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# JIRCAS Newsletter

## FOR INTERNATIONAL COLLABORATION

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Fruit market in Vietnam
(Photo by Kosugi Sho)

CONTENTS



JIRCAS
JAPAN INTERNATIONAL RESEARCH CENTER FOR AGRICULTURAL SCIENCES

# Research Project "Farming Systems in Mekong Delta" — a Workshop at JIRCAS —

*Shigeo Matsui*

Under the research project on "Evaluation and Improvement of Farming Systems Combining Agriculture, Animal Husbandry, and Fisheries in the Mekong Delta" a workshop was held on December 8-9, 1997 in JIRCAS International Conference Room to review the project and to develop a closer cooperation with Vietnam organizations. Six researchers from Vietnam headed by Dr. Vo-Tong Xuan, Director, Farming Systems R&D Institute, Cantho University were invited. The meeting started with opening remarks by Dr. Maeno, Director General, JIRCAS and the keynote address of Dr. Vo-Tong Xuan titled "History and future farming systems in the Mekong Delta". Then 4 sessions followed:

In session 1, the farming systems were described with 3 case study reports presented by Mr. Nguyen Xuan Lai, Dr. D. N. Thanh and Mr. Duong Van Ni. Rapid increase in rice production and constraints were outlined. Mr. Ni, Farming Systems R&D Institute, reported that in the case of Hoa An village, the introduction of *Melaleuca* trees into farming systems had enabled to plant two crops of rice a year in an area with strongly acidic soils. In session 2 which dealt with technology development, Mr. T. Kon, Tohoku National Agricultural Experiment Station, Dr. S. Yoshihara, National Institute of Animal Health and Dr. M. Wilder from JIRCAS reported on current achievements and constraints in rice production, swine husbandry, and aquaculture, respectively. In session 3, reports by Dr. R. Yamazaki, Rakuno Gakuen University and Mr. S. Kosugi, JIRCAS stressed the need for organizing farmers into farmers' cooperatives because credit and/or collective commodity marketing are indispensable for the future development of farming systems. In session 4, Mr. Le Thanh Duong, Farming Systems R&D Institute discussed the problems for the promotion of sustainable agriculture. Mr. N. Vromant, VVOB, Belgium working at the same institute, reported about rice-fish farming systems with emphasis placed on proper water management. Mr. R. Yamada, JIRCAS outlined his plan of research on farm management.

Although rice production has markedly increased in the Mekong Delta, farmers' incomes and living standards have remained low. The workshop concluded that the development of sustainable farming systems which combine rice cultivation, animal husbandry and aquaculture is definitely important. It was also stressed that the creation of viable credit and marketing channels as well as the promotion of technology transfer, etc. is the key to further development of agriculture in the Mekong Delta.

Among the participants, Dr. Matsuno, Tokyo University of Agriculture, Dr. Cho, Kyushu University, Dr. Furukawa, Kyoto University and Dr. Oe, Tokyo University of Agriculture and Technology, old friends of Dr. Vo-Tong Xuan enjoyed their reunion.

Prior to the workshop, Dr. Maeno, Director General of JIRCAS had attended the ceremony marking the 20th anniversary of CLRRI held at O Mon, Cantho, Vietnam on December 2. He expressed his deep gratitude for the cooperation in the project.

*Photo: Discussions at the Workshop in Tsukuba (center) and Farming Systems in Mekong Delta.*

### Collaborative Research with ICIPE

# Edible Insects in East Africa

*Shigemi Yagi*

More than 500 insect species are used for human consumption in the tropical and subtropical regions of the world. In Africa, many species of insects have been used as traditional foods among indigenous people and have played an important role in the history of human nutrition. Many insects usually considered as crop pests such as locusts, grasshoppers, weevils and some termite species have been used as important food sources. Interviews with 9 main Kenyan ethnic groups and field surveys in western Kenya revealed that at least 8 insect families representing 6 orders are eaten. The major orders of edible insects include *Isoptera* (termites), *Orthoptera* (locusts, grasshoppers, crickets), *Coleoptera* (beetles), *Hymenoptera* (honey bees), *Lepidoptera* (moths) and *Diptera* (lakeflies). The most common edible insects are the termites which are highly appreciated by practically every ethnic group in Kenya. The sexual winged forms (reproductive forms) of termites are frequently caught for food.

Our research in the Maragoli area in western Kenya has shown that villagers can easily distinguish species and the emergence patterns of termites. They apply various methods for catching termites. In one method, they build a tent-like structure consisting of branches and leaves to cover some of the emergence holes (Photo 1). By closing the other holes, the termites have to emerge from the holes in the tent structure which has an opening on one side to which the flying termites are attracted by sunlight, artificial light or moonlight. Near this opening, a receptacle is placed to collect the termites. In another method they introduce a light source inside a bucket lined with wet slippery banana leaves, and then the bucket is placed near an active mound. Attracted by the light, termites drop in the bucket. In the dry season, termites can be induced to come out when stimulated by fumes of smoke from burnt dried leaves of specific wild plants or the slow rhythmic vibrations created by striking stones or by beating a large piece of wood with two sticks. A similar drumming technique for collecting termites has been reported in Uganda.

*Photo 1: A termite trap along the road in Maragoli area in western Kenya.*

Termites are prepared in various ways for eating. In Enzaro village, Maragoli, it is common to lightly fry the termites in their own fat over a low heat, add a little salt and sometimes remove the wings. Fried winged termites are tasty after being dried in the sun and they can be consumed for a rather long period of time. In some areas, termites are used as gifts for marriage. Raw termites are also frequently eaten. In some areas of western Kenya, sun-dried termites are packed in various containers and sold during the rainy season in the local food markets. They are sometimes transported over long distances to urban markets of East African large cities such as Kisumu, Kampala or even Nairobi (Photo 2).

Our field surveys, suggest that termites play an important role in daily food consumption in the Maragoli area in the rainy season, when there is a shortage of maize supply. We concluded that the termites are especially valuable for children and pregnant women which require a high calory diet and nutritious food. Research should be further promoted to create an awareness about the importance of insects as a good and cheap source of lipids and animal protein.

*Photo 2: Termites sold in an open market in Kampala, Uganda.*

Collaborative Research with IITA

# Traits for Drought Tolerance in Cowpeas

*Iwao Watanabe*

Three cowpea accessions (TVu 11979, 11986, 12348), which were identified as highly drought-tolerant, yielded about one ton of grain per ha in the dry season at Kano in Sudan Savanna. This trial encouraged farmers to cultivate drought-tolerant cowpea varieties to alleviate food shortage in the dry season and their acreage under cultivation has been increasing in drought-prone areas of Sudan Savanna. However, some of the agronomic traits of these accessions should be further improved. In the breeding programs for tolerance to drought, information on causative traits for the tolerance is important for the selection of progenies after crossing. Therefore, physiological studies were conducted to compare tolerant and susceptible lines.

1. Distribution percentage of dry matter to roots was higher in the tolerant lines. Root weight of these lines increased steadily even at maturity in contrast with the considerable decline in the susceptible ones after flowering. This deep-rooting trait enables plants to collect residual soil moisture receding downwards day by day and to grow vigorously in the dry season. This trait adversely affects the production of grains under well-watered conditions, due to the lower distribution percentage of dry matter to pods. These tolerant lines, therefore, should be recommended as specific cultivars for drought-prone areas or for the introduction of a new cropping system in the dry season.

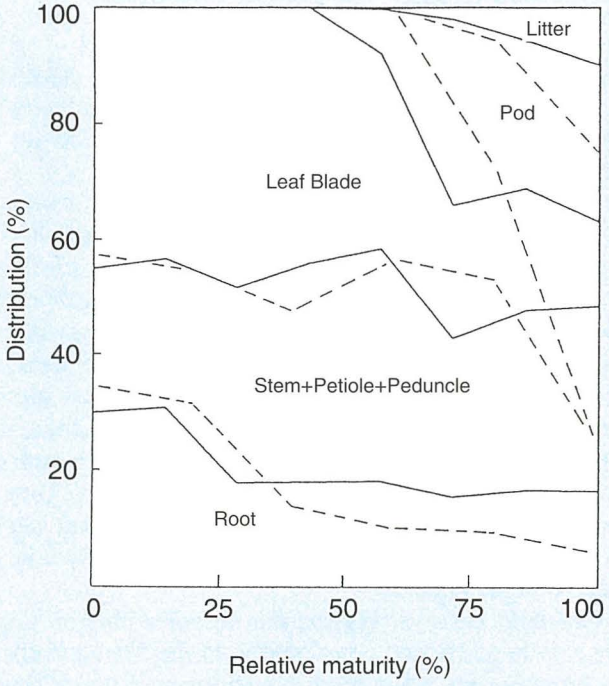


Fig. 1. Time course of dry matter distribution among plant organs

Relative maturity
0: 25 days after sowing 100: last sampling
———— Highly tolerant line, TVu 11979
-------- Highly susceptible line, TVu 9357.

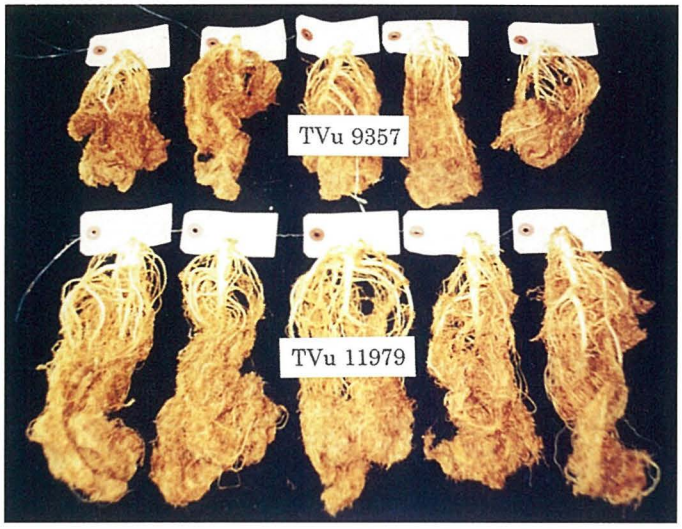


*Photo: Roots of potted cowpeas at 67 days after sowing. Root weight of highly tolerant line, TVu 11979, exceeded that of highly susceptible line, TVu 9357, by fifty percent.*

2. Transpiration rate of tolerant lines under lethal water stress was lower than that of susceptible ones. This trait for economical use of water allows tolerant lines to survive for a longer period of time under lethal water stress.
3. No difference was observed among cowpea lines in the water use efficiency, measured by the increase in the dry matter per unit amount of water lost through transpiration. Photosynthesis/transpiration ratio was also almost the same among the cowpea lines tested. These results suggest that the vigorous growth of tolerant lines in the dry season described earlier must have been due to the active absorption of water and not to the efficient use of water.
4. There are two types of drought in Sudan Savanna. One is the initial drought at the seedling stage. At this stage, roots are short yet and no available moisture remains in the root zone except for the moisture supplied by current precipitation. In this type of drought, therefore, seedlings are faced with lethal water stress. The only strategy for survival until the next rain is the economical use of water. The other type is the terminal drought at the ripening stage due to delayed planting caused by late arrival of the rainy season. At the ripening stage, a fairly large amount of available water remains in deep soil layers. In this type of drought, therefore, the strategy for completing the life cycle and getting seeds for the next generation is the continued absorption of water associated with the deep-rooting traits. In the long history of adaptation of cowpeas to drought-prone areas, they must have acquired the two traits simultaneously, that is the trait for economical use of water under lethal water stress and that for deep-rooting.

# Mechanism of Adaptation of Upland Rice Genotypes to Highly Weathered Acid Soils of Savannas in South America

*Kensuke Okada and Albert J. Fischer**

Tropical humid savannas which extend over 240 million hectares in South America are covered with highly weathered acid soils (Oxisols and Ultisols). A crop-pasture rotation has been introduced to these under-exploited ecosystems as a sustainable cropping system, in which upland rice is an important component due to its relative tolerance to acidity and infertility of soils. Since upland rice displays a wide range of genotypic differences in tolerance to soil acidity, the lack of suitable screening techniques had hampered rapid development of breeding. Aluminum has been considered to be the major limiting factor for plant growth in acid soils in general, but in the case of savanna soils, deficiency of other nutrients complicates the situation. Therefore, JIRCAS-CIAT collaborative project initiated since 1992, attempted first to identify the major limiting factors for the growth of upland rice on acid savanna soils, then to analyse the mechanism controlling the genotypic differences in the tolerance, in order to contribute to the promotion of efficient methods of breeding of upland rice for tropical savannas.

Field experiments on the response to liming were conducted using both tolerant and susceptible genotypes over a period of 4 years at two sites in the Eastern Plains of Colombia (Llanos Orientales). The acidity of the top soil was found to increase during crop growth due to the accumulation of KCl and urea which were applied sequentially according to farmers' practice. The yield of the tolerant varieties did not respond to lime application, while that of the susceptible ones declined at a very low rate of liming (<300 kg $ha^{-1}$), at which the relative yield (the ratio of yield at low lime rate to the yield at high lime rate (3 t $ha^{-1}$)) of the susceptible varieties correlated significantly ($p<0.05$) only with the amount of exchangeable Ca of soil (Fig. 1-C).

Other indicators of soil acidity such as soil pH and amount of exchangeable Al did not show any significant correlation with yield decline in the susceptible varieties, and further, the tendency was opposite in terms of indication of soil acidity (Fig. 1-A, B). Al saturation which is the indicator most widely used for soil acidity, was not correlated significantly, either (Fig. 1-D). These results suggested that the amount of exchangeable Ca should be used as indicator of soil acidity for upland rice, rather than Al-related parameters. This finding has a practical implication for the selection of stressful sites for on-site field screening.

Then pot experiments for lime response were conducted using top and subsoils of savanna. In addition to other soil chemical characteristics, aluminum concentration in the soil solution was measured. First, it was found that soil acidity

*Photo: Root sampling in upland rice experimental field in Llanos, Colombia.*

increased gradually as in the case of field experiments, and that where the growth was more suppressed, the soil acidity was more pronounced because the salts were not absorbed by plant roots but accumulated. Therefore, although the growth of plants was apparently negatively correlated with the concentration of Al in the soil solution, it was found that the high aluminum concentration was not the cause but rather the result of the growth retardation. Also, no varietal differences were detected in the response to Al concentration in the soil solution. Second, total Ca supply (exchangeable Ca of original soil plus applied Ca as lime) determined the total growth even when the results of both top and subsoils were combined. The adaptation of the tolerant variety to low Ca conditions was attributed to the low requirement of Ca when Ca in soil started to be deficient.

Since it was concluded that Ca absorption rather than direct Al toxicity is the key factor which differentiates the degree of tolerance, the relative affinity of Ca and Al to the root cell wall (at the level of which these two elements compete) was investigated by measuring the ion exchange and chelating characteristics of the root tip surface. It was found that the lower interference of Al in the Ca retention by the root cell wall was the main reason for the high efficiency of uptake and utilization of Ca for tolerant varieties.

These results indicate that the better growth of the tolerant varieties at the low lime rate was due to their tolerance to a low Ca supply rather than to tolerance to high Al in acid soils, which has a direct implication in determining the target of both field and laboratory screening tests. It was suggested that the ion exchange and chelating characteristics of the root cell wall should be used as criteria for acid soil tolerance.

*Formerly: CIAT Rice Program, presently: University of California, Davis, USA.

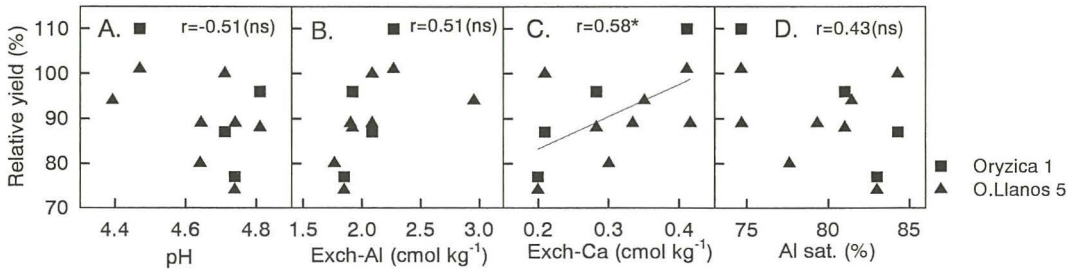


Fig. 1. Response of susceptible varieties of upland rice to indices of soil acidity in the topsoil of savanna (0–20 cm).

# China-Japan Joint Workshop Held on "Migration and Management of Insect Pests of Rice in Monsoon Asia"

The rice planthoppers are international insect pests of rice, which undertake long-range migrations from tropical to temperate rice areas in Asia. The collaborative research project on "Long-range migration of rice insect pests in monsoonal East Asia" between JIRCAS and National Agro-Technical Extension and Service Center (NATESC), P.R. China was initiated at China National Rice Research Institute (CNRRI) in 1992. The project which enabled to clarify the dynamic process of the rice planthopper migrations from Indochina to Japan *via* South China, was successfully terminated in January, 1997. In the same year, JIRCAS and CNRRI agreed to continue the research collaboration on rice planthoppers, shifting the research focus from migration to management for the subsequent 5-year period.

Taking this opportunity, JIRCAS organized the China-Japan Joint Workshop on "Migration and Management of Insect Pests of Rice in Monsoon Asia" in collaboration with CNRRI and NATESC to review the collaborative research project and to promote the new JIRCAS-CNRRI project on "GEU-based IPM (Integrated Pest Management) for migratory insect pests of rice in China". The Workshop was held during the period 27-29, November, 1997 at CNRRI. Eighteen speakers were invited, including 7 overseas participants from Korea, Laos, Myanmar, Philippines, Taiwan and Vietnam. The Workshop started with introductory remarks on the management of insect pests of rice in China by NATESC, and reviews of planthopper migration studies in Japan and China by JIRCAS and CNRRI, respectively. The Workshop program was divided into the migration and IPM sessions. A study report on computer simulations of windborne migrations developed by JIRCAS, and 6 case studies on migrations to South and Central China, Taiwan, Ishigaki Island, and Korea were presented in the "Migration Session". The "IPM Session" consisted of 4 country reports on the ecology and management of rice planthoppers and other insect pests in Vietnam, Laos, and Myanmar, and 2 papers on theoretical approaches for sustainable pest management in rice ecosystems. In the "Closing Session", monsoon-linked long-range migrations of rice planthoppers, practical significance of insect resistance in rice in IPM, and new paradigms for rice pest management were highlighted and subjected to discussions.

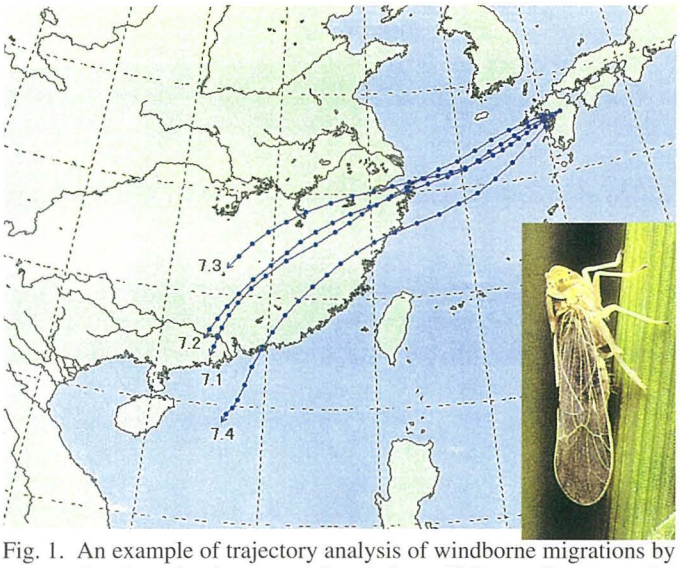


Fig. 1. An example of trajectory analysis of windborne migrations by the rice planthoppers (photo) from China to Japan on the computer program developed by JIRCAS.

***(Kazushige Sogawa)***

# 3rd Seminar on "Brackish Water Project" Held in Malaysia

On December 8-9, 1997, the 3rd "Brackish Water Project" seminar was held in the Conference Room of the Institute of Postgraduate Studies and Research, University of Malaya in Kuala Lumpur, Malaysia. This seminar is held annually as a part of the comprehensive project on "Productivity and Sustainable Utilization of Tropical and Subtropical Brackish Water Mangrove Ecosystems". The project aims to evaluate the productivity of such areas and identify the criteria for sustainable utilization. The west coast of Peninsular Malaysia was selected as the study area due to the presence of various types of mangrove forests. Counterpart organizations include the Fisheries Research Institute (FRI), the University of Malaya (UM) and the Forest Research Institute of Malaysia (FRIM).

Subjects addressed in the seminar were as follows: 1) Water quality, 2) Forest and litter fall, 3) Food web, 4) Meio and macro-fauna, 5) Socio-economic aspects and policy, and 6) Fish and prawns. About 40 scientists from Japan, England, and Malaysia participated in the seminar, and fourteen papers were presented.

During the 3rd seminar, Professor T. K. Mukherjee, Dean, Institute of Postgraduate Studies and Research, University of Malaya gave a welcome address, Dato' Mohd.

*Photo: Discussion at the 3rd "Brackish Water Project" Seminar.*

Mazlan b. Jusoh, Director General, Department of Fisheries gave an opening address, and Dr. Shiro Uno of JIRCAS made closing remarks.

During the two days' seminar, it was concluded that the research surveys conducted in 1996-1997 in the unexploited mangrove brackish water area had been completed and that in future the surveys should be concentrated in areas subjected to deforestation such as the Lumut mangrove area (Dinding river) in Perak State.

***(Shigeo Hayase)***

## The 5th JIRCAS International Symposium

# Postharvest Technology in Asia
## — A Step Forward to Stable Supply of Food Products —

The symposium on "Postharvest Technology in Asia" organized by JIRCAS will be held in Tsukuba, Japan during the period of September 9-11, 1998.

In Asia, agricultural research so far has been mainly centered on the improvement of crop production itself to achieve self-sufficiency in food in order to support the growing population of the respective countries. It is anticipated that, in the near future, the food supply problems will become more complex as patterns of food consumption have improved in the region along with the increase of income and social development.

Postharvest technology, which encompasses issues ranging from harvesting methods in farmers' fields to food processing, should be more emphasized to prevent crop losses and for utilizing agricultural products efficiently to meet the changes in the food demand, especially the demand for processed foods. Food industries are closely related to crop production in the region but due to the lack of proper technology, sound progress of the food industry can not be fully achieved. In this symposium, the development of the food industry in Asia will be reviewed and the basic technical problems involved for future progress will be outlined.

The Japan International Research Center for Agricultural Sciences (JIRCAS) is implementing collaborative projects in Asian countries and "postharvest technology" should receive more attention in future research collaboration. Development of "postharvest technology" could contribute to securing a stable supply of food products in addition to the increase of agricultural income and improvement of the diet in the developing regions of Asia.

The symposium program consists of a keynote speech and three sessions as follows:

**Keynote Speech**
*Keiji Kainuma* (BRAIN, Japan)

**Session1: Main priorities and constraints in postharvest technology in Asia**

***Priorities and constraints of postharvest technology:***
***-Vietnam***
*Le Van To* (Post-harvest Technology Institute)
***-Philippines***
*Silvestre C. Andales* (BPRE)
***-Thailand***
*Jingtair Siriphanich* ( Kasetsart Univ.)
***-China***
*Feng Shuangquing* (Chinese Agric. Univ.)
***-India***
*Ananthaswamyrao Ramesh* (CFTRI)

**Session 2: Current development and future orientation of technology of grain storage and preservation in the tropics**

***-Alternative chemicals for methyl bromide.***
*Bruce R. Champ* (Australia)
***-Hermetic storages of grains in the tropics.***
*Filipinas Caliboso* (BPRE, Philippines)
***-Role of biological control of grain storage in the tropics.***
*Hiroshi Nakakita* (NFRI, Japan)
***-Minimizing aflatoxin production in grains in the tropics.***
*Prisnar Siriacha* (Kasetsart Univ., Thailand)
***-Strategies to maintain grain quality in the humid tropics.***
*Mulyo Sidik* (Ministry of Food Affairs, Indonesia)
***-General comments***
*Greg Johnson* (ACIAR, Australia)

**Session 3: Current situation and future orientation of technology of food industries in Asia**

***Development and constraints in the food industries:***
***-Thailand***
*Saipin Maneepun* (Kasetsart Univ.)
***-Philippines***
*Josue S. Falla* (BPRE)
***-China***
*Deng Yong* (Chinese Agric. Univ.)
***-Indonesia***
*Aman Wirakartakusumah* (Bogor Agric. Univ.)
***-Taiwan***
*Liu Tin-Yin* (FIRDI)
***-Korea***
*Cherl-Ho Lee* (Korea Univ.)
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*Hideki Uehara* (Nihon Univ.)

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***(Hiroko Takagi)***

# PEOPLE

## New Visiting Researchers in Okinawa

Nine visiting researchers will participate in JIRCAS Visiting Research Fellowship Program in Okinawa to carry out collaborative research focused on important topics related to tropical agriculture until September, 1998.

- Development of techniques for environmental control by using plants and microorganisms specific to the tropics and subtropics
  **El Khawas Hussein** (Egypt)
  **Wang Bujun** (China)

- Studies on the mechanism of heat tolerance of tropical and subtropical crops
  **Liu Jian** (China)
  **Yakubov Bakhtiyor** (Uzbekistan)

- Identification and evaluation of salt-tolerant crops
  **Safdar Hussain Shah** (Pakistan)
  **Li Chengyun** (China)
  **Sumanasinghe Vithanaarachchige Ariyawanse** (Sri Lanka)
  **Masood M. Shahid** (Pakistan)

- Evaluation and development of long-term conservation techniques of genetic resources of vegetatively propagated crops in the tropics and subtropics
  **Narinder Pal Singh Dhillon** (India)

*Photo: JIRCAS visiting research fellows outside the Okinawa Subtropical Station.*

**Dr. Iwao Watanabe**, Biological Research Division was appointed as Deputy Director General of the Food and Fertilizer Technology Center in Taipei. He is going to assume the post from April 7, 1998. Dr. Watanabe has worked as senior researcher in the field of plant physiology and cultivation management for the Tropical Agriculture Research Center and JIRCAS since 1990. During this time, he was based at the International Institute for Tropical Agriculture for the collaborative research on drought tolerance in cowpea from 1990 to 1992. Dr. Watanabe received an award from the Japanese Society of Tropical Agriculture on March 27, 1998 for his research at IITA (related article in Research Highlights). The award is given to a researcher in recognition of his contribution to agricultural research for the tropics.

*Photo: Dr. I. Watanabe with Mr. Akin at IITA Kano station, Nigeria.*

**Dr. Akinori Noguchi**, a food scientist, became Director of JIRCAS's Crop Production and Postharvest Technology Division on March 1, succeeding Dr. Koji Kawashima who became Professor at Seitoku University. Dr. Noguchi worked as a Research Coordinator for China in JIRCAS's Research Information Division (1996-1998) after carrying out studies at the National Food Research Institute as the Head of Food Engineering Laboratory.

*Photo: Dr. A. Noguchi, new Director of Crop Production and Postharvest Technology Division, JIRCAS.*

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