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Landscape of Jaja Village, Niger (Photo by S. Tobita)

In This Issue

JIRCAS
JAPAN INTERNATIONAL RESEARCH CENTER FOR AGRICULTURAL SCIENCES

Overview of JIRCAS Researches for Africa

Agricultural research: the key to overcoming poverty in Africa

High resolution digital images of African scenes are frequently shown on TV these days. Even in Africa, the center of the capitals are heavily built-up with multi-stories buildings: if you can see the cities in the Republic of South Africa where the World Cup football competition was held this year, you might take them as European cities. Still in the rural areas dominating Africa, the most common scenes are the farmers cultivating their fields with a hand hoe, or the pastoralists chasing their cows and sheep in the withered savanna during the dry season. More than 60 % of the population which lives in rural area in Africa is engaged in agriculture. Agricultural production is not catching up with population growth in recent years though. While developed countries have extended their crop yield through varietal improvement and the use of fertilizers, Africa is the only region where the yield has hardly increased. Therefore, even now the rate of malnutrition is high: it is higher than 35% in more than 15 countries. We can still remember the scattered social unrest in various countries due to the soaring food prices in 2008.

To cope with such food shortages and poverty in Africa, it is already known that technological development and human capacity building through 'agricultural research' are the most effective ways in terms of the cost benefit-ratio and sustainability. JIRCAS is the only Japanese research center working for agriculture in developing regions, and it has been dispatching researchers to Africa since the 1970s. JIRCAS' basic strategies and the overview of some of the on-going projects for Africa are briefly summarized below.

Four pillars of African research strategy

There are four pillars in our strategies for Africa. Firstly, the most urgent and relevant research agenda should be tackled; JIRCAS chose the soil fertility improvement for food production increase as such. Secondly, the researches in which Japan has comparative advantages should be emphasized; researches for rice and the paddy field were selected. Thirdly, we emphasize that adaptive, on-farm researches bring about quick impact. Fourthly, we laid more weight on the collaboration through regional and international systems to increase the efficacy of researches in African countries which are geographically far away from Japan.

Making the soils fertile to prevent hunger

Rainfall in the Sahel region started to decline from the 1950s and the region experienced a large scale famine in around the 1970s claiming hundreds of thousands of people as victims. Once therefore, the largest problem of African agriculture was considered to be water scarcity. The yearly rainfall, however, recovered in the 1980s and then since the 1990s, low soil fertility, rather than water scarcity, started to be recognized as the root cause of low productivity in Africa.

In 2006, the Africa Fertilizer Summit was held which gathered the heads of states, and the whole of Africa became ready to tackle this agenda. JIRCAS actually started a collaborative project with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) to improve soil fertility in Niger since 2003. The farmers in this region were usually unable to acquire enough food within several months before harvest. Although it was known that the yield of their staple food, pearl millet, can be increased by the input of fertilizers, they do not have purchasing power for chemical fertilizers. Therefore, technologies to improve soil fertility and increase the utilization efficiency of the scarcely applied chemical fertilizers by utilizing locally available organic matters such as cow manure and crop residues have been developed. Also, soil erosion and the loss of organic matters on the soil surface due to strong winds were recognized as aggravating factors and the new cropping system and the measures of soil conservation were developed to increase yield. Now, we are developing methods to disseminate these useful technologies effectively to the farmers.

Rice and tubers as ignitors to transform African villages

Rice is a staple cereal which is easy to store and cook, and therefore, its consumption is increasing in Africa especially in the cities. The production of rice is not catching up with the consumption and many countries are pursuing the needed increase in rice production. Rice is also a good source of income and very important for alleviating the poverty in villages. I heard that in Uganda, for example, farmers can easily sell rice and can afford to send their children to school while they cannot sell traditional crops such as cassava and maize.

Japan started a new initiative in May 2008 to double rice production in Africa within ten years as an important pillar to assist Africa through the Japan International Cooperation Agency (JICA). JIRCAS is also collaborating with the initiative and executing the rice projects in Ghana, Benin and other countries in Africa. Rice production is the research area where Japan has comparative advantage over other developed countries and therefore can contribute significantly. In fact, Japan is expected to show leadership in this area. The projects on genetic improvement of rice in Africa including NERICA, which is becoming popular in Japan, and the improvement of management technologies for rice will be explained in other articles in this issue.

Besides rice, people in many African countries consume yam, a kind of roots and tuber crop as their staple food. Japanese Yamanoimo (or Yamaimo, Jinenjo) is also a species which belongs to the same genus of Yam. Japan is the only developed country where these crops are consumed as human food. JIRCAS started a collaborative yam project with the International Institute of Tropical Agriculture (IITA) in Nigeria, trying to develop the technologies for efficient propagation of the seedlings and to enhance genetic improvement and fertility management.

Development of farmer-centric technologies

Most of our research projects are not aimed at directly transferring Japan made technologies to Africa. Rather, for example, we place more emphasis on on-site evaluation for the development of varieties tolerant to unfavorable environments. For the technology improvement of paddy field development and rice management, we study the issue awareness of the village farmers first and then develop appropriate technologies with locally available materials and resources. We are also implementing projects which focus on participatory approach of farmers towards the better management of environment and waters. Field-oriented approach to promptly respond to the impeding issues is a feature of the JIRCAS projects in Africa.

(Photo by Y. Fukuta)

Horizontal collaboration

In most of the African countries, national research institutes and universities are not well prepared for effective researches. Therefore, the Forum for Agricultural Research in Africa (FARA) was established in 2002 to assist their national research capacity through pan-African research collaboration. JIRCAS puts high priority on collaboration with such regional organizations and established the African Liaison Office within the FARA premises in July, 2009. Through this new mechanism, we can further promote effective collaborative researches appropriate to the realities to contribute to poverty alleviation in Africa.

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Research and Development of Low-Input Rice Farming Technology in Wet Lowlands

The history of rice farming in Africa extends back to approximately 3,500 years ago. The rice variety cultivated at that time was African rice (*Oryza glaberrima* Steud.), which is native to Africa. African rice is well adapted to the severe local climate but has had little opportunity to be improved or selected by humans. It is therefore wild and of low productivity, and Asian rice (*O. sativa* L.), which is consumed in Japan on a daily basis, accounts for a high proportion of the rice consumed in Africa today. Development and promotion of NERICA—the New Rice for Africa, which is described in detail in another chapter of this special topic, is attracting attention in Africa. Moreover, the properties of African rice, which was employed as a parent strain in the production of NERICA, are now being reassessed. In this manner, rice farming in Africa has been developed differently from that in Asia, and the cultivation and cooking methods also differ in many ways.

Although rice consumption in African countries has shown an increasing trend in recent years, the production rate does not meet the demand. The volume of rice imported is increasing every year, and this is having a detrimental effect on African countries' economies. To resolve these issues, we need to increase the rice production rate, by either expanding the production area or improving the productivity per unit area. However, realization of this goal is impeded primarily by the poor agricultural environment and unsophisticated agricultural technologies in Africa. In addition, farmers account for 80 percent of the population in African countries and make up a greater proportion of those below the poverty line than in Asian countries. It is therefore difficult, even for rice farmers, to acquire sufficient equipment and materials. In this respect, unlike with the intensive rice farming that has been successful in Asian countries, to facilitate rice farming in Africa as a sustainable business, it will be crucial to systematize a low-input rice farming technology.

In this light, we focused on the potential agricultural productivity of the wet lowlands that are widely distributed in Africa. Rice productivity in these wet lowlands is massively higher than that in the dry fields in terms of soil fertility and water availability, and unused areas of wet lowlands extend over the river basins. Accordingly, efficient utilization of the wet lowlands could be an effective means of resolving food problems. We, therefore, aimed to develop a low-input rice farming technology to expand the areas of rice fields in wet lowlands and establish stable production. We are currently conducting various investigations and research projects in the natural and social sciences fields, as follows: First, we examine the water regime and its behavior in a target area by remote sensing and geographic information system (GIS) technology. We evaluate the soil potential by analyzing its physical and chemical properties and particle composition in order to develop a natural resource management technology. In addition, we perform geological mineral analyses to investigate the possibility of producing fertilizers from local phosphate minerals. To develop a cultivation management technology, we identify and classify the local noxious weeds and investigate effective weed control methods that are based on knowledge of existing cultivation systems in the field.

Furthermore, we conduct various growth comparison tests and use the results to select cultivars that are suitable for wet lowland farming. At the same time, we investigate and analyze the financial and management status of the target farmers so that we can understand the farm productivity issues that they face from the viewpoint of agricultural economics. Past surveys and research results imply that the introduction and expansion of rice farming in the target areas will be fully feasible. In Fiscal Year 2010, we will apply the achievements we have made in these multidisciplinary studies and will propose an effective and sustainable farming technology through field tests and investigations.

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The "Fallow Band" System: A Proposed New Low-Input Technology Option Contributing Both to the Prevention of Desertification and the Increase of Pearl Millet Yield in the Sahel, West Africa

Wind erosion is a major cause of the spreading desertification in the Sahel region of West Africa. Our previous studies showed that wind erosion induces the loss of a significant amount of relatively fertile materials from the surface of crop fields. We have also revealed that the wind-eroded soil materials can be captured by leeward herbaceous fallow vegetation. With the application of these findings, we have developed a new agricultural practice, called the "Fallow Band" system, for combating the expansion of desertification in the Sahel.

The outline of the "Fallow Band" system in a temporal sequence of land use is shown in Figure 1. (A) Five -meter-wide fallow bands are arranged at a right angle to the direction of erosive storms (East wind) in a cultivated field during the rainy season. Then, fallow bands can be easily created by skipping the usual seeding and weeding. Crops (pearl millet) are cultivated in other areas of the field in a conventional way. The fallow bands are also maintained in the next dry season, so they are expected to catch wind-blown materials containing a lot of nutrients. (B) In the next rainy season, new fallow bands are made aside from the former bands toward the direction of the wind. Vegetation on the previous fallow bands are cleared away and crops are cultivated on them as well as in other areas of continuous cultivation. (C) Repeat (B) every year.

The "Fallow Band" system was actually applied to farmers' pearl millet fields in Katanga Village, Koro Prefecture, Niger (Photo 1), and its effects toward the prevention of wind erosion and on improving the millet yield were evaluated. The results were shown as below: i) The efficiency of a fallow band to capture wind-blown soil materials was estimated to be 74%. ii) Millet yield on the former fallow bands was higher when the spacing between the bands was widely arranged (Figure 1). iii) The positive effect of fallow bands on millet yield continued at least two years after clearance of the vegetation (data not shown). iv) Based on the data described in ii) and iii), and assuming that the effect continues after the third year, the ratio of yield increase was simulated as functions of the field size (E-W length) and the band spacing (Figure 3). On a whole field basis, the yield was estimated to be increased by 36% (small field) to 81% (large field) as compared with the area not applied with the "Fallow Band" system. v) Likewise, wind erosion was reduced by 52% (small field) to 80% (large field) on a whole field basis with application of the system (data not shown).

A quantitative evaluation showed that the "Fallow Band" system can be useful both for the prevention of desertification and the increase of pearl millet yield in the Sahel, West Africa. It is worthy to note that this novel practice does not impose any additional labor, resource or money requirements on the local farmers.

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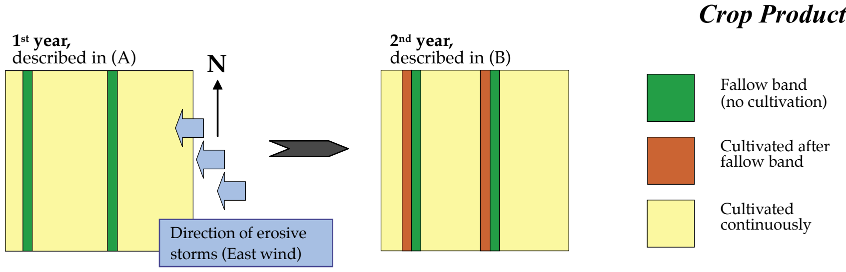

Fig. 1. Outline of the "Fallow Band" system with temporal sequence of the arrangement of fallow bands and cultivation areas.

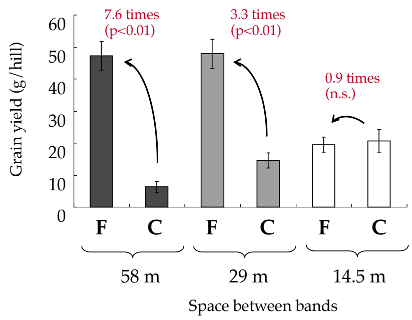

Fig. 2. Grain yield of pearl millet cultivated on the previous fallow bands (F) of different spacing,as compared with that cultivated continuously (C).

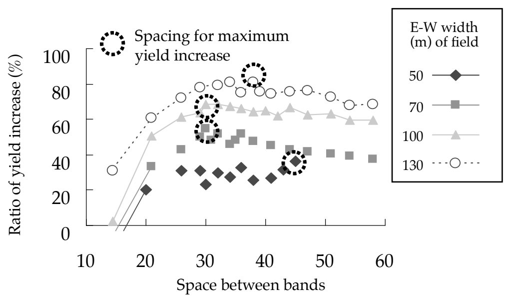

Fig. 3. Simulated results on the ratio of yield increase on a whole field basis as functions of the width of the field and the fallow band spacing applied. Theoretical maximum yield increase was indicated in each width of the field.

Photo 1. A view of the pearl millet field applied with the "Fallow Band" system at the vegetative stage. Left and center rows: Cultivated after one year fallow band, Right row: Cultivated continuously.

Establishment of the JIRCAS Liaison Office in Africa

On July 15, 2009 (Local time 4:30 PM, July 14), the Inauguration Ceremony of the JIRCAS Africa Liaison Office was held at Accra City, Republic of Ghana, Africa.

During the Inauguration Ceremony, Dr. Masami Yasunaka, JIRCAS Vice President and Dr. Tetsuji Oya, Regional Coordinator, introduced all JIRCAS activities in Africa and the role of the Liaison Office; the representative of the Forum for Agricultural Research in Africa (FARA), Exec. Dir. Monty Jones, expressed his appreciation and stated the significance of FARA being chosen as the base of JIRCAS activities in Africa. Likewise, congratulatory greetings were received from the Japanese Ambassador to Ghana, Mr. Keiichi Katakami, CSIR(Counsil for Scientific and Industrial Research), FONG(Farmers Organization Network in Ghana), and JICA representative. With the mutual exchanges between the participants, awareness was raised on the importance of the role of the Liaison Office and the Regional Coordinator.

Hereinafter, we will work as the base station for Japanese agricultural researches in Africa.

The JIRCAS Liaison Office in the FARA premises

Participants of the Inauguration Ceremony.

The Japan International Award for Young Agricultural Researchers

On November 4, 2009, the Commendation Ceremony of the Japan Award for Young Agricultural Researchers (sponsored by the Agriculture, Forestry and Fisheries Research Council) was held at the Yayoi Auditorium, Ichijo Hall in the University of Tokyo. In this Awarding Ceremony, which was held for the third time last year, the Chairman of the Agriculture, Forestry and Fisheries Research Council extended his commendation to young foreign researchers who have distinguished themselves by achieving excellent performances in research and development in agriculture, forestry, fisheries and other related industries for developing countries. The winners and their achievements were as follows:

Dr. Junemie Hazel Leonida Lebata-Ramos
(Southeast Asian Fisheries Development Center Aquaculture Department -SEAFDEC/AQD, Republic of the Philippines)
Stock enhancement of commercially important and threatened marine invertebrates in tropical areas

Dr. Amos Adeyinka Onasanya
(Africa Rice Center –AfricaRice, Federal Republic of Nigeria)
Molecular and pathotyping characterization of blast, rice yellow mottle virus, bacterial leaf blight and African rice gall midge in West Africa

Dr. Kevin Kit Siong Ng
(Forest Research Institute Malaysia –FRIM, Malaysia)
Spatial structure and impact of logging on genetic diversity of selected tropical tree species

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