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* *Editorial Board members, with the exception of Jonathan J. Tew, are staff members present as of August 1, 2003 (FY 2003)*

Message from the President

President
Dr. Mutsuo Iwamoto

I highly value my appointment on April 1st, 2003 as President of the Japan International Research Center for Agricultural Sciences (JIRCAS), and look forward to building upon our strong tradition of scientific research and achievement. JIRCAS and its predecessor, the Tropical Agricultural Research Center (TARC), have made substantial contributions to the mitigation of many challenging and significant world problems in the areas of agriculture, forestry, and fisheries by conducting cutting-edge scientific research and development. We continually strive to create new systems and technologies that address the hunger, malnourishment, and declining living standards that afflict many rural populations in developing regions, while not compromising or neglecting the environment; JIRCAS research programs exemplify how human and environmental interests can be balanced without sacrificing results. In this new era of increased globalization, urbanization, and population growth, rapid changes have necessitated that agricultural productivity be both sufficient to meet growing demand and environmentally sustainable. As a result, research institutions and organizations must be highly responsive, adaptable, and network oriented. Our status as an Incorporated Administrative Agency (IAA) provides us with the administrative autonomy and independence that enables us to be such a flexible organization, and in 2002, we have continued to build upon and strengthen our tradition of scientific achievement and industrial application.

Background

More than 800 million people currently suffer from hunger and malnourishment, and more than 10 million children starve to death each year. These alarming figures are only expected to increase, for the world population is predicted to nearly double by the year 2050, and the already limited area of arable land decreases yearly with the rapid progress of industrial development. Such development, in conjunction with urban growth, has caused serious resource problems in unexpected regions such as Monsoon Asia, where areas once abundant with water supplies are now plagued by severe water shortages. The International Food Policy Research Institute and International Water Management Institute have raised concerns that approximately 350 million tons of cereal production, which exceeds the amount produced by the United States, could be phased out by 2025 if appropriate measures for water resource management are not implemented.

To make these problems manageable, the production of principal crops such as rice, wheat, and corn, as well as vegetable varieties rich in micronutrients and vitamins must be made more efficient. Yet attempts to intensify agriculture and increase productivity have resulted in unexpectedly severe environmental problems and productivity declines. Recently we have witnessed such problems as the deterioration and desertification of natural grasslands, outbreaks of soil-borne diseases such as sudden death syndrome, severe incidences of clubroot disease, and the devastation of aquacultural production by infectious disease. These problems, compounded by comparatively poor rural incomes, encourage farmers to abandon agriculture and seek better lifestyles in the cities, a trend that is exacerbating already plummeting self-sufficiency rates. It is against this background that JIRCAS has formulated its research strategies and policies for promoting international research collaboration.

Agriculture, forestry and fisheries in Japan

JIRCAS's research and development is also applicable to the agricultural situation of Japan. Japan's self-sufficiency rate in terms of caloric intake has declined from over 70 percent 30 years ago to 40 percent today, the lowest percentage of any major industrialized nation in the world. Such a situation has resulted from the gradual westernization of Japanese dietary habits, the increase in imports of low-price agricultural products, including wheat, soybean, corn, and feed, and the emphasis placed on producing agricultural commodities that foster comparative advantage. Targeting this problem, the Japanese government implemented a program to reach a 45% self-sufficiency rate by 2010 as outlined in legislation enacted in 2000 (Basic Law on Food, Agriculture, and Rural Areas). Low self-sufficiency rates make Japan dependent upon agricultural commodity imports, which in turn affects world-wide materials cycling, causing large quantities of nitrogen and phosphorus to accumulate in the Japanese archipelago. As a result, lakes, as well as seas and underground water, have become polluted. The government's heightened concern over this environmental threat has led to the enactment of stricter regulations against imports, and attempts will be made to bolster domestic production and promote agricultural technologies that can recycle and reutilize organic wastes. Considering the current stage of agriculture, forestry, and fisheries production in Japan and trends of consumption, it is

imperative that steadfast efforts be made to achieve these goals. In addition, the global situation outlined above makes it even more necessary for Japan to make significant contributions towards increasing world food productivity through research collaboration. JIRCAS believes that world food supply and environmental problems are inexorably linked to Japan's own domestic problems, and we thus place primary emphasis on conducting international research activities.

Research activity at JIRCAS

JIRCAS research divisions receive numerous requests from institutions in developing countries to pursue collaborative research projects in order to help enhance their overall quality of research, often through the implementation of biotechnological applications. In fact, JIRCAS and TARC have conducted substantial research projects with developing countries for more than thirty years, forging strong relationships with international research centers, including those affiliated to the Consultative Group on International Agricultural Research (CGIAR). Due to the significance of global food, environmental and energy problems and their relevance to the food security of Japan itself, we are currently building on our commitment to international cooperation by conducting collaborative work with numerous organizations and universities throughout Southeast Asia, China, Africa and South America, as well as other regions.

In accordance with this research, we are also developing and implementing novel research methodologies. Since most agriculture, forestry and fisheries activities in developing countries are operated on a family basis, we believe it to be essential that a field-based approach be applied to the R&D and technology application processes. Farmers in these regions often depend upon multiple sources of income, and thus their particular socioeconomic circumstances must be understood at the family level. A field-based approach enables researchers to develop 'farmer-specific' technologies that will significantly impact food production and have considerably longer sustainability because they are tailored directly to individual farmer needs. In conjunction with this approach, JIRCAS is implementing a more comprehensive and integrated research methodology that encompasses the entire production-consumption chain, from crop grading, drying and packaging to secondary processing, storage, marketing and distribution. An incredible 20 to 30 percent of production is lost in the post-harvest stages due to insect infestation, handling, transportation and storage, and thus even a 10% reduction would have substantial ramifications for reducing hunger and malnourishment. It is thus our hope that by implementing these new methodologies and building upon our unique history of global collaboration and scientific achievement that our determined efforts will continue to address the most daunting problems afflicting agriculture, forestry and fisheries.

JIRCAS Main Building.

Note about Annual Report 2002

In keeping with past efforts to highlight JIRCAS activities in particular areas of the world, Annual Report 2002 will feature descriptions of our ongoing programs with research organizations in Thailand. JIRCAS has a long history of successful research with various institutions and universities in Thailand, and during the past 35 years, more than 1500 scientists have been dispatched to conduct projects there. JIRCAS has recently concluded a seven-year project to develop sustainable farming systems by improving local-farmer transferable, agricultural technologies for crop and livestock production. We hope to place a special emphasis on that effort in Annual Report 2002, as part of our desire to continually improve the transparency of our research activity in accordance with our IAA status. However, while JIRCAS has conducted an impressive number of joint projects with various Thai organizations, we also conduct research in partnership with institutions in many other parts of the world. It is our hope that the full extent of JIRCAS's international research programs will be evident in Annual Report 2002.

President
MUTSUO IWAMOTO

HIGHLIGHTS FROM 2002

During Fiscal Year 2002, the Japan International Research Center for Agricultural Sciences (JIRCAS) made a number of strides in its overall efforts to improve world food security. As an Incorporated Administrative Agency (IAA), JIRCAS held a number of evaluation meetings to share and discuss the progress being made in various projects. We are pleased to highlight these activities and achievements in greater detail.

IMPORTANT NEW DEVELOPMENTS

In-house and government evaluation of JIRCAS's performance in Fiscal Year 2002

An incorporated administrative agency (IAA), formerly referred to as an independent administrative institution (IAI), is obligated by the Japanese Government to evaluate its own performance in order to better direct future research strategies and objectives. Each fiscal year, JIRCAS prepares an Annual Plan in order to achieve the research goals laid out in a five-year Mid-Term Plan approved by the Ministry of Agriculture, Forestry and Fisheries (MAFF). In order to assess performance based on the Annual Plan, an in-house evaluation system has been established that incorporates both internal and external analyses as part of a two-step review process. During the internal review process, all research and administrative activities are evaluated by JIRCAS staff, the results of which are further evaluated by the nine members of the external evaluation committee appointed by the president of JIRCAS.

During December 19 to January 11 of Fiscal Year 2001, JIRCAS's first year as an IAA, each research division evaluated its international collaborative projects, and staff members of the Administration Division and Research Planning and Coordination Division assessed managerial and administrative performance, both prior to the internal and external review processes. As specified in the Annual Plan for 2001, the results of these appraisals were summarized on two forms (Form 1 for managerial and administrative operations; Form 2 for research and achievements), and then submitted for internal review on February 1, 2002. The conclusions of the internal review were then submitted for external evaluation to be carried out on March 26 and 27. Following a few modifications recommended by the external review, the in-house evaluation process was completed.

As the performance of each IAA is evaluated by the Japanese government each

JIRCAS senior administrators pose for a group photograph at the JIRCAS front entrance. Front row: K. Nakajima, N. Kikuchi, Y. Morooka, M. Iwamoto, K. Kato, A. Noguchi, M. Suzuki. Back row: Y. Fukuda, T. Taniguchi, T. Hayashi, O. Ito, O. Koyama, R. Ikeda. Absent: A. Fujimoto.

fiscal year, the in-house evaluation report for 2001 was prepared and submitted to the Ministry of Agriculture, Forestry, and Fisheries (MAFF) Evaluation Committee at the start of Fiscal Year 2002. JIRCAS's performance received an evaluation of "A," denoting the successful achievement of more than 90% of the planned objectives expressed in the 2001 Annual Plan. At the same time, JIRCAS was provided with several recommendations to further strengthen research activity in Fiscal Year 2002, and strategies and objectives have been incorporated along these lines.

Evaluation of research staff activity

In order to enrich and improve research activity in 2002, research staff, of which approximately half are stationed on long-term or short-term assignments in counterpart research institutes abroad, were systematically and thoroughly evaluated during 2001. Since both domestic and international research assignments can carry substantial administrative duties as well, the evaluation system takes into account both research and administrative achievement in context of the significance of each undertaking. In total, about 90 research staff members were evaluated in 2002 with the following results: exceptional, 12 percent; excellent, 20 percent; and good, 68 percent. Directors of each division and the Okinawa Subtropical Station make use of these results in order to supply guidance to their research staff, and thereby further vitalize JIRCAS's research activities.

Mid-term evaluation meeting for the project "Development of agroforestry technology for the rehabilitation of tropical forests"

JIRCAS held a mid-term evaluation meeting for the project "Development of agroforestry technology for the rehabilitation of tropical forests," in Tsukuba on November 14, 2002. A meeting relating to this research project, which began after the signing of a Memorandum of Understanding (MOU) with the Forest Research Centre in Sabah on December 10, 2001, was conducted to evaluate the progress of the project and examine future research strategies.

The project review committee consisted of five scientists: Dr. Minoru Kumazaki, President of the Gifu Academy of Forest Science and Culture; Dr. Fujio Kobayashi, Chairman of the Japan Forestry Association; Mr. Hideki Miyagawa, Director of the Forestry and Natural Environment Cooperation Department, Japan International Cooperation Agency (JICA); Dr. Yoshiya Tadaki, Director of the Ecological Research Center, PREC Institute Inc.; and Dr. Mitsuyoshi Yatagai, Professor, Graduate School of Agriculture and Life Sciences, the University of Tokyo.

Reviewers at the mid-term evaluation meeting for the project "Development of agroforestry technology for the rehabilitation of tropical forests".

After an overview of the project by Dr. Kiyoshi Nakashima, Director of JIRCAS's Forestry Division, Japanese scientists presented research accomplishments attained thus far, as well as prospective research strategies and objectives. The reviewers provided favorable comments, and then suggested that additional studies should be implemented on location-specific cash crop mechanisms, and how the production-consumption chain could be improved to address the needs of rural farmers. Along these lines, it was advised that a systematic survey be conducted on actual intercropping systems used by farmers in Java or Sumatra. The question was also raised as to how technological innovations could reduce cultivation costs for mushrooms, and how such technology would be transmitted to local farmers. In conclusion, the reviewers recommended that JIRCAS and the FRC increase research ties and publish the results of the project in a textbook entitled, "Good examples of agroforestry," which could be

disseminated during future workshops in order to exchange ideas with local inhabitants.

Mid-term evaluation meeting for the project "Studies on sustainable production systems of aquatic animals in brackish mangrove areas"

On December 2-3, 2002, JIRCAS and the Department of Fisheries, Malaysia jointly held a workshop and a midterm evaluation meeting for the international comprehensive project entitled "Studies on sustainable production systems of aquatic animals in brackish mangrove areas" in Penang, Malaysia. The workshop promoters, Dato' Hashim Ahmad, Director General of the Fisheries Department, Malaysia and Dr. Takahiro Inoue, former JIRCAS President, welcomed the participants, and continued with a 12-subject presentation, after which rigorous and thorough discussion was carried out. At the culmination of the workshop, a midterm evaluation meeting was held, and Professor Emeritus, Fumitake Seki of Tsukuba University announced the results of the review committee. Participating in the workshop and midterm evaluation meeting were 35 members of the following nine institutions: JIRCAS, Malaysia's Department of Fisheries and Aquaculture Research Center, Thailand's Kasetsart University, the Philippines' Southeast Asian Fisheries Development Center, Aquaculture Department (SEAFDEC/AQD), the World Fish Center, Japan's Fisheries Research Agency and Forestry and Forest Products Research Institute, and the University of Malaya.

During the workshop, sub-projects entitled, "Studies on the ecology of juvenile grouper in brackish mangrove areas," "Phosphorus absorption mechanisms of mangrove forests," "Distinctive fatty acid accumulation in tropical aquaculture fishes," and "Shedding light on the viruses that cause mass mortality in tropical aquaculture" all received high evaluations from the participants. Regarding the direction of future research, it was agreed that the sub-projects entitled, "Economic and business evaluation of sustainable culture industries," "Status of the aquacultural production industry in mangrove forest areas," "Elucidating the humification mechanisms of microorganisms," as well as "Research on benthic feeds," should be strengthened. Toward this end, research strategies and objectives until 2005 were further delineated and defined.

Final evaluation meeting and workshop for the project "Comprehensive studies on the development of sustainable agro-pastoral systems in the subtropical zone of Brazil"

A workshop and final evaluation meeting for the JIRCAS project entitled "Comprehensive studies on the development of sustainable agro-pastoral systems in the subtropical zone of Brazil" was held in Tsukuba on March 18-19, 2003 in order to review the results of the project and discuss future research opportunities regarding agro-pastoral systems in Brazil.

The subtropical region of Brazil is a location of continuous, large-scale field crop production and extensive cattle grazing, and as such, is critically important to the economy of Brazil and the food supply of South America. Since the majority of fertile land has received minimal inputs, agricultural

Participants in the mid-term evaluation meeting for the project "Studies on sustainable production systems of aquatic animals in brackish mangrove areas" pose for a group photograph.

production in this region has been increased primarily by aggressively expanding the cultivation of arable land. As a consequence, much of the region has become environmentally vulnerable and its productivity has fluctuated significantly due to crop growth retardation, outbreaks of diseases and pests, and soil erosion.

The aforementioned project was initiated in 1996 to develop productive yet sustainable farming systems in environmentally degraded areas, and was conducted in collaboration with the National Beef Cattle Research Center (EMBRAPA Gado de Corte) in Campo Grande, Mato Grosso Do Sul, Brazil. For the evaluation meeting, JIRCAS invited the following individuals to serve as commentators: Dr. Peter C. Kerridge, former Coordinator of the International Center for Tropical Agriculture (CIAT)-Asia; Prof. Kazuo Kawano, Kobe University; Prof. Makie Kokubun, Tohoku University; and Dr. Muneo Oikawa, Director of the Research Division, Japan Grassland Farming Forage Seed Association.

Former JIRCAS President Dr. Takahiro Inoue initiated a workshop to precede the evaluation meeting with an opening address, and Dr. Marcio C.M. Porto, Head of the Secretariat for International Cooperation, EMBRAPA gave a keynote address on the importance of agro-pastoral systems in Brazil. Thirteen papers were presented in two sessions and approximately 50 scientists from Brazil and Japan participated in the workshop.

Following the workshop, Dr. Akinori Oshibe, International Research Coordinator and the coordinator of this project, outlined the relevance of the research project to the evaluators, after which Dr. Taniguchi, Director of the Animal Production and Grassland Division, summarized the major outputs and future problems related to the project goals. It was determined that agro-pastoral systems effectively improved the productivity of continuous cropping using soybeans, as well as animal productivity on pastures. In addition, it was discovered that the maintenance of soil nitrogen fertility, along with adequate grazing frequency, are critical for the sustainability of agro-pastoral systems. Concluding his remarks, Dr. Taniguchi reported that the physiological characteristics of grasses will provide useful information for genetically improving tropical grasses so that they can be adapted to low nutrient soils. Subsequent to the presentation of project results, the project leaders suggested that further evaluation of agro-pastoral systems on soybean farms should include on-farm participatory research focusing on crop and livestock productivity, as well as an economic survey. Dr. Oshibe proposed that the following three follow-up research projects should be conducted: 1) "Identification of genetic stocks of *Brachiaria humidicola* with high levels of nitrification ability;" 2) "On-farm research on agro-pastoral systems;" and 3) "Nutrient cycling in agro-pastoral systems."

At the final stages of the meeting, favorable comments and recommendations were received from all four reviewers. They emphasized the following points: 1) the three areas suggested for follow-up research were well-selected and will be supported by EMBRAPA and JIRCAS; 2) collaboration should be continued with the Brazilian scientists of the Beef Cattle Research Center, the Soybean Research Center of EMBRAPA, and the EMBRAPA-Agrobiology Center, CIAT; and 3) appropriate procedures for sharing results need to be implemented prior to the initiation of the projects.

Final evaluation meeting for the project "Improving food security in West Africa through increased productivity in rainfed rice systems"

On March 4, 2003, JIRCAS organized a final evaluation meeting in Tsukuba for the project "Improving food security in West Africa through increased productivity in rainfed rice systems." This five-year project was conducted in collaboration with the West Africa Rice Development Association (WARDA) in order to increase rice production through the improvement and dissemination of optimal rice varieties and cultivation technologies suitable for the region.

During the final evaluation meeting, project achievements and research outputs were reviewed and discussed, after which each member of the review committee provided a written evaluation report. WARDA, as the host organization of the project, also provided a written assessment of the results. The project review committee consisted of five members: Prof. Ryuichi Ishii, Nihon University; Prof. Keijiro Otsuka, National Graduate Institute for Policy Studies; Mr. Masataka Minagawa, Sasakawa Africa Association; Mr. Shigenari Koga, Japan International Cooperation Center; and Dr.

Hiroshi Nemoto, National Institute of Crop Science.

To achieve the project goals, research was organized along the following two themes: 1) genetic and ecophysiological characterization of indigenous upland rice varieties and inter-specific progenies (*Oryza sativa* × *Oryza glaberrima*), with an emphasis placed on tolerance to drought and acidic soil conditions; and 2) socioeconomic studies on the effective utilization of rainfed lowlands for rice cultivation in West Africa.

During the project, WARDA developed the first ever NERICA (New Rice for Africa) varieties through inter-specific hybridization, which were quickly disseminated throughout the region. JIRCAS was not directly involved in the dissemination procedure, but provided the basic data and scientific information that will contribute to WARDA's efforts to further improve and disseminate NERICA varieties.

Unfortunately, the project did experience considerable difficulty in pursuing its research during 2002 due to the deteriorating security situation in Côte d'Ivoire following the internal disturbances that took place during September. Although the objectives of each research theme could not be completed, each research theme, as well as the personal effort exerted by the researchers, was given high reviews from the research committee.

Reviewers also pointed out that JIRCAS should continue to collaborate with WARDA on basic research and technology development in order to accelerate the expansion of NERICA varieties in Africa. Although this project was terminated at the end of March 2003, JIRCAS continues to collaborate with WARDA aiming to complete the project's originally planned research objectives.

Final evaluation meeting for the project "Evaluation and improvement of regional farming systems in Indonesia"

JIRCAS held a final evaluation meeting for the research project entitled "Evaluation and improvement of regional farming systems in Indonesia," on February 26, 2003 at its Tsukuba premises. The project, conducted with the Agency for Agricultural Research and Development (AARD), Indonesia was reorganized significantly three years prior to its culmination in order to incorporate suggestions provided during the mid-term evaluation meeting of 2000. As a result, the focus of the project became the evaluation of vegetable-based farming systems and the improvement of vegetable and fruit cultivation in the highland regions of West Java.

The review committee consisted of Dr. Ken Menz, Australian Centre for International Agricultural Research (ACIAR), Australia; Dr. Haruo Inagaki, former Director of the Economic and Social Commission for Asia and the Pacific (ESCAP) CGPRT Centre, Indonesia; Prof. Koji Tanaka, Kyoto University, Japan; and Mr. Ryozo Hanya, Japan International Cooperation Agency (JICA), Japan. In addition, representatives from JIRCAS's Indonesian counterpart institute, including Dr. Joko Budianto, Director General, Agency for Agricultural Research and Development (AARD) were in attendance.

The meeting was chaired by Dr. Yoshinori Morooka, JIRCAS Vice-President, and after the opening address was delivered by Dr. Takahiro Inoue, the former President of JIRCAS, Dr. Osamu Ito, Director of JIRCAS's Crop Production and Environment Division introduced the methods used to evaluate the project. The project leader, Mr. Osamu Koyama, Director of JIRCAS's Development Research Division reported the research outputs briefly, initiating a lively discussion among the participants, particularly on the mutual benefits and implications of the research outputs.

To conclude the meeting, Dr. Inagaki, committee chief, summarized the opinions of the evaluators, remarking that the project had produced substantial results covering a wide range of physical, biological, ecological and economic areas, but that it had been a little ambitious in attempting to elucidate the aspects and conditions of farming and marketing systems in their entirety. He also recommended that the research results should be disseminated in a timely manner to counterpart institutes to facilitate further research on pertinent topics facing Indonesia.

NEW RESEARCH COLLABORATION

New MOU initiated in Fiscal Year 2002

JIRCAS, and its predecessor, the Tropical Agricultural Research Center (TARC), and the Forest Research Institute of Malaysia (FRIM) have a substantial history of bilateral research collaboration from 1971. Upon expiration of a previous Memorandum of Understanding (MOU) in March 2002, the MOU with FRIM was renewed after a series of discussions.

As the development of sustainable forestry management systems for tropical forests is urgently required, JIRCAS and FRIM have agreed to collaborate in the planning and implementation of projects related to the "Sustainable management of tropical forests." Dr. Takahiro Inoue, former President of JIRCAS and Dr. Abdul Rasak Mohd, Director General of FRIM thus signed and renewed the MOU at FRIM on November 29, 2002 for a period of five years, concluding on November 28, 2007. A JIRCAS researcher specializing in forest hydrology has been dispatched to FRIM to research how the construction of logging roads and new harvesting methods that employ mobile tower yarder systems, might impact the environment.

Former JIRCAS president Dr. Takahiro Inoue and Forest Research Institute of Malaysia (FRIM) Director General Dr. Abdul Rasak Mohd sign a new MOU.

New project: Improvement of fertility of sandy soils in the semi-arid zone of West Africa through organic matter management

The semi-arid zone of West Africa is a region where harsh climatic conditions severely threaten food security. As a result, millet/sorghum-based farmers and cattle herders have come to cooperate in developing agro-pastoral systems that have been basic to the region for decades. However, recent population increases, compounded by inadequate soil management associated with climate change, have altered the agro-environmental resources of the region and are thereby endangering the sustainability of agriculture and livelihood of the people.

The soils in semi-arid, tropical Africa are mostly sandy, and have a minimal content of clay that serves as a nutrient-retaining medium. Low nutrient retention capacity is thus an intrinsic limiting factor of agricultural production in the region. In such soils, organic matter is important for soil fertility as a nutrient retention mechanism. Even when sufficient quantities of chemical fertilizers are applied, the maintenance of soil organic matter is important for preserving soil fertility. However, the efficacy and roles of organic matter in sandy soils of the semi-arid zone have not been sufficiently elucidated. Moreover, the sources of organic matter, such as crop residues and manure are very limited, which constrains the improvement of soil fertility through organic matter management. In order to address this problem, JIRCAS has initiated a five-year project in Niamey, Niger beginning in April 2003 in collaboration with the International Crops Research Institute for the Semi Arid Tropics (ICRISAT) and Kyoto University.

The main purpose of the project is to study the effects of organic matter on soil fertility by determining the structure and function of organic-inorganic complexes in sandy soils under semi-arid conditions. Since pressing agricultural problems in Africa have compelled scientists to focus on short-term solutions, fundamental research issues such as the dynamics and retention of organic nitrogen in soils, and the interaction between organic and inorganic fertilizers, have not been thoroughly addressed. Recently, it has been demonstrated that there are significant differences among crop species regarding

their ability to utilize different fractions of organic nitrogen in soils. Accumulating such fundamental information and knowledge could be useful for the purpose of developing rational fertility management systems in the region.

This project will also implement a systematic evaluation of plant genetic resources, with a particular emphasis placed on legume crops having efficient utilization capacities in agricultural systems. Indigenous and exotic plant genetic resources will be evaluated for characteristics related to soil fertility preservation, such as biomass production as a source of organic matter, solubilization of immobile nutrients, prevention of soil erosion, and nitrogen-fixing ability.

Based on the results of these research activities, improved systems and techniques for the sustainable management of natural resources and preservation of soil fertility in the region will be proposed and tested at actual farm sites in close collaboration with ICRISAT, Kyoto University, and other research institutes in the region.

Farmers taking a short break during millet sowing after the rain in early July, near Niamey, Niger.

ACADEMIC PRIZES AND AWARDS

JIRCAS is pleased to note that many of its staff members have been recipients of academic prizes and awards from scientific societies and other organizations. The following is a brief summary of achievements which we are proud to include in the Highlights of Annual Report 2002.

Dr. Toru Hayashi, Director of the Food Science and Technology Division received the **Award for Achievement in Technical Research of the Japanese Society for Food Science and Technology** for his work on "Soft-electron treatment of food." The award is given to individuals who have developed technologies carrying significant potential for industrial application. In his work, Dr. Hayashi proposed a novel technology to treat foods and agricultural products for the purposes of disinfection, disinfestation and sprout inhibition with soft-electrons (low-energy electrons). As a result, commercial scale equipment utilizing soft-electron technology has been developed and marketed, and is expected to serve as an alternative to chemical fumigation and spraying.

Dr. Kazuko Yamaguchi-Shinozaki, Senior Researcher in the Biological Resources Division received the **Tsukuba Prize of the Science and Technology Promotion Foundation of Ibaraki** in cooperation with Dr. Kazuo Shinozaki of the RIKEN Tsukuba Institute for their work on the identification of abiotic stress tolerance genes in plants and the development of plants tolerant to stresses induced by drought, high salinity, and cold temperatures. In their work, many tolerant genes were isolated and investigated for their role on the regulation of gene expression and signal transduction in response to stress. They have utilized these genes to improve plants' stress tolerance through gene transfer, and this new biotechnology is expected to have important applications for increasing the productivity of many agriculturally important crops.

Dr. Marcy N. Wilder, Senior Researcher in the Fisheries Division received the **Minister's Prize of the Ministry of Education, Culture, Sports, Science, and Technology, Government of Japan** for her work on basic crustacean biochemistry and applied work in developing and promoting new freshwater prawn culture technology in Vietnam. The award is given to individuals who have conducted scientific research at the highest academic level, have demonstrated the applications of that research to relevant industries, and have thereby already substantially impacted society and the economy. Dr. Wilder has elucidated the full amino acid sequence (primary structure) of yolk protein in important prawn species, and has thereby developed new technology for evaluating the reproductive capability of female spawners used in aquaculture operations. In addition, Dr. Wilder's work, in cooperation with Cantho University, led to the development of freshwater prawn seed production technology adapted to the needs of the Mekong Delta; this technology has been transferred throughout the Mekong Delta, and is contributing to the further development of the freshwater prawn culture industry in Vietnam.

Dr. Hidekazu Sasaki, Senior Researcher in the Biological Resources Division, received the **Japanese Society for Horticultural Science Award for the Encouragement of Young Scientists** on April 4, 2003. The award is given to societal members who are responsible for significant research achievements that will facilitate future progress in the area of horticultural science. In his work, Dr. Sasaki investigated the acquisition and loss of freezing tolerance in cabbage (*Brassica oleracea* L.) and elucidated the short-term mechanisms of de-acclimation in cabbage grown in fields during winter. In addition, Dr. Sasaki examined the relationship between freezing tolerance and sugar accumulation, including sucrose metabolizing enzymes, which revealed the importance of the de-acclimation of plants. Utilizing his research findings, Dr. Sasaki has made substantial contributions to the development of new countermeasures for plant damage caused by frost and freezing temperatures.

RESEARCH STRUCTURE AND EVALU

Research Structure at JIRCAS

JIRCAS is located in the Tsukuba Science City, approximately 60 km northeast of Tokyo. Many of the Incorporated Administrative Agencies (IAAs) affiliated to the Ministry of Agriculture, Forestry and Fisheries (MAFF) are also located in Tsukuba, which itself is home to numerous other national, private and independent research institutions and experimental facilities.

JIRCAS currently has 162 staff members, including research scientists and administrators. Thirty-four of these staff members are located at the JIRCAS Okinawa Subtropical Station on Ishigaki Island in the southernmost region of Japan. JIRCAS is headed by a President and Vice-President, in addition to an Executive Advisor and Auditor who oversee the utilization of institutional funding and all matters related to budgeting and finance. The Research Planning and Coordination Division oversees seven research divisions which are comprised of the Development Research Division, Biological Resources Division, Crop Production and Environment Division, Animal Production and Grassland Division, Food Science and Technology Division, Forestry Division, and Fisheries Division, as well as the five laboratories of the Okinawa Subtropical Station. The Administration Division is responsible for general administrative affairs. JIRCAS's organizational structure is delineated in Fig. 1.

Research Planning and Coordination Division

The Research Planning and Coordination Division itself does not act as a research division, but rather serves to oversee and support the activities of the seven Research Divisions and the Okinawa Subtropical Station. The Division consists of four sections: the Research Planning Section, Research Coordination Section, International Relations Section, and Publication and Documentation Section. In addition, several International Research Coordinators and a Public Information Officer are assigned to the Division.

In order to promote the implementation of research programs both overseas and in Japan, the first three sections listed above are responsible for the overall planning of JIRCAS research projects, dispatching of researchers on long- or short-term bases, implementation of programs for the invitation of researchers and administrators, and liaison and coordination with international and domestic institutions and agencies. The Publication and Documentation Section is responsible for the collection, classification and provision of bibliographic materials from both overseas and domestic sources, as well as the release of public relations materials. The International Research Coordinators are responsible for overseeing JIRCAS's comprehensive projects, such as those relating to China, South America, and Africa. The Public Information Officer oversees the planning, revision and release of all JIRCAS publications and is responsible for promoting public understanding of the institution's research activities. In addition, the Division is responsible for coordinating the organization of various meetings and workshops including JIRCAS's International Symposia.

Administration Division

The Administration Division consists of three sections: the General Affairs Section, Accounting Section, and Overseas Staff Support Section. The General Affairs Section is responsible for the management of official documents, personnel-related matters and social affairs pertaining to JIRCAS staff. The Accounting Section handles overall accounting, auditing, budgeting, settlements, and wage distribution. The Overseas Staff Support Section is in charge of all matters pertaining to JIRCAS's overseas operations, including general international affairs, overseas expenditures, and overseas shipments of equipment and materials.

Other

The Okinawa Subtropical Station has a General Affairs Section that is overseen by the aforementioned Administration Division (Fig. 1). Additionally, JIRCAS has two field management sections that oversee JIRCAS's experimental fields; one section is directly under the Okinawa Subtropical Station management, and the other is attached to the Research Planning and Coordination Division.

ATION AT JIRCAS

Fig. 1. JIRCAS organizational structure

Domestic institutional support of JIRCAS international collaborative research

JIRCAS's primary mission is to promote sustainable development of agriculture, forestry and fisheries compatible with preservation of the environment in developing regions of the world through integrated, collaborative research programs. Towards this objective, JIRCAS endeavors to play an active role in the international research community. Its collaborative projects in developing countries adopt a multi-disciplinary approach including the evaluation of socio-economic conditions in the target countries. In this way, JIRCAS and its counterpart specialists carry out "comprehensive research" in an effort to address the region's most urgent and important agricultural issues. Domestic research at JIRCAS in Japan, the JIRCAS visiting fellowship program, and cooperation with international research institutions all contribute towards and support these overseas research efforts.

To orchestrate a project, JIRCAS first systematically collects and analyzes data from a variety of sources including food supply and agricultural research in developing regions and then proposes international collaborative research strategies and policies tailored to the specific needs of the target country. In this capacity, by devising comprehensive research and policy proposals, JIRCAS essentially functions as a think tank. Next, JIRCAS utilizes existing technologies, policies and research to expand its role into the initiation of research programs to effectively confront such pressing matters as sustainable agricultural development, food security and environmental problems. Currently JIRCAS is conducting 10 comprehensive projects around the world in countries and regions such as Southeast Asia, China, South America, and Africa. Each project is guided and administered by a working group generally composed of the participating scientists, international research coordinators, and JIRCAS directors, who make the necessary adjustments as the project evolves.

JIRCAS maintains a formal staff of over 100 researchers, approximately 40 of whom are on long-term research assignments abroad. In addition, JIRCAS's international collaborative research projects receive substantial support from the Ministry of Agriculture, Forestry and Fisheries' seven other affiliated Incorporate Administrative Agencies (IAAs) and their 2,700-strong research staff. For example, when a project requires additional human resources, JIRCAS can request the dispatch of researchers from other IAAs on short-term bases typically lasting 1-2 months. JIRCAS researchers who are not on long-term assignments abroad are located in Tsukuba and at the Okinawa Subtropical Station; these staff support international collaborative projects by conducting project-related domestic research that cannot be accomplished in the target countries.

Finally, JIRCAS conducts an "Annual Meeting for the Review and Promotion of Research for International Collaboration" with the participation of representatives from MAFF, other MAFF-affiliated IAAs, universities, non-governmental organizations (NGOs), and the private sector, in order to ensure the efficient implementation of each project. At this meeting, the previous year's activities are evaluated and new strategies and goals are established for the coming year.

JIRCAS as an Incorporated Administrative Agency

On April 1, 2001, under the Government of Japan's administrative reform facilitating the reorganization of government-affiliated research organizations, the Japan International Research Center for Agricultural Sciences (JIRCAS) became an Incorporated Administrative Agency (IAA) under the supervision of the Ministry of Agriculture, Forestry and Fisheries (MAFF).

The most distinctive feature of an IAA is its semi-autonomy, with limited prior control from external authorities and an *ex post facto* evaluation system by which it evaluates its own performance. The results of the evaluation are then applied to subsequent activities. Under this new system, MAFF defined JIRCAS's five-year mid-term objectives in April 2001, including the enhancement of research efficiency and the improvement of the quality of research programs and financial performance. Based on these objectives, JIRCAS drafted and implemented a detailed five-year plan (see Mid-Term Plan and in-house evaluation system below and Appendix).

The performance and budgeting management of research activities conducted by JIRCAS will periodically undergo evaluation by the IAA Evaluation Committee

established within MAFF, which is composed of experts from the private sector, universities and other research organizations. During each fiscal year, the Committee will investigate and analyze progress towards achieving the mid-term objectives, and the results of this evaluation will be applied, as necessary, to structural modifications of operational and financing systems for subsequent fiscal years.

The comprehensive assessment of JIRCAS's performance will contribute towards the enhancement of the quality of research programs as well as towards more efficient utilization of financial resources for promoting collaborative research in developing regions. To meet the requirements of this rigorous evaluation, JIRCAS has established an in-house evaluation system, which is described in the following sections.

The Japanese government's basic concepts of science and technology evaluation

Under the 2001 "Science and Technology Basic Plan" which is reflected in the Japanese government's relevant policies, the Japanese community's acceptance of science and technology is extremely important. Research organizations that have become IAAs must clearly identify their research objectives and the implementation of research and development must be enhanced while utilizing funds in an efficient, cost-effective manner. IAAs are also responsible for explaining and communicating their performance both in research and administrative operations to the Japanese people through various information channels that are accessible to the public. To achieve these goals, it is necessary to establish an evaluation system that clearly defines the methodology and orientation of research activities in a manner that will meet public expectations.

Along these lines and in order for JIRCAS to accomplish its objectives, appropriate evaluation of the institution's research and administrative operations are to be conducted from quantitative and qualitative viewpoints based on an objective evaluation system.

JIRCAS Mid-Term Plan and in-house evaluation system

JIRCAS conducts its research activities based on mid-term and annual plans (Table 1), with the results and efficiency of outcome evaluated by the aforementioned IAA Evaluation Committee. This evaluation system is best characterized as a bilateral process by which feedback is exchanged between JIRCAS and the Committee.

As shown in Fig. 2, under JIRCAS's in-house evaluation system, individual research themes outlined in the Mid-Term Plan and

(con't on p. 22)

Fig. 2. JIRCAS In-House Evaluation System.

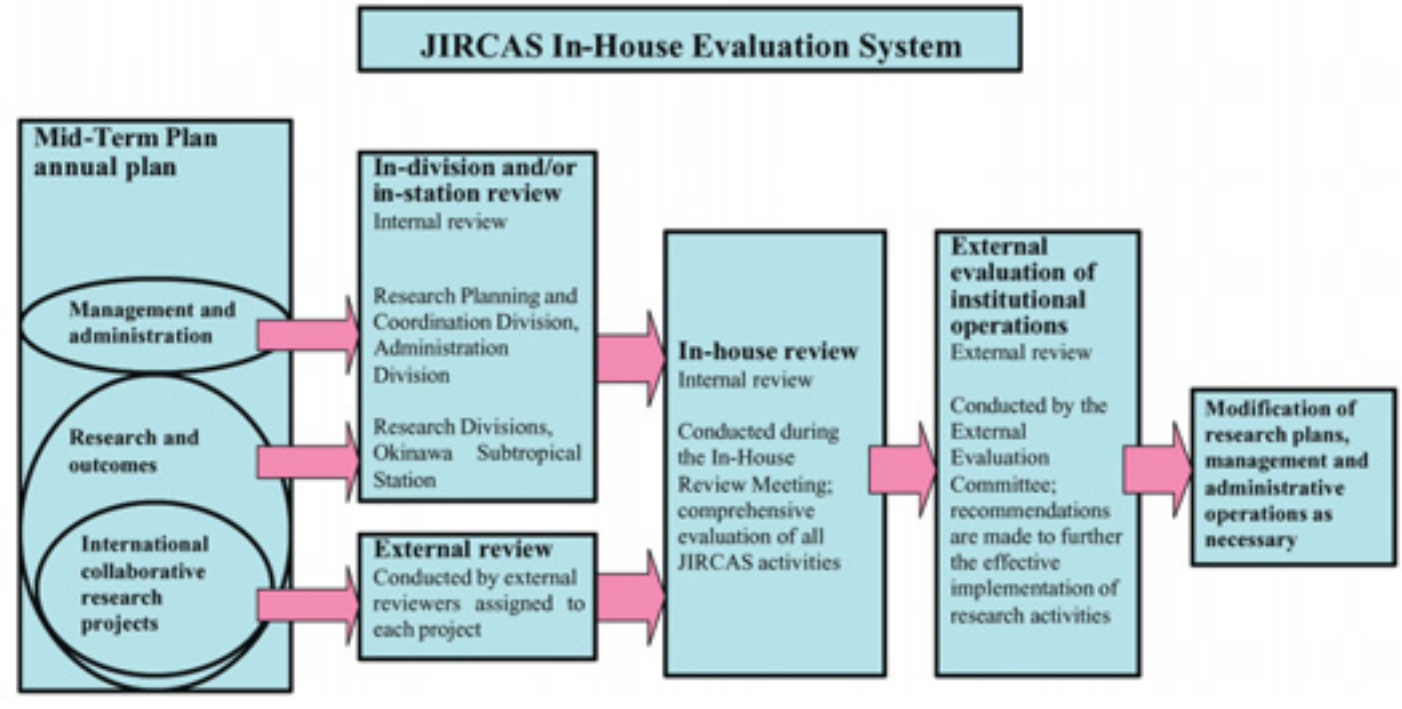

Table 1.

JIRCAS Mid-Term Plan (April 2001-March 2006) Experiments, research and investigations	INTERNATIONAL		
	Agro-pastoral systems in Brazil	Production and utilization of major food resources in China	
A. Improvement of food supply and demand in the developing regions			
1) World food supply and demand and collaborative research strategy			
(1) Analysis for JIRCAS research strategy building			
(2) World food supply and demand model, particularly in China		●	
2) Characteristics and direction of development related to food supply and the environment			
(1) Major constraints on development in Indonesia, West Africa, Vietnam, and other developing regions			
(2) Trends of development of sustainable farming systems in Indonesia, Vietnam, Thailand, South America, and other regions	●		
B. Research for sustainable development			
1) Sustainable production technology for agriculture, forestry and fisheries commodities in harmony with environmental preservation			
(1) Evaluation of nutrient cycling in diversified cultivated ecosystems and soil amelioration		●	
(2) Low input production technology for rice and upland crops in Thailand, Vietnam, China, Indonesia, South America, West Africa, and other developing regions	●	●	
(3) Major diseases and insect pests of rice, soybean, and other crops in Southeast Asia, South America, and China	●	●	
(4) Local forage resources suitable for agro-pastoral systems	●	●	
(5) Physiological characteristics of livestock and of prevalent animal diseases in Thailand, Vietnam, and other developing regions			
(6) Supplementary natural regeneration of valuable tree species in tropical forests			
(7) Environment-friendly methods of aquaculture for aquatic organisms			
2) Quality evaluation, distribution and processing of agriculture, forestry and fisheries commodities in developing regions			
(1) Quality parameters including appearance and aroma of food resources in Southeast Asia			
(2) Processing technology and prevention of quality deterioration of aromatic rice and other crops		●	

●							●	●	●						●				Soybean production and utilization in South America
								●					●						Rice production in West Africa
								●				●	●						Farming systems in Indonesia
●			●		●			●	●			●	●						Farming systems in the Mekong Delta
●	●												●						Reducing postharvest losses of staples in Southeast Asia
				●								●							Agroforestry technology for tropical forests
			●									●							Production systems in brackish mangrove areas
			●		●			●				●							Increasing economic options in rainfed agriculture in Indochina through efficient use of water resources
					●			●					●		●	●			DOMESTIC PROJECTS
●	●		●	●	●	●		●	●			●	●		●	●			DOMESTIC PROJECTS SUPPORTED BY MAFF
				●									●		●				**PROJECTS WITH OTHER GOVERNMENT AGENCIES**
							●	●							●				**COMMISSIONED RESEARCH AND MAFF SPECIAL RESEARCH ALLOTMENTS**

COLLABORATIVE RESEARCH PROJECTS

MISCELLANEOUS PROJECTS

Table 1.

JIRCAS Mid-Term Plan (April 2001-March 2006) Experiments, research and investigations	INTERNATIONAL		
	Agro-pastoral systems in Brazil	Production and utilization of major food resources in China	
(3) Uses for under-utilized wood resources such as oil palm residue			
(4) Uses for under-utilized aquatic resources in China		●	
3) Genetic resources and biological functions in developing regions			
(1) Genetic engineering and mechanisms of resistance to environmental stresses			
(2) Evaluation of resistance to disease and pests of rice, wheat and other crops, and development of breeding materials		●	
(3) Collection, evaluation and preservation of genetic resources of vegetables, fruit trees, and various crops in tropical and subtropical regions			
4) Environmental resources and bio-diversity in developing regions			
(1) Environmental resources related to agricultural production and land use	●	●	
(2) Regeneration of tropical forests and introduction of agro-forestry technology			
(3) Aquatic resources in coastal and brackish water mangrove ecosystems in Southeast Asia			
5) Research activities in Okinawa			
(1) Characterization of heat and salinity resistance of snap beans and rice			
(2) Evaluation and utilization of characteristics of sugarcane and root crops			
(3) Regulation of tree form and eating quality of fruits and mass propagation of tropical fruit trees including mango and papaya			
(4) Incidence of major pests and diseases, such as citrus greening disease, in the tropics and subtropics			
(5) Meteorological and soil factors which cause instability in crop production on tropical and subtropical islands			
(6) Adjustment of variations in heading traits for the generation advancement of rice, wheat, and other crops			

	COLLABORATIVE RESEARCH PROJECTS								MISCELLANEOUS PROJECTS			
	Soybean production and utilization in South America	Rice production in West Africa	Farming systems in Indonesia	Farming systems in the Mekong Delta	Reducing postharvest losses of staples in Southeast Asia	Agroforestry technology for tropical forests	Production systems in brackish mangrove areas	Increasing economic options in rainfed agriculture in Indochina through efficient use of water resources	DOMESTIC PROJECTS	DOMESTIC PROJECTS SUPPORTED BY MAFF	**PROJECTS WITH OTHER GOVERNMENT AGENCIES**	**COMMISSIONED RESEARCH AND MAFF SPECIAL RESEARCH ALLOTMENTS**
	●											
									●	●	●	
	●	●							●	●		●
									●			
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										●	●	
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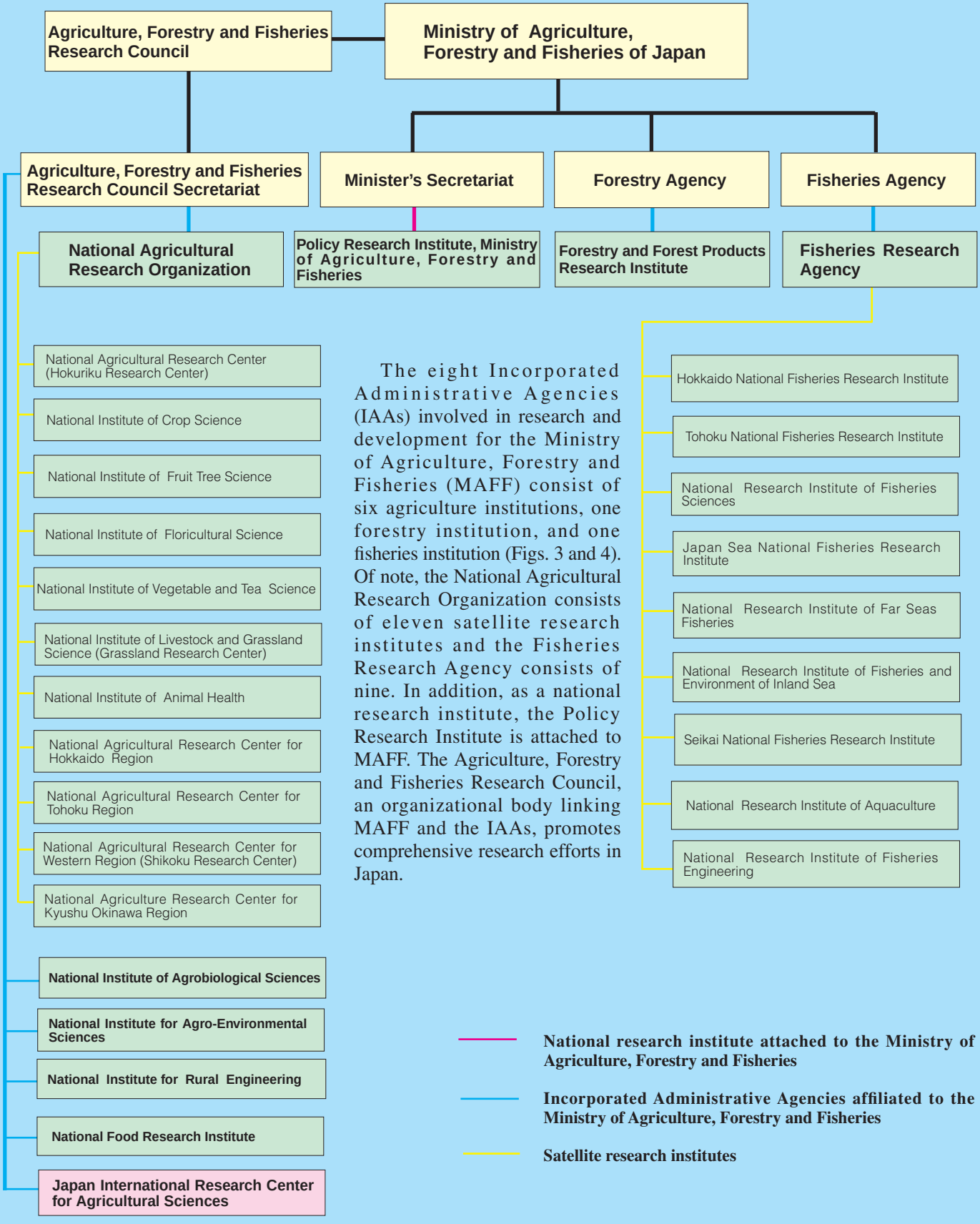
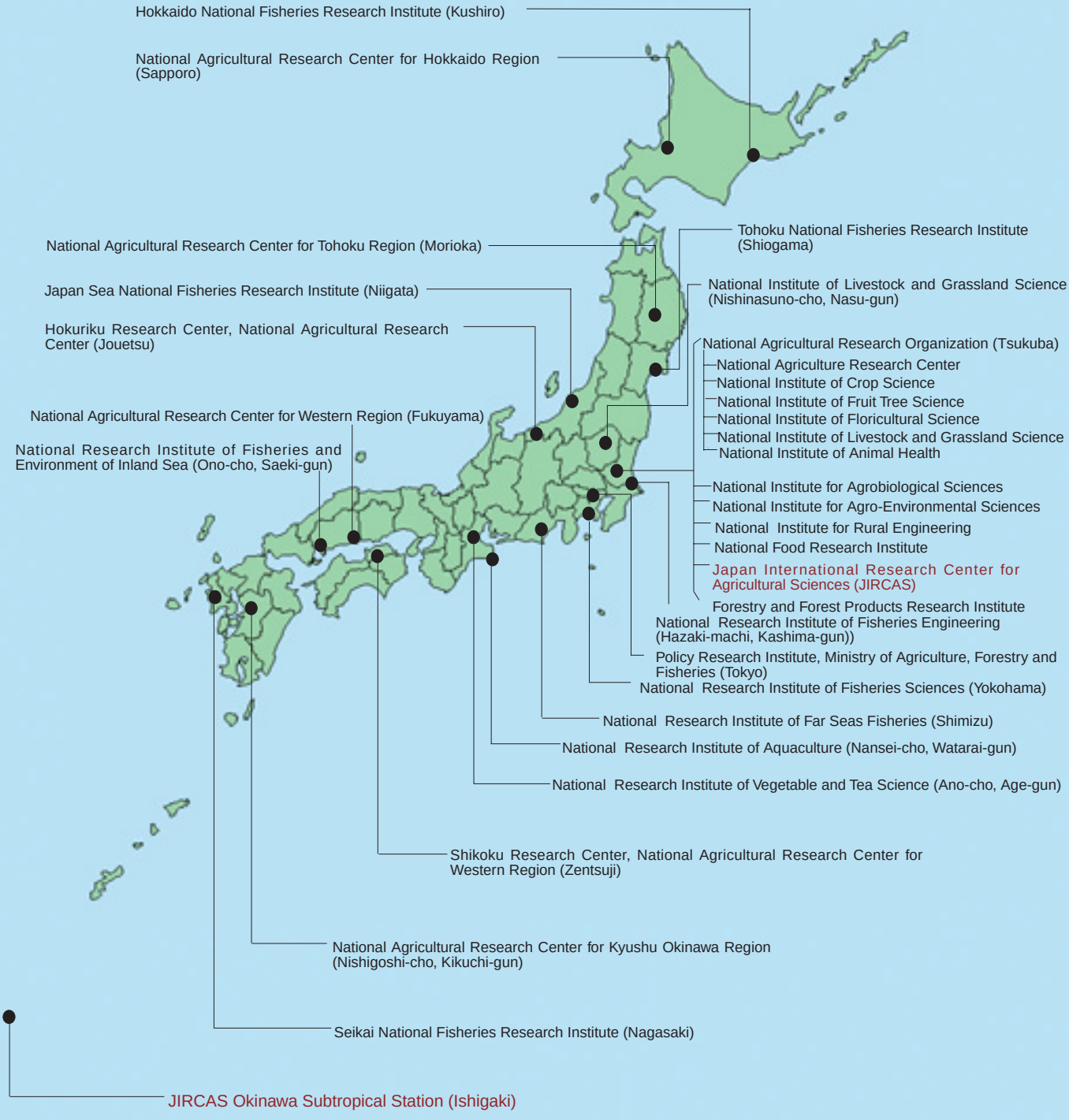
Fig. 3. Incorporated Administrative Agencies affiliated to the Ministry of Agriculture, Forestry and Fisheries



The eight Incorporated Administrative Agencies (IAAs) involved in research and development for the Ministry of Agriculture, Forestry and Fisheries (MAFF) consist of six agriculture institutions, one forestry institution, and one fisheries institution (Figs. 3 and 4). Of note, the National Agricultural Research Organization consists of eleven satellite research institutes and the Fisheries Research Agency consists of nine. In addition, as a national research institute, the Policy Research Institute is attached to MAFF. The Agriculture, Forestry and Fisheries Research Council, an organizational body linking MAFF and the IAAs, promotes comprehensive research efforts in Japan.

Fig. 4. Location Map



(con't from p. 15)

annual plan are firstly evaluated at the division or station level by each director during internal review meetings attended by JIRCAS administrators and directors. These meetings are conducted from mid-December through early January. Concurrently, evaluation of the management and administration of JIRCAS's operations is jointly conducted by the Research Planning and Coordination Division and the Administration Division. The Research Divisions and the Okinawa Subtropical Station evaluate JIRCAS's research and outcomes, and examine the effectiveness of the dissemination of research results.

For efficient implementation of the individual research components of the Mid-Term Plan and annual plans, most of the components are organized into international collaborative research projects that focus on specifically targeted geographical or topical areas. Prior to in-house review, external reviews are conducted annually for individual international collaborative research projects by Japanese and foreign scientists, and administrators and officers from the public sector who are appointed by the president of JIRCAS. Several reviewers are assigned to each project.

Based on the above three types of evaluation, a comprehensive in-house evaluation of all of JIRCAS's activities takes place during the In-House Review Meeting held in early February, which is attended by all administrators, directors and International Research Coordinators. In March, the outcomes and conclusions of the In-House Review Meeting are presented to the External Evaluation Committee appointed by JIRCAS's president for the evaluation of all aspects of institutional operations. These external reviewers evaluate the overall achievement of objectives defined in JIRCAS's Mid-Term Plan and annual plans and make recommendations for the further effective implementation of JIRCAS's research activities as necessary.

Experiments, research and investigations conducted according to the JIRCAS Mid-Term Plan are shown in Table 1. The tenets of the Mid-Term Plan are detailed in the Appendix.

JIRCAS ANNUAL REPORT EDITORIAL BOARD

JIRCAS's Annual Report is managed by the Research Planning and Coordination Division and an editorial board formed by staff administrators and researchers. In addition to a Chairman, Vice-Chairman, Editors-in-Chief, Editorial Committee, and Advisory Panel, the Board receives the participation of a student intern from Harvard University who serves as a Special Assistant to the Editors-in-Chief. (front row: Sho Kosugi, Akinori Noguchi, Marcy N. Wilder; back row: Takaharu Hayashi, Shuichi Asanuma, Jonathan Joel Tew, Vidya Jayasankar, Kumi Yasunobu, Zenko Hamada)

INTERNATIONAL RESEARCH AT JIRCAS

International collaborative projects at JIRCAS encompass all fields of agriculture, forestry and fisheries and are carried out in association with various other institutions, including international research centers, other Incorporated Administrative Agencies (IAAs), and universities. When the Tropical Agricultural Research Center (TARC) was restructured to create JIRCAS, a series of comprehensive projects were launched that focused on responding to various agricultural problems such as developing sustainable agricultural systems and addressing food supply and environmental issues, all of which confront today's developing countries. Projects combine research in both the natural and social sciences. Within the scope of a given project, JIRCAS dispatches long- and short-term researchers to developing countries and often sponsors research-related conferences and workshops with the partner country. In addition to these comprehensive projects, JIRCAS continues to promote specific, focused, unidisciplinary projects that were originally carried out under TARC and a variety of other miscellaneous projects.

The following section presents recent developments in JIRCAS's ongoing comprehensive projects. In keeping with Annual Report 2002's focus on Thailand, this section also highlights important research sites in Thailand where new collaborative projects are currently being pursued. A complete listing of comprehensive projects undertaken by JIRCAS researchers can be found at the end of this section.

COMPREHENSIVE PROJECTS

In 2002, JIRCAS was involved in ten comprehensive projects in Indonesia, Vietnam, South America including Brazil, Argentina, and Paraguay, the People's Republic of China, West Africa including Côte d'Ivoire and Mali, and Southeast Asia including Malaysia, Thailand, and the Philippines. These projects have been divided into three classifications: "site-specific comprehensive projects", "country-based comprehensive projects", and "multinational comprehensive projects".

Site-specific comprehensive projects first systematically analyze the agricultural, forestry and fisheries issues of a specific region through focused research on the relationships between various factors such as natural resources, environment, technology, and administration. These projects then draw upon multidisciplinary research to address the needs of the region. Projects in Indonesia, Vietnam, Thailand, Laos, and Malaysia are examples of site-specific projects. Country-based comprehensive projects identify the most significant food supply and agricultural problems of the partner country and then select several representative research fields and themes in which JIRCAS can best contribute toward the resolution of those problems. In addition, these projects promote comprehensive joint research through collaboration with the government of the partner country. Both the China and Brazil projects fall under this classification. Multinational comprehensive projects incorporate researchers in many fields from a wide region encompassing multiple countries in a cooperative effort to resolve strategically important issues. The projects in South America and West Africa are multinational projects.

Each comprehensive project has a project leader who organizes and oversees collaboration among researchers in participating research divisions. During the planning stages of these comprehensive projects, socioeconomic studies are conducted to identify research priorities in counterpart countries.

BRAZIL:
Comprehensive studies on the development of sustainable agro-pastoral systems in the subtropical zone of Brazil

The subtropical region of Brazil is considered to be one of the origins of modern agriculture in South America. This area, where large-scale continuous cultivation of field crops and extensive cattle grazing have constituted the major form of agriculture, is at present extremely important to the food supply and economy of the country. Those living in subtropical areas of Brazil have increased agricultural production by continuously expanding the boundaries of arable land and maintaining a high dependence on the net primary productivity of fertile land with minimum input. As a result, the land in most of this area has become environmentally vulnerable, while production

efficiency and agricultural technologies have remained at the same low levels. Plant growth retardation associated with continuous cropping, the occurrence of diseases, outbreaks of pests, and soil erosion threaten the agricultural production of this region and are the main obstacles precluding high levels of sustainability and productivity.

The project "Comprehensive studies on the development of sustainable agro-pastoral systems in the subtropical zone of Brazil," initiated by JIRCAS in 1996, was one of several South America-based research programs. By emphasizing more effective land utilization through the adoption of crop-pasture rotation systems, this project aimed to develop highly productive, sustainable farming systems in the environmentally degraded areas of Brazil's subtropical zone. Collaborative research has been conducted with the National Research Center for Beef Cattle (CNPGC), the Brazilian Agricultural Research Corporation (EMBRAPA), and the National Federation of Agricultural Cooperative Associations for Colonization (JATAK).

The four primary objectives of this project were as follows: 1) analysis and evaluation of traditional land utilization systems for agriculture; 2) multidisciplinary studies for the adoption of sustainable crop-pasture rotation systems; 3) socioeconomic evaluation of crop-pasture rotation systems; and 4) on-farm participatory research on newly developed agro-pastoral systems. Two long-term and five short-term scientists were dispatched in 2002, the final year of this seven-year project. A workshop and final evaluation meeting was held in Tsukuba in March, 2003 in order to review the results of the project, and to discuss future prospects for agro-pastoral systems in Brazil. Review of the project concluded that agro-pastoral systems were effective, and that maintenance of soil nitrogen fertility and adequate grazing frequency are necessary for sustainability. It was also determined that the system might also improve soybean and animal productivity in private farms, and that the physiological characteristics such as efficiency of nitrogen utilization and nitrification inhibition provide useful information for how to genetically improve tropical grasses' ability to adapt to low nutrient soil. The last two research objectives described above will be incorporated into a new project "Comprehensive studies on the development of sustainable soybean production technology using agro-pastoral systems in South America."

Experimental field for agro-pastoral systems at CNPGC-EMBRAPA. (Photo: T. Taniguchi)

CHINA: Development of sustainable production and utilization of major food resources in China

Since 1997, JIRCAS has been conducting a seven-year comprehensive research project with the national government of the People's Republic of China (PRC), the Japanese Agriculture, Forestry and Fisheries Research Council (AFFRC), and the Chinese Ministry of Agriculture (MOA). The goal of this project is to develop technologies for sustainable production and utilization of major food resources in China. Such resources, including rice, soybeans, corn, and freshwater fish, will become increasingly important as economic development strengthens the purchasing power of ordinary Chinese citizens and enhances their concern for dietary nutrition.

The initial impetus behind concerns over the future of China's food supply stems from a report by the World Watch Institute entitled "*Who Will Feed China? Wake-up Call for a Small Planet*" (Brown, 1995). Since that report, many Chinese and foreign researchers have analyzed food supply problems in China with a primary focus on the grain sector. However, reports published thus far have shown a lack of agreement concerning future food production and demand scenarios, most likely due to differences in underlying assumptions, data, and estimation processes. Sufficient consensus does exist that China's food demand will increase continuously over the next three decades, and that available food supplies will not meet this demand. Consequently, rising demand for imported

foodstuffs will likely occur. Major factors inhibiting agricultural production increases in China include the area of arable land, poor quality of farmland, weak response of soils to fertilizer, and the small-ownership structure of private Chinese farms. At present, crop yields in China remain significantly lower than those in advanced industrialized nations, and rapid economic growth will continue to reduce the amount of farmland used for non-agricultural purposes. New efforts to reclaim land and recent increases in crop indices do not seem to have halted the trend toward declining levels of land cultivation.

Major factors influencing future food demand include population growth, changes in the structure of Chinese society due to urbanization, increases in family income, changes in the price of agricultural products, and the persistence of poor infrastructure. This project aims to develop an effective production and distribution system for food resources in order to help China address the changing supply and demand structures of agricultural products. To achieve this goal, it will be necessary to evaluate how new technology is disseminated and the economic impact such technology has on selected rural areas and individual farmers. The project will also have to generate a supply and demand modeling structure for food resources, develop a system to analyze corresponding farming areas and agricultural products, and design more effective control systems.

Agricultural development in China has changed dramatically through its accession to the WTO framework in 2001. The economic development gap between coastal and inland regions has increased, and agricultural development has severely suffered from climatic disasters (see photo) and environmental degradation. A plan to strategically restructure agricultural systems and rural economies needs to be created that will increase farmer income and rural social development.

For this project, the following ten research subjects are currently being studied: 1) changes in food policies, rural communities and production structures, the regional food balance, marketing, resource use, and the environment; 2) remote-sensing and GIS applications for land resource use; 3) the impact of new technologies on regional and farm economies; 4) evaluation and utilization of the genetic resources of rice, development of novel breeding materials, and the establishment of sustainable high-yield production methods; 5) development of technologies for insect pest management; 6) evaluation and utilization of the genetic resources of soybeans; 7) studies on materials cycling in agro-ecosystems, and development of farming systems in paddy fields that address environmental conservation needs; 8) development of processing, preservation and distribution technologies of food-stuffs; 9) utilization of corn and its residues for animal feeds and evaluation of resulting meat products; and 10) development of processing, distribution and storage technologies for freshwater fish.

During Fiscal Year 2002, JIRCAS dispatched four long-term researchers and 16 short-term researchers to accomplish the project plan. Six administrators and coordinators visited China to discuss project progress and accomplishments. In addition, eight Chinese administrators and counterpart researchers were invited to JIRCAS in order to further discuss mutual goals.

Japanese and Chinese researchers examing rice affected by cold damage in Jiamusi, Heilongjiang Province.

SOUTH AMERICA: Comprehensive studies on soybean improvement, production and utilization in South America

The soybean, *Glycine max*, is considered to be one of the principal crops supporting human sustenance. Production of this valuable crop has increased rapidly in the past three decades in comparison with that of rice, wheat, corn, and other major grains, and encouraging the continuation of this trend may aid efforts to stabilize the world food supply. At present, Brazil, Argentina, and Paraguay (MERCOSUR countries) account for approximately 40 percent of global soybean production, placing them among the leading soybean export countries. However, no-tillage cultivation of soybean in South America has been carried out frequently under

environmentally vulnerable conditions – arid, acid soils characterized by low fertility. In addition, the history of soybean cultivation in these areas is relatively short, giving rise to concerns that continuous cropping, pest and disease outbreaks, and soil erosion may threaten future soybean production. Comprehensive, multinational research efforts focused on the development of sustainable and more efficient soybean production systems in South America are thus increasingly necessary.

The JIRCAS research project "Comprehensive studies on soybean improvement, production, and utilization in South America" marks a new initiative to promote multidisciplinary studies on soybean production and utilization in MERCOSUR countries through collaborative research among Japanese and South American specialists. JIRCAS dispatched four long-term and nine short-term scientists to the Brazilian Agricultural Research Corporation (EMBRAPA), the Ministry of Agriculture and Livestock (MAG) in Paraguay, and the National Institute of Agricultural Technology (INTA) in Argentina during 2002. Several South American and Japanese research institutes are involved, including those affiliated to EMBRAPA, MAG, and INTA, as well as Centro Tecnologico Agropecuario en Paraguay (CETAPAR-JICA). This comprehensive project complements earlier efforts in the field by focusing research on five areas: genetics and breeding, soil management and pest control, crop management and production, post-harvest technology, and socioeconomic factors.

Two pertinent problems in relation to sustainable soybean production are sudden death syndrome, now a serious problem in Argentina, and abiotic stress. The pathogen causing sudden death syndrome has recently been identified for the first time in collaboration with INTA and the National Institute of Agrobiological Sciences (NIAR) of Japan, and based on this finding, research on how to create an efficient protection system and identify pathogen resistance genes in soybean using molecular techniques, will continue to be performed.

Research on abiotic stress has also produced significant results. In conjunction with EMBRAPA, researchers analyzed basic physiological information on plant protection mechanisms to drought stress and found that net assimilation rate is one of the critical factors for drought protection.

Expansive soybean fields extend to the horizon in the central-west region of Brazil. (Photo: M. Kato)

INDONESIA: Evaluation and improvement of regional farming systems in Indonesia

In Indonesia, temperate vegetables such as cabbage, potato, carrot, and Chinese radish are produced in regions of high elevation, usually 700 m above sea level or higher, and within the vicinity of large cities. Since domestic demand for these vegetables has the potential to increase significantly in the near future as the result of population growth, urbanization and changes in life style, temperate vegetables have become promising commodities for improving the household income of rural farmers. With this situation in perspective, a comprehensive research project was reorganized to focus on the effects of vegetable based farming systems, as well as on designing systems to improve cultivation and post-harvest technologies in West Java. This project was initiated in April 2000 and concluded in March 2003 with great success in each of the five targeted subject areas.

In the first subject entitled, "Analysis of physical environmental resources for evaluation and improvement of vegetable-based farming systems," a 30-meter mesh data-set for the research site was constructed, and the conditions surrounding vegetable fields were analyzed in order to determine the optimal areas for cultivation. Through both the evaluation of rainfall patterns and the development of new methods used in the Universal Soil Loss Equation (USLE), a map of estimated soil loss under various conditions of land use and rainfall 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

Mixed planting at a project site in Indonesia.

derived from historical farming system transitions was expounded for selected households and villages. The vertical distributions 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 vegetable distribution systems are competitive and efficient. Through surveys, farmers' marketing strategies were collected, and important processes such as methods for 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 the efficacy of seed raising, as well as ability of IPM technology to slow the occurrence of insect pests, were tested in order to bolster agricultural productivity. Several applicable post-harvest technologies were also tested and proved to be useful. In the fifth subject, the "Evaluation and utilization of indigenous upland crops and fruit trees," approximately 40 vegetable species, 30 fruit trees and 20 miscellaneous species were collected during field studies in 14 provinces.

During the final review meeting, held in February 2003, reviewers provided positive evaluations since the five-part project had attained the 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. Following the culmination of the project, several follow-up studies on sustainable technologies and their effect on increasing income will be conducted in coordination with other institutes.

WEST AFRICA: Improving food security through increased productivity in rainfed rice systems

The demand for rice in sub-Saharan Africa is growing faster than that of any other major food staple, with consumption expanding across all socio-economic classes, including the poor. Rapid demographic expansion and urbanization in Africa have shifted food preferences from traditional foodstuffs to more easily prepared rice and bread. These patterns are especially evident in West Africa where the substitution of rice for coarse grains and traditional root and tuber crops has fueled rice demand at an annual growth rate of 5.6 percent between 1961 and 1992.

Increased rice production in Africa is hampered by a number of constraints such as disease, pests, weed infestation, inadequate water management, soils with low fertility, lack of suitable rice varieties, and socio-economic factors. To help address these problems, JIRCAS initiated a five-year collaborative research project with the West Africa Rice Development Association (WARDA) in April 1998.

The project focuses on two major subjects. The first involves genetic and ecopysiological characterization of indigenous rice varieties and interspecific progenies. Farmers in the region grow two species of rice, Asian rice (*Oryza sativa*) and African rice (*Oryza glaberrima*), yet they are far from achieving high yields due to production constraints associated with each species. In order to develop new cultivars for the region that combine the advantages of these two species, WARDA is currently working on the Interspecific Hybridization Project. As part of this project, JIRCAS researchers are aiming to develop a simple but reliable method to assess tolerance to drought and soil acidity and to establish a marker-assisted selection system for selecting desirable interspecific rice progenies.

JIRCAS researchers analyzed phosphate contents in the leaves at the maximum tillering stage in order to evaluate Asian and African rice germplasm and promising interspecific progenies. African rice genotypes showed higher responsiveness to phosphate application than those in Asian rice, leading to the conclusion that genetic selection would be possible for desirable traits

in the African species. In phosphate deficient soil, researchers were able to show that the greater the root volume of rice seedlings produced during the early stage of vegetative growth, the less growth inhibition they suffered. Such results suggest that rice plants' tolerance to stress induced by phosphate deficiency might be linked with the contents of phosphate absorption.

In other work, WARDA conducted QTL analysis for some traits affecting growing ability during early vegetative growth using a complete set of a chromosome segment of *O. glaberrima* backcrossed into *O. sativa* provided by Kyushu University. The QTL for transpiration ability was detected at the DNA markers between Q23 and Q204 on chromosome 2 of *O. glaberrima*. Similarly, JIRCAS researchers detected QTLs for tillering ability both on chromosome 2 of *O. sativa* and on chromosome 4 of *O. glaberrima*.

The second facet of the project involves the study of socioeconomic aspects in relation to sustainability of lowland rice cultivation in West Africa. In 1999, a JIRCAS agricultural economist initiated collaborative research under WARDA's Policy Support Program. The objective of this project is to assess how the institutional and economic environment affect farmers' capacity to adopt new technology effectively. The target areas for this survey are rainfed lowland regions that have no modern irrigation systems, but possess significant potential for improving water control. This year JIRCAS continued its research focus on analyses of how the land tenure system affects the adoption of rice cultivation in areas with well-suited biophysical conditions. Close to 200 villages were covered in this extensive survey.

Similar studies were carried out in Ghana to provide comparative analysis on how rice cultivation is adopted under two discrete socioeconomic conditions. Two surveys, including statistical analysis, were conducted in the lowland areas of Côte d'Ivoire and Ghana. It was determined that immigrants might be accelerating rice cultivation in the rainfed lowlands of Ghana, whereas in Côte d'Ivoire, the villages with higher populations developed a tendency to try rice cultivation. Moreover, in both places access to markets from the village, the number of immigrants, education, and the adoption of water management technology all helped determine whether rice cultivation would be sustained. As a result of higher relative wages and a history of irrigation system development in Côte d'Ivoire, water management is becoming more widespread in Côte d'Ivoire than in Ghana. The adoption of irrigation systems in the rainfed lowlands has increased the rice yield, but surprisingly, there was no correlation between the adoption of modern rice varieties and yield per unit area.

VIETNAM: Development of new technologies and their practice for sustainable farming systems in the Mekong Delta

In the past decade alone, rice production in Vietnam has expanded to such a degree that the country has become not only self-sufficient, but the world's second largest exporter as well. However, in the Mekong Delta, a leading area of rice production, low rice prices, market uncertainty, poor marketing facilities, and competition with other rice-exporting countries are drastically undermining farmers' incomes. Furthermore, intensive farming technologies have caused many unexpected detrimental effects on the environment, prompting the Vietnamese government to encourage crop diversification as a means of promoting balanced development. Fortunately, various farming systems, including VACR systems (a Vietnamese acronym standing for V: fruits and vegetables; A: aquaculture; C: livestock; R: rice), have evolved in response to the natural and socioeconomic conditions of each area in the Mekong Delta.

In order to foster agricultural practices that are not only economically profitable but also ecologically sustainable as farming systems, the second phase of a comprehensive project entitled "Development of new technologies

Pigs being reared at the JIRCAS project site in Tan Phu Thanh Village, Cantho Province.
(Photo: A. Kamakawa)

and their practice for sustainable farming systems in the Mekong Delta (Mekong II)" has been conducted since 1999 in cooperation with Cantho University, the Cuu Long Delta Rice Research Institute (CLRRI), and the Southern Fruit Research Institute (SOFRI). Research topics include the development of component technologies of farming systems for rice, livestock, fruit, and aquaculture production.

In recent progress, techniques were developed for breeding salt-tolerant varieties of rice and implementing an integrated pest management system for rice cultivation. Regarding livestock, feeding management practices for swine production were improved and a method for diagnosing pathogens of porcine diseases was developed. For fruit production, a model orchard was established at JIRCAS's on-farm trial site in Tan Phu Thanh Village, Cantho Province. In aquaculture, basic technology for freshwater prawn seed production was developed and several rice-prawn farming trials were conducted around Cantho and Vinh Long Provinces. Furthermore, methods for assessing nitrogen cycling at various trial sites were established and are currently being evaluated, adjusted, and improved.

In socioeconomic studies, farming systems in the Mekong Delta were classified and analyzed in terms of cause-effect relationships in context of their technical and economic problems. The project has attempted to evaluate the present VACR systems, develop technologies to enhance their environmental sustainability, evaluate how to implement these technologies, and to establish model VACR farming and extension systems at JIRCAS's on-farm trial site.

In 2002, four researchers were dispatched to Vietnam for long-term projects. Their specific research activities were implemented according to the recommendations and proposals given during the mid-term evaluation meeting held at JIRCAS's Tsukuba premises during February 2001.

From November 26-28, 2002, a workshop was held at Cantho University. There were three participants from Japan, including two JIRCAS research staff members and a collaborator from the National Agricultural Research Organization. The participants agreed that technologies developed during the project should be evaluated at the on-farm sites, and that appropriate farming systems should be proposed based on those technologies during the remaining period of the project. On the final day of the workshop, all participants visited the on-farm trial sites, where they exchanged views on project performance and suggested ways to achieve future success.

SOUTHEAST ASIA: Development of agroforestry technology for the rehabilitation of tropical forests

Natural forests have been rapidly destroyed and degraded as the result of excessive commercial logging and tree cutting for fuel, and the unremitting exploitation of arable land being conducted to help satisfy an escalating demand for food production. Forests having high biodiversity have been converted into monoculture plantations with fast growing trees, rubber trees or oil palms, particularly in developing countries. Unsustainable forest harvesting, repeated short-term cultivation shifting, and forest fires damage forest ecosystems and cause losses of flora and fauna, erosion, flooding, deterioration of forest resources and soil degradation. These effects in turn cause serious economic and environmental problems not only at the local level but also on a global scale. To address these problems, it is necessary that forests be rehabilitated and managed in a sustainable fashion, for which the first step must be to enrich denuded and

A trial of intercropped fruit trees under a canopy of fast growing trees in the Philippines.

degraded lands.

On the basis of previous research, the JIRCAS Forestry Division proposed a collaborative research project entitled "Development of agroforestry technology for the rehabilitation of tropical forests" with the University of the Philippines, the Forest Research Center (FRC) and the Sabah Forestry Department (SFD), State Government of Sabah. The objective of this project is to use technology to grow forests that are rich in biodiversity, produce high value timber, and perform critical environmental functions. Researchers also plan to grow fruit tree orchards where soil fertility has been improved or is well maintained. This project will contribute to the mitigation of agriculture-forestry conflicts while promoting environmental conservation and sustainable forest resource management.

During the seven-year project (2000-2006), specific objectives will include socio-economic evaluation of agroforestry, including how to re-establish a productive environment for agroforestry and develop agroforestry techniques that utilize shade trees to grow non-arboreal corps. Three JIRCAS scientists have been conducting long-term research assignments in forest ecology, soil science and mycology since December 2001, and another three scientists have conducted short-term research assignments with the FRC.

SDF Director Daniel K.S. Khiong and Dr. Lee Ying Fah, head of the FRC visited JIRCAS's Tsukuba premises from September 24 to October 3, 2002 to discuss project collaboration in detail. Mr. Jupiri Titin, Chief of the Soil Science Laboratory, was invited to JIRCAS and the Forestry and Forest Products Research Institute as a visiting scientist, where he conducted research on "Evaluation of the environment for agroforestry production" from September 24 to October 24, 2002.

A mid-term evaluation meeting was held at JIRCAS on November 14, 2002 in order to assess current research progress and examine future research directions and strategies. After an overview of the project by Dr. Kiyoshi Nakashima, Director of JIRCAS's Forestry Division, Japanese scientists presented their research achievements and future plans. The meeting concluded with favorable comments and suggestions from the external review committee.

THAILAND:
Development of low-input technology for reducing postharvest losses of staples in Southeast Asia

Food security has become a major global concern as a result of world population growth and limited available arable land. While increasing food production is important, reducing postharvest losses of agricultural products is also essential. In Southeast Asian countries, postharvest losses, caused by improper drying and insect infestation during crop storage under hot and humid climatic conditions, have been estimated at 30 percent.

With the world's most widely used fumigant, methyl bromide, set to be phased out by 2015 because of its ozone-depleting potential, and the occurrence of tolerant insects to phosphine, another pesticide, many countries have endeavored to develop alternative methods for disinfesting agricultural products. JIRCAS believes that technologies which reduce postharvest losses need to be not only environment-friendly but also affordable to small farmers and rural enterprises in Southeast Asia. This five-year project (2000 to 2004) is designed to achieve two goals: 1) to develop disinfestation methods for grains by employing natural insect enemies and botanicals; and 2) to develop low-input rice drying technologies using natural energy sources such as sunlight, husk, and straw. To do so, researchers are analyzing the causes of postharvest grain deterioration, while developing and systemizing low-input and environment-friendly technologies for reducing postharvest losses. These technologies will help establish a more effective and cost-efficient system for minimizing postharvest losses of grains that

Site for monitoring stored-product insects and natural enemies near Khon Kaen, Thailand. (Photo: T. Yoshihashi)

are essential to Southeast Asian countries. During an initial experiment, insect pests and their natural enemies were monitored at nine rice mills/storage houses in seven provinces and three regions (central, north and northeast) where rice is mainly produced in Thailand. The population dynamics of insect pests and their natural enemies showed reverse trends; pest populations dramatically increased between May and August and decreased slightly in September, while the natural enemy populations increased slightly from an already small total in September. The optimal temperature for development, developmental zero, total effective temperature, and number of predations were investigated for several major natural enemies. It was also discovered that several volatile and non-volatile components of botanicals showed inhibitory activity against insect pests.

This project has been conducted in cooperation with the Thai Department of Agriculture, Kasetsart University, and King Mongkut's University of Technology, as well as with Japanese institutions such as the National Food Research Institute and National Agricultural Research Organization. In 2003, research will continue in order to determine how effective natural enemies are in controlling stored product insect pests, and how drying conditions affect rice quality.

SOUTHEAST ASIA: Studies on sustainable production systems of aquatic animals in brackish mangrove areas

Mangrove forests, which formerly prospered along the coastlines of tropical and subtropical areas, have diminished to half their previous area as the result of human population and economic growth. Unfortunately, brackish areas, which are found around mangrove forests, have also been compromised. Brackish environments support high biological activity, and serve as a habitat in which vast arrays of organisms process the organic materials that stream in from land areas. Microorganisms thriving there serve as a source of feed for fish, and these areas support enormous fish populations. The purpose of this project is to achieve a scientific explanation for the inherent functionality of the brackish mangrove areas and to develop a mechanism for restoring sustainable aquaculture and fisheries to damaged areas.

This international collaborative project was initiated in 2001, and involves broadly based research with the Philippines, Thailand and Malaysia. It is promoted by JIRCAS's Fisheries Division, Development Research Division, and Forestry Division, with additional support provided by the Fisheries Research Agency and the Forestry and Forest Products Research Institute. A mid-term evaluation meeting and workshop were held in Penang, Malaysia, in December 2002.

The Aquaculture Department of the Southeast Asian Fisheries Development Center (SEAFDEC/AQD), located in Iloilo, Philippines, is engaged in joint research in three fields: fish disease, seed production, and fisheries economics. Significant results have been obtained under the fish disease research program. In research on seed production, it was revealed that adding squid meal to broodstock feeds is particularly effective in the production of healthy juvenile fish. It has also been found that the fatty acid components of tropical fish eggs differ from those of coldwater fish, a result that has been valuable in the formulation of broodstock feed. In the fisheries economics study, researchers examined the structure of Philippine aquaculture operations and analyzed the characteristics of aquaculture according to the type of fish.

The Fisheries Research Institute, located in Penang, Malaysia, is performing joint research on the behavior and ecology of important fish species living in brackish mangrove areas. They have discovered that snappers and groupers, which are high-value fish, swim into the brackish mangrove areas from the open sea when they are young. There, they continue to develop, feeding on crustaceans, polychaetans, and shellfish for six months to a year before returning to the open sea. Further elucidation of these fish

Aquaculture facilities at the Southeast Asian Fisheries Development Center/Aquaculture Department.

behavioral patterns will provide valuable information for developing modes of resource management.

At Kasetsart University in Bangkok, Thailand, joint research is being carried out on the natural purification mechanisms of brackish mangrove areas. The results of a model experiment, in which a mangrove forest was planted in a simulation tank, revealed that the repeated ebb and flow of tides is essential for the absorption of phosphorus components. In the future, researchers plan to further explore the various inherent functions of brackish mangrove areas and promote research for the development of aquacultural techniques based on these functions.

INDOCHINA: Increasing economic options in rainfed agriculture in Indochina through efficient use of water resources

Rainfed agricultural regions where agricultural production is absolutely dependent on the supply of water from rainfall are common throughout the central part of the Indochina Peninsula. In order to stabilize agricultural production in such regions, the development of technologies that efficiently utilize scarce water resources is imperative. Such technologies must not only make use of rainfall, but also the water resources in catchment-basins, taking into account the micro-topography of hills and the shallow-layer ground water. Furthermore, local farmers must participate in the actual adoption of the technology. This project aims to develop individual technologies that more efficiently collect, store, and distribute water in order to improve crop production. The target areas of the project are the lowland-upland boundary zones spread over Northeast Thailand and Laos, where small-scale mixed farming is predominant. The project consists of three main objectives: (1) to assess regional water availability and identify factors that limit more efficient use of water in existing farming systems; 2) to develop crop production technologies for more effective water use and 3) to adapt and integrate new technologies into farming systems through local farmer participation.

Collaboration has been a critical factor for research progress during the first year of this project. JIRCAS dispatched three long-term and 31 short-term scientists to conduct research activities in Thailand and Laos, while five scientists from counterpart organizations were invited to carry out research at JIRCAS. The following series of workshops, meetings and seminars took place to further strengthen collaboration: 1) workshop for the development of high biomass forage crops tolerant to water stress by interspecific, intergeneric crossing (May, 2002 at JIRCAS with 6 participants; 2) workshop for strengthening collaboration between JIRCAS and the LDD (June, 2002 at JIRCAS with 10 participants); 3) annual project planning meeting (August, 2002 at Khon Kaen with 15 participants); 4) annual outcome discussion meeting (February, 2003 at Khon Kaen with 18 participants); 5) JIRCAS-CIAT-NAFRI seminar (February, 2003 at Vientiane with 34 participants); and 6) first soil physics seminar on “Identification of soil structure and water movement” (February, 2003 at Khon Kaen with 34 participants). A mini-training course was also organized with the assistance of an International Center for Tropical Agriculture (CIAT) specialist in order to familiarize our Thai counterparts with the farmer participation model of project research. That course took place during two days in October 2002 at Khon Kaen, with 22 attendees.

Pumping up water from a farm pond into neighboring fields in Nong Saeng, 34 km south of Khon Kaen, Thailand.

RESEARCH SITES IN THAILAND

As a part of this year’s spotlight on JIRCAS initiatives in Thailand, the following pages detail sites at which JIRCAS researchers are currently undertaking projects in cooperation with Thai governmental, university, and international organizations.

JIRCAS, and its predecessor, the Tropical Agriculture Research Center (TARC), have a

GIS Laboratory at the LDD.

long history of research collaboration with Thailand. In 1967, TARC began conducting research with the Department of Agriculture (DOA) and the Department of Livestock Development (DLD). After TARC was reorganized into JIRCAS in 1993, research collaboration was extended to include the Land Development Department (LDD), the Asian Institute of Technology (AIT), Kasetsart University, Khon Kaen University and the International Training Center for Agricultural Development (ITCAD). During the past thirty-five years TARC/JIRCAS has dispatched more than a 100 scientists with long-term assignments and 1,500 with short-term assignments to carry out research with these organizations. As a result, significant progress has taken place in the development of sustainable crop production systems in rainfed regions where deforestation has complicated the efficient management and utilization of water resources.

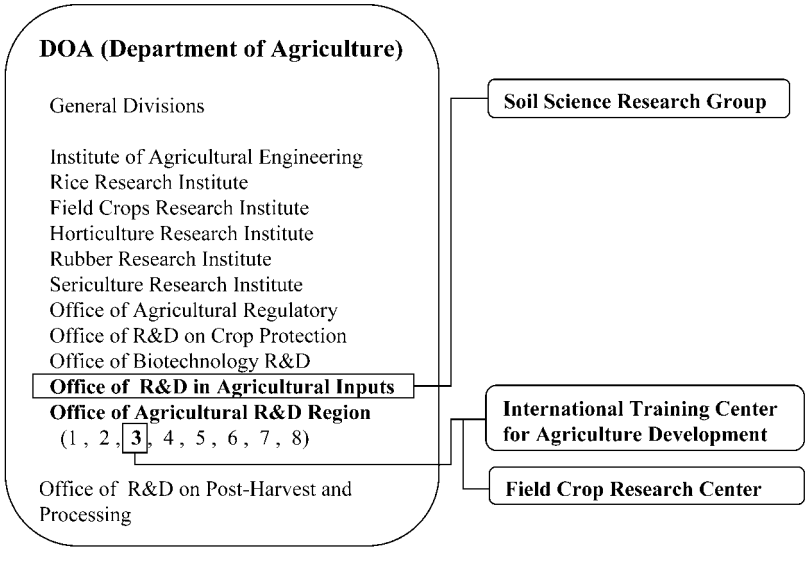
Recently, JIRCAS concluded a seven-year integrated research project in Northeast Thailand entitled "Development of sustainable agricultural technology in Northeast Thailand" (1995-2001). The main objective of this project was to develop maintainable farming systems by improving local-farmer transferable agricultural technologies for crop and livestock production. In April 2002, a concurrent project was launched, entitled "Increasing economic options in rainfed agriculture in Indochina through efficient use of water resources," in order to develop efficient water use technologies that can be integrated into high value-added production systems in a farmer-participatory process. This project is currently being carried out in close collaboration with the LDD, ITCAD, DOA, DLD and Khon Kaen University.

Land Development Department (LDD)

The Land Development Department (LDD), a part of the Ministry of Agriculture and Cooperatives, was established in 1963. The LDD carries out a range of functions for land development. It conducts soil surveys and surveys of economic land use, produces soil resource maps, and carries out research on soils, land improvement, soil and water conservation, watershed conservation, and other topics relevant to land development and farmer needs. It also disseminates land development technologies to relevant government personnel, farmers, and other interested persons.

The LDD is currently carrying out 18

Organizational structure of the Department of Agriculture in Thailand in relation to the "Rainfed Agriculture" project in collaboration with JIRCAS.



major projects. Of particular relevance to the Rainfed Agriculture Project are the Small Scale Water Resources Project, the Farm Ponds Development Project, and the Land Use Planning for Watershed Management Project. The Small Scale Water Resources Project focuses on rainfed areas. Its objectives are: 1) to develop more effective water conservation in non-irrigated areas; and 2) to improve land and water resource management in these areas for higher productivity through self-reliance.

The LDD has classified agricultural land based on suitability for different uses and found that 28% is suitable for paddy rice, 21% suitable for cash crops, and 5% suitable for trees, while 47% is unsuitable for economic crops or agriculture. The LDD is addressing four main problems of land resource use: 1) misuse of agricultural and forest land for residential and industrial purposes; 2) erosion and low organic matter resulting from poor land management; 3) topographical and environmental problems, including flooding and gravelly soil structure; and 4) natural problem soils, specifically acid and saline soils. With 41% of all agricultural land in Thailand located in the Northeast, this region is an important focus of these LDD activities.

Also of note, the LDD maintains two innovative programs for users of land resources: 1) digital soil suitability maps for economic plants; and 2) the "Soils Doctor" program. The digital soil suitability map is an expert system that does not require special skills to use. A user first selects the location (province, village, or map location) for which information is needed. If the user specifies a crop, the system will indicate which soils in the area are suitable. If the user specifies a soil type, the system will indicate which crops are suitable. In the "Soils Doctor" program, "Bare Foot Doctors" with simple equipment for soil analysis are sent out to villages each year. These are aided by 65,000 volunteer farmers trained by the LDD. The "Bare Foot Doctors" work closely with farmers, including those in up-country areas, to assist them with their needs relating to soil conservation and improvement.

Soil Science Research Group, Department of Agriculture (DOA)

The Soil Science Division in the DOA has been the closest counterpart to TARC/JIRCAS since collaborative research was first initiated. The Soil Science Group was reorganized as the Soil Science Research Group in October 2002 and is now under the jurisdiction of the Office of Research and Development of Agricultural Crop Production Inputs (ORDAI) with 56 staff members. In total, ORDAI is composed of three groups, the other two being the Agricultural Chemistry Research Group and Agricultural Toxic Substance Research Group. The Soil Science Research group conducts research and development on soil, water, and fertilizer in order to achieve sustainable crop production. Research project objectives are usually broken down and assigned to the following five research sub-groups: Soil Chemistry, Soil Physics, Fertilizer and Soil Conditioners, Soil Microbiology, and the Fertilizer Recommendation Program Research and Development.

JIRCAS's collaboration with the Soil Science Division has been based primarily at their headquarters in Bangkok, also the location of the TARC/JIRCAS regional office. However, now that JIRCAS's research activity has shifted to Northeast Thailand, so has a substantial amount of its research activity. In the new project, "Increasing economic options in rainfed agriculture through efficient use of water resources," scientists in the Soil Group conduct research with JIRCAS scientists at the JIRCAS project site in Khon Kaen.

The International Training Center for Agriculture Development (ITCAD)

The ITCAD office is located on the opposite side of Khon Kaen University and across the national highway in Khon Kaen City. ITCAD was established in 1996 to succeed the Agricultural Development Research Center (ADRC) with the goal of

ITCAD Main Building.

improving agricultural production in Northeast Thailand. ITCAD was initially under the jurisdiction of the Office of the Permanent Secretary, MOAC, but was transferred to the jurisdiction of the DOA in 1998. In 2002, the DOA placed ITCAD under the authority of their regional office following the restructuring of the agricultural research system by the Thai government.

ITCAD's objectives are: 1) to facilitate collaboration between developed and less developed countries; 2) to establish national and international networks that promote agricultural development; and 3) to empower individuals and groups by acting as an agent of change. ITCAD also conducts research on the agro-ecological aspects of sustainable agricultural development and employs demonstration plots to pilot new agricultural technologies. The results of their research and development in these areas are disseminated during a variety of ITCAD-organized workshops and seminars. In this way, ICTAD plays a seminal role in the transfer of technology, and as an information center for agricultural development.

JIRCAS has conducted research with ITCAD since the establishment of their demonstration farm in Khao Suan Kwang, 45 km north of Khon Kaen City, in 1992. The farm's operation is supervised by an ITCAD field manager together with assistant managers from the LDD, the DOA and Khon Kaen University.

Khon Kaen Field Crop Research Center (KKFCRC), DOA

At present, the total area in Thailand used to cultivate rice rests at about 50 percent, or 10.93 million hectares, of available agricultural land, and is expanding yearly as more irrigated areas are developed to increase production. As a result, the total area of agricultural land used for field crops, including field corn, cassava, sugercane, mungbeans and soybeans, has fallen below 25 percent, or approximately 5.12 million hectares.

The Field Crops Research Institute is responsible for the research and development of agricultural technologies targeted for certain identified field crop priority areas, and to increase farmer income through the transfer of those technologies. The Field Crops Research Institute is placed under the jurisdiction of the DOA, and is composed of a Central Unit and a Regional Unit, which consists of nine Field Crops Research Centers (FCRCs) and eleven Field Crops Experiment Stations (FCESs) located throughout the country. The KKFCRC, founded in 1963 as the Seed Multiplication Station, is one of the nine FCRCs located in Khon Kaen with two FCESs at Kalasin and Loei. The primary objectives of the KKFCRC include the following: 1) research on yield and quality improvement for cassava, sugarcane, soybeans and peanuts; 2) development of adaptive field crop production technologies for specific areas using on-farm trials and village field tests; 3) analysis on improving transfer technologies; 4) distribution of the foundation seeds of recommended field crop varieties; and 5) dissemination of information on new agricultural technologies to farmers.

In a previous project, the KKFCRC collaborated with JIRCAS to develop cultivation technologies that improve soil fertility management and decrease the quantity of labor inputs needed to cultivate upland crops. In a current project, entitled "Development of high biomass crops tolerant to water stress by interspecific and intergenetic crossing," researchers from JIRCAS's Okinawa Subtropical Station have collaborated with KKFCRC scientists to develop sugarcane varieties with increased biomass production and tolerance to dry conditions through interspecific hybridization. Such varieties are expected to be utilized as animal feeds.

KKFCRC Main Gate.

Khon Kaen Animal Nutrition Research and Development Center (KKANRDC)

The Khon Kaen Animal Nutrition Research and Development Center

KKNRDC Main Building.

(KKANRDC), established in 1963, is one of seven animal research centers under the Animal Nutrition Division, Department of Livestock Development (DLD), MOAC and is located at Kohn Kaen Provincial Agriculture and Cooperatives in Khon Kaen City. The KKANRDC covers ten provinces (Khon Kaen, Udonthani, Mahasarakham, Kalasin, Mukdaharn, Nakornphanon, Lois, Sakolnakorn, Nongkhai, and Nongbualampoo), and is composed of three sections (Administration, Research, Forage Production) and eight stations, which are staffed with 12 permanent employees, including three researchers and three scientists, as well as 30 permanent workers.

As a result of the economic development occurring in Thailand, demand for milk and meat products has risen quickly, placing a heavy burden on farmers in terms of feed and pasture management in the northeastern region of Thailand, a center of large ruminant production. Against this background, KKANRDC researchers conduct research on animal nutrition, including locally available feedstuffs, feed management, nutrient requirements, forage crop production, and pasture seed production. As part of the livestock development program, the Center provides pasture seed production and extension services to farmers for the production of silage, forage fodders, and hay to feed herds of livestock. In addition, the KKANRDC develops demonstration technologies and management strategies for animal feeds, forage production, and pasture management for farmers.

Since 1994, the KKANRDC has maintained a close relationship with JIRCAS, the Japan International Cooperation Agency (JICA) and the International Center for Tropical Agriculture (CIAT) in order to help accomplish its objectives. In 1999, a technical cooperative project for the development of pasture seeds was launched in Northeast Thailand with support from JICA.

Khon Kaen University

Khon Kaen University was established in 1964 as one of three regional universities following a decentralized development plan for higher education in Thailand. One of the University's most important missions is to develop Northeast Thailand, which is generally recognized as the poorest region of the country. The campus is located in the northwest part of Khon Kaen city, and covers approximately 900 hectares.

The University is composed of 17 faculties, four academic support centers and a research institute. The Faculty of Agriculture was one of the three faculties first established in 1964 with the support from the Governments of Canada and New Zealand under Colombo Plan Assistance. Both basic and applied research is conducted to strengthen the academic level of staff members and to develop technologies that address contemporary obstacles to increased agricultural productivity. The faculty now has nine departments (Agricultural Economics, Agricultural Extension, Agronomy, Animal Science, Entomology, Horticulture, Fishery Science, Land Resources and Environment, and Plant Pathology) and cooperates with several foreign research centers and universities.

In the integrated project entitled "Increasing economic options in rainfed agriculture in Indochina through efficient use of water resources,'' JIRCAS closely collaborates with staff from the Department of Agriculture Economics, who have expertise in and teach courses on farm management, agricultural marketing, and agri-business. The

Khon Kaen University.

Department's research is further bolstered by collaboration with the International Rice Research Institute (IRRI), under which a project entitled the "Interactions between sugarcane expansion and upper paddy production in Korat Basin Northeast Thailand" is being conducted using a multi-agent systems approach.

INTERNATIONAL COMPREHENSIVE PROJECTS

All projects are handled by JIRCAS Research Divisions.

Time Frame	Project Title	Research Site
1996-2002	Comprehensive studies on the development of sustainable agro-pastoral systems in the subtropical zone of Brazil	National Center for Beef Cattle Research, Brazilian Agricultural Research Corporation (EMBRAPA), Center for Tropical Agriculture Technology (CIAT), and JATAK International Center for Agriculture Technology, Brazil
1997-2003	Development of sustainable production and utilization of major food resources in China	Institute of Agricultural Economics, Institute of Natural Resources and Regional Planning, Research Center for Rural Economy, China Agricultural University, Institute of Soil Science (ISS), China National Rice Research Institute, Shanghai Fisheries University, the Soil and Fertilizer Institute (SFI) and the Soybean Institute and Animal Science Branch of the Jilin Academy of Agricultural Sciences (SIJAAS), People's Republic of China
1997-2006	Comprehensive studies on soybean improvement, production and utilization in South America (multinational)	Ministry of Agriculture and Livestock (MAG), Paraguay, JICA-Agricultural Technology Center in Paraguay (CETAPAR), Paraguay; National Center for Soybean Research and National Center for Beef Cattle Research, Brazilian Agricultural Research Corporation (EMBRAPA), Brazil; and Marcos Juarez Agricultural Experiment Station, the National Institute for Agricultural Technology (INTA), Argentina
1998-2002	Improving food security in West Africa through increased productivity in rainfed rice systems	West Africa Rice Development Association (WARDA), Côte d'Ivoire
1998-2002	Evaluation and improvement of regional farming systems in Indonesia	Agency for Agricultural Research and Development (AARD), Indonesia
1999-2003	Development of new technologies and their practice for sustainable farming systems in the Mekong Delta (Phase II)	Cuu Long Delta Rice Research Institute (CLRRI), Cantho University, and the Southern Fruit Research Institute, (SOFRI), Vietnam
2000-2006	Development of low-input technology for reducing postharvest losses of staples in Southeast Asia	Kasetsart University, King Mongkut's University of Technology, and the Department of Agriculture (DOA), Thailand
2000-2006	Development of agroforestry technology for the rehabilitation of tropical forests	Sabah Forest Research Centre, Malaysia
2001-2005	Studies on sustainable production systems of aquatic animals in brackish mangrove areas	The Southeast Asian Fisheries Development Center (SEAFDEC), the Philippines; Fisheries Research Institute (FRI) and the University of Malaya, Malaysia; Faculty of Fisheries, Kasetsart University, Thailand
2002-2008	Increasing economic options in rainfed agriculture in Indochina through efficient use of water resources	Department of Agriculture (DOA), Khon Kaen Animal Nutritional Research Center, Department of Livestock Development (DLD); Thailand

JIRCAS RESEARCH DIVISIONS

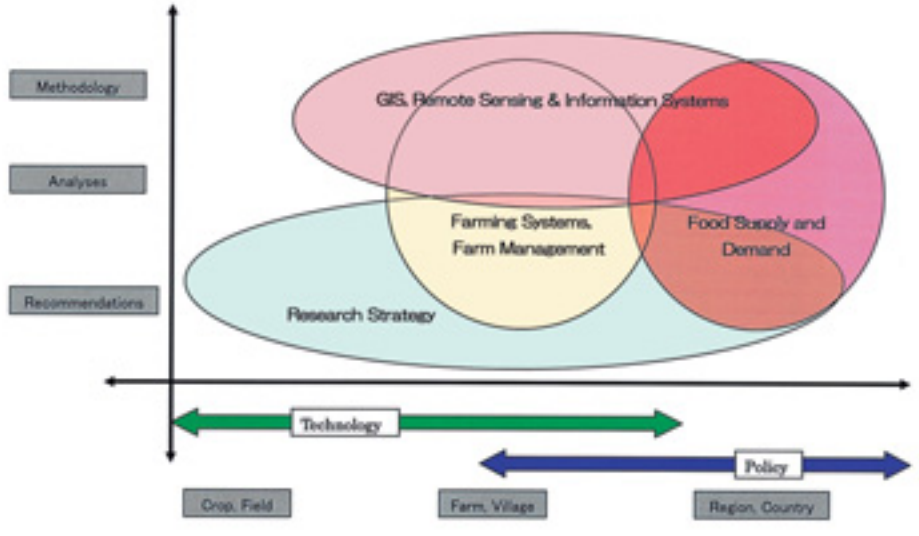
The following pages offer an introduction to the wide range of activities pursued by the seven Research Divisions and the Okinawa Subtropical Station. Each Division summary features a brief overview describing current research priorities within the Division, followed by more detailed descriptions of selected topics pursued during Fiscal Year 2002.

DEVELOPMENT RESEARCH DIVISION

The Development Research Division consists of 17 senior researchers who specialize in a variety of academic disciplines and conduct distinctive interdisciplinary research on a range of issues regarding technology development, resource management and socio-economic institutions in developing countries. As a whole, the Division aims to investigate and identify significant problems within these research themes by conducting surveys and analyses on both the micro (households, villages) and macro (regions, countries) level. These activities also focus on enhancing the research and development process by improving rural survey methods, farming systems research, information networks, remote-sensing and geographical information systems, and econometric/quantitative models.

In order to achieve Division goals, the following four research groups have been established according to specific target areas: 1) Research Strategy Group; 2) Food Supply and Demand Analysis Group; 3) Farm-Management and Farming Systems Group; and 4) GIS and Information Systems Group. During Fiscal Year 2002, the Research Strategy Group was officially formed to conduct organized studies to identify important research priorities addressing developing regions. The first action of the group was to evaluate the current situation of international collaborative research conducted by various international institutions, including relevant corollary studies on such topics as the historical trend of developmental economics.

In other research, the Food Supply and Demand Analysis Group analyzed the competitiveness of Chinese corn in international markets using statistical data collected in Jilin Province for the purpose of elucidating the structural changes that have occurred in Chinese agriculture following accession to the World Trade Organization. Another study based on the recently published "China Agricultural Census" illustrated that enormous regional gaps have emerged in terms of both employment structure and industrialization in Chinese rural areas. The consumption of milk, one of the new promising commodities in China, was also analyzed by comparing statistics for different urban areas and for different generations. In addition, with regard to methodology, the Group improved on the World Food Supply and Demand Model, a formal econometric model for mid- to long-term projection, which is expected to contribute substantially to further analyses of China's structural changes. New functions that can handle 'variable



Research strategy in the Development Research Division.

parameters' were introduced into the model, enabling researchers to simulate structural changes that occur over long time periods. In related research, a forest products model was developed in order to analyze the potential costs and benefits of resource management policies.

Members of the Farm-Management Group identified factors currently limiting the production and distribution of temperate vegetables in Indonesia, demonstrating that the efficient use of production technologies is the determining factor for vegetable selection. To determine factors contributing to the increase of rice production in the wet lowland areas of West Africa, quantitative analyses were carried out based on locally collected household data. This study surprisingly demonstrated that the introduction of new rice varieties did not always result in increased rice yields. In separate research, analyses on the various farming systems models based in Vietnam and Northeast Thailand were evaluated to identify the conditions for profitability and the applicability of newly recommended cropping fishing systems.

Lastly, the GIS Group improved previous methods for conducting spatial analyses of land use and environmental resource change in order to quantify the degradation of grasslands in Brazil, compute the total planting acreage of wheat in China, and evaluate land use in the seasonal flooding areas of Mali. Studies on the highland areas of Java, Indonesia presented a map displaying the hazardous situation of land erosion associated with vegetable cropping periods, based on the combination of climatic, agronomic and geographical information. A new study to assess appropriate water management using remote-sensing technologies was initiated in the upper-middle areas of the Mekong River Basin.

In other activities, the Division co-sponsored a joint seminar in Fukuoka with the Asia Pacific Advanced Network (APAN) on the topic of multilingual services for purposes of agricultural information exchange. In January 2003, the Division organized a seminar on the role of international collaborative research, inviting prominent speakers from related institutes in Japan. In addition, various international and national institutes including the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Service for National Agricultural Research (ISNAR), the French Agricultural Research Centre for International Development (CIRAD), and the German Technical Cooperation (GTZ) were visited and interviewed by division members.

TOPIC 1

The sloping lands of West Java, Indonesia: Using geographic information systems (GIS) to produce a digital map of the hazardous conditions of soil erosion

Temperate vegetable fields are spread widely over the sloping highland areas of West Java Province in Indonesia. Within this region, the intensity and distribution of rainfall tends to vary spatially and temporally. During the rainy season, however, intense rainfall lasts for months and often leads to soil erosion. Other influential factors contributing to soil erosion can include the type of topography and soil, and nature of conservation control, variables that can be characterized using geographic information. In this study researchers attempted to estimate how hazardous the conditions of soil erosion are in West Java by using geographic information systems (GIS).

The study site used for this project was Langensari Village located in the Lembang Sub-District, Bandung District, West Java Province in Indonesia. The average altitude of the village is about 1200 meters above sea level and the annual amount of precipitation is about 2000 mm. Researchers gathered various kinds of geographic information, including satellite remote sensing data, aerial photos, topographic maps, meteorological data, and field survey data and employed the Universal Soil Loss Equation (USLE) to estimate real

Fig. 1. A vegetable field located on a slope in the southern part of Langensari Village, Indonesia.

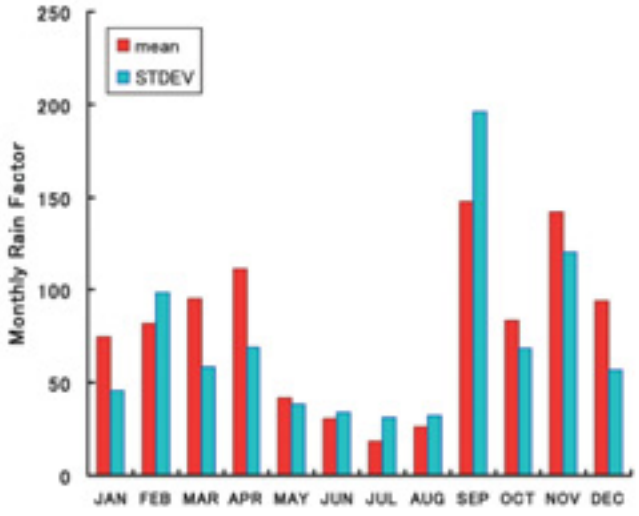


Fig. 2. Monthly rain factor showing the mean and standard deviation (STDEV) estimated from daily rainfall data from 1990 to 2000.

soil loss in the village. The study performed the following tasks: 1) installation of rain gauges and measurement of rainfall characteristics; 2) sampling of soils and laboratory analysis; 3) measurement of positions using the Global Positioning System (GPS); and 4) observation of topography and land use at the site. Fig. 1 shows a vegetable field located on a slope in the southern part of Langensari Village, a location particularly prone to soil erosion.

Rain factor (R) used in the USLE was calculated by multiplying the energy of rainfall by the peek intensity of rainfall during a 30-minute period. In this case we developed a method to estimate factor R from the daily rainfall data at the Research Institute of Vegetables (RIV), located on the northern side of Langensari Village. Fig. 2 shows the results of the estimated factor R using the daily rainfall data during the 1990 to 2000 period. In the middle of the dry season, i.e. from May to August, both the mean and standard

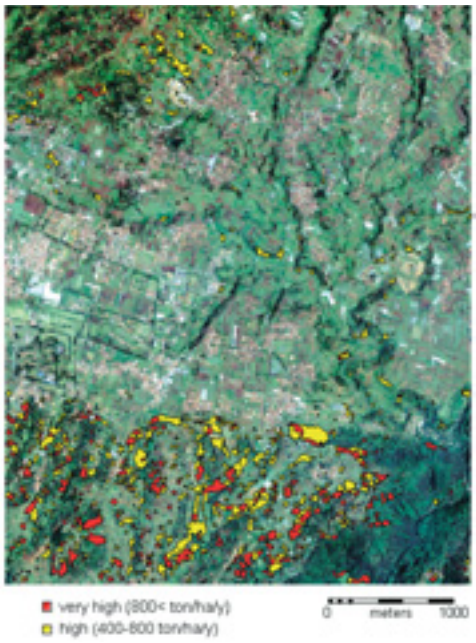


Fig. 3. Distribution of potentially hazardous erosion areas expressed in terms of the annual amount of soil loss.

deviation values were low compared with those of other periods. However, high values of both parameters appeared in September, which is a transition period from the dry to rainy season. This point corresponds with the phenomenon that while very severe rainfall occurred in September during some years of the past decade, there was no rainfall in others.

Soil factor (K) was calculated by the Center for Soil and Agro-Climate Research and Development in Indonesia, using the results of physical analysis performed on soil samples taken from the site. Slope inclination factor (S) was obtained from digital elevation data produced by digitizing elevation contours on the 1:25,000 topographic map. The slope

Table 1. Assumed cropping period and estimated annual soil loss in the Langensari Village area (388 ha).

Pattern	Sowing Time			Estimated Soil Loss (ton/ha/year)		
				Maximum during the period 1990-2000	Averaged over up to 3rd maximum	Averaged over up to 5th maximum
1	Jan.	May	Sept.	221	178	157
2	Feb.	Jun.	Oct.	182	160	147
3	Mar.	Jul.	Nov.	155	147	140
4	Apr.	Aug.	Dec.	168	158	149
Present Land Use	Feb. Apr.	(Jun.) (Aug.)	Oct. Dec.	171	158	148

length factor (L) was estimated from an empirical relation between factor S and factor L, which was obtained from the results of field observation. In order to estimate the crop management factor (C), we analyzed remote sensing data from three temporal satellites to obtain the land cover/use data, which involves information from the cropping period. By assigning the monthly value of factor C for each land use, we could produce a digital map of the distribution of factor C. In order to estimate the conservation practice factor (P), we applied texture features obtained from aerial photos to examine the conditions of agricultural field terraces against soil erosion.

Researchers integrated all the factors obtained from the remote sensing and geographical data, and then estimated the amount of soil loss caused by water erosion from 1990 to 2000. Another map was produced of the hazardous state of soil erosion using the 11-year averaged value, which was displayed over the satellite image as shown in Fig. 3. The methods employed in this study enabled researchers to predict how the amount of soil loss would change if land use type or cropping pattern was altered. For example, four patterns in terms of the sowing time of agricultural fields were discriminated. Table 1 summarizes the results of the calculation for the four patterns of cropping, where all the agricultural fields were cultivated simultaneously three times per year. This table indicates that the amount of soil loss differs remarkably depending on the sowing pattern, particularly in case of 1994, the most erosion-prone year. The amount of soil loss of Pattern 3 is far less than that of Pattern 1, presumably due to the effect of vegetation cover in September.

(S. Uchida)

TOPIC 2

Impact on food supply and demand under changing water resources in Shandong Province, China

Farm production diversification and modernization in China has caused an increased dependence on irrigation water. At the same time, growing demand for water from city and township enterprises severely restrains the available water supply needed to improve farm production. While this water resource problem may not be solvable, quantitative analysis on changing water resources and their relation to grain production might elucidate an approach for improving the situation.

Fig. 1. Corn affected by drought in Shandong Province, China.

Shandong Province, with a population of 90 million and a high economic growth rate, is one of the major agricultural production areas in China, and is suffering from a severe lack of rainfall. Rainfall in the provincial capital Jinan during 2002 was only 382 mm, or 60 percent of the yearly average, causing grain production to decrease by as much as 20 percent from the previous year (Fig. 1). The present study uses a simulation model to analyze how changing water resources influences grain production.

In Shandong Province, the drought of the 1980's damaged roughly 3.45 million hectares of land at a yearly average of 3 million hectares. During the 1990's, damaged land area increased to 4.16 million hectares. As a result, the yearly supply-demand (production and consumption) gap during these years (12.87 million tons) was 3 million tons more than that of the non-damage years (Fig. 2). Taking into account the decrease of agricultural land caused by future population

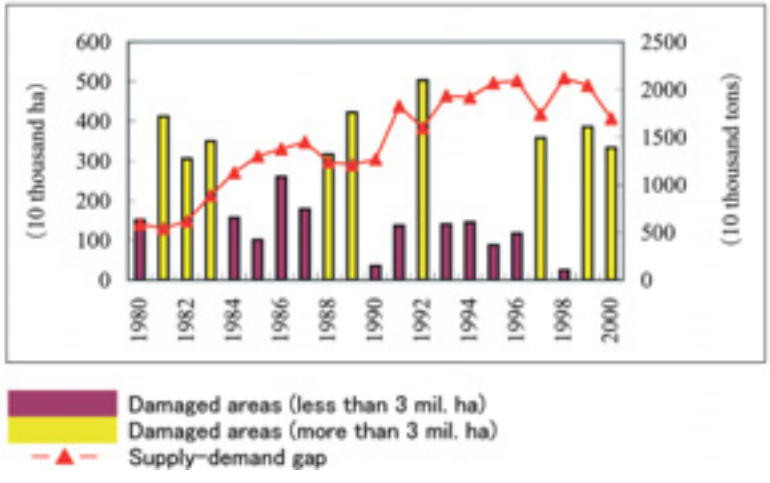


Fig. 2. Area of damage caused by drought and prediction of food supply-demand gap. Note: grain products include cereal, tubers and beans. Colors in the damaged areas over 3 million hectares are yellow. Source: "China Statistical Yearbook (1990-2001)", "China Rural Statistical Yearbook (1985-2001)"

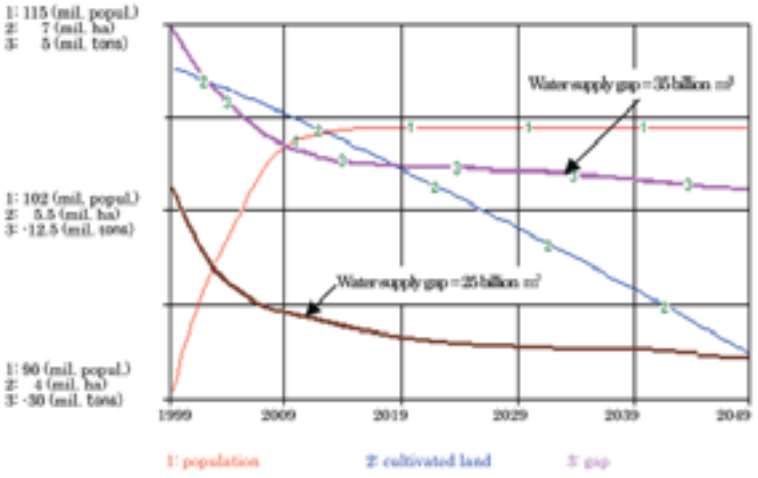


Fig. 3. Changes in the food supply-demand gap according to quantity of water supply

growth, city expansion, and industrial progress, simulation analysis, measuring how the food supply-demand gap and water supply are related, was carried out using the system dynamic model.

Assuming an average yearly water supply of 25 billion m^3, the food supply-demand gap will expand continuously and exceed 20 million tons in 2008 (Fig. 3). On the other hand, if it is assumed that the water supply will increase to 35 billion m^3 (the minimum water demand in 2030 in Shandong Province is predicted to be 33.5 billion m^3), the food supply-demand gap will then be reduced by an amount predicted not to exceed 10 million tons. If the supply-demand gap is not reduced, the possibility of the province losing its status as a major grain production area will continue to remain high.

(C. Hsiaoping)

TOPIC 3

Development of the World Forest Products Model (WFPM)

The preservation of forest resources is a critical issue in forest product trade negotiations. Many countries have analyzed the potential effects caused by liberalizing the trade of forest products on the natural environment based on quantitative models. On this topic, a project team composed of researchers from JIRCAS and the Forestry and Forest Products Research Institute developed a global quantitative model, with a particular emphasis on Pacific Rim countries that export large quantities of forest products to Japan, in order to analyze how the reduction of tariff rates would affect the forest product markets and the sustainability of forest resources.

The model, termed the "World Forest Products Model (WFPM)," is a comprehensive, yet practical model that forecasts the influence of trade and environmental policies based upon the previous leading world forest models, such as the GFPM (Global Forest Products Model) of the FAO or the GTM (Global Trade Model) of the IIASA (International Institute for Applied Systems Analysis). The World Forest Products Model is a simultaneous equation model using the same structure of the World Food Model, created by the FAO, and the International Food Policy Simulation Model, created by JIRCAS. While these other models are based on mathematical programming, the simultaneous equation structure was selected in order to make full use of the knowledge accumulated from the development of agricultural models.

The characteristics of the WFPM are as follows: 1) a partial equilibrium model focused specifically on forest products; 2) a multi-products model determining equilibrium prices of products that relate to each other simultaneously; 3) a multi-country or regional world model forecasting trade activity among regions; 4) a dynamic model using lagged variables to forecast time-series changes; 5) a synthetic model employing parameters estimated in other models; and 6) a policy simulation model analyzing the effects of policy changes such as the change of tariff rates.

The WFPM analyzes the following six products: round wood for industrial use and sawn wood, and wood-derived panels, boards, pulps and paper. The data incorporated into the model include yearly time-series data that are aggregated from the FAOSTAT database. The model handles thirty-five regions of which twenty-four are individual countries and the rest are aggregated county groups. The equations of the model consist of behavioral equations such as demand and supply functions, technological linkage functions, such as conversion functions between pulp and paper, and identities such that the total supply equals production plus net imports minus stock change. For the parameters of the behavioral equations and linkage functions, weighted averages are selected from GFPM or GTM, which are commonly used during trade negotiations. Fig. 1 displays the structure of the WFPM.

The effects of tariff rate changes on supply and demand were tentatively measured during

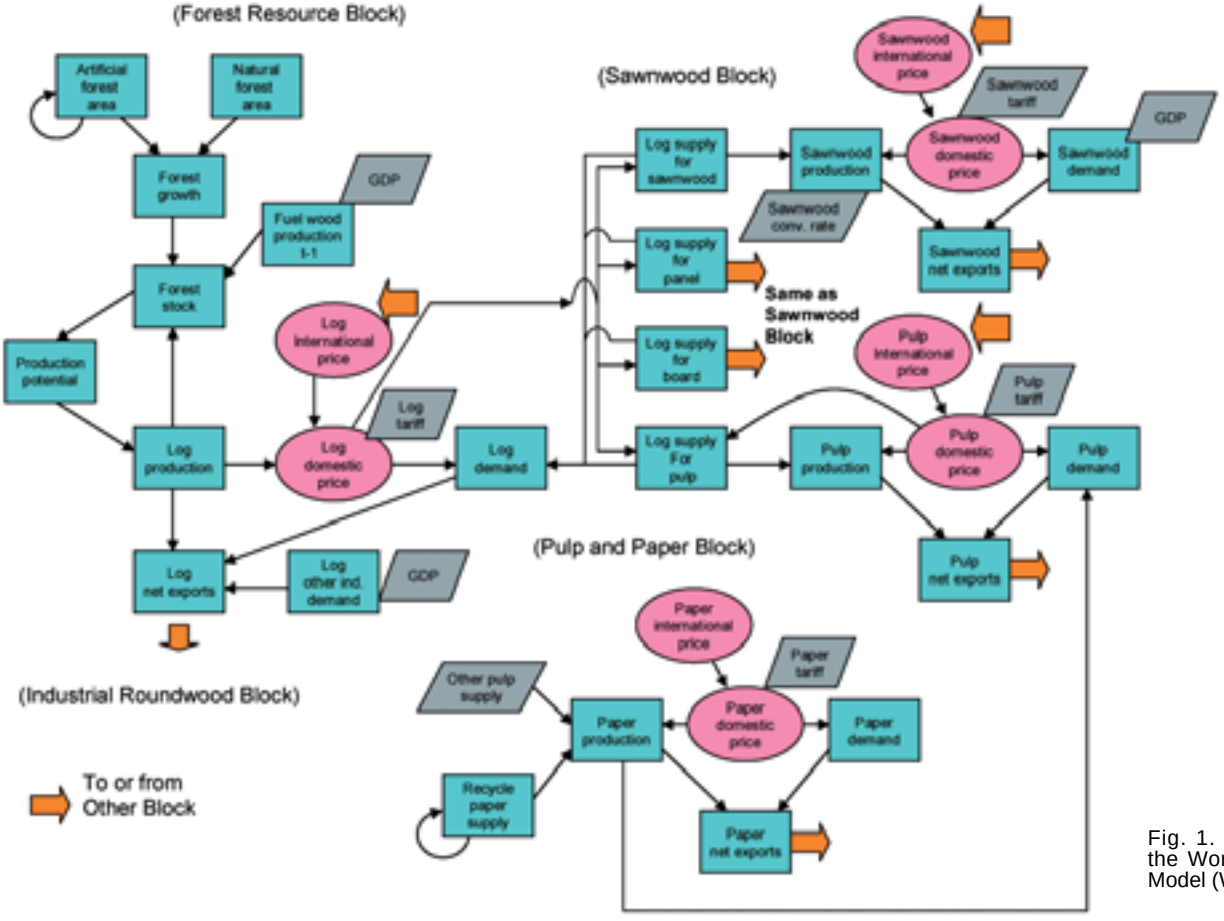


Fig. 1. Structural chart of the World Forest Products Model (WFPM).

a sensitivity test of the model. In this case, the tariff rates were placed at zero for 2005. From the model, it was determined that few price changes occur at the world level (from -0.5% to 2.4%), for tariff rates are already at low rates. However, considerable effects on demand were discerned in the industrial markets, although product and regional effects vary substantially. In future research, efforts to improve the model, especially in variable selections and parameter estimations, will continue to be carried out.

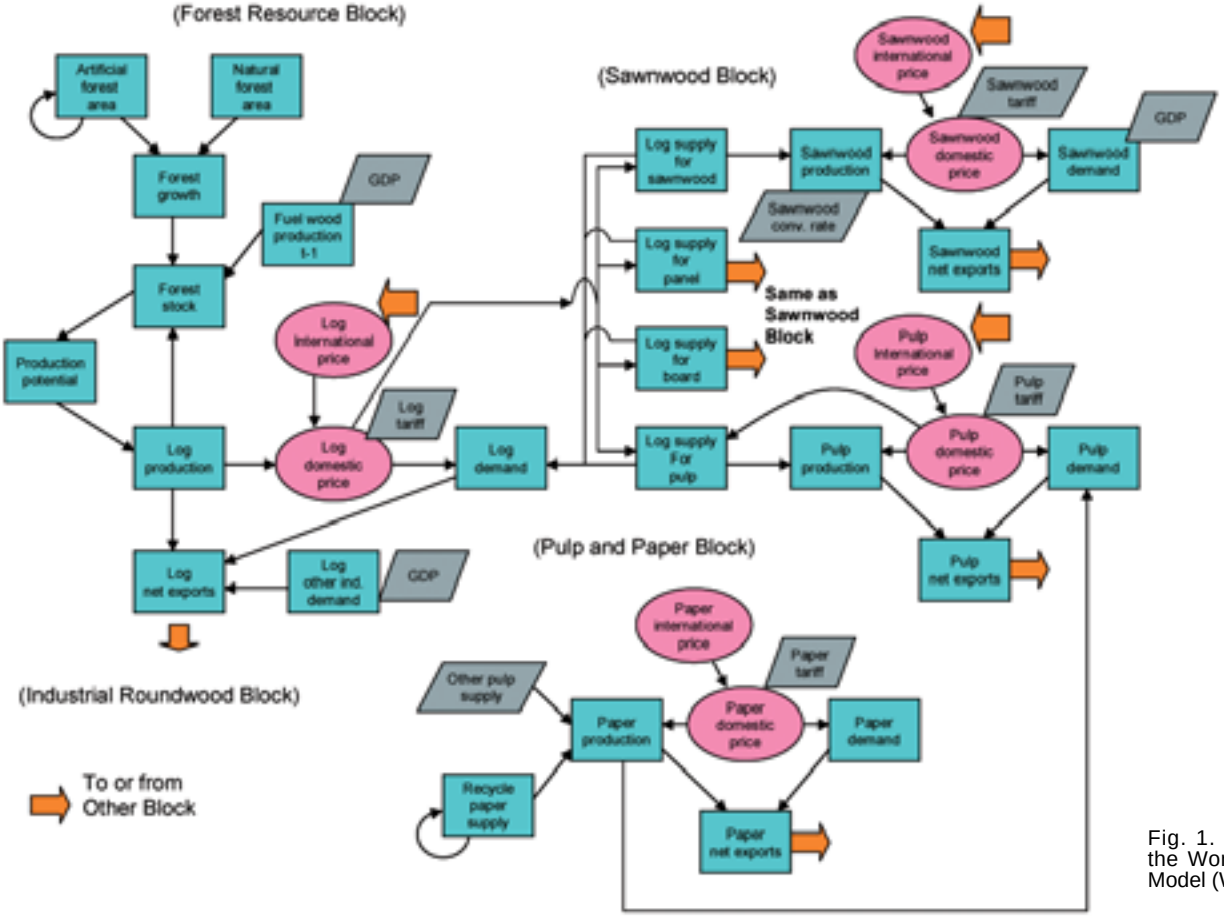
(O. Koyama and J. Furuya)

BIOLOGICAL RESOURCES DIVISION

Biological resources play a pivotal role in addressing global challenges facing food security and environmental preservation in developing countries. The international community is committed to the goals of safe conservation, sustainable use, and equitable sharing of the benefits of biodiversity. To use genetic diversity for sustainable socio-economic development presents a tremendous challenge for scientists and policymakers.

Over the last decade, there has been remarkable progress in science and the development of technological tools for improved utilization and understanding of genetic diversity. For example, nearly all economically useful plants are now amenable for transformation, and the molecular bases of biological functions such as stress tolerance are now much more clearly understood. Genomic science is providing sound tools and techniques for the manipulation of genes and their functions for plant improvement. The Division is taking full advantage of such progress to engage the challenges facing developing countries, promoting the active use of genetic diversity for sustainable socio-economic development.

We have carried out collaborative projects with two centers supported by the Consultative Group on International Agricultural Research (CGIAR). In cooperation with the International Rice Research Institute (IRRI) in the Philippines, the Division has been developing isogenic lines with different resistance genes to blast. QTLs for dry matter production of rice have been analyzed using substitution lines of the



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indica rice chromosome segment in *japonica* rice. Working with the West Africa Rice Development Association (WARDA) in Côte d'Ivoire, the Division has conducted QTL analysis for the high transpiration ability of African rice. Researchers used the F_2 population by substituting a particular chromosome segment of *O. glaberrima*, for high transpiration ability, in *O. sativa*. The QTL for transpiration ability was detected on chromosome 2 of *O. glaberrima*.

Important work has been conducted in collaboration with CIMMYT to develop wheat resistance to *Fusarium* head blight and rust disease. The QTLs responsible for tolerance to the *Fusarium* head blight toxin were identified on the 6D chromosome short-arm and 7A chromosome short-arm. Similarly, the zones related to FHB resistance were found on the short-arm of chromosome 3B, and on the long-arm of chromosome 2L or 2D. Three genes resistant to stem rust were found on the long-arm of chromosome 2B, on the long-arm of 5D and on the short-arm of 6D.

As part of JIRCAS's comprehensive project entitled "Comprehensive studies on soybean improvement, production and utilization in South America," the Division staff, in collaboration with INTA-Marcos Fuarez (Argentina), is working on the delineation of sudden death syndrome (SDS), which is becoming a major threat to sustainable soybean production in MERCOSUR countries. It was determined that SDS is caused by *Fusarium solani* sp. *glycines* in Argentina. A nested-PCR based method was developed to identify the pathogenicity of *Fulsarium solani* isolates from naturally infected plants, and intensive studies have been carried out to develop a simple and reliable test of diverse germplasm for resistance to *Fusarium* solani isolates. QTL analysis was also conducted for SDS resistance using the hybrid population provided by Chiba University, and four resistant genes were identified on the soybean linkage map.

Currently, a Division staff member is working with the Asian Vegetable Research and Development Center (AVRDC) on the evaluation and use of traditional vegetable germplasm in South and Southeast Asia. Traditional vegetables are expected to contribute to improving the nutritional status of the low-income population in these regions, and offer income-generating opportunities. More than four hundred accessions of vegetable species were evaluated for antioxidant activity as well as vitamin C and phenol compounds. Some specimens of *Toona sinensis*, *Moringa* spp., *Celosia argentea*, *Perilla frutescens*, *Canaus cajan*, *Solanum nigram*, *Zanthoxylum ailanhtoides*, *Capsicum annuum* and *Corchorum* spp. showed high antioxidant activity. Significant variation was discovered within and between species, and promising accessions of high nutritional value have been selected.

At present China is importing a large quantity of soybeans to close the gap between domestic production and consumption, despite the fact that it is the country of origin of this important crop. JIRCAS is supporting China's efforts to boost the productivity of soybeans in order to reduce reliance on foreign imports. More than 1,500 accessions of native soybean germplasm have been evaluated in the field for 13 morphological and physiological traits. The known germplasm serving as the medium resistant to cyst nematode disease was reevaluated for its resistance to hot field conditions in Jilin province and 16 promising lines have been selected. By SSR marker analysis, the genetic variation of soybean germplasm in China was determined to be much wider than in Japan.

The Division's molecular biology group has utilized biotechnological methods to study tolerance to environmental stresses such as drought, salinity, and freezing temperatures. In particular, the group made important advances toward understanding the molecular mechanisms of a plant's defenses against environmental stresses such as elucidating the dehydration responsive element binding protein (DREB) of *Arabidopsis*. Techniques have also been developed for their genetic manipulation. The group analyzed transgenic plants having the dominant-negative mutant

Testing for resistance to soybean cyst nematode in the field at the Jilin Academy of Sciences.

of the histidine kinase gene ATHK1 from *Arabidopsis thaliana*, which was expected to function as an osmosensor in plants. The transgenic plants showed tolerance to freezing, drought and salinity, but the expression of ATHK1 genes was independent of any stresses. The plants with the *DREB1A* gene showed a high level of proline in the absence of stresses. The expression pattern of the ABA-responsive gene, *rd29B* and its transcriptor showed that the expression could be controlled in different ways between the young seedling and adult stages of the plant.

In addition, unique DNA sequences of A/GCCGACNT were discovered on the promoter field of the target gene of *DREB1A*. The genes *OsDREB1A* and *OsDREB1B*, as well as genes from *Arabidopsis*, *DREB1A*, *DREB1B*, and *DREB1C*, were introduced into rice with the promoter of ubiquitin to develop transgenic rice. The transgenic plants showed over-expression of the tolerance genes to stresses under natural conditions. Seventy rice genes were identified through microarray and Northern blot analysis and classified by stress-responsiveness and function. This strongly indicates the potential for engineering rice plants possessing abiotic stress tolerance as previously demonstrated by studies on *Arabidopsis* and tobacco plants.

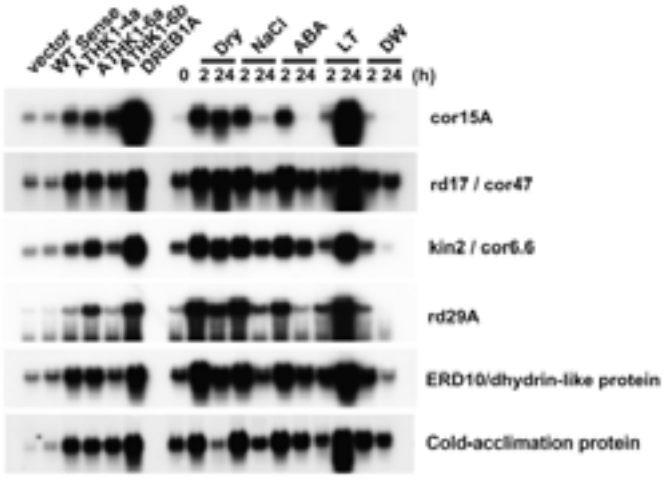

Fig. 1. Northern blot analysis of stress-inducible genes. Expression levels of a number of stress-inducible genes were higher in all of the dominant negative ATHK1 (1-4a, 1-6a, 1-6b) and DREB1A overexpressors (DREB1A) than those in the control (vector) and wild-type ATHK1 overexpressors (WT sense) under unstressed conditions. These genes were also induced by dehydration stress, high osmolarity (NaCl), absicic acid (ABA), low temperature (LT) or water (DW) in wild-type *Arabidopsis* plants.

TOPIC 1

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. 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 instable crop productivity. To address this problem, researchers had 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. Prior shortcomings have indicated that introducing a large number of genes into a plant is necessary to confer fully improved stress tolerance. Thus, researchers need to manipulate a regulatory gene that controls the quantities and timing of the numerous effector molecules described above.

To determine which regulatory gene to target, division researchers analyzed intracellular responses during drought. Under drought conditions, a change in cellular osmotic pressure caused by water loss triggers various intracellular responses. Such responses activate signal tra nsduction pathways and gene expression of osmoprotectants. When this occurs, a sensor or receptor protein(s) will perceive the osmotic changes at the plasma membrane. It was decided to target the osmosensor as the regulatory gene to be engineered.

Based on an analogy in bacteria and yeast, it was expected that histidine kinase(s) would function as an osmosensor in plants. It was thus decided to clone a cDNA encoding a histidine kinase ATHK1 from *Arabidopsis*. RFLP mapping showed that the ATHK1 gene is on chromosome 2. The ATHK1 mRNA was more abundant in roots than other tissues and accumulated under conditions of high salinity and low temperature. Histochemical analysis of GUS activities driven by the ATHK1 promoter further indicated that the ATHK1 gene is transcriptionally up-regulated in response to changes in external osmolarity. These results suggest that ATHK1 is necessary for efficient sensing of environmental signals such as high salinity and drought stresses.

ATHK1 contains two hydrophobic transmembrane regions adjacent to a putative extracellular domain in the N-terminal half. This suggests functional similarity with the yeast osmosensor SLN1. 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

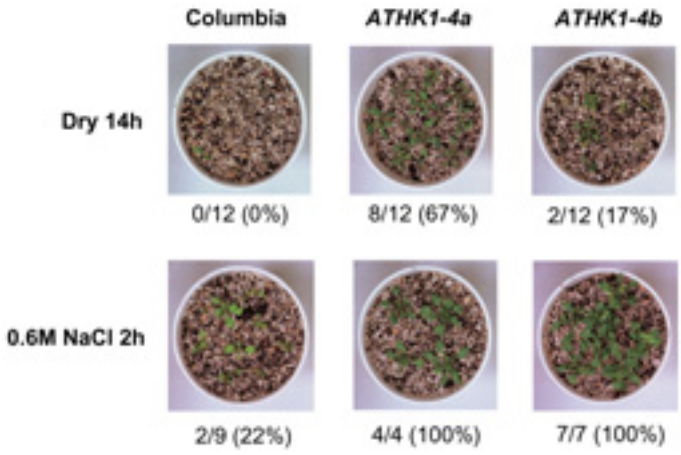

Fig. 2. Drought and high salinity tolerance of the dominant-negative ATHK1 overexpressors. 3-week-old plants were dehydrated for 14 hours on paper and re-hydrated for 2 days with water. The plants were then transferred to a pot for 5 days. 67% and 17%, respectively, of the dominant-negative ATHK1 overexpressors survived, but all wild-type plants died under the same conditions. 3-week-old plants were exposed to 600 mM NaCl solution for 2 hours and then grown in a pot for 5 days. The salt tolerance of the dominant-negative ATHK1 overexpressers (100% survival) was much stronger than that of the wild-type plants (22% survival).

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 conditions of high osmolarity. This suggests that the ATHK1 activity changed to an inactive state from an active state in response to increases in external osmolarity. Thus, using the yeast osmosensing-defective mutants, division scientists analyzed both sensing (input) and catalytic (output) activities of ATHK1 in vivo, and concluded that ATHK1 has an ability to sense and transduce a signal of external osmolarity to downstream targets.

In order to examine the function of ATHK1 in plants, researchers attempted to generate *Arabidopsis* plants transformed with mutated ATHK1 cDNAs. The dominant-negative ATHK1 mutants that inhibit the activity of the wild-type ATHK1 were screened first. This in turn suppressed the yeast SLN1 deletion mutant and allowed the isolation of six candidates (ATHK1-1 to 6). Sequence analysis revealed that ATHK1-6 has a nucleotide substitution at a putative ATP binding site. Researchers then generated transgenic *Arabidopsis* plants overexpressing the dominant-negative ATHK1 cDNAs, and found that several lines exhibit late germination, growth retardation, short roots, and accumulation of anthocyanin and stomatal closure under normal growth conditions. Analysis using a cDNA microarry and northern blotting indicated that a number of stress-inducible genes are constitutively expressed in the dominant-negative ATHK1 overexpressors under unstressed conditions (Fig. 1). Moreover, the dominant-negative ATHK1 overexpressors were more tolerant to dehydration and high salinity stresses than were wild-type plants (Fig. 2).

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.

(T. Urao and K. Yamaguchi-Shinozaki)

TOPIC 2

Evaluation of antioxidant activity of indigenous vegetables from South and Southeast Asia

More than eight hundred million people currently suffer from hunger and malnourishment. Improving the production of principal food crops such as rice, wheat, corn and root crops has thus become one of the most important research subjects in the field of agriculture. Yet, sufficient levels of micronutrients and vitamins are also essential for maintaining good health, especially for pregnant women and preschool children in rural areas. Since vegetables can provide high levels of micronutrients, vitamins and fiber, producing more vegetable varieties has become an important task. To help develop vegetable variety, indigenous vegetables that are under-utilized globally but sufficiently adopted to local areas in growth and taste preferences (Fig. 1) can be of great value. The purpose of this study, conducted in collaboration with the Asian Vegetable Research and Development Center (AVRDC), has been to select the most superior indigenous leaf vegetables based on functional properties.

To complete this objective, various

Fig. 1. Genetic diversity of Amaranth or Chinese spinach (*Amaranthus spp.*)

Table 1. The highest rated indigenous leafy vegetables in terms of antioxidant activity, ascorbic acid and total phenol contents at the AVRDC.

	Indigenous leafy vegetables / Young shoots of fruit vegetables	Scientific name	Antioxidant activity [1]	Ascorbic acid content [2]	Total phenol content [3]
(Antioxidant activity : Strong)					
1	Chinese mahogany	*Toona sinensis*	128	125	(3,784)
2	Leaf of horseradish tree (Mo13)	*Moringa oleifera*	115	(287)	(691)
3	Feather cockscomb (purple)	*Celosia argentea*	114	(134)	(947)
4	Perilla	*Perilla frutescens*	114	84	(727)
5	Leaf of pigeon pea	*Cajanus cajan*	113	(259)	(833)
6	Leaf of horseradish tree	*Moringa* spp.	113	(245)	(713)
7	Leaf of black nightshade	*Solanum nigrum*	112	(146)	432
8	Ailanthus	*Zanthoxylum ailanthoides*	111	82	(2,134)
9	Leaf of capsicum pepper (purple)	*Capsicum annuum*	108	(226)	(1,158)
10	White jute	*Corchorus* spp.	107	(153)	503
11	Leaf of African eggplant	*Solanum macrocarpon*	105	120	537
12	Leaf of Chinese wolfberry	*Lycium chinense*	105	116	597
13	Parsley	*Petroselinum crispum*	104	(132)	271
14	Leaf of capsicum pepper	*Capsicum* spp.	99	(128)	(817)
15	Basil	*Ocimum basilicum*	99	28	302
16	Water convolvulus	*Ipomoea aquatica*	99	45	(726)
17	Gynura	*Gynura bicolor*	97	35	313
18	Madeira-vine	*Anredera cordifolia*	97	59	232
19	Dandelion	*Taraxacum officinale*	96	27	137
20	Sweet potato vine	*Ipomoea batatas*	96	35	684
(Antioxidant activity : Weak)					

Data in parentheses represent the top ten vegetables in terms of ascorbic acid and total phenol content.
[1] Relative value against 10 mM BHA positive control (%).
[2] Ascorbic acid content (mg/100g FW)
[3] Total phenol content (mg chlorogenic acid equivalent /100g FW)

Table 2. Diversity of antioxidant activity, ascorbic acid and total phenol contents in young shoots and leaves of indigenous vegetables from South and Southeast Asia

	Indigenous vegetables (Scientific name)	No.of accessions	Antioxidant activity [1] Max. - Min.	Ascorbic acid [2] Max. - Min.	Total phenol content [3] Max. - Min.
1	Perilla (*Perilla frutescens*)	7	118 - 110	98 - 67	1,039 - 479
2	Pigeon pea (*Cajanus cajan*)	51	116 - 86	259 - 78	1,348 -757
3	Horseradish tree (*Moringa* spp.)	26	118 - 92	323 - 158	983 - 566
4	Black nightshade (*Solanum nigram*)	18	116 - 108	178 - 128	570 - 357
5	White jute (*Corchorus* spp.)	49	110 - 100	216 - 70	666 - 318
6	Water convolvulos (*Ipomoea aquatica*)	72	116 - 80	68 - 31	1,324 - 478
7	Capsicum pepper (*Capsicum* spp.)	22	108 - 93	226 - 82	1,158 - 428
8	Basil (*Ocimum basilicum*)	11	107 - 87	31 - 23	481 - 182
9	Spider flower (*Cleome gynandra*)	17	97 - 91	160 - 113	322 - 243
10	Garland chrysanthemum (*Chrysanthemum coronarium*)	20	96 - 89	57 - 35	343 - 210
11	Amaranth (*Amaranthus* spp.)	100	103 - 33	135 - 28	452 - 124
12	Malaber spinach (*Basella alba*)	78	94 - 35	154 - 53	547 - 211

[1] Final concentration of BHA was 40 μM and that of samples was 2 mg (FW) / mL. Antioxidant activity (AOA) : AOA (%) of sample / AOA (%) of 10 mM BHA × 100
[2] Ascorbic acid content (mg / 100g FW)
[3] Total phenol content (mg chlorogenic acid equivalent / 100g FW)

accessions of indigenous vegetables from South and Southeast Asia were evaluated for their antioxidant activity, levels of ascorbic acid (vitamin C), and total phenol count. Antioxidant activity was assayed by a modified thiocyanate method using ethanol extracts; total phenolic compounds were determined by the Folin-Denis method using the same ethanol extracts; and ascorbic acid content was evaluated by RQflex and use of analytical test strips. These methods do not require the use of expensive analytical instruments such as high performance liquid chromatography (HPLC).

Among the twenty tested vegetable varieties, the top nine were determined to have young shoots and leaves with extremely strong antioxidant activity. These include Chinese mahogany (*Toona sinensis*), Horseradish tree (*Moringa* spp.), Feather cockscomb (*Celosia argentea*), Perilla (*Perilla frutescens*), Pigeon pea (*Cajanus cajan*), Black nightshade (*Solanum nigrum or S. americanum*), Ailanthus (*Zanthoxylum ailanthoides*), Capsicum pepper (*Capsicum annuum*) and White jute (*Corchorus* spp.). These vegetables also had a tendency to have higher ascorbic acid and total phenol contents (Table 1). Antioxidant activity, ascorbic acid and total phenol contents differed not only among vegetable species but also among accessions (Table 2).

For the selection of superior indigenous vegetables, evaluation of antioxidant activity, ascorbic acid and total phenol contents can be used as a novel index together with morphological and ecological characterization, and yield evaluation.

(T. Sato)

TOPIC 3

Identification of the sudden death syndrome pathogen in Argentinean soybean crops

Recently, concerns have grown about the spread of and damage caused by soil-borne diseases. One such disease is sudden death syndrome (SDS), which has been associated with continuous cropping of soybean plants on untilled land in MERCOSUR countries. In order to bring SDS under control, identification of the pathogen that causes the disease is critical. Toward this objective, JIRCAS has conducted cooperative studies with the National Institute of Agricultural and Farming Technology (INTA) in Marcos Juarez, Argentina, entitled the "Ecology and control of major diseases of soybeans" since 1999.

In Argentina, severe outbreaks of SDS have occurred in the Cordoba and Santa Fe Provinces. Infected plants were collected from the fields and the symptoms of SDS were observed and recorded. The symptoms of SDS are characterized by yellow spots on the leaves in the early stages of the disease, by the browning interveins of the leaves in the later stages, and by a loss of leaves in the final stage. SDS also causes red-brown discoloration at the upper part of the main and lateral roots, and root rot, making the plant easy to unearth (Figs. 1, 2).

While researchers are aware of the symptoms of SDS, identification of the pathogen that causes the disease has proven more difficult. Using PCR, a detection method was created that would identify the

Fig. 2. Leaves displaying symptoms of sudden death syndrome in the greenhouse (top), and in the field (bottom).

Fig. 1. Leaves and roots displaying symptoms of sudden death syndrome in the field.

Table 1. Re-isolation of the MJ161 strain of *Fusarium solani* f. sp. *glycines* from roots infected in a greenhouse test.

Roots	Pieces tested	* Re-isolated	%
Upper main root	25	19	76.0
Lower main root	25	4	16.0
Lateral root	25	12	48.0

* Confirmation of the characteristics of the MJ161 strain on test tube culture of a PDA.

pathogen in both artificially inoculated and naturally infested plants. Tissue samples were taken from the infected plants and the isolated pathogen was observed under a microscope for its morphological characteristics.

A pathogen was also taken and inoculated on a grain of sorghum, then dried and macerated to inoculate one-month old soybean plants grown in a greenhouse. The pathogen displayed a very slow growth rate on the potato dextrose agar (PDA) with one half to a third of the saprophytic *Fusarium* producing more than 50 μm of macroconidia, while the rest produced none. Sporodochya of the pathogen were frequently observed on the surface of the lesion of the roots. *Fusarium* was more frequently isolated from the red-brown colored tissues of the upper main roots and the lower hypocotyls than from the lateral roots (Table 1). The symptoms of the leaves and roots tested in greenhouse conditions were similar to those observed in fields. Yellow spots formed on the leaves two weeks after inoculation and the interveins subsequently began to brown.

Based on the observations and the application of Koch's Three Principles, it was concluded that the SDS pathogen in Argentina could be identified as *Fusarium solani* f. sp. *glycines*. The identification of the SDS pathogen is expected to help in the process of cultivating SDS-resistant soybean plants in Argentina.

(Y. Honma)

CROP PRODUCTION AND ENVIRONMENT DIVISION

The Crop Production and Environment Division carries out research to develop sustainable agricultural technologies that increase the efficiency of crop production and minimize crop waste or deterioration at all stages of the production chain. In achieving this objective, researchers utilize natural resources and the diversified functions of crops and microbes, which in turn support natural ecosystems and environmental conservation on a global scale. A substantial proportion of our research is collaborative in nature, as more than one third of our scientists are dispatched overseas to work on various comprehensive projects organized by JIRCAS.

At present, the Division consists of five research groups: material cycling, crop management, plant physiology and nutrition, water resources management and plant protection. In Fiscal Year 2002, our research groups conducted 42 projects relating to the following three sub-themes of JIRCAS's mid-term plan: 1) evaluation of material cycling of nitrogen and the improvement of soil amelioration technology in diversified agro-ecosystems, 2) development of crop production technologies that reduce labor and resource needs for rice and upland crops in Thailand and Vietnam; and the 3) investigation of current major pests and diseases threatening rice and soybean crops in Southeast Asia and South America.

The material cycling group, in conducting analyses on agricultural problems related to the overuse of nutrients in intensive farming, found that 30 to 40 percent of nitrogen fertilizer is released through ammonia volatilization in the paddy fields of Hunan and Jiangsu Provinces. After determining that ammonia volatilization is most likely caused by high pH and ammonia concentrations in the surface water, researchers concluded that ammonia volatilization could be reduced three to ten percent by utilizing slow-release fertilizers. In another research project, analyses were conducted in Cantho Province, Vietnam in order to estimate the volume of nitrogen flows up to the year 2010. Since considerable quantities of livestock and aquaculture feeds are predicted to be brought into the province due to industrial expansion, and feces and urine quantities are expected to increase from 19 kgN/ha/yr in 1999 to 59 kgN/ha/yr in 2010, water system pollution due to nitrogen will cause substantial problems unless better management systems are instituted.

The crop management group has

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The crop management group has

developed an unhulled rice-dryer suitable for use by individual farmers in the Mekong Delta of Vietnam in order to improve drying efficiency and consistency during the rainy season. The dryer has already produced tangible results in Vietnam, and since the dryer is easy to employ, and can dry two tons of moist unhulled rice within approximately 13 hours without diminishing the quality of rice, it is expected to improve production efficiency, minimize loss, and thereby significantly improve the earnings potential of individual farmers. In other research, the crop management group investigated how severe incidences of clubroot disease threaten temperate vegetable production in the West Java highlands in Indonesia. To address this problem, researchers designed short-term crop rotation systems that implement three crop rotation cycles yearly, and then tested these systems under field conditions. It was determined that a rotation system that included carrot and potato plants could control clubroot disease to the extent that early growth could be maintained and a high first year yield could be produced.

The plant physiology and nutrition group analyzed the physiological characteristics of rice plants in order to evaluate their tolerance to low phosphorus conditions. Researchers concluded that four African rice cultivars, including Tog6594, had relatively high phosphorous uptake capacities, and that such cultivars could significantly improve production in the acidic upland rice fields that are widely distributed in the humid forest areas of West Africa. Similar experiments were conducted to evaluate rice tolerances to high aluminum and iron, as well as soybean tolerances to drought. Using rain-out shelter treatment to test South American soybean varieties, it was discovered that cultivar BR183 displays stable tolerance to drought and could thus be used to increase production in areas affected by water shortages.

The water resource management group developed a system for estimating how ground water contributes to water storage in the extensively constructed farm ponds of Northeast Thailand. Since the contribution of groundwater can be estimated from the isotope distribution of radon, researchers developed a simple and small-scale apparatus to concentrate radon in water samples. After preliminary measurements, it was concluded that that groundwater contributes only minimally to farm ponds during the rainy season.

The crop protection group illustrated that rice could be cultivated using fewer insecticides by introducing rice varieties highly tolerant to whitebacked planthoppers. Cultivating such varieties is expected to be more profitable than cultivating high-yield

hybrid rice varieties, which require extensive and frequent insecticide application. And lastly, in another major project, researchers investigated methods for improving the cultivation of grasshoppers, and concluded that the insect could be grown with artificial feeds, a discovery that will bolster the large-scale culturing of this insect.

TOPIC 1

Development of a small unhulled rice-dryer suitable for use in the Mekong Delta

The Mekong Delta is Vietnam's largest rice producing region. During the rainy season harvest time, conventional sun-drying methods can cause the quality of unhulled rice to deteriorate. Problems also arise during days of intense sunlight, when drying occurs too quickly and causes grains to crack. To assist cultivators in drying their rice in a more efficient and consistent fashion, researchers developed an all-weather, easy-to-use compact dryer that can dry approximately two tons of unhulled rice without deterioration and cracking.

This dryer operates using a honeycomb coal furnace, air blower fan, and driving engine with slanted drying layers on both sides. Since the drying layers are located at a low position, it is easy to hold, mix and take out unhulled rice. An easily prepared weather protection tent allows users to continue to conduct drying even during sudden rainfall (Fig. 1 and Table 1). When the dryer is installed outdoors on an uneven surface, users must ensure that air does not leak from the ground plane.

Two tons of uhulled rice can be dried in approximately 13 hours with 25 percent initial moisture content without adverse effects. Drying can generate uneven moisture on the upper and lower layers of dry unhulled rice. However, this moisture can be reduced if the drying speed is increased by mixing and agitating the rice after five hours of operation. Since four people and approximately four hours are needed to complete the entire process of assembling, drying, and removal, one-time mixing and agitation is sufficient.

Fuel costs for honeycomb coal and light oil are approximately 74,000 VND (about 620 yen) per one ton of dry unhulled rice. The dryer is priced at 6,500,000 VND (about 54,000 yen), excluding the weather tent. Forty units are currently in use, primarily in the Mekong Delta area.

(M. Daikoku and H. Kobayashi)

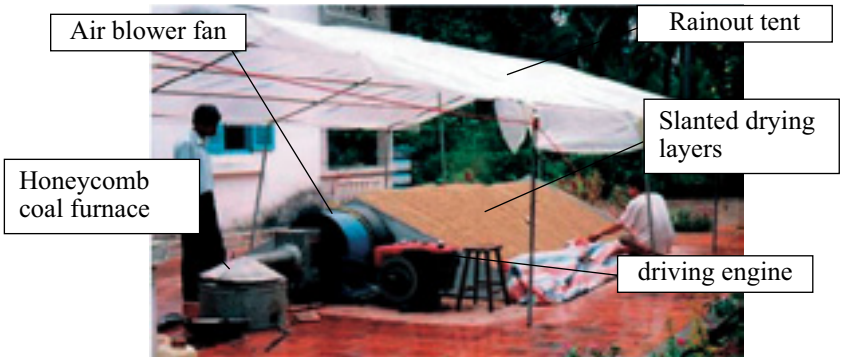


Fig. 1. Unhulled rice dryer.

Table 1. Dryer specifications.

Drying layer	width (mm)	2,900
	length (mm)	4,000
	height (mm)	700
	depth (mm)	280
Fan blower	fan diameter (mm)	450
	blowing capacity (m^3/s)	2.0
Heat source	honeycomb coal	2 sets
Driving engine		diesel
Rainout tent	width x length (m)	2 x 6

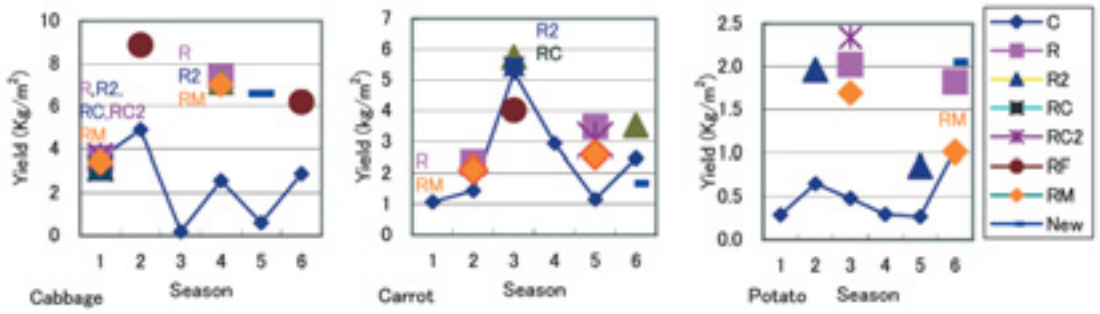


Fig. 1. Effects of continuous cropping on vegetable yield. C: continuous cropping; R: cabbage-carrot-potato rotation; R2: cabbage-potato-carrot rotation; RF: R1 rotation inserted with fallow cropping every two seasons; RC: R1 rotation, but inserted with corn after every vegetable; RC2: R2 rotation inserted with corn after every vegetable planting; RM: R1 rotation with mixed vegetables.

TOPIC 2

Employing one-year crop rotations with three vegetable combinations to control clubroot damage in the West Java highlands

Indonesia is a typical tropical island country having a mountainous and volcanic terrain. Such geographical conditions are well suited for temperate vegetable cultivation throughout the year, which enables high quantities of such vegetables as cabbage, Chinese cabbage, and carrots, to be produced and consumed, particularly in areas close to big cities. However, as a result of rapid industrialization and urbanization, incomes in rural areas have decreased in comparison with those in urban areas. The potential does exist, however, of reducing the severe income disparities that afflict farmers in highland areas since lucrative temperate vegetables grow more easily there than in lowland areas, yet progress brought by continuous and/or highly frequent cropping of Cruciferae family plants has now been reversed due to the emergence of clubroot damage. Therefore, it is critical that new cropping technologies be developed that can reduce clubroot damage, while also minimizing the harm done to the environment by using fewer chemicals.

In addressing the problem of clubroot disease, short-term crop rotation systems that rotate three crop cycles within a year were designed and investigated under field conditions. It was decided to cycle carrots and potatoes with cabbage since they are also widely produced in highland areas. As the control, a continuous cropping system and two crop sequences were designed and set up using those vegetables. The inclusion of fallow for one cropping season was also tested because cropping is limited in many places by insufficient water supplies during the dry season.

The continuous cropping of cabbage produced the yield trend shown in Fig. 1. In the first season, all cabbage plant yields were rather low due to improper insect management, and no plants displayed severe clubroot disease symptoms. From the second season to sixth season, continuous cropping plot yields showed large fluctuations, but all values were lower than those produced from crop rotation and non-continuous cropping plots, thus indicating that considerable yield reduction will occur when vegetables are grown continuously.

With regard to pest damage, none could be observed in the continuous cropping plots during the second season. Compared to the cropping plot covered in black plastic film and kept in fallow during the last season, however, early stage growth and the yields from continuous cropping plots were significantly low. Since clubroot symptoms were observed in both cropping systems without significant differences in harvesting time, the reason for low yields in the continuous cropping plot was unknown. However, in the third season, many cabbage plants in the continuous cropping plots died from clubroot disease, suggesting that

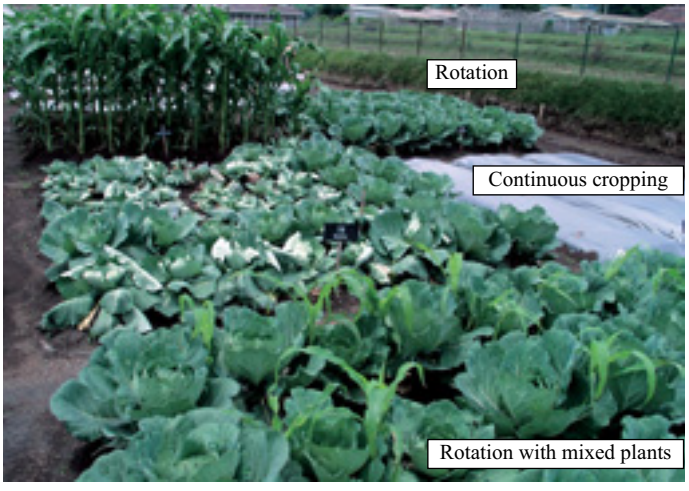


Fig. 2. Damage caused by clubroot disease in a continuous cropping plot.

clubroot disease causes more damage when crops are infected during the growth stages. It is possible that the strong growth of cabbage plants in fallow cropping might suppress or delay clubroot disease outbreaks in the early growth stages. In the sixth season, the continuous cropping and fallow cropping plots were compared again and a clubroot damage score was assigned to both. The continuous cropping plot score was 93, while the fallow cropping plot score was 7. The same score occurred even during harvest time, which confirms that crop rotations help mitigate the damage caused by clubroot disease.

The effectiveness of crop rotations was also confirmed in the fourth season, after one cycle of the rotations. The cabbage yield of the rotation plots ranged from 7.07 to 7.39 kg/m^2 compared to a continuous cropping plot value of 2.57 kg/m^2. Researchers concluded that the continuous cropping plots were attacked by clubroot disease after witnessing early stage wilting symptoms (Fig. 2) and determining their clubroot damage score. While crop rotations did not perfectly suppress clubroot disease, they reduced the damage to an economically acceptable range. It was also determined during these analyses that crops must be continually rotated in order to be successful.

The results of this experiment illustrate that cropping rotations, including the rotation combinations, substantially support cabbage cultivation, but in order to evaluate the system as a whole, results from the carrot and potato rotations should be considered. The carrot yield trend produced by continuous cropping is shown in the middle of Fig. 1. No severe pest damage or adverse effects caused by continuous cropping were observed. In the fifth season, continuous cropping plot yields were low due to cabbage armyworm damage, but this was also observed in newly planted plots in the sixth season, indicating that its occurrence is unpredictable.

In the case of potatoes, it was observed that the top parts of the plants in continuous cropping plots wilted and died early in the second planting due to bacteria wilt, and that the disease's intensity grew more severe with each successive planting. Fig. 1 illustrates this dramatic decline in potato yield. Since plant growth was inhibited in the early stages, the tubers diminished in size and the quantity of rotten tubers increased. The weight of the tubers from continuous cropping plots was only 1/3 of those from the third season rotation plots, thus indicating that crop rotation substantially reduces damage caused by bacteria wilt. Rotation sequence, however, was not important, as was the case with cabbage plants.

Clubroot disease is a common and adverse result of continuous cropping in the West Java Highlands. However, the potential damage caused by clubroot disease can be mitigated by short-term crop rotations, which removes host plants for brief periods of time. Although the stability of crop rotations has to be confirmed by long-term observation, short-term crop rotations are a practical way to maintain cabbage and other vegetable production in ways that do not threaten the environment.

(M. Yamada)

TOPIC 3

Paddy field ammonia volatilization with double cropping and its control in the Red Soil Region of China

The People's Republic of China is the world's largest producer and consumer of food. New technologies and reform policies have substantially improved the conditions necessary to meet China's growing demand for grain. Yet the adverse environmental effects of intensive modern agriculture have recently raised concerns about land resource sustainability and the environment. Intensive farming has caused significant land degradation, irrigation water shortages, and air and water pollution, all of which are now serious issues in China. Many of these problems stem from farmlands being overloaded with nutrients, particularly nitrogen. China's use of nitrogen fertilizer has increased to 27.4% of world consumption, and a total of 22.4 x 10^6 tons of nitrogen were

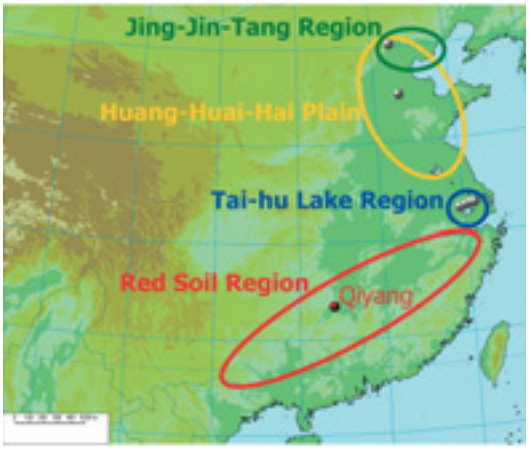


Fig. 1. Four major agricultural regions in the People's Republic of China. Dots indicate joint research sites (the red dot is the location of the Red Soil Experimental Station).

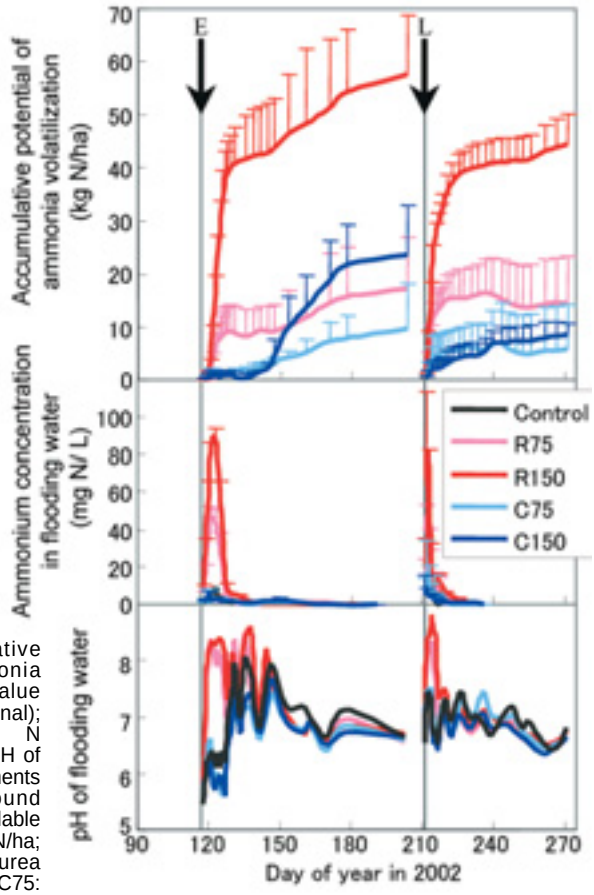


Fig. 2. Top: accumulative potentials of ammonia volatilization (control value subtracted from the original); middle: ammonium N concentrations; bottom: pH of flooding water. Measurements were carried out around sunset. R75: readily available urea at a rate of 75 kg N/ha; R150: readily available urea at a rate of 150 kg N/ha; C75: coated urea at a rate of 75 kg N/ha; C150: coated urea at a rate of 150 kg N/ha; E: early rice transplanting and fertilizer application on April 26, 2002; L: late rice transplanting and fertilizer application on July 30, 2002. Vertical bars indicate the SD's of triplicate measurements (average for flooding water pH only).

used in 2001 alone. Excess nitrogen in the environment poses numerous health and environmental problems. Health issues include methemoglobinemia, caused by the presence of nitrate in drinking water, while environmental issues range from freshwater and estuary productivity diseases to increased greenhouse gas emissions and acid rain.

JIRCAS launched a seven-year research sub-project, entitled "Evaluation and development of methods for sustainable agriculture and environmental conservation," being conducted with two Chinese research institutes: the Chinese Academy of Agricultural Sciences's Institute of Soils and Fertilizers and the Chinese Academy of Sciences's Institute of Soil Sciences. The project, which began in 1997, involves nitrogen cycling field experiments at research sites in four major agricultural regions in China (Fig. 1).

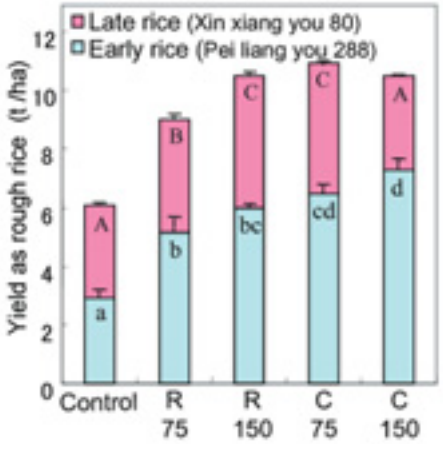


Fig. 3. Yields of early and late rice in 2002 in terms of rough rice. Vertical bars indicate the SD's of triplicate measurements. Means in a crop followed by the same letter are not significantly different at $P < 0.05$ by the Student's T-test. Abbreviations as in Fig. 2.

A nitrogen cycling field experiment in the Red Soil Region, one of the most important double rice cropping hill areas in China, was carried out at the Red Soil Experimental Station, Chinese Academy of Agricultural Sciences, Qiyang County, Hunan Province (26°45′21″N, 111°52′22″E). The goal was to quantify the present conditions of non-point source N pollution in the region and to develop methods to mitigate that pollution. Using a polyolefin-coated urea (MEISTER S9 for early rice, MEISTER 10 (40%) + MEISTER S15 (60%) for late rice) at a rate of 150 kg N/ha (conventional level) or 75 kg N/ha for each crop just after flooding (keeping other conditions the same), five treatments were prepared with triplicates. These were R150 (readily available urea at a rate of 150 kg N/ha), R75 (readily available urea at a rate of 75 kg N/ha), C150 (coated urea at a rate of 150 kg N/ha), C75 (coated urea at a rate of 75 kg N/ha) and a control (no nitrogen). By using an open-chamber method and monitoring other environmental data, ammonia volatilization potential for each plot was determined. The total ammonia volatilization potential during the early rice and late rice cropping period reached 35 percent of applied N at R150, decreasing to 21, 11 and 10 percent at R75, C150 and C75, respectively (Fig. 2, top). High ammonia concentrations in flooding water (Fig. 2, middle) and high pH (Fig. 2, bottom) were observed for one week after applying readily available urea. This period corresponded well to the period when high ammonia volatilization potential was observed. C75 produced a high yield that did not differ significantly from that of R150, but was significantly higher than that of C150, which suffered damage from a blast and sheath blight (Fig. 3).

It was concluded that the high ammonia volatilization potential observed from conventional management of paddy fields in this region can be mitigated. To do so, controlled-release fertilizer can be used such that a reduced fertilizer application rate is made compatible with a high yield.

A simultaneously ongoing watershed survey in this area aimed to determine the

rates of N flows via surface water. The results of the watershed survey and the field experiments, the status of nitrogen pollution in this region, as well as those of other research sites in this project, have all been evaluated. At the end of the project, alternative management strategies that can minimize the environmental impact of nitrogen will be proposed

(Y. Hosen)

TOPIC 4

Characterization of nitrogen utilization by tropical grasses (*Brachiaria* species) in the Brazilian savannas.

Since the 1970's, *Brachiaria* species have been introduced to 40 million hectares, or 85 percent, of grassland area in the Brazilian Cerrados. The three most common species cultivated in the region are *Brachiaria decumbens* (BD), *Brachiaria brizantha* (BB), and *Brachiaria humidicola* (BH). Empirically it is known that these species have different nutrient requirements in the order of BB > BD > BH. However, interspecific differences regarding nutrient uptake and efficiency of use are not still clear. Poor nutrient status of the soil, especially related to nitrogen (N), is a main factor limiting grass productivity in low fertility and acid soil areas in Brazilian Cerrados.

This research aimed to determine whether an agropastoral system (crop-pasture rotation) with fertilizer inputs might improve the physical and chemical properties of the soil and enable farmers to introduce high quality grasses. JIRCAS scientists thoroughly analyzed how the grasses responded to different nutrient supplies with a particular emphasis on how they differed in terms of nutrient uptake and efficiency of use. During that analysis, the N utilization characteristics of BB, BD, and BH, grown under different N conditions, were compared, as well as the grass absorption and utilization mechanisms.

BB, BD, and BH were grown under different levels of N (0, 50, and 150 kg N/ha)

Table 1. Contribution ratio of fixed N derived from air in plants. (%Ndfa)

	N content (mgN g/DM)	$\delta^{15}N$ (‰)	%Ndfa (%)
BB	13.5	5.7	26.8
BD	11.4	6.0	24.0
BH	8.7	7.0	9.2
PM	12.1	7.9	

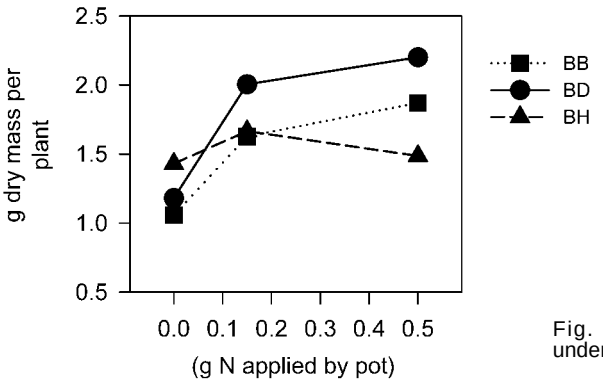


Fig. 1. Dry mass in plants under different levels of N.

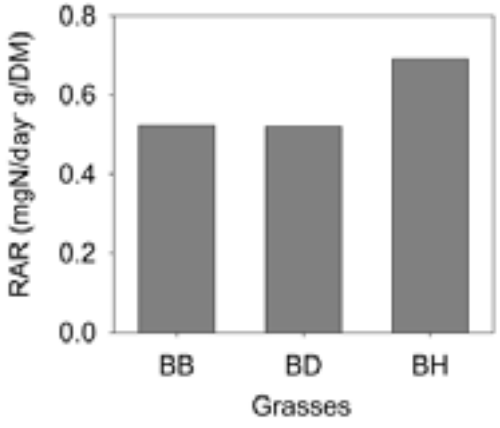


Fig. 2. Relative N absorption rates in plants with no N application.

in a pot experiment. The dry matter weight of BH was higher than those of BD and BB when no N was applied (Fig. 1). In BD and BB, dry matter weight increased when applied N levels were increased, and after sufficient N conditions, surpassed the dry matter weight of BH. The dry matter weight of BH did not increase with N application, suggesting that BH is better adapted to limited N conditions than the other two grasses. The relative N absorption rate (RAR) was of BH was higher than those of the other two grasses in the treatment without N application (Fig. 2). The smaller reduction of BH's dry matter weight under low-N conditions could be due to a high-N absorption rate.

In a field experiment, researchers estimated the contribution ratio of fixed N derived from air in the plants (%Ndfa) under no N application using the ^{15}N natural abundance technique. *Panicum maximum* (PM) was considered to be suitable as a reference crop for the estimation because δ

Table 2. Kinetic constants of NO_3^- uptake in *B. brizantha*, *B. decumbens*, and *B. humidicola*.

	BB	BD	BH
Vmax (μmol m^{-2} h^{-1})	152.4	146.4	160.6
Km (μM)	11.2	7.5	4.4

^{15}N of PM was highest among the four plants (Table 1). The %Ndfa of *Brachiaria* species was 9.2-24.0%, the %Ndfa of BH being lower than those of BD and BB. This indicated that the contribution ratio of soil N would be higher in BH than in BD and BB.

To evaluate root nitrate uptake capacity, a kinetic experiment was conducted. Nitrate uptake rate can be expressed according to Michaelis-Menten kinetics using the following equation:

$$\nu = \frac{V\max \times C}{Km + C}$$

where ν is the uptake rate of nitrate, Vmax is the maximum nitrate uptake rate, Km represents the Michaelis constant, and C is the concentration of nitrate in the solution. To estimate the kinetic parameter for nitrate uptake, the depletion-method was used. The concentration of nitrate in the incubation solution was reduced over time and ultimately became a constant (data not shown). Based on this data, the kinetic parameters were calculated (Table 2). *Vmax* was higher in BB than in BD and BH, but there was no significant difference among the three species. *Km* in BH was lower than BB and BD, suggesting that BH has a high affinity to nitrate and can maintain a high nitrate uptake rate under limited N conditions.

BH can maintain dry matter production under limited N conditions because its roots have a high nitrogen uptake ability. BD and BB, on the other hand, can achieve high productivity under N-sufficient conditions because of their high response to applied N.

(T. Nakamura)

TOPIC 5

Estimation of changes in nitrogen flow accompanying agricultural development in Cantho Province, Vietnam predicted for 2010

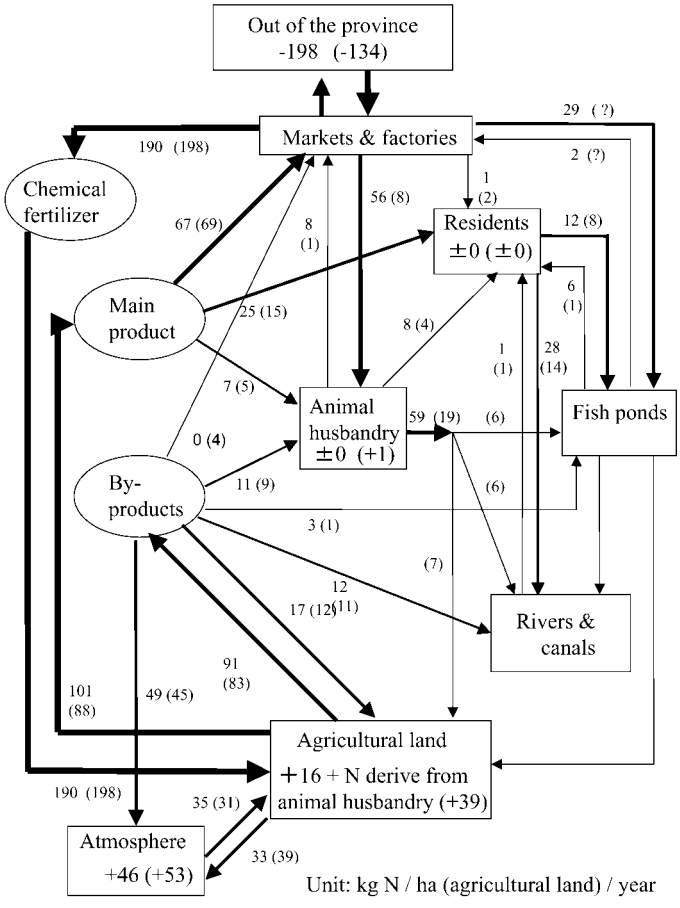


Fig. 1. Predicted nitrogen flow in Cantho Province (2010).

Farming systems in Vietnam's Mekong Delta have been subjected to increased agro-chemical input in order to greatly intensify agricultural activity, and thereby significantly raise profits. As a result, however, material flows of various chemicals, and in particular, nitrogen, have been disturbed, a process that could lead to an increase in water pollution. The goal of this study was to estimate nitrogen flow in 1999 in order to determine how agricultural development will impact nitrogen flow and water pollution through the year 2010 in Cantho Province, Vietnam.

Cantho Province lies on the right bank of the Hau River in the central part of the Mekong Delta, and supports a population of more than 1,815,272 over 296,422 ha of land. A model was constructed to calculate nitrogen flow during 1999 and estimate nitrogen flows during 2010. The unit nitrogen flow (kg N/ha/year) refers to the nitrogen flow (kg N/year) divided by the area of agricultural land or planned agricultural land of Cantho Province in 1999 and 2010, respectively. To determine the volume of nitrogen flows, researchers used the official agricultural development plan authorized by the People's Committee of Cantho Province, entitled "Agricultural

Table 1. Agricultural data for Cantho Province.

	unit	1999	2010
Pigs	10^3 heads	243	700
Milk cows	10^3 heads	0	23
Poultry	10^3 heads	2,940	6,000
Freshwater fish	t	8,040	64,400
Freshwater prawns	t	60	3,000
Agricultural lands	ha	249,995	239,513

Fig. 2. Example of a biogas digester.

Planning for Cantho Province to 2010," in order to provide the predicted figures for agricultural production, cultivated area, livestock, food consumption by residents, and population for the year 2010. Where information was not provided, researchers compensated by using data from related reports published in Japan and other foreign countries.

The estimated nitrogen flow in Cantho Province in 1999 and 2010 is shown in Fig. 1. The plan predicts rapid development in the areas of animal husbandry and aquaculture (Table 1), which will bolster the demand for animal and fish feeds. If the number of livestock increases as reported, livestock excreta per unit area of agricultural land will increase from 19 kg N/ha/year to 59 kg N/ha/year. Although material cycling in Cantho Province has been intensified with the development of agriculture since the 1980s, the nitrogen balance in the agricultural land was +39 kg N/ha/year in 1999, and it seems that this balance will not change significantly towards 2010. These results indicated that the nitrogen balance will be in relatively good condition through 2010. Therefore, since the agricultural land of Cantho Province still maintains a capacity to absorb nitrogenous wastes from animal husbandry and aquaculture, it is essential that more livestock excreta be applied to agricultural land, rather than be discarded directly into rivers, in order to protect public health and the environment. To this end, the use of biogas digesters (Fig. 2) and the composting of livestock feces should be promoted in this region.

(T. Watanabe)

TOPIC 6

Drought tolerance characteristics of Brazilian soybean cultivars

Soybean production in South America is highly productive but severely diminished if drought occurs during the reproductive growth stages of soybean crops. In order to illuminate the physiological and morphological characteristics associated with drought tolerance as measured by a yield index, scientists artificially measured drought

Table 1. Seed yield of ten Brazilian soybean cultivars under drought conditions using rainout shelters.

No.	Cultivar	Seed yield (t ha^{-1})	
		1999/2000	2000/2001
1	BR-16	1.01	1.38
2	BR-37	1.24	1.76
3	Embrapa 48	1.07	1.72
4	Embrapa 59	0.86	1.34
5	BRS 132	1.05	1.68
6	BRS 133	1.08	2.02
7	BRS 134	1.06	1.20
8	BRS 183	1.23	2.38
9	BRS 184	1.10	1.99
10	BRS 185	0.88	1.57
	LSD(5%)	0.70	0.84

After first flowering, soybeans received no rain for one month under rainout shelters. Cultivars with high drought tolerance are represented in blue and those with low tolerance in red.

Table 2. Growth parameters of soybean cultivars in rainout-treated (RS) plots during the drought stress period (1999/2000).

No.	Cultivar	RGR	NAR	LAR
		g g^{-1}d^{-1}	g m^{-2} d^{-1}	m^2 g^{-1}
1	BR-16	0.015	1.3	0.012
2	BR-37	0.035	3.1	0.012
3	Embrapa 48	0.006	0.6	0.010
4	Embrapa 59	0.010	0.8	0.012
5	BRS 132	0.030	2.8	0.011
6	BRS 133	0.034	2.9	0.012
7	BRS 134	0.019	1.6	0.012
8	BRS 183	0.046	3.9	0.012
9	BRS 184	0.031	2.7	0.011
10	BRS 185	0.031	3.0	0.011

After first flowering, soybeans received no rain for one month under rainout shelters. RGR = NAR × LAR. Cultivars with high drought tolerance are represented in blue and those with low tolerance in red.

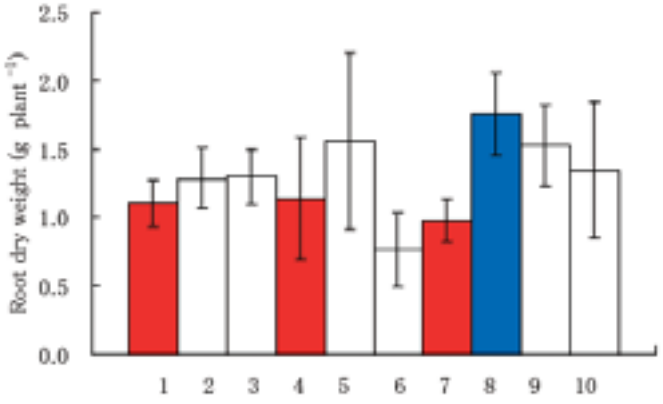


Fig. 1. Root dry weight of soybean plants 20 days after first flowering (2000/2001). Means±SD of 3 replicates. Cultivars with high drought tolerance are represented in blue and those with low tolerance in red.

stress during the reproductive growth stage of soybean cultivars from southern Brazil using rainout shelter treatment from 1999 to 2000.

Researchers determined that yield ranking among cultivars in the rainout shelter (RS) plots was stable across the two-year period with a correlation coefficient for yield ranking significant at the1% level (r=0.78). Although the irrigated plot showed the yield rankings in a different order, there was a significant correlation between the rankings for two seasons, suggesting that drought tolerance should be detectable using rainout treatment.

On the basis the RS plot yield figures, cultivar BRS 183 displayed high drought tolerance, while BR-16, Embrapa 59, and BRS 134 showed low drought tolerance (Table 1). The results of growth analysis (Table 2) in the RS plots during the rainout treatment period illustrated that the BRS 183 had a high relative growth rate (RGR), and thus, a high drought tolerance. BR-16, Embrapa 59, and BRS 134 displayed low RGRs and low drought tolerance. RGR differences reflected a difference in net assimilation rate (NAR), but the leaf area ratio (LAR) did not differ among cultivars. BRS 183 had large root dry weight during the drought period compared with the low drought tolerance cultivars, namely BR-16, Embrapa 59, and BRS134 (Fig. 1).

Based on these results, it was concluded that relative growth rate during drought conditions for a one-month period following flowering can serve as a good index for analyzing how drought tolerance differs among cultivars. However, if drought occurs during other periods, drought response may not necessarily be the same as reported in this study.

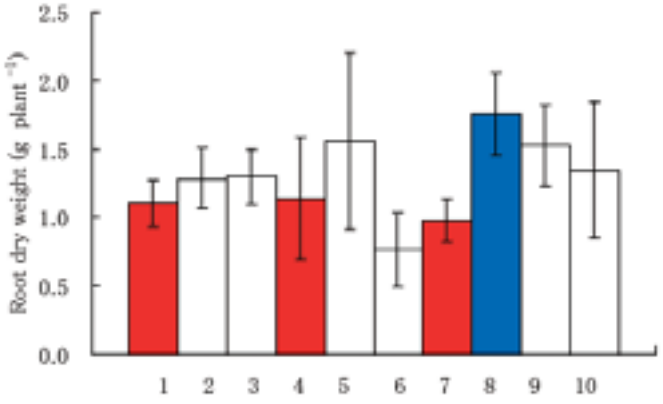
(T. Oya)

ANIMAL PRODUCTION AND GRASSLAND DIVISION

In many different capacities, domesticated animals are beneficial to the lives of people in developing countries. Not only do animals produce meat, milk, and hides that are essential to daily life and serve as important sources of income, but they also contribute to agricultural farming systems through nutrient recycling, where wastes are used as organic fertilizer for infertile land. Trying to maximize these benefits can be hazardous, however, as over-grazing frequently causes the deterioration and desertification of natural grasslands. In order to determine optimal methods for livestock management, researchers must evaluate each developing region's natural, social, and economic resources to determine how human needs and sustainability can be balanced effectively. Effective livestock management systems must also control productivity, reduce disease, employ environmentally sound, recycling systems of livestock husbandry, and develop technologies that help facilitate efficient forage production.

The Animal Production and Grassland Division conducts research aimed at achieving sustainable increases in animal production without generating adverse environmental consequences. In order to achieve this goal, the Division seeks to enhance the productive capacity of natural resources, manage grasslands to secure feed resources, enhance the utilization of agro-industrial by-products, control invasive animal diseases, and improve management practices in developing regions of the world.

During Fiscal Year 2002, one overseas collaborative research project and two supporting projects in Tsukuba moved toward successful conclusion. In the overseas project, JIRCAS worked with the International Livestock Institute (ILRI) to clarify the mechanisms of infection and development of trypanosomosis using mice that lacked trypanotolerance related genes. The domestic research projects, entitled "Isolation and evaluation of endophytic bacteria of grasses" and "creation of DNA markers closely linked to resistance genes against disease and pests in soybean" were conducted at Chiba University. Both projects operate under the



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project “Comprehensive studies on soybean improvement, production and utilization in South America.”

Four long-term international research projects, ranging from one to three years in duration, are currently underway. Division researchers are working with the National Center for Research on Beef Cattle (CNPGC-EMBRAPA), the National Center for Soybean Research (CNPSo) in Brazil, and the International Center for Tropical Agriculture (CIAT) in Colombia to focus on sustainable management and utilization of grasslands under agro-pastoral systems. A second cooperative research project entitled “Improvement of pig feeding management systems in the Mekong Delta” is being conducted with Cantho University. The third project researches the use of lactic acid bacteria for agricultural products in Thailand with the Department of Agriculture (DOA), the Department of Livestock Development (DLD) of Thailand, and Kasetsart University. Lastly, a joint study is being conducted to improve large ruminant feeding management using high biomass forage crops resistant to water stress. This project began within the framework of the collaborative research project “Increasing economic options in rainfed agriculture in Indochina through efficient use of water resources with the Khon Kaen Animal Nutrition Research Center and the DLD.

In addition to the long-term projects, the Division also conducted one-to-three month short-term assignments with a number of different research centers and universities. With the Khon Kaen Animal Nutrition Research Center and the DLD, projects focused on the nutritive value and current utilization of drought-resistant forage crops, as well as the metabolic characteristics of large ruminants fed with drought-resistant forage crops in Northeast Thailand. Projects conducted with Cantho University in Vietnam included studies that evaluated how sugar cane juice concentrates affect pig growth performance in the Mekong Delta, analyses of how to diagnose pig diseases using the enzyme-linked immunoy absorbent assay (ELISA) test, assessments of the losses associated with pig management in the Mekong Delta, and research on the bacteriological characteristics of pathogenic *Escherichia coli* isolated from swine in the Mekong Delta. Evaluation of grasses and technologies introduced into agro-pastoral systems were conducted with CNPGC and JATAK. The Chinese Agricultural University in northern China assisted with analyses on the feed characteristics of corn stalk silage and agricultural by-products prepared in China, studies on how to improve corn stalk silage preparation, and research on improving the quality of the corn stalk silage by fermentation control additives. Lastly, research with the ILRI Ethiopia campus analyzed how to mitigate farm animal methane emission in Africa and how to establish a methane measuring system for ruminants.

Cattle grazing in Ethiopia. (Photo: F. Terada)

One overseas and one domestic research project will be carried out from fiscal year 2003. The former will analyze expression mechanisms of genes related to trypanosomosis tolerance with ILRI, and the later will evaluate available plant endophytic bacteria.

The Division receives numerous requests from institutions in developing countries to pursue collaborative research, primarily concerning how to incorporate biotechnological applications and enhance their overall quality of research. In order to address such needs, the Division has been promoting basic research at JIRCAS’s Tsukuba premises in order to support overseas activities. At present, studies on the evaluation and utilization of endophytic bacteria of grasses, and studies on the socio-economic evaluation of major constraints on domestic animals in Thailand and Vietnam constitute the focus of domestic research.

TOPIC 1

Screening of candidate genes for trypanotolerance in mice livers using a DNA microarray

African trypanosomosis, a protozoan disease transmitted by tsetse flies, is among the most important disease constraints to livestock production, as well as human health, in sub-Saharan Africa. It is difficult to

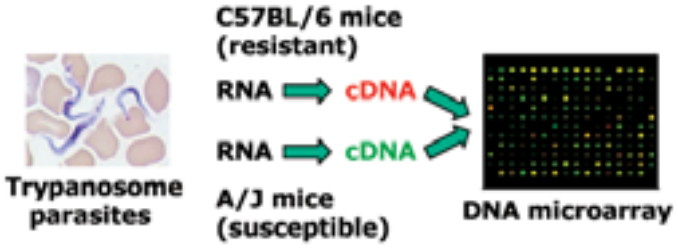


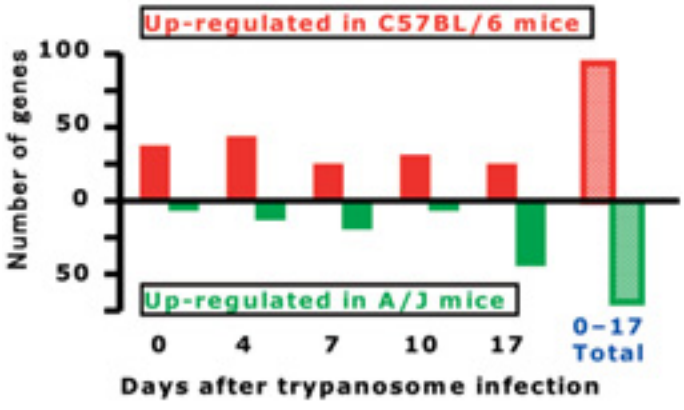
Fig. 1. Conceptual diagram of DNA microarray analysis used to screen candidate genes for trypanotolerance.

overcome this disease because vaccination trials have failed in controlling trypanosome proliferation caused by antigen variations, extermination of the vector is almost impossible, trypanocidal drugs are expensive and have side-effects, and resistance to trypanocidal drugs is often established.

It has been shown that breeds of cattle and inbred strains of mice exhibit genetically based differences in the degree to which they are resistant to the disease. Classical analyses have been made to understand the relation between resistance and host factors specified through characteristic signs and alterations during infection. However, such analyses have failed to elucidate fully the mechanisms of trypanotolerance. In the present study, gene expression levels between mouse strains were comprehensively compared to screen candidate genes for trypanotolerance using a DNA microarray carrying thousands of cDNA fragments.

A DNA microarray was prepared by spotting 7,445 species of 65-mer mouse oligonucleotide probes onto a slide glass using an automatic gene arrayer. Resistant C57BL/6 and susceptible A/J mice were infected with trypanosome parasites, and liver samples were obtained on days 0, 4, 7, 10 and 17 after infection. Total RNA was extracted from each tissue, and four pooled RNA samples, each containing five individual samples, were prepared from each mouse strain at each sampling time point. They were then used to synthesize cDNA fragments labeled with red or green fluorescent dye. Red-labeled cDNA of one strain and green-labeled cDNA of the other strain derived from the same sampling time point were mixed and hybridized with the microarray. Following hybridization, signal intensities of both fluorescent dyes bound to each probe were scanned using a laser-confocal array scanner. Differentially expressed genes between C57BL/6 and A/J mice were detected by calculating a ratio of signal intensities from the two mouse strains. Fig. 1 shows a conceptual diagram of DNA microarray analysis.

Fig. 2. Number of differentially expressed genes in mice liver compared between strains examined using a DNA microarray.



A total of 169 genes were differentially expressed in the livers between the two mouse strains during the course of trypanosome infection (Fig. 2). These included genes encoding important factors involved in a variety of host responses, such as acute phase proteins, complement factors, cytokines and chemokines, electron transporters, intracellular signaling factors, apoptosis factors, ion channels and metabolic enzymes. These genes should be further studied for their roles in conferring genetically based differences in resistance and susceptibility to trypanosome infection among mouse strains.

The present study was conducted under collaboration with International Livestock Research Institute, the University of Liverpool and the Medical Research Council-UK.

(Y. Nakamura)

TOPIC 2

Modification of the pouch method to evaluate the ability of lactic acid bacteria (LAB) strains for improving silage quality

A recent swell in demand for raw milk and fermented milk products in Thailand threatens to further reduce Thailand's self-sufficiency ratio, which currently stands at approximately 60 percent of the total demand. The source of low productivity seems to be poor feeding management, the result of dairy farming inexperience. Most cows are fed with fresh baby corn residues after harvest, fresh pasture crops, and rice straw, and produce an average amount of raw milk at about 3,100 kg/head/lactation. However model farms and innovative farmer groups produce a significantly greater volume of raw milk, around 4,200-4,500 kg/head/lactation, by using superior quality silage as feed. Silage

Table 1. Fermentation quality and microbial flora of silages prepared in Thailand.

Silage Sample[1)]	pH	MC[2)] (%)	Microorganism count[3)] (cfu/g) TVC	LAB	CFB	Yeast	Mold
SS 1	7.71	60.4	5.0×10^6	$< 10^1$	9.0×10^3	6.9×10^4	2.0×10^4
SS 2	4.35	48.8	9.0×10^4	2.0×10^6	1.3×10^3	4.0×10^5	2.0×10^4
CS 1	3.82	78.0	5.1×10^6	3.3×10^6	$< 10^1$	5.4×10^4	$< 10^1$
KS 1	5.10	28.1	4.6×10^7	2.8×10^7	$< 10^1$	2.0×10^2	$< 10^1$

[1)] SS 1: Grass silage in bunker silo (surface); SS 2: Grass silage in bunker silo (inside); CS 1 and KS 1: Corn silage in bagged silo.
[2)] MC: Moisture content. [3)] TVC: Aerobic bacteria; LAB: Lactic acid bacteria; CFB: Coliform bacteria (Enterobacteria).

Table 2. Effects of inoculum size on the growth of typical silage microorganisms in a pouch.

IS[1)]	Culture time (h)	*Lactobacillus* sp. LG 2-1 pH	Microbe count (cfu/g) LAB	CFB	Yeast	*Lactococci* sp. N-22 pH	Microbe count (cfu/g) LAB	CFB	Yeast
A	6	5.69	1.1×10^6	1.2×10^6	1.1×10^6	5.89	1.0×10^5	1.1×10^6	1.0×10^6
	24	5.47	2.8×10^6	3.2×10^6	2.0×10^6	5.59	1.0×10^5	9.0×10^5	1.0×10^5
B	6	5.69	3.2×10^7	2.0×10^5	1.0×10^6	5.79	1.9×10^8	1.3×10^6	7.0×10^5
	24	5.34	1.2×10^8	2.2×10^6	4.0×10^6	5.66	5.0×10^5	1.2×10^6	2.0×10^5
C	6	5.86	1.1×10^6	2.8×10^7	1.0×10^6	5.91	1.0×10^5	7.8×10^7	1.0×10^6
	24	5.55	2.0×10^6	2.0×10^6	2.4×10^6	5.44	1.0×10^6	8.0×10^4	2.0×10^6
D	6	5.51	1.2×10^6	3.2×10^7	2.4×10^7	5.77	4.4×10^7	6.0×10^7	1.4×10^7
	24	5.52	2.8×10^6	1.0×10^8	1.5×10^8	5.55	2.8×10^6	6.2×10^7	9.2×10^6

[1)] IS: Inoculum size (cfu/g), A (LAB 10^2, CFB 10^2, yeast 10^2); B (LAB 10^5, CFB 10^2, yeast 10^2); C (LAB 10^2, CFB 10^5, yeast 10^2); D (LAB 10^2, CFB 10^2, yeast 10^5).

preparation in Thailand is not a common technique, and improving the quality of silage can be difficult. One major reason for this involves the complexity of bacteria effects during silage production. It is generally recognized that lactic acid bacteria (LAB) significantly contributes to the improvement of silage, and thus, a silage fermentation model was constructed to evaluate LAB specifically adapted to the tropical environments of Thailand by modifying the pouch method, a simple and easy system used to evaluate LAB in Japan.

To modify the pouch method, microbial flora of silages prepared in Thailand were examined (Table 1). The counts of aerobic bacteria, enterobacteria (coliform bacteria: CFB) and yeast in grass silages were relatively abundant, but counts of butyric acid bacteria, mold and LAB were low. In corn silages, aerobic bacteria as well as LAB were abundant while CFB and yeast were small. These results suggest that when LAB inhibits the growth of yeast, aerobic bacteria, and CFB, good quality silage can be made.

A silage fermentation model was constructed by modifying the pouch method in which napiergrass was used as silage material and yeast strain SG2-1Y (tentatively identified as *Saccharomyces cerevisiae*) and CFB strain SG1-1T (tentatively identified as *Enterobacter* sp.) were used as typical silage microbes. Napiergrass was harvested after 30 days of cultivation, cut into 2 cm lengths, dried at 105℃, and then autoclaved. After inoculation, napiergrass (with moisture content adjusted to 75 percent and 1.5 percent of glucose added) was placed into a bag made from air-tight plastic film (oxygen permeability: 1 ml/m^2/day) with the yeast, and CFB and LAB strains, sealed by vacuum sealer and cultured at 45℃ for 2 days.

The inoculum size of each microorganism greatly affected the growth of silage microbes in the pouch. For example, as shown in Table 2, when the inoculum size of LAB strain LG2-1 was 10^3 times higher than that of yeast and CFB, LAB growth was accelerated while

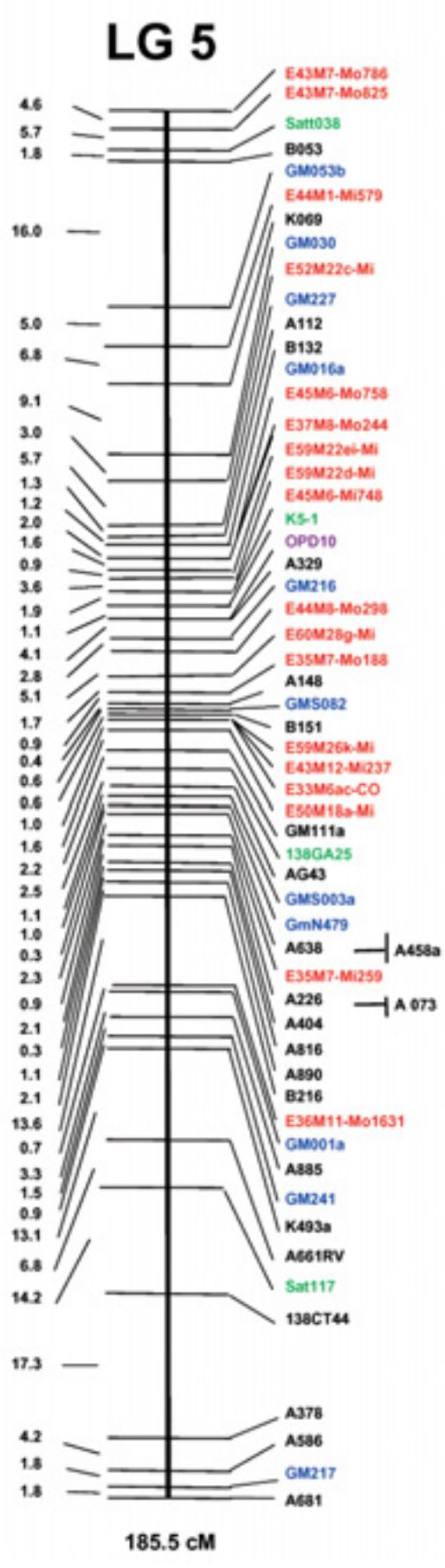


Fig. 1. Soybean molecular linkage map of linkage group 5. Distances according to the Kosambi function and markers are shown on the left and right of the bar, respectively. The total length of this linkage group is shown on the bottom. Color separation indicates marker type (i.e. black: RFLP markers derived from genomic DNA; blue: RFLP markers derived from cDNA; green: SSR markers; red: AFLP markers; and purple: RAPD markers).

CFB growth was repressed. However, the LAB strain N-22 never repressed the growth of yeast and CFB during its quick early stage growth. Therefore, the mixed inoculation of LAB strain LG2-1 and N-22 at a high inoculum size causes the quick growth of the LAB strain. This in turn causes pH levels to drop quickly from the early stage of fermentation.

The modified pouch method can evaluate a substantial quantity of LAB strains easily and quickly, helping researchers to screen practical-use LAB strains that can contribute to improving the quality of silage in tropical regions, including Thailand.

(S. Ohmomo)

TOPIC 3

Construction of a molecular linkage map in soybean

A molecular linkage map covering a large region of the genome with informative DNA markers is very useful for effective and efficient plant selection in breeding programs. It is also essential for identifying and isolating the genes responsible for various quantitative traits. Recently, some soybean linkage maps have been developed with restriction fragment length polymorphism (RFLP) markers, based on soybean genomic DNA, and simple sequence repeat (SSR) markers. DNA markers based on polymerase chain reaction (PCR), such as SSR markers, are suitable for the rapid selection of plants in breeding programs. However, DNA markers derived from expressed genes are important for the identification of gene-rich regions as well as quantitative trait loci (QTLs). In addition, since DNA sequences that code for genes are conserved among many plant families, this kind of marker can also be used in other species. Therefore, a molecular linkage map is highly precise when constructed using complementary DNA (cDNA) markers derived from expressed genes in addition to DNA markers based on PCR.

The soybean (*Glycine max*) varieties Misuzudaizu and Moshidou Gong 503 were crossed to develop a segregated population of 190 F2 plants. Based on this population, linkages were calculated among RFLP markers derived from cDNA and genomic DNA, SSR markers, amplified fragment length polymorphism (AFLP) markers, random amplified polymorphic DNA (RAPD) markers, and qualitative trait loci.

A portion of the constructed soybean molecular linkage map is shown in Fig. 1. This molecular linkage map has 724 markers, including 412 RFLP markers (223 cDNA and 189 genomic DNA), 106 SSR markers, 218 AFLP markers, and one RAPD marker. These markers contain 472 DNA markers developed originally (unpublished data for AFLP markers). This map is the first soybean linkage map having a large number of cDNA markers.

This linkage map also consists of 20 major linkage groups that may correspond to the 20 pairs of soybean chromosomes. The total length of the linkage groups is 3,221 cM of the soybean genome according to the Kosambi function, indicating that this map covers the soybean genome almost completely. This linkage map may thus be used for various aspects of soybean genetic study and breeding.

This study was conducted at Chiba University under partial support from the JIRCAS research project entitled "Comprehensive studies on soybean improvement, production and utilization in South America."

(K. Harada and N. Yamanaka)

FOOD SCIENCE AND TECHNOLOGY DIVISION

Global food production must be increased substantially to meet the needs of a rapidly burgeoning population. Since environmental conditions and a limited area of arable land impede significant increases in food production, harvested products should be consumed with a minimal loss occurring during handling, transportation and storage. In developing countries, insect infestations, microbial infection, and improper handling cause postharvest grain losses estimated at 20 to 30 percent. The Food Science and Technology Division develops postharvest technologies that address this problem, and thereby contribute to food security, poverty alleviation and sustainable development on a global scale. Many postharvest operations in agriculture and horticulture are necessary to maintain food quality, reduce transaction costs, and improve the living standards of rural farmers, and thus, Division's postharvest research covers the entire production-consumption chain, from crop grading, drying and packaging as well as secondary processing, storage, marketing and distribution in order to add value to agriculture products and extend their shelf life.

Indigenous vegetables being sold at a market in Thailand. (Photo: T. Yoshihashi)

Although agriculture remains the largest sector of rural economies, substantial increases in urban incomes have perpetually diminished the scale of agriculture in many developing regions, as rural farmers migrate to cities in search of an improved livelihood. It is therefore essential that rural farmers be given the tools and methods to increase their income so that they can continue to cultivate their lands and rear their livestock. First, since agricultural commodity prices continue to decline and their value as a percentage of the final consumer price decreases, value must be added to these commodities. Secondly, it is necessary for rural farmers and entrepreneurs to produce market products that meet the demands of urban consumers. With the growth of urban economies, consumers have become increasingly concerned about the quality and safety of food products. Changes in urban life-styles have generated a demand for a more diversified diet and for processed and convenience foods. Studies to ensure the quality and safety of agricultural commodities and to enhance their value will therefore greatly contribute to the improvement of rural incomes.

The Division is currently conducting a research project in collaboration with Thai scientists entitled the "Development of low-input technology for reducing post-harvest losses of staples in Southeast Asia." The purpose of this project is to develop low-input drying technology using natural energy sources such as sunlight, husk and straw, and to develop insect pest controlling technology for rice by employing natural enemies and

A portion of the constructed soybean molecular linkage map is shown in Fig. 1. This molecular linkage map has 724 markers, including 412 RFLP markers (223 cDNA and 189 genomic DNA), 106 SSR markers, 218 AFLP markers, and one RAPD marker. These markers contain 472 DNA markers developed originally (unpublished data for AFLP markers). This map is the first soybean linkage map having a large number of cDNA markers.

This linkage map also consists of 20 major linkage groups that may correspond to the 20 pairs of soybean chromosomes. The total length of the linkage groups is 3,221 cM of the soybean genome according to the Kosambi function, indicating that this map covers the soybean genome almost completely. This linkage map may thus be used for various aspects of soybean genetic study and breeding.

This study was conducted at Chiba University under partial support from the JIRCAS research project entitled "Comprehensive studies on soybean improvement, production and utilization in South America."

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bioactive botanicals. In an experiment, researchers were able to determine that the population dynamics of insect pests and their natural enemies showed reverse trends; pest populations dramatically increased between May and August and decreased slightly in September, while natural enemy populations increased slightly from an already small total in September. It was also discovered that several volatile and non-volatile components of botanicals showed inhibitory activity against the insect pest.

Two other projects are being conducted and have also produced significant results. In the first, researchers analyzed the bioactivities of indigenous Thai plants and determined that several plants, including *Micromelum minutum*, showed high antimutagenicity due in part to the compound mahanine, a carbazole alkaloid. In the second project, entitled the "Development of sustainable production and utilization of major food resources in China," researchers are working to improve production processes for traditional Chinese foods, such as soy-curd (tofu) and rice noodle (miefun). As a result of this study, researchers have found that fermented soy-curd (sufu) showed higher antioxidative activity and angiotensin converting enzyme inhibitory activity than did tofuyo, another tofu product that is produced in Okinawa.

The Division conducts research not only to reduce postharvest losses and add value to traditional foods and indigenous plants, but also to develop alternative postharvest technologies that are less dependent on chemicals in order to promote food safety and environmental sustainability. For example, the world's most widely used fumigant, methyl bromide, is to be phased out by 2015 because of its potential to deplete the ozone. Research is thus underway to establish alternative methods to disinfest agricultural products.

TOPIC 1

Formation of flavor compound in aromatic rice and its fluctuations with drought stress

With consumer demand for rice surging, farmers throughout the world face substantial pressure to increase productivity while maintaining the quality of their product. Such pressure is particularly severe for farmers cultivating Khao Dawk Mali 105, a major aromatic rice variety usually marketed as "Jasmine," in Northeast Thailand, where drought-stricken sandy soils and other constraints have caused infertility and restricted sufficient cultivation. What is more, cultivation conditions and postharvest practices are compromising the aromatic quality of the rice. During this project, research was conducted to determine how the flavor compound of aromatic rice is formed and how its quality can be controlled.

2-acetyl-1-pyrroline, a compound having a "popcorn"-like flavor, is a characteristic flavor component of aromatic rice, and has a lower odor threshold (less than 0.1 ppb in water) than other volatile compounds found in aromatic rice varieties. This compound has also been isolated and identified from pandan (*Pandanus amalyrofolys* Roxb.) plant leaves and popcorn, and contributes to the aroma of roast beef and wheat and rye bread crusts. There have been no reports thus far elucidating the formation of 2-acetyl-1-pyrroline in aromatic rice varieties, yet formation of this compound in cocoa fermented products and baked products such as breads have been reported. In bread this compound is formed from ornithine and triose phosphates during baking through the Strecker degradation of ornithine. In cocoa, this compound is produced from both L-proline and L-ornithine by *Bacillus cereus*

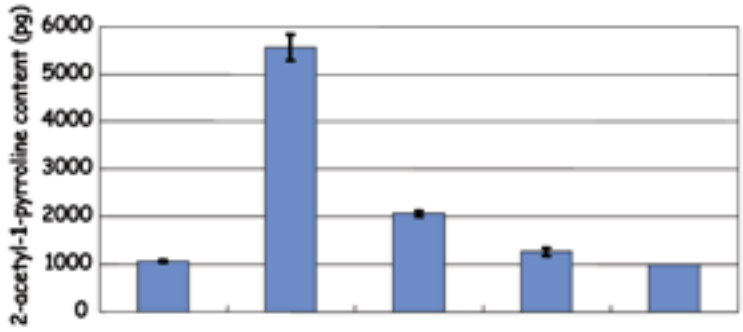

Fig. 1. Effects of amino acid addition to rice seedlings on 2-acetyl-1-pyrroline formation. When proline (Pro) was added to the solution for rice seedlings, 2-acetyl-1-pyrroline increased in concentration by more than 3-fold in comparison to the control. Addition of glycine (Gly) and histidine (His) did not increase the content in rice seedlings.

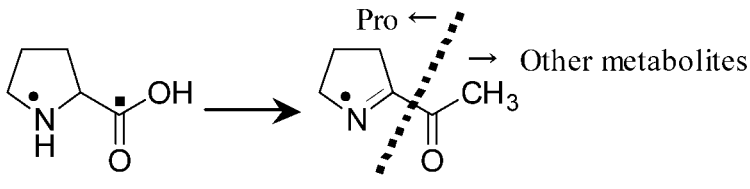

Fig. 2. Possible pathway for 2-acetyl-1-pyrroline formation from proline. Dots show nitrogen in the pyrrolidine ring on proline, and squares show the carbonyl carbon on proline. Carbonyl carbon was not derived from proline, although the nitrogen source was proline.

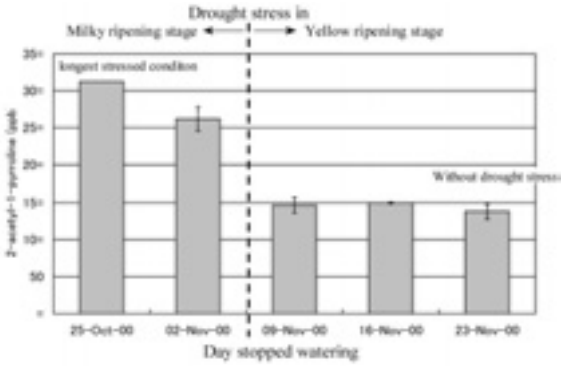

Fig. 3. Drought stress induced 2-acetyl-1-pyrroline content when rice was in the milky ripening stage, although stress in the yellow ripening stage did not affect the content as the result of the pot-based experiment using the Thai aromatic variety Khao Dawk Mali105.

during fermentation. The formation of these compounds was investigated using a stable isotope dilution method and tracer analysis with ^{15}N amino acids to determine the structure of the precursor (Fig. 1). Analysis confirmed that 2-acetyl-1-pyrroline formed at normal temperatures in the aerial part of aromatic rice, and that L-proline was the nitrogen precursor (Fig. 2). Storage tests also indicated that this compound in aromatic rice kernels can exist as a complex within the hydrophobic region of crystalline starch.

These results suggested that certain pre-harvest factors control the quality of aromatic rice, particularly aroma. It was therefore hypothesized that osmotic stress and nitrogen fertilizer application would increase L-proline concentration in rice kernels during ripening. Researchers tested these factors on Khao Dawk Mali 105 and found that osmotic stress during the milky ripening stage increased 2-acetyl-1-pyrroline content, whereas stress after the yellow ripening stage did not. Experiments on nitrogen fertilizer application indicated that application slightly increased 2-acetyl-1-pyrroline content (Fig. 3). These results indicate the possibility of controlling the quality of aromatic rice during cultivation, particularly through ripening and postharvest practices.

(T. Yoshihashi)

TOPIC 2

Antimutagenicity of local vegetables in Thailand

Epidemiological studies have revealed that high consumption of fruits and vegetables reduces the risks of chronic diseases and cancer. In fact, cancer rates in several Thai

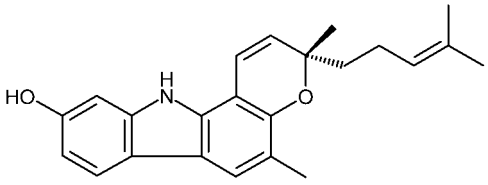

Fig. 1. *Micromelum minutum* twigs, and structure of the isolated antimutagen, mahanine.

cities, where many indigenous plants and minor crops are utilized as food and medicine, are significantly lower than those of northern Europe and North America (IARC/ WHO). In this research, indigenous plants from Thailand were analyzed to determine their antimutagenic and/or anticancer effects.

The antimutagenic activity of methanol extracts from 118 samples (108 species) of edible Thai plants against Trp-P-1 (3-amino-1,4-dimethyl-*5H*-pyrido[*4,3-b*]indole) was firstly examined using the Ames Test. Next, the antimutagenic activity of plant extracts was compared in terms of their ED_{90} values, which refers to the quantity of plant extract required to supress 90% of the mutagenesis. It was observed that five plants, *Micromelum minutum* (Thai name: *yod mui*), *Oroxylum indicum* (*pheka*), *Cuscuta chinensis* (*sai mai*),

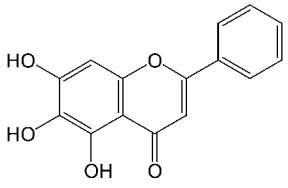

Fig. 2. *Oroxylum indicum*, and structure of the isolated antimutagen, baicalein.

Azadirachta indica (*sadao*), and *Litsea petiolata* (*thammang*) exhibited significant antimutagenic ED_{90} values lower than 5 µL/plate (dry plant material equivalent of 0.1mg). *M. minutum*, which showed the highest activity in the antimutagenic screening, is a shrub belonging to the Rutaceae family, and is consumed mainly in the southern part of Thailand as a fresh vegetable served with thin rice noodles and spicy sauce, a meal commonly referred to as *kanom chin nam ya* or *ka-nom chin kaeng tai pla*. Various parts of *M. minutum*, including edible twigs (Fig. 1), are also used as folk medicine to treat fever or dizziness. The activity-guided fractionation of the *M. minutum* extracts resulted in the isolation of an active principle, which was identified as mahanine based on its physicochemical properties. Mahanine is a carbazole alkaloid derivative previously found in *Murraya koenigii* (curry leaf, consumed in South Asia), which is a species related to *M. minutum*. Mahanine displayed a wide range of biological activities, including antimutagenicity against heterocyclic amines such as Trp-P-1 with an ED_{50} of 5.2 µM, cytotoxicity against a tumor cell line HL60 with a minimum inhibitory concentration (MIC_{100}) of 4.0 µg/mL, and antimicrobial activity against *Bacillus cereus* and *Staphylococcus aureus* with MIC_{100} of 6.25 and 12.5 µg/mL.

Oroxylum indicum (Fig. 2), a deciduous tree belonging to the Bignoniaceae family, is distributed throughout South Asia, Southeast Asia and China. The tree is typically used as a crude ingredient in Indian Ayurvedic medicine and Chinese medicine for curing stomach disorders, diarrhea, dysentery and rheumatic swelling. In Thailand, the fruits and flowers of the plant are consumed as a popular vegetable in the north and northeastern areas. The active constituent of the fruit of *Oroxylum indicum* responsible for antimutagenicity was baicalein (Fig. 2), a flavone. The antimutagenic ED_{50} of baicalein against Trp-P-1 was 2.78 ± 0.15 µM. The high content of baicalein (3.95 ± 0.43%, dry weight basis) is associated with the potent antimutagenicity of the original extract.

In addition to the antimutagenic effect of mahanine and baicalein against Trp-P-1, it was also discovered that they have antimutagenic effects against various mutagenic heterocyclic amines such as Trp-P-2 (3-amino-1-methyl-5H-pyrido [*4,3-b*] indole), and PhIP (2-amino-1-methyl-6-phenylimidazo [*4,5-b*] pyridine).

(K. Nakahara)

TOPIC 3

Antioxidative and angiotensin I-converting enzyme inhibitory activities of sufu (fermented tofu) extracts

Traditional fermented soybean foods, such as miso, natto, and tempeh have long been an important nutritional staple in Asian societies. Recently, researchers have become increasingly interested in the physiological functionality of these foods in terms of antioxidative activity and anti-hypertensive effects. Some research has shown that many types of fermented soybean foods exhibit

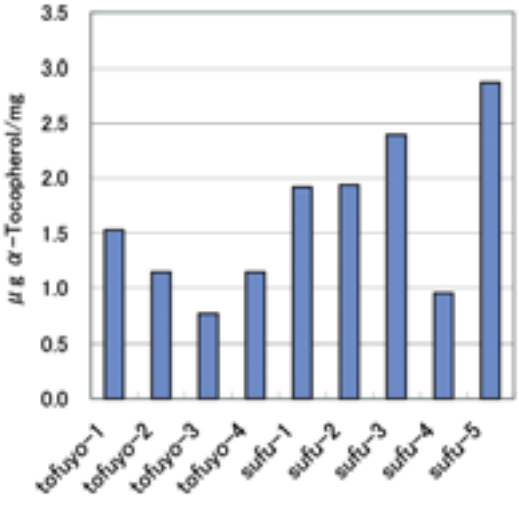

Fig. 1. Antioxidative activities of tofuyo and sufu extracts. Tofuyo 1 to tofuyo 4: various types of tofuyo from Okinawa, Japan; sufu 1 to sufu 5, various types of sufu from China.

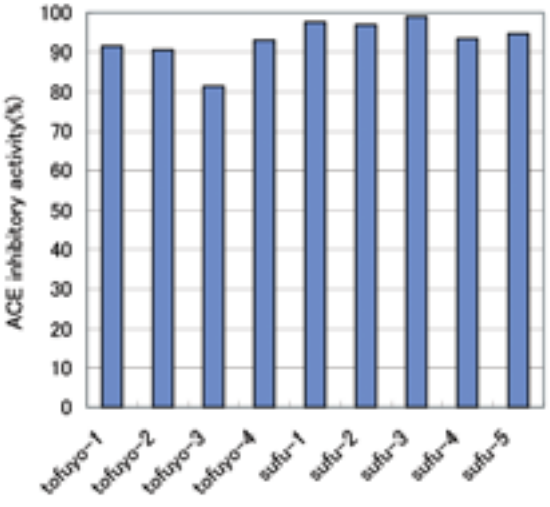

Fig. 2. ACE inhibitory activities of tofuyo and sufu extracts. Tofuyo 1 to tofuyo 4: sufu 1 to sufu 5, same as in Fig. 1

significantly stronger antioxidative activity than unfermented ones, yet there have been few investigations associated with such functions in sufu and tofuyo. Sufu is a fermented tofu product popular throughout China, while tofuyo, a similarly fermented tofu product considered to have originated in China, is commonly produced in Okinawa. Understanding the physiological functionality of sufu may help to improve the fermentation process required to produce a highly functional food product, as well as new sufu products. In our study, antioxidative activity and angiotensin I-converting enzyme (ACE) inhibitory activity was analyzed in water extracts from four types of tofuyo and five types of sufu. ACE is an enzyme that increases blood pressure, and thus materials that inhibit ACE are considered to be useful for preventing hypertension.

The antioxidative activities of the tofuyo and sufu extracts determined by the DPPH radical scavenging method are shown in Fig. 1. Antioxidant activity varied depending on the conditions of production, but all the sufu extracts except one sample showed higher antioxidative activities than the four tofuyo extracts. ACE inhibitory activities of the tofuyo and sufu extracts are shown in Fig. 2. All samples exhibited ACE inhibitory activity, and sufu displayed higher ACE inhibitory activity than did tofuyo.

Research showed a positive correlation between antioxidative activity and ACE inhibitory activity of the extracts from the nine samples. The SDS-polyacrylamide gel electrophoresis peptide patterns in the extracts indicated that the molecular weights of most peptides were less than 10 kDa. Researchers estimated that samples with high antioxidative and ACE inhibitory activities also contained high quantities of small peptides. Significant variations in antioxidative and ACE inhibitory activities of the extracts from several types of Okinawa tofuyo and Chinese sufu were observed. Such variations might be closely related to the conditions of processing, e.g. the kind of microorganism used or the duration of fermentation. Thus by changing the fermentation conditions, researchers are able to produce many kinds of peptides with different activities.

The major components responsible for the antioxidative and ACE inhibitory activities of tofuyo and sufu extracts were considered to be the peptides. Although further investigation on the structure of peptides in the extracts should be conducted, and the relationship between peptide structure and the two activities should be determined, it was shown that sufu contained highly active components and could be used as a functional food. Division researchers are continuing research to identify the physiological activity of various sufu products and to analyze the relationship between the conditions of processing and function. Through continued research, researchers will be able to improve processing methods to produce highly active, functional sufu that will ultimately increase the demand for sufu products.

(M. Saito and E. Tatsumi)

FORESTRY DIVISION

Global population and economic growth continue to cause the eradication of 9.4 million ha of natural forests per year. Taken alone, however, this rate is too large to mask the severity of deforestation and forest degradation occurring in developing countries and tropical areas, for the area of non-tropical forests has stabilized and is even slightly increasing. Approximately 47 percent of world forests are distributed in tropical regions, and during the last decade, 94.4 percent of natural forest deforestation has occurred in the tropics, where forests are converted to support agriculture, and excessive logging is conducted to abet swelling industrial demand.

In the tropical forests of Southeast Asia, local residents depend upon forest benefits for their livelihood, yet biodiversity and the environmental ecosystem must be sustained for them to continue to benefit from forest resources. Oil palm and rubber tree plantations, as well as fast-growing species

Mangrove forests growing in brackish water areas in Thailand.

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such as *Acacia* and *Eucalyptus* have been expanding very rapidly and extensively. These concentrated and mono-cultured forest plantations might have adverse effects on biological diversity, forest function and sustainability in the near future. It is thus important to establish a manageable relationship between inhabitants and farmers.

Recently, however, a global trend has emerged to supply more timber from artificial forests. In Southeast Asian countries, extensive afforestation has occurred, accounting for approximately 62 percent of total global afforestation, yet progress has been hindered because of a lack of knowledge concerning tropical forest ecosystems, and because technologies better suited for temperate or boreal zones have been employed. In order to improve afforestation efforts, researchers from JIRCAS's Forestry Division are conducting extensive research to develop tree species adaptable to multiple environmental conditions, as well as new technologies for raising seedlings. In addition, significant progress has been made in developing technologies that rehabilitate degraded forests and grasslands while also contributing to the sustainable use of forest products in Southeast Asia. Having reviewed our activities and research goals relating to the "Sustainable use of forest resources in the tropical areas," a five-year mid-term research plan was established in 2000. Moreover, three new objectives were instituted to help attain our goals: 1) development of regeneration technology in order to preserve the environmental function of forests; 2) development of technology to improve forest quality; and 3) development of processing technology for the effective use of unexploited forest resources.

Coinciding with these objectives, a comprehensive research project was initiated in collaboration with the University of the Philippines in 2000, which is aimed at mitigating agriculture-forestry conflicts as well as promoting environmental conservation and the sustainable management of forest resources. The Forest Department of Sabah, Malaysia joined the project in December 2001, and a research site was established in Sandakan under the auspices of the Sabah Forest Research Centre. Three JIRCAS scientists are currently working there on long-term assignments on the topics of forest ecology, soil science and mushroom cultivation.

TOPIC 1

Water conservation practices and how they differ between tropical rainforest and rubber plantation sites

The construction of agricultural plantations for oil palm and rubber production has devastated a significant proportion of Malaysia's natural forests during the early 20th century, and the conversion of forests to cultivate crops has caused major soil disturbances which have led to an increase of stormflow. The primary objective of this research was to compare the physical properties of forested and rubber plantation sites in order to determine how soil disruption impacts water conservation and how available water resources might differ depending on land-use qualification.

Table 1. Physical properties of soil in a tropical rain forest and rubber plantation.

Site	Depth (cm)	Macro-porosity (%)	Meso-porosity (%)	Total porosity (%)	Saturated hydraulic conductivity (mmh^{-1})
Tropical	10	8.5	35.2	72.1	1573.0
rain	20	9.7	30.2	69.5	1498.0
forest	40	8.6	16.7	61.9	706.0
	80	8.6	15.9	55.5	378.0
Rubber	10	5.7	8.4	45.4	29.9
plantation	20	4.0	11.1	39.9	19.8
bench terrace	40	5.2	5.9	29.2	18.4
Rubber	10	5.0	21.1	60.4	921.0
plantation	20	5.4	20.5	65.2	838.0
riser bank	40	2.7	9.7	51.1	1062.0
	80	3.8	6.7	51.7	260.0

Soil depth and physical properties were investigated at the Bukit Tarek Experimental Watershed in a tropical rain forest (Fig. 1a) and an adjacent rubber plantation (Fig. 1b) in Peninsular Malaysia. Using a portable dynamic cone penetrometer, it was discovered that total soil depth in the rubber plantation was shallower than the 277 cm mean observed in the tropical rain forest. Moreover, total soil depth at the rubber plantation terrace bench, with a mean of 119 cm, was shallower than the 141 cm mean of the rubber plantation riser bank.

Saturated hydraulic conductivities (Ks) were measured using vertical undisturbed soil cores from the tropical rain forest and the rubber plantation site (Table 1). Ks values decreased with increasing soil depth at both sites, however, the average Ks values in the tropical rain forest were larger than the prevailing rainfall intensity in this region, illustrating that rainwater infiltrates the soil. Though the average Ks values at the rubber plantation riser bank were similar to those in the tropical rain forest, the average Ks values at terrace bench were smaller. Soil porosities decreased with increasing soil depth with the following order of magnitude: the tropical rain forest > riser bank > bench terrace (Table 1).

Mechanical establishment of rubber plantations causes considerable topsoil removal and compaction. Plantation workers further compact terrace bench topsoil when trapping and collecting latex. Thus, terrace bench soils display low permeability and low water storage capacity, characteristics that could explain the frequent overland flow of rainfall during storms (Fig. 1c), while forest soils display high permeability and water storage capacity, which leads to higher rainfall absorption and baseflow production. These results should help policy makers and land managers understand how water conservation differs in forest and rubber plantation sites.

(S. Noguchi)

Fig.1. (a) Example of a tropical rain forest. (b) Example of a rubber plantation. (c) Overland flow and surface detention at terrace benches in a rubber plantation during a heavy storm.

FISHERIES DIVISION

At present, roughly 3 million tons of lobster, shrimp, and prawn are produced worldwide each year, of which about 1 million are traded as high-value products. The prawn culture industry is experiencing significant growth, and is important to the economies of developing countries, particularly Thailand, India, Indonesia, Vietnam, China, Bangladesh, Malaysia, and Ecuador. However, reliable aquacultural techniques, in which broodstock is maintained in captivity, have thus far not been fully established. For these reasons, prawn culture and other forms of aquaculture depend greatly on the use of broodstock or larvae captured from natural sources. In addition, intensive high-density aquaculture carries a substantial risk of the outbreak of disease, and the use of antibiotics frequently has the counterproductive effect of making aquaculture products unsafe for human consumption.

The Fisheries Division of JIRCAS has been engaged in various types of research with the goal of improving aquaculture technology. In Annual Report 2001, a diagnostic method of viral diseases of prawns was described. This year, our report features the results of research carried out in order to determine maturity levels in female prawns and develop larval cultivation technologies. The Division is currently conducting research on the elucidation of reproductive mechanisms in important species of prawns and shrimps and the development of effective seed production technology in order to establish sustainable production systems for fisheries and aquaculture in the brackish mangrove areas of Southeast Asia.

In another substantial project, researchers are developing technologies that will improve fish processing systems in China in order to add value to freshwater fish. While the production of cultured freshwater fish in China has recently surpassed 15 million tons, and has the potential to ensure the reliable provision of animal protein not only to the Chinese people but also to the fish-eating populations of East Asia, Chinese consumer tastes are shifting to upmarket carnivorous fish, crabs and prawns. In light of the fact that low market value Cyprinidae, such as silver

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Mechanical establishment of rubber plantations causes considerable topsoil removal and compaction. Plantation workers further compact terrace bench topsoil when trapping and collecting latex. Thus, terrace bench soils display low permeability and low water storage capacity, characteristics that could explain the frequent overland flow of rainfall during storms (Fig. 1c), while forest soils display high permeability and water storage capacity, which leads to higher rainfall absorption and baseflow production. These results should help policy makers and land managers understand how water conservation differs in forest and rubber plantation sites.

(S. Noguchi)

Fig.1. (a) Example of a tropical rain forest. (b) Example of a rubber plantation. (c) Overland flow and surface detention at terrace benches in a rubber plantation during a heavy storm.

FISHERIES DIVISION

At present, roughly 3 million tons of lobster, shrimp, and prawn are produced worldwide each year, of which about 1 million are traded as high-value products. The prawn culture industry is experiencing significant growth, and is important to the economies of developing countries, particularly Thailand, India, Indonesia, Vietnam, China, Bangladesh, Malaysia, and Ecuador. However, reliable aquacultural techniques, in which broodstock is maintained in captivity, have thus far not been fully established. For these reasons, prawn culture and other forms of aquaculture depend greatly on the use of broodstock or larvae captured from natural sources. In addition, intensive high-density aquaculture carries a substantial risk of the outbreak of disease, and the use of antibiotics frequently has the counterproductive effect of making aquaculture products unsafe for human consumption.

The Fisheries Division of JIRCAS has been engaged in various types of research with the goal of improving aquaculture technology. In Annual Report 2001, a diagnostic method of viral diseases of prawns was described. This year, our report features the results of research carried out in order to determine maturity levels in female prawns and develop larval cultivation technologies. The Division is currently conducting research on the elucidation of reproductive mechanisms in important species of prawns and shrimps and the development of effective seed production technology in order to establish sustainable production systems for fisheries and aquaculture in the brackish mangrove areas of Southeast Asia.

In another substantial project, researchers are developing technologies that will improve fish processing systems in China in order to add value to freshwater fish. While the production of cultured freshwater fish in China has recently surpassed 15 million tons, and has the potential to ensure the reliable provision of animal protein not only to the Chinese people but also to the fish-eating populations of East Asia, Chinese consumer tastes are shifting to upmarket carnivorous fish, crabs and prawns. In light of the fact that low market value Cyprinidae, such as silver

Marine fish being sold at a local market in Bangkok, Thailand.

carp, bighead carp, and grass carp, presently account for over 80 percent of Chinese freshwater fish culture production, this shift in consumer demand has become a threat and discouragement to existing Chinese freshwater fish culture enterprises. For this reason, the Division plans to conduct extensive research on processing technology designed to convert freshwater fish into higher value-added foodstuffs so as to maintain Chinese freshwater fish production as a secure food source.

TOPIC 1

Development of freshwater prawn seed production technology suitable for use in the Mekong Delta region of Vietnam

The Mekong Delta is the most productive region for freshwater aquacultural development in Vietnam, with the potential to significantly improve rural income and welfare. The most commonly cultured species in this area include Chinese carp and catfish of the *Pangasius* genus, although more recently, the giant freshwater prawn, *Macrobrachium rosenbergii* (Fig. 1), has been pinpointed by the Vietnamese government as one of the major target species of the aquaculture sector. Existing culture systems of *M. rosenbergii* include improved-extensive culture in rice fields, and semi-intensive and/or intensive culture in ponds, orchard canals and pens. Until the beginning of 2000, the supply of hatchery reared *M. rosenbergii* was still far from being sufficient to meet the growing needs of commercial prawn culture. Although several national large-scale hatcheries had previously been established, such as the Long My Hatchery belonging to Cantho Province, the Vung Tau Hatchery belonging to the Research Institute of Aquaculture No. 2, and the Nha Be Hatchery belonging to Ho Chi Minh City, these had been operating at low levels of productivity.

Recognizing this supply 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 1994 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, was applicable to the local conditions of 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 1). Moreover, the "green water" model

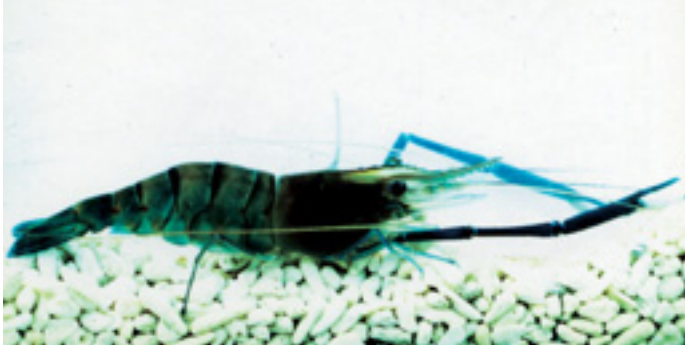


Fig. 1. The target species, the giant freshwater prawn, *Macrobrachium rosenbergii*.

Table 1. 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	52.5
60 larvae/l	18.6	28.8
90 larvae/l	28.4	31.7
120 larvae/l	32.9	27.4
"Green water" system		
30 larvae/l	27.7	92.3
60 larvae/l	27.8	46.3
90 larvae/l	41.7	46.4
120 larvae/l	38.8	32.3

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. Representative of such hatcheries, Cantho University's mini-hatchery is shown in Fig. 2.

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.

Furthermore, in order to bolster prawn larvae survival rates, different feeding diets were designed and evaluated. Experiments illustrated that 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 (data not shown). It was also determined that this diet could be further improved by the supplementation of vitamin C and lecithin. The results of these studies showed that vitamin C and lecithin 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. In order to select suitable female spawners for purposes of seed production, JIRCAS and Cantho University have developed jointly a technology entitled "A process for determining maturity by using anti-serum against shrimp egg yolk protein"

Fig. 2. Cantho University's mini-hatchery.

which is currently in submission to the Japan Patent Office (JPO). This technology is based on studies elucidating yolk protein structure in freshwater prawns and other economically significant species of shrimp and is described in the subsequent article. In addition, we have examined osmoregulatory function in freshwater prawn larvae. The target species, *M. rosenbergii*, is a freshwater prawn, but since its larvae require brackish water for survival, hatchery operations are usually conducted using 12 parts per thousand (12 ppt) salinity. However, having examined survival rates and physiological parameters such as ion-regulating Na/K-ATPase enzymatic activity, we have found that *M. rosenbergii* can be produced at salinities lower than 12 ppt, and are applying this result in hatchery operations in order to minimize the use of seawater and lower production costs.

The above research and development has generated a great deal of valuable information for the establishment of effective *M. rosenbergii* seed production technology utilizing the "green water" model. Since the beginning of 2000, the "green water" model has been introduced to various users (including provincial authorities and the private sector), and the number of hatcheries and quantity of post-larvae produced rapidly increased. In fact, the production of post-larvae reached over 50 million by the end of 2001 or about 50-fold compared to the 1990s. 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. These hatcheries are now contributing to meeting prawn seed demands for use in farming systems and other aquaculture systems in Vietnam.

At present, this JIRCAS project is attempting to accelerate the technology transfer process and to prepare for publication a manual of prawn hatchery operation and management practices based on the "green water" model. In addition, a CD-ROM is being produced to accompany the manual. Interested persons will be able to access these materials through Cantho University or by purchase at bookstores. It is expected that the knowledge these materials will disseminate will contribute greatly to the development of the freshwater prawn culture industry in Vietnam, especially in the Mekong Delta.

(M.N. Wilder)

TOPIC 2

Development of technology to determine maturity in important prawn species

In recent years, shrimp aquaculture has rapidly expanded and developed as an important commercial enterprise in Southeast Asian regions, and is also becoming economically significant worldwide. However, at present, in hatchery operations it remains necessary to use broodstock collected from the wild, which has resulted in a decline in natural resources due to over-exploitation. Moreover, lack of reliable methods for accurately determining maturation stage of spawners makes broodstock selection a difficult process, often leading to eggs and larvae of poor quality, and unstable production.

Given this background, in order to enable selection of suitable female spawners for purposes of stable seed production, it has been necessary to develop a technology to determine ovarian maturity based on studies elucidating yolk protein structure and processing in economically important species of shrimp. We firstly purified four major yolk proteins (vitellins, Vn) from the mature ovary of the giant freshwater prawn, *Macrobrachium rosenbergii* by reversed-phase high performance liquid chromatography (HPLC). The N-terminal and some internal amino acid sequences of each of the four Vns were determined and cDNA fragments encoding the four Vns were cloned. Based on these cDNA sequences, the cDNA encoding vitellogenin (Vg) was cloned and its complete amino acid sequence deduced. Similar methods were then used to elucidate the complete amino acid sequences of Vg in *Penaeus japonicus* and the coonstriped shrimp, *Pandalus hypsinotus*. These studies, and those by other authors have demonstrated that a high degree of identity exists among yolk proteins in various shrimp and prawn species (Fig. 1). Results obtained from the determination of primary structure and from electrophoretic and immunological analyses of the subunit composition of yolk proteins in the hemolymph and ovary in *M. rosenbergii* have clarified the site of synthesis and processing mechanism of Vg. After being synthesized in the hepatopancreas as a precursor molecule, Vg is proteolytically cleaved into two subunits, VgA and VgB-C which are released into the hemolymph. In the hemolymph, the VgB-C subunit is further cleaved, forming two subunits VgB and VgC. The three subunits Vgs A, B and C are then sequestered by the ovary to give rise to Vn (Fig. 2). It is very likely that these processing mechanisms are common features among many prawn species. On the basis of the structural similarities of Vg in prawn species, an anti-serum against shrimp yolk protein has been developed and used in quantitative determination of hemolymph Vg levels in prawn and shrimp species by dot-blots and enzyme immunoassays. Our studies have also shown that when Vg mRNA levels and hemolymph Vg levels are high, gonadosomatic index is also high and is an indication that the prawn is close to molting and spawning (Fig. 3). Determination of hemolymph Vg levels by these methods can thus be used to confirm actual Vg gene levels.

This thus-developed technology, "A process for determining maturation by using

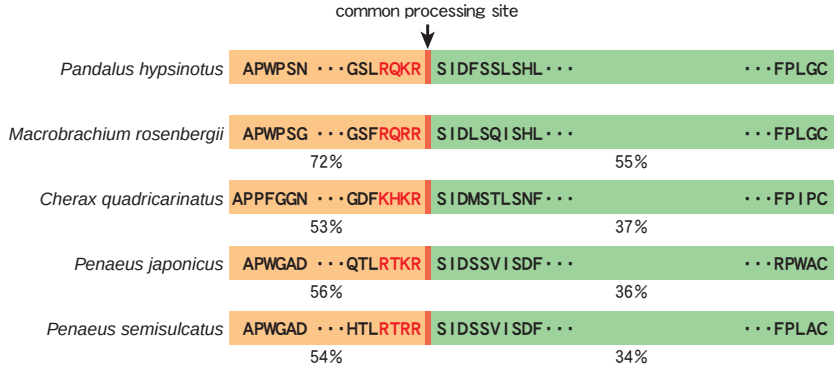


Fig. 1. Representation of vitellogenin primary structure in significant shrimp and prawn species. Degree of amino acid identity compared to *Pandalus hypsinotus* is indicated by percent. Location of a common processing site (see also Fig. 2) is indicated by the arrow.

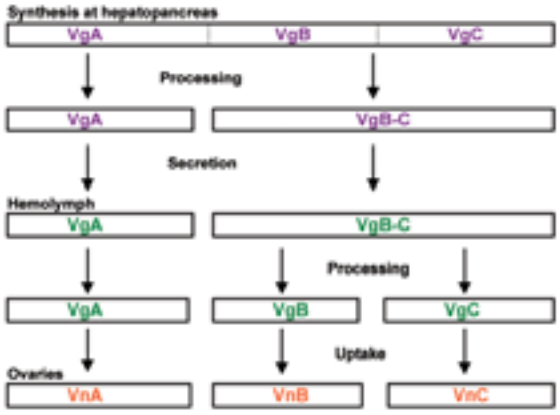


Fig. 2. Processing of vitellogenin (Vg) in *Macrobrachium rosenbergii*. Vg is initially produced at the hepatopancreas, undergoes procesing at two different locations, and is taken into the ovaries as vitellin (Vn).

anti-serum against shrimp egg yolk protein," is currently in submission to the Japan Patent Office (JPO), and can therefore be used in the development of immunological kits to measure yolk protein levels, and in combination with morphological observations. This will prove to be a useful and reliable tool for assessing maturity in aquaculture-important prawn species. Currently, we are evaluating this technology at Cantho University in Vietnam. Shrimps of hatchery and natural origins without mature ovaries, and weighing 5, 10, 20, 30 and 40 g are being monitored for a two-month period. During this period, the presence or absence of ovaries is being recorded and hemolymph Vg levels are being measured every week, using the technology developed at JIRCAS. Hemolymph Vg levels will be used to determine the time of ovarian maturation and assess the suitability of broodstock. The quality of larvae obtained from shrimp selected by this method will be assessed by counting the number of larvae produced and subjecting them to stress by exposure to formalin. These tests will help improve current methods of seed production in hatcheries.

(M.N. Wilder)

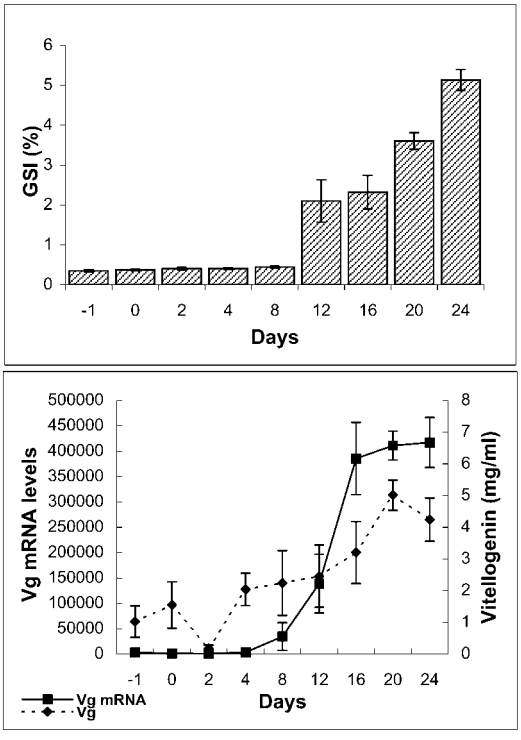


Fig. 3. Gonadosomatic index (GSI), vitellogenin (Vg) mRNA levels and Vg hemolymph levels in *Macrobrachium rosenbergii* during ovarian development.

TOPIC 3

Mass mortalities associated with viral nervous necrosis in hatchery-reared orange-spotted grouper in the Philippines

In Southeast Asia, aquaculture production has increased more than tenfold during the last decade. However, culture systems have brought about the occurrence of problems such as mass mortality caused by infectious diseases. Such problems seriously hamper seed production and broodstock culture operations. In 2001, severe acute mortality characterized by anorexia and abnormal swimming behavior was observed among hatchery-reared larvae of the orange-spotted grouper *Epinephelus coioides* in the Philippines. Mortality rates of 5 to 10 percent per day were observed with 100 percent morality being reached within 10 days. A viral etiological study on this mass mortality was conducted using histopathological techniques, cell culture utilizing SNN-1 cell lines (established cells derived from snakehead whole fry), reverse transcription-PCR (RT-PCR) and electron microscopy.

The initial clinical signs of affected larvae were reduced feeding activity followed by darkening pigmentation. Diseased fish became lethargic, often lying with their abdomen-up and rising to the surface of water. Abnormal swimming behaviors, such as rotating, spinning, and horizontal looping were observed (Fig. 1). Under necropsy, the digestive tract was empty and transparent due to reduced food intake, but no marked gross pathological lesions were observed. Bacteriological and parasitological examination revealed no dominant bacteria or parasites in the infected fish.

Histopathological examination by light microscopy revealed heavy vacuolation in the brain and retina (Fig. 2). There were no apparent histopathological changes in other organs of affected fish. Cytopathic effects were observed in SSN-1 cells two days after inoculation with the filtrate of the affected grouper characterized by cytoplasmic vacuole formation. Virus titers in the filtrated tissue homogenates of moribund fish was $10^{9.0}$ $TCID_{50}$/ml. Using PCR and primers based on the sequence of the striped jack nervous necrosis virus RNA 2 gene, an amplified product of about 430 base pairs was observed in samples from naturally infected fish and the culture supernatant of SSN-1 cells inoculated with the tissue filtrate of affected fish. The size of the PCR product was consistent with that of other piscine nodaviruses using the same primer set. Small spherical, non-enveloped virus particles 20-25 nm in diameter arranged in paracrystalline arrays or in membrane-bounded vesicles were abundantly observed in the cytoplasm of the brain (Fig. 3) and retina as observed by electron microscopy.

The histopathological lesions and other clinical signs observed in moribund orange-spotted grouper were very similar to those described in other viral nervous necrosis (VNN)-affected fish species. Infected SSN-1 cell cultures developed extensive cytopathic effects, and the isolated virus was identified as a piscine nodavirus based on the results of RT-PCR and electron microscopy performed on infected cell cultures. Furthermore, the inoculation of the isolated virus reproduced the same clinical signs and the virus was re-isolated from the experimentally infected fish (Fig. 4). Taken together, these results clearly indicate that the mass mortality of the larval grouper was caused by VNN. This is the first documented outbreak of VNN among hatchery-reared larvae of orange-spotted grouper in the Philippines.

Piscine nodavirus infection has been associated with high mortalities in cultured grouper species in Southeast Asia, and consequently has the potential to cause severe economic loss in these aquaculture areas. Therefore, it is urgently needed to know the susceptibility of other important aquaculture fish species to the present virus. JIRCAS is conducting a study targeting this issue in collaboration with South East Asian Fisheries Development Center, Aquaculture Department under JIRCAS's international

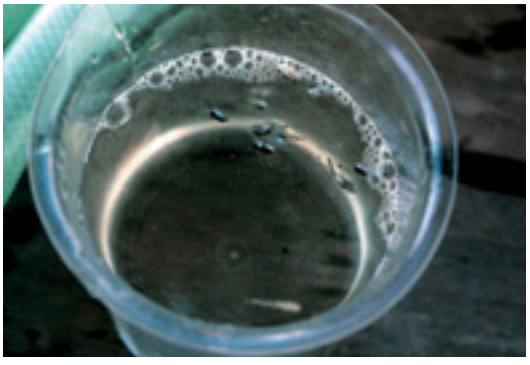


Fig. 1. Orange spotted grouper larvae affected with viral nervous necrosis (VNN).

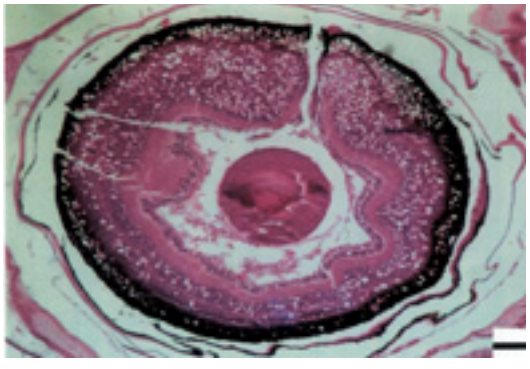


Fig. 2. Light micrograph showing vacuolation in the retina of affected orange-spotted grouper larvae. Haematoxylin and eosin staining. Scale bar = 100 µm.

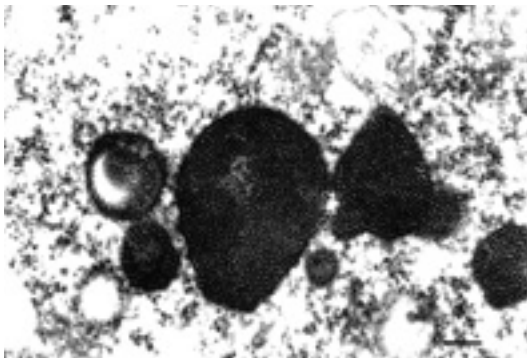


Fig. 3. Electron micrograph of virus particles in the brain cytoplasm of affected orange-spotted grouper. Scale bar = 200 nm.

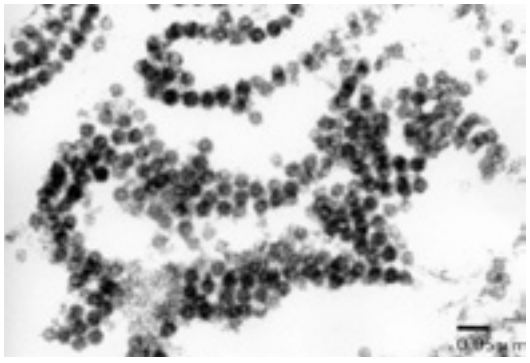


Fig. 4. Electron micrograph of virus particles in the brain cytoplasm of experimentally infected orange-spotted grouper. Scale bar = 50 nm.

research project “Studies on sustainable production systems of aquatic animals in brackish mangrove areas.”

The results of the present study also highlight the need for continued epidemiological surveillance of piscine nodaviruses and the development of effective control measures. Thus, screening of broodstock and their corresponding larvae for VNN is imperative to prevent the further spread of this disease.

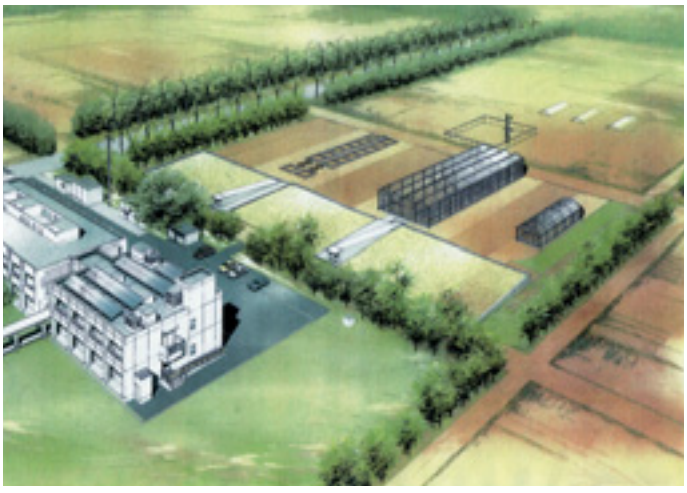
(Y. Maeno)

OKINAWA SUBTROPICAL STATION

The Okinawa Subtropical Station strives to develop technologies for sustainable agricultural production on small islands in developing regions; it is located on Ishigaki Island, which is well suited for conducting research in this area due to its subtropical environment. Since high temperatures are common in tropical and subtropical areas, sustainable agricultural production is difficult to achieve, particularly with temperate vegetable varieties, and for this reason, researchers are currently analyzing the mechanisms of plant responses to heat stress in order to elucidate ways to develop heat tolerance.

The Okinawa Subtropical Station is also researching and developing ways to combat Citrus Greening Disease, which is not only threatening citrus production in Southeast Asian countries, but also production in the southwestern islands of Japan. To provide the best possible resources for this major project, entitled the "Biological studies of citrus greening disease in tropical and subtropical areas," a greenhouse belonging to the Plant Protection Laboratory was renovated to enable researchers to grow infected plants under isolated conditions for purposes of analysis. It is currently known that the occurrence of this disease in Japan coincides with the distribution of *Citrus phylla*, the vector insect of the disease, but additional research is necessary to illuminate the mechanisms of the disease and develop plant tolerance and resistance.

Considering global climatic and environmental changes, the Okinawa Subtropical Station will also serve as a novel research station for the sustainability of insular environments. Construction of an insular environment and facilities for technological development was started in 2002 and will be completed by the end of June 2003. The facilities include a large-scale lysimeter, where the transpiration of crops, evaporation and infiltration of soil water, and water movement in a soil-crop continuum can be measured accurately. In run-off plots, analysis can be conducted on how soil management and different crop varieties affect erosion mechanisms, and based on those conclusions, more effective countermeasures can be proposed. The addition of these facilities is expected to bolster Station research activities and will hopefully lead to a better understanding of tropical and subtropical island environments, and consequently, more sustainable agricultural production.



An aerial view depicting the insular environment and technology development facilities of the Okinawa Subtropical Station.

TOPIC 1

Occurrence of abnormal pods and abscission of flowers at high temperatures in snap bean

As the result of high temperature stress, which causes damage to plants during the

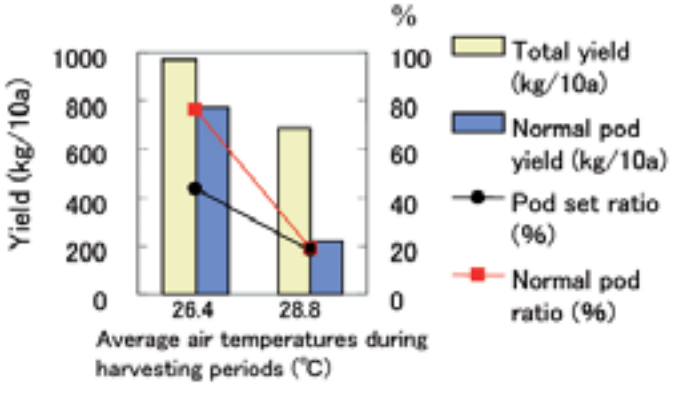


Fig. 1. Relationship between average air temperatures, yield and pod set ratio (cv. ‘Kentucky wonder’).

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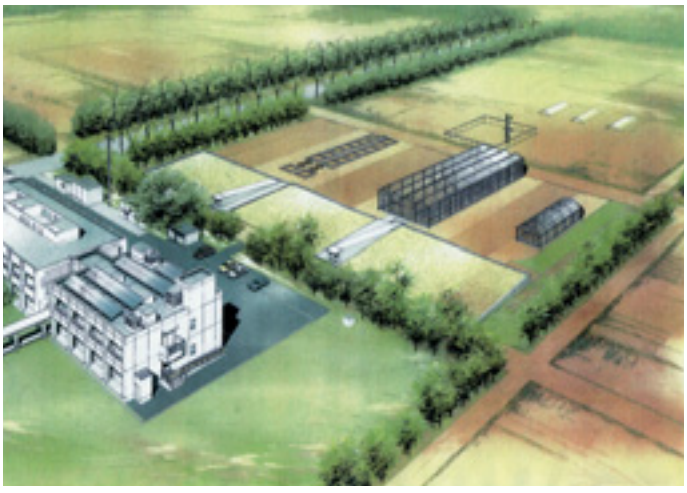

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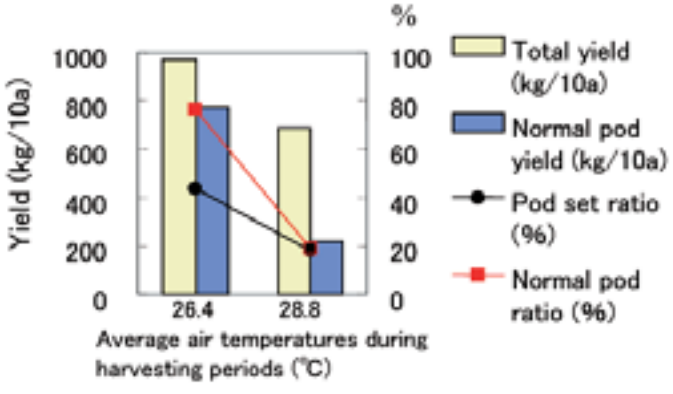

Fig. 1. Relationship between average air temperatures, yield and pod set ratio (cv. ‘Kentucky wonder’).

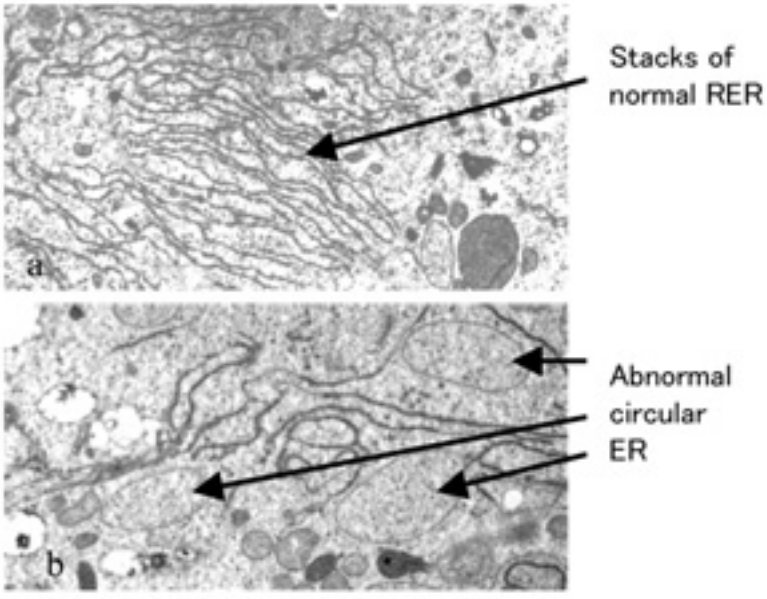

Fig. 2. Endoplasmic reticulum (ER) in tapetum at the uninucleate pollen stage. a: normal conditions (24℃); b: high temperature conditions (29℃)

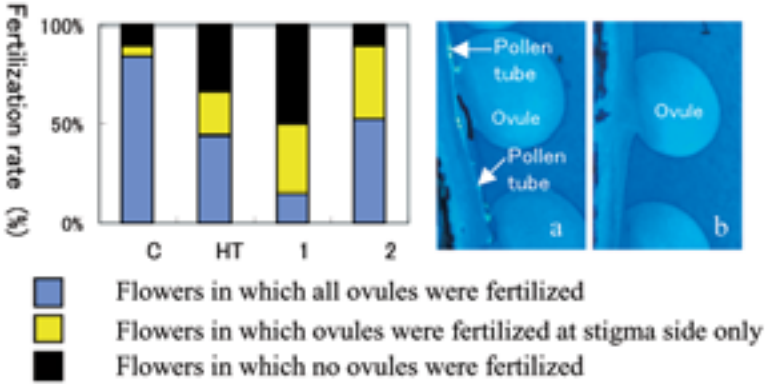

Fig. 3. (Left) Changes in ovule fertilization rate after heat treatment; right: fertilized ovules (a) and non-fertilized ovules (b). C: Control (27/23℃); HT: heat treatment day (29-34℃, 18h); 1: one day after HT (27/23℃); 2: two days after HT (27/23℃).

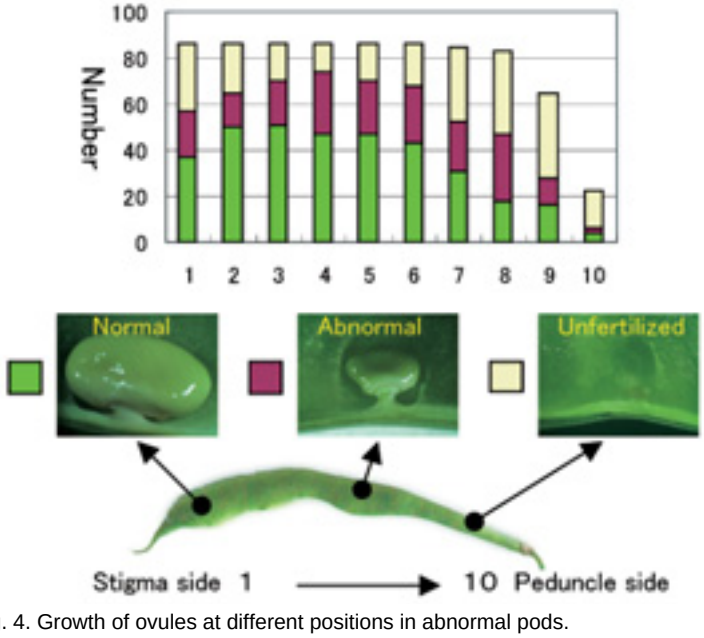

Fig. 4. Growth of ovules at different positions in abnormal pods.

reproductive growth stage, production of temperate vegetables in tropical and subtropical areas has become unstable. However, research has thus far not completely discerned how reproductive organs are damaged under conditions of high temperature stress.

Under high temperature stress, the yield reduction in snap bean (*Phaseolus vulgaris*) was closely related to the abscission of flowers and occurrence of abnormal pods (Fig. 1). To understand how this occurs, researchers investigated how the organs that maintain pollen viability, which is critical to feritilization, might be impaired by heat. It was discovered that high atmospheric temperatures alter the structure of the endoplasmic reticulum in the tapetum and disenable the tapetum to supply nutrients to microspores in the anther (Fig. 2). The tapetum degenerates earlier than usual, resulting in high pollen sterility, and anther indehiscence occurs when pollen stainability falls below 20 percent.

Pollen tubes were stained with aniline blue to make the ovule more observable under optimum conditions, although heat treatment still limits visibility. Researchers were still able to determine that heat stress at the flowering stage blocked pollen tube elongation in the style, particularly high temperatures exactly occurring one day before flowering (Fig. 3). Both normal pollen development in the anther and normal pollen tube elongation in the style are necessary for successful fertilization under high temperature conditions.

Abnormal pods occurred along with failure of fertilization because the pollen tubes did not reach the ovules on the peduncle side under high temperatures. Even when fertilization occurred successfully, abnormal pods appeared with poor ovule development (Fig. 4).

These effects also occurred in the field when air temperatures exceeded 28℃. Pollen fertility, pollen tube elongation, and ovule development after fertilization are important factors allowing the production of normal pods in snap bean.

(K. Suzuki, M. Shono, and Y. Egawa)

Thermotolerance of transgenic tobacco with altered expression of mitochondrial small heat shock proteins

All organisms have evolved mechanisms to overcome various environmental stresses. Such mechanisms are thought to be especially important in plants, which have the disadvantage of immobility. Plants respond to heat stress by repressing the expression of mRNAs for most normal proteins that induce the synthesis of heat shock proteins (HSPs). Heat-stressed plant cells accumulate more mitochondria-located small heat shock proteins (MT-sHSP) than ordinary HSP60 and HSP70 (HSPs are designated by their approximate molecular weight in kDa), and the accumulation of MT-sHSP is synchronized with the thermotolerance of mitochondria. Under heat stress, mitochondrial metabolic pathways breakdown and function abnormally, thus diminishing cell viability. While Division researchers have already shown that tomato MT-sHSP has a molecular chaperone function *in vitro*, the goal of this study was to clarify the role of MT-sHSP *in vivo* during heat-shock response using MT-sHSP transgenic tobacco.

Researchers introduced the tomato MT-sHSP gene into tobacco plants (*Nicotiana tabacum* L. cv. SR1) with sense and antisense constructs under the control of the CaMV 35S promoter, and then examined the thermotolerance of the seedlings. Sense plants overexpressed MT-sHSP even under normal growth temperatures, while antisense transformants accumulated less MT-sHSP than control plants under heat stressed conditions (Fig. 1). Irrespective of gene

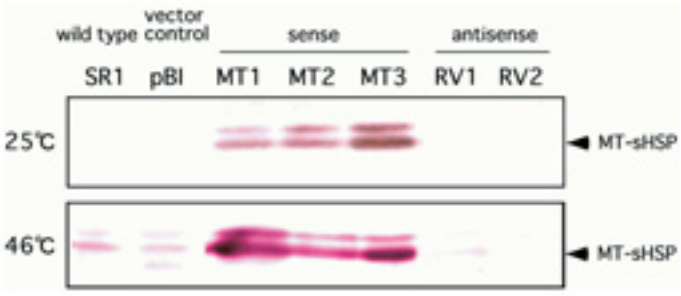

Fig. 1. Expression of the gene for MT-sHSP in transgenic tobacco plants. Four-week-old seedlings of the wild type (SR1) and T_2 homozygous lines into which a vector without an insert (pBI) or the MT-sHSP gene was introduced (sense: MT1, 2 and 3, antisense: RV1 and 2) were subjected to Western blot analysis with anti-MT-sHSP antibody. Mitochondrial fractions for the analysis were prepared using seedlings sampled before (25℃) and after (46℃) the heat stress treatment for 2 hours.

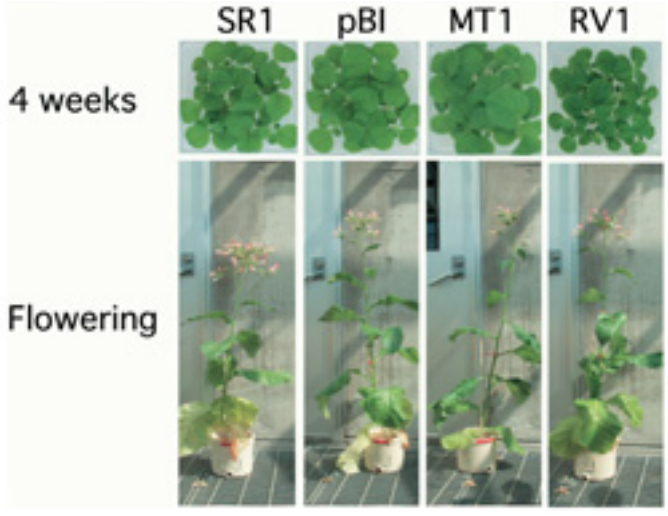

Fig. 2. Transgenic tobacco plants having the tomato MT-sHSP gene. Tobacco plants of the wild type, SR1 and T2 transgenic lines without an insert or with the MT-sHSP sense or antisense gene (pBI, MT1 and RV1, respectively) were germinated and grown on MS medium for 4 weeks. The young seedlings were then transferred to soil in a greenhouse and kept at 25℃. The morphology and growth rate of the plants were observed 4 weeks after seeding and on the day of flowering.

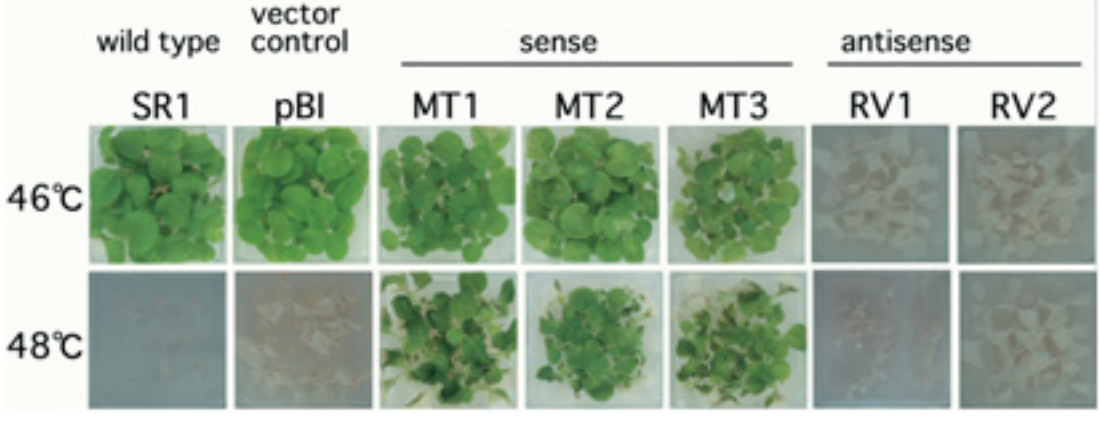

Fig. 3. Thermotolerance of the transgenic plants with the MT-sHSP gene. Four-week-old seedlings of the wild type and T_2 homozygous lines grown as shown in Fig. 2 were exposed to heat stress at 46℃ or 48℃ for 2 hrs. The seedlings were photographed 7 days after treatment.

orientation, sense or antisense, transgenic plants exhibited a normal morphology and growth rate in the vegetative growth stage (Fig. 2). Thus, MT-sHSP does not have a pleiotropic effect on vegetative growth under normal conditions.

When the 4-week-old seedlings (T_2 progeny) were exposed to sudden high temperature stress for two hours, sense plants exhibited thermotolerance and survived at 48℃, whereas control tobacco did not survive. On the other hand, antisense plants were susceptible to stress at 46℃, whereas control tobacco can survive under such conditions (Fig. 3). These results indicate that MT-sHSP plays a pivotal role in heat-shock response.

(M. Shono, K. Sanmiya, K. Suzuki and Y. Egawa)

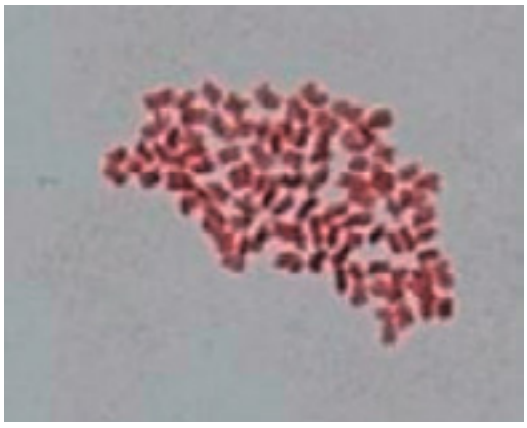

Fig. 2. Metaphase chromosome spread on root tips of accession number 22.

TOPIC 3

Development of high biomass forage crops tolerant to water stress by interspecific and intergeneric crossing

The lack of sufficient feed resources during the dry season has substantially limited ruminant production in Northeast Thailand. Forage crops of high yield and nutritive value must be produced in order to address these problems. It has been reported that some interspecific and intergeneric hybrids of *Saccharum* complex have shown good ratooning ability, as well as markedly vigorous growth and high yield. It is expected that new, highly adaptable forage crops can be bred in Northeast Thailand using such hybrids and a series of new criteria selection processes.

The purpose of this study was to screen breeding materials for high biomass and adaptability to the environmental conditions of Northeast Thailand, and then to breed new types of forage crops using interspecific and intergeneric hybridization among sugarcane and their wild relatives. This project has been conducted in collaboration with the Khon Kaen Field Crops Research Center [KKFCRC] (Fig. 1).

In 2002, researchers evaluated the wild relatives of sugarcane collected in Thailand and characterized some of these as breeding materials using cytological analysis (Fig. 2). In addition, researchers modified methods for crossing and pollen cryopreservation.

(M. Matsuoka)

Fig. 1. Sugarcane germplasm conservation field at the KKFCRC. Researchers are shown evaluating and characterizing the wild relatives of sugarcane.

MISCELLANEOUS PROJECTS OUTLINE

In addition to international comprehensive projects, JIRCAS conducts a variety of miscellaneous projects including projects located abroad, domestic projects in cooperation with other MAFF affiliated incorporated administrative agencies, commissioned research primarily in cooperation with universities, cross-ministry projects currently involving the Ministry of Education, Culture, Sports, Science and Technology and the Ministry of Environment, as well as other organizations, and special allotment projects.

OVERSEAS PROJECTS

Research on the uses of lactic acid-producing bacteria in agricultural products in Thailand's agricultural industry
(At Kasetsart University, 2000-2003)

Evaluation of the nutritive and active components of Southeast Asian indigenous vegetables
(At Asian Vegetables Research and Development Center, 2000-2003)

Investigation of the roles of the TNFα gene in trypanosomosis and elucidation of mechanisms of infection and development of trypanosomosis
(At International Livestock Research Institute [ILRI], 2001-2002)

Evaluation of environmental impact associated with the construction of logging roads
(At Forest Research Institute of Malaysia, 2001-2003)

DOMESTIC PROJECTS

In close cooperation with related research organizations, JIRCAS conducts domestic research at its main premises in Tsukuba and at its Okinawa Subtropical Station in an effort to support its international collaborative projects.

JIRCAS further enhances its comprehensive projects through its Tsukuba and Okinawa research fellowship programs in which foreign researchers from JIRCAS counterpart organizations are invited to carry out studies which support ongoing collaborative projects abroad. In addition, these programs also promote positive relationships between JIRCAS and foreign institutions and facilitate future exchanges of individual research staff. JIRCAS domestic research has produced a variety of significant results, especially in the areas of drought-resistant crop development and world food supply and demand analysis. By focusing on fields where it can bring its strengths in research management and coordination to bear, JIRCAS is able to effectively utilize its limited budget and personnel in resolving critical agricultural and food supply problems in developing countries. Current domestic research focuses on: 1) world food supply analysis; 2) development of sustainable agriculture; 3) technology development for the utilization of animal resources; 4) crop tolerance to low temperatures, drought, and blight; 5) circulation of nitrogen in soil; 6) the utilization of remote sensing technology for evaluating environmental resources; 7) technology for the preservation and utilization of environmental resources; 8) evaluation of foodstuff quality in developing countries; and 9) cultivation and practical application of fisheries resources.

Development of technologies to strengthen the functional components of fruit
(Okinawa Subtropical Station, 1996-2003)

Research and development of highly functional food products using computer technology
(Food Science and Technology Division, 1997-2005)

Elucidating the molecular mechanisms of plant responses and resistance to low temperature stress
(Biological Resources Division, 1998-2003)

Development of resistance to high-level environmental stresses in order to add practical value to farm products
(Biological Resources Division, 1999-2005)

Development of trench planting technology for vegetable and fruit tree protection against high temperatures and typhoons
(Okinawa Subtropical Station, 2001-2003)

Developing an improved model for forecasting future supply and demand statistics
(Development Research Division, 2001-2005)

Development of a PCR marker for EST mapping of wheat
(Biological Resources Division, 2002-2004)

Development of widely usable, stable technologies for the production of high biomass sugarcane
(Crop Production and Environment Division, 2002-2006)

Economic evaluation of the impact of global warming on world agricultural, forestry and fisheries production
(Development Research Division, 2002-2006)

COMMISSIONED RESEARCH

Creation of DNA markers closely linked to resistance genes of soybean diseases and pests of soybean
(Animal Production and Grassland Division in cooperation with Chiba University under the project "Comprehensive studies on soybean improvement, production and utilization in South America," 2000-2002)

Application of inter-specific hybrids for stable rice production in West Africa: Evaluation of potential properties of African rice (*Oryza glaberrima*) using chromosome substitution lines
(Biological Resources Division in cooperation with Kyushu University, 2001-2003)

RESEARCH PROJECTS WITH OTHER GOVERNMENT MINISTRIES AND ORGANIZATIONS

In cooperation with the Ministry of Education, Culture, Sports, Science and Technology

Combining advanced climatological weather modeling and farmer knowledge for risk reduction in cereal-based cropping systems in West Africa
(Development Research Division, 2000-2002)

Development of a model to estimate the potential water supply derived from river basins in the Asian Monsoon Region
(Crop Production and Environment Division, 2002-2006)

In cooperation with the Ministry of Environment

Evaluation of water supply and function in logged areas
(Forestry Division, 2002-2004)

Research on techniques used to evaluate the relationship between environmental changes and tropical forest ecology and function
(Forestry Division, 2002-2004)

In cooperation with the Japan Science and Technology Cooperation

Functional analysis of rice genes encoding transcription factors
(Biological Resources Division, 2002-2007)

Research on changing water use in the Mekong Delta and its influence on economic growth in Delta countries and development of a model for water usage and management
(Development Research Division and Crop Production and Environment Division, 2002-2007)

Use of biotechnology in developing regions in order to stabilize agricultural production and fisheries resources
(Biological Resources Division and Fisheries Division, 2001-2005)

Research and development of comprehensive technologies used to preserve soil and water quality in tropical and subtropical island areas
(Okinawa Subtropical Station, 2002-2007)

In cooperation with the Bio-oriented Technology Research Advancement Institution (BRAIN)

Physiologicical and genetic studies on heat tolerance in crops and development of tolerant crops
(Okinawa Subtropical Station, 1998-2002)

Development of transgenic crops tolerant to environmental stresses
(Biological Resources Division, 2000-2004)

Study on regulation of gene expression and signal transduction pathways regulated by a plant hormone ABA (abscisic acid) and its application to biotechnology
(Biological Resources Division, 2001-2005)

MAFF SPECIAL RESEARCH ALLOTMENTS

Physio-genetic studies on yield determination and ecological adaptability for sustainable agriculture
(JIRCAS in cooperation with the International Rice Research Institute [IRRI], 1999-2003)

Physiological and ecological studies for the development of IPM for economically important pests in Africa
(JIRCAS in cooperation with the International Centre of Insect Physiology and Ecology [ICIPE], 2000-2004)

INVITATION PROGRAMS AT JIRCAS

In keeping with its role as an international research center, JIRCAS has implemented several invitation programs for foreign researchers and administrators at counterpart organizations. These programs facilitate the exchange of information and opinions concerning agriculture, forestry and fisheries administration while strengthening international research ties among scientists and administrators in other countries. Current programs are described in greater detail below.

1) Administrative Invitation

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. In addition, the program exposes administrators to current activities at JIRCAS and other MAFF-affiliated Incorporated Administrative Agencies (IAAs). Finally, 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. Thirty-seven individual visits to JIRCAS were made during FY 2002 under the Administrative Invitation program, including thirteen invitations to the International Symposium. Invited administrators and their home institutions are listed below.

FY 2002		
Werapon Ponragdee	Senior Researcher Leader of Sugarcane Breeding Group Khon Kaen Field Crop Research Center Department of Agriculture, Ministry of Agriculture and Cooperation Thailand	May 27-June 5, 2002
Shima Morakul	Director General Land Development Department Ministry of Agriculture and Cooperation Thailand	June 2-6, 2002
Daniel K.S. Khiong	Director Forestry Department, State Government of Sabah Malaysia	Sept. 24-Oct. 3, 2002
Lee Ying Fah	Head Forestry Department, State Government of Sabah Malaysia	Sept. 24-Oct. 3, 2002
Cheng Shihua	Director General China National Rice Research Institute People's Republic of China	Oct. 21-26, 2002
Prathak Tabthipwon	Vice Dean Faculty of Fisheries, Kasetsart University Thailand	Nov. 30-Dec. 6, 2003
Tang Huanjun	Director General Institute of Natural Resources and Regional Planning Chinese Academy of Agricultural Sciences People's Republic of China	Jan. 1-11, 2003
Li Shuyun	Deputy Division Director, Professor Department of International Cooperation Chinese Academy of Agricultural Sciences People's Republic of China	Jan. 8-11, 2003

Jiao Jiang	Director General Crop Cultivation Institute Heilongjiang Academy of Agricultural Sciences People's Republic of China	Jan. 8-11, 2003
Qian Keming	Director General Institute of Agricultural Economics Academy of Agriculture Science People's Republic of China	Jan. 21-28, 2003
Susana V. Siar	Section Head Socioeconomics Section Southeast Asian Fisheries Development Center Aquaculture Department The Philippines	Jan. 27-Feb. 9, 2003
Didi B. Baticados	Senior Reseacher Southeast Asian Fisheries Development Center Aquaculture Department The Philippines	Jan. 27-Feb. 9, 2003
Joko Budianto	Director General Agency for Agricultural Research and Development (AARD), Ministry of Agriculture Indonesia	Feb. 24-28, 2003
Pantjar Simatupang	Director Center for Agro-Socioeconomic Research and Development (CASERD) Indonesia	Feb. 24-28, 2003
Bram Kusbiantoro	Research Program Coordinator West Java Assessment Institute for Agricultural Technology (West Java AIAT) Indonesia	Feb. 24-28, 2003
Anna L.H. Dibiyantoro	Senior Researcher Research Institute for Vegetables (RIV) Indonesia	Feb. 24-28, 2003
Abdurachman Adimihardja	Director Center for Soil and Agro-climate Research and Development (CSARD) Indonesia	Feb. 24-28, 2003
Ken Menz	Research Program Manager Australian Center for International Agricultural Research (ACIAR) Australia	Feb. 24-28, 2003
Osni Corrêa de Souza	Researcher The Brazilian Agricultural Research Corporation (EMBRAPA) Brazil	Mar. 16-22, 2003
Peter C. Kerridge	Program Coordinator CIAT-Asia, International Tropical Agriculture Center (CIAT) Brazil	Mar. 17-21, 2003
Cesar Heraclides Behling Miranda	Researcher The Brazilian Agricultural Research Corporation (EMBRAPA), Gado de Corte Brazil	Mar. 17-26, 2003

Yoshihiko Sugai	Researcher The Brazilian Agricultural Research Corporation (EMBRAPA), Sede Brazil	Mar. 17-22, 2003
Cacilda Borges do Valle	Director of Research Section National Beef Cattle Research Center of the Brazilian Agricultural Research Corporation (EMBRAPA) Brazil	Mar. 17-22, 2003
Marcio Carvalho Marques Porto	Head Secretariat for International Cooperation The Brazilian Agricultural Research Corporation (EMBRAPA) Brazil	Mar. 17-22, 2003

International Symposium Invitees, FY 2002

Li Suoping	Head Research Project Management and Development Department, Institute of Agricultural Economics Chinese Academy of Agricultural Sciences (CAAS) People's Republic of China	Oct. 15-18, 2002
Wang Xi Chang	Associate Professor College of Food Science and Technology Shanghai Fisheries University People's Republic of China	Oct. 15-18, 2002
Li Lite	Vice President China Agricultural University People's Republic of China	Oct. 15-18, 2002
Nerlie M. Manalili	Head Agro-Industrial Development Program (AIDP) SEAMEO Regional Center for Graduate Study and Research in Agriculture (SEARCA) The Philippines	Oct. 15-19, 2002
Le Van To	Director Post-Harvest Technology Centre Vietnam	Oct. 15-19, 2002
Made Sudiana Mahendra	QA Expert Office of the Association for Integrated Horticulture Development in Upland Areas Project (IHDUA) Indonesia	Oct. 15-19, 2002
Daniela Battaglia	Animal Production Officer FAO	Oct. 15-18, 2002
Gassinee Trakoontivakorn	Deputy Director Institute of Food Research and Product Development Kasetsart University Thailand	Oct. 15-18, 2002
Tan Sen Min	Chief Southeast Asian Fisheries Development Center Marine Fisheries Research Department Singapore	Oct. 15-19, 2002

Joko Sulistyo	Senior Researcher Research Center for Biology, Indonesian Institute of Sciences (LIPI) Indonesia	Oct. 15-18, 2002
Asanee Kawtrakul	Associate Professor Kasetsart University Thailand	Jan. 20-25, 2003
Byong-Lyol Lee	Chief National Center for Agrometeorology (NCAM), Suwon Meteorological Office Korea Meteorological Administration (KMA) Korea	Jan. 20-25, 2003
He Chunpei	Director International Cooperation Division, Scientech Documentation & Information Center (SDIC) Chinese Academy of Agricultural Sciences (CAAS) People's Republic of China	Jan. 20-25, 2003

2) Counterpart Researcher Invitation

The Counterpart Researcher Invitation Program provides invitations for periods of up to six months to researchers engaged in collaborative work with members of the JIRCAS research staff. Counterparts conduct in-depth research at JIRCAS, at other MAFF-affiliated Incorporated Administrative Agencies (IAAs), at prefectural research institutes, or at national universities. This invitation program aims both to enhance the quality of research conducted in foreign countries and to facilitate exchanges between individual research staff. Twenty-five researchers were invited under the Counterpart Researcher Invitation program during FY 2002. Invited researchers, their affiliated research organizations, and their research activities are summarized below.

FY 2002

At Japan International Research Center for Agricultural Sciences, Apr. 7-May 1, 2002		
Yupa Hanboonsong	Department of Entomology Faculty of Agriculture Khon Kaen University Thailand	Prevention of stored insect pests using natural enemies and botanicals
At Japan International Research Center for Agricultural Sciences, May 20-July 26, 2002		
Yang Zhenyu	Laboratory of Soybean Breeding Soybean Institute Jilin Academy of Agricultural Sciences People's Republic of China	Development of technology to measure soil moisture and erosion
At Japan International Research Center for Agricultural Sciences and National Agricultural Research Center for Kyushu and Okinawa Region, National Agricultural Research Organization, May 28-July 11, 2002		
Mahithon Putiso	Soil Survey and Classification Division Land Development Department Ministry of Agriculture and Cooperation Thailand	Development of technology to measure soil moisture and erosion

At Japan International Research Center for Agricultural Sciences, June 3-July 17, 2002		
Qian Minze	State Information Center of P. R. China Department of Strategy & Development People's Republic of China	A model analysis of food demand and supply in major regions
At Japan International Research Center for Agricultural Sciences and National Institute of Animal Health, National Agricultural Research Organization, June 4-July 18, 2002		
Ho Thi Viet Thu	Department of Veterinary Medicine College of Agriculture Cantho University Vietnam	Improvement of diagnosis for swine infectious diseases using ELISA techniques
At Japan International Research Center for Agricultural Sciences, June 25-Sept. 6, 2002		
Li Zaigui	Food College, China Agriculture University East Campus People's Republic of China	Chemical changes of food materials under distribution conditions and preservation technologies
At Japan International Research Center for Agricultural Sciences, July 15-Sept. 6, 2002		
Wang Lijun	Food College, China Agriculture University East Campus People's Republic of China	Improvement of gelling and functional properties of soy protein
At Japan International Research Center for Agricultural Sciences, July 16-Oct.8, 2002		
Dwi Kuntjoro	Remote Sensing Research Division Center for Soil and Agroclimate Research and Development Indonesia	Study on evaluation of land degradation hazards of sloping areas in West Java
At Japan International Research Center for Agricultural Sciences and National Institute of Livestock and Grassland Science, Aug. 5- Oct. 29, 2002		
Le Thi Men	Department of Animal Science College of Agriculture Cantho University Vietnam	Effects of high temperature on feed intake, digestibility and feed efficiency of pigs
At Japan International Research Center for Agricultural Sciences and National Research Institute of Aquaculture, Aug. 19-Oct. 23, 2002		
Chittima Aryuthaka	Department of Marine Science Faculty of Fisheries Kasetsart University Thailand	Elucidation of the food chain using stable isotopes
At Japan International Research Center for Agricultural Sciences and National Institute of Food Sciences, Aug. 26-Oct. 31, 2002		
Rungsima Kengkanpanich	Stored Product Insect Research Group, Entomology and Zoology Division Department of Agriculture Ministry of Agriculture and Cooperation Thailand	Ecology of natural enemies of stored product insect pests
At Japan International Research Center for Agricultural Sciences, Aug. 29-Nov. 26, 2002		
Yubao Zuo	Dezhou Experimental Station Chinese Academy of Agricultural Sciences People's Republic of China	Evaluation of fertilized N dynamics and the effects on ammonia volatilization

At Japan International Research Center for Agricultural Sciences, Sept. 2, 2002-Mar. 14, 2003		
Muhammad Ayub Khan	Researcher Oilseeds Research Programme National Agricultural Research Centre Pakistan	Monitoring the expression pattern of rice genes under drought stress by using a full-length cDNA microarray
At Japan International Research Center for Agricultural Sciences, Sept. 3, 2002-Mar. 7, 2003		
Sri Wahyuni	Researcher Research Institute for Spice and Medicinal Crops Indonesia	Analysis of genetic diversity of ginger (*Zingiber officinale* Rosc.) by using AFLP
At Japan International Research Center for Agricultural Sciences and National Institute of Fruit Tree Sciences, National Agricultural Research Organization, Sept. 9-Dec. 27, 2002		
Nguyen Thanh Nhan	Applied Biotechnology Division Southern Fruit Research Institute (SOFRI) Vietnam	Gene analysis on growth and introduction of foreign genes into citrus for development of disease-free seedlings
At Japan International Research Center for Agricultural Sciences, Sept. 9, 2002-Mar. 14, 2003		
Qin Feng	Researcher Laboratory of Plant Molecular Biology Department of Biological Sciences and Biotechnology Tsinghua University People's Republic of China	Functional analysis of DREB2 genes encoding transcription factors involved in drought and salt stress response in plants
At Japan International Research Center for Agricultural Sciences, Sept. 10, 2002-Mar. 10, 2003		
Hasran Masrom	Researcher Malaysian Agricultural Research and Development Institute (MARDI) Strategic Research Center Malaysia	Development of microsatellite markers for molecular genetic assessment of *Mangifera* species
At Japan International Research Center for Agricultural Sciences, Sept. 19-Dec. 12, 2002		
Javier Ramon Gilli	Marcos Juarez Agricultural Experiment Station INTA Argentina/Laboratory of Soybean Breeding Argentina	Identification of main soybean disease-resistance genes and development of gene isolation methods. II. Studies on the identification and isolation of resistance gene loci for soybean sudden death syndrome
At Japan International Research Center for Agricultural Sciences, Sept. 24-Oct. 24, 2002		
Jupiri Titin	Soil Science Section Forest Research Centre, Sabah Malaysia	Evaluation of the environment for agroforestry production
At Japan International Research Center for Agricultural Sciences and National Agricultural Research Center for Tohoku Region, National Agricultural Research Organization, Sept. 29-Nov. 9, 2002		
Nongluck Suphanchaimat	Department of Agricultural Economics Faculty of Agriculture Khon Kaen University Thailand	Identification of farm management and marketing factors limiting more efficient water use in existing farming systems
At Japan International Research Center for Agricultural Sciences, Oct. 2, 2002-Mar. 8, 2003		
Teuku Tajuddin	Center for the Assessment and Application of Biotechnology Indonesia	Establishment of a method to arrange BAC clones based on fingerprinting in soybean

At Japan International Research Center for Agricultural Sciences, Oct. 11- 31, 2002		
Roongnapa Tawanron	Soil Survey and Classification Division Land Development Department Ministry of Agriculture and Cooperation Thailand	Analysis of agro-environment in rainfed paddy
At Japan International Research Center for Agricultural Sciences, Oct. 14-Nov. 8, 2002		
Patcharee Tungtrakul	Institute of Food Research and Product Development Kasetsart University Thailand	Effect of amylopectin chain length distribution in rice on gelatinization properties
At Japan International Research Center for Agricultural Sciences and National Institute of Livestock and Grassland Sciences, National Agricultural Research Organization, Oct. 28-Dec. 20, 2002		
Qi Hongwei	Laboratory of Plant Molecular Biology Department of Biological Sciences and Biotechnology Tsinghua University People's Republic of China	Fattening of beef cattle and evaluation of quality in beef
At Japan International Research Center for Agricultural Sciences, Jan. 14-Feb. 4, 2003		
Muhammad Farid B. Abdul Rashid	Corporate Development Division Forest Research Institute Malaysia	Studies on the evaluation of environmental impact associated with forest disturbances

3) JIRCAS Visiting Research Fellowship Program at Okinawa

The Okinawa Visiting Research Fellowship Program was initiated in FY 1992, prior to the reorganization of the Tropical Agricultural Research Center (TARC) into JIRCAS. The program invites post-doctoral scientists to conduct research for a period of one year at the Okinawa Subtropical Station. Researchers must focus on important topics relating to tropical agriculture in developing countries within one of five research themes: 1) efficient use of water and fertilizers, 2) evaluation and utilization of heat- and salt-tolerant crops, 3) evaluation and characterization of tropical and subtropical fruits, 4) evaluation and utilization of useful traits in sugarcane and sweet potato, and 5) integrated pest management of tropical and subtropical crops.

More information on the Okinawa Visiting Research Fellowship Program can be obtained by contacting the International Relations Section, Japan International Research Center for Agricultural Sciences, 1-1 Ohwashi, Tsukuba, Ibaraki 305-8686, Japan. (Tel.:+81-29-838-6335; Fax:+81-29-838-6337; e-mail: irs@jircas.affrc.go.jp).

Okinawa Fellows in 2002 pose for group photograph with Subtropical Station Director, Dr. M. Suzuki (at far right)

from October 2001 to September 2002

Nur Ahmed Khondaker	Bangladesh Agricultural Research Council Bangladesh	Maximizing water use efficiency by micro-irrigation watering under differing irrigation depths and amounts
Wan Abdullah Wan Yusoff	Malaysia Agricultural Research and Development Institute Malaysia	Evaluation of soil erosion and nutrient flux in Ishigaki Island

Tarlan Mamedov	Azerbaijan Academy of Sciences Azerbaijan	Characterization of heat tolerance in transgenic tobacco (ER-sHSP)
Sabaruddin Zakaria	Syiah Kuala University Indonesia	Pollen tube growth and accumulation of reserve substances under high temperature stress in snap bean
Mohamed Koronfel	Brawijaya University Indonesia	Genetic engineering of salt tolerance in rice plants
Arifin Noor Sugiharto	Brawijaya University Indonesia	Development of transformation methods and suitable tissue culture procedures for generating high survival rate of sugarcane regenerants
Yunxia Liu	Chinese Academy of Agricultural Sciences People's Republic of China	Differential screening of anthocyanin transcriptional activator genes of sweet potato
Muchdar Soedarjo	Research Institute for Legume and Tuber Crops Indonesia	Cloning of anthocyanin transcriptional activator genes from a cDNA library of sweet potato
Jiang Ling	Huazhong Agriculture University People's Republic of China	Establishment of genetic transformation techniques in papaya plants
Bui Thi Ngan	Research Institute for Cotton and Fiber Crops Vietnam	Evaluation and utilization of the natural predator, *Antilochus coqueberti* against the cotton stainer

from October 2002 to September 2003

Nur Ahamed Khondaker	Planning and Evaluation Division Bangladesh Agricultural Research Council Bangladesh	Water savings and water use efficiency under differing micro-irrigation depths
Samuel M. Contreras	Water Resources Management Division Bureau of Soils and Water Management The Philippines	Analysis of effects of ploughed hardpan on sub-soil stored water use in sugarcane
Prakash Chandra Nautiyal	National Research Centre for Groundnut (ICAR) India	Heat tolerance of transgenic tomato with small heat shock protein gene(s)
Shang Qingmo	Institute of Vegetables and Flowers Chinese Academy of Agriculture Sciences People's Republic of China	Physiological studies on heat tolerance in snap bean
Efendi	Faculty of Agriculture Syiah Kuala University Indonesia	Development of efficient transformation methods and introduction of useful genes in sugarcane
Muchdar Soedarjo	Research Institute for Legume and Tuber Crops (RILET) Indonesia	Isolation and characterization of anthocyanin transcriptional activator genes from a cDNA library of sweet potato
Bui Thi Ngan	Research Institute for Cotton and Fibre Crops Vietnam	Life history traits of the cotton stainer, *Dysdercus cingulatus*, and evaluation, utilization of natural predator, *Antilochus coqueberti* against the cotton stainer
Wanphen Srithongchai	Plant Virology Section Division of Plant Pathology and Microbiology Department of Agriculture Thailand	Purification of citrus greening organism and analysis of pathogen-specific proteins

4) JIRCAS Visiting Research Fellowship Program at Tsukuba

A program similar to the Okinawa Visiting Research Fellowship Program has been implemented on JIRCAS's Tsukuba premises since October 1995. The Tsukuba Visiting Research Fellowship Program aims to promote collaborative research to address various problems confronting countries in developing regions. Until September 2001, eight researchers have been invited annually under the programs; four researchers engaged in two-year projects (long-term) at JIRCAS and four researchers conducted short five-month projects (short-term) at the National Institute of Agrobiological Sciences (NIAS). For the period October 2001 to September 2002, however, some changes were initiated in the long-term invitation program. The two-year term was shortened to a one-year term and the number of invitees was increased to five. Starting from October 2002, a total of 10 researchers will have been invited under the one-year term program and four researchers under the short-term program. Recent invitees and their research activities are listed below.

More information on the Tsukuba Visiting Research Fellowship Program can be obtained by contacting the International Relations Section, Japan International Research Center for Agricultural Sciences, 1-1 Ohwashi, Tsukuba, Ibaraki 305-8686, Japan. (Tel.: +81-29-838-6335; Fax: +81-29-838-6337; e-mail: irs@jircas.affrc.go.jp).

Tsukuba fellows and host scientists pose for group photograph with JIRCAS President, Dr. Mutsuo Iwamoto (at center).

Long-term at JIRCAS from October 2000 to September 2002		
Donghe Xu	Tianjin Agricultural Academy of Sciences People's Republic of China	Mapping of resistance genes to *Fusarium* head blight (FBH) in wheat
Nguyen V. Dong	Agricultural Genetics Institute Vietnam	Mapping of resistance genes to *Fusarium* head blight (FBH) in wheat
Nguyen T. Huong	Institute of Chemical Technology Prague, Czech Republic (from Vietnam)	Comparison of volatile components in non-glutinous and glutinous rice
Subbarao V. Guntur	International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) India	Physiological studies on nitrification inhibition and nitrogen absorption in *Brachiaria humidicola*

Long-term at JIRCAS from October 2001 to September 2002		
Ketut Wikantika	Bandung Institute of Technology Indonesia	Diversification of vegetable type mapping in mountainous area using remote sensing and GIS data
Lam-Son Phan Tran	Japan Advanced Institute of Science and Technology Nara, Japan (from Vietnam)	Functional analysis of drought-inducible genes for transcription factors containing a NAC DNA binding domain in plants
Pang Xin	Chinese Academy of Sciences People's Republic of China	Physiological mechanisms of nutrient acquisition by crops from low-fertility tropical soils
Rowena H. Oane	International Rice Research Institute (IRRI) The Philippines	Studies on the ecology and physiology of endophytic microorganisms (nitrogen-fixing bacteria, chitinase-producing bacteria) in plants

Molay Kumar Roy	Ehime University, Japan (from Bangladesh)	Studies on the mechanism of apoptotic cell death induced by some dietary components in human cancer cell lines

Long-term at JIRCAS from October 2002 to September 2003

Omer Elgaili Elsheikh	Agricultural and Resource Economics The University of Tokyo (from Sudan)	Returns to agricultural research investment of rice production in West Africa: the case of Nigeria and Côte d'Ivoire
Wang Lei	China National Rice Research Institute Agricultural Economics and Information People's Republic of China	Development of methods of monitoring agricultural land use and crop production by using MODIS data
Lam-Son Phan Tran	JIRCAS Fellow (from Vietnam)	Functional analysis of drought-inducible genes for transcription factors containing a NAC DNA binding domain in plants
Maxim Petre	Research Institute for Cereals and Industrial Crops Romania	Studies on mapping of brittle rachis genes and contributions for agronomic traits in wheat
Haiyan Chu	Laboratory of Material Cycling in Pedosphere People's Republic of China	Effects of N fertilization management on soil microbial properties and atmospheric environment
Md. Samiul Alam	Agricultural and Environmental Biology The University of Tokyo (from Bangladesh)	Physiological mechanisms of iron toxicity in rice
Adel Elsayed Elbeltagy	Laboratory of Microbiology Botany Department, Faculty of Agriculture Minufiya University Egypt	Molecular characterization of endophytic nitrogen-fixing bacteria in rice
Molay Kumar Roy	JIRCAS Fellow (from Bangladesh)	Cell cycle disregulation in cancer cells by food components
Leh Cheu Peng	Wood, Paper and Coatings Technology University Science Malaysia Malaysia	Studies on chlorine-free bleaching for pulp production from tropical lignocellulose
Safiah Jasmani	JIRCAS Fellow (from Malaysia)	Elucidation of osmoregulatory mechanisms in the giant freshwater prawn, *Macrobrachium rosenbergii*, and relationship to the reproductive process

Short-term at NIAR during October 2002 to September 2003

Ewa Forczek	Jagiellonian University of Cracow Poland	Elucidation of induction mechanisms of cryptobiosis of *Polypedilum vanderplanki*: localization of trehalose
Fida Mohammad Abbasi	National Agricultural Research Center Crop Sciences Institute Pakistan	Identification of proteins responsive to salt stress
Sundaram Chitra	Central Sericultural Research & Training Institute India	Development of breeding methods by using DNA markers in the silkworm, *Bombyx mori*
Paramanathen Saravanakumar	University of Peradeniya Sri Lanka	Analysis of *Vigna* species diversity in South Asia

5) Other fellowships for visiting scientists

The Government of Japan sponsors a postdoctoral fellowship program for both Japanese and foreign scientists through the Japan Society for the Promotion of Science (JSPS). This fellowship program, which was formerly administered by the Science and Technology Agency (STA), was transferred to the Japan Society for the Promotion of Science (JSPS) on April 1, 2001 (FY 2001). The program places post-doctoral and sabbatical fellows in national research institutes throughout Japan according to research theme and prior arrangement with a host scientist for a term of generally one month to three years. Fellowships can be undertaken in any of the ministries and many fellows are currently working at various Incorporated Administrative Agencies affiliated to the Ministry of Agriculture, Forestry and Fisheries (MAFF). In 2002, the following visiting scientists resided at JIRCAS: Dr. Vidya Jayasankar (India), Fisheries Division; Dr. Safiah Jasmani (Malaysia), Fisheries Division; Dr. Hua Xu (People's Republic of China), Crop Production and Environment Division; Dr. Najeeb S. Alzoreky (Yemen), Food Science and Technology Division; and Dr. Ashid Rabbani Malik (Pakistan), Biological Resources Division.

In addition, six Japanese fellows, Dr. Y. Ito, Biological Resources Division; Dr. Y. Osakabe, Biological Resources Division; Dr. Y. Fujita, Biological Resources Division; Dr. T. Watanabe, Crop Production and Environment Division; Dr. K. Suzuki, Development Research Division; and Dr. C. Oguchi, Crop Production and Environment Division, also conducted research at JIRCAS.

SYMPOSIA AND WORKSHOPS

1) INTERNATIONAL SYMPOSIA

Between 1967 and 1993, the Tropical Agriculture Research Center (TARC), JIRCAS's predecessor, sponsored annual international symposia in order to promote scientific exchange while accurately gauging and responding to agriculture, forestry and fisheries needs of the world's developing regions. Since its transition from TARC, JIRCAS has continued this practice. At present, each year's JIRCAS International Symposium is organized around themes of central importance to international agricultural research.

Appropriately, the 9th JIRCAS International Symposium, held in October 2002, focused on "Value-addition to agricultural products", and the program appears below.

9th JIRCAS International Symposium
VALUE-ADDITION TO AGRICULTURAL PRODUCTS – TOWARDS THE INCREASE OF FARMERS' INCOME AND VITALIZATION OF THE RURAL ECONOMY –

On October 16-17, 2002, JIRCAS held its 9th International Symposium entitled "Value-addition to agricultural products - towards the increase of farmers' income and vitalization of the rural economy" in cooperation with the National Agricultural Research Organization (NARO), National Food Research Institute (NFRI), Fisheries Research Agency (FRA), and the PhAction and Food Forum Tsukuba. A total of 209 scientists, administrators and technical experts representing 40 different countries participated in the symposium and exchanged views on the issues raised during each session.

Opening address and welcoming remarks

- Inaugural address by Dr. Takahiro Inoue, (former) President, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan
- Welcoming remarks by Mr. Katsuyuki Nagayama, Research Councilor, Agriculture, Forestry and Fisheries Research Council Secretariat (AFFRC), Japan

Keynote addresses

- "Status of the postharvest sector and its contribution to agricultural development and economic growth" by Dr. Geoffrey C. Mrema and Dr. Rosa S. Rolle, Food and Agriculture Organization of the United Nations (FAO), Italy
- "Linking farmers to markets" by Dr. Guy Poulter, Natural Resources Institute (NRI), University of Greenwich, United Kingdom

Session 1: Current status of the rural economy, measures for increasing farmers' incomes and vitalization of the rural economy

Chaired by Dr. Greg Johnson, Australian Centre for International Agricultural Research (ACIAR), Australia, and Mr. Kazuyuki Tsurumi, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan

- Government measures to increase farmers' income and develop the rural economies in China. S. Li, Chinese Academy of Agricultural Sciences (CAAS), China
- The Philippine rural economy: Status and measures for increasing farmers' income and economic vitalization. N.M. Manalili and H.C. Jalotjot, Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA), the Philippines
- Current status of the Vietnamese rural economy and measures for its vitalization and improving farmers' income. L.V. To, Post Harvest Technology Centre (PHTC), Vietnam
- Current status of the rural economy and measures for vitalizing it and increasing farmers' income in Indonesia: Development of substantial Gedong gincu mango plantations in West Java. M.S. Mahendra, M. Suryadi, and N. Padmono, University of Udayana, Indonesia
- Postharvest innovation systems in South Asia: Research as capacity development and its prospects for impact. A. Hall and R.V. Sulaiman, Department for International Development (DFID), Crop Post-Harvest Programme, South Asia, India
- Strategic alliances of cassava farmers with private and public sectors: A new approach for

the development of cassava crop in Latin America. B.O. Patino and R. Best, Latin American and Caribbean Consortium to Support Cassava Research and Development (CLAYUCA), Colombia

- The challenges of globalization and opportunities for accessing value-added markets for African producers. R.S.B. Ferris and P. Robbins, International Institute of Tropical Agriculture (IITA), Uganda

Session 2: Systems for ensuring food quality and safety

Chaired by Dr. Tadahiro Nagata, National Food Research Institute (NFRI), Japan and Dr. Toshiaki Taniguchi, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan

- Codex standards and food safety. Y. Yamada, National Food Research Institute (NFRI), Japan
- Grain quality from harvest to market. J.F. Rickman, International Rice Research Institute (IRRI), the Philippines
- Safety of feed and animal products. A.W. Speedy and D. Battaglia, Food and Agriculture Organization of the United Nations (FAO), Italy
- Extending the pre-rigor state of fish by enhancing mitochondrial ATP synthesis. S. Watabe and S. Itoi, University of Tokyo, Japan

Session 3: Research on value-addition and novel utilization

Chaired by Dr. Kouji Nakamura and Dr. Kazuki Shinohara, National Research Institute of Fisheries Science (NFRI), Japan

- Issues facing the traditional fish products industry in Southeast Asia. Y. Soon-Eong and T. Sen-Min, Southeast Asian Fisheries Development Centre (SEAFDEC), Singapore
- Development of an intermediate foodstuff from freshwater fish in China. X. Wang, Y. Fukuda, S. Chen, M. Yokoyama, Y. Cheng, C. Yuan, Y. Qu, and M. Sakaguchi. Shanghai Fisheries University, China
- Application of value-adding technologies in Thailand. G. Trakoontivakorn, Institute of Food Research and Product Development, Kasetsart University, Thailand
- Inventory of indigenous plants and minor crops in Thailand based on bioactivities. K. Nakahara, M.K. Roy, N.S. Alzoreky, V.N. Thalang, and G. Trakoontivakorn, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan
- Functionalities of traditional foods in China. L. Lite, Y. Lijun, Z. Jianhua, Z.Xiaofeng and Z. Lin, China Agriculture University, China
- Functional foods and their utilization in Japan. M. Shimizu, University of Tokyo, Japan

Session 4: General discussion

Chaired by Dr. Geoffrey C. Mrema, Food and Agriculture Organization of the United Nations (FAO), Italy, and Dr. Toru Hayashi, Japan International Research Center for Agricultural Sciences, Japan

- What needs to be done to make postharvest research and development serve the needs of poor farmers in their efforts to find markets for their products?
- Changing focus of postharvest research - from postharvest losses towards value-addition - re-evaluation of indigenous products and traditional foods

Closing Remarks by Dr. Le Van To, Post Harvest Technology Centre (PHTC), Vietnam

2) SPECIAL PROGRAMS

WORKSHOP ON THE RESULTS AND PROSPECTS OF "COMPREHENSIVE STUDIES ON THE DEVELOPMENT OF SUSTAINABLE AGRO-PASTORAL SYSTEMS IN THE SUBTROPICAL ZONE OF BRAZIL"

The research project entitled "Comprehensive studies on the development of sustainable agro-pastoral systems in the subtropical zone of Brazil" has been in operation since 1996, with a primary focus on the following four subjects: 1) Analysis and evaluation of traditional land utilization systems for agriculture; 2) Multidisciplinary studies for the adoption of sustainable crop-pasture rotation systems; 3) Socio-economic

Workshop participants pose for a group photo during the final evaluation meeting for the project "Comprehensive studies on sustainable agro-pastoral systems in the subtropical zone of Brazil." (Photo: T. Taniguchi)

evaluation of crop-pasture rotation from the standpoint of farming systems; and 4) On-farm participatory research on newly developed "agro-pastoral systems." These studies are being carried out in collaboration with the National Beef Cattle Research Center (EMBRAPA-Gado de Corte), Campo Grande, Mato Grosso Do Sul, Brazil, International Center for Tropical Agriculture (CIAT) and JATAK (Federacao Nacional das Cooperativa Agricola de Colonizacao) Agricultural Training Center (JATAK-ATC).

In order to support the project's final goals, a workshop was held at Tsukuba from March 18-19, 2003 in order to review the results obtained during the implementation of the project, and to discuss future prospects for agro-pastoral systems in Brazil. Dr. Peter C. Kerridge, former Coordinator of International Center for Tropical Agriculture (CIAT)-Asia, Prof. Kazuo Kawano, Kobe University, Prof. Makie Kokubun, Tohoku University and Dr. Muneo Oikawa, Director of Research Division, Japan Grassland Farming Forage Seed Association, were invited to serve as commentators, and approximately fifty scientists from Brazil and Japan participated in the workshop.

Opening address by Dr. Takahiro Inoue, (former) President of the Japan International Research Center for Agricultural Sciences (JIRCAS), Japan

Keynote address by Dr. Marcio C.M. Porto, Brazil, "Importance of agro-pastoral systems in Brazil"

Session 1: Project outputs

- Development of grassland management technology for sustainable agro-pastoral systems in the subtropical zone of Brazil. T. Kanno, National Agricultural Research Center for Tohoku Region, Japan
- Results of soybean yields, grass productivity and soil fertility changes in agro-pastoral systems. C.H.B. Miranda, National Beef Cattle Research Center (EMBRAPA-Gado de Corte), Brazil
- Nitrogen dynamics in agro pastoral-systems. K. Kanda, National Institute for Agro-Environmental Sciences, Japan
- Characterization of nitrogen utilization by tropical grasses in Brazilian savannas. T. Nakamura, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan.
- Organic residues accumulation in soil under agro-pastoral systems in the Cerrados of Brazil. C.H.B. Miranda, National Beef Cattle Research Center (EMBRAPA-Gado de Corte), Brazil
- Effects of termite activities on nutrient recycling in agro-pastoral systems. E. Fukuda, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan
- Enhancement of phosphorus leaching by soybean cultivation especially in Brazilian oxisols. N. Ae, National Institute for Agro-Environmental Sciences, Japan
- Inhibition of nitrification in *Brachiaria humidicola*, T. Ishikawa, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan

Session 2: Prospects for agro-pastoral systems

- Diagnosis of pasture degradation by multi-temporal satellite imagery. Y. Yamamoto, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan
- Problems and perspectives of regional land conservation systems in the cerrados highlands in relation to the Pantanal wetland. O. Correa de Souza, National Beef Cattle Research Center (EMBRAPA-Gado de Corte), Brazil
- Tropical forage breeding in EMBRAPA: Current situation and prospects, C. Borges do Valle, National Beef Cattle Research Center (EMBRAPA-Gado de Corte), Brazil
- Socio-economic evaluation of agro-pastoral systems. Y. Sugai, National Beef Cattle Research Center (EMBRAPA-Headquarters), Brazil
- Actual situation and possibilities of the extension of agro-pastoral systems in the subtropical zone of Brazil. S. Aoki, National Institute of Livestock and Grassland Science, Japan

A SYMPOSIUM ON SUSTAINABLE AGRICULTURAL TECHNOLOGY RESEARCH AND DEVELOPMENT

The year 2002 marked the observance of 30th Anniversary of the Restoration of Diplomatic Relations between Japan and China. During these last three decades, exchanges of agricultural science and technology between Japan and China have facilitated substantial progress in terms of agricultural production, as both countries have similar small-scale farming and labor-intensive systems in the Asian Monsoon region. This year was crucial for China because of the country's restructuring. Various activities are being undertaken to develop sustainable agriculture in both China and Japan under the international framework of the World Trade Organization (WTO). With the aim of promoting further development of sustainable agriculture, the Japanese Ministry of Agriculture, Forestry and Fisheries (MAFF), the Chinese Ministry of Agriculture (MOA) and the Japan International Research Center for Agricultural Sciences (JIRCAS) jointly held a symposium on June 27-28, 2002 at the China-Japan Research and Development Center for Agricultural Technology, Beijing, also the venue for the celebration of the Center's establishment, which was financially supported by the Japan International Cooperation Agency (JICA). The symposium was attended by more than 100 participants from Japan and China.

Opening address and welcome remarks

- Mr. Liu Jian, Vice Minister, Ministry of Agriculture (MOA), People's Republic of China
- Mr. Akihiko Ohmori, Senior Councilor for Technical Affairs, Ministry of Agriculture, Forestry and Fisheries (MAFF), Japan
- Dr. Zhai Huqu, President, Chinese Academy of Agricultural Sciences (CAAS), People's Republic of China
- Dr. Takahiro Inoue, (former) President, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan

Keynote address

- Prof. Tian Weimin, China Agricultural University, People's Republic of China
- Dr. Takashi Shinohara, Director General, Policy Research Institute, Japan

Session 1: WTO and agricultural policy

Chaired by Mr. Kazuo Hirashima, General Food Policy Bureau, Ministry of Agriculture, Forestry and Fisheries (MAFF), Japan

- Adjustment of Chinese agricultural policy to the WTO accession. Z. Hongyu, Department of Agricultural Policy, Ministry of Agriculture, People's Republic of China
- Proposal by Japan on WTO agricultural negotiations. S. Akahori, General Food Policy Bureau, Ministry of Agriculture, Forestry and Fisheries, Japan
- Adjustment of Chinese agriculture and rural economic policy after the WTO accession. X. Xiaoqing, Development Research Center of the State Council, People's Republic of China

- Economic development and agriculture in East Asia. A. Ikegami, Meiji University, Japan
- Comparative competition of Chinese agriculture after the WTO accession. Q. Keming, Institute of Agricultural Economics, Chinese Academy of Agricultural Sciences (CAAS), People's Republic of China
- For establishing fair and appropriate rules of agricultural product trade. Y. Nakamura, Central Union of Japan Agricultural Cooperatives, Japan

Session 2: Sustainable agriculture

Chaired by Dr. Kao Shangbao, Department of Education, Ministry of Agriculture, China

- Sustainable agriculture in Japan, challenges and issues. K. Cho, Kyushu University, Japan
- Sustainable development and technology transfer to China. W. Yiming, China-Japan Research and Development Center for Agricultural Technology, Chinese Academy of Agricultural Sciences (CAAS), People's Republic of China
- Environmental conservation and sustainable agriculture. K. Minami, National Institute for Agro-Environmental Sciences, Japan
- Expected achievements in the China-Japan Sustainable Agricultural Technology Research and Development Project. Y. Huaiwen, China-Japan Research and Development Center for Agricultural Technology, Chinese Academy of Agricultural Sciences (CAAS), People's Republic of China
- Case study in development of a sustainable agricultural system for various agro-ecosystems. O. Ito, Y. Hosen, N. Matsumoto and T. Watanabe, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan; and K. Yagi, National Institute for Agro-Environmental Sciences, Japan
- Ecological environmental safety and agricultural sustaining development. L. Erda, China-Japan Research and Development Center for Agricultural Technology, Chinese Academy of Agricultural Sciences (CAAS), People's Republic of China

Signboard in Chinese for the Sustainable Agricultural Technology Symposium.

WORKSHOP AND FINAL EVALUATION MEETING OF THE COLLABORATIVE PROJECT ON EVALUATION AND IMPROVEMENT OF REGIONAL FARMING SYSTEMS IN INDONESIA

A final evaluation workshop was conducted on February 25, 2003 at JIRCAS's premises in Tsukuba in order to conclude the research project entitled "Evaluation and improvement of regional farming systems in Indonesia" carried out with the Agency for Agricultural Research and Development (AARD), Indonesia since 1998. Since the project was reorganized to focus on the evaluation of vegetable-based farming systems and the improvement of vegetable and fruit cultivation in the highland regions of West Java, research achievements from only the previous three years of the project were presented.

The project consisted of five research subjects, including the use of geographic information systems (GIS), socio-economic analyses, plant protection and the utilization of biological resources. During the workshop, research successes based on the use of interdisciplinary approaches in each subject were discussed in addition to the insights provided from the unidisciplinary studies. Representatives from the counterpart institute provided their comments on the implications and the future prospects of each research subject, and concluded that the project yielded many applicable research outputs as well as unprecedented experiences during the region-specific comprehensive research project.

Welcome address by Dr. Takahiro Inoue, (former) President, Japan International Research Center for Agricultural Sciences (JIRCAS)
Project Introduction by Mr. Osamu Koyama, Project Leader, Japan International Research Center for Agricultural Sciences (JIRCAS)

Reporting Session
Chaired by Mr. Osamu Koyama

- Analysis of physical environment resources for evaluation and improvement of vegetable-based farming systems in the highland regions of West Java - Development of techniques to integrate information on spatial characteristics for the management of regional agricultural systems. S. Uchida, Development Research Division, Japan International Research Center for Agricultural Sciences (JIRCAS), and Wahyunto, Center for Soil and Agro-climate Research and Development (CSARD), Indonesia. Comments by Dr. Abdurachman Adimihardja, Director, CSARD.
- Changes in farming systems and analysis of future demands for domestic consumption and exports - historical review of development of temperate vegetable production and prediction of future development. H. Mayrowani, Center for Agro Socio-Economic Research and Development (CASERD), Indonesia; K. Miyatake, National Agricultural Research Center, National Agricultural Research Organization (NARO), Japan; and S. Kosugi, Development Research Division, Japan International Research Center for Agricultural Sciences (JIRCAS).
- Evaluation of new technologies for temperate vegetable production in terms of the household economy. S. Kosugi, Japan International Research Center for Agricultural Sciences (JIRCAS); H. Mayrowani, CASERD; and T. UBARNA, West Java Assessment Institute for Agricultural Technology (AIAT-West Java), Indonesia. Comments by Dr. Pantjar Simatupang, Director, CASERD.
- Spatial analysis of the cropping patterns of temperate vegetables and identification of research topics in collaboration between farmers' associations and regional research. J. S. Caldwell, Development Research Division, Japan International Research Center for Agricultural Sciences (JIRCAS); and I. Ishaq, AIAT-West Java. Comments by Dr. Bram Kusbiantoro, AIAT-West Java.
- Analysis and evaluation of marketing systems for temperate vegetables in West Java. W. Adiyoga, Research Institute for Vegetables (RIV), Indonesia; A. Nonaka, National Agricultural Research Center for Tohoku Region, National Agricultural Research Organization (NARO), Japan; and S. Kosugi, Japan International Research Center for Agricultural Sciences (JIRCAS). Comments by Dr. Pantjar Simatupang, Director, CASERD.
- Evaluation of the present cultivation and plant protection technologies of temperate vegetables and development of sustainable technologies. M. Yamada, Crop Production and

Environment Division, Japan International Research Center for Agricultural Sciences (JIRCAS); H. Higashio and T. Kitamura, National Institute of Vegetables and Tea Science, National Agricultural Research Organization (NARO); and A. A. Asanshi, RIV. Comments by Dr. Anna L. H. Dibiyantoro, Senior Researcher, RIV.

- Evaluation and utilization of indigenous upland crops and fruit trees planted in the farming systems in the highland regions. Y. Egawa and H. Fukamachi, Okinawa Subtropical Station, Japan International Research Center for Agricultural Sciences (JIRCAS); and I. Ishaq, AIAT-West Java. Comments by Dr. Bram Kusbiantoro, Research Program Coordinator, AIAT-West Java.

General Discussion

Chaired by Mr. Osamu Koyama, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan

General Comments

Dr. Joko Budianto, Director General, Agency for Agricultural Research and Development (AARD), Indonesia

WORKSHOP ON THE DEVELOPMENT OF NEW TECHNOLOGIES AND THEIR PRACTICE FOR SUSTAINABLE FARMING SYSTEMS IN THE MEKONG DELTA (MEKONG II)

JIRCAS has conducted the Mekong Delta Project (Mekong II) since 1999 in collaboration with Cantho University, the Cuu Long Delta Rice Research Institute (CLRRI), and the Southern Fruit Research Institute (SOFRI) for the purpose of developing technologies that can reuse and recycle by-products and wastes generated by VACR systems (VACR is a Vietnamese acronym standing for fruits and vegetables, aquaculture, livestock, and rice-farming systems). On November 27-29, 2001, the CLRRI hosted a three-day workshop to serve as a venue for the mid-term evaluation of the project. More than 100 participants attended the workshop, including members of the Vietnamese local authorities and agricultural extension departments, as well as representatives from Tan Phu Thanh Village, one of the on-farm trial sites, and faculty members from Cantho University. During the workshop, a consensus was reached that the technologies developed thus far in the project should be tested at farm sites, and that technology-specific farming systems should be proposed based on the results. On the final day of the workshop, all participants visited the on-farm trial sites and exchanged views on project performance, while also providing suggestions for future research strategies.

Session 1: Developing technologies for rice production

Chaired by Dr. Pham Sy Tan, Cuu Long Delta Rice Research Institute (CLRRI), Vietnam

- Genetic variability of salt tolerance in rice. N.T. Lang, Cuu Long Delta Rice Research Institute (CLRRI), Vietnam
- Development of salt tolerant varieties in the Mekong Delta. N.T. Lang, Cuu Long Delta Rice Research Institute (CLRRI), Vietnam
- Optimum seed rates derived from row seeding using different crop management practices. T.Q. Khuong, Cuu Long Delta Rice Research Institute (CLRRI), Vietnam
- Effect of seed rates and seeding methods using different nitrogen rates. T.Q. Khuong, Cuu Long Delta Rice Research Institute (CLRRI), Vietnam
- Effect of irrigation and drainage management practices on rice yield under irrigated rice culture. T.Q. Khuong, Cuu Long Delta Rice Research Institute (CLRRI), Vietnam
- Lowland rice weeds in Vietnam. D.V. Chin, Cuu Long Rice Research Institute (CLRRI), Vietnam
- Biological control of *Leptochloa chinensis* (L.) Nees. using fungus *Setosphaeria rostrata*. D.V. Chin, Cuu Long Rice Research Institute (CLRRI), Vietnam
- Rice resistance against insect pests and natural enemies determined by yield: Comparing the effectiveness of early protection - one day before sowing - and partial protection - the four leaves stage. L.M. Chau, Cuu Long Rice Research Institute (CLRRI), Vietnam
- Third year report on pest constraint surveys in Tan Phu Thanh Village. P.V. Du, Cuu Long

Rice Research Institute (CLRRI), Vietnam

- Effect of organic and bio-fertilizer applications on rice-soybean-rice cropping systems. T.T.N. Son. Cuu Long Rice Research Institute (CLRRI), Vietnam
- Performance test of fabricated simple small dryers. L.V. Banh, Cuu Long Rice Research Institute (CLRRI), Vietnam
- On-farm trials of seeding and fertilizer application methods on wet direct seeding rice (WS 2001 and DS 2001-02). H. Kobayashi, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan

Session 2: Fruit production

Chaired by Dr. Pham Van Kim, Cantho University, Vietnam

- Third year progress report on fruit tree production based on integrated pest management (IPM) in Tan Phu Thanh Village of the Mekong Delta, Vietnam. D. Minh, Cantho University, Vietnam
- Case study on the spread of greening disease (Huanglongbing) into new citrus orchards in Tan Phu Thanh Village (Chau Thanh District, Can Tho Province). D. Minh, Cantho University, Vietnam
- Useful histological methods for distinguishing citrus yellowing leaves infected with Huanglongbing from those caused by other factors. N.T.N. Truc, Southern Fruit Research Institute (SOFRI), Vietnam
- DIBA test for quick detection of virus on vegetable crops in Tan Phu Thanh Village. B.T.N. Lan. Southern Fruit Research Institute (SOFRI), Vietnam
- IPM on citrus with an emphasis on citrus psylla control in Tan Phu Thanh Village. H.T. Duc, Southern Fruit Research Institute (SOFRI), Vietnam
- Progress report on integrated pest management (IPM) systems for mango using green ants, *Oecophylla smara*, in Tan Phu Thanh, Can Tho Province, Mekong Delta. H.T. Duc, Southern Fruit Research Institute (SOFRI), Vietnam
- Preliminary observations of the natural infection of alternative citrus species hosts by Huanglongbin pathogens. N.T.N. Truc, Southern Fruit Research Institute (SOFRI), Vietnam
- Screening for the water logging and salinity tolerances of citrus species. V.H. Thoai, Southern Fruit Research Institute (SOFRI), Vietnam

Session 3: Livestock production

Chaired by Dr. Seishi Yamasaki and Ms. Akemi Kamakawa, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan

- Utilization of water spinach (*Eichhornia crassipes*) as a supplement in diets for fattening pigs. V.V. Son, Cantho University, Vietnam
- Replacement of protein concentrates with water hyacinth (*Eichroria Crassipes*) in the diets of growing pigs. L.H. Manh, Cantho University, Vietnam
- Evaluation of water hyacinth diets for fattening pigs in Tan Phu Thanh Village. L.T. Men, Cantho University, Vietnam
- Water hyacinth (Eichroria Crassipes): ensiling techniques, its nutritive value, and intake for pigs. N.X. Dung, Cantho University, Vietnam
- Effect of admixing synthetic antioxidants and sesame with rice bran on daily weight gain, feed intake and feed efficiency of swine in the Mekong Delta, Vietnam. S. Yamasaki, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan
- Pig management in Tan Phu Thanh Village and characterization of losses. A. Kamakawa, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan
- Sero-survey of viral porcine diseases in the Mekong Delta. A. Kamakawa, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan
- Genomic and serological characteristics of pathogenic *Escherichia coli* from growing pigs in the Cantho Province of Vietnam. L.T.L. Khai, Cantho University, Vietnam
- Prevalence of pathogenic *Escherichia coli* in an environment of swine breeding in Cantho Province of Vietnam. L.T.L. Khai, Cantho University, Vietnam
- Isolation and identification of piglets' diarrhea caused by enterotoxigenic *Escherichia coli* K88, K99, K987P and treatment using antibiotics in Cantho Province, Vietnam. L.T.L. Khai, Cantho University, Vietnam
- Efficiency of loperamide HCl in treating acute diarrhea in piglets. H.T.V. Thu, Cantho

University, Vietnam
- Study on tapeworms (class Cestode) in duck in the Chau Thanh and O Mon districts of Cantho Province. N.H. Hung, Cantho University, Vietnam

Session 4: Aquacultural production

Chaired by Dr. Duong Nhut Long, Cantho University, Vietnam

- Rearing of climbing perch (*Anabas testudineus*) in concrete tanks. N.A. Tuan, Cantho University, Vietnam
- Study on the effects of vitamin C sources and levels on the growth and survival rates of giant freshwater prawn (*Macrobrachium rosenbergii*) larvae. T.T.T. Hien, Cantho University, Vietnam
- Culture of freshwater prawns in rice fields and orchard canals in Tan Phu Thanh Village, Chau Thanh A District, Can Tho Province. P.T. Liem, Cantho University, Vietnam
- Study on the effects of feeding diets on the growth of climbing perch (*Anabas testudineus*) cultured in ponds. P.T. Liem, Cantho University, Vietnam

Session 5: Development of technology for environmental conservation

Chaired by Dr. Ngo Ngoc Hung, Cantho University, Vietnam

- Nitrogen flow estimation in Can Tho province in 2010. T. Watanabe, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan
- Improvement of soil fertility by rice straw manure. L.H. Man, Cuu Long Rice Research Institute (CLRRI), Vietnam
- Tentative report on nitrogen dynamics and phytoplankton in the irrigated water of paddy fields. T. Watanabe, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan
- Introduction of low-cost plastic biogas digesters in the integrated farming systems of small-scale farms. V. Lam, Cantho University, Vietnam
- Development of techniques to make swine compost suitable for small farms in the Mekong Delta. T.T. Phan, Cantho University, Vietnam

Session 6: Farming Systems

Chaired by Dr. Vo-Tong Xuan, Mekong Delta Farming Systems Research and Development Institute, Cantho University, Vietnam

- Application of the socio-economic characteristics of land evaluation using GIS techniques - a case study in Tan Phu Thanh Village, Chau Thanh district, Can Tho province. V.Q. Minh, Cantho University, Vietnam
- Multicriteria and multi-objective land use planning - a case study in Tan Phu Thanh Village, Chau Thanh District, Can Tho Province. V.Q. Minh, Cantho University, Vietnam
- Economic evaluation of bio-gas digesters in Tan Phu Thanh Village, Can Tho Province. R. Yamada, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan
- Economic evaluation of row seeding technologies in Omon District, Can Tho Province. R. Yamada, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan
- Economic effects of component technology development for use in integrated farming systems at the farm-household level. N.Q. Tuyen, Cantho University, Vietnam
- Preliminary diffusion of new technologies during the Japan International Research Center for Agricultural Sciences's project. L.C. Dung, Cantho University, Vietnam
- Impact of household resource management by adopting new technologies. L.C. Dung, Cantho University, Vietnam
- Specifying the difficulty of farmers joining in cooperative economic organizations in Can Tho. T.V. Binh, Cantho University, Vietnam
- Evaluating the operating efficiency of cooperative economic organizations in Can Tho Province. N. Hao, Cantho University, Vietnam
- Developing a model for an economic community organization in Can Tho Province. N.P. Son, Cantho University, Vietnam
- Sustainable farming systems research on acid sulfate soil: sustainable development. D.V. Ni, Cantho University, Vietnam
- A participatory research approach supporting small-scale household farming development in rainfed lowland in Baclieu. N.D. Can, Cantho University, Vietnam

Session 7: Discussion on the activities planned for the final year of the Project
Chaired by Dr. Vo-Tong Xuan, Cantho University, Vietnam, and Mr. Satoru Miyata, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan

STUDIES ON SUSTAINABLE PRODUCTION SYSTEMS OF AQUATIC ANIMALS IN BRACKISH MANGROVE AREAS.

On December 2-3, 2002, JIRCAS and Malaysia's Department of Fisheries held a joint workshop for the international comprehensive project entitled "Studies on sustainable production systems of aquatic animals in brackish mangrove areas" in Penang, Malaysia. The thirty-five workshop participants included officials of the Government of Malaysia, members of the Malaysian Fisheries Research Institute, long-term and short-term visiting JIRCAS researchers, counterparts of JIRCAS, members of the Fish World Center, and JIRCAS organizers. Following the workshops, a mid-term evaluation meeting was conducted, and it was announced that the project was being successfully and efficiently implemented. The participants of the meeting are continuing their efforts to achieve the planned results through the subsequent three-year period, ending in 2005.

Opening address by Dr. Takahiro Inoue, (former) President, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan and Mr. Hashim Ahmad, Director General, Department of Fisheries, Malaysia

-Topics-

- Migration, growth and feeding habits of John's snapper *Lutjanus johnii* and duskytail grouper *Epinephelus bleekeri* in the Merbok mangrove brackish river. Y. Ogawa, Japan International Research Center for Agricultural Science (JIRCAS), Japan
- Actual conditions of marine capture fisheries and aquaculture of snappers and groupers in Malaysia. S.H. Yahya, Fisheries Research Institute (FRI), Malaysia; and Y. Ogawa, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan
- Preliminary study of the stomach contents of snappers and groupers of Pulau Sembilan Coral Reefs. M.P. Abdullah and C.Z. Ismail, Fisheries Research Institute (FRI), Malaysia
- Mangrove zooplankton of Matang mangrove estuaries: Preliminary assessment of spatio-temporal abundance in relation to environmental parameters. C.V. Ching, O.A. Lin, C.L. Lee, University of Malaya, Malaysia; and Y. Ogawa, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan
- A study on the meiobenthic community in mangrove purification experimental tanks. C. Aryuthaka, Kasestsart University, Thailand; T. Shimoda, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan; and S. Pleumarum, Kasestsart University, Thailand
- Fisheries management, utilization of fishing ground and marine catches in Peninsular Malaysia. M.F. Haron, Fisheries Research Institute (FRI), Malaysia; and Y. Ogawa, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan
- Reproductive performance of the mangrove red snapper, *Lutjanus argentimaculatus*, fed broodstock diet. A.C. Emata, I.G. Borlongan and E.S. Garibay, Southeast Asia Fisheries Development Center, Aquaculture Department (SEAFDEC/AQD), Philippines; and H.Y. Ogata, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan
- Notable features of fatty acid composition in mangrove fish species. H.Y. Ogata, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan; A. Cabading Emata, E.S. Garibay, Southeast Asia Fisheries Development Center, Aquaculture Department (SEAFDEC/AQD), the Philippines; and H. Furuita, Fisheries Research Agency (FRA), Japan
- Development of control methods of factors suppressing sustainable production of aquaculture species: Isolation of a piscine nodavirus from hatchery-reared sea bass, *Lates calcarifer* in the Philippines. Y. Maeno, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan; and L.D. de la Pena and E.R. Cruz-Lacierda, Southeast Asia Fisheries Development Center, Aquaculture Department (SEAFDEC/AQD), the Philippines

- Development of control methods of factors suppressing sustainable production of aquaculture species: Experimental transmission of viral nervous necrosis induced by piscine nodavirus to orange-spotted grouper *Epinephelus coioides*. Y. Maeno, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan; and L.D. de la Pena and E.R. Cruz-Lacierda, Southeast Asia Fisheries Development Center, Aquaculture Department (SEAFDEC/AQD), the Philippines
- Phosphorus budget in mangrove woods and ecosystems added with artificial nutrients and wastewater from shrimp aquaculture ponds. T. Shimoda, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan; and C. Aryuthaka and C. Srithong, Kasetsart University, Thailand
- Trends in cultivation management after the decline of prawn production in brackish water aquaculture in the Philippines. T. Matsuura, Fisheries Research Agency (FRA), Japan
- Above ground dry matter gain and loss of a young mangrove forest in the stand development process - an example in Southern Thailand. R. Tabuchi, Forestry and Forest Products Research Institute (FFPRI), Japan; and S. Bunyavejchewin, Royal Forest Department (RFD), Thailand

Presentation session at the workshop for the brackish water project.

MEKONG REGION RAINFED AGRICULTURE PROJECT 2002 PARTICIPATORY METHODS WORKSHOPS

The Rainfed Agriculture Project, in collaboration with the International Center for Tropical Agriculture (CIAT) and the Participatory Research and Gender Analysis (PRGA) Working Group on Natural Resource Management, held two workshops on participatory methods during 2002. The first workshop titled, "Improving Adoption of Agricultural Technologies – How Participatory Research can Complement Conventional Research Approaches," was held from March 4-8, at Tsukuba, Japan, and attended by JIRCAS project members. The second workshop titled, "Mini-Workshop on Participatory Research (PR) Methods," was held from October 28-29, at Khon Kaen, Thailand, and was attended by Thai project members, with support from the International Training Center for Agricultural Development (ITCAD) and Khon Kaen University.

WORKSHOP ON "IMPROVING ADOPTION OF AGRICULTURAL TECHNOLOGIES – HOW PARTICIPATORY RESEARCH CAN COMPLEMENT CONVENTIONAL RESEARCH APPROACHES"

This workshop was the first of two workshops conducted under the Rainfed Agriculture Project in collaboration with International Center for Tropical Agriculture (CIAT) and the Participatory Research and Gender Analysis (PRGA) Working Group on Natural Resource Management. It was designed to give participants practical experience with approaches, skills and tools for better targeting of research toward the development of agricultural technologies with greater farmer acceptability. Thirteen participants used a range of techniques, including idea generation, card voting, focus groups, ranking and weighting, preference analysis, and scoring. Case studies were presented where participatory approaches have led to successful improvements by farmers. The goal of participatory research is to develop a wider range of options for unpredictable, risky outcomes, rather than to seek one solution that all farmers are expected to adopt. This involves a process of farmer needs assessment, identification of entry-point technologies to provide quick initial results for a key problem, and negotiation among researchers and farmers for research on longer-term, more difficult problems. Participants were divided into two groups, each of which developed a research plan: 1) erosion, focused on problems identified from farmer needs assessment in 2001; and 2) dry season lowland water management, for priorities to be identified in 2003.

AFRICAN AGRICULTURE SEMINAR IN 2002

JIRCAS has undertaken preparations for a new project coming in April 2003 at Niamey, Niger in collaboration with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). The five-year project focuses on soil fertility preservation through organic matter management, and trough introduction of legumes to diversify and enrich agricultural systems.

In this context, a series of seminars was organized in this fiscal year in order to widen understanding and exchange views on the semi-arid zones of Africa.

In total, six seminars were carried out from March 2002 to March 2003. Seminar speakers were invited from universities, national research institutes and NGOs, including Kyoto University, the National Institute for Agro-Environmental Sciences, Hokkaido University, Tokyo University of Agriculture, Earth and Human Co. Ltd., and the National Agricultural Research Center. The number of the speakers totaled 16, and seminar titles were as follows:

- On the concept of soil fertility in tropical Africa and proposed research directions for improvement.
- Environmental problems of agriculture and rural societies in semi-arid Africa.
- Problems in soil preservation in arid and semi-arid Africa.
- Utilization of plant genetic resources in semi-arid regions.
- Soil and environmental problems in semi-arid tropical Africa, and related activities at the Sahelien Center of ICRISAT
- Development of agricultural technologies and their extension in Africa.

During the seminars, issues such as the efficacy and utilization of organic matter and chemical fertilizers in the region, the relationship between livestock systems and crop cultivation, and the diversity and utilization of indigenous plant genetic resources were discussed.

This seminar series on African agriculture will be continued in 2003 with wider perspectives, focusing not only on semi-arid zones, but also on agricultural problems and research needs in tropical Africa, with particular emphasis on rice production.

JIRCAS SEMINAR ON "A NEW STRATEGY FOR INTERNATIONAL COLLABORATIVE RESEARCH TOWARD THE COEXISTENCE OF VARIOUS AGRICULTURAL SYSTEMS"

On January 26-27, 2003, JIRCAS hosted a seminar on new international collaborative research strategies being employed to achieve sustainable development and the coexistence of various types of agriculture, forestry and fisheries in cooperation with the Institute of Development Economics (Japan External Trade Organization), International Cooperation Center for Agricultural Education (Nagoya University), Graduate School of Asian and African Area Studies (Kyoto University), and the Graduate School for International Development and Cooperation (Hiroshima University). The seminar was conducted to review international collaborative research activities carried out by various Japanese institutions including public institutions, universities and NGO/NPOs, and to establish a common consensus and working platform in order to improve their efficiency. More than 100 participants, including current students, scholars, researchers, and government officials attended the seminar, discussing and formulating potential strategies for international cooperation between institutions and universities that have faced rapid and extensive organizational changes. Particular attention was given to regional strategies focusing on collaborative research and development in Africa, South Asia and East Asia, which possess dense populations suffering from hunger and malnourishment. In order to build upon and further promote achievement of the seminar's goals, JIRCAS has initiated a follow-up international meeting scheduled to take place in the fall of 2003.

Inaugural Address by Dr. Takahiro Inoue, (former) President, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan

Keynote Address

Chaired by Mr. Osamu Koyama, Director of the Development Research Division, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan

- Issues and perspectives of Japan's international cooperation for development. Prof. Hiroyuhi Kohama, Shizuoka Prefectural University, Japan

Session 1: Perspectives on area and development studies and their implications for technology development

Chaired by Dr. John S. Caldwell, Dr. Kensuke Okada, and Mr. Satoru Miyata, Japan International Research Center for Agricultural Sciences (JIRCAS)

- Reconstructing African economics. K. Hirano, Institute of Development Economics, Japan External Trade Organization (JETRO), Japan
- Characteristics of African agriculture and issues for its sustainable development. S. Araki, Graduate School of Asian and African Area Studies, Kyoto University, Japan
- Issues on agricultural research and development in Africa. J. Sakagami, Japan International Center for Agricultural Sciences (JIRCAS), Japan
- Economic reform and labor markets in India. S. Uchikawa, Institute of Development Economics, Japan External Trade Organization (JETRO), Japan
- Issues on agricultural research and development in South Asia. S. Mukai, Japan Green Resource Cooperation, Japan
- Linkages in food and agricultural commodities in East Asia. H. Shuto, Tsukuba University, Japan
- Issues for the sustainable development of agriculture in East and Southeast Asia. K. Tanaka, Center for Southeast Asia Studies, Kyoto University, Japan

Session 2: Present status of international collaborative research and potential changes

Chaired by Dr. Shuichi Asanuma, Head of the Research Planning Section, Research Planning and Coordination Division, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan

- Approaches used by university agricultural faculties. T. Matsumoto, International Cooperation Center for Agricultural Education, Nagoya University, Japan

- Approaches used by graduate schools to foster international development and cooperation. T. Nakao, Graduate School for International Development and Cooperation, Hiroshima University, Japan
- Approaches used by government-linked institutions. S. Miyata, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan

Session 3: Synthesis and new proposals

Chaired by Dr. Akinori Noguchi, Director of the Research Planning and Coordination Division, Japan International Research Center for Agricultural Sciences (JIRCAS), Japan

JOINT WORKSHOP ON COPING AGAINST THE EL NIÑO FOR STABILIZING RAINFED AGRICULTURE: LESSONS FROM ASIA AND THE PACIFIC

A workshop "Coping against the El Niño for stabilizing rainfed agriculture: Lessons from Asia and the Pacific" was organized by the UN-ESCAP/CGPRT Centre (Regional Coordination Centre for Research and Development of Coarse Grains, Pulses, Roots and Tuber Crops in the Humid Tropics of Asia and the Pacific, United Nations Economic and Social Commission for Asia and the Pacific) in coordination with JIRCAS, the Philippine Department of Agriculture, the Australian Center for International Agricultural Research (ACIAR), and the International Water Management Institute (IWMI) and took place in Cebu, the Philippines from September 17-19, 2002.

The main purpose of this workshop was to exchange and disseminate the results of the research project entitled "Stabilization of upland agriculture and rural development in the El Niño vulnerable countries," which was conducted by the ESCAP/CGPRT Centre and funded by the Government of Japan. Over 60 participants from seven countries and three international organizations attended the workshop.

During the opening session, an inaugural address was delivered by Dr. Takahiro Inoue, (former) President of JIRCAS, through which he conveyed the significance of the El Niño study and the importance of technological development for sustaining crop production under unfavorable climate conditions.

On the first day of the workshop, four prominent scientists delivered keynote presentations related to climate change and the use of disaster mitigation systems. Dr. Felino P. Lansigan from IWMI introduced a method of systems analysis for evaluating the impact of climate variability and initiatives in coping with climate variability. Dr. Jeff F. Clewett from the Department of Primary Industries, Australia, presented a case study based on the development and application of "Australian rainman," a computer package that helps farmers develop skills for managing climate variability by analyzing the effects of the El Niño on rainfall. Dr. Masaharu Yajima, from the National Agricultural Research Center in the Tohoku Region of Japan, introduced the "Climatic early warning system," created to address damage caused by cold summer conditions. And lastly, Mr. Shigeki Yokoyama of the CGPRT Centre presented ENSO impacts on food crop production and the role of CGPRT crops in Asia and the Pacific.

On the second day, officials from Indonesia, Malaysia, Papua New Guinea, the Philippines, and Thailand presented country reports detailing the impact of the El Niño and the methods used to mitigate its adverse effects, while specialists from each country delivered supplementary comments. Through the subsequent discussions, the participants reached a consensus that a socioeconomic approach, in addition to agronomical and plant physiological approaches, was necessary in order to accurately describe the vulnerability of the Asian and Pacific regions to El Niño-induced weather changes. At the culmination of the workshop, it was concluded that the findings of the project should be published in order to disseminate needed technical information to farmers, and that further estimation of the value of mitigation measures would be useful to policy makers.

3) INTERNATIONAL RESEARCH WORKSHOPS

Attended jointly by JIRCAS researchers and foreign invitees, these workshops aim to facilitate discussion regarding the numerous collaborative research projects that JIRCAS is currently undertaking with counterpart institutions throughout the world.

May 28, 2002	Workshop on "Development of high biomass forage crops tolerant to water stress by interspecific, intergeneric crossing." Tsukuba, Japan *Attended by representatives of JIRCAS, Japan; Khon Kaen Field Crop Research Center (KKFCRC), Thailand*
June 3, 2002	Workshop on "Strengthening collaboration between JIRCAS and the LDD." Tsukuba, Japan *Attended by representatives of JIRCAS, Japan; Land Development Department (LDD), Thailand*
August 5, 2002	Annual planning meeting "Increasing economic options in rainfed agriculture in Indochina through efficient use of water resources." Khon Kaen, Thailand *Attended by representatives of JIRCAS, Japan; Department of Agriculture (DOA), Land Development Department (LDD), Department of Livestock Development (DLD), and Khon Kaen University, Thailand*
September 18-19 2002	Symposium on "White spot virus of shrimp." Penang, Malaysia *Attended by representatives of JIRCAS and Fisheries Research Agency, Japan; Department of Fisheries, Fisheries Research Institute, National Fish Health Research Center, and National Prawn Fry Production and Research Center, Malaysia*
November 26-28 2002	Annual workshop on "Development of new technologies and their practice for sustainable farming systems in the Mekong Delta." Cantho, Vietnam *Attended by representatives of JIRCAS, Japan; Cuu Long Delta Rice Research Institute, Southern Fruit Research Institute, and Cantho University, Vietnam*
December 2-3 2002	Workshop on "Sustainable production systems of aquatic animals in brackish mangrove areas." Penang, Malaysia *Attended by representatives of JIRCAS, Forestry and Forest Products Research Institute, and Fisheries Research Agency, Japan; Department of Fisheries, Fisheries Research Institute, and Institute of Biological Sciences, University of Malaya; Department of Marine Science, Kasetsart University, Thailand; Aquaculture Department, Southeast Asian Fisheries Development Center, the Philippines; and World Fish Center (formerly ICLARM).*
January 9-10, 2003	Workshop on "Development of early prediction systems for stable crop production in China." Tsukuba, Japan *Attended by representatives of JIRCAS, National Agricultural Research Organization, National Institute for Agro-Environmental Sciences, International Research Division of the Agriculture, Forestry and Fisheries Research Council (AFFRC), the Ministry of Agriculture, Forestry and Fisheries (MAFF), Japan; Department of International Cooperation of Ministry of Agriculture, Institute of Natural Resources and Regional Planning of Chinese Academy of Agricultural Sciences, Crop Cultivation Institute of the Heilongjiang Academy of Agricultural Sciences, People's Republic of China*
February 10, 2003	Annual outcome discussion meeting on the project "Increasing economic options in rainfed agriculture in Indochina through efficient use of water resources." Khon Kaen, Thailand

Attended by representatives of JIRCAS, Japan; Department of Agriculture (DOA), Land Development Department (LDD), Department of Livestock Development (DLD), and Khon Kaen University, Thailand

February 12, 2003 — JIRCAS-CIAT-NAFRI seminar on "New collaboration on spatial analysis for water resource assessment in Laos." Khon Kaen, Thailand
Attended by representatives of JIRCAS, Japan; Centro Internacional de Agricultura Tropical (CIAT); National Agriculture and Forestry Research Institute (NAFRI), Thailand

February 24, 2003 — Seminar on "Identification of soil structure and water movement." Khon Kaen, Thailand
Attended by representatives of JIRCAS, Japan; Land Development Department (LDD) and Khon Kaen University, Thailand

March 11-12, 2003 — Sixth planning workshop on "Evaluation and development of methods for sustainable agriculture and environmental conservation." Nanjing, China.
Attended by representatives of JIRCAS, Japan; Institute of Soil and Fertilizer, Chinese Academy of Agricultural Sciences and Institute of Soil Sciences, Chinese Academy of Sciences, People's Republic of China

March 18-19, 2003 — Workshop on "Results and prospects of comprehensive studies on the development of sustainable agro-pastoral systems in the subtropical zone of Brazil." Tsukuba, Japan.
Attended by representatives of JIRCAS, National Agricultural Research Center for Tohoku Region, National Institute of Livestock and Grassland Science, and National Institute for Agro-Environmental Sciences, Japan; Headquarters of Brazilian Agricultural Research Corporation (EMBRAPA) and National Center for Beef Cattle Research (CNPGC), EMBRAPA, Brazil

March 19, 2003 — Workshop on "Production, distribution and international competition of Chinese rice." Beijing, China.
Attended by representatives of JIRCAS, Japan; Institute of Agricultural Economics, Chinese Academy of Agricultural Sciences, People's Republic of China

March 21, 2003 — The second workshop on "Strategic restructuring and sustainable development of Chinese agriculture." Beijing, China.
Attended by representatives of JIRCAS, Japan; Research Center for Rural Economy, Ministry of Agriculture and Institute of Natural Resources and Regional Planning, Chinese Academy of Agricultural Sciences, People's Republic of China

4) INTERNATIONAL RESEARCH SEMINARS

International research seminars are held throughout the year, either on JIRCAS premises or overseas. During these seminars, foreign guests give presentations on topics of importance related to international agricultural research. The following ten seminars were held in FY 2002.

April 25, 2002	Japan and CIAT: New direction for a mature relationship. *J. Voss*
June 17, 2002	Agricultural development in Africa and the CGIAR system. *P. Hartmann*
July 17, 2002	Current situation and activity of IFPRI. *M. Cohen*
July 17, 2002	Bolivian agriculture and the Bolivia CIAT's initiative in research and development. *J.L. Llanos*
July 31, 2002	Issues and challenges facing the development of technologies for the sustainable production of rice. *D.V. Tran*
August 30, 2002	Soil degradation in Ghanaian agriculture. *R.D. Asiamah*
October 22, 2002	Current status and prospects on rice research in China. *C. Shihua*
December 2, 2002	What is FARA? *M. Jones*
January 22, 2003	Impacts of China's accession to the WTO. *Q. Keming*
March 12, 2003	ICARDA's research in water and agriculture in CWANA. *A.S. El-Beltagy*

5) JIRCAS RETURN SEMINARS

At JIRCAS, researchers returning from overseas dispatches or research projects give an oral presentation accompanied by a written summary of activities that is distributed to JIRCAS staff. These sessions are termed "JIRCAS Return Seminars" and are held during the interim or upon the completion of research projects or dispatch assignments. Such seminars are ordinarily held twice per month, and each year approximately 30 scientists give presentations.

PUBLISHING AT JIRCAS

OFFICIAL JIRCAS PUBLICATIONS

In English

1) JARQ (Japan Agricultural Research Quarterly)	Vol. 36-No. 2, No. 3, No.4 Vol. 37-No. 1
2) Annual Report	No. 8 (2001)
3) JIRCAS Newsletter	No. 31, No. 32, No. 33, No. 34
4) JIRCAS International Symposium Series	No. 10 Water for Sustainable Agriculture in Developing Regions - More Crop for Every Scarce Drop -
	No. 11 Value-Addition to Agricultural Products -Towards the Increase of Farmers' Income and Vitalization of the Rural Economy -
5) JIRCAS Working Report Series	No. 24 Soybean Production and Postharvest Technology Innovation in Indonesia
	No. 25 Economic Analyses of Agricultural Technologies and Rural Institutions in West Africa
	No. 26 Development of New Technologies and their Practice for Sustainable Farming Systems in the Mekong Delta
	No. 29 Potential and Constraints of Banana-based Farming Systems: a Case of an Upland Village in West Java.
	No. 30 Development of Sustainable Agricultural Systems in Northeast Thailand through Local Resource Utilization and Technology Improvement

In Japanese

1) JIRCAS News	No. 30-31, No. 32, No. 33, No. 34
2) JIRCAS Working Report Series	No. 27 Development of a Supply-Demand and Trade Equilibrium Model for Forest Products
	No. 31 Analysis of Food Supply and Demand and the Structural Change of Agriculture in China
3) JIRCAS International Agriculture Series	No. 12 Emergence of a New Type of Rice Farmer in Malaysia
4) JIRCAS Research Highlights	No. 9

LIBRARY ACQUISITIONS

April 1, 2002 - March 31, 2003

	Books			Periodicals (titles)			Materials (Proceedings, maps and other)		
Language	Purchase	Gift	Total	Purchase	Gift	Total	Purchase	Gift	Total
Japanese	136 (38)	0 (0)	136 (38)	42 (18)	374 (49)	416 (67)	17	253	270
Foreign	43 (16)	5 (0)	48 (16)	95 (16)	322 (13)	417 (29)	11	206	217
Total	179 (54)	5 (0)	184 (54)	137 (34)	696 (62)	833 (96)	28	459	487

( ) Indicates separate holdings of the Okinawa Subtropical Station

JIRCAS PUBLICATIONS AND CONTENTS

JIRCAS Working Report No. 24

Soybean Production and Post Harvest Technology - For Innovation in Indonesia -

Keynote Lecture

Modern Processing and Utilization of Legumes - Recent Research and Industrial Achievements for Soybean Foods in Japan
A. Noguchi

Production and postharvest technology for soybean

Soybean production and post harvest technology in Indonesia
T. Adisarwanto
Soybean foods in Indonesia.
J. S. Utomo and S. Nikkuni
Uniformity improvement of soybean seeds in Indonesia
T. Sanbuichi, N. Sekiya, Jamaluddin, Susanto, D. M. Arsyad, and M. Adie

JIRCAS-RILET collaborative research works on soybean

The establishment of integrated pest management on soybean using insect resistant genotypes: A challenge for plant breeder and entomologist
Suharsono, M. Adie, Tridjaka, and K. Igita
Evaluation of Indonesian soybean varieties for the processing and improvement of fermented foods
Part I. Evaluation of Indonesian soybean varieties for food processing
S. S. Antarlina, J. S. Utomo, E. Ginting, and S. Nikkuni
Improvement of Kecap Koji making process using a white-spored mutant induced from Koji mold
S. Nikkuni, T. Goto, S. S. Antarlina, E. Ginting, and J. S. Utomo

AARD/JIRCAS research collaboration in Indonesia

AARD/JIRCAS research collaboration in Indonesia - past, present and future
S. Asanuma

Appendixes: RILET (MARIF) – JIRCAS collaborative research works

Studies on the relationship between incidence of plant parasitic nematodes and cropping systems in lowland and upland fields in Indonesia.
K. Nakasono, Y. Baliadi, Chaerani, and N. Minagawa
Low input-cultivation method for soybean in Indonesian cropping systems
K. Igita, M. Adie, Suharsono, and Tridjaka

JIRCAS Working Report No. 25

Economic Analyses of Agricultural Technologies and Rural Institutions in West Africa

Part 1: The roles of economic analyses in the field of agricultural research in West Africa

Economic research on rice farming in West Africa at WARDA
Frederic Lancon, Olaf Erenstein, and Ali Toure
Impact of modern varieties on rice biodiversity

Aliou Diagne, Kouame Kouadio Arsene, Abi Monnet Innocent and Robert Guei
Economic research at IITA for the improvement of agriculture in the sub-humid and humid zones of West Africa
Victor M. Manyong
Improving rice production in mixed rainfed/irrigated production systems in the semi-arid tropics of sub-Saharan Africa: Bio-economic modeling and livelihood strategies, and technology evaluation
Barry I. Shapiro
Socio-economic research in sub-Saharan Africa: JIRCAS's experience and challenge
Takeshi Sakurai

Part 2: Economic Analyses: Methodology and applications
Micro-household surveys and development microeconomics: With special emphasis on child health and intrahousehold resource allocation in sub-Saharan Africa and South Asia
Takashi Kurosaki and Mika Ueyama
Land tenure systems and adoption of water control technologies in lowland rice production
Takeshi Sakurai
Lowland rice cultivation in Ghana: A field survey around an inland market, Kumasi
Towa Tachibana, Makoto Shinagawa, and Takeshi Sakurai

JIRCAS Working Report No. 26
Development of New Technologies and Their Practice for Sustainable Farming Systems in the Mekong Delta
Part 1: Development of component technologies of farming systems
1. Rice production
Optimum application rates of nitrogen fertilizer for high-yielding rice cultivars based on growth diagnosis in the Mekong Delta
Tran Thi Ngoc Huan, Hiroyuki Hiraoka, Hiromi Kobayashi, and Pham Sy Tan
Optimum method and rate of seeding rice under various cultural practices in the Mekong Delta
Trinh Quang Khuong, Hiroyuki Hiraoka, Hiromi Kobayashi, and Pham Sy Tan

2. Livestock production
Replacement of concentrate protein by water spinach (*Ipomoea aquatica*): Effects on digestibility, feed intake and live weight gain in pig production
Luu Huu Manh, Nguyen Nhut Xuan Dung, Le Thi Men, Ryozo Takada, and Seishi Yamasaki
A survey of Salmonella pollution in farms and water systems in the Mekong Delta
Tran Thi Phan, Ly Thi Lien Khai, Hideki Hayashidani, Masato Akiba, Takeshi Watanabe,
Toshiaki Taniguchi, and Chau Ba Loc

3. Fruit production
Citrus huanglongbin disease at Tan Phu Thanh Village in the Mekong Delta
Nguyen Thi Ngoc Truc and Le Thi Thu Hong
A suggested citrus nursery certification program in the Mekong Delta
Nguyen Minh Chau and Le Thi Thu Hong

4. Aquaculture
Development of freshwater prawn (*Macrobrachium rosenbergii*) seed production and culture technology in the Mekong Delta of Vietnam: A review of the JIRCAS project at Cantho University
Nguyen Thanh Phuong, Nguyen Anh Tuan, Tra Thi Thanh Hien, Tran Ngoc Hai, Marcy Wilder, Hiroshi Y. Ogata, Motohiko Sano, and Yukio Maeno

Part 2: Development and evaluation of sustainable farming systems
1. Development of technology for environmental conservation
Nitrogen flow in Can Tho Province of the Mekong Delta
Takeshi Watanabe and Toshiyuki Nagumo
Nitrogen and phosphorus balance in fishponds under pig-fish system in the Mekong Delta
Takeshi Watanabe, Duong Nhut Long, Lam My Lan, Duong Thi Hoang Oanh, Nguyen Van Lanh, and Le Thi Ngoc Thanh
A case study: Introduction of low-cost biogas digester to small-scale farming systems
Vo Lam, Takeshi Watanabe, Tran Thi Phan and Ly Thi Lien Khai

2. Development of VACR farming systems
   Classification of alluvial soil area for land use planning of the Mekong Delta
   Vo Quang Minh, Le Quang Tri, and Ryuichi Yamada
   Analysis of relationships among problems in farming systems of the Mekong Delta
   - Application of Dematel-Method -
   Ryuichi Yamada, Nguyen Quang Tuyen, Le Canh Dung and Toshiyuki Monma
   Farming systems research on acid sulfate soil area of the Mekong Delta
   Duong Van Ni, Ryuichi Yamada, Ngo Thanh Binh, and Huynh Van Nghiem

3. Model establishment of VACR farming systems and extension
   Farmers' perception on on-farm trial technologies in the Mekong Delta
   Ryuichi Yamada, Vo Van Tuan, and Vo Van Ha
   The agricultural extension system and farmer's concerns in the Mekong Delta
   Le Canh Dung, Ryuichi Yamada, Nguyen Quang Tuyen, Nguyen Thanh Hung
   Characterization of fruit markets in the Mekong Delta
   Nguyen Phu Son, Ryuichi Yamada, Nguyen Van Thach, and Nguyen Thi Cam Chi

JIRCAS Working Report No. 27
Development of a Supply-Demand and Trade Equilibrium Model for Forest Products (In Japanese)

CHAPTER 1
Development of World Forest Products Model (WFPM)
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RESEARCH STAFF ACTIVITY 2002-2003

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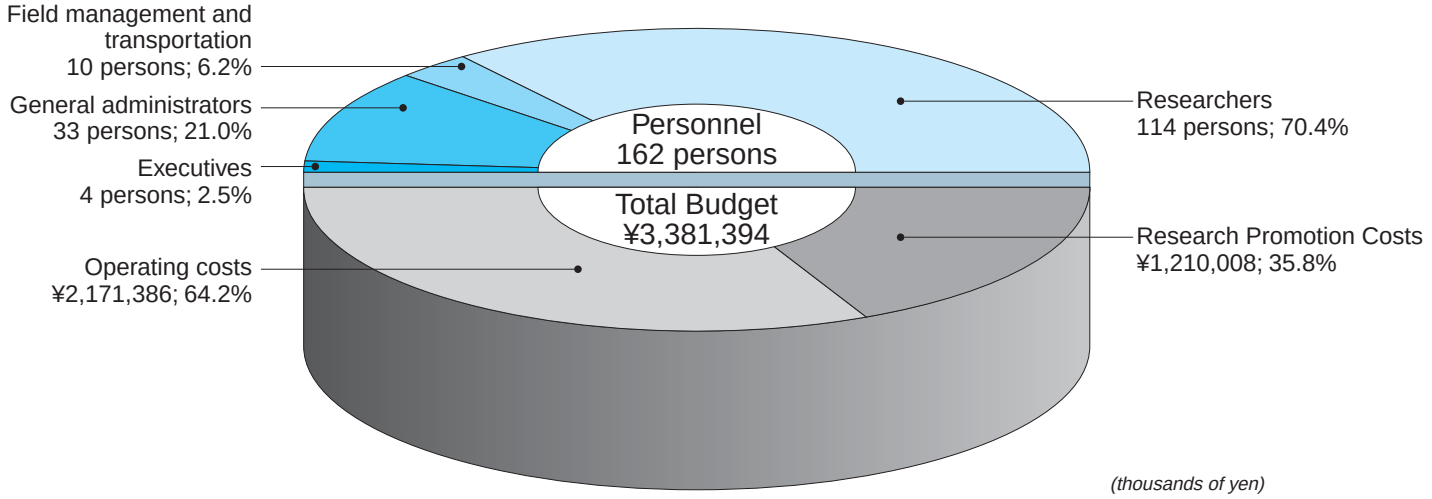
FINANCIAL OVERVIEW

Fiscal Year 2002

	thousands of yen
TOTAL BUDGET	**3,381,394**
OPERATING COSTS	**2,171,386**
Personnel (162)	1,712,752
President (1), Vice-President (1), Executive Advisor & Auditor (2)	
General administrators (34)	
Field management and transportation (10)	
Researchers (114)	
* Number of persons shown in ( )	
Administrative Costs	458,634
RESEARCH PROMOTION COSTS	**1,210,008**
Research Development	289,436
Overseas Dispatches	287,769
Research Exchange/Invitation	12,037
Research Information Collection	104,532
International Collaborative Projects	339,967
Fellowship Programs	176,267

Budget FY 2002 (Graph)



TENETS OF THE JIRCAS MID-TERM PLAN (APRIL 2001–MARCH 2006)

On April 1, 2001, the Japan International Research Center for Agricultural Sciences (JIRCAS) was inaugurated as an Incorporated Administrative Agency (IAA) and commenced implementation of research programs and administrative operations according to a five-year Mid-Term Plan approved by the Ministry of Agriculture, Forestry and Fisheries (MAFF). The tenets of this Mid-Term Plan, divided into research and administrative operations, are detailed in the following outline.

RESEARCH

I. Enhancement of the quality of experiments, research and investigations

A. Analysis of the orientation of agriculture, forestry and fisheries activities in developing regions, examination of research status in Japan and overseas, and elucidation of trends in technology development

1) Analysis of trends in world food supply and demand, and development of mid-term strategies to promote international collaborative research

1. Analysis of research orientation in major developing countries
   An information network necessary for the accumulation of research information will be developed; the background, future objectives, and orientation of research themes pursued by developing countries and relevant international research organizations will be examined and mid-term research strategies will be proposed.
2. Improvement of models for world food supply and demand through analysis of trends, particularly in China
   In order to define medium- and long-term trends in world food supply and demand, JIRCAS's world food supply model will be modified based on analyses of relevant policies and economic conditions, particularly in China.

2) Analysis of regional characteristics and orientation of development relating to food production and environmental conditions in developing regions

1. Analysis of major constraints on agriculture, forestry and fisheries development as well as trends in technological and economic development in Indonesia, Vietnam, West Africa, and other regions. The characteristics of each region will be analyzed in terms of background, social customs, and differences in technological levels in order to implement research collaboration in an effective manner.
2. Analysis of trends in the development of sustainable farming systems in Indonesia, Vietnam, Thailand, South America, and other regions. Examination of the status of farming systems in these developing regions and analysis of constraints on their effective adoption will be conducted.

B. Research and development for sustainable agriculture, forestry and fisheries in developing regions

1) Improvement and development of sustainable and environment-friendly production technology

1. Improvement of technology for soil amelioration and nutrient cycling evaluation in diversified ecosystems
   Nutrient cycling will be studied in target areas and techniques will be developed for the management of cultivated ecosystems and soil.
2. Development of low-input production technology for rice and upland crops in Thailand, Vietnam, and other countries
   More efficient methods of soil management and cultivation, as well as technology to improve water management and achieve higher yields and quality, will be developed.
3. Analysis of the prevalence of major diseases and insect pests in rice and soybean in Southeast Asia, South America, and other developing regions
   The incidence of major disease pathogens and insect pests will be determined in order to develop suitable countermeasures.
4. Analysis of characteristics of under-utilized local forage resources, such as gramineous pasture grasses, maize stems and leaves under agro-pastoral systems
   The physiological and ecological characteristics and nutritive value of forage resources will be determined and potential utilization methods will be examined.
5. Analysis of physiological characteristics of cattle, pigs and other livestock, as well as the prevalence of major livestock diseases in Thailand, Vietnam, and other countries

Physiological characteristics such as nutrient metabolism will be analyzed and the prevalence of diseases such as trypanosomosis will be evaluated.

6. Development of technology for supplementary natural regeneration of valuable tree species in tropical forests having tree species of low quality
   Silvicultural and logging technology for the sustainable management of forests in Southeast Asia will be developed, and the restoration of forests in degraded grassland areas through the utilization of useful low-quality trees will be promoted.
7. Development of environment-friendly aquaculture technology
   Analyses of maturation and spawning stages, feeding behavior, selection and culture of biological feeds, and identification and utilization of various artificial feeds for major aquaculture species will be conducted. Aquaculture technology characterized by low feed and drug inputs will be developed.

2) Improvement and development of technology for quality evaluation, distribution, and processing of agriculture, forestry and fisheries commodities in developing regions
   1. Analysis of quality parameters for food resources in Southeast Asia
      Methods of evaluation utilizing low-cost instrumentation and materials will be developed for determining basic characteristics of food resources prior to harvest, and during postharvest processing and distribution. Factors affecting quality changes will be identified.
   2. Development of methods for the prevention of quality deterioration and methods for the improvement of processing technology
      Technology for low-input drying and storage of food commodities will be developed in order to reduce postharvest losses. Local processing technology will be improved in order to develop more value-added products.
   3. Development of technology for the use of under-utilized wood resources
      Technology for the processing of wood materials into wood products will be developed through analyses of the characteristics of materials such as oil palm residue.
   4. Development of technology for the use of under-utilized aquatic resources and the production of surimi (fish paste) in China
      Technology for environment-friendly utilization of aquatic products will be developed while considering the state of food production, distribution and consumption in China.

3) Development of technology for the analysis and utilization of genetic resources and biological functions in developing regions
   1. Development of technology for the analysis and transformation of mechanisms of resistance to environmental stresses
      Resistance mechanisms in model plant species will be analyzed at the molecular level in order to develop genetically-modified crops having resistance to drought, salinity and other stresses.
   2. Development of breeding materials and technology to evaluate the resistance of rice and wheat to disease and insect pests
      The characteristics of crops such as rice, wheat and soybean related to diseases and insect pest resistance will be elucidated for the purposes of developing useful breeding materials.
   3. Collection, evaluation and preservation of genetic resources of vegetables and fruit trees in tropical and subtropical regions
      JIRCAS will serve as a sub-bank to the central gene bank of the National Institute of Agrobiological Sciences (NIAS), a fellow MAFF-affiliated IAA.

4) Evaluation of environmental resources and bio-diversity
   1. Evaluation of characteristics of environmental resources related to agricultural production and analysis of the mechanisms of changes in land use
      Technology for the analysis and effective utilization of environmental resources will be developed, and the relationship between changes in land use and these resources will be elucidated.
   2. Analysis of necessary conditions for introducing agroforestry technology in Malaysia and other developing countries
      The establishment of productive and environment-friendly agroforestry systems will be promoted, with emphasis on bio-diversity and sustainability of tropical forest regeneration.
   3. Analysis of changes in major aquatic resources in coastal and brackish water mangrove ecosystems in Southeast Asia
      The changes in major fish and aquatic resources associated with the development of coastal areas, including environmentally valuable brackish water mangrove areas, will be analyzed.

5) Research activities in Okinawa

1. Evaluation and utilization of heat and salinity resistance in snap beans and rice
   Through the evaluation of characteristics related to high-temperature stress tolerance in vegetable species such as the snap bean, useful breeding materials will be collected and studied.
2. Development of technology for the evaluation and utilization of useful traits in sugarcane and root crops
   Characteristics related to useful traits of vegetatively propagated crops from tropical and subtropical regions will be evaluated, and breeding materials having outstanding characteristics will be developed through genetic engineering.
3. Development of basic technology for the evaluation and mass propagation of tropical fruit trees
   The production of substances required for regulation of tree form, fruit set and flowering will be studied. Basic technology will be developed for quality evaluation and for mass propagation.
4. Analysis of ecological characteristics and the incidence of major insect pests and diseases in tropical and subtropical areas
   The eco-physiological characteristics of major diseases, insect pests and natural enemies occurring in tropical and subtropical crops will be elucidated.
5. Analysis of factors leading to the instability of crop production on tropical and subtropical islands, and the development of technology for crop cultivation using low water and fertilizer inputs
   The effect of environmental factors such as weather and soils on crops and their subsequent response will be elucidated.
6. Development of methods for controlling variations in heading traits through generation advancement of rice and other crops
   Technology will be developed for effectively fixing variations in heading traits through generation advancement.

II. Contribution to society through research activities

A. Analyses and consultations
Upon the requests of administrative authorities, corporations, and universities, JIRCAS will conduct various analyses and experiments, extending its expertise to other organizations.

B. Training courses and programs

1) JIRCAS will organize training courses and lectures for administrative authorities and various research organizations and offer its collaboration in programs sponsored by the government or the private sector.
2) JIRCAS will make significant efforts to receive trainees from other IAAs, universities, national public organizations, and the private sector in order to further develop human resources, upgrade existing technology, and promote information and technology transfer. JIRCAS will also conduct invitation programs for overseas counterpart scientists.
3) JIRCAS will be entrusted by the Japanese government to develop and provide human resources for activities related to research in the fields of international agriculture, forestry and fisheries.
4) JIRCAS will establish consultations with various organizations in order to conduct information exchange on technical problems.

C. Collaboration with administrative authorities, international organizations, academic societies, and other organizations
JIRCAS will dispatch delegates to participate in committee meetings and conferences sponsored by administrative authorities, international organizations and academic societies. Upon request from administrative authorities, JIRCAS will also supply relevant technological information both in Japan and overseas.

III. Publication and dissemination of research results

A. Promotion and utilization of research results
Manuals and databases will be prepared for use by administrative authorities, research organizations and primary producers in developing regions. Efforts will also be made to promote the dissemination and application of research results through the MAFF research network and through international collaborative efforts.

B. Publication and dissemination of research results
1) JIRCAS researchers will be encouraged to present research results at meetings organized by academic societies and at symposia held in Japan and overseas. During the period covered in the Mid-Term Plan, a goal has been established to publish over 540 reports in scientific journals and organizational bulletins.
2) Research results will be made available on the Internet and published at expositions and other appropriate venues. Important achievements will also be reported through suitable mass media.

C. Acquisition and utilization of intellectual property rights
1) Active acquisition of intellectual property rights will be encouraged; a goal has been established to submit over 20 patent applications to the Japan Patent Office during the period covered in the Mid-Term Plan. JIRCAS will also encourage the submission of patent applications in countries other than Japan.
2) Plant varieties developed through breeding research will be registered based on the Seed and Stock Law. JIRCAS will also encourage applications by foreign organizations to utilize registered varieties overseas.
3) Information concerning intellectual property rights will be disseminated through the Internet, and requests for their utilization will be actively considered.

ADMINISTRATION

I. Evaluation and review of research activities

A. Internal review will be conducted under the guidance of experts from outside organizations, as well as JIRCAS directors and administrators.
B. Review of research themes will be conducted in order to evaluate research strategies, planning and progress. These results will be evaluated under the guidance of outside experts and JIRCAS directors and administrators, and will be made public.

II. Efficient utilization of resources allocated for research activities

A. Resources for research activities will be allocated in context of the objectives of the Mid-Term Plan.

III. Promotion of liaison and collaboration

A. Liaison and collaboration with other IAAs
Liaison and collaboration with other MAFF-affiliated IAAs will be actively pursued, including common research objectives, joint research and personnel exchange.
B. Liaison and collaboration with research organizations in developing regions
1. Research administrators from counterpart organizations will be invited to Japan through the Administrative Invitation program for exchanging information and opinions concerning policymaking and project design.
2. Researchers from counterpart organizations in developing regions will be invited to Japan to conduct collaborative research.

C. Liaison and collaboration with organizations from the private sector, universities, and the government
1. Collaborative research or researcher exchange with national public organizations, universities, the private sector, overseas organizations, international organizations, and the Japan International Cooperation Agency (JICA) will be actively promoted.
2. Research collaboration conducted with public organizations utilizing governmental support will be promoted.
The status of mutual relations and collaboration will be evaluated annually. The promotion of research activities at JIRCAS will be examined with the participation of representatives from related IAAs and administrative authorities as well as from municipal, district and prefectural organizations.

ADVISORS AND PRINCIPAL STAFF

Advisors

Hisao Azuma	Vice-President, Japan International Cooperation Agency (JICA)
Hiroshi Kakurai	Economic Analyst, formerly Commentator, Nippon Hoso Kyokai (NHK)
Sakue Matsumoto	President, Japan Food and Agriculture Organization (FAO) Association

JIRCAS External Evaluation Committee

Haruo Inagaki	Councilor, Japan Food and Agriculture Organization (FAO) Association
Keiji Ohga	Professor, Graduate School of Agricultural and Life Sciences, the University of Tokyo
Naoto Owa	Professor, Department of Applied Biological Chemistry, Faculty of Agriculture, Niigata University
Shuichi Kitada	Professor, Department of Aquatic Biosciences, Faculty of Fisheries, Tokyo University of Fisheries
Katumi Musiake	Professor, Institute of Industrial Science, the University of Tokyo
Seiichi Murayama	Professor, Department of Bioproduction, Faculty of Agriculture, University of the Ryukyus
Keiko Morishima	Professor, Department of Agriculture, Faculty of Agriculture, Tokyo University of Agriculture
Hitoshi Yonekura	Professor, Graduate School of Agricultural Science, Tohoku University
Hiroyuki Watanabe	Professor, Graduate School of Agriculture, Kyoto University

External Reviewers for International Collaborative Projects

Development of sustainable agricultural technology in Northeast Thailand

Paiboon Prabuddham	Assistant Professer, Department of Soil Science, Faculty of Agriculture, Kasetsart University
Waewchark Kongpolprom	Director, Central Land Consolidation Office, Ministry of Agriculture and Cooperatives
Terdsak Subhasara	Lecturer, Faculty of Science, Mahasarakham University
Sakol Ooraikul	Specialist, Agricultural Economic Production and Marketing, Office of Agricultural Economics, Ministry of Agriculture and Cooperatives
Yoshitaka Sumi	Deputy Director, Planning and Evaluation Department, Japan International Cooperation Agency (JICA)
Masaki Shibata	Director, Department of Research Planning and Coordination, National Agricultural Research Center for Kyushu Okinawa Region, National Agricultural Research Organization (NARO)

Comprehensive studies on the development of sustainable agro-pastoral systems in the subtropical zone of Brazil

Peter Kerridge	CIAT Asia Program, Lao PDR Office, Centro Internacional de Agricultura Tropica (CIAT)
Kazuo Kawano	Professor, University Farm, Faculty of Agriculture, Kobe University
Muneo Oikawa	Director, Department of Grassland Ecology, National Institute of Livestock and Grassland Science, National Agricultural Research Organization (NARO)

Makie Kokubun	Professor, Graduate School of Agricultural Science, Faculty of Agriculture, Tohoku University

Development of sustainable production and utilization of major food resources in China

Yoshihiro Kaida	Professor, the Center for Southeast Asian Studies, Kyoto University
Kunio Takase	Advisor, International Development Center of Japan
Naohiro Kitano	Section Chief, Division 1, Development Assistance Department, Japan Bank for International Cooperation
Tokio Inbe	Director, Department of Rice Research, National Institute of Crop Science, National Agricultural Research Organization (NARO)

Comprehensive studies on soybean improvement, production and utilization in South America (multinational)

Peter Kerridge	CIAT Asia Program, Lao PDR Office, Centro Internacional de Agricultura Tropica (CIAT)
Kazuo Kawano	Professor, University Farm, Faculty of Agriculture, Kobe University
Shinji Sakai	Director, Department of Integrated Research for Agriculture for the Kanto and Tokai Region, National Agricultural Research Center, National Agricultural Research Organization (NARO)
Makie Kokubun	Professor, Graduate School of Agricultural Science, Faculty of Agriculture, Tohoku University

Improving food security in West Africa through increased productivity in rainfed rice systems

Ryuichi Ishii	Professor, College of Bioresource Sciences, Nihon University
Hiroshi Nemoto	Department of Rice Research, National Institute of Crop Science, National Agricultural Research Organization (NARO)
Keijiro Ohtsuka	Professor, National Graduate Institute for Policy Studies, Japan
Masataka Minagawa	Head of Finance and Administration, Tokyo Office, Sasakawa Africa Association
Shigenari Koga	Director, Planning Division, Agricultural Development Cooperation Department, Japan International Cooperation Agency (JICA)

Evaluation and improvement of regional farming systems in Indonesia

Ken Menz	Program Manager, Australian Center for International Agricultural Research (ACIAR)
Koji Tanaka	Professor, the Center for Southeast Asian Studies, Kyoto University
Ryozo Hanya	Director, Agricultural Technology Cooperation Division, Agricultural Technology Cooperation Department, Japan International Cooperation Agency (JICA)
Haruo Inagaki	Councilor, Japan Food and Agriculture Organization (FAO) Association

Development of new technologies and their practice for sustainable farming systems in the Mekong Delta (Phase II)

Vo-tong Xuan	Director, Mekong Delta Farming Systems Research and Development Institute, Cantho University; Rector, An Giang University
Tetsuo Shioya	Professor, University Farm, Faculty of Agriculture, Tokyo University of Agriculture and Technology

Yoshiaki Kano	Director, Tsukuba International Center, Japan International Cooperation Agency (JICA)
Michiko Takagaki	Lecturer, Faculty of Horticulture, Chiba University

Development of low-input technology for reducing postharvest losses of staples in Southeast Asia

Greg Johnson	Program Manager, Australian Center for International Agricultural Research (ACIAR)
Toshinori Kimura	Professor, Institute of Agricultural and Forest Engineering, the University of Tsukuba
Yoshimi Hirose	Professor Emeritus, Kyushu University
Tadashi Miyata	Professor, Department of Biological Resources and Environmental Sciences, School of Agricultural Sciences, Nagoya University

Development of agroforestry technology for the rehabilitation of tropical forests

Minoru Kumazaki	President, Gifu Academy of Forest Science and Culture, Gifu Prefecture
Hideki Miyakawa	Director, Forestry and Natural Environment Cooperation Department, Japan International Cooperation Agency (JICA)
Mitsuyoshi Yatagai	Professor, Graduate School of Agricultural and Life Sciences, the University of Tokyo
Yoshiya Tadaki	Director, Ecological Research Center, PREC Institute Inc.
Fujio Kobayashi	Vice-Chairman, the Japan Forestry Association

Studies on sustainable production systems of aquatic animals in brackish mangrove areas

Fumitake Seki	Professor Emeritus, the University of Tsukuba
Makoto Terazaki	Professor, Ocean Resarch Institute, the University of Tokyo
Kunihiko Fukusho	Director, Breeding and Exhibit Department, Port of Nagoya Public Aquarium
Prathak Tabthipwon	Vice Dean, Faculty of Fisheries, Kasetsart University

Increasing economic options in rainfed agriculture in Indochina through efficient use of water resources

Paiboon Pramopjanee	Associate Professor, Department of Soil Science, Faculty of Agriculture, Kasetsart University
Tawachai Na Nagara	Adviser and Former Director, Soil Science Division, Department of Agriculture, Ministry of Agriculture and Cooperatives
Sakol Ooraikul	Agricultural Economics Specialist, Department of Agriculture, Ministry of Agriculture and Cooperatives
Takeshi Horie	Professor, Laboratory of Crop Science, Faculty/Graduate School of Agriculture, Kyoto University
Hideo Yano	Professor, Division of Applied Sciences, Faculty/Graduate School of Agriculture, Kyoto University
Akira Goto	Professor, Environmental Engineering, Faculty of Agriculture, Utsunomiya University

JIRCAS STAFF FY 2002

President

Takahiro Inoue
(Mutsuo Iwamoto; from April 1, 2003)

Vice-President

Yoshinori Morooka

Executive Advisor & Auditor

Kunihiko Kato
Akimi Fujimoto

Research Planning and Coordination Division

Akinori Noguchi, Director

Research Planning Section
Shuichi Asanuma, Section Head
Kumi Yasunobu, Senior Researcher
Tomohide Sugino, Senior Researcher
Marcy N. Wilder, Senior Researcher in Fisheries Division, Joint Appointment

Research Coordination Section
Takahito Noda, Section Head
Shoichi Kawasugi, Senior Researcher
Kazuo Ise*, Senior Researcher

International Relations Section
Sayuki Nikkuni, Section Head
Kiyomi Kosaka, Section Officer

International Research Coordinators
Masanori Inagaki, Wheat Breeding
Hiroko Takagi-Watanabe, Plant Breeding
Akinori Oshibe, Animal Feeding

Public Information Officer
Tadahiro Hayashi, Information Engineering

Publication and Documentation Section
Nobuo Ueno, Chief Librarian
Hiromi Miura, Librarian

Field Management Section
Haruo Tamura, Chief
Takashi Komatsu, Field Operator

Administration Division

Katsuyuki Kiryu, Director

General Affairs Section
Masahiro Horiguchi, Section Chief
Masao Tachiya, Assistant Section Chief
Teruki Kurihara, Personnel Overseer
Yasuhiro Onozaki, Section Manager
(Gaku Takeda*, Section Manager)
Masae Kudo, Section Officer
Isao Takahashi, Personnel Manager
(Yasuhiro Onozaki*, Personnel Manager)
Ryo Okamoto, Personnel Officer
Masayuki Matsumoto, Social Affairs Manager

Accounting Section
Hisashi Kamimura, Section Chief
Ryoichi Saito, Assistant Section Chief
Yoshinori Ohnuma, Auditing Chief
Yoshihiko Sumomozawa, Financial Manager
(Isao Takahashi*, Financial Manager)
Makoto Nishiyama, Financial Officer
Tsutomu Wada, Accounting Manager
Takeshi Akiyama, Accounting Officer
Hideko Shimada, Auditing Manager
(Yoshihiko Sumomozawa*, Auditing Manager)
Koji Ito, Supplies/Equipment Manager
Naomi Yamamoto, Supplies/Equipment Officer
Kuniaki Katsuyama, Facilities Manager
Tomoko Maeno, Facilities Officer

Overseas Staff Support Section
Ryoichi Hizukuri, Section Chief
Nobuharu Fukui, Overseas Affairs Overseer
Hiroshi Tanaka, Overseer Stationed Overseas
Gaku Takeda, Overseas Operations Manager
(Hideko Shimada*, Overseas Operations Manager)
Kazuo Miyajima, Overseas Expenditures Manager
Makoto Shibagaki, Overseas Travel Manager
Atsuzo Nishino, Overseas Shipments Manager

Development Research Division

Osamu Koyama, Director
(Kazuyuki Tsurumi*, Director)

Development Research Coordinators
John S. Caldwell, Horticulture and Farming Systems
Tetsushi Hidaka*, Fruit Breeding
Osamu Koyama*, Agricultural Economics

Satoru Miyata, Agronomy and Agricultural Economics
Yutaka Mori, Applied Microbiology
Masaharu Yajima*, Plant Physiology

Research Staff
Masuo Ando, Agricultural Economics
Jun Furuya, Agricultural Economics
Chien Hsiaoping, Agricultural Economics
Sho Kosugi, Agricultural Economics
Kazuo Nakamoto, Agricultural Economics
Jun-Ichi Sakagami, Agronomy
Takeshi Sakurai, Agricultural Economics
Satoshi Uchida, Geographic Information Systems
Ryuichi Yamada, Agricultural Economics
Yasuharu Yamada, Geographic Information Systems
Yukiyo Yamamoto, Geographic Information Systems
Norihiro Yamashita, Agricultural Economics

Biological Resources Division

Ryoichi Ikeda, Director
(Masaru Iwanaga*, Director)

Research Staff
Taizan Adachi*, Soybean Breeding
Tomohiro Ban, Wheat Breeding
Yoshihisa Honma, Plant Pathology
Kazuo Ise, Rice Breeding
Mie Kasuga, Plant Molecular Biology
Kazuo Nakashima, Plant Molecular Biology
Takanori Sato, Vegetable Breeding
Kazuhiro Suenaga, Wheat Breeding
Hiroshi Tsunematsu, Rice Breeding
Takeshi Urao, Plant Molecular Biology
Kazuko Yamaguchi-Shinozaki, Plant Molecular Biology
Naoki Yamanaka, Plant Molecular Genetics

Crop Production and Environment Division

Osamu Ito, Director

Research Staff
Shotaro Ando*, Soil Microbiology
Hiroshi Fujimoto, Plant Physiology
Hiromasa Hamada, Groundwater Hydrology
Tamao Hatta, Mineralogy and Geology
Naoki Horikawa, Water Management
Yasukazu Hosen, Soil Physics and Chemistry
Takayuki Ishikawa, Plant Physiology
Hiromi Kobayashi, Agronomy
Naruo Matsumoto, Environmental Conservation
Takuji Nakamura, Soil and Plant Nutrition
Satoshi Nakamura, Insect Ecology
Chikara Ogura, Agricultural Land Improvement
Kensuke Okada, Plant Physiology
Kazushige Sogawa, Insect Ecology
Guntur V. Subbarao, Crop Physiology and Nutrition
Satoshi Tobita, Plant Nutrition and Physiology
Takeshi Watanabe, Soil Chemistry
Mitate Yamada, Agronomy

Associated Researchers
Kiyoko Hitsuda, Soil Fertility and Plant Nutrition
Tetsuji Oya, Agronomy

Animal Production and Grassland Division

Toshiaki Taniguchi, Director

Research Staff
Yasuo Ando, Plant Microbiology
Eiki Fukuda, Pasture Management
Akemi Kamakawa, Livestock Development
Hiroshi Kudo, Rumen Microbiology
Yoshio Nakamura, Veterinary Parasitology
Masaharu Odai*, Animal Nutrition
Sadahiro Ohmomo, Applied Microbiology
Tomoyuki Suzuki, Animal Nutrition
Seishi Yamasaki, Animal Nutrition

Food Science and Technology Division

Toru Hayashi, Director

Research Staff
Tsutomu Fushimi, Food Analysis
Kazuhiko Nakahara, Food Chemistry
Hiro Nakamura, Cereal Chemistry and Plant Breeding
Masayoshi Saito, Food Science
Eizo Tatsumi, Food Science
Tadashi Yoshihashi, Food Evaluation

Forestry Division

Kiyoshi Nakashima, Director

Research Staff
Hisashi Abe, Wood Science
Masahiro Inagaki, Forest Soil Science

Koichi Kamo, Silviculture
Motoe Miyamoto, Social Forestry
Shoji Noguchi, Forest Hydrology
Yukihito Ochiai, Silviculture
Kazunori Takahashi, Silviculture
Ryohei Tanaka*, Cellulose Chemistry
Akihiko Yokota, Mycology

Fisheries Division

Yutaka Fukuda, Director

Research Staff
Yukio Maeno, Fish Pathology
Hiroshi Ogata, Fish Nutrition
Yasuki Ogawa, Crustacean Zoology
Toru Shimoda, Coastal Ecology
Marcy N. Wilder, Crustacean Biochemistry
Masahito Yokoyama, Fish Biochemistry

Okinawa Subtropical Station

Masaaki Suzuki, Director
Kiyoshi Ozawa, Associate Director for Research

General Affairs Section
Mitsuyuki Saito, Section Chief
(Kenichi Hasse*, Section Chief)
Satoshi Kawamitsu, Section Manager
Shuji Hirose, Section Officer
Takao Ohga, Accounting Manager
Yoshiyuki Hoshinoya, Accounting Officer
Hitoshi Sekiguchi, Accounting Officer

International Collaborative Research Section
Mitsuyoshi Katsuda, Section Head

Islands Environment Management Laboratory
Kenji Banzai, Environmental Conservation, Head
Ken Nakamura, Soil Science

Environmental Stress Laboratory
Yoshinobu Egawa, Plant Genetic Resources, Head
Mariko Shono, Plant Physiology
Katsumi Suzuki, Plant Morphology

Tropical Crop Breeding Laboratory
Makoto Matsuoka, Plant Breeding, Head
Koshun Ishiki, Plant Breeding and Genetic Resources
Yasuaki Tamura, Rice Breeding
Masahiko Tanio, Wheat Breeding

Tropical Fruit Crops Laboratory
Kazunori Ogawa, Plant Chemistry, Head
Hiroshi Fukamachi, Pomology
Hidenori Kato, Plant Physiology

Plant Protection Laboratory
Masatoshi Ohnuki, Plant Virology, Head
Kunimasa Kawabe, Plant Virology
Katsuyuki Kohno, Entomology
Tadafumi Nakata, Entomology

Field Management Section
(Yoshimitsu Katsuda*, Section Head)
Masakazu Hirata, Machine Operator
Hirokazu Ikema, Machine Operator
Yuho Maetsu, Machine Operator
Atsushi Ogasawara, Machine Operator
Yasuteru Shikina, Machine Operator
Masato Shimajiri, Machine Operator
Koji Yamato, Machine Operator
Masaki Yoshida, Machine Operator

Researchers on Loan to Other Organizations

International Maize and Wheat Improvement Center (CIMMYT)
Masaru Iwanaga, Director General

International Rice Research Institute (IRRI)
Yoshimichi Fukuta, Rice Breeding
Takuhito Nozoe, Soil Chemistry
Seiji Yanagihara, Plant Breeding

Japan International Cooperation Agency (JICA)
Takasuke Ishitani, Postharvest Technology (China)

Part-Time informal employees
Nearly 90 persons are working at JIRCAS as non-permanent staff. They serve as editorial advisors for many of JIRCAS's publications, perform much of the institute's secretarial work, function as laboratory technicians, and maintain the buildings and laboratories. Their services to JIRCAS are highly valued.

* Indicates transfer within JIRCAS, relocation, retired, or deceased during the Fiscal Year covered by this Annual Report.

( ) Indicates previous position holder

IN MEMORIAM

Dr. Chiyoichi Noda, a plant virologist and International Research Coordinator in the Research Planning and Coordination Division died tragically in a traffic accident on December 19, 2001. Dr. Noda received his Ph.D. in Plant Pathology from Okayama University in 1989. After joining TARC, now JIRCAS, he conducted collaborative research with the Department of Agriculture in Thailand for three years. As the Head of JIRCAS's Crop Protection Laboratory, Okinawa Subtropical Station from 1995 to 2001, Dr. Noda conducted research on the effects of viral diseases on tropical and subtropical crops, and was responsible for the improvement of a "Citrus greening disease detection technology" utilizing monoclonal antibodies. This technology will be employed in a new research project planned for Southeast Asia. In addition to his research achievements, Dr. Noda was responsible for many administrative duties, including the management of comprehensive projects being conducted in South America. Dr. Noda will also be remembered as a talented marathon athlete who competed in both Ishigaki and Tsukuba.

Mr. Taizan Adachi, a soybean breeder and Senior Researcher in the Biological Resources Division passed away on June 7, 2002 after a long battle with cancer. Mr. Adachi graduated from Hokkaido University with a Master's Degree in Agronomy in 1976. He joined JIRCAS in 1999 after making significant contributions to the development of food legume varieties such as adzuki bean "Erimoshozu" and soybean "Suzumaru" at the Hokkaido Prefectural Agricultural Experiment Station and Tohoku National Agricultural Experiment Station. At JIRCAS, Mr. Adachi conducted research on the "Evaluation and utilization of soybean genetic resources in Northeast China" in collaboration with the Soybean Institute, Jilin Academy of Agricultural Sciences. His dedication to improving Chinese agriculture culminated in the registration of four new soybean varieties in Jilin Province. The Soybean Institute has kindly planted a pine tree in his memory.

THE JAPANESE FISCAL YEAR AND MISCELLANEOUS DATA

The Japanese Fiscal Year and About Annual Report 2002

The Japanese fiscal year is defined as a period of fiscal activity occurring from April 1 through March 31 of the following year. Thus, Fiscal Year (FY) 2002 covers the period from April 1, 2002 through March 31, 2003. Annual Report 2002 is intended to summarize the full extent of JIRCAS activities that occurred during this time period. The following Annual Report will detail events and activities from April 1, 2003, through March 31, 2004 (FY 2003)

Buildings and campus data

Land	(units: m^2)
Tsukuba premises	109,538
Okinawa Subtropical Station	294,912
Total	404,450

Buildings	(units: m^2)
Tsukuba premises	10,749
Okinawa Subtropical Station	8,696
Total	19,445