ISSN 0919-8822
Dec 2003
No.37

JIRCAS Newsletter

for

INTERNATIONAL COLLABORATION

Research site of the collaborative project on vegetable based farming systems in Java, Indonesia
(Photo by M. Yamada)

In This Issue

JIRCAS
JAPAN INTERNATIONAL RESEARCH CENTER FOR AGRICULTURAL SCIENCES

Evaluation and Improvement of Regional Farming Systems in Indonesia

In Indonesia, regional diversity in agriculture has been maintained, as the country is composed of many islands with varied geographical features. Even with the advent of modern agricultural technologies, the values of traditional farming technologies and appropriate technologies based on the farmer's requests are being reconsidered. Given this background, a collaborative research project was initiated in Fiscal Year 1998, aiming at the establishment of a sustainable farming system through the evaluation of indigenous agricultural systems and the application of participatory approaches.

In the beginning, two broad research themes were planned. One was the elucidation of limiting factors for agricultural development and the other was the comprehensive improvement of regional farming systems by introducing new technologies. With respect to the first theme, the experiences of" farming systems research and extension "in Indonesia were assessed and some proposals on the formation of farmers' associations were made based on the surveys in banana-based agricultural villages. As for the latter theme, suitability of domestic soybean varieties for the manufacture of processed products such as tofu and Tempe was examined and some of their characteristics such as high protein content were proved to be superior to imported soybeans. In addition, a fermented seasoning (Kecap) was developed from soybean using new types of fungi which can easily be distinguished from toxic ones.

However, the implementation of the original research plan was delayed due to the social instability caused by the Asian Financial Crisis. In addition, the integration of research themes was strongly recommended by the reviewers. In April 2000, the project was re-organized in order to focus on evaluation of vegetable-based farming systems and on the improvement of the cultivation and post-harvest technologies of vegetables in West Java. Although temperate vegetables in West Java have become promising commodities for Indonesian farmers to increase their household income due to the strong demand in urban areas, various difficulties have also been reported. Achievements in the five subject areas of the re-organized project can be described as the following.

In the first subject entitled," Analysis of physical environmental resources for evaluation and improvement of vegetable-based farming systems, "conditions of vegetable fields were analyzed using geographic information systems (GIS), in order to determine the optimal areas for cultivation. Through both the evaluation of rainfall patterns and the development of an improved equation for soil erosion estimation, a map of simulated soil loss under various rainfall and land use conditions was constructed. In the second subject entitled," Historical review and future prediction of vegetables, "statistical trends based on the historical data of consumption and trade were calculated, and the current situation of farm management and historical transition of farming systems were expounded for selected households and villages. The vertical distribution of cropping systems and farmers 'perspectives were also analyzed and incorporated into the study.

In the third subject, the" Analysis and evaluation of marketing systems, "it was concluded that the existing vegetable distribution system was fairly competitive and efficient. Through surveys, farmers 'marketing strategies were collected and important processes such as methods of information dissemination and transaction rules were analyzed. In the fourth subject, the" Evaluation of the present cultivation and plant protection technologies and development of sustainable technologies, "it was determined that crop rotation systems were efficient for preventing damage caused by clubroot disease. The use of local materials to improve efficacy of seedling raising as well as ability of IPM technology to slow the occurrence of insect pests, were tested in order to bolster agricultural productivity and sustainability. Several applicable post-harvest technologies were tested and proved to be useful. In the fifth subject," Evaluation and utilization of indigenous upland crops and fruit trees, "about 40 vegetable species, 30 fruit trees and 20 miscellaneous species were collected from 14 provinces, and their potential in farming systems was assessed.

The final evaluation meeting of the project was held in February 2003 at JIRCAS, Tsukuba, and was attended by Dr. Budianto, Director General, Agency for Agricultural Research and Development (AARD), Indonesia, as well as four members of the review committee. Reviewers provided positive evaluations as the five-part project had attained methodological goals of applying interdisciplinary and participatory approaches to contribute to Indonesian agriculture by improving farming systems and technologies that can be adopted by farmers. However, it was also pointed out that coordination among the subjects and on-farm evaluation of the newly developed technologies had not been sufficiently conducted in the project. At present, follow-up studies related to these remaining issues are being carried out in Indonesia.

This project was carried out jointly by AARD and its member institutes, namely the Center for Agro Socio-Economic Research and Development (CASERD), the Center for Soil and Agro-climate Research and Development (CSARD), the Central Research Institute of Food Crops (CRIFC), the Research Institute for Legume and Tuber Crops (RILET), the Research Institute for Vegetables (RIV), the West Java Assessment Institute for Agricultural Technology (AIAT-West Java), as well as the National Agricultural Research Organization (NARO) and the National Food Research Institute (NFRI) of Japan.

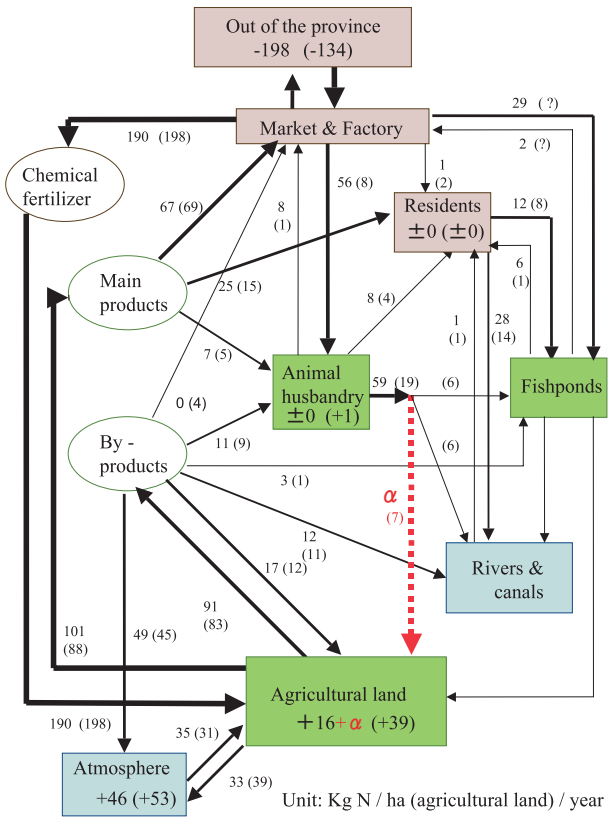
Osamu Koyama
Director, Development Research Division

Papaya orchard at 900 m altitude (Photo by T. Sugino).

Estimation of Change in Nitrogen Flow Based on the Rural Development Plan for 2010 and the Necessary Counter Measures: A Case Study in Cantho Province, Vietnam

Farming systems in the Mekong Delta, Vietnam have been highly evaluated for their effective use of by-products originating from agricultural activities. However, in recent years these have been drastically changing with the development of market economy. Accompanied with these changes, material flow in farmlands has been disturbed resulting in environmental pollution. It is therefore necessary to correct this altered material flow to suit the present situation. To protect the regional environment and maintain agricultural production, it is indispensable that researchers cooperate with local authorities. In this study, nitrogen flows in the Cantho Province, Mekong Delta was predicted for 2010 based on the estimations for 1999. This information will help us to understand the problems likely to be faced in the near future and to take the necessary precautionary measures.

First, a model that indicates nitrogen flow associated with agricultural activities and food consumption was constructed. Then, nitrogen flows in 1999 and 2010 were calculated based on this model (Figure). Numerical data for 2010 were quoted from an official agricultural development plan authorized by the local government. The lacking information was supplemented with data from related reports published in Japan and other countries and assumptions based on the understanding of local experts.



Nitrogen flow in Cantho Province (2010).
Data in brackets is the N flow in 1999.
Nitrogen flow from animal husbandry to agricultural land (α) will change depending on the local government and the people.

Agricultural statistical data for Cantho Province (2010: Planned Data)

	Unit	1999	2010
Swine	$\times 10^3$ heads	243	700
Milk cows	$\times 10^3$ heads	0	23
Poultry	$\times 10^3$ heads	2,940	6,000
Fish	t	8,040	64,400
Prawn	t	60	3,000
Arable land	ha	249,995	239,513

According to the development plan for Cantho Province, animal husbandry and aquaculture production are expected to grow rapidly. If the number of livestock increases as planned, the livestock excreta per unit area of agricultural land will increase from 19 kg N ha^{-1} $year^{-1}$ to 59 kg N ha^{-1} $year^{-1}$. In the Mekong delta, the amount of livestock excreta produced used to be small enough to be effectively used as fish feed in fishponds and canals. However, with the increase in number of livestock their excreta has become a source of water pollution. At present, although nitrogen concentration in rivers and canals is still within an acceptable limit in many cases (less than 1 ppm as NH_4-N), biological water pollution caused by the flow of human and livestock excreta into the public water system has already been recognized as an urgent environmental problem by the local community in Cantho Province. Moreover, the capacity of fishponds to accept livestock excreta is not likely to increase even if aquaculture production increases, since the intensive fish culture system being developed in the region depends on artificial condensed feed. It is therefore indispensable that the local government and the people consider measures to reduce the amount of livestock excreta being directly disposed into rivers and canals in order to protect public health and the environment.

Nitrogen balance in the agricultural land of Cantho Province showed a surplus of 39 kg N ha^{-1} in 1999. According to the agricultural development plan, the rice cropping area is expected to decrease without any decrease in production. If this plan is implemented without increasing fertilizer input for a unit cropping area, the chemical fertilizer input would decrease from 198 kg N ha^{-1} $year^{-1}$ in 1999 to 190 kg N ha^{-1} $year^{-1}$ in 2010. Compared with the expected nitrogen fertilizer input in 2010, the nitrogen excreted from livestock is likely to be about one third. If livestock excreta were to be processed to organic fertilizer, it would divert the flow of nitrogen from the water systems to agricultural land. In order to control environmental pollution and maintain sustainable farming systems, priority should therefore be given to increasing the amount of livestock excreta applied to agricultural land after appropriate processing.

Takeshi Watanabe
Environment and Crop Production Division, JIRCAS

Development of Freshwater Prawn Seed Production Technology Suitable for Use in the Mekong Delta Region of Vietnam

The Mekong Delta of Vietnam is a region having high potential for freshwater aquacultural development, and recently, the giant freshwater prawn, *Macrobrachium rosenbergii* (Photo), has been pinpointed by the Vietnamese Government as one of the major target species of the aquaculture sector. Until the beginning of 2000, the supply of hatchery-reared *M. rosenbergii* depended on a few previously established national hatcheries, and was still far from being sufficient to meet the growing needs of commercial prawn culture.

Recognizing this problem as a major factor limiting the development of *M. rosenbergii* culture in the Mekong Delta, JIRCAS and Vietnam's Cantho University initiated collaborative research in 1995 in order to develop a more productive and sustainable seed production model. Initial studies were conducted to determine whether the“ green water ”model, developed in Malaysia, could be suitable for use in the Mekong Delta, and whether the technology could be successfully transferred to local users. Researchers compared the“ green water ”model to another system of seed production, the“ re-circulating water ”model. Densities of 60 to 120 larvae per liter were recommended for both models, but the“ green water ”model yielded more post-larvae (PL) per liter, varying from 27.8-41.7 PL/liter compared with 18.6-32.9 PL/liter for the“ re-circulating water ”model (Table). Moreover, the“ green water ”model requires less labor, and is easier to implement in“ back-yard ” hatching facilities that are likely to be adopted by farmers engaging in prawn-rice culture.

Based on these results, and the experience of Cantho University counterparts in the field, researchers developed a modified static“ green water system ”suitable for the conditions of seed production in the Mekong Delta. In this system, super-saturated seawater from salt fields in the southernmost coastal parts of the Mekong Delta and freshwater are mixed in appropriate quantities to obtain the desired salinity concentration, and the water is treated for several days with chlorine. Next, in order to create“ green water ”, tilapia are stocked for a week in a separate tank to create an environment where planktonic algae bloom and the water turns green; algal blooms serve as bio-agents that stabilize the environment within the culture tanks. *Chlorella* is obtained selectively by filtration, and the water is then transferred to tanks to be used for prawn seed production. After larval prawn hatch, they are reared for nearly 30 days without the exchange of water until they metamorphose into post-larvae.

Survival rates of larvae and final number of post-larvae (PL) produced under the“ re-circulating water ”and“ green water ”systems

Treatment	PL Density	Survival rate (%)
“ Re-circulating water ” system		
30 larvae/l	19.5/l	52.5
60 larvae/l	18.6/l	28.8
90 larvae/l	28.4/l	31.7
120 larvae/l	32.9/l	27.4
“ Green water ” system		
30 larvae/l	27.7/l	92.3
60 larvae/l	27.8/l	46.3
90 larvae/l	41.7/l	46.4
120 larvae/l	38.8/l	32.3

The target species, the giant freshwater prawn, *Macrobrachium rosenbergii*.

Furthermore, in order to bolster prawn larvae survival rates, different feeding diets were designed and evaluated. Larvae fed a custard diet formulated from chicken egg yolk, milk powder and squid oil provided the most satisfactory results in terms of survival rate and number of post-larvae produced per liter. This diet could be further improved by the supplementation of vitamin C and lecithin, which not only increased post-larvae survival rates, but also improved the quality of post-larvae; these results are now used in our standard methods of seed production.

In addition, studies at JIRCAS's Tsukuba premises have been conducted on reproductive and osmoregulatory mechanisms in freshwater prawns with the aim of addressing problems related to broodstock cultivation and larval rearing under captive conditions. This research has also enabled the development of technology for determining maturity levels in female spawners, and low-salinity larval rearing techniques that are now being tested.

Since the beginning of 2000, the“ green water ”model has been introduced to various users, and the number of hatcheries and quantity of post-larvae produced rapidly increased 50-fold, reaching over fifty million in 2001. As of mid-2002, the“ green water ”model has been transferred to eleven state-run hatcheries in different provinces of the Mekong Delta, and Cantho University staff trained 108 persons in the Mekong Delta and in a few provinces of central Vietnam. Of these 108 persons, 83 individuals have set up small-scale hatcheries throughout the Mekong Delta and Vietnam (utilizing 10-20 cubic meters of rearing water) based on the“ green water ”model.

The giant freshwater prawn is cultured in a variety of ways, but prawn-rice combined farming systems are considered especially important in raising impoverished farmers' standards of living. We believe that these newly-established hatcheries are now contributing to meeting prawn seed demands for use in prawn-rice farming and other aquaculture systems in Vietnam. We are now implementing a socioeconomic survey to evaluate the impacts of this technology transfer.

Marcy Wilder
Fisheries Division, JIRCAS

An Osmosensor as a Molecular Tool for the Genetic Improvement of Drought-Tolerant Crops

As the world population is predicted to double by 2050, food production must be increased substantially and stabilized. In marginal or arid lands in developing countries, environmental factors such as drought, high salinity, high temperature, and flooding are serious problems that lead to unstable crop productivity. To address this problem, researchers developed stress-tolerant plants by transfering a gene encoding protective proteins or enzymes involved in stress tolerance from various organisms. These past efforts had limited success, however, due to the genetic complexity of stress responses and adaptation. To overcome this limitation, our current approach is to manipulate a regulatory gene that controls the amounts and timing of numerous effector molecules described above. Under drought conditions, a change in cellular osmotic pressure caused by water loss triggers various intracellular responses, including activation of signal transduction pathways followed by gene expression of osmoprotectants. (Fig. 1) The first step in this event is the perception of osmotic changes by a sensor or receptor protein(s) at the plasma membrane. (Fig. 2) Therefore, we targeted the osmosensor as the regulatory gene to be engineered.

Based on an analogy in bacteria and yeast, histidine kinase(s) was expected to function as an osmosensor in plants, leading us to clone a cDNA encoding a histidine kinase ATHK1 from *Arabidopsis*. ATHK1 contains two hydrophobic transmembrane regions adjacent to a putative extracellular domain in the N-terminal half, suggesting functional similarity with the yeast osmosensor SLN1 (Fig. 2). Overexpression of the ATHK1 cDNA suppressed the lethality of a yeast *sln1* mutant. In contrast, the substitution of either putative phosphorylation site, His or Asp, failed to complement the *sln1* mutant, indicating that ATHK1 acts as a histidine kinase and that ATHK1 is in an active form in the absence of external signals (e.g. high osmolarity). Moreover, introduction of the ATHK1 cDNA into a yeast mutant lacking both osmosensors, SLN1 and SHO1, allowed normal growth and activation of the HOG1 MAPK cascade under high osmolarity conditions, suggesting that the ATHK1 activity changed to an inactive state from an active state in response to increases in external osmolarity. Thus, we demonstrated, by analyzing both sensing (input) and catalytic (output) activities of ATHK1 *in vivo* using the yeast osmosensing-defective mutants, that ATHK1 has an ability to sense and transduce a signal of external osmolarity to the downstream targets. In order to examine the function of ATHK1 in plants, we attempted to generate *Arabidopsis* plants transformed with mutated ATHK1 cDNAs. We initially screened dominant-negative ATHK1 mutants that inhibit the activity of the wild-type ATHK1, which in turn suppresses the yeast SLN1 deletion mutant, and isolated six candidates (ATHK1-1 to 6). Sequence analysis revealed that ATHK1-6 has a nucleotide substitution at a putative ATP binding site. We then generated transgenic *Arabidopsis* plants overexpressing the dominant-negative ATHK1 cDNAs, and found that several lines exhibit late germination, growth retardation, short roots, accumulation of anthocyanin and stomatal closure under normal growth conditions. A cDNA microarray followed by Northern blot analysis indicated that a number of stress-inducible genes are constitutively expressed in the dominant-negative ATHK1 overexpressors under unstressed conditions. Moreover, the dominant-negative ATHK1 overexpressors were more tolerant to dehydration and high salinity stresses than wild-type plants. These results, together with yeast genetic analysis, suggest that ATHK1 is an osmosensor in *Arabidopsis*. This is the first evidence that a plant histidine kinase acts as an osmosensor. The ATHK1 gene could be one of the most useful molecular tools or biological resources for the genetic improvement of drought-tolerant crops.

Takeshi Urao[1] and Kazuko Yamaguchi-Shinozaki[2]
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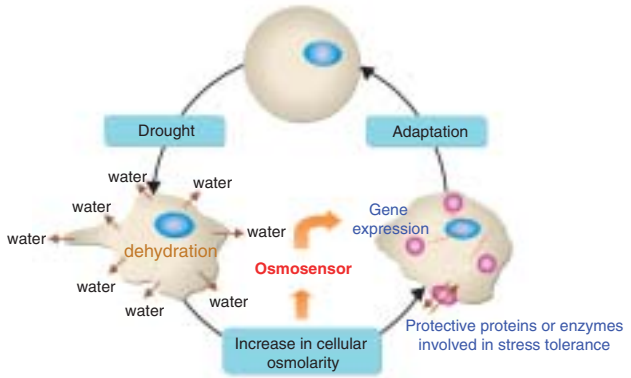

Fig. 1 Drought stress and osmosensor

A change in cellular osmotic pressure (osmolarity) caused by water loss triggers various intracellular responses followed by gene expression of osmoprotectants. The first step in this event is the perception of osmotic changes by a sensor or receptor protein(s) at the plasma membrane.

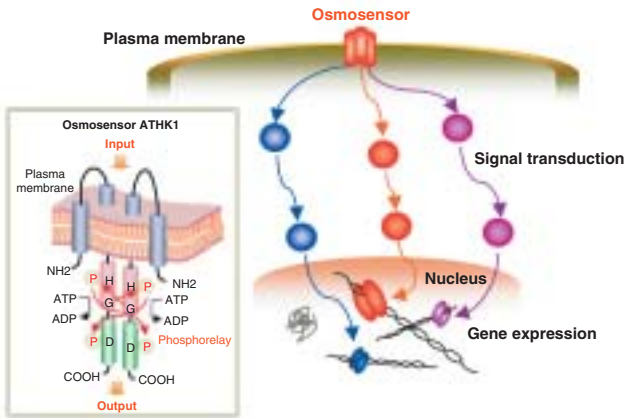

Fig. 2 An *Arabidopsis* histidinekinase, ATHK1, in osmosensing

ATHK1 contains two hydrophobic transmembraneregions adjacent to a putative extracellulardomain in NH2-terminal half.ATHK1 recognizes increases in external osmolarityand autophosphorylatesa histidineresidue (H) within the kinasedomain.The phosphorylgroup (P) is transferred to an aspartateresidue (D) within the receiver domain, and then activates downstream signal transducer(s).

JIRCAS Visiting Research Fellows from October 2002 to September 2003

Under the JIRCAS Visiting Research Fellowship Program, 18 researchers carried out research with their JIRCAS counterparts at the Tsukuba premises and at the Okinawa Subtropical Station for one year, on the following themes. This program has been implemented since 1995 and more than one hundred overseas researchers have achieved brilliant results.

Tsukuba Head Quarters

1. **Economic returns on agricultural research investment for rice production in West Africa: The case of Nigeria**
   Omer Elgali Elsheikh (Sudan)
2. **Role of the zinc-finger homeodomain and NAC transcription factors in drought-inducible expression of the erd1 gene**
   Lam-Son Phan Tran (Godollo University of Agricultural Sciences, Vietnam)
3. **Rice Production Monitoring by Using MODIS Satellite Data**
   Lei Wang (China National Rice Research Institute, China)
4. **Studies on mapping of brittle rachis genes and contributions for agronomic traits in wheat**
   Maxim Petre (Research Institute for Cereals and Industrial Crops, Romania)
5. **Effects of N-fertilizer management on soil microbial properties and atmospheric environment in barley field plots**
   Haiyan Chu (Chinese Academy of Science, China)
6. **Characterization of nitrogen-fixing endophytic bacteria associated with grasses**
   Adel Elsayed Elbeltagy (Minufiya University, Egypt)
7. **Involvement of a mitochondrial-dependent pathway in mahanine-induced apoptosis in human cancer cell lines**
   Molay Kumar Roy (Bangladesh)
8. **Role of oxygen delignification on chlorine-free bleaching of chemical pulps produced from tropical lignocellulosic resources**
   Leh Cheu Peng (University Science Malaysia, Malaysia)
9. **Elucidation of osmoregulatory mechanisms in the giant freshwater prawn, *Macrobrachium rosenbergii*, and relationship to the reproductive process**
   Safiah Jasmani (Malaysia)
10. **Studies on the tolerance to iron and aluminum toxicity in rice plants**
    Samiul Alam (Bangladesh)

Fellows at the Tsukuba premises.

Okinawa Subtropical Station

Fellows at the Okinawa Subtropical Station.

1. **Water saving and water use efficiency under differing micro irrigation depths**
   Nur Ahamed Khondaker (Bangladesh Agricultural Research Council, Bangladesh)
2. **Analysis of effects of plowed hardpan on sub-soil stored water use in sugarcane**
   Samuel M. Contreras (Bureau of Soils and Water Management, Philippines)
3. **Physiological and molecular characterization of thermotolerance in transgenic (MT- and ER-sHSPs) tomato**
   Prakash Chandra Nautiyal (National Research Center for Groundnut, India)
4. **Changes in antioxidant enzyme activities and hydrogen peroxide contents by high temperature stress in leaves of two genotypes of snap bean**
   Shang Qingmao (Institute of Vegetable and Flower, Chinese Academy of Agriculture Sciences, China)
5. **Development of an efficient transformation method in sugarcane**
   Efendi (Syiah Kuala University, Indonesia)
6. **Isolation and characterization of anthocyanin transcriptional activator genes from a cDNA library of sweet potato**
   Muchdar Soedarjo (Research Institute for Legume and Tuber Crops, Indonesia)
7. **Purification of citrus greening organism and analysis of pathogen-specific proteins**
   Wanphen Srithongchai (Division of Plant Pathology and Microbiology, Department of Agriculture, Thailand)
8. **Evaluation and utilization of the natural predator, *Antilochus coqueberti* against the cotton stainer, *Dysdercus cingulatus***
   Bui Thi Ngan (Research Institute for Cotton and Fiber Crops, Vietnam)

JIRCAS Actively Participated in the Side Events of TICAD Ⅲ

The 3rd Tokyo International Conference on African Development (TICAD Ⅲ) was held from September 29 to October 1, 2003 in Tokyo, with the UN and other organizations serving as cosponsors at a time of ever-growing international efforts to forge ahead with the continent's development. Some 1,300 African and other foreign delegates, including the heads of state of 23 African countries, participated in the conference hosted by the Japanese government.

TICAD was initiated in Tokyo ten years ago in 1993, with the main aim of regaining the interest of the international community in Africa, which was at that time waning. Since then, with concrete actions, Japan has tackled African development and over the last decade has provided assistance amounting to US$12 billion to Africa.

In 1982, JIRCAS initiated a collaborative research project with the then International Laboratory for Research on Animal Diseases (ILRAD), which in 1995 merged with another institute to form the International Livestock Research Institute (ILRI). JIRCAS has also been dispatching researchers to the International Centre of Insect Physiology and Ecology (ICIPE), International Institute of Tropical Agriculture (IITA), Kano Office, and West Africa Rice Development Association (WARDA).

Dr. Sakagami explaining JIRCAS's role in African development to visitors at the TICAD Ⅲ Side Events.

Side Events were held during the conference. More than 50 delegates participating in TICAD Ⅲ provided poster displays, lectures, and informative material. JIRCAS displayed posters, and distributed copies of the latest JIRCAS Newsletter. JIRCAS President Dr. Iwamoto and other staff attended lectures including that on "NERICA-on the Move: A symbol of Hope for Rice Farmers in Africa" presented by Dr. Kanayo F. Nwanze, Director General of WARDA.

Grand Opening of a New Laboratory with Large-Scale Lysimeters at the Okinawa Subtropical Station

JIRCAS celebrated the grand opening of a new laboratory at the Okinawa Subtropical Station on July 31, 2003. The new building has large-scale lysimeters outside and inside a greenhouse, where the transpiration of crops, evaporation and infiltration of soil water, and the water movement in a soil-crop continuum can be measured accurately (Photos). Furthermore, by using the runoff plots, the mechanism of erosion can be studied more precisely. The addition of these new facilities is expected to give a boost to international collaborative research projects at the Station.

Large-scale lysimeters at the facility.

Recording equipment in the basement of the laboratory.

Festival for International Cooperation 2003

The "International Cooperation Festival 2003" was held at Hibiya Park, Tokyo on the 3rd (Sat) and 4th (Sun) of October 2003. This event has been held since 1990 in commemoration of the "International Cooperation Day" on October 6th. Presentations by approximately 200 governmental and non-governmental organizations engaged in international cooperation activities, as well as international authorities and various embassies in Tokyo were made. Various events, such as the "ODA town meeting" were held concurrently. Approximately 69,000 people attended the festival.

JIRCAS has attended the festival since 2001, using a portion of the booth space provided for CGIAR (Consultative Group on International Agricultural Research), and introduced its activities. This year, however, JIRCAS participated in the festival independently and introduced its research activities by means of panels, publications and other materials. Among others, the exhibition on NERICA (*note) attracted visitors' attention. Many visitors showed keen interest in NERICA and its distinctive features and raised several questions to the JIRCAS staff. During the festival, hundreds of people visited JIRCAS's booth and gained an understanding of the institute's research activities.

(*note) NERICA is the abbreviation for New Rice for Africa. This is a rice variety group developed by WARDA, with assistance from Japan, including JIRCAS and other donors. NERICA rice varieties are inter-specific crosses between African rice and Asian rice. The main features of these varieties are early maturation and high yield. Seven varieties are now being disseminated in African countries.

Nerica and Poster displays.

JIRCAS Visiting Research Fellowship Program 2003 at Tsukuba and Okinawa

The Japan International Research Center for Agricultural Sciences (JIRCAS) has been implementing the" Visiting Research Fellowship Program, "which aims at the promotion of collaborative research to address various problems confronting the countries in developing regions on a global scale, including the critical situation of food production, the progression of desertification and the gradual disappearance of genetic resources. JIRCAS invites young promising researchers from developing regions who will play a major role in the future to carry out collaborative research.

Under the Fellowship Program 2003, 9 researchers will undertake collaborative research at JIRCAS ' s Tsukuba premises and 9 others at the Okinawa Subtropical Station for one year, while 4 researchers will undertake research at the National Institute of Agrobiological Sciences (NIAS) in Tsukuba for 5 months. This year ' s invitees are as follows.

[Long-term at JIRCAS Tsukuba from October 2003 to September 2004]

1. **Huoyan Wang** (Division of Soil Fertility and Plant Nutrition, Institute of Soil Science, Chinese Academy of Sciences, China)
2. **Yin Lijun** (Sino-Japanese Food Research Center, China Agricultural University, China)
3. **Xiuqing Wang** (College of Economics and Management, China Agricultural University, China)
4. **A. K. M. Mohiuddin** (Biotechnology Division, Bangladesh Rice Research Institute, Bangladesh)
5. **Adel Elsayed Elbeltagy** (Botany Department, Faculty of Agriculture, Minufiya University, Egypt)
6. **Oladimeji Idowu Oladele** (Agricultural Extension & Rural Development, University of Ibadan, Nigeria)
7. **Kashfia Ahmed** (Bangladesh)
8. **Xu Hua** (Laboratory of Material Cycling in Pedosphere, Institute of Soil Science, Chinese Academy of Sciences, China)
9. **Safiah Jasmani** (Malaysia)

Fellows at the Tsukuba premises

[Short-term at NIAS from October 2003 to March 2004]

1. **Ahsol Hasyim** (Plant Protection Division, Research Institute for Fruit, Indonesia)
2. **Mohammad Pourkheirandish** (Genomics, Guilan University, Iran)
3. **Rasamee Dhitikiattipong** (Rice Research Institute, Department of Agriculture, Thailand)
4. **Katarzyna Snigorska** (Biology and Earth Sciences, Jagiellonian University, Poland)

[Long-term at Okinawa Subtropical Station from October 2003 to September 2004]

1. **Roland Nuhu Issaka** (Soil Fertility and Plant Nutrition, CSIR-Soil Research Institute, Ghana)
2. **Meiru Li** (Laboratory of Chemistry and Molecular Ecology, South China Institute of Botany, The Chinese Academy of Sciences, China)
3. **Ashok Kumar** (Department of Agronomy, CCS Haryana Agricultural University, India)
4. **Mohammad Abul Kashem Chowdhury** (Genetics and Plant Breeding, Patuakhali Science and Technology University, Bangladesh)
5. **Winarso Drajad Widodo** (Department of Agronomy, Faculty of Agriculture, Bogor Agricultural University (IPB), Indonesia)
6. **Efendi** (Genetics and Plant Breeding, Faculty of Agriculture, Syiah Kuala University, Indonesia)
7. **Shuzhen Zhang** (National Key Biotechnology Laboratory for Tropical Crops, Chinese Academy of Tropical Agricultural Sciences, China)
8. **Azoy Kumar Kundu** (Plant Pathology, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Bangladesh)
9. **I Made Sudiana** (Microbiology, Research Center for Biology, The Indonesian Microbiology Institute of Science, Indonesia)

Fellows at the Okinawa Subtropical Station

JIRCAS Newsletter
Japan International Research Center for Agricultural Sciences (JIRCAS)

December 2003-No.37
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