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for INTERNATIONAL COLLABORATION

▲ Harvesting of rice varieties from Africa and other countries at JIRCAS's Experimental Field in Hachimandai (Photo by K. Toriyama)

Participatory varietal selection of rice at a farmer's field in Côte d'Ivoire (Photo by S. Tobita) ▶

In This Issue

JIRCAS
JAPAN INTERNATIONAL RESEARCH CENTER FOR AGRICULTURAL SCIENCES

Promotion of Research Capitalizing on JIRCAS's Advantage

JIRCAS is a unique, composite research center that deals with research covering almost all fields of natural and social sciences, and is considered rare from both domestic and international viewpoints for having its own independent research structure and personnel. In its functions and structure, JIRCAS resembles well renowned international research organizations such as CIRAD (Centre de coopération internationale en recherché agronomique pour le développement) of France and NRI (Natural Resources Institute) of the University of Greenwich, England. Moreover, the inclusion of Forestry and Fisheries in JIRCAS's research agenda differentiates it from other Incorporated Administrative Agencies (IAAs) under the umbrella of the Ministry of Agriculture, Forestry and Fisheries (MAFF) that are involved in agricultural research. Furthermore, while research activities pursued by other IAAs have national interests as their main targets and concern, and the Japanese people as beneficiaries of the contributions arising from their research, those of JIRCAS focus on problems confronting the international community, particularly the developing countries. JIRCAS is committed to contributing as many Global Public Goods as possible to people worldwide. In the light of being a representative of the Japanese people, the international contributions generated by JIRCAS's research efforts would accordingly become those of the Japanese public. In order to make the best of its advantageous position of being engaged in research that cuts across various fields of natural and social sciences it is necessary for JIRCAS to promote integrated multi-field research, by combining each element technology. Promotion of new research domains that are rather difficult for other independent organizations to realize has to be pursued. In order to achieve this, the following concerns have to be seriously considered:

1. Exchange of information and ideas and constant consultation among researchers

Research subjects and issues, which JIRCAS needs to address, should be analyzed and tackled from a wider perspective. In general, however, the greater the differences among the research fields involved, the more difficult it becomes for this kind of action to voluntarily ensue at the actual research sites. Accordingly, the stimulus from research planners and coordinators, and the Research Information Division becomes indispensable.

2. Concretization of objectives and strong leadership

It is necessary not only to select a strong and capable research leader in order to concretize research objectives, but also to provide him/her the authority to make decisions on matters such as budget management. Needless to say, the cooperation and support of research collaborators are also essential in this regard.

3. Securing and development of manpower capable of promoting and evaluating integrated multi-field research

Akinori Noguchi
Vice President, JIRCAS

Confronted by a number of difficulties, the promotion of integrated multi-field research is indeed a very challenging task. In addition, research staff capable of engaging in such research are lacking, and even if they are available or being trained it would be difficult for them to apply the present conventional assessment methods to evaluate integrated research. Such a situation calls for, among other things, the development of new evaluation procedures that are different from the current ones, as well as an appropriate research field-based recruitment process.

4. Treatment of research projects in a broad sense

Since the categories of research namely, international research and domestic research are basically meant only to refer to the sites where the research is actually conducted, having the same framework for both research categories is not expected to present any problems. Based on this concept, it would, therefore, be strange to designate research implemented overseas as "international research project," while treating that conducted within Japan as a "non-project." In the promotion of JIRCAS projects, although earlier projects, having been based on the premise that they are going to be conducted abroad have comparatively bigger budget allocations, it should be reasonable to give the research conducted within the country also a "project" status if it has the same objective(s) and is geared towards the same goal of developing Public Goods. The bottom line is to ascertain where the research is directed and where it is linked. From this viewpoint, it would not be surprising to see research groups working on the promotion of both domestic and international research activities of JIRCAS under the common banner, "project."

5. Breakaway from a research domain-oriented vertical structure

As described in the beginning, in order to actively carry out the integration of different research fields, it is highly important to establish an organizational system that leads individual researchers to cooperate with one another. To successfully achieve this cooperation, it is thus necessary to consider a transition from a research domain-oriented structure to a project-oriented one.

Historical Overview of JIRCAS's International Collaboration in Rice Research : A Perspective of Collaboration in Malaysia

JIRCAS has always emphasized the importance of strengthening international collaboration with Asian counterparts, and although the number of collaborative projects in Asia has declined recently, this still remains our highest priority. In particular, we have had a long history of collaboration with Malaysia and Thailand since the 1960's. On the occasion of the World Rice Research Conference (WRRC 2004) which will be held this November, we will review the history of collaborative research on rice between Malaysia and JIRCAS, to highlight the uniqueness of JIRCAS's style of collaboration.

Bilateral collaboration between Malaysia and Japan was initiated much before TARC (JIRCAS's predecessor) was established in 1970, under the "Colombo Plan" which Japan became a member of in 1954. From 1958 to 1967, 16 researchers were dispatched to Malaysia under the Plan and were successful in developing 12 new rice varieties including "Malinja (1964)," and "Mahsuri (1965)." These varieties developed by Japanese breeders spread widely and accounted for 90% of the rice produced in Malaysia in the early 1970's. The researchers dispatched to the Malaysian Agricultural Research and Development Institute (MARDI) until 1997 were thus successful in implementing rice breeding projects.

The Muda Irrigation Area, which was most prominent during the Green Revolution and which is the largest granary area in Southeast Asia, has been one of the main rice research sites of JIRCAS. Muda Agricultural and Development Authority (MADA) and MARDI were JIRCAS's main counterparts. After the completion of the construction of irrigation systems in 1970, semiannual cropping began to be practiced on the Muda Plain. Consequently, rice research with on-farm trials have often been carried out and concentrated in this area. After the 1980's direct seeding replaced the traditional transplanting method in this region. Research collaboration between Malaysia and Japan has focused on solving these farming problems by adopting a multidisciplinary approach which helped in understanding complex agronomic practices with the cooperation of the rural communities. From 1967 to 2001, a total of 49 researchers were dispatched from JIRCAS for rice research to Malaysian institutions in fields such as agricultural engineering (13 researchers), rice breeding (11), rice cropping and agronomy (8), farm management (5), entomology (5), farm machinery (4) and weed science (3). As for the short-term researchers who mostly stayed in Malaysia for a minimum of 1-4 months, 213 were dispatched from 1970 to 1998.

Breeding of new rice varieties ended in 1997 after the development of anti-virus varieties, tastier rice varieties, hybrid rice varieties and so on. As a result of the continuous efforts of breeders, rice breeding in Malaysia was established systematically over a period of time. With respect to farm mechanization, the method of plowing and preparation of dry paddy fields with a rotary tiller was examined and introduced in order to increase work efficiency. Four-row walking type transplanters were also used and adaptability of transplanters was examined under Malaysian field conditions. Irrigation engineering studies laid stress on the efficient use of irrigation water, and methods of recycling irrigation water were also developed. It was found that techniques including the setting of a fallow period could solve the problem of yield decline caused by tungro disease. In the end of the 1980's, the Muda area experienced serious water shortage which led to the expansion of direct seeding culture. In direct seeding, cultivation methods and physiology and ecology of paddy rice are totally different from those for transplanting. The collaboration team studied these methods and proposed an improved method of direct seeding suitable for scarce water conditions. Studies on farm management dealt with the managerial evaluation of technology and economic analysis of mechanized farming; ways to improve farm management were also examined using the results of detailed farm management and household surveys.

From our past experiences, we can conclude that the key factors that contribute to the uniqueness of JIRCAS's collaboration style are as follows. First, the 40-year-history of collaboration helps mutual understanding and facilitates the formation of research networks and information

Table 1. Rice related research projects implemented by multidisciplinary teams in Malaysia

Major Project Title	Year
Mechanization of rice cultivation in the Tropics	1973～1977
Mechanization of farm operation in the paddy growing areas in the Tropics	1978～1982
Promotion of rice double cropping through rationalization of system water management and farming system in the lowland area of the Tropics	1983～1987
Crop disease and insect control for double cropping of rice in the Tropics	1985～1989
Promotion of rice double cropping through direct-seeding culture in the Tropics	1988～1992
Development of methods of control of biotic agents injuring rice plants under direct seeding culture in Malaysia	1993～1997
Development of performance-oriented water requirement model for large-scale paddy fields in Malaysia	1998～2001

exchange. Second, the multidisciplinary nature of the research teams generates a synergetic effect; that is, researchers from different disciplines analyze and share information on the same sites to help promote an understanding of the problems. This helps the stakeholders to decide how the research issues could be resolved.

Although collaborative research on rice between Malaysia and Japan was discontinued in 2001, JIRCAS has been carrying out research at other sites in Asia such as in Thailand, China and the Philippines. We would like to continue these efforts to expand our knowledge along with our counterparts in Asia and work towards a common goal.

Kumi Yasunobu and Kazunobu Toriyama
Development Research Division, JIRCAS

Rice Breeding Using a Wide Diversity of Genetic Resources

Crop breeders require various sources of parental germplasm to be made available to them for improving modern cultivars. Landraces cultivated in developing countries are a valuable source of this genetic diversity. We demonstrate here the usefulness of rice landraces based on cooperative research with the Yunnan Academy of Agricultural Sciences of China.

Highly Cold-Tolerant Rice

Low temperatures cause major environmental stress in rice grown in temperate regions and at high elevations in the tropics and subtropics. Improved cold tolerance is thus an important objective in rice breeding. Rice cultivars in northern parts of Japan were considered most tolerant to cool weather in summer, but we found landraces from Yunnan to be even more tolerant. We have recently clarified that genes controlling cold tolerance at the reproductive stage are located on chromosomes 3, 6, and 7 of the twelve pairs of rice chromosomes.

Low-Amylose Rice

Endosperm starch amylose content is a major determinant of the edibility of cooked rice. We had earlier developed "Milky Queen," a rice cultivar with low endosperm starch amylose content at the National Agriculture Research Center of Japan by using a chemical mutagen. "Milky Queen" is considered superior in cooking, eating, and processing qualities to "Koshihikari," the cultivar most popular among Japanese consumers.

In China however, we found that the Yunnan minorities had already been using different rice landraces with low amylose content, having selected and maintained upland-rice with wide variations in starch amylose content even without a knowledge of modern breeding techniques such as chemical mutagens and biotechnological methods.

Rice Storage Problems

Rice grain deterioration and staleness developing during storage are serious problems that reduce rice quality. Lipid degradation is considered responsible for this. The lack of lipoxygenase in rice grains may reduce oxidative deterioration during storage. After screening 108 varieties of germplasm collected from rice genetic resources at Yunnan, we detected 22 varieties that lacked lipoxygenase-3,

Fig. 1. Cold tolerance of Yunnan lowland-rice at the flowering stage; highly resistant (left) and susceptible (right).

Fig. 2. Rice cultivated in Yunnan upland field with banana plants.

the major component among isozymes. Most varieties without the enzyme belonged to upland rice.

Crop Genetic Resources

We exchanged over 700 accessions of rice genetic resources between Japan and China in the research project. These have been used for rice breeding and genetic research in both countries.

Crop landraces are rapidly being lost as farmers receive seeds of improved cultivars in developing countries. We are thus working to evaluate and utilize such landraces for sustainable agriculture through crop improvement.

Kazuo Ise
Biological Resources Division, JIRCAS

Increasing Adaptability of Rice to Unfavorable Environments

Rice is the only major crop that is well adapted to various environments and suitable for cultivation in diverse agricultural ecosystems. For instance, rice is commonly cultivated in tropical and temperate zones, but can also be grown in the subarctic zone. Varietal differentiation makes it possible to grow rice in uplands, rainfed and irrigated lowlands, and flood-prone areas, sometimes even in mangrove swamps. Modifying unfavorable environments for agricultural utilization would be one of the options to improve world food security. Expansion of rice cultivation to these adverse ecological areas appears to be promising because rice is already equipped with adaptability to a wide range of environmental conditions. The research activities of JIRCAS, have therefore focused on the elucidation of genetic and eco-physiological mechanisms of tolerance to such unfavorable environments in rice.

Among these studies, drought tolerance is currently the most prioritized by JIRCAS. Although this trait is very significant not only for rice but also for other terrestrial plants, it is extremely difficult to quantify. Generally, rooting depth is positively correlated with drought tolerance in many crops, but it is not the only determinant of the trait. The photosynthetic ability of a crop under conditions of limited water would be another key factor to affect dry matter production under drought stress. Hence, quantitative indices of the abilities of a crop to acquire and utilize water, should be established in order to be applied to QTL search and selection procedures. Xylem exudation rate (water acquisition) and carbon isotope discrimination [$\delta^{13}C$] (water utilization) are therefore being examined as promising criteria for the quantification of drought tolerance.

For the expansion of area cultivated to rice, some problem soils should also be targeted, such as acidic (Al toxic and P deficient), iron toxic, and saline soils. Accordingly, we plan to have a special session entitled "Challenge in expanding rice production in unfavorable environments," during the World Rice Research Conference (WRRC) to be held this November at Tsukuba, to discuss the various approaches to be considered to achieve these goals in a multidisciplinary manner.

Satoshi Tobita
Crop Production and Environment Division, JIRCAS

Fig. 1. Upland rice (javanica subspecies) cultivation in Brazil.

Fig. 2. Measurement of xylem exudation rate of rice seedlings in an upland field in West Africa.

Seasonal Changes in Land Cover over Paddy Areas Observed from Space

Land cover conditions over paddy areas tend to change by season. Although the temporal changes in conditions at a specific point may be continuous over time, the conditions over a wide area at a particular time are never homogeneous. This is due to the effects of the variations in cropping time and varieties as well as the environmental stresses. Thus, an investigation of the spatial pattern of land cover is necessary for the purpose of analyzing the relationship between crop growth and the factors mentioned above.

Satellite remote sensing is an effective tool to monitor conditions of land cover over a wide area. However, it has constraints in that the cloud coverage of the site significantly deteriorates the quality of data, especially for paddy areas where cultivation is generally done in the rainy season. The following two cases are examples of good quality data obtained for analysis.

The first example is the case of Subang District, located in the West Java Province in Indonesia. This study site was characterized to be a part of the established irrigation system of the Jatiluhur reservoir. The distribution of NDVI (Normalized Difference Vegetation Index) obtained from Landsat-TM data acquired on June 26, 1997 is shown in Figure 1a, while the distribution on July 28, 1997, 32 days later, is shown in Figure 1b. These figures also display the boundaries of division, S1 to S4 of the irrigation plan of which the planting of rice at 15-day intervals was scheduled to start first in S1, followed by S2, S3 and S4. According to the plan, the division of S2 was scheduled for the harvesting period in July, S3 for the flowering to harvesting period, and S4 for the flowering period. These figures indicate that there was considerable variation in the value of NDVI even within a single division and some parts within a division were found not to follow the planned schedule. It is also possible to visualize the pattern of progress of harvest by analyzing the changes of NDVI between two sets of temporal data.

The second example is the case of Mopti and its surrounding areas along the Niger River in Mali, West Africa. Rice fields are widely found in parts where the land is very gently sloped and inundated by flood waters from the upper reaches of the river. The flooded part also extends to the inland area due to factors such as rainfall and micro-topography. Figures 2a, b and c represent the color composite images of Landsat-ETM+ acquired on August 26, 2000, October 29, 2000, and January 1, 2001, respectively. From these figures we were able to interpret changes in the patterns of land cover in the period following the latter part of the rainy season, from June to September, and estimate the conditions of topography, duration of the inundated period, and other features.

Satoshi Uchida
Development Research Division, JIRCAS

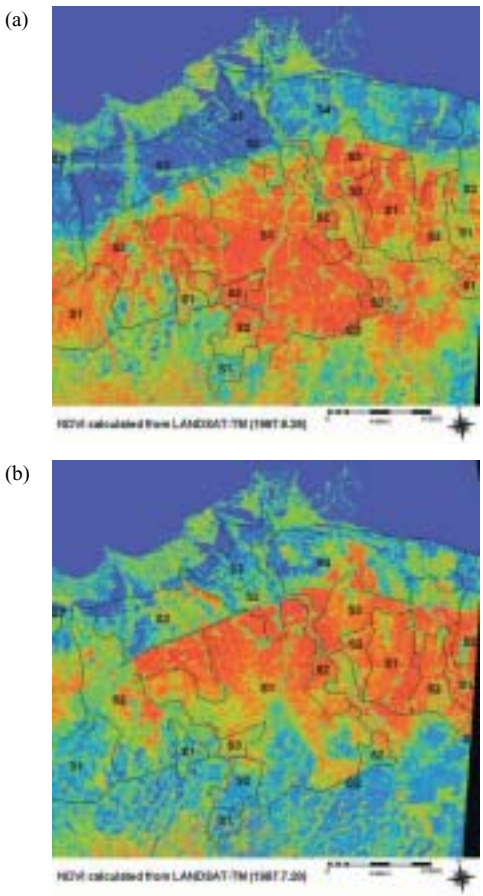

Fig. 1. Distribution of NDVI and the boundary of divisions of the irrigation plan (a:1997. 6. 26, b:1997. 7. 28).

Fig. 2. Temporal changes in land cover conditions over a flooded area (a:2000. 8. 26, b:2000. 10. 29, c:2001. 1. 1).

Initiation of a New China-Japan Collaborative Research Project

A new China-Japan collaborative research project entitled "Stable food supply systems for mitigating the fluctuations of production and markets in China" has recently been initiated. This project aims to vitalize and stabilize farm and rural economy in China, particularly in inland and northeastern regions, e.g. Heilongjiang Province, where economic growth is not as rapid as in coastal regions, by developing stable food supply systems for mitigating the fluctuations of food production and markets caused by both natural and economic phenomena.

More specific objectives of this project are: 1) to develop early-warning systems for mitigating the risks caused by climatic disasters such as cool summers and droughts through technological enhancement of agro-meteorological monitoring and crop-model simulation, and 2) to propose alternative farm management and institutional measures by conducting various socio-economic analyses on farm management risks, farmer-market integration as well as domestic and international market fluctuations.

Signing of MOUs between JIRCAS and Chinese counterpart research organizations at a ceremony held in Beijing.

This project was proposed at the 21st meeting of the Japan-China Agricultural Science and Technology Exchange Group in 2002 and the idea was further developed through a review process undertaken by experts from both countries. In June 2004, a pre-evaluation meeting was held in Tsukuba. The invited Chinese officials and researchers emphasized the relevance of the project to the current agricultural problems in China, and the external reviewers pointed out the importance of mutual concurrence on the final outputs of the project and the need for integrating socio-economic subjects with other disciplines.

In July 2004, the four parties involved, namely, the Ministry of Agriculture, China, the Chinese Academy of Agricultural Sciences, the Ministry of Agriculture, Forestry and Fisheries, Japan (Agriculture, Forestry and Fisheries Research Council Secretariat) and JIRCAS agreed on the initiation of the project and signed the "Comprehensive Agreement" of the collaborative research at the 23rd meeting of the same group held in Xian, China. Based on this agreement, five Memoranda of Understanding (MOUs) between JIRCAS and five Chinese counterpart research organizations (three institutes affiliated to the Chinese Academy of Agricultural Sciences, namely, the Institute of Agricultural Resources and Regional Planning, the Institute of Environment and Sustainable Development in Agriculture, and the Institute of Agricultural Economics, as well as the Heilongjiang Academy of Agricultural Sciences and the Development Research Center of the State Council) were signed at a ceremony attended by Dr. Iwamoto, President of JIRCAS, in Beijing on September 14, 2004.

Through these official procedures, this new five-year project was initiated as an inter-governmental collaborative research project. Several new approaches will be used in the management of the project. For example, cooperation among the counterpart research institutes will be strengthened in order to achieve a better overall project outcome, and evaluation and planning meetings will be held periodically.

China has been promoting international relationships including that with Japan through the introduction of open-market policies, and the situation of food production and consumption in China has also been influencing neighboring countries. In this context, the new project is expected to contribute not only to the stabilization of rural economy in China but also to the generation of common agricultural and scientific knowledge and the stabilization of the food supply-demand situation, for establishing a sustainable co-existence with East Asian agriculture.

Osamu Koyama
Director, Development research Division, JIRCAS

PEOPLE

Dr. Takashi Kumashiro, formerly Director of the Agri-Business Division of Japan Tobacco Inc., was appointed as Director of the Biological Resources Division.

Establishment of a New Forum on International Agricultural Research

On July 27, 2004, the Japan Forum on International Agricultural Research for Sustainable Development (J-FARD) was established at a gathering held at the Tokyo International Forum. This forum aims to foster new partnerships between organizations and individuals involved in international research for development in the fields of agriculture, forestry and fisheries and to build a platform for interdisciplinary coordination among stakeholders in Japan.

Twenty-eight prominent leaders from these fields, represented by Dr. Koji Tanaka, Director of the kyoto University Center for Southeast Asian Studies, participated in setting up the forum and Mr. Hisao Azuma, President of Japan FAO Association, was elected as its first chairman. In the symposium held on the same day to commemorate the establishment of the forum, Dr. Francisco Reifschneider, Director of CGIAR, Dr. Kenzo Henmi, Honorary Professor of Tokyo University and Dr. Tomoki Takamura, former chairman of the Japan Tropical Agricultural Research Association made encouraging presentations before an audience of over 110 scientists, after the greetings from representatives of the Ministries of Foreign Affairs, Agriculture and Education and Science.

JIRCAS is now serving as the secretariat of the forum and has set up an independent home page on the internet in September at http://ss.jircas.affrc.go.jp/J-FARD/index.html.

Toshihiro Uetani
Research Planning and Coordination Division, JIRCAS

Administrative Invitation Program FY2004 (April – September)

Under the Administrative Invitation Program, JIRCAS invites administrators from counterpart organizations to its Tsukuba premises to engage in discussions and review ongoing research in order to ensure that collaborative projects run smoothly. The program provides opportunities for the exchange of information and opinions concerning policy-making and project design at the administrative level, thereby contributing to deeper mutual understanding and international cooperation. Invited administrators during FY2004 (April-September), their home institutions and purpose of visit are listed below.

No	Name	Country	Designation/Organization	Purpose of visit	Invitation term
1	Udin S. Nugraha	Indonesia	Director, Indonesian Vegetable Research Institute	Development of research collaboration on vegetable cropping system in West Java	7/11-7/16
2	Liu Zhongwei	China	Director, Division of Asian & African Affairs, Department of International Cooperation, Ministry of Agriculture	Participation in the preliminary evaluation meeting of the project "Stable Food Supply Systems for Mitigating the Fluctuations of Production and Markets in China"	6/27-7/1
3	Tang Huajun	China	Director, Institute of Natural Resources & Regional Planning, Chinese Academy of Agricultural Sciences (CAAS)	Participation in the preliminary evaluation meeting of the project "Stable Food Supply Systems for Mitigating the Fluctuations of Production and Markets in China"	6/27-7/1
4	Ana Maria Sadir	Argentina	Director, INTA Castelar, Veterinary and Agronomic Sciences Research Center	Discussion and consultation on the ongoing project on soybean production in South America	8/29-9/13
5	Tran Than Thi Hoa	Vietnam	Information Centre for Agriculture and Rural Development (ICARD),Vietnam Ministry of Agriculture and Rural Development (MARD)	Participation in the JIRCAS Joint Workshop on "Multilinguality in Agricultural Information Access"	8/8-8/13
6	Md. Akhtaruzzaman	Bangladesh	Professor, Bangladesh Agricultural University	Participation in the JIRCAS Joint Workshop on "Multilinguality in Agricultural Information Access"	8/8-8/13
7	Setyo Pertiwi	Indonesia	Associate Professor, Faculty of Agricultural Technology, Bogor Agricultural University	Participation in the JIRCAS Joint Workshop on "Multilinguality in Agricultural Information Access"	8/8-8/13

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