20% and irrigated rice constitutes about 6%.

Paper Presented at the Seminar on Promotion of Rice Production and Dissemination in Africa.
AICAD, Kenya, 10 – 12th February 2004

There has been a steady increase but fluctuating area under paddy production since 1980 the highest production at 849,500 Metric tonnes was recorded in 1998 from harvested area of 654, 500 hectares (FAO, 1999). Current average yield in the country estimated at 1.7 tons per hectare, is however low as compared to that of other countries like Korea & Japan where yields are above 6 tons per hectare (FAO, 1995).

A number of factors have been attributed as constraints to rice production in Tanzania. These include poor weed management, pests and diseases, lack of improved varieties with acceptable gain quality, inadequate soil and water management and unavailability of inputs and credits. Research has therefore to address the major constraints so that production can be raised to meet at least the domestic demand. This paper reviews the past and present research effort to raise rice production the country. It also puts forwards future strategies especially taking into consideration the role of SUA.

2. Rice Production and consumption in Tanzania

Rice is increasingly becoming an important food crop in Tanzania. It is a a food crop in the diet of 60 percent of people, and is particularly important among the urban population whose population is increasing due to rapid urbanization. The population of Tanzania is growing at a rapid rate (2.80%), this, plus the high elasticity of demand for rice and change in traditional food habits had lead to a consistent increase in consumption (FAO, 1994,) The capita consumption has increased from 15 kg/ year in the seventies to 50 kg / year in 1990s (IRRI, 1994).

Paddy production showed strong growth rate in the second half of the 1980s rising from 355,000 metric tonnes in 1984 to 718,000 metric tonnes in 1989. (Table 3). Much of this increase is attributed to good weather as well as the attractive prices received by farmers. The subsequent decline in output in 1992 was largely due to adverse weather conditions, whilst the increase to 655,000 t over the period 1993 to 1995 corresponds to a period of increasing prices (MAFS, 2001). Similarly, the poor performance in 1997 was caused by severe drought. The extraordinary increase in 1998 is due to the *El nino* factor which brought about a lot of rain. Rice imports have been fluctuating between 45,000 mt in 1981 to 191,000 Mt in 2000 with import value between 8,299,000 US$ to 72,736,000 US$ in 1998 (Table 4).

The increase in imports put a pressure on the already meagre foreign exchange reserves. Apart from imports, there has been some export prior to 1980s and from 1997. Other years reported zero export, however, a large amount of rice sold by the farmers themselves to middlemen and traders from the neighboring countries is not accounted for.

3. Rice ecosystems in Tanzania

Rice is grown in all twenty regions of mainland Tanzania and Zanzibar with varying levels of importance. Conditions under which rice is grown are varied. There are different systems of rice culture based on soil moisture and water regime. Generally, the rice growing ecosystems in Tanzania can be grouped as follows:

3.1 Upland rice (Dry land) which is grown in naturally well-drained soils, where the water table is always below the rice roots. The moisture supply is depended on rainfall. This ecosystem occupies 20% of the total area and is common in Morogoro, Mbeya, Coast, Mtwara and Lindi regions.

3.2 Rain-fed lowland rice is gown in soils where the rice roots are periodically saturated by fluctuating water table in addition to the rainfall during crop growing season. On the basis of water management, rainfed lowland rice can be sub-categorised into bunded and unbunded rice growing environments. Rainfed lowland rice is common in valleys of rivers e.g. Kilombero, Rufiji, Wami etc, in swampy shores of lakes Victoria, Tanganyika & Nyasa and in Tabora and Shinyanga regions. This ecosystem occupies 74% of the total rice land in the country.

3.3 Irrigated Rice ecosystem

This can be characterized into fully irrigated under large-scale farm and traditional supplementary irrigated rice under small-scale farmers. This ecosystem occupies about 6% of the total rice area in the country. This ecosystem is however increasing due to the increase in number and acreage of smallholder irrigation schemes.

4. Constraints to Rice Production

Major constraints limiting rice production in the country have been summarized by Monyo (1976), Kihupi and Pillai, (1989). These include weeds, poor water management, diseases and insect pests, lack of improved varieties with good acceptable grain quality, inadequate soil and water management and unavailability of inputs and credits.

4.1 Weed Management

Weed control is one of the most labour intensive operations in rice production and is a constraint in all rice ecosystems. The problem of weeds in rainfed rice is exacerbated by delayed and poor land preparation as well as inefficient weeding associated with broadcast sowing, random transplanting and lack of appropriate agricultural implements. Other factors contributing to poor weed control include late weeding, inadequate water control, variable distribution of rainfall and lack of bunding to impound water.

The common weeds under rainfed lowland and irrigation rice culture are wild rice *(Oryza longistaminata and O.barthii), Mimosa invisa, Cyperus spp., Leevsia hexandra, Commelina benghalensis and Galinsoga pariflora*, while those for the upland ecosystem are *Ageratum conyzoides, Galinsoga parviflora, Clotalaria incana and Rottboellia conchinensis.* Wild rice is causing concern in irrigation schemes while striga has been reported in upland fields.

Hand weeding is the most pre-dominant practice among the farmers. This practice is tedious and time consuming. The use of herbicides is still uncommon with small-holder farmers because of high cost coupled with non-availability.

4.2 Water Management

Water is one of the most important factors in rice production. Research has shown that maximum yield potential of rice exists when soil is maintained under flooded or saturated conditions. Most of the cultivated rice in Tanzania depends on rainfall. Annual variations in the amount and poor distribution make rain-fed production susceptible to flooding and/or drought often within the same season. Water control can be enhanced through the use of improved bunding, on-farm reservoirs, irrigation and drainage systems.

4.3 Pest and Disease Management

As rice production increases through intensification and better management, disease and pest incidences are increasing. A range of insect pests have been reported in the Country. These include stem borers such as *Chilo partellus, C.orichalcociliellus, Maliarpha separatella, Sesamia calamisties and Diopsis spp.* Recently, African rice gall midge (*Orseolia oryzyrora*) has become an important pest in the Usangu plains in the Southern Western part of Tanzania.

Several diseases caused by fungi including rice blast caused by *Pyricularia grisea*, brown leaf spot caused by *Helminthosporium spp*. and sheath rot caused by *Acrocylindrium oryzae* have been considered to be serious constraints to rice production in the country.

Rice Yellow Mottle virus (RYMV) has been identified as an important disease in Tanzania. The disease has been noted in most rice growing areas in the country (Yamamoto *et al.,* 1995, Most of the rice cultivars grown by the farmers are susceptible to the disease (Luzi-Kihupi *et al*., 2000). RYMV is transmitted mechanically and by chrysomelid beetles. *Chaetocnema pulla* Chapus is believed to be an important vector of the disease in Tanzania Banwo *et al*., 2001).

Bacterial diseases are also becoming important. A study conducted by the Department of Crop Science and Production at SUA and Danish Institute of Seed Pathology for Developing Countries (DGISP) in Denmark has identified a number of bacterial pathogens infecting the rice crop. These include *Acidovorax avenae* subsp *avenae* causing brown streak and *Pantoea agglomerans* causing palea browning and *Bulkholderia glumae* causing grain rot in rice (Luzi-Kihupi *et al.* ,1999).

4.4 Lack of Improved varieties

There are several local/traditional varieties grown by farmers in the rainfed lowland and upland ecosystems. These varieties are preferred by farmers because of their good eating quality, tolerance to various environmental stresses and good performance under high risk and low management conditions.

These characteristics are a result of many years of local adaptation and farmers' selection of cultivars to suit their environments. Most of these varieties, however, have low yield potential, are late maturing, tall and prone to lodging when improved management practices such as application of nitrogen fertilizer are employed.

On the other hand, improved varieties have high yield potential, especially when grown under irrigation. They are also resistant to some diseases. However most of them have poor eating and milling quality and some are not well adapted to the local conditions. The adoption of most of these improved varieties by small-scale farmers has therefore been poor.

4.5 Fertilizer and Soil amendments

Fertilizers are the most effective of all production inputs in rice, though they are expensive. Fertilisers are rarely applied in the farmers' fields. Most of it is used by the large-scale farms. Research studies however, show that the local varieties do not respond to more than 40 kg/ha of Nitrogen. Studies conducted on station have indicated that the improved varieties of rice respond to Nitrogen up to 100 kg/ha (Kihupi & Pillai, 1989). However, improper and long-term use of in organic fertilizer can be detrimental to the soil.

5. History of Rice Research in Tanzania.

Research on rice in Tanzania started as for back as in 1935 at Mwabagole near Ukiriguru and it was transferred to Agric. Research Station, Ilonga in 1966. Research at that time was geared toward improvement of local varieties through selection and increasing production through improvement of cultural practices. The Rice Research headquarters was, however, shifted from Ilonga to Ifakara in 1975, from then onwards KATRIN started to function as the Main Rice Research Centre. Breeding, Agronomy, Plant Protection and other research activities are being conducted at KATRIN and at other Institutes such as Sokoine University Agriculture, A.R.I. Ilonga, A.R.I. Ukiriguru, A.R.I. Uyole, and Dakawa Agro-Scientific Research Centre. Some adaptive research work is also conducted in various irrigation projects.

Early varietal improvement work was primarily done to improve popular local varieties by pure line selection, varietal introduction and evaluation, hybridisation between local and introduced varieties and mutation breeding of indigenous varieties.

Outstanding lines from this work have been screened in multi locational national variety trials, since the late 1960s and several varieties have been released to farmers. The recommended varieties included Faya Theresa, Kihogo Red (Morogoro), Afaa Mwanza 1/159, Afaa Mwanza 0/746, Afaa Kilombero 0/906, Kihogo selections 7 and 21 and 23.

5.1 Varietal Introduction

Introduction of rice varieties from other countries has been and it is still the most important source of germplasm for rice in the country. Supa India (Surinam V-880) an introduction from Surinam is still very popular in Tanzania. The co-operation between Tanzania and the International Rice Research Institute (IRRI) dates back to the early 1970's. In 1971, a number of varieties bred at IRRI were tested in different locations in Tanzania (Monyo & Mwaruka 1974). Many promising lines from International Rice Testing Programme (IRTP) have been performing well in various locations in Tanzania. KATRIN (IET 2397) is one of the cultivars which have been released to farmers through this cooperation. Subarmati, IR54 and IR58 are popular in some irrigation projects in the country.

5.2 Hybridization:

Hybridization work, involving a series of crosses between local and introduced varieties was initiated in 1971 at Ilonga. Several crosses were made using, Faya Theresa, (Kihogo Red (Morogoro) Kihogo Red (Mbarali) & Gamti as local parents and IR5, IR8, IR22, IR 24 and Surinam V-880. This work was carried on at Ilonga up to F4 generation and the subsequent work was continued at KATRIN. From this project, a promising variety "Salemwa" from the cross Kihogo Red (Mbulu) x IR 661-1-170-1-3 was released to the farmers for growing under rainfed lowland conditions.

Hybridization programs are continuing at KATRIN, and Dakawa Agro-Scientific Research Centre & SUA. The breeding objects include developing rice varieties having early maturity, higher yield potential, intermediate stature, resistance to major pests and diseases and acceptable cooking and eating quality. Some promising lines have already been released from these programmes (TXD 85, TXD 88, TXD 306).

5.3 Mutation Breeding:

A program of mutation breeding was initiated in 1972 (Monyo, 1974) with financial assistance from the International Atomic Energy Agency.

The objectives were:

(a) To develop genotypes with high seed protein
(b) To breed genotypes with resistance to diseases, particularly rice blast.
(c) To improve the yield potential of local varieties.

Faya Theresa and Kihogo Red were used in the FAO/IAEA "Co-ordinated Mutation Breeding Programme for the improvement of Grain protein content and quality". Mutants selected from this project were as tall as the parents though some combined high grain yield and high protein content (Kihupi, 1984).

6. Rice Research at Sokoine University of Agriculture

Sokoine University of Agriculture (SUA) was established on 1st July, 1984. Before then, it existing a Faculty of Agriculture, Forestry and Veterinary Science of the University of Dar es Salaam. Currently, the University has four Faculties: the Faculty of Agriculture, the Faculty of Forestry and Nature Conservation, the Faculty of Veterinary Medicine and the Faculty of Science. It has also two Institutes, the Institute of Continuing Education, and the Development Studies Institute. In addition, there is a Directorate of Research and Postgraduate Studies, the SUA Centre for Sustainable Rural Development, the Sokoine National Library and the Computer Centre. The mandate for SUA are teaching, research and extension in the field of agriculture, fisheries, forestry, Veterinary and allied or complementary Sciences.

Sokoine University of Agriculture has been involved in developing varieties with higher yield potential for different rice ecologies in Tanzania since 1960's. The activities at SUA have always been part of the National Rice Research Coordinated Programme. There is a modest breeding programme which involves varietal testing and selection, some hybridisation and mutation breeding. There is also some agronomic work mostly on weed management. The Current research activities are as indicated below:

6.1 Improvement of indigenous cultivars through induced mutation.

The present mutation breeding based at SUA aims at reducing plant height and maturation period of the popular indigenous cultivars while maintaining some of the good qualities of the parents. This project is funded by the International Atomic energy Agency. Prior to 1999, the project was under co-ordinated project titled Improving "Improvement of Basic Food Crops in Africa through Plant Breeding including the use of induced mutation".

The activities were later on expanded under the Technical cooperation project titled "Improvement of Basic Food Crops of Tanzania using nuclear Techniques".

Afaa Mwanza 1/159, Supa India, Salama, Kaling'anaula, Ringa Nyeupe, Kihogo Red, Usiniguse and SSD35 have so far been subjected to irradiation.

6.1.1 Afaa Mwanza 1/159 cultivar

Afaa Mwanza is high yielding local cultivars which is tall and have a long maturation period. This cultivars was sent to Vienna for irradiation in 1987. The selected advanced mutant lines were evaluated for yield in replicated trials at SUA, KATRIN, Dakawa and Ilonga. Mutants No.4, 6, 9 and 12 were found to be highly promising in terms of yield and other agronomic characters. The grain quality of these mutants was, however, not acceptable to the consumers. Breeding work is continuing to improve the grain quality.

6.1.2 'Supa' variety

Supa is widely grown cultivar in Tanzania. Its has excellent cooking and eating qualities but the yield potential is low. It is too tall, photo period sensitive and has a long maturation period and is also susceptible to diseases such as blast and rice yellow mottle virus.

The seeds of supa cultivar were irradiated in 1994. The selected variants with improved plant type have been selected and evaluated at SUA, Dakawa and KATRIN. Mutants which were selected using single seed descent were found to be very early in maturity and are resistant to Rice Yellow Mottle virus. These mutants are SSD1, SSD3, SSD5 SSD7 and SSD35. The other mutants though high yielding are susceptible to blast and RYMV.

6.1.3 "Salama" Cultivar

Salama, an upland variety recommended for cultivation since the late 1970s was sent for irradiation with the objective of reducing the plant height and maturation period. The seed of this variety were sent irradiated in 1994. The improved mutants originating from this cultivar combined high yield potential and resistance to RYMV. The selected mutants are Salama M-19, Salama M-38. Salama M-55 and Salama M-57.

6.2 Detection and characterization of seed borne Pathogenic Bacteria of rice cultivars

This is part of the work under Field Research Project between the Danish Government Institute of feed Pathology for Developing countries (DGISP) and the Department of Crop Science and Production at SUA. Various methods including the slide cassette holder method, liquid assay and direct planting are used to isolate bacterial pathogens in rice. The isolated bacterial strains are identified. *Acidovorax avenae* subsp *avenae* was found to be prevalent in rice seed samples. Other pathogens identified are *Pantoea aggromerans* causing palea browning and *Burkholderia glumae* causing grain rot of rice (Luzi-Kihupi *et al*., 1999)

6.3 Breeding for Resistance to Rice Yellow Mottle Virus

A research project under SUA/NORAD Frame Agreement was conducted with the main objectives of determing the importance of rice yellow mottle vins in selected rice growing areas and to develop resistant rice varieties though breeding. Screening of available germplasm from local and external sources was done since 1998. Survey of the disease conducted in Kyela, Morogoro, Kilombero and Kilosa district revealed that the virus was found in all rice growing areas (Luzi-Kihupi *et al.,* 2000).

Results from varietal screening revealed that a number of introduced rice varieties/lines are resistant to the virus using Kyela and Ndungu strains under Morogoro environment. Such resistant varieties can be used in the breeding programme or may replace the prevailing susceptible varieties. Apart from the screening work, hybridisation between resistant varieties and local susceptible cultivars was also done. The segregating plants were inoculated with Kyela strain of RYMV and some genotypes showed resistant reaction (Table7).

6.4 TARP II – SUA Research activities

Sokoine University of agriculture in collaboration with the Ministry of agriculture and Food Security and the Agricultural University of Norway is implementing a research project on "Improving Food Security and Household Income for Smallholder Farmers in Tanzania. This is applied research with emphasis on women". The Norwegian Government through the Norwegian Agency for Development (NORAD) and the Government of Tanzania financially support this project, which started formally in September 2000. A number of rice based research activities are being implemented.

6.4.1 Introduction of sequential cropping systems in selected villages of Morogoro.

This study aims at improving food production and income security or rural households in rice based cropping ecosystems. The project farmers were given improved varieties of rice for the main season crop and improved varieties of cowpea bean, tomato, onion and okra to plant as off-season crops. This project is implemented in three villages

The most preferred sequences by the farmers are rice – cowpea, rice-maize, rice-vegetable (okra, onion & tomato). The participating farmers were able to select four rice genotypes and upland crops that are suitable in the sequence under their growing conditions. The off-

season crop provided the farmers vegetables, which can be eaten by the family and also be sold to obtain cash that contribute to the family income.

6.4.2 Integrated Rice Improvement programme for women Rice Farmers in the Kilombero River Basin, Morogoro

This objective of this study is the to understand and improve rice production and marketing systems for women farmers in the Kilombero river basin. The study which is conducted in two villages has three main activities:

i) Characterisation and promotion of improved genotypes adapted to various agro-ecological zones.

Participating farmers were given ten improved varieties to evaluate in their fields and allowed to selecte the best according to their preference.

ii) Evaluation of water management technologies. Two methods of water management; with buds and without bunds were demonstrated on farmers' fields.

iii)Evaluation of integrated soil and weed management technologies. Use of rice husks applied as mulch to conserve moisture and suppress weeds and the use of herbicides for weed control were demonstrated in the farmers fields.

So far, the participating farmers have chosen five rice lines viz. TXD 306, TXD 85, TXD 88 Jaribu and SSD 3 for further testing in their farms. Preliminary results show that rice husks applied as mulch increased yield of rice by suppressing weeds and conserving moisture.

6.4.3 On farm Development and promotion of Integrated Disease Management options for Rice Yellow Mottle virus disease in Kyela District, Southern Highlands of Tanzania.

The objective of this project is to reduce yield losses and sustain household food security and income through development and promotion of measures for Rice Yellow mottle virus (RYMV) disease control in Kyela district.

Experiments were conducted on communal fields in highly disease-infected areas and on station at Kikusya in Kyela. During the first year, 84 elite rice genotypes were tested. Highly significant differences were observed among the genotypes for RYMV Susceptibility reactions. During the second year 2002/03, twenty-four genotypes selected by farmers the previous season were further tested to verify their reaction. Participatory evaluation for disease severity was done. Highly significant differences in disease incidences and severity among

the genotype and site x genotype interaction were observed due to variation in disease pressure between the locations.

There was considerable variation in farmer preference of new genotypes based on morphological characters. Farmers were particularly interested in early maturing varieties as they claim to get food early. The early maturing varieties escape disease although bird scaring is a problem because they flower earlier in the season. The farmers selected the following lines: SSD 35, H 234 – 18 – 1 -, SSD 3, and IRAT 133.

6.4.4 Evaluation and Genetic Analysis or Rice Mutants for Rooting and Nutrient uptake.

This is part of the FAO/IAEA Co-ordinated Research Project entitled " Mutation Analysis of Root Characters in Annual field plants related to plant performance.
The main objectives of this project are:

i) To identity rice mutants with deep rooting and branching characteristics
ii)To establish any relationship between the rooting characteristics and major nutrient uptake and thus grain yield of rice mutants.
iii)Establish the role of rooting characteristics in tolerance to nutrient stresses. Preliminary results show great variation for root characteristics, yield and yield components. Tall plants recorded superiority performance in terms of maximum root length, more root weight and more total N uptake. All rice genotypes tested performed well under no water stress conditions (WR). However, under water stress conditions some of the mutants each as Afaa Mwanza M9, Salama M-49, SSD1 & SSD7 performed better than other genotypes during 2001/2002.

6.4.5 Weed Management

Prof. K. P. Sibuga and co-workers have conducted a number of studies on weed management in rice fields. Preliminary results on studies on management of perennial wild rice in lowland rice culture indicate that tillage to 24 cm deep uprooted and destroyed the rhizomes of *Oryza longistaminata* through desiccation. Furthermore, under no tillage practice, glyphosate systematically killed the wild rice rhizomes and other weeds leading to reduced weed biomass (Mtwaenzi and Sibuga, 2001).
In an earlier study, Mkocha & Sibuga (1999) found out that ploughing of paddy fields during the dry season followed by high seed rates can help to reduce wild rice density. Weeding

twice at 30 and 50 DAT and application of glyphosate at a rate of 3.6 and 5.4 kg a.i. ha applied before planting when wild rice is in the tillering stage were the most effective management practices.

6.5 The Potential role of SUA Centre for Sustainable Rural Development (SCSRD)

The SUA Centre for Sustainable Rural Development (SCSRD) was officially launched on July 1st 1999 with the support for the Government of Japan through its Japan International Co-operation Agency (JICA).

The Centre is facilitating SUA Staff and students to work with rural communities, particularly in Mbinga and Morogoro District to plan, implement, in a participatory manner, various rural development initiatives, which may lead to sustainable improvements in the rural areas SCSRD, 2003).

The SCSRD method called SUA method is based in fieldwork and it aims at understanding the realities of rural areas from multidimensional and interdisciplinary approaches. Through its activities the centre has the potential to be involved in adaptive rice research and extension activities. Some of these activities include participatory varietal selection, on-farm varietal evaluation, on farm seed multiplication.

7. Rice Research in the ECSA Region.

Rice growing environments in the East, Central and Southern Africa (ECSA) countries are very diverse, however, most of rice is grown under rain fed conditions. Rice researchers in the region have identified both technical and socio-economic constraints which affect rice production in the region (ECSARRN, 1999). Some of these biophysical constraints are similar across the region thus advances made by research programme in one country may be adapted to, or be easily modified to fit the conditions in another country. Scarce research resources will therefore be efficiently used and greater impact at farm level will be expected through spill over effects. For this reason, ECSA rice researchers have expressed their interest in collaborating more closely through the ASARECA rice network- The East, Central and Southern Africa Rice Network (ECSARRN). Once this network is established, sharing of information and research findings will be ensured.

8. Future Research Strategies

Since the constraints to rice production have already been identified, Research should be geared towards solving them.

8.1 Weeds

Research on weed management should be given priority to ease the drudgery of small-holder farmers. This can include monitoring weeds and crop losses in terms of specific weed species, alternate land preparation methods, alternate weeding methods, alternate crop establishment methods, and testing of bunding and water impoundment to control weeds.

8.2 Moisture stress and water control

Research in this area should involve test of water impoundment by bunding, identification of submergence tolerant and drought tolerant cultivar, and development of short duration cultivars.

8.3 Diseases and pests

Major focus should be made on research on Rice Yellow mottle virus. Other studies include crop losses, and epidemiology of the disease relative to rice environments and crop management, testing and selection of resistant varieties and incorporation of disease and insect resistance in some improved lines through breeding.

8.4 Lack of improved varieties with acceptable grain quality.

Breeding for acceptable cooking and eating quality should put emphasis on farmers' criteria for varietal preference. Their participation in the breeding programme should be encouraged.

8.5 Germplasm development, evaluation and conservation.

The collection of germplasm is essential as a source of genetic variability for future breeding work. Attempt should made to systematically collect, characterise and conserve local cultivars which are now grown by farmers before they can be completely lost.

Conclusions

Research strategies should address the principal constraints and the need of improving the farm productivity of resource-poor farmers who do not have adequate means to purchase the inputs. No single Institution can expect to make significant progress over diverse rice

producing environments. Rather, interdisciplinary research involving all relevant national, regional and International Institutions is necessary in order to lay foundation for increase in productivity.

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Table 1: Rice Production statistics for Selected ECSA Countries.*1

Country	Population (X1000)*2	Growth rate *3	GNP per Capita (US$)	Area Rice (1000ha)	Yield Paddy*4 (kg/ha)	Total Paddy*4 Production (1000T)
BURUNDI	6335	2.8	160	17,540	3150	55466
DEM. REP. CONGO	50,948	3.2	120	449,955	755	339,716
KENYA	30669	2.9	280	18,561	2795	52,054
MADAGASCAR	15,970	3.1	230	1,204,136	2034	2,448,400
MALAWI	11,308	3.1	170	43,301	1945	84,631
MOZAMBIQUE	18,292	1.8	80	172,904	1012	175,148
RWANDA	7,609	0.6	180	4,402	2547	11,199
SOUTH AFRICA	43,309	2.3	3160	1,300	2292	2,980
TANZANIA	35,119	3.1	120	460,389	1255	577,960
UGANDA	23,300	3.0	240	67,200	1427	96,200
ZAMBIA	10,421	2.6	400	11,826	874	10,481

*1 Growth rate and GNP per capita 1997 World, Bank Atlas; Population, Area, Yield Total

*2 Production 1997 – 2001, FAO Production Yearbook.
2000

*3 1985 – 1995

*4 Average of five years 1997 – 2001.

Table 2: Area under paddy in '000' hectares by Region

REGION/YEAR	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98**
Arusha	4.1	1.2	1.2	2.0	9.0	9.0	8.1
Coast/DSM	10.5	18.1	19.5	2.5	23.6	23.3	50.9
Dodoma	1.2	1.4	1.4	1.5	1.5	1.5	1.4
Iringa	1.3	2.6	2.6	2.5	2.5	2.5	5.4
Kagera	2.0	2.0	1.9	3.3	1.7	1.5	1.5
Kigoma	2.5	2.9	2.9	0.3	2.9	2.9	2.8
Kilimanjaro	1.0	6.2	6.0	5.0	6.8	6.8	10.6
Lindi	14.3	10.8	1.6	12.8	12.2	11.7	11.7
Mara	1.2	0.1	0.1	17.9	0.0	0.3	1.5
Mbeya	30.0	48.7	52.1	29.7	51.7	50.5	50.5
Morogoro	49.1	54.6	59.2	57.5	78.3	77.6	43.4
Mtwara	23.4	33.0	12.7	10.4	25.4	25.1	25.1
Mwanza	51.9	62.6	62.6	81.7	64.9	58.3	41.3
Rukwa	14.3	4.3	4.2	3.1	38.5	36.3	27.0
Ruvuma	25.6	12.1	12.1	16.1	12.4	12.1	29.1
Shinyanga	50.0	54.5	51.9	33.0	73.3	63.1	190.5
Singida	1.4	6.0	50.7	55.3	52.4	5.9	6.9
Tabora	21.1	52.2	50.7	55.3	52.4	47.0	20.0
Tanga	2.7	3.6	3.7	4.1	3.9	3.0	20.5
Total	307.6	376.8	397.3	394.0	513.4	439.3	548.2

Source: Early Warning and Crop Monitoring Unit *=> NSCA data ** => Estimates

Table 3: Area, Production and yield of rice in Tanzania for the period 1980-2001

Year	Area Harv (Ha)	Yield (kg/Ha)	Production (Mt)
1980	245,000	1.1878	291.000
1981	280,000	0.7143	200.000
1982	300,000	1.0667	320.000
1983	224,110	15.583	349,231
1984	271,210	1.3104	355.385
1985	236,540	1.8081	427.692
1986	273,760	2.0006	547.692
1987	351,190	1.8355	644.615
1988	345,000	1.7836	615.385
1989	385,310	18.646	718.461
1990	384,500	1.9246	740.000
1991	368,700	1.6941	624.615
1992	306,570	1.2794	392,220
1993	353,700	1.8123	641.000
1994	352,600	1.7422	614.300
1995	394,000	1.5802	622.600
1996	513,400	1.5715	806.800
1997	439,300	1.2513	549.700
1998	654,500	1.2973	849.100
1999	473,900	1.6425	778.400
2000	516,900	1.5134	782.300
2001	401,070	1.2816	514.000

Source: FAOSTAT, 2003

Table 4: Imports and Export in Tanzania for the period 1980 - 2002

Year	Imports – Qty (Mt)	Imports – Val (1000$)	Exports – Qty (Mt)	Exports – Val (1000$)
1980	103,654	48,065	977	796
1981	45,477	23,485	211	148
1982	126,712	49,214	0	0
1983	63,843	32,148	0	0
1984	64,000	31,000	0	0
1985	53,192	18,007	0	0
1986	141,665	34,936	0	0
1987	83,500	21,700	0	0
1988	50,400	13,348	7	2
1989	21,025	8,299	0	0
1990	34,000	12,000	0	0
1991	60,000	20,000	0	0
1992	70,000	24,500	0	0
1993	91,000	27,300	0	0
1994	60,000	19,200	0	0
1995	67,721	11,961	0	0
1996	48,074	17,262	0	0
1997	98,975	24,773	1,151	424
1998	181,412	73,736	11,922	4.707
1999	85,594	33,865	15,932	5.692
2000	19,659	56,310	5,687	1.651
2001	139,029	29,939	6,432	2.486
2002	76,500	11,916	99,055	1.972

Source: FAOSTAT, 2003

Table 5: Cultivars/lines screened for and showed resistance to RYMV (Score 1 & 3) – 1st set, SUA, 1998

Entry No.	Designation	Source	Score	% Height Reduction	% Yield Reduction
	IR 53234 – 27-1**	IRRI	1(1)	0	20.6
	IRAT 133	IRAT	1(1)	15	20.6
	IR 47686-15-5-1**	IRRI	1(1)	0.9	12.8
	IRAT 156	IRAT	1(1)	16	20.9
	FARO 11	Nigeria	1(1)	11	35.5
	WABIS 18	WARDA	1(1)	21.6	5.7
	CT 6948-2-1-1-P	CIAT	1(1)	19.5	28.6
	FAR0 300	NIGERIA	1(1)	11.8	8.9
	TGR 78	TOGO	1(1)	18.2	29.0
	ITA 305	IITA	1(1)	17.3	27.4
	CABACU**	IITA	3(1)	31.6	41.9
	IRAT 302	Irat	1(1)	19.8	17.2
	WABIS 844**	WARDA	1(1)	10.0	18.9
	CT 7244-9-1-52	CIAT	1(1)	1.0	17.9
	Gigante**	WARDA	3(1)	2.8	8.0
	IRAT 252	IRAT	1(1)	31.4	6.4
	Supa SSD I**	SUA	1(i)	4.2	15.1
	Supa SSD 5**	SUA	1(1)	10.2	20.1
	SSD 35**	SUA	3(1)	5.8	18.4
	Salama M-55	SUA	1(1)	13.0	26.0
	FARO 29**	NIGERIA	1(1)	13.0	26.0
	Supa (Control)	SUA	7(7)	9.6	92.0

*Average of three scorings, Figures in parenthesis refer to screenhouse score
** - Used in hybridization programme

Table 6: Cultivars/lines screened for resistance to RYMV (Score 1 & 3) – 2nd set **(**1999**)**

Entry No.	**Designation**	Source	Score	% Height reduction
38	Supa SSD 1*	SUA	1	10
39	Supa SSD 3*	SUA	1	2
40	Supa SSD 5*	SUA	1	0.4
45	Salama M-30	SUA	1	6
46	Salama M-35	SUA	1	5
47	Salama M-37	SUA	1	15
48	Salama M-49	SUA	3	15
49	Salama M-55*	SUA	1	0
50	Salama M-57	SUA	1	7
58	Salama M-19	SUA	1	2
60	Salama M-38	SUA	1	0
64	Salama (Control)	SUA	1	10
87	IR 6560-7-2-3	IRRI	3	13
98	HR 5824-B-3-2-3	IRRI	3	4
100	Sakha 102	IRRI	3	15
102	Sakha 101	IRRI	3	4
104	Giza 176	IRRI	3	0
121	Skybonnet	USA	1	9
124	Texmont	USA	1	10
141	Malilora	Pemba	1	15
146	Wahiwahi	Kilimanjaro	5	0
42	Salama M-16	SUA	3	29
51	Salama M-61	SUA	3	28
	Supa (Susp-Check)	SUA	7	36
	IR 47686-15-5-1* (Res. Check)	IRRI	1	10

*Also resistant in the 1st set

Table 7: Selected lines form Pedigree Nursery, 2003

Entry No.	Description	Cross	Resistance to RYMV	Plant Height (cm)	Days to 50% flowering
630	SUA 14-4-3	Mutant 12/M_{100}/Supa	7	95.4	86
634	SUA 15-1-2	Mutant 6/Salama M-55	7	102.7	82
647	SUA 17-1-3	Mutant 12/PSBRC 50	1	127.9	84
654	SUA 17-4-1	Mutant 12PSBRC 50	3	118.1	69
658	SUA 18-1-2	Jefferson/SSD 1	1	80.4	70
661	SUA 18-2-	Jefferson/SSD 1	3	115.2	66
688	SUA 3-2-1-1	CT 6515-18-1-3/Supa	1	88.87	69
689	SUA 3-2-1-2	CT 6515-18-1-3/Supa	1	82.17	71
693	SUA 3-2-3-2	CT 6515-18-1-3/Supa	1	122.0	71
696	SUA 3-2-5-1	CT 6515-18-3/Supa	1	105.7	65
697	SUA 3-2-5-2	CT 6515-18-3/Supa	1	85.63	64
714	SUA 4-2-4-2	Jefferson/SSD 1	1	118.7	66
751	SUA 5-2-6-2	Jefferson/IR 53234-27-1	1	80.2	72
752	SUA 6-1-1-1	Jefferson/SSD 35	1	109.6	67
757	SUA 6-1-3-1	Jefferson/SSD 35	3	99.83	73
758	SUA 6-1-4-1	Jefferson/SSD 35	1	76.97	71
759	SUA 6-1-4-2	Jefferson/SSD 35	1	78.83	71
761	SUA 6-1-5-1	Jefferson/SSD 35	1	87.17	69
787	SUA 8-1-14	Rexmont/CT 6515-18-1-3	3	105.8	69
790	SUA 8-1-2-2	Rexmont/CT 6515-18-1-3	3	83.07	72
795	SUA 8-2-1-1	Rexmont/CT 6515-18-1-3	3	93.07	64
797	SUA 8-2-1-2	Rexmont/CT 6515-18-1-3	3	98.07	65
801	SUA 8-2-2-3	Gulfmont/Supa	5	93.53	71
838	SUA 10-1-2-1	IR8/M_{100}/Supa	1	97.97	72
850	SUA 12-1-6-3	IR 8/M_{100}/Supa	1	118.0	69
852	SUA 12-1-6-5	IR 8/M_{100}/Supa	3	114.6	71
857	SUA 12-2-3-1	IR 8/M_{100}/Supa	1	92.40	69
858	SUA 12-2-3-2	IR8/M_{100}/Supa	1	82.63	69
866	SUA 12-3-1-1	IR 8/M_{100}/Supa	1	119.2	67
871	SUA 12-3-4-1	IR 8/M_{100}/Supa	3	119.3	69
873	SUA 12-3-6-1	IR 8/M_{100}/Supa	1	105.2	64
875	SUA 12-4-12-2	IR 8/M_{100}/Supa	3	99.67	70
	Kihogo Red (check)		7	141	94
	Supa (check)		7	145	95
	M-100 (check)		7	100	90
	SSD 35 (check)		1	114	60

Table 8: Location mean yields and individual farmers assessment of some promising rice genotypes from on-farm trials 2003 season

	Genotype tested	Location mean yield k/ha						Mean	General remarks form farmers.
		Itope	Mwaya	Kilwa	Ngonga	Mababu	Lukwego		
1.	SSD 35	2250	2400	-	2100	2550	2000	2.2	Very good but difficult to thresh. Continue production.
2.	SSD 1	2400	2000	3000	2000	2350	2100	2.8	More seed increase before tasting
3.	Tule na bwana	2200	-	2600	5000	-	-	3.2	Good variety. Increase production
4.	H 234-18-1-1	2100	-	-	2600	2400	-	2.3	Very good aromatic. Increase production
5.	SSD 3	2200	-	-	2400	2420	-	2.3	Very good. Increase production
6.	SSD 5	2500	-	-	2300	2400	-	2.4	Not palatable, discontinue
7.	Wahiwahi	1200	-	2000	1700	2400	-	1.9	Very good in taste continue production.
8.	IRAT 252	21200	-	-	1700	-	2200	2.0	Seem good. Further seed increase.
9.	TGR 78	3300	-	3500	3300	3100	-	3.3	Difficult to thresh: too sticky not good
10.	FARO 300	1800	2000	1805	2000	2900	-	2.1	Not good for food somehow good.
11.	IRAT 133	2050	2300	-	2250	2500	-	2.3	Good, more production
12.	Jicho la Samora	3300	-	-	2600	3000	3000	2.9	Good, more production
13.	TXD 305	2100	1870	-	1900	1650	-	1.8	Good but was diseased
14.	Salama M55	1700	-	1600	1800	2800	1200	1.8	Catch diseases. Not sticky
	Mean	2.2	2.1	2.4	2.4	2.5	2.1	2.3	

Key: Not tested at that site.

Rice Improvement and Production in Tanzania

Ashura Luzi-Kihupi and K.Tamura

SUA, Morogoro, Tanzania

Introduction..

- Rice is the staple food of half of World's popn.
- 95% of World's rice is produced and consumed in Developing Countries
- sub-Saharan Africa cultivates 6.8M. ha.
- In SADC Countries Tz. is the second largest producer after Madagascar

Table 1: Rice Production statistics for Selected ECSA Countries.

Country	Population (X1000)[2]	Growth rate [3]	GNP per Capita (US$)	Area Rice (1000ha)	Yield Paddy[4] (kg/ha)	Total Paddy[4] Production (1000T)
BURUNDI	6335	2.8	160	17,540	3150	55466
D.R. CONGO	50,948	3.2	120	449,955	755	339,716
KENYA	30669	2.9	280	18,561	2795	52,054
MADAGASCAR	15,970	3.1	230	1,204,136	2034	2,448,400
MALAWI	11,308	3.1	170	43,301	1945	84,631
MOZAMBIQUE	18,292	1.8	80	172,904	1012	175,148
RWANDA	7,609	0.6	180	4,402	2547	11,199
SOUTH AFRICA	43,309	2.3	3160	1,300	2292	2,980
TANZANIA	35,119	3.1	120	460,389	1255	577,960
UGANDA	23,300	3.0	240	67,200	1427	96,200
ZAMBIA	10,421	2.6	400	11,826	874	10,481

[4]Average of five years 1997 – 2001.

Introduction Cont..

- Tz produces 800,000t from 548.000 ha
- Rice is grown in all regions of Tanzania with varying levels of importance
- 74% of rice is grown under rain-fed lowland, 20% upland and 6% under irrigation

Table 3:Area under paddy in '000' hectares by Region

REGION/YEAR	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98**
Arusha	4.1	1.2	1.2	2.0	9.0	9.0	8.1
Coast/DSM	10.5	18.1	19.5	2.5	23.6	23.3	50.9
Dodoma	1.2	1.4	1.4	1.5	1.5	1.5	1.4
Iringa	1.3	2.6	2.6	2.5	2.5	2.5	5.4
Kagera	2.0	2.0	1.9	3.3	1.7	1.5	1.5
Kigoma	2.5	2.9	2.9	0.3	2.9	2.9	2.8
Kilimanjaro	1.0	6.2	6.0	5.0	6.8	6.8	10.6
Lindi	14.3	10.8	1.6	12.8	12.2	11.7	11.7
Mara	1.2	0.1	0.1	17.9	0.0	0.3	1.5
Mbeya	30.0	48.7	52.1	29.7	51.7	50.5	50.5
Morogoro	49.1	54.6	59.2	57.5	78.3	77.6	43.4
Mtwara	23.4	33.0	12.7	10.4	25.4	25.1	25.1
Mwanza	51.9	62.6	62.6	81.7	64.9	58.3	41.3
Rukwa	14.3	4.3	4.2	3.1	38.5	36.3	27.0
Ruvuma	25.6	12.1	12.1	16.1	12.4	12.1	29.1
Shinyanga	50.0	54.5	51.9	33.0	73.3	63.1	190.5
Singida	1.4	6.0	50.7	55.3	52.4	5.9	6.9
Tabora	21.1	52.2	50.7	55.3	52.4	47.0	20.0
Tanga	2.7	3.6	3.7	4.1	3.9	3.0	20.5
Total	307.6	376.8	397.3	394.0	513.4	439.3	548.2

Source: Early Warning and Crop Monitoring Unit *=> NSCA data => Estimates**

Table 4: Area, Production and yield of rice in Tanzania for the period 1980-2001

Year	Area Harv (Ha)	Yield (kg/Ha)	Production (Mt)
1980	245,000	1.1878	291.000
1981	280,000	0.7143	200.000
1982	300,000	1.0667	320.000
1983	224,110	15.583	349,231
1984	271,210	1.3104	355.385
1985	236,540	1.8081	427.692
1986	273,760	2.0006	547.692
1987	351,190	1.8355	644.615
1988	345,000	1.7836	615.385
1989	385,310	18.646	718.461
1990	384,500	1.9246	740.000
1991	368,700	1.6941	624.615
1992	306,570	1.2794	392,220
1993	353,700	1.8123	641.000
1994	352,600	1.7422	614.300
1995	394,000	1.5802	622.600
1996	513,400	1.5715	806.800
1997	439,300	1.2513	549.700
1998	654,500	1.2973	849.100
1999	473,900	1.6425	778.400
2000	516,900	1.5134	782.300
2001	401,070	1.2816	514.000

Rice Production and Consumption

- About 60% of population in Tz eat rice
- Importance of rice is increasing due to:
  - High popn. Growth rate (2.8)
  - High elasticity of demand for rice
  - Change in traditional food habit

Constraints to Rice Production

- Weed management
- Weeds are a problem to all rice ecosystems The problem is exacerbated by
  - Delayed and poor land preparation
  - Inefficient weeding associated with broadcast sowing and random transplanting
  - Lack of appropriate agric. implements.
  - Late weeding and inadequate water control

Constraints cont...(Weeds)

- Hand weeding is the most pre-dominant practice among the farmers. This practice is
  - Tedious and time consuming
- The use of herbicides is still uncommon due to high cost coupled with non-availability

Constraints cont...(water management)

- Most of rice grown in Tz. depends on rainfall
- Therefore annual variation in amount and distribution affect the rice plant, either with too much or too little water.
- Water control can be enhanced by the use of bunds, reservoirs and irrigation

Constraints cont..(Insects and Diseases)

Insect Pests

. *Chilo suppreasallis*

- *C. Orichalcoiciliellus*
- *Maliarpha separatella*
- *Sesamia calamisties*
- *Diopsis spp.*
- *Orseolia oryzyvora*

- Diseases
  - *Pyricularia grisea*
  - *Helminthosporium spp.*
  - *Acrocylindrium oryzae*
  - Rice yellow mottle virus
  - Other diseases are:
    - *Acidovorax avenae* subsp *avenae*
    - *Pantoea agglomerans*

Constraints cont..(Lack of improved varieties)

- Many local /traditional varieties are grown by the farmers.
- Most of these have low yield potential, late maturing, Tall and prone to lodging under improved management
- However they have good cooking and eating qualities

Constraints.. (Lack of improved varieties)

- Improved varieties have high yield potential and some are resistant to pests and diseases
- However most of them have poor cooking and eating quality and are not easily accepted by farmers and consumers.

Constraints..(Fertilizer and soil amendments)

- Fertilizers are rarely applied in farmers' fields because they are rather expensive.
- Local cultivars do not respond to more than 40kg N/ha.
- Studies have however shown that improved varieties respond to N up to 100kg/ha.

History of rice Research in Tz.

- Rice is believed to have been introduced to E.A. since early times by traders and merchants
- Research on rice in Tz. Started since 1935 at Mwabagole near Ukiriguru along the shows of Lake Victoria.
- In 1966, transferred to Ilonga Research Station.

History..

- The main objectives then were:
  - Improvement of local varieties through selection
  - increasing production through improvement of cultural practices.
  - In 1975, the headquarters was transferred to KATRIN, Ifakara

History..

- Currently research activities are conducted at the following Institutions:
  - A.R.I. KATRIN
  - SUA
  - A.R.I. Ilonga
  - Dakawa Agro-scientific research Centre
  - A.R.I. Ukiruguru
  - A.R.I. Uyole

History..

- Early variety improvement was based on
  - pure line selection of popular varieties
  - Varietal introduction and evaluation
  - Hybridization
  - Mutation breeding of indigenous varieties

History..

- Recommended varieties includes:
  - Faya Theresa
  - Kihogo Red (Morogoro)
  - Afaa Mwanza 1/159, 1/746
  - Afaa Kilombero
  - Kihogo selections 7, 21,and 23
  - Supa India (Surinam V-880) from Surinam is very popular cultivar in Tz.

History..

- Varietal Introduction is an important source of germplasm.
  - Co-operation with IRRI started since early 1970s
  - IR 8 variety was grown in Irrigation Schemes for many years, although its cooking and eating quality was not very acceptable.
  - IET 2397, Subarmati, IR 54, IR58, IR 64

History ..

- Hybridization
  - Started since 1971 at Ilonga
  - Several crosses were made using local cultivars such as Faya Theresa, Kihogo red, Gamti and introduced varieties such as IR 5, IR 24 and Surinam V-880.
  - Promising line from this work was named as Selemwa in 1984 (IR8 x Faya Theresa).

History..

- Hybridization programmes are continuing at
- KATRIN, SUA and Dakawa.
- Objectives
  - Early maturity, higher yield potential, intermediate stature, resistance to major pests and diseases and acceptable cooking and eating quality.

History..

- Mutation Breeding
- Started since 1972 with the following aims:
  - To develop genotypes with high seed protein
  - To breed genotypes with resistance to diseases
  - To improve the yield potential of local cultivars
  - Faya Theresa and Kihogo red were irradiated with physical and chemical mutagens.

History..

- This was part of FAO/IAEA co-ordinated project on “Mutation Breeding programme for improvement of protein content and quality”.
- Mutants selected from this project were as tall as the parents although they combined high grain yield and high protein content.
- No line was recommended to farmers.

Rice research at SUA

- SUA was established in 1984 by the act of Parliament.
- Before then it was the Faculty of Agric, Forestry and Vet. Sci. of UDSM.
- Currently there are four Faculties:
  - FoA, FoF&NC, FoVM and FoSc
  - There are also two Institutes:
    - ICE and DSI

SUA..

- In addition
  - Direcrorate of Research and Postgraduate studies
  - SUA Centre for Sustainable Rural Development
  - Sokoine National Library
  - Computer Centre

SUA..

- SUA has been involved in developing varieties with higher yield potential since 1970s
- SUA rice research activities are part of the National Rice Research Programme
- Research activities involve:
  Varietal testing and selection, hybridization and mutation breeding

Current Research activities at SUA.

- Improvement of indigenous cultivars through induced mutation
  - Objective:
    - Reducing the plant height and maturation period of popular indigenous cultivars while maintaining some of the good qualities.

SUA cont.

- So far the following cultivars have been sent for irradiation
  - Afaa Mwanza 1/159
  - Supa India
  - Salama
  - Kaling'anaula
  - Ringa Nyeupe,
  - Kihogo red, Usiniguse and SSD 35.

SUA activities

- Detection and characterization of seed-borne pathogens in rice cultivars
  - This is part of the work under Field Research Project between SUA and the Danish Government Institute of Seed Pathology for developing countries

SUA activities cont..

- *Bacteria species identified include:*
- *Acidovorax avenae* subsp. *Avenae*
- *Bhukholderia glumae*
- *Pantoea agglomerans*

SUA Activities ..

- Breeding for resistance to RYMV
- Objectives
  - To determine the importance of rice yellow mottle virus in selected rice growing areas
  - To develop resistant rice varieties through breeding

RYMV screening

- JICA Expert and KATC staff observing RYMV screening at SUA.

Sampling of RYMV infected plants

Screening of RYMV at Ndungu

RYMV Field screening at SUA

SUA activities..

- Some 22 resistant strains were identified using Kyela and Ndungu viral strains.
- These include:
- IR 53234-27-1, IRAT 133, IR47686-15-5-1, FARO 300, TGR 78, IRAT 252, SSD 1 SSD 3, SSD 5, SSD35, Sal. M57, Sal. M55, H234-18-1-1, H232-44-1-1, Gigante

Reaction of rice genotype to Ndungu and Kyela strains

TARP11-SUA Research activities

- Introduction of sequential cropping systems in selected villages of Morogoro.
- Objectives:
  - To improve food production and income security of rural household in rice based cropping ecosystems.

TARP11-SUA (Sequential Cropping)

- Participating farmers were given improved rice varieties to grow during the main cropping season and improved varieties of cowpea, bean, tomato, maize, onion and okra to plant during the off-season
- Preferred sequences by farmers are rice-cowpea, rice-maize, rice-onion/okra/tomato

Sequential Cropping

- Participating Farmer at Mkindo showing visiting farmers from Southern Highland her bean crop planted after rice.

Sequential cropping

- A cowpea field planted after rice

TARP11-SUA (Integrated rice improvement)

- Implemented in two villages.
- The main objective is to understand and improve rice production and marketing systems for women farmers in the Kilombero river basin;

TARP11-SUA (Integrated rice Improvement)

- There are 3 main activities:
  - Characterisation and promotion of improved genotypes
  - Evaluation of integrated soil and weed management technologies
    - Use of rice husks applied as much to conserve moisture and to control weeds
    - Use of herbicides for weed control

Integrated rice Improvement

- Evaluation of water management technologies.
- The use of bunds and no bunds was demonstrated to farmers.
- So far the participating farmers have chosen five lines out of ten provided.
- Preliminary results show that use of rice husks increased yields of rice,

TARP11-SUA Projects..

- On Farm Development and Promotion of Integrated management of RYMV in Kyela District
- Objective:
  - To reduce yield losses and sustain household food security and income through development and promotion of measures to control RYMV in Kyela

TARP11-SUA On farm RYMV management

- Experiments were conducted on communal fields in highly disease infected areas and on station in Kyela.
- Out of 84 elite lines tested during 2001, 24 which showed resistance were tested again during the second year.
- Participatory evaluation of the disease was done.

TARP11-SUA..

- Farmers were able to identify early maturing RYMV resistant lines which they would like to further evaluate in their fields.
- These are:
  - SSD 35, SSD3, H234-18-1-1, IRAT 133.

Evaluation of mutants for rooting and Nutrient uptake

- This is part of FAO/IAEA coordinated Research project.
- Objectives:
  - To identify rice mutants with deep rooting and branching characteristics
  - To establish any relationship between rooting and major nutrient uptake
  - role of rooting in tolerance to nutrient stress

Evaluation of Rooting characteristic..

- Preliminary results show great variation in root characteristics, yield and yield components.
- Tall plants were superior in maximum root length, root weight and total N uptake.
- Under stress conditions, mutants A.Mz M9, Sal. M49, SSD1, SSD7 performed better than other genotypes.

Weed management

- Studies on weed management are done by Prof. K.P.Sibuga and co-workers.
- Preliminary results:
  - Tillage to 24 cm deep uproot and destroy the rhizome of *O.longistaminata* through desiccation
  - Under no tillage, glysophate systematically killed wild rice rhizomes and other weeds

Weed management..

- Ploughing of paddy fields during the dry season followed by high seed rates reduces wild rice density
- Weeding twice at 30 and50 DAT and application of glysophate at a rate of 3.6 and 5.5 kg a.i./ha applied before planting when wild rice is in tillering stage are the most effective management practices.

Potential for SCSRD

- SCSRD was launched on 1st July 1999 with the support from JICA
- The Centre facilitates SUA staff and students to work with rural communities esp. in Mbinga and Morogoro districts to implement, in, participatory manner, various rural development initiatives which may lead to sustainable impro. in rural areas

SCSRD (Vision)

- Vision
  - Development which recognizes the capacity of rural people to influence their own future, by combining the people's experiences, observations, needs and insights with modern science and practice

SCSRD ..Mission

- The centre will contribute to the development and dissemination of approaches, which recognize the community setting and the contribution of other stakeholders of rural development as important complements in the identification and implementation of interventions leading to sustainable rural development

SUA Method

- The SCSRD method called “SUA Method” is based in field work and it aims at understanding the realities of rural areas from multi- dimensional and interdisciplinary approaches.

SCSRD

- Through its activities the centre has the potential to be involved in:
  - On-farm varietal evaluation
  - Participatory plant breeding
  - On-farm seed multiplication

The Regional Context

- Rice Researchers in ECSA have identified both technical and socio-economic constraints to rice production which are common.
- The Researchers through ECSARRN the ASARECA rice network have expressed interest to collaborate more closely

Regional Context..

- Once this network becomes functional, sharing of information and research finding will be ensured and this will be greater impact at the regional level.

Future Research Strategies- Solving of identified constraints

- Weed management
- Moisture stress and water management
- Development of improved varieties with acceptable cooking qualities
- Management of diseases and insects
- Germplasm collection, evaluation and utilization.

Conclusion

- Research should address the identified constraints
- Interdisciplinary research involving all relevant Institutions is required to order to increase productivity at the farm level.
- Regional Co-operation will solve the common problems facing rice industry in the region.

Dissemination of NERICA under African Rice Initiative (ARI)

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African Rice Initiative launched on 27 March 2002 in Cote d'Ivoire will be implemented through the NERICA Consortium for Food Security in Sub-Saharan Africa. ARI has two main complementary Action Plans to achieve production of 744,000 tons/year by cultivated area of 210,000 ha in West and Central Africa CA:

A. Stakeholders' Platform with 7 Action Plans: To determine goals and promote wide dissemination of NERICAs through seed production (Community-Based Seed-multiplication System) and complementary technologies. A total cost was estimated at US$12.6 million.

B. Research Network with 5 Action Plans: To continue the research process, especially integrating technologies and looking into bottlenecks to scaling up through close monitoring of the progress in socio-economic and environmental aspects. This network will also catalyze information exchange between research and stakeholders. A total cost was estimated at US$2.6 million.

ARI membership is open to any Sub-Saharan African country, but the initial focus was on 7 West African Pilot countries: Benin, Côte d'Ivoire, The Gambia, Guinea, Mali, Nigeria, and Togo. In 2003 Ghana and Sierra Leone were added, making a total of 9 countries. NERICAs will also be promoted in 8 non-pilot countries in West and Central Africa through PVS. In East and Southern Africa 7 countries were identified to disseminate NERICA on an experimental basis through the World Bank's new and existing programmes: Ethiopia, Madagascar, Malawi, Mozambique, Tanzania, Uganda and Zambia.

Summary of Current Donors Support for ARI-Action Plans

The process of ARI was badly affected by the political unrest in Cote d'Ivoire, which took place in September 2002, and the implementation was delayed at least one year. The Secretariat of the CMC commenced functioning after the appointment of General Coordinator on 1 July 2003. The second CMC was held in Mali in September 2003 and reviewed the progress and identified issues to tackle. Current operations are summarized as follows:

① Operations amounting to US$ 35 million are under way in 8 pilot countries, which concentrate on the seed production: Benin, Cote d'Ivoire, Ghana, Gambia, Guinea, Mali, Nigeria, Sierra Leone.
② Donors support has not been available in the research network: B-1 – B-5, which require further effort for the resource mobilization;
③ Countries in East and Southern Africa are gaining small experimental research projects to test NERICA in the local farm conditions;
④ Due to the strong support of the African Development Bank, ARI targets will be likely achieved in production, though the year of achievement might be delayed toward 2008;
⑥ NERICA success stories in poverty reduction are emerging in villages in Guinea, which is also becoming a seed center. It has provided 10 tons of seeds to the Gambia, 10 tons to Mali and 17 tons to other countries in 2002/2003.

Major issues

The entire programme of ARI seems to have been delayed at least two years. NERICA dissemination in 8 pilot countries is progressing, however, the overall ARI Action Plans are not necessarily in a good progress. The lack of funds other than the seed production is the main issue. It is now necessary for donors to support the research network to carefully and systematically monitor the progress with appropriate data and information. At the moment, the capacity of the Secretariat is very small. It is urgently needed to strengthen its capacity to monitor, coordinate and mobilize resources to move forward the entire Action Plans.

Dissemination of NERICA under ARI

1. ARI Action Plans
2. Current Donors' Support to ARI Action Plans
3. Current Needs for Donors' Support to ARI Action Plans
4. Prospect in Achieving ARI Targets
5. Major Issues

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ARI: Action Plans

A. Stakeholders Platform of the African Rice Initiative: Major Actions and Outputs (Unit: US$ thousand)

A.1	Action	Establishment and operation of Secretariat:	2,371
A.2	Action	Establishment and operation of National NERICA teams in each pilot country	994
A.3	Action	Development of national scaling-up strategy under the guidance of the NERICA teams	151
A.4	Action	Implementation of and training for national scaling-up strategy:	7,942
A.5	Action	Agro-based industry development by NTs	648
A.6	Action	Regional workshops:	529
A.7	Action	Extrapolation to East and Southern Africa:	
		Sub Total	**12,642**

B. NERICA Research Network: Major Actions and Outputs

B.1	Action	Research coordination and implementation:	1,015
B.2	Action	Information exchange between research and other stakeholders:	108
B.3	Action	Monitoring and evaluation of existing NERICA-based technologies:	589
B.4	Action	Development of new NERICA-based lines.	108
B-5	Action	Socio-economic research into scaling-up process:	729
		Sub total	**2,549**
		Grand Total A + B	**15,191**

ARI:. Action Plans and Outputs

A. Stakeholders Platform of the African Rice Initiative: Major Actions and Outputs

A.1	Action	Establishment and operation of Secretariat: 1) Partners set-up the Secretariat of the African Rice Initiative based at WARDA: Prepares TORs, identifies and recruits Consortium Coordinators, and Programme Assistant cum Secretary. As need arises the Secretariat will be extended with a communication specialist, and a technology module developer. 2) The Secretariat designs and operates information exchanges mechanisms among Members of the Initiative based on progress reports and monitoring. 3) Secretariat activates strong partnership network and develops in country partnerships
	Output	1) Secretariat becomes and remains operational. 2) Information exchange mechanisms established between Members of the African Rice Initiative and between Stakeholder platform and Research Network.
A.2	Action	Establishment and operation of National NERICA teams in each pilot country 1) NARES take the lead to form NERICA teams (NTs) in each country, regrouping the relevant stakeholders and using existing structures, and identify a National NERICA Coordinator.
	Output	1) 7 pilot national NERICA teams operational with relevant personnel on board
A.3	Action	Development of national scaling-up strategy under the guidance of the NERICA teams 1) NTs identify rice development stakeholders and organize first national workshop in consultation with the Secretariat ARDA to prioritize stakeholder needs, and identify the situation on the ground; 2) NTs conduct rapid surveys on extension capacity, policy issues, including food and nutrition security and gender, and relevant input (e.g. seed, fertilizer) and output market channels in pilot countries. They will identify priorities, constraints and an implementation plan. 3) NTs organize second stakeholder workshop to review scaling-up strategy and results from NERICA Research Network.
	Output	1) Workshops conducted resulting in draft scaling-up strategy and priority zones identified in each of the pilot countries. 2) Bottlenecks for technology dissemination identified and addressed. 3) Second stakeholder workshop held in each pilot country; 4) Final version of strategy for scaling-up available; 5) Complementary technologies identified

A.4	Action	Implementation of and training for national scaling-up strategy: 1) Secretariat and NTs provide training on proven technologies/approaches (CBSS, PVS, leguminous crops, food security, gender mainstreaming) in Year 1 onward through both new and ongoing programs; 2) WARDA increases the supply of Foundation seeds in collaboration with private sector 3) Secretariat and NTs develop country-specific training modules (PVS, ASI and CBSS); 4) WARDA provides TOR for future NERICA Resource Persons at WARDA and at Keysites of NERICA Research network 5) Trained NERICA resource persons organize training courses on NERICA-based technologies in their respective home countries, effectively accelerating diffusion. NARES make sure that these efforts are backstopped by extensive information campaigns in each country to close as much as possible gaps between technological solutions, policy options and organizational and institutional issues. 6) NTs implement approaches (CBSS, PVS, food security and gender mainstreaming) and disseminate proven technology packages. 7) National NERICA teams ensure organizational and institutional factors constraining the dissemination of proven technologies are addressed through collaborative activities with concerned stakeholders, including private sector operators.
	Output	1) Dissemination of proven technologies and approaches (CBSS, PVS, leguminous crops, food security, gender mainstreaming,1st year onwards). 2) Production of Foundation seeds increased. 3) Country-specific training modules completed; 4) NERICA Resource Persons trained to provide training at Keysites of Network. 5) Wide-scale adoption of NERICA-based innovations in pilot countries and extensive information campaigns.
A.5	Action	Agro-based industry development by NTs 1) Assessment of research and development needs for agro-based industry technologies, including female friendly technologies, and prioritization of necessary activities in pilot countries. 2) Experimental application and production of agro-based industry technologies, commencing with items already available within the region (e.g. ASI thresher-cleaner). 3) Training of national personnel in selected agro-based industry technologies.
	Output	1) Action plans for agro-based industry development in six countries; 2) Selected agro-based industrial products assessed and promoted (e.g. ASI thresher-cleaner) 3) National personnel trained in selected agro-based industries.
A.6	Action	Regional workshops: 1) Secretariat organizes a regional workshop in Year 3 to evaluate results obtained in the first two years. 2) Secretariat organizes a concluding workshop in Year 5 to evaluate results and discuss next steps.
	Output	1) Mid-term workshop at WARDA to evaluate progress made. 2) Concluding workshop held at WARDA.
A.7	Action	Extrapolation to East and Southern Africa: 1) NARES in seven East and Southern African countries (Tanzania, Malawi, Zambia, Mozambique, Madagascar, Ethiopia and Uganda) start with PVS and CBSS work
	Output	PVS and CBSS activities implemented in five East and Southern African countries.

B. NERICA Research Network: Major Actions and Outputs

B.1	Action	Research coordination and implementation: 1) Secretariat recruits multi-disciplinary theme coordinators 2) NTs recruit 10 multi disciplinary Ph.D. students. 3) Theme coordinators work on themes for five years. 4) Ph.D. students' work on themes for four years.
	Output	1) Two theme coordinators recruited. 2) Ten Ph.D. students identified and recruited from the region.
B.2	Action	Information exchange between research and other stakeholders: 1) Secretariat and other international research organizations, NARES, farmers organizations, NGOs, etc. identify relevant technologies to increase productivity for rainfed environments during first national stakeholder workshops 2) Secretariat and NTs feedback results on research to improve technologies – improved seeds, dissemination practices, food security, gender mainstreaming. 3) Secretariat and NTs translate results in easy-to-use extension material and feed forward to NERICA Platform.
	Output	1) Potential complementary technologies, i.e. NERICA-based innovations, and agro-based industries identified during first national stakeholder workshops. 2) Technology development improved and more client-oriented. 3) Promising complementary technologies are fed forward to the NERICA Stakeholder Platform.
B.3	Action	Monitoring and evaluation of existing NERICA-based technologies: 1) NTs identify keysites and conduct rapid socio-economic and biophysical baseline surveys. 2) NTs establish monitoring and evaluation mechanisms of NERICA-based innovations at keysites. 3) Continuous monitoring of NERICA-based innovations at keysites (agronomic and socio-economic performance). This includes a minimum number of focused plant and soil samplings and analyses, food security assessments, and gender performance indicators. 4) NTs evaluate NERICAs and complementary technologies, including agro-based industries, using a common set of socio-economic and biophysical performance indicators
	Output	1) Representative keysites identified, and biophysical and socio economic typology available. 2) Monitoring and evaluation mechanism of NERICA-based innovations established at keysites. 3) Record on agronomic and socio-economic performance of NERICA-based innovations at keysites 4) Complementary technologies for NERICAs evaluated with farmers at keysites, prioritization of promising technology options complete and results documented.
B.4	Action	Development of new NERICA-based lines 1) Expedite current efforts by WARDA and NARES to develop new NERICAs, especially for lowland conditions. 2) NARES evaluate NERICAs for lowland conditions at keysites.
	Output	1) New NERICAs for lowland ecosystems evaluated at keysites.

B.5	Action	<u>Socio-economic research into scaling-up process:</u> 1) Process research by Ph.D. students to identify and enhance scaling-up mechanisms for NERICA-base innovations. 2) Conduct mid-term review of Consortium activities in Year 3. 3) Evaluate Consortium activities in Year 5
	Output	1) Enhanced understanding of scaling-up mechanisms for NERICA-base innovations, including more efficient and effective dissemination mechanisms for NERICA-base innovations. 2) Mid-term review of overall Consortium activities conducted. 3) Overall evaluation of Consortium activities conducted.

Current Donors' Support to ARI Action Plans (as of January 2004)

	Actions	Budget Estimate (US$ thousand)	Supporting Donors	Countries supported by donors	Commitments (US$ thousand)
A-1	Establishing the Secretariat	2,378	Rockefeller Foundation AFDB	Secretariat Secretariat & WARDA	600 1,230
A-2	Establishing national NERICA team and	994	AFDB	7 countries	1,510
A-3	Establishing national scaling up strategy	151	AFDB	7 countries	
A-4	Dissemination of NERICA through CBSS	7,942	Japan/UNDP	Guinea and Cote d'Ivoire	846
	Dissemination of NERICA through CBSS		AFDB	7 countries	27,550
	Dissemination of NERICA through SPFS		Japan/FAO	Ghana & Sierra Leone	1,800
	Exposure of farmers to NERICA through PVS		Rockefeller Foundation	Mali and Nigeria	380
	Exposure of farmers to NERICA through PVS		Japan/UNDP	Burkina Faso, Ghana and Sierra Leone	421
	Exposure of farmers to NERICA through PVS		Gatzby Foundation		
A-5	Agro-based industry development	648	Japan/UNDP	Guinea (under prepara.)	300
			SG2000	Guinea	100
A-6	Regional workshops	529			
A-7	Dissemination of NERICA in East/Southern Africa		Japan/UNDP	Ethiopia	180
	A-1 -- A-7 Sub Total	**12,642**			**34,917**
B-1	Research coordination and implementation	1,015			
B-2	Information exchange between research and other stakeholders	108			
B-3	Monitoring and evaluation of existing NERICA-based technologies	589			
B-4	Development of new NERICA-based lines for low land conditions	108			
B-5	Socio-economic research into scaling-up process	729			
	B-1 -- B-5 Sub Total	**2,549**			**0**
	Grand Total	**15,191**			**34,917**

Note: 7 Countries supported by AFDB are Benin, Gambia, Ghana, Guinea, Mali, Nigeria, Sierra Leone

Prospect in Achieving ARI Targets

1. Targets set by ARI (2002-2006)

By 2006 (Year 5), the NERICAs are expected to have attained:

- Cultivated area of 210,000 ha in West and Central Africa (WCA)
- Production of 744,000 tons/year in WCA
- Rice import substitution value of almost US$88 million
- 1.7 million African farmers exposed to NERICAs
- Adoption rate among exposed farmers of 35-40 %
- Adopting farmers allocating 15-20% of their rice land to NERICA

2. Targets set by the AFDB supported project (2004-2008)

The project includes technology transfer, production support, capacity building, and project coordination.

- Cultivated area of 400,000 ha
- Production of 600,000 tons/year (average 1.5 ton/ha)
- Rice import substitution value of US$100 million by 7 countries
- 33,000 farm families will participate in PVS and 241,000 farm families will be benefited
- Farmers will be benefited from the former a net loss of $19.50/ha to a net gain of $216.30/ha
  (An internal rate of return of 42 % without fertilizer and 61% when fertilizer applied on the basis of 20 years rotation period)

3. Additional elements to achieve ARI Targets

Expected additional cultivated areas and production in crease in WCA

- Cote d'Ivoire supported by Japan/UNDP/WFP
- FAO supported SPFS projects in Ghana and Sierra Leone
- Rockefeller Foundation supported projects in Mali and Nigeria
- SG2000 supported projects in Burkina Faso, Ghana, Guinea and Mali
- Gatsby Foundation supported projects in Ghana and Nigeria
- Other donors supported projects in Mali (AFD, USAID, CIDA), and Sierra Leone (EU, China, and the Islamic Development Bank, World Vision)

4. Prospect to achieve the targets

- The achievement of production targets will be delayed toward 2008 without changes in climate and political conditions in WCA.

Major Issues

1. Mobilizing Resources for the Research Network (B-1 – B-3 and B-5)

The entire programme of ARI seems to have been delayed at least two years. NERICA dissemination in 8 pilot countries is progressing, however the overall ARI Action Plans are not necessarily in a good progress. The lack of funds other than the seed production is the main issue. It is now necessary for donors to support the research network to carefully and systematically monitor the progress with appropriate data and information. At the moment, the capacity of the Secretariat is very small. It is urgently needed to strengthen its capacity to monitor the progress, coordinate the implementation of the Action Plans and mobilize resources to move forward the entire Action Plans.

2. Enhancing participation of more donors in a coordinated manner

Current major donors supporting ARI are the Government of Japan, UNDP, African Development Bank, Rockefeller Foundation, and FAO. It is heard that the World Bank, IFAD, USAID, CIDA and DIFID, etc are interested in NERICA dissemination. In order to equally cover and benefit all the interested countries under ARI, the participation of more donors in a coordinated manner is needed.

3. Expanding PVS in Non-pilot countries

While the dissemination of NERICA is focused on pilot countries, PVS should be further expanded in Non-pilot countries. Otherwise, Non-pilot countries will be left out.

4. Systematizing the dissemination of NERICA in East and Southern Africa

Currently, the dissemination of NRICA in East and Southern Africa is not systematically operated. Donors coordination is needed in partnership with WARDA and ARI secretariat in order to ensure a great success in the sub-regions. Particular importance is placed on the sharing of information for the experimental data in local conditions.

5. Systematizing the production and dissemination of foundation seeds

It is urged that the ARI Secretariat will prepare the needs survey for NERICA foundation seeds in WCA as well as East and Southern Africa, and make a plan how to produce and distribute them. The information network is therefore badly needed to collect and share such information and the results of the seed production.

Dissemination of NERICA under ARI

1. ARI Action Plans
2. Current Donors' Support to ARI Action Plans
3. Current Needs for Donors' Support to ARI Action Plans
4. Prospect in Achieving ARI Targets
5. Major Issues

Ken Fujimura
Senior Advisor on South-South Cooperation
Special Unit for South-South Cooperation (SU/SSC), UNDP

Action Plans

A. Stakeholders Platform

(US$ thousand)

A-1	Establishment and operation of Secretariat	2,371
A-2	Establishment and operation of National NERICA teams in each pilot country	994
A-3	Development of national scaling-up strategy under the guidance of the NEICA teams	151
A-4	Implementation of and training for national scaling-up strategy	7,942
A-5	Agro-based industry development by NTs	648
A-6	Regional workshops	529
A-7	Extrapolation to East and Southern Africa	
	Sub Total	12,642

B. Research Network

(US$ thousand)

B-1	Research coordination and implementation	1,015
B-2	Information exchange between research and other stakeholders	108
B-3	Monitoring and evaluation of existing NERICA-based technologies	589
B-4	Development of new NERICA-based lines	108
B-5	Socio-economic research into scaling-up process	729
	Sub Total	2,549
	Grand Total (A + B)	15,191

Current Donors' Support to ARI Action Plans

A. Stakeholders Platform

(US$ thousand)

Code	Budget estimate	Supporting donors	Targeted countries	Commit-ment
A-1	2,378	Rockefeller F. AFDB	Secretariat Secretariat & WARDA	600 1,230
A-2	994	AFDB	7 countries	755
A-3	151	AFDB	7 countries	755
A-4	7.942	Japan/UNDP AFDB Japan/FAO Rockefeller F. Japan/UNDP	Guinea, Cote d'Ivoire 7 countries Ghana, S. Leone Mali, Nigeria B. Faso, Ghana, S. Leone	846 27,550 1,800 380 421
A-5	648	SG2000 Japan/UNDP	Guinea Guinea	100 300
A-6	529			
A-7		Japan/UNDP	Ethiopia	180
Sub Total	12,642			34,917

B. Research Network

(US$ thousand)

Code	Budget estimate	Supporting donors	Targeted countries	Commit-ment
B-1	1,015			
B-2	108			
B-3	589			
B-4	108			
B-5	729			
Sub Total	2,549			
Grand Total	15,191			

Current Needs for Donors' Support to ARI Action Plans

A. Stakeholders Platform

(US$ thousand)

Code	Budget estimate	Supporting donors	Targeted countries	Commitment
A-1	2,378	Rockefeller F. AFDB	Secretariat Secretariat & WARDA	600 1,230
A-2	994	AFDB	7 countries	755
A-3	151	AFDB	7 countries	755
A-4	7,942	Japan/UNDP AFDB Japan/FAO Rockefeller F. Japan/UNDP	Guinea, Cote d'Ivoire 7 countries Ghana, S. Leone Mali, Nigeria B. Faso, Ghana, S. Leone Non-pilot countries	846 27,550 1,800 380 421
A-5	648	SG2000 Japan/UNDP	Guinea Guinea	100 300
A-6	529			
A-7		Japan/UNDP	Ethiopia East and Southern Africa	180
Sub Total	12,642			34,917

Current Needs for Donors' Support to ARI Action Plans
B. Research Network

(US$ thousand)

Code	Budget estimate	Supporting donors	Targeted countries	Commit-ment
B-1	1,015			
B-2	108			
B-3	589			
B-4	108			
B-5	729			
Sub Total	2,549			
Grand Total	15,191			

Prospect in Achieving ARI Targets

- **Targets set by ARI (2002~2006)**
  - Cultivated area of 210,000 ha in West and Central Africa
  - Production of 744,000 tons/year in WCA
  - Rice import substitution value of almost US$88 million
  - 1.7 million African farmers exposed to NERICAs

- **Targets set by the AFDB supported project (2004~2008)**
  - Cultivated area of 400,000 ha in 7 countries in WCA
  - Production of 600,000 tons/year (Average 1.5 ton/ha without fertilizer)
  - Rice import substitution value of US$100 million by 7 countries
  - 33,000 farmers families will participate in PVS and 241,000 farmers families will be benefited.
  - Farmers will benefit from reversing a net loss of $19.50/ha to a net gain of $216.30/ha

Additional Elements to contribute to ARI in addition to AFDB supported projects

- **Additional cultivated areas and production increase in WCA**

  - Cote d'Ivoire supported by Japan/UNDP/WFP
  - FAO supported SPFS projects in Ghana and Sierra Leone
  - Rockefeller Foundation supported projects in Mali and Nigeria
  - SG2000 supported projects in B. Faso, Ghana, Guinea, Mali,
  - Gatzby Foundation supported projects in Ghana and Nigeria
  - Other donors supported projects in Mali (AFD, USAID, CIDA), and S. Leone (EU, China, Islamic D. Bank, World Bank)

- **The achievement of production targets will be delayed toward 2008 without changes in climate and political conditions in WCA**

Major Issues

- **Mobilizing resources for the Research Network**
- **Enhancing participation of more donors in a coordinated manner**
- **Expanding PVS in Non-pilot countries**
- **Systematizing the dissemination of NERICA in East and Southern Africa**
- **Systematizing the production and distribution of foundation seeds**

KENYA AGRICULTURAL RESEARCH INSTITUTE

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

NEW RICE FOR AFRICA (NERICA) PROJECT

Preliminary Varietal Evaluation of NERICA varieties in Kenya

With compliments of
Centre Director
KARI Kibos
P O Box 1490
KISUMU

January 20, 2004

A. PROGRESS

Preliminary Varietal evaluation of New Rice for Africa varieties in Kenya

W O Kouko, J N O Okech, J O Okora, W A O Kore, G O Siage and G O Omuga

Introduction

Rice production in Kenya has remained stagnant over the last decade. This has occurred despite increasing consumption demand occasioned by increase in population and shift in eating habits especially with the urban population. While consumption now stands at 150,000 metric tones (mt) of milled rice, production has fluctuated between 32,843 to 60,000 mt over the last two decades. Increased consumption requires parallel increase in production that could be realized through productivity, increase in area under the crop, and reduction of pre and post harvest losses. The mean grain yield for rainfed rice is 1.5 t ha^{-1} while 5.0 t ha^{-1} is attained under irrigated systems. The most cited constraints to high productivity are lack high of yielding varieties, intense weed competition, diseases, and drought among other management difficulties. In upland cultures time of planting and earliness are crucial to maximize on the limiting moisture regime. This calls for early land preparation and appropriate system of seed multiplication and distribution.

Irrigated rice area has fluctuation between 8,000 ha to 11,000. While expansion of irrigated systems is limited by high capital investment, the national potential area for rainfed rice production that could be easily tapped stands at 400,000 ha. It is important that the appropriate varieties are evaluated for these ecologies to realize increased yield and area. However rainfed rice requires a well-distributed rainfall over the growth and development period. This means at least 200 mm of rainfall per month over three months with 7 – 10 rainy days intervals up to grain filling stages. Early maturity, drought and disease tolerance, and fast canopy establishment to control soil erosion and weeds are among the most appropriate requirements for upland rice varieties.

Objectives

- To evaluate for early maturity and high yielding NERICA rice varieties of good cooking and grain qualities that are well adapted to different rainfed cultures of Kenya.

- To screen NERICA varieties against biotic and abiotic stresses under rainfed ecologies.
- To identify rainfed rice cultivars suitable for further evaluation in replicated yield trials in Kenya.

Material and Methods

Three replicated yield trials and three stress screening observation nurseries were established at KARI Kibos in 2003 to evaluate NERICA rice varieties along other INGER and local lines. The germplasms tested in replicated yield trials were 15 for both upland – early (Table 1) and upland - medium (Table 2) and 13 for lowland ecologies (Table 3). Each kit had varied number of NERICA varieties as follows; upland "early" had 4, upland "medium" 2 and lowland had 5 NERICA varieties. Observations were made on the three nurseries. While three trials were planted on a randomized complete block design of three replicates, single plots were planted for observation nurseries. The seed was directly drilled in rows of 25 cm spacing on plots measuring 2.5 m x 5 m. Basal application of phosphate fertilizers were made at a rate of 46 kg P_2O_5 ha^{-1} while nitrogen was top dressed in two equal splits of 25 kg N ha^{-1} at 20 and 50 days after seedling emergence. The crop was kept weed free by hand hoes and labour hired to control birds from flowering to harvesting. All other cultural practices were maintained throughout the trial period using recommended practices.

Paddy rice was weighed and individual plot yields adjusted to 14% moisture content. Data collected include; germination (%), reproductive tillers (%), number of grains per panicle, filled grains (%) per panicle (using salt water 1:13 gravity), panicle length (cm), plant height (cm), 1000 grain weight (gm), grain yield (kg ha^{-1}), and other biotic and abiotic stress scores.

Data was compiled and subjected to analysis of variance with means separated by Duncan's multiple range test (DMRT).

Results and Discussion

The results are presented on Tables 1 to 6.

1. Upland rice replicated yield trials (Early)

The results of upland rice replicated yield trials are shown on Table 1. The grain yield ranged from 1.440 kg ha^{-1} for variety ITA 337 to 3760 kg ha^{-1} (variety WAB224-16-HB) during the season. The results were promising with the highest yielding varieties WAB 224-16-HB attaining 3,760 kg ha^{-1}, followed by ITA150 (FARO046), (TOX502-41-1-1) with 3,306.7, WAB376-B-14-H2-HB (3,146.7), WAB 32-55 (2,853.3), WAB 450-11-1-3-P_4O-HB (2,720 0), WAB 450-11-1-3-P41-HB (26667) and RY1 attaining (2,506.0). These seven varieties gave over 2.5 t ha^{-1} that is a good performance under upland conditions that had neither supplementary irrigation nor bunding to conserve moisture around the roots. Four other varieties that gave acceptable yields include WAB450-1-B-P-160-HB at 2,266.7, WABC (1AC165) and WAB 450-11-1-1-P41-HB that attained 2,186.7 kg ha^{-1} each. The varieties have high potential under upland cultivation since only two; ITA337 (1440.0) and WAB 326-B-B-9-L2-L1-LB (1493.3) gave the grain yields below the national average of 1500 kg ha^{-1}. Other yield components ranges varied as shown. For plant height the range was between 661 to 872 cm, Panicle length (17-8-228), filled grains (59.0 - 90.3), grains per panicle (78-211) 1000-grain weight in grams (8.3 - 32.7).

2. Upland rice replicated yield trials (Medium).

The results of the trial are summarized in Table 2 below. There were significant ($P \leq 0.001$) differences in grain yield that were relatively lower than in the early maturing varieties in Table 1. There was a wide yield range from 156.0 kg ha^{-1} for variety WAB 519-55-3 to 2613.3 (WAB 33-17). The grain yields attained by three most promising varieties were not significantly ($P > 0.05$) different at 2613.3 in WAB 33-17, 2540.0 (M 55) and 1893.3 (WAB 515-151-4). The three varieties were closely followed by WAB 99-1-1 with grain yield of 1735.5 kg ha^{-1}, which was however not significantly ($P > 0.05$) different from variety WAB 515-151-4.

The highest yielding varieties such as WAB 33-17, WAB 515-151-4, WAB 99-1-1, M 2 and K 1 were also the tallest plants recorded except M55. Six high yielding varieties; WAB 3317, M55, WAB 515-151-4, WAB 99-1-1, K1 and M2 had a general trend in rank for yield components. This was true except for a few cases. The

number of grains per panicle was significantly ($P \leq 0.001$) different with a wide range of 67 (M 2) to 165 (WAB 99-1-1). The highest number of grains per panicle recorded in variety IDSA 6 (IRAT 216) (ROK 18) (152), CT 6775-5-17-4-2-10P (134) and WAB 519-55-3 (132) were not statistically different. The percent filled grains per panicle had a range of 31% (CNA 6681) to 87% (M 55). Variety WAB 99-1-1 gave the highest percentage of filled grains per panicle at 82%, followed by IDSA 6 (IRAT 216) (ROK 18) at 77%, CT 6196-33-11-2-2-3P (76%) and CT 6775-5-17-4-2-10P (75%). The longest panicles were also recorded in high yielding varieties WAB 33-17 with 21.4 cm, WAB 99-1-1 (21.2) except (619.7) LAC 23 (ROR17) with 19.7 that had low grain yields. Six high grain yielding varieties had also the heaviest grain weight for a 1000 grain weight M 55 (34.0 g), WAB 33-17 (30.0) WAB 99-1-1 (27.0), M 2 (24.7) K I (26.0), VAMO (24.7) and WAB 515-151-4 (23.3). Variety WAB 515-151-4 had relatively smaller grains compared to the other six. Variety VAMO because of its relatively larger grain size was among the most promising varieties. Percent reproductive tillers had a range of 64% - 93.3% that followed similar trend as variety WAB 33-17 gave 93.3 followed by WAB 99-1-1, K 1, M 55, M 2 and WAB 515-151-4.

Recommendation

For future participatory varietal evaluation the seven varieties should be considered for further research work with farmers, although confirmatory tests are necessary for verification of these results. Further participatory evaluations should be conducted with farmers, extension and other stakeholders. The sites should have relatively longer periods of rainfall but preferably 4 rainy months.

3. Lowland rice replicated yield trials

The results are summarized in Table 3 below. There were significant differences between the varieties in all the parameters recorded. The grain yield ranged from 132.8 kg ha^{-1} for USEN (ACC. 32560) to 1280.0 kg ha^{-1} for WAT 46-TGR-3-3. This was comparatively lower than expected in lowland ecologies. The site was not adequately endowed with the lowland characteristics. Four varieties; SIK 11-5-4-2-4, LAC 23 (ROK 17), SIK P5-0-4-3-5-2-4 and SIK 25-349-4 gave yields that were not significantly ($P > 0.05$) different but relatively low at 613.3 kg ha^{-1}, 474.9, 418.1 and 393.3, respectively. This took place despite the high performance realized in yield

components as depicted from the percent reproductive tillers (81.5 – 97.4) that is indicative of high panicle formation efficiency. There was a wide range of number of grains per panicle from 49 to 151 with low percent filled grains (14.0 % - 69.7) compared to expected 70 – 80 %. The highest percentage of filled grains per panicle was recorded by the highest yielding variety WAT 46-TGR-3-3. The low percentage germination of WAT 46-TGR-3-3 perhaps led to compensatory development of yield components due to less competition among the plants and may have contributed to high grain filling percentage. Although major indicators for yield like reproductive tillers, number of grains per panicle were high, the same were not reflected in the grain yields due to the adverse weather effects that affected the trials during the critical grain filling period. Low seed weight for 1000-grain weight was realized with a range of 12.3 to 24.3. These experiments were however, extremely affected by mid season drought hence the poor performance. The seed so attained would be useful for planting in typical lowland rice ecologies the following season.

Recommendation

It is observed that despite poor performance in the trial Variety WAT 46-TGR-3-3 could be further tested in future participatory experiments especially under farmer, research and extension management. Further tests are necessary to confirm these results.

4. Rice Stress Screening Observation Nurseries for Lowland and Upland Ecologies

Results presented in Table 4 shows that seven (7) entries were well adapted and 3 entries were fairly well adapted to the prevailing conditions at KARI Kibos. Time to flower from seedling emergence ranged from 94 – 165 days with the seven well-adapted varieties being earlier maturing than the other three fairly well adapted lines. An ideal rice cultivar for Kenyan upland conditions should mature within 90 – 120 days to attain grain yields ranging from 1500 kg ha^{-1} to 3,000. Meanwhile the yield range for this observation nursery was between 76.8 kg ha^{-1} to 2640.0. It is important that all the eight NERICA entries performed well with a yield range of 1840.0 kg ha^{-1} to 2640 except one namely WAB450-12-2-BL1-DV1 that performed dismally and gave only 375.2 kg ha^{-1}.

Table 5 shows result of another stress screening nursery that had only one promising line with grain yield of 640.0 kg ha^{-1}. The variety WAT 68-TGR-4-4 showed good characteristics but could not produce grain yields higher than the national average. The variety should be tested further in longer duration rainfall conditions in Kenya

Table 6 shows results of a blast screening nursery that did not produce any evidence of disease attack throughout the season. The grains yield was however very low with only one KARI Rice giving high yields comparable to the national average. Further evaluations should be undertaken to confirm some of these results in longer rainy duration conditions.

Table 1: Mean Grain Yield and other Agronomic Characteristics for early Upland Rice Varieties

Varieties	Grain yield (kg ha^{-1})	1000-grn weight per (gm)	Grains per panicle (No)	Filled grains (%)	Panicle length (cm)	Height (cm)	Reproductive tillers (%)
IDSA 109	1733.3^{de}	23.7^{g}	120^{cde}	85.3^{ab}	19.2^{def}	73.8^{cde}	82.6^{ab}
ITA 150 (FARO 46)(TOX 502-41-1-1)	3306.7^{ab}	32.7^{a}	78^{g}	89.3^{a}	18.9^{ef}	80.4^{abc}	41.2^{d}
ITA 337	1440.0^{e}	26.7^{d}	126^{cd}	59.0^{e}	21.4^{abc}	74.1^{cde}	82.5^{ab}
RY 1	2506.7^{abcde}	31.0^{b}	90^{efg}	79.3^{bcd}	18.7^{ef}	70.0^{de}	88.7^{a}
WAB 181-32	2266.7^{bcde}	25.3^{def}	126^{cd}	75.0^{cd}	20.8^{bcd}	79.5^{abc}	50.5^{cd}
WAB 224-16-HB	3760.0^{a}	25.0^{efg}	162^{b}	83.3^{abc}	22.7^{a}	77.4^{bcd}	90.8^{a}
WAB 326-B-B-9-L2-L1-LB	1493.3^{e}	26.3^{de}	107^{defg}	80.0^{bcd}	18.8^{ef}	76.1^{bcd}	80.9^{ab}
WAB 32-55	2853.3^{abcd}	8.3^{c}	117^{def}	83.0^{abc}	20.0^{cde}	81.8^{abc}	52.0^{cd}
WAB 375-B-4-H2-HB	1973.3^{cde}	25.7^{de}	126^{cd}	73.3^{d}	20.4^{cde}	80.8^{abc}	64.2^{bc}
WAB 376-B-14-H2-HB	3146.7^{abc}	25.3^{def}	151^{bc}	89.7^{a}	19.4^{def}	70.5^{de}	87.8^{a}
WAB 450-11-1-1-P41-HB	2186.7^{bcde}	24.0^{fg}	86^{fg}	86.3^{ab}	17.8^{f}	69.1^{de}	52.0^{cd}
WAB 450-11-1-3-P40-HB	2720.0^{abcde}	25.3^{def}	94^{defg}	87.0^{ab}	19.1^{def}	66.1^{e}	44.5^{cd}
WAB 450-11-1-3-P41-HB	2666.7^{abcde}	25.7^{de}	114^{def}	79.7^{bcd}	20.4^{cde}	75.7^{bcd}	32.2^{d}
WAB 450-1-B-P-160-HB	2266.7^{bcde}	25.3^{def}	163^{b}	79.3^{bcd}	22.3^{ab}	83.3^{ab}	52.2^{cd}
WABC 165 (IAC 165) check	2186.7^{bcde}	30.7^{b}	211^{a}	90.3^{a}	22.8^{a}	87.2^{a}	92.1^{a}
Mean	2433.8	26.7	125	81.3	20.2	76.4	66.2
Range	1440-3760	8.3-32.7	78-211	59.0-90.3	17.8-22.8	66.1-87.2	41.2-92.1
CV %	27.3	3.1	-	5.8	4.7	5.9	17.0

Means with the same letters in each column are not significantly different (DMRT)

Table 2: Mean Grain yield and other agronomic characteristics for medium upland rice at Kibos

Variety	Grain yield (kg ha^{-1})	1000-grain weight (gm)	Grains per Panicle (No)	Filled Grains (%)	Panicle length (cm)	Height (cm)	Reproductive Tillers (%)
CNA 6681	176.8^{d}	15.3^{h}	97^{cde}	31.0^{d}	16.3^{d}	46.0^{d}	76.7^{a}
CT 6196-33-11-2-2-3P	324.4^{d}	20.0^{g}	81de	76.3^{a}	18.1^{cd}	51.9^{cd}	73.3^{a}
CT 6775-5-17-4-2-10P	898.9^{cd}	21.0^{fg}	134^{abc}	75.0^{ab}	18.5^{cd}	60.8^{bc}	53.3^{c}
IDSA 6 (IRAT 216) (ROK 18)	265.9^{d}	22.0^{efg}	152^{ab}	77.3^{a}	18.7^{cd}	67.5^{ab}	5.0^{e}
K 1	1422.1^{bc}	26.0^{cd}	67^{e}	72.3^{ab}	18.4^{cd}	68.1^{ab}	78.3^{a}
LAC 23 (ROK 17)	192.5^{d}	23.0^{defg}	88de	47.7^{bcd}	19.7^{abc}	79.1^{a}	5.7^{e}
M 2	1306.7^{bc}	24.7^{cde}	67^{e}	67.3^{abc}	19.1^{bc}	78.2^{a}	80.0^{a}
M 55	2540.0^{a}	34.0^{a}	72de	86.7^{a}	16.5^{d}	56.6^{bcd}	78.3^{a}
MOROBEREKAN	222.9^{d}	22.7^{efg}	76de	44.3^{cd}	17.6^{cd}	77.7^{a}	75.0^{a}
SP 8	773.3^{cd}	21.7^{fg}	81de	73.0^{ab}	18.4^{cd}	75.0^{a}	75.0^{a}
VAMO	933.3^{cd}	24.7^{cde}	70de	66.7^{abc}	18.7^{cd}	69.8^{ab}	70.0^{ab}
WAB 33-17	2613.3^{a}	30.3^{b}	108^{cde}	73.7^{ab}	21.4^{a}	77.8^{a}	78.0^{a}
WAB 515-151-4	1893.3^{ab}	23.3^{def}	113^{bcd}	67.7^{abc}	18.3^{cd}	68.0^{ab}	70.0^{ab}
WAB 519-55-3	156.0^{d}	14.7^{h}	132^{abc}	43.7^{cd}	17.6^{cd}	56.5^{bcd}	56.7^{bc}
WAB 99-1-1	1735.5^{b}	27.0^{c}	165^{a}	82.3^{a}	21.2^{ab}	66.7^{ab}	31.7^{d}
Mean	1030.3	23.4	100	65.7	18.6	66.6	77.1
Range	156.0 – 26	14.7-34.0	67-165	31.0-86.7	16.3-21.4	46.0-79.1	64.0-93.3
CV %	39.9	7.3	22.8	22.3	6.9	11.0	14.6

Table 3: Mean Grain yield and other agronomic characteristics for lowland rice varieties at Kibos

Variety	Grain yield kg ha^{-1}) (gm)	1000-grain weight (No)	Grains per Panicle (%)	Filled Grains (cm)	Panicle length	Height (cm) (%)	Reproductive Tillers	Germ (%)
SIK P5-0-4-3-5-2-4	418.1^{bcd}	16.7^{d}	106^{bcd}	29.0^{cd}	18.2^{bcde}	50.6^{ef}	97.4^{a}	50.0^{abc}
SIK 25-349-4	393.3^{bcd}	21.0^{bc}	91^{cd}	23.7^{d}	17.9^{cde}	57.3^{de}	73.6^{cd}	65.0^{a}
LAC 23 (ROK 17)	474.9^{bc}	23.0^{ab}	98^{bcd}	47.3^{bc}	18.6^{abcde}	86.7^{a}	81.5^{cd}	51.7^{abc}
SIK P7-1-18-5-1-4	249.6^{cd}	19.3^{c}	70de	23.0^{d}	15.5^{fg}	48.8^{f}	86.8^{abc}	36.7^{bc}
SIK 49-314-4	246.7^{cd}	19.7^{c}	106^{bcd}	14.0^{d}	17.5^{ef}	53.5^{def}	90.0^{ab}	45.0^{abc}
WAT107-TGR-2-2	170.4^{cd}	18.7^{cd}	109^{bcd}	20.7^{d}	17.9^{cde}	46.7^{f}	85.3^{abc}	2.7^{d}
WAT 64-TGR-3-3	296.8^{cd}	23.0^{ab}	151^{a}	24.0^{d}	20.5^{a}	72.2^{bc}	87.0^{abc}	60.0^{ab}
USEN (ACC. 32560)	132.8^{d}	12.3^{e}	49^{e}	14.0^{d}	13.5^{g}	47.0^{f}	92.4^{ab}	51.7^{abc}
SIK P4-0-128-3-4-5-2	269.3^{cd}	13.7^{e}	134^{ab}	18.0^{d}	20.4^{ab}	56.0^{de}	67.6^{d}	51.7^{abc}
WAT 75-TGR-2-1	227.5^{cd}	24.3^{a}	91^{cd}	34.3^{bcd}	19.9^{abc}	77.3^{b}	79.1^{bcd}	66.7^{a}
SIK 11-5-4-2-4	613.3^{b}	24.3^{a}	131^{abc}	50.3^{b}	17.2^{ef}	58.9^{d}	88.8^{abc}	48.3^{abc}
WAT 55-TGR-4-2	308.3^{cd}	22.3^{ab}	120^{abc}	46.0^{bc}	19.6^{abcd}	68.5^{c}	87.8^{abc}	65.0^{a}
WAT 46-TGR-3-3	1280.0^{a}	19.3^{c}	116^{abc}	69.7^{a}	17.4^{def}	51.1^{ef}	88.0^{abc}	31.7^{c}
Mean	390.8	19.8	105	31.8	18.0	59.6	85.0	48.7
Range	132.8 – 1280.0	12.3 – 24.3	49 – 151	14 – 69.7	13.5 – 20.5	46.7 – 86.7	67.6 – 97.4	2.7–66.7
CV %	41.5	7.2	20.5	35.0	6.8	6.4	9.2	25.4

Means followed by the same letter (s) in each column are not significantly different (DMRT) (P≤ 0.001)

Table 4: Upland Rice Stress Screening Nursery for Drought (URSSN)

Variety	Grain Yield (Kg ha^{-1})	Days to maturity (No.)	Filled grains (%)	Rep tillers (%)	Panicle length (cm)	Plant Ht (cm)	Germ (%)
056 (FARO 11)	76.8	165	46	77.7	15.4	67.5	75
MOROBEREKHAN	308.8	165	57	76.8	18.6	73.6	65
WAB 450-11-2-BLI-DRI	1920.0	94	91	52.9	23.5	86.9	70
WAB450-11-2-BLI-DRS2	1840.0	94	82	51.8	21.8	80.0	65
WAB450-12-2-BLI-DVI	375.2	165	56	80.3	16.5	67.4	65
WAB450-11-2-BLI-DV3	2480.0	94	87	67.4	21.1	79.0	65
WAB450-5-1-BL2-DV6	2400.0	94	73	73	20.4	75.8	65
WAB450-16-2-BLI-DRI	2480.0	94	86	44.0	21.42	85.9	70
WAB450-16-2-BL2-DRI	1920.0	94	85	40.7	22.1	85.3	65
WAB450-16-2-BL2-DV1	2640.0	94	86	43.5	21.5	90.6	70
Mean	1680.0	115	75	60.8	20.2	79.2	61

Table 5: Rainfed low land Stress Screening Nursery (RLSSN)

Variety	Grain Yield (Kg ha^{-1})	Days to mature (No.)	Filled grains (%)	Rep tillers (%)	Panicle length (cm)	Plant Ht (cm)	Germ (%)
MOROBEREKHAN	223.2	165	51	57	17.5	87.1	30
MASHURI (ROK 25)	16.0	188	0	64	15.4	49.6	50
WAT 50-TGR-4-2	92.0	165	9	84	18.2	55.0	55
WAT54-TGR-2-5	8.0	188	1	60	16.2	51.2	50
WAT55-TGR-4-2	256.8	165	40	76	18.1	66.4	60
WAT 64-TGR-3-4	140.0	165	41	84	19.5	72.6	55
WAT 68-TGR-4-4	640.0	188	34	68	19.3	47.5	30
WAT 75-TGR-1-5	190.4	188	35	85	19.7	65.9	45
WAT 83-TGR-3-4	10.4	188	2	84	17.9	63.8	50
WAT 85-TGR-5-5	**61.6**	**188**	**46**	**77**	**16.7**	**59.9**	**40**
Mean	163.8	179	26	74	17.9	61.9	47

Table 6: Rainfed lowland Stress screening Nursery for Blast (RLSSNB)

Variety	Grain Yield (Kg ha^{-1})	Days to mature	Filled grains (%)	Rep tillers (%)	Panicle length (cm)	Plant Ht (cm)	Germ (%)
1056(FARO)	108.8	188	50	71.7	17.9	76.4	50
TOX 4331T 92-2-2-1-1-1	63.2	188	33	81.4	12.4	47.4	40
TOX 4332 WAT 7-2-1-2-1-1	125.5	188	42	89.3	12.6	38.7	10
TOX 4332 WAT 15-2-3-1-1-1	80.8	165	37	87.3	16.1	43.5	2
TOX 4332 WAT 34-1-2-3-1-1	200.0	188	40	85.4	13.2	39.8	2
TOX 4332 WAT 50-1-2-1-1-1	183.2	165	31	90.4	12.9	42.3	45
TOX 4335 WAT 13-1-1-3-1	100.8	188	20	84.7	14.3	55.0	55
TOX 4335 WAT 21-2-1-1-1	241.6	165	66	60.8		91.8	45
TOX 4335 WAT 26-1-1-2-1-1	20.8	188	3	54.0	18.4	65.2	20
KARI RICE	1680.0	94	93	40.7	21.9	75.1	60
Mean	280.5	172	42	74.6	15.5	57.5	33

B. Current Follow-up Activities.

- The most important activities following the lessons learnt in the project is to reconstitute promising NERICA varieties for a participatory varietal selection process.
- Conduct participatory varietal selection with farmers using the promising elite NERICA lines such as WAB 450-11-1-1-P41-HB, WAB 450-11-1-3-P40-HB, WAB 450-11-1-3-P41-HB and WAB 450-1-B-P-160-HB in comparison other most outstanding local and WARDA varieties such as WAB 224-16-HB, ITA 150 (FARO 46)(TOX 502-41-1-1), WAB 376-B-14-H2-HB and WAB 32-55.
- Conduct preliminary varietal evaluation on the most outstanding NERICA lines from the observation Nursery such as WAB450-16-2-BL2-DV1, WAB450-11-2-BLI-DRI, WAB450-11-2-BLI-DRS2, WAB450-12-2-BLI-DVI, WAB450-11-2-BLI-DV3, WAB450-5-1-BL2-DV6, WAB450-16-2-BLI-DRI and WAB450-16-2-BL2-DRI.
- Import NERICA varieties for adaptation and adaptability studies.
- Conduct agronomic evaluation with four most promising NERICA varieties with high yields and high grain quality.
- Continue with participatory seed multiplication and later distribution with rice farmers.

C. Way Forward

Future rice research priorities to develop and:

- Adapt high yielding NERICA varieties
  - Early to medium maturing varieties,
  - Resistance to disease, insect pests and other stresses.
- Appropriate Agricultural machinery and farm implements
  - Rice Planting, Cultivation, Harvesting, and Threshing.
- Develop Integrated Pest Management System for NERICA Rice
- Integrated cropping and farming systems for NERICA rice
- Procedures for technology transfer through participatory varietal selection, seed multiplication and distribution, on-farm adoption, verification and support activities
- Strong human resource capability for National Rice Research Program.

D. Contribution of rice research towards Rural Development

- **Rural development**

Rural development process in developing countries consists of a complex Socio economic set up. Actors in rural development often confront problems from different perspectives.

Resource poor communities have resorted to subsistence farming as a way of ensuring survival. Today family labor which has for long been a key resource in rural development is fast becoming a major constraint, basically because of rural urban migration; phenomenon. The available labor has become too expensive to hire. Cost reducing, yield increasing and resource conserving technologies inaccessible to most rural folk partly due to lack of sensitization and partly due to poverty. It is important that as rice research focuses on developing technologies to address production constraints, it should also focus on how these technologies can be made accessible to the end users.

First step is to carry out participatory Rural Appraisal (PRA) to draw community action plans to guide development agents and the communities in their endeavours to address identified constraints.

- **Food security**

In Kenya one of the national challenge is how to ensure the population has access to food through out the year in a balanced form and at competitively affordable prices. There are technologies that are appropriate for ecological zones less endowed with optimum conditions for crop and livestock development.

Rice for instance is grown under irrigated and rainfed cultures. Rainfed rice production technology is geared towards enabling farmers to produce rice in environments that are suitable for other cereals such as maize. Irrigated rice requires heavy capital investment that the rural folk can ill afford. This fortifies the need for research to focus on easy to implement technologies. Rainfed rice meets these criteria. Food security issue however needs multisectoral and multidisciplinary approach.

Credit sector would do a great deal of service to the community were it to provide some grants o enable them to acquire some of the available technologies. The sector would contribute immensely to building of resource base that would open the way for farmers to access and use technologies such as rainfed rice to combat the escalating

food insecurity. Other technologies that would make a difference include integrated rice and fish farming. A Community Based Organization (CBO) in western Kenya is currently using this technology along with others to satisfy their food security requirements.

- **Employment creation:**

It has become fashionable to use community-based organizations as entry points to enhance rural development. Employment opportunities have continued to decline and alternatives must be found. Facilitating development efforts through transfer of appropriate technologies to the rural folk seems a practical attempt at creating employment in rural areas. Farmers organized into legal CBOs are better placed to catalyze the process of employment creation. Technologies channeled through such organization are quickly up scaled with in built sustainability mechanisms. Rainfed rice plant can be processed into other useful products. This gives rise to the need to establish micro processing industries that would just be the answer to unemployment problems.

- **Natural resource management**

The dwindling productivity of natural resources has been a cause of concern for actors in rural development. There is need to stem any further degradation through appropriate measures. Research efforts should therefore be concentrated on natural resource conserving technologies. Proper land preparation practices, cropping systems and utilization of rice plant that will ultimately evolve from intensified research activities require consideration. CBOs in Kenya have adopted various methods of conserving natural resources. This includes conservation tillage. It is in the interest of rural development for NERICA research to come up with cost effective technologies that communities can adopt and practice.

- **Wealth creation:**

Wealth creation is a function of proper natural resource management. It starts with generating income part of which is saved and invested.

Investment opportunities are many. However it is not an easy task to identify viable enterprises. The rural folk require some capacity building to be in a position to understand and make informed decisions. Wealth creation is a process that comes

after immediate goals of food security have been attained. It has much to do with accumulation of assets and being able to live comfortably above the poverty line. Increased rice yields and low marketing margins can indicators of improving wealth status among the rural folk.

Rainfed rice research should look into high yielding varieties, resistant to adverse environmental factors in order to increase food security and income levels of the rural folk.

KENYA AGRICULTURAL RESEARCH INSTITUTE
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

REPORT ON PRELIMINARY FINDINGS OF VATIETAL EVALUATION OF NERICA VARIETIES IN KENYA

PAPER PRESENTED DURING SEMINAR ON PROMOTION OF RICE PRODUCTION AND DISSEMINATION IN AFRICA
(NAIROBI, Kenya)
February 10 – 11, 2004

PRESENTED BY:
W O Kouko, J N O Okech, J O Okora and W A O Kore

INTRODUCTION

- Rice production in Kenya-stagnant for over a decade.
- Production fluctuates between 32,843 to 60,000 mt.
- Consumption stands at 150,000 mt
- Importation range between 90,000 – 130,000 mt

Yield per ha:	Potential	Current
➢ Rainfed Rice 1.5 t ha $^{-1}$	400,000 ha	15,000 ha
➢ Irrigated Rice 5.0 t ha $^{-1}$	N/A	11,000 ha

- **Production constraints:**
- Lack of high yielding early - medium varieties
- Intense weed competition
- Diseases and pests
- Drought and flooding
- High Capital Investment for Irrigated System
- Lack of well distributed Rainfall

OBJECTIVES

- To evaluate for adapted high yielding - early maturing rice varieties of good cooking and grain qualities to different cultures of Kenya.
- To screen rice varieties against biotic and abiotic stresses under varied ecologies
- To identify rice cultivars suitable for further evaluation in replicated yield trials in Kenya.

MATERIALS AND METHODS

- Three Replicated Yield Trials – of 3 Replicates each on RCBD with 15 lines for upland early and medium each and 13 lowland varieties from WARDA.
- Used WARDA kits with NERICAs in the Observations
- Upland early had 4 NERICAs, Medium 2, Lowland 5
- Three Kits of Stress Screening Nurseries with10 varieties in Single Plots
- Seed - Directly Drilled on 25 cm Row Spacing - Plots 2.5 X 5 m.
- Basal Application of P-Fertilizers at 46 kg P_2O_5 ha^{-1}
- Nitrogen Top Dressed in Two Equal Splits of 25 kg N ha^{-1} at 20 and 50 dase.
- Experiments were kept weed free by Hand Hoes and Labour hired to control Birds from Flowering to Harvesting.
- All Recommended Cultural Practices Maintained
- Grain yield weighed at 14 % MC plus other Data separated using DMRT

RESULTS AND DISCUSSION

➢ Upland Rice Replicated Yield Trials (Early)

- Grain yield ranged
  - ✓ ITA 337 attained 1,440 kg ha^{-1}
  - ✓ WAB224-16-HB 3,760 kg ha^{-1} followed by ITA150 with 3,306.7
  - ✓ 7 varieties attained yields more than 2,500 kg ha^{-1}
- Plant height 661 to 872 cm
- Panicle length (17.8 - 22.8)cm
- Filled grains (59.0 - 90.3)
- Grains per panicle (78 - 211)
- 1000-grain weight in grams (8.3 - 32.7)

➢ Upland rice replicated yield trials (Medium)

- Grain yield were much lower than in previous trials.
- Yield range 156.0 kg ha-1 - WAB 519-55-3
  to 2,613.3 - WAB 33-17

❖ 3 promising varieties WAB 33-17 (2,613.3), M55 (2,540.0) and WAB 515-151-4 (1,893.3).

➢Lowland Rice Replicated Yield Trials

- Grain yields were very low compared to the other two trials
- Range of 132.8 – 1,280.0 kg ha^{-1} for varieties USEN and WAT46-TGR-3-3, Respectively
- Adverse weather during critical grain filling stages
- High panicle formation efficiency noted in % reproductive tillers (81.5–97.4)
- Wide range of Number of grains per panicle (49 – 151)
- Low % filled grains per panicle (14.0 – 69.7 % Compared to expected 70 –80%)
- Low seed weight for 1,000 grain wt 12.3 – 24.3

Stress Screening Nurseries for Lowland and Upland Ecologies

- Seven promising Upland NERICA varieties were highly adapted to drought conditions with yields ranging from 1840 to 2640 kg ha^{-1}. (Table 4)
- The two lowland screening nurseries perform poorly and need to be planted under lowland cultures. (Table 5 and 6)

CONCLUSION and RECOMMENDATIONS

- **Upland rice replicated yield trials (early)**
  - All the varieties needs evaluation in participatory varietal selection tests in more sites
  - The lowest yielding variety ITA 337 may be observed in these sites
  - More NERICAs should be included in further tests
- **Upland rice replicated yield trials (medium)**
  - Seven varieties should be considered for participatory varietal evaluation with farmers, extension and other stakeholders
  - Confirmatory tests are necessary for these results.
  - Choice of sites must consider longer periods of 4 rainy months.
- **Lowland rice replicated yield trials**
  - All varieties need to be tested in sites with longer period of rainfall.

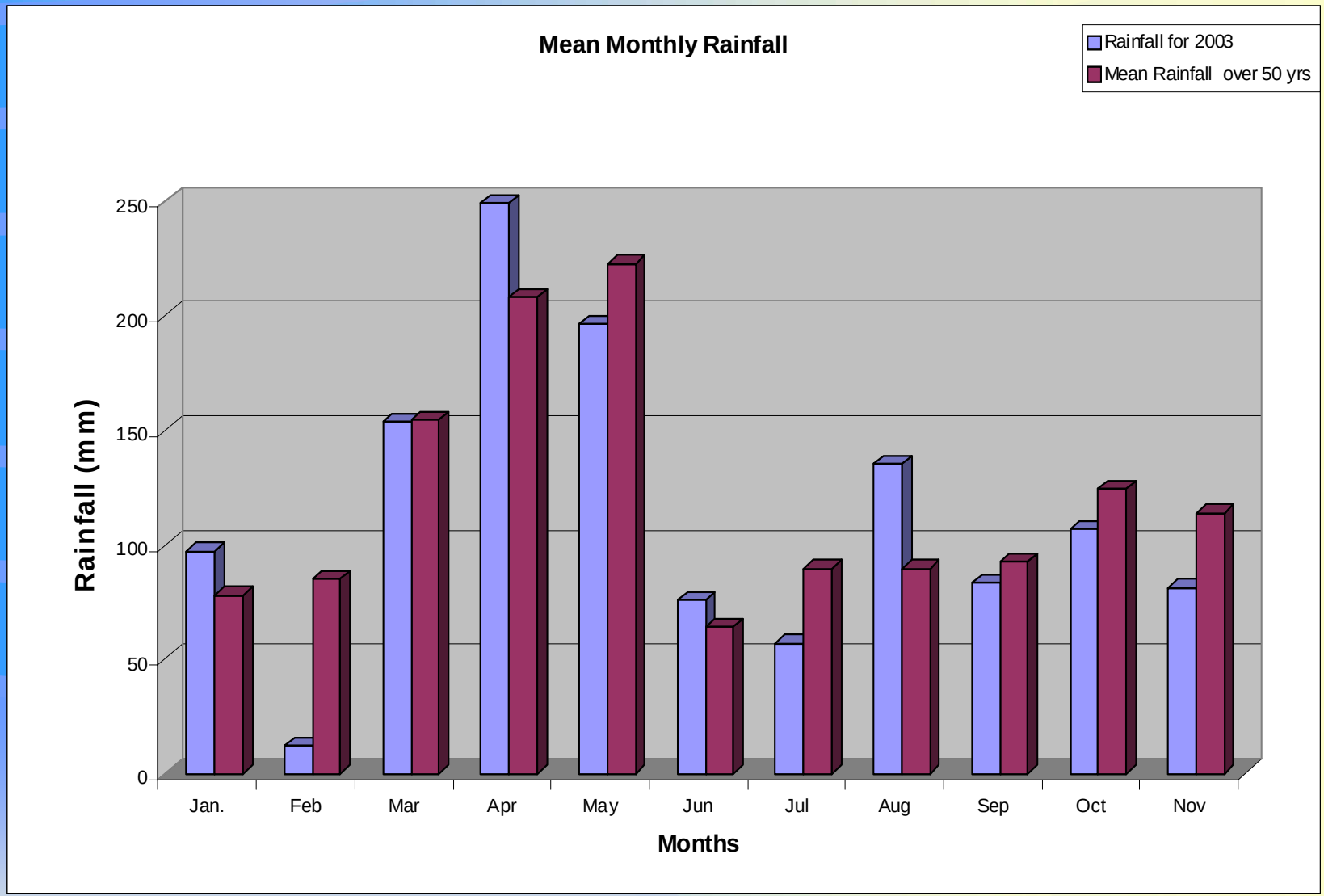

Figure 1. Comparison of rainfall Data between mean of 50 yrs and Annual rainfall 2003

WAY FORWARD

- Adapt high yielding NERICA varieties
- Early to medium maturing varieties
- Resistant to diseases, insect pests and other stresses
- Develop appropriate Agricultural machinery and farm implements
- For planting, cultivation, harvesting and threshing.
- Develop integrated Pest Management System for NERICA Rice
- Develop integrate cropping and farming systems for NERICA Rice
- Develop Procedures for technology transfer through participatory varietal selection, seed multiplication and distribution, on farm adoption, verification and support activities.
- Strong human resource capability for National Rice Research Program

Contribution of Rice Research Towards Rural Development

- **Rural Development**
- Rural development consist of a complex socio economic set up. Actors confront problems from different perspectives.
- Resource poor communities have resorted to subsistence farming.
- Rural urban migration is making family labour very scarce.
- Available labour has become too expensive to hire. This calls for production cost reduction, high productivity and resource conservation technologies.
- NERICA rice research should therefore focus on how these technologies can be made accessible to the end users.
- Participatory Rural Appraisal (PRA) to draw community action plans should be the first step.

Food Security

- National challenge is access to food throughout the year in a balanced form and at competitively affordable prices.
- Appropriate Technologies are needed to achieve this
- Irrigated rice is relatively expensive making rainfed rice most suitable and useful in combating escalating food insecurity.
- Food security issue needs multi- sector and multidisciplinary approach.
- Credit sector to provide grants to enable farmers to adopt new technologies.
- Integrated rice and fish farming technology needs consideration, for example, a CBO in western Kenya is currently using this technology to satisfy their food security requirements.

Employment Creation

- Community-based organizations are entry points to enhance rural development.
- Employment opportunities are scarce and alternatives be found.
- Transfer of appropriate technologies to farmers seems a practical attempt of creating employment.
- CBOs catalyze the process of employment creation.
- Technologies channeled through CBOs are up scaled faster if in built with sustainability mechanisms.
- Micro processing industries would be most appropriate to employment creation.

Natural Resource Management

- Productivity of natural resources has been dwindling.
- There is need for appropriate measures to reduce degradation
- NERICA rice research with natural resource management strategies need emphasis.
- Proper land preparation practices, cropping systems and utilization of rice plant require consideration.
- Some CBOs in Kenya have adopted conservation tillage.
- NERICA rice research would be instrumental in rural development strategies through cost effective technology transfer to communities.

Current follow - up Activities

- Reconstitute promising NERICA varieties for a participatory varietal selection process.
- Conduct participatory varietal selection using promising elite NERICA lines i.e. WAB 450-11-1-1-P41-HB and WAB-450-11-1-3-P40-HB.
- Conduct preliminary varietal evaluation on the most outstanding NERICA lines from the stress screening Nursery i.e. WAB 450-16-2-BL2-DV1, WAB450-11-2-BLI-DRI.
- Import NERICA varieties for adoption and adaptability studies.
- Conduct agronomic evaluation with the most promising NERICA varieties with high yields and high grain quality.
- Continue with participatory seed multiplication and later distribution to rice farmers.

Wealth Creation

- Wealth creation starts with income generation, savings and investment which requires viable enterprises. Capacity building is vital to enable rural communities make informed decisions on Wealth creation.
- However, Wealth creation is a process that is second to food security. It involves accumulation of assets and ability to live comfortably above the poverty line.
- Increased rice yields and low marketing margins are indicators of improving wealth status among the rural communities.
- High yielding varieties, resistance to adverse environmental factors are important for food security and income generation.

Sub-sectors yielding Highest Returns to Investment

- Growth targets estimated from the Economic Recovery Strategy (ERS).
- Agricultural is projected to grow by 3.1% between 2003 & 2007.
- Overall sector growth derived from sub-sector growths.
- Sub-sectors in order of importance in contribution to growth; Rice, Sugar, Tea, Tobacco, Cotton, Milk & beef
- Investment opportunities exist in the specified sub-sector.

Sub-sectors Yielding Highest Returns to Investment

Projected Growth Rates %

Sub-sector	% GPD	Average (2003-2007)
Total agriculture	24.07	3.08
Milk	4.46	3.11
Beef, Sheep and Goats	2.17	3.00
Maize	2.51	1.79
Coffee	1.55	-1.36
Tea	4.42	5.09
Fruits& vegs	2.45	2.30
Potatoes & roots	1.18	0.67
Sugar	0.26	6.46
Cotton	0.04	3.94
Tobacco	0.10	5.06
Rice	0.11	7.91
Others	4.81	3.01

On-farm Growth Constraints

- Climatic factors-droughts, rainfall.
- Prices-domestic & international (incentives)
- Poor Market access-local & foreign.
- Lack of Credit & financing
- Land tenure complexities.
- Technological factors.
- Policy weakness.
- Poor infrastructure & weak institutions.

Poverty incidence by Region

Region	1994	2000
Central	31.9	35.32
Coast	55.6	69.88
Eastern	57.8	65.90
Rift Valley	42.9	56.38
North Eastern	58.0	73.06
Nyanza	42.2	70.95
Western	53.8	66.11
Nairobi	25.9	52.56
Rural	46.8	59.56
Urban	28.9	51.48
National	46.8	56.78