

Annual Report 2004 (Apr. 2004–Mar. 2005)

JAPAN INTERNATIONAL RESEARCH CENTER FOR AGRICULTURAL SCIENCES

Annual Report 2004 (Apr. 2004 – Mar. 2005)

JAPAN INTERNATIONAL RESEARCH CENTER FOR AGRICULTURAL SCIENCES





About JIRCAS's symbol mark: The mark was conceived by Takayuki Ishikawa, Senior Researcher in the Crop Production and Environment Division, and Toshifumi Murakami, former Senior Researcher in the Research Planning and Coordination Division. The Earth enveloped in a revolving swirl of clouds represents the dynamics of international research and JIRCAS's aims to target all world areas. The star was added to serve as a polestar for international agricultural research and to represent the importance of cooperation.

Japan International Research Center for Agricultural Sciences

Annual Report 2004

(April 2004-March 2005)

Japan International Research Center for Agricultural Sciences
1-1 Ohwashi, Tsukuba, Ibaraki 305-8686
JAPAN

EDITORIAL BOARD

Chairman

Shinobu Inanaga	President
-----------------	-----------

Vice-Chairman

Masami Yasunaka	Director, Research Planning and Coordination Division
-----------------	---

Editors-in-Chief

Fumio Yoshida	Head, Publication and Documentation Section
Marcy N. Wilder	Senior Researcher, Fisheries Division and Research Planning and Coordination Division

Editorial Committee

Yoshinobu Egawa	Head, Research Planning Section
Kunimasa Matsumoto	Public Information Officer, Research Planning and Coordination Division
Ryuichi Yamada	Senior Researcher, Research Planning and Coordination Division
Junji Hashimoto	Head, JIRCAS Editorial Office Staff
Noriko Moriyama	JIRCAS Editorial Office Staff

Advisory Panel

Akinori Noguchi	Vice-President
Tokuzo Ono	Director, Administration Division
Osamu Koyama	Director, Development Research Division
Takashi Kumashiro	Director, Biological Resources Division
Osamu Ito	Director, Crop Production and Environment Division
Shuichi Oshio	Director, Animal Production and Grassland Division
Yutaka Mori	Director, Food Science and Technology Division
Shozo Nakamura	Director, Forestry Division
Koji Nakamura	Director, Fisheries Division
Toshihiro Senboku	Director, Okinawa Subtropical Station

telephone	81-29-838-6313/6330
facsimile	81-29-838-6316
e-mail	head@jircas.affrc.go.jp
www	http://www.jircas.affrc.go.jp

CONTENTS

Message from the President	2
Highlights from 2004	4
Research structure and evaluation at JIRCAS	14

Research Overview

International research at JIRCAS	26
JIRCAS Research Divisions	36
Development Research Division	36
Biological Resources Division	42
Crop Production and Environment Division	47
Animal Production and Grassland Division	54
Food Science and Technology Division	56
Forestry Division	61
Fisheries Division	63
Okinawa Subtropical Station	65
Miscellaneous projects outline	72

Training and Invitation Programs and Information Events

Invitation programs at JIRCAS	76
Administrative Invitation Program	76
Counterpart Researcher Invitation Program	84
Fellowship Programs	87
Symposia and workshops	92

Appendix

Publishing at JIRCAS	104
Official publications and library acquisitions	104
Research staff activity	105
Financial overview	113
Tenets of the JIRCAS Mid-Term Plan (April 2001-March 2006)	114
Advisors and principal staff	118
The Japanese fiscal year and miscellaneous data	124

JIRCAS 2004 ANNUAL REPORT

Message from the President



**President
Dr. Shinobu
Inanaga**

JIRCAS's first mid-term plan, a five-year period which commenced on April 1, 2001, will come to an end on March 31, 2006 in accordance with the Government of Japan's designation of JIRCAS as an Incorporated Administrative Agency (IAA). With JIRCAS's inauguration as an IAA, Dr. Takahiro Inoue and Dr. Mutsuo Iwamoto served in succession as President from April 2001 through March 2003, and from April 2003 through March 2005. Dr. Inoue strived to achieve a "soft landing" during JIRCAS's transition from its existence as a national research institute toward that of an IAA while preserving the best of the culture and knowledge that had been built up over its many years as a government institution. Dr. Iwamoto also made extensive contributions in ushering JIRCAS through this period of change, and instituting many new activities for the institute designed to clearly distinguish JIRCAS in its new role as an IAA. His achievements include the expansion of activities with and strengthening of relationships between the Consultative Group on International Agricultural Research (CGIAR) and its affiliated CG centers, the implementation of new research activities with international research institutes representing advanced countries (see under "New MOUs" in the Highlights section), the establishment of a new program to dispatch young researchers to CG centers, and finally, the inauguration of the Japan Forum on International Agricultural Research for Sustainable Development (J-FARD), a broad consortium of research organizations, universities, and organizations involved in international cooperation as well as individual researchers, academicians, and international development workers. As a part of Dr. Iwamoto's legacy, JIRCAS is responsible for providing leadership among the diverse groups constituting the consortium and the running of the Forum secretariat. With the first half of the mid-term plan having already passed, and having entered into the latter half of the mid-term plan with only one year remaining, this is a critical time for JIRCAS as the drawing up of the next mid-term has become urgent. Having newly assumed my position as the President of JIRCAS in April 2005, I feel the weight of the responsibilities that are now placed upon me.

This Annual Report is a recapitulation of JIRCAS achievements and activities during fiscal year 2004. As the subsequent Highlights section describes, we are very proud of JIRCAS's selection as a CGIAR Focal Point Institution on July 26, 2004, and our first-ever conclusions of Memoranda of Understanding with agricultural-related research organizations in advanced countries (France's Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD) and Korea's Rural Development Administration (RDA)), the inauguration of J-FARD, and the hosting of the World Rice Research Conference. These achievements represent to us the culmination of important key activities that define us, our

mandate, and our goals. As for key internal developments, JIRCAS's new research strategy has been solidified, a working group to ensure efficient utilization of in-house funding within JIRCAS has been put in place, a new informal research group working on the development of crops capable of growing under adverse environmental conditions was set up, and finally, JIRCAS's Thai office was upgraded.

The primary role of JIRCAS lies in our contribution to the solution of the world's food and environmental problems through cooperative research with developing nations and areas. In this way, we are thus able to foster the sustainable development of environmentally harmonious agriculture, forestry and fisheries activities that address the needs and problems of the respective areas. This is indeed our obligation on the international stage. While up until the present, a great deal of our efforts have been concentrated on promoting bilateral relationships with the relevant national research institutions and universities in various developing countries, we have also instituted collaboration with international research organizations in order to contribute to the development of global public goods. To this end, we have concluded MOUs with many of the CG centers starting since the time of JIRCAS's predecessor, the Tropical Agriculture Research Center (TARC). In total, MOUs have been signed with 12 CG centers: first with the International Potato Center (CIP) in 1988, followed by the International Institute of Tropical Agriculture (IITA) in 1990, the International Rice Research Institute (IRRI) in 1995, the International Livestock Research Institute (ILRI) in 1995, the International Water Management Institute (IWMI) in 1997, the International Centre for Research in Agroforestry (ICRAF) in 1997, the Africa Rice Center (WARDA) in 1998, the International Maize and Wheat Improvement Center (CIMMYT) in 1998, the International Center for Tropical Agriculture (CIAT) in 2002, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in 2003, the International Center for Agricultural Research in Dry Areas (ICARDA) in 2003, and the International Food Policy Research Institute (IFPRI) in 2004. During this history of collaboration with the CGIAR, JIRCAS personnel relevant to specific research projects have been dispatched to the respective CG centers and the research results thus achieved have been disseminated worldwide through the various programs of the CG centers.

As well, starting in fiscal year 2004, we have been furthering our goals of collaboration through the dispatch of JIRCAS research staff to the CGIAR headquarters in Washington D.C. We also have implemented a new program which dispatches 11 selected graduate students to CG centers on short-term missions, funded by Japan's Ministry of Agriculture, Forestry and Fisheries (MAFF) under a project designed to develop human resources and

new capacity to conduct international collaborative research. In this way, we are striving to nurture Japan's next generation of researchers who will carry out international collaborative research and contribute the Africa Rice Center (WARDA) to our country's efforts to further the goals of international development.

The year 2004 was the International Year of Rice. JIRCAS hosted the World Rice Research Conference held in both Tokyo and Tsukuba in cooperation with IRRI and several other IAAs affiliated to MAFF. This conference was a focal point for both overseas and Japan-based persons in which registered participants numbered nearly 1,200. Through special symposia, oral and poster presentations, and exhibitions, the conference shed light on the significance of rice culture, the importance of rice as a staple food, and the inter-relationships among rice cultivation, agriculture, and social infrastructure. Its wide-ranging approach was well received by the various participating research organizations and individual attendees.

In recent years, it has become evermore necessary for JIRCAS to utilize its limited human and financial resources in a more effective manner to achieve its goals with maximum efficiency. To this end, a clear strategy and well-defined tactics are essential. JIRCAS has formulated its own international research strategy based on the ODA Charter and Guidelines for the Promotion of International Agricultural Research, compiled by the Agriculture, Forestry and Fisheries Research Council of MAFF. Its main aims are (1) to enhance production technology under adverse environmental conditions, (2) to develop the sustainable usage and control of resources, (3) to enhance added value goods and improve agricultural profitability by diversification, and (4) to address global environmental and food problems. This agenda will serve as a blueprint for restructuring our research capability as we move into the next mid-term plan (2006-2011). In this fiscal year, a new group working on the development of crops adaptable to adverse environmental conditions was created as an initial step toward redefining and restructuring our research capabilities. The group is comprised of a functional development team, materials development team, and evaluation team. These teams are expected to produce a great deal of output through integrated research and development relating to crop production under less than favorable environments.

In order to implement research projects which will realistically achieve the goals that are delineated for them, it is of utmost importance to understand the conditions that surround agriculture and the environment in the regions that are targeted. Our three existing liaison offices (in Bangkok, Thailand; Beijing, China; Londrina, Brazil) are mandated to collect and analyze agricultural and environmental information in their respective countries, and develop new strategies and projects, in addition to



JIRCAS Main Building

providing routine clerical support and facilitating communication with JIRCAS's main premises. In our first attempt to meet such needs, our Bangkok office, which has the longest track record of our three liaison offices, has been reorganized into a research and communications hub in Bangkok to cover the whole of Southeast Asia. A similar strategy will be applied to the other two offices in order to widen the scope of their activities in the near future.

Agricultural and environmental problems are becoming more diversified and complicated as the world becomes increasingly globalized. It would be difficult to solve these problems based only on narrow approaches categorized by technology, territory, and region. To address the complicated problems and difficulties that are now arising, there is a need to develop the multifaceted alliances as discussed above. At the same time, it is essential to maintain personnel who have a global outlook and an ability to integrate a range of information and work within several fields. JIRCAS is unique as a comprehensive research center that covers a range of fields in both the natural and social sciences as relevant to promoting sustainable agriculture, forestry and fisheries-related activities. We are pleased that we have several staff scientists who are foreign nationals, as well as many visiting overseas researchers from abroad who have been raised under different cultures. In this way, it may be said that JIRCAS has fostered the ideal climate in which comprehensive views and research strategies may develop and evolve. It is our constant hope that all of those residing at JIRCAS will take full advantage of the uniqueness of our institute, and strive to fulfill the goals of our mandate.

Finally, I wish to thank the members of the Editorial Board of this Annual Report for making this year's publication possible.

稲永忍

HIGHLIGHTS FROM 2004

During Fiscal Year 2004, the Japan International Research Center for Agricultural Sciences (JIRCAS) made a number of strides in its overall efforts to improve world food Japan security. In particular, JIRCAS was involved in establishing the Japan Forum on International Agricultural Research for Sustainable Development (J-FARD), and hosting the 2004 World Rice Research Conference. In addition, several new MOUs were concluded.

IMPORTANT NEW DEVELOPMENTS

Establishment of the Japan Forum on International Agricultural Research for Sustainable Development (J-FARD)

In order to intensify and strategize planning and implementation of research activities and efforts of Japanese scientists and other related stakeholders involved in international agricultural research, the Japan Forum on International Agricultural Research for Sustainable Development (J-FARD) was established on July 28, 2004 by 28 founding members. This Forum will serve as a common platform for coordinating and fostering new partnerships among organizations and individuals involved in international cooperation and promoting the exchange of knowledge and experience through symposia, workshops, and collaborative research. The Forum will also strive to improve domestic

and international information exchange, including that with international research organizations. At the inaugural congress of J-FARD, Prof. Koji Tanaka expounded on its framework and objectives.

The Forum's Board of Directors is comprised of five members, including Mr. Hisao Azuma, President of the Japan Food and Agriculture Organization (FAO) Association; Dr. Koji Tanaka, Professor at Kyoto University, and chosen as President, Vice-President, and Secretary, respectively, Dr. Mutsuo Iwamoto, President (former) of JIRCAS, Mr. Ryuzo Nishimaki, Senior Advisor at JICA, and Dr. Masaru Osanai, Professor at the National Graduate Institute for Policy Studies (GRIPS). The J-FARD Secretariat was installed at JIRCAS. The Board, at its second meeting, discussed the holding of an international symposium jointly with JIRCAS in 2005.

Currently, J-FARD has 72 members, and is extending its invitation to relevant stakeholders who share its views to join them. For more information on J-FARD, please visit the official website at <http://ss.jircas.affrc.go.jp/J-FARD/index.html>.

World Rice Research Conference—the largest scientific event in the International Year of Rice 2004 (the 11th JIRCAS International Symposium)

The United Nations has declared 2004 to

JIRCAS senior administrators pose for a group photograph at the JIRCAS front entrance. Front row: O. Koyama, S. Inanaga, A. Noguchi, K. Nakamura. Back row: Y. Mori, T. Kumashiro, O. Ito, M. Yasunaka, T. Ono.



K. Ito



A. Fujimoto



S. Oshio



S. Nakamura



T. Senboku



be the International Year of Rice under the slogan “Rice is Life.” To help provide solutions to the many challenges facing the rice cultivation industry, Japan’s Ministry of Agriculture, Forestry and Fisheries (MAFF), International Rice Research Institute (IRRI), Asian Productivity Organization (APO), and six research institutions in Japan, including JIRCAS, organized the World Rice Research Conference (WRRC) 2004, held from November 4-7, 2004 in Tokyo and Tsukuba. JIRCAS acted as the secretariat of this important conference by arranging for relevant institutions to present high-quality content, including 20 sessions under the four main themes shown below, as well as by logistical work to ensure a smoothly run conference.

The main themes for this conference were as follows: 1) Innovative technologies for boosting rice production, 2) Perspectives on the place of rice in a healthy lifestyle, 3) Adaptable rice-based systems that improve farmers’ livelihoods, and 4) The role of rice in environmentally sustainable food security. Session themes are listed in the latter part of this report.

The commemorative opening ceremony for WRRC 2004 was held in Tokyo, with 500 participants, who enjoyed welcome addresses given by the Crown Prince and the Minister of Agriculture, Forestry and Fisheries, followed by keynote speeches by four distinguished guests: Prof. Gudev Kush (University of California, Davis), Prof. Yoshiko Kagawa (Kagawa Nutrition University), Prof. Kenichi Matsumoto (Reitaku University), and Dr. Joachim von Braun (President, International Food Policy Research Institute). A special speech from the Director General of the Food and Agriculture Organization (FAO) was also given. The four keynote speakers, plus Director Generals of IRRI and the Africa Rice Center (WARDA), co-chaired by Mr. Hisao Azuma, Vice Chairperson of the Japanese Committee for the International Year of Rice, and Dr. Mutsuo Iwamoto, President (former) of JIRCAS, took part in a panel discussion on the importance of rice research covering the aspects of food security, sustainable rice production in developing countries and related training programs, water productivity in water-scarce environments, NERICA (New Rice for Africa) adaptable to lowland paddy fields, Integrated Management of Rice, improvement of rain-fed ecosystems, and post-genome research.

The subsequent research conference in



Mr. Hisao Azuma, President of J-FARD, giving an address at J-FARD's inaugural congress. Dr. Francisco Reifschneider, Chairman of the CGIAR, gave a lecture entitled “*The Role of Agriculture in Sustainable Development: The Japan-CGIAR Partnership in Action*” at the congress (inset).

Tsukuba was attended by 1,278 participants from 42 countries including 312 from overseas. Oral presentations were given by 186 speakers across 20 scientific sessions and six workshops, and poster presentations were also given by 312 presenters. Many participants visited the extensive exhibition on rice set up by 35 institutions including research institutes in Japan and abroad, food processing companies, and farmers’ groups.

Three keynote lectures were given by three speakers: Prof. Vaclav Smil (University of Manitoba) on “Feeding the world: how much more rice do we need?” which estimated the demand for rice in the 21st century; Prof. Riota Nakamura (Nihon University) on “Development of sustainable agriculture based on rice, water and living environment,” which discussed the multifunctionality of rice-based cropping systems; and Dr. Ronald Cantrell (Director General, International Rice Research Institute) on “Research strategies for rice in the 21st century.” The Proceedings of this conference were published by IRRI on CD, entitled “Rice is Life: Scientific Perspectives for the 21st century” in July 2005. The Proceedings include keynote lectures, orally-presented papers, posters, and wrap-up papers by session conveners.

Participants attending the opening address of the World Rice Research Conference in the main hall of the Tsukuba International Congress Center on November 5, 2004.



NEW RESEARCH COLLABORATION

New MOUs initiated in Fiscal Year 2004

JIRCAS signs MOU with the China National Rice Research Institute (CNRRI) to conduct a follow-up study on the whitebacked planthopper

JIRCAS launched its first comprehensive research project with the national government of the People's Republic of China in May 1997. The aim of the project was to develop technologies to enable sustainable production and utilization of major food resources in China. As one of the research themes of the project, JIRCAS carried out intensive studies on integrated management of migratory rice planthoppers in China in collaboration with the China National Rice Research Institute (CNRRI), leading to the proposal of an effective means to reduce the damage they cause through a combination of reduced insecticide application and the development of planthopper-resistant rice varieties. In order to follow up on these research outputs, JIRCAS and the CNRRI, which is affiliated to China's Ministry of Agriculture and has its headquarters in Hangzhou, Zhejiang Province, have reached a mutual agreement to launch a new collaborative research project with the aim of breeding whitebacked planthopper-resistant japonica rice varieties suitable for cultivation in the Changjiang River Valley. The new project is supported by resource inputs from both parties.

The three main objectives of the project are 1) to develop a new rice variety with yield potential 5% higher than existing recommended varieties, having the same degree of resistance to whitebacked planthopper as the Chunjiang 06 variety and being suitable for cultivation along the Changjiang River; 2) to clarify the function of gene loci responsible for resistance to sucking inhibition and ovicidal reaction, and 3) to develop a rapid breeding procedure with marker-aided selection for resistance to whitebacked planthopper by tagging the resistance genes at the 4th and 6th chromosomes with molecular markers.

MOU with the International Food Policy Research Institute: A new collaboration in social sciences

A general agreement was signed between the International Food Policy Research

Institute (IFPRI) and JIRCAS in May 2004. IFPRI is one of research centers affiliated to the Consultative Group on International Agricultural Research (CGIAR) with its headquarters being located in Washington D.C., USA, and specializes in research on public policies relating to sustainable food security and nutritional improvement. The MOU is intended to strengthen cooperation between the two institutions through the exchange of information and personnel, implementation of joint workshops and carrying out of collaborative research projects specified by the Japanese government. The MOU in addition draws up guidelines outlining the research activities and obligations of both parties. Thus far, IFPRI and JIRCAS have worked together on limited topics, such as the development of econometric models via short-term exchange visits. With this agreement, the two institutions will be able to implement collaborative research on a continuous basis.

Under this MOU, the role of foreign direct investment and vertical coordination will be studied with the aim of fostering high value agricultural production in Asia. Despite many outstanding achievements in agriculture and economics in many Asian countries, widespread rural poverty persists. This project will attempt to identify possible measures against rural poverty by investigating the pros and cons of "High Value Agriculture," in which foreign direct investment and vertical coordination such as contract farming play key roles. The study will be made based on field surveys targeting farms, distributors, manufacturers and the public sector.

The three-year project will be jointly conducted by IFPRI researchers and a JIRCAS-dispatched researcher working with local counterparts. We have much expectation that this agreement will enhance international collaborative efforts in the social sciences arena, with the purpose of addressing the urgent development issues of today such as poverty reduction and social sustainability.

JIRCAS signs MOU with the Institut de Recherche Agronomique de Guinée (IRAG) to explore the potential of African rice varieties

Rice production in West Africa has been increasing rapidly in recent years and the areas used for its cultivation have been expanding into various ecosystems such as rainfed uplands (41%), rainfed lowlands (34%), irrigation (13%), and the mangrove

and deep water areas (11%). The productivity of rice in rainfed conditions is extremely low (0.9-1.8 t/ha) compared to that in the irrigated lowlands (3.0-4.5 t/ha). There is an urgent need to increase rice productivity in the rainfed regions to stabilize food security and to improve agricultural income in West Africa.

Rice is widely cultivated in Guinea thanks to its suitable climate and soil conditions. The improvement of rice production is a strategic goal for the government of Guinea, where currently 84 percent of the active population is dependent on agriculture, the majority being small-scale farmers. To build up research capabilities for agricultural development, in 1989 the government established the Agricultural Research Institute of Guinea (Institut de Recherche Agronomique de Guinée: IRAG) under the Ministry of Agriculture and Livestock. The institute is headquartered in Conakry and has four regional centers. In addition to these regional centers, IRAG also has a center in Koba specializing in aquatic production systems in coastal basins and mangroves. IRAG accounted for nearly two-thirds of the country's agricultural researchers and expenditures in 2001.

JIRCAS and IRAG reached an agreement and signed an MOU on May 2004 to conduct eco-physiological studies on rice to identify



rice varieties suitable for cultivation in rainfed conditions. The studies cover the following areas: 1) an ecological study of rice cultivation, 2) a physiological study of improvement of drought resistance of rainfed lowland rice, 3) development of rice cultivars adapted to rainfed lowland ecosystems, and 4) analysis of physio-genetic mechanisms of resistance to submergence in rainfed lowlands.

The research building at the Foulaya Experimental Station, one of the regional centers of IRAG, in which the JIRCAS project is accommodated.

MOU concluded between JIRCAS and the Africa Rice Center (WARDA)

An MOU between the Africa Rice Center (WARDA) and JIRCAS was renewed and signed by Dr. Kanayo F. Nwanze, Director General of WARDA, and Dr. Mutsuo Iwamoto, President (former) of JIRCAS, on May 31, 2004. A previous MOU that was initiated in 1998 expired in 2003.

Comprehensive MOU to strengthen partnership with the Royal Forest Department (RFD) of Thailand

In tropical regions, mahogany and teak are regarded as among the most valuable and important commercial tree species. However, insects such as the mahogany shoot borer, *Hypsipyla robusta*, and the teak beehole borer, *Xyleutes ceramica*, have widely infested plantations producing these tree species. In order to establish new, effective means of pest control, JIRCAS's Forestry Division proposed a new project in collaboration with the Royal

Forest Department of Thailand's Ministry of Natural Resources and Environment, which was initiated in Fiscal Year 2003. In this project, we aim to determine the chemical structure of the sex pheromones in these insects, leading to the development of methodology for the monitoring and control of both of these species.

In order to formalize this joint project, Dr. Mutsuo Iwamoto, President (former) of JIRCAS, and Mr. Chatchai Ratanophat, Director General of RFD, signed an MOU between their two organizations in August 2004.

MOU with the Southern Fruit Research Institute (SOFRI) of Vietnam to control citrus huanglongbing

MOU with the Southern Fruit Research Institute (SOFRI), which is affiliated to Vietnam's Ministry of Agriculture and Rural Development, has its principal office in Tien Giang Province. SOFRI's R&D efforts focus

on the improvement of fruit cultivars that provide higher yields and better quality products destined for local consumption, processing, and export; the improvement of technology for fruit tree propagation and farming; the development of protection technology for high-yielding and high-quality fruit products; and the development of farmer-oriented handling, processing, and marketing techniques for fruit products. SOFRI is additionally mandated to provide consultation and training services relating to fruit production technology.

SOFRI and JIRCAS conducted collaborative research on technology development for fruit production under a comprehensive project, "Development of new technologies and their practice for sustainable farming systems in the Mekong Delta," which concluded in fiscal year 2003. Following this, SOFRI and JIRCAS pursued avenues for further collaborative research on citrus huanglongbing, also referred to as citrus greening disease. A new project, "Development of new technologies for the control of citrus huanglongbing (HLB) in Southeast Asia," commenced in April 2004.

To this end, JIRCAS concluded a new MOU with SOFRI on August 2, 2004. The collaboration put forth in the MOU comprises the planning and implementation of predetermined and mutually agreed-upon research projects and improving technologies related to fruit production for the benefit of producers in Vietnam. A work plan outlining research subjects included in the project has been included in the MOU.

Comprehensive MOU to strengthen future cooperation with the Republic of Korea

JIRCAS has undertaken a new approach to solving the problems faced by developing countries by working together with research institutions of other advanced nations. The Rural Development Administration (RDA) of the Republic of Korea is the central government organization responsible for extensive agricultural research and services in Korea. The Administration is comprised of the National Agriculture Research and Extension System, ten research institutes, one educational agency, and four bureaus and offices within their headquarters.

On May 28, 2004, Mr. Young Wook Kim, Administrator of the RDA, visited JIRCAS, where discussions took place on the possibility of concluding an MOU with JIRCAS. Subsequently, in the following

September, Dr. Akinori Noguchi, Vice-President of JIRCAS, visited the RDA and discussed the MOU's final plan. As a result, JIRCAS concluded a comprehensive MOU with the RDA on September 13, 2004. Forms of collaboration described in the MOU are as follows: Mutual exchange of scientists, experts, and trainees; exchange of scientific and technical information; development and utilization of a database on agricultural research in developing countries; joint organization of seminars, symposia, conferences, and other scientific meetings on subjects of common interest; and joint planning and implementation of collaborative research with developing countries.

Dr. Hong-Kil Moon, Deputy Director of the International Technical Cooperation Center (ITCC), visited JIRCAS in December 2004. The ITCC facilitates and manages the international affairs of the RDA. During his two-day visit, Dr. Moon inquired about JIRCAS's organization, budget, and present research activities, as well as planning procedures for new JIRCAS projects and research strategies, and discussed future RDA-JIRCAS collaboration based on the MOU with JIRCAS's International Relations Section. On the JIRCAS side, it was proposed that the ITCC participate in several areas corresponding to research projects that JIRCAS is currently carrying out in developing countries.

Comprehensive Agreement and Memoranda of Understanding signed for a new collaborative research project with the People's Republic of China

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

This project had been proposed at the 21st meeting of the China-Japan Agricultural Science and Technology Exchange Group in 2002, and the idea was further developed through a review process undertaken by experts from both countries. In June 2004, a pre-evaluation meeting was held at Tsukuba,



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

where the relevance of the project to current agricultural problems in China was emphasized, and the importance of mutual concurrence on the final outputs of the project and the need for integrating socio-economic subjects with other disciplines was stressed.

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

These official procedures marked the launch of this new five-year project as an inter-governmental collaborative research project. Several new approaches were adopted in the management of the project. For example, cooperation among the counterpart research institutes will be strengthened to achieve a better overall project outcome, and evaluation and planning meetings are to be held periodically.

Renewal of existing Memorandum of Understanding with the International Institute for Tropical Agriculture (IITA) in order to reinforce research activities in Africa

Aiming at further strengthening our agricultural research programs in Africa, JIRCAS renewed an existing Memorandum of Understanding with the International Institute for Tropical Agriculture (IITA), which had been executed in March 1990 between IITA and JIRCAS's predecessor, the Tropical Agriculture Research Center (TARC). A ceremony to execute the new MOU between IITA and JIRCAS was held at JIRCAS's Tsukuba premises on October 14, 2004, and was attended by signatories Dr. Peter Hartmann, Director General of IITA, and Dr. Mutsuo Iwamoto, President (former) of JIRCAS. JIRCAS Vice-President Dr. Akinori Noguchi witnessed the event.

IITA was founded in 1967 with a mandate to improve food production in the humid tropics based on the development of sustainable production systems. The mission of IITA is to enhance food security, increase income levels, and contribute to the well-being of resource-poor people in sub-Saharan Africa by conducting research and related activities leading to increased agricultural production, improved food production systems, and the sustainable management of natural resources. Its research agenda addresses crop improvement, plant health, and resource and crop management within a food systems framework in the context of the needs of designated major agro-ecological zones. Research focuses chiefly on cassava, cowpeas, maize, plantains and bananas, soybeans, and yams.

In 2003, JIRCAS initiated and has since been conducting a new project aimed to improve the fertility of sandy soils in the Sahelian zone through organic management in collaboration with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). Given that this project deals with organic materials, plant germplasm such as that for cowpea is considered to be of much significance in improving soil fertility. In order to identify which types of plant germplasm have the greatest potential to increase soil fertility in various target regions, we believe that our partnership with IITA is essential in carrying out the necessary research. In this regard, as JIRCAS furthers its research programs in Africa, cooperation with IITA and its wealth of experience and

accumulated research assets will lead to yet new opportunities in sub-Saharan Africa.

Comprehensive Memorandum of Understanding to strengthen partnership with the French Agricultural Research Centre for International Development (CIRAD)

As described in the previous article on the conclusion of an MOU between JIRCAS and the Republic of Korea's Rural Development Administration (RDA), JIRCAS has initiated a new approach to international collaborative research in which partnerships are created with research institutions in other advanced nations. On December 17, 2004, JIRCAS concluded a comprehensive MOU with CIRAD (Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement: the French Agricultural Research Centre for International Development) to strengthen future cooperation shortly following the MOU with the RDA. The signing ceremony, held at the French Embassy in Tokyo, was attended by signatories Dr. Patrice Debré, President of CIRAD, and Dr. Mutsuo Iwamoto, President (former) of JIRCAS. Dr. Akinori Noguchi, JIRCAS Vice-President, and the French Attache for Science and Technology, Dr. Stéphane Roy, witnessed the event in the presence of French Ambassador Mr. Bernard de Montferrand and CIRAD Coordinator Dr. Patrick Durand as well as representatives from JICA and Japan's Ministry of Foreign Affairs.

CIRAD was established as a French research center after World War II in order to address issues related to agriculture, forestry and fisheries research and development in developing countries. CIRAD's mandate is to

contribute to rural development in tropical and subtropical countries through research, experimentation, training operations in France and overseas, and scientific and technical information, primarily in the fields of agriculture, forestry, and agri-foods. This mandate has been broadened to include environmental issues and natural resource management, and also involves the drawing up of public development aid policy. CIRAD's staff numbers approximately 1,800 personnel, of whom about 650 are carrying out overseas assignments. In the past, CIRAD's main research fields were located in Indochina and Africa, especially in Côte d'Ivoire. Currently, however, Brazil and Vietnam are the principal countries in which research activities are being implemented. JIRCAS's predecessor, the Tropical Agriculture Research Center (TARC), which was established in 1970, is modeled after CIRAD.

JIRCAS launched a new project in Fiscal Year 2004 aiming to control citrus huanglongbing (HLB) disease in Vietnam, in collaboration with Vietnam's Southern Fruit Research Institute (SOFRI) and CIRAD. Our partnership with CIRAD will be central to the effective implementation of this project. Likewise, with regard to our research programs in Africa, we expect that future cooperation with CIRAD, given the organization's substantial track record of achievement in that area, will be an added boost. Along these lines, JIRCAS is planning further collaboration with CIRAD in order to contribute to our common goals of alleviating starvation and poverty worldwide.

JIRCAS signs MOU with the Asian Regional Center of the World Vegetable Center (AVRDC-ARC) and Kasetsart University

On March 2, 2005, Dr. Mutsuo Iwamoto, President (former) of JIRCAS, Dr. Masaaki Suzuki, Director of the AVRDC-ARC, and Dr. Rungsit Suwanketnikom, Director of the Research and Development Institute of Kasetsart University signed a Memorandum of Understanding (MOU) in order to launch a collaborative research project entitled "Physiological functionalities of indigenous vegetables in Southeast Asia."

The project is being implemented focusing on 1) Evaluation of the functionalities of indigenous vegetables, 2) Isolation and identification of bioactive compounds from vegetables with high functionalities, and 3) Elucidation of horticultural factors enhancing these functionalities. The ultimate goal of the

MOU-signing ceremony between JIRCAS and CIRAD at the French Embassy in Tokyo.

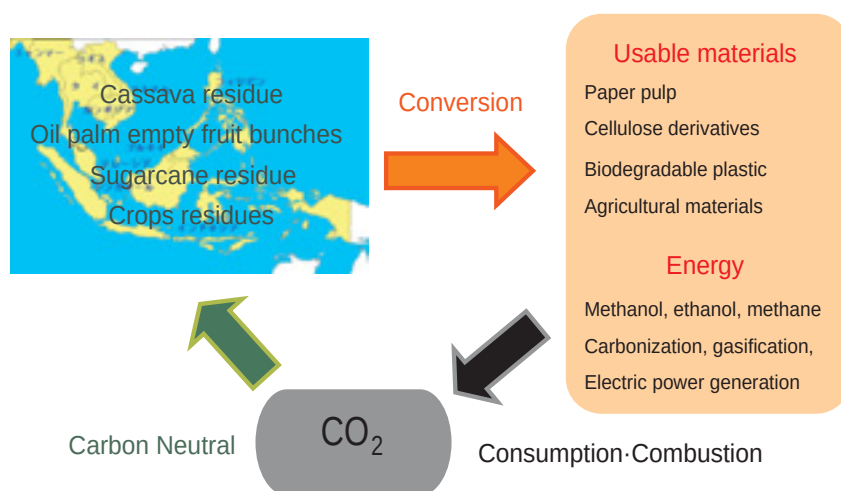


project is to improve the economic status of farmers in Southeast Asia by adding new value to local indigenous vegetables, and to provide safer and healthier food for consumers.

New projects

Utilization of biomass resources in Southeast Asia for sustainable development

Southeast Asian countries are expected to make rapid economic progress, which due to their large population will have a great impact on the world's energy situation and the environment. To contribute to attaining sustainable development in Southeast Asia with minimum pressure on the environment, JIRCAS has launched a six-year (2005-2010) project entitled "Utilization of biomass resources in Southeast Asia for sustainable development." This project deals with the following two primary themes: 1) Developing regionally optimized biomass conversion technologies for energy and production of usable materials; and 2) Drawing up of blueprints for sustainable social systems for



selected areas through utilizing locally available biomass resources such as agricultural and forestry residues.

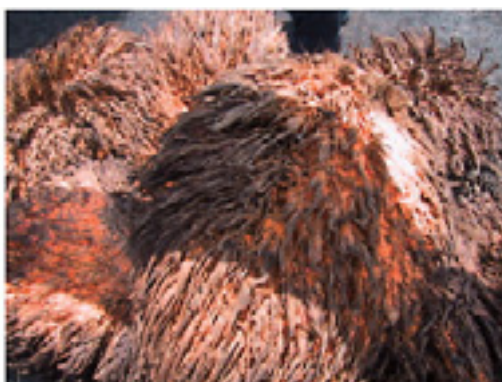
In 2005, one subject under Primary Theme 1, "Development of an ethanol fuel production system from tropical soft biomass," commenced in Thailand. The aim of this topic is the production of an alternative fuel to petroleum using agricultural waste, such as rice husks/straw, sugarcane bagasse/leaves,

Fig. 1. Potential of biomass resources in Southeast Asia for energy and materials.

Cassava root



Oil palm empty fruit bunches



Sugarcane



Wild relatives of sugarcane



Fig. 2. Typical biomass resources in Southeast Asia. (Photos: Y. Mori et al.)

and cassava stalks/peel. The remainder of the project is scheduled to start in 2006 and includes the “Production of usable materials from tropical forestry residues in Malaysia.”

The outcomes of the project will also provide basic means by which Japan can obtain Clean Development Mechanism (CDM) credits and achieve the carbon dioxide emission reduction target imposed by the Kyoto Protocol.

Physiological functionalities of indigenous vegetables in Southeast Asia

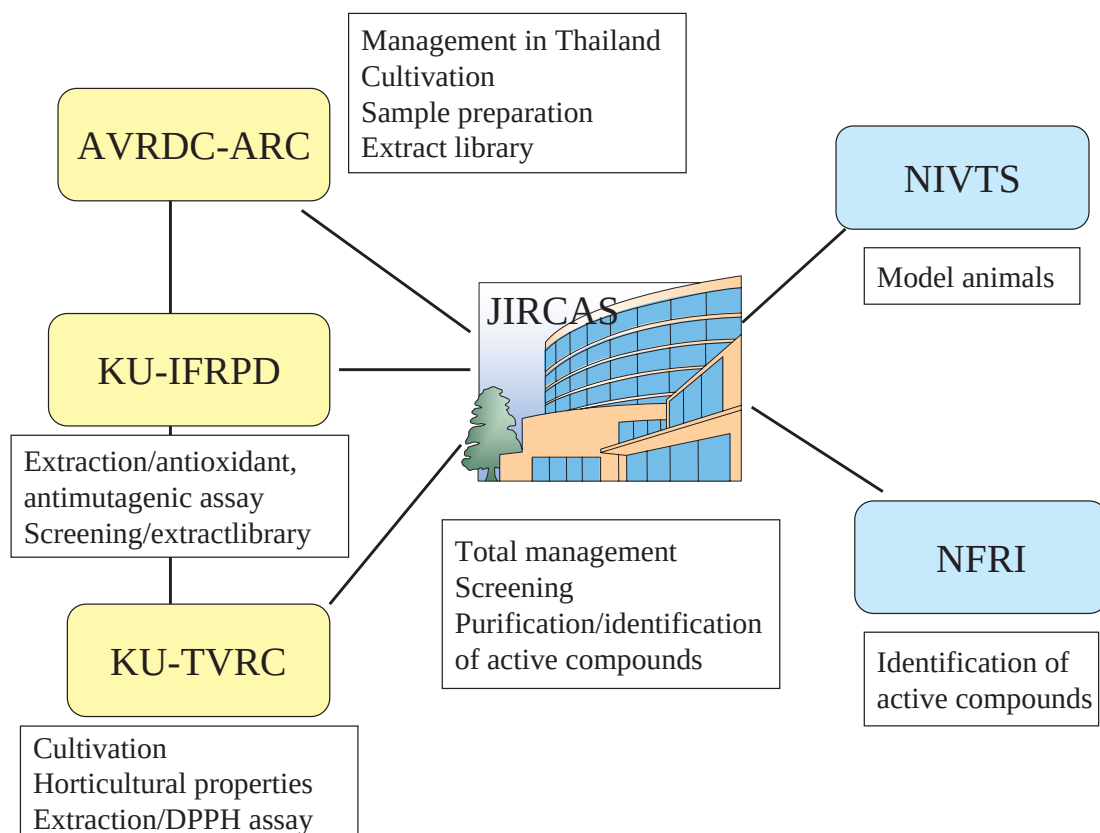
Vegetables are important sources of nutrients necessary for human health. Recent research has indicated that they also supply a wide variety of compounds called functional components which exhibit chemopreventive effects against various diseases. In Southeast Asia, thousands of indigenous plants have been utilized as vegetables which have the potential to serve as major sources of functional components. It is expected that thorough and reliable scientific data on functionalities will provide new economic value to indigenous vegetables and attract consumers.

In 2004, JIRCAS launched a three-year project entitled “Physiological functionalities of indigenous vegetables in Southeast Asia”

in cooperation with the Asian Regional Center (ARC) of AVRDC - the World Vegetable Center (AVRDC-ARC), the Institute of Food Research and Product Development (IFRPD), and the Tropical Vegetable Research Center (TVRC) of Kasetsart University (KU), Thailand, as well as Japanese institutions such as the National Institute of Vegetable and Tea Science (NIVTS) and the National Food Research Institute (NFRI). The project is being implemented focusing on 1) Evaluation of antioxidant capacity, antimutagenicity, and several other important functionalities of indigenous vegetables; 2) Isolation and identification of highly active antioxidative and antimutagenic principles from selected vegetables; 3) Elucidation of horticultural factors controlling antioxidant capacity and antimutagenicity in some selected vegetables; 4) Confirmation of bioavailability using model animals; and 5) Drawing up of an inventory and extract library of indigenous vegetables.

The overall goal of this project is to improve the economic status of farmers in Southeast Asia by adding new value to local indigenous vegetables and to provide safer and healthier food for consumers through the evaluation of indigenous vegetables from the viewpoint of food functionality.

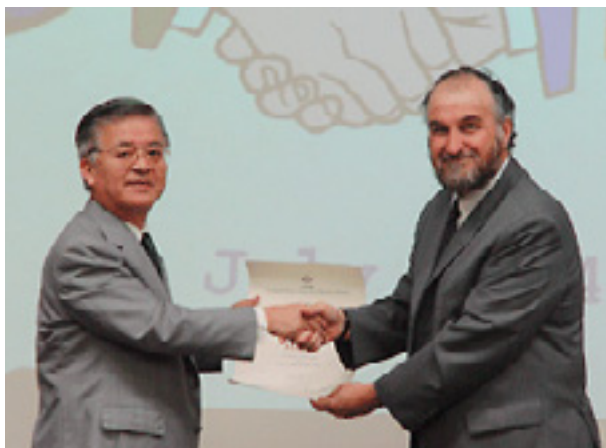
The roles of participating organizations in the project.



OTHER HIGHLIGHTS

JIRCAS CHOSEN AS CGIAR FOCAL POINT INSTITUTION

CGIAR Director Dr. Francisco Reifschneider presented a scroll to former JIRCAS President Dr. Mutsuo Iwamoto, on July 26, 2004, acknowledging JIRCAS's long-standing support to international agricultural research and the CGIAR system, and identifying JIRCAS as a "key partner of the CGIAR and thereby as a CGIAR focal point institution in Japan." We are indeed pleased and honored by this recognition on behalf of the CGIAR.



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 2004.

Dr. Tomoyuki Suzuki, researcher in the Animal Production and Grassland Division, received the Young Scientist Award at the 11th International Congress of the Asian-Australasian Association of Animal Production Societies held in Kuala Lumpur, Malaysia on September 5-9, 2004 for his work, "Utilization of mixed silage prepared with sugarcane, brewer's grain and rice straw." In this research, Dr. Suzuki developed a new way of using sugarcane as a ruminant feed. Despite there being many varieties of sugarcane, only those used for sugar production have up to now been actively cultivated. However, many other types of sugarcane have useful characteristics, including high biomass yield, drought tolerance, and sustainability. Dr. Suzuki evaluated the nutritional value of many types of sugarcane and hybrids of *Saccharum spontaneum* or *Erianthus* spp. and selected cultivars suitable for use in ruminant feed. He also developed storage methods for sugarcane silage and identified optimal harvesting intervals to obtain better quality feed.



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 163 staff members, including research scientists and administrators. Thirty-five 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 an administrative office 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 multidisciplinary 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 eight 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 Incorporated 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 in both 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 outcomes 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 Annual Plan are firstly evaluated at the

(con't on p. 24)

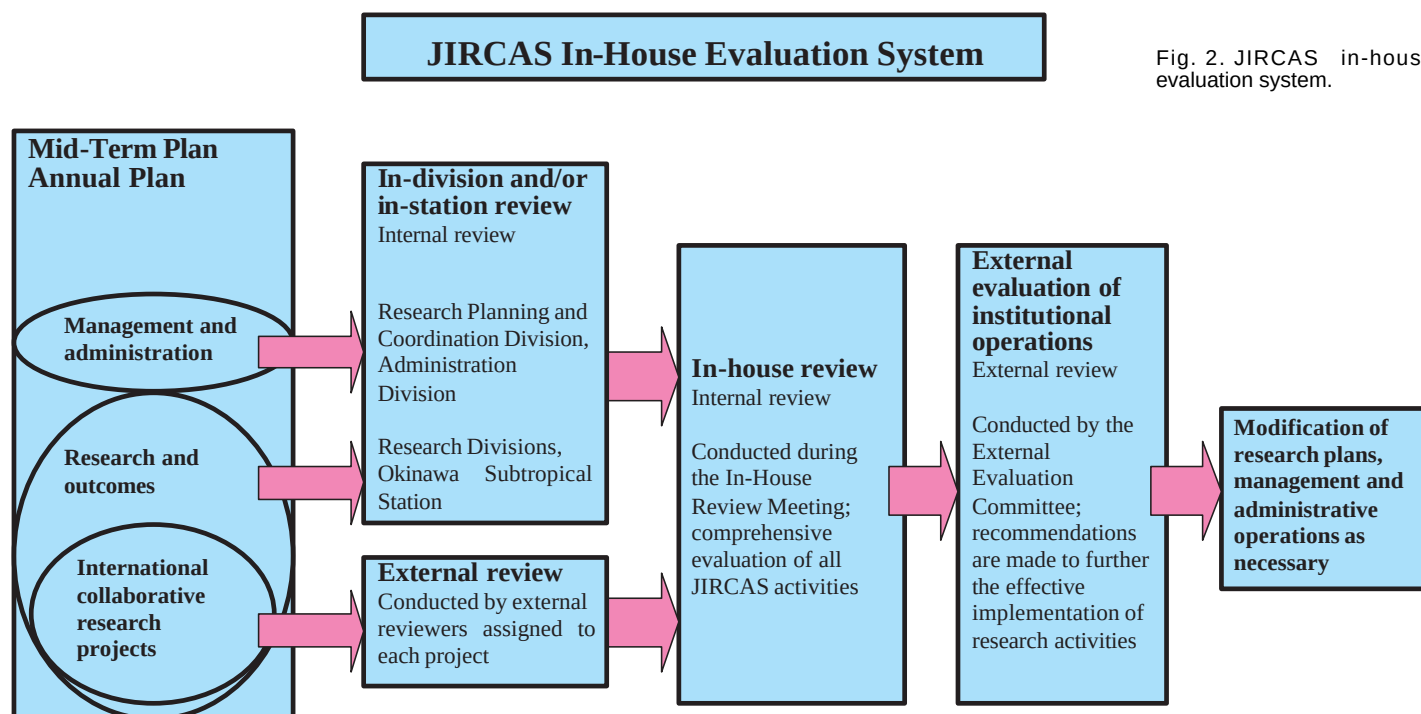


Fig. 2. JIRCAS in-house evaluation system.

Table 1.

JIRCAS Mid-Term Plan (April 2001–March 2006) Experiments, research, and investigations		Soybean production and utilization in South America
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 for 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 in the development of sustainable farming systems in Indonesia, Vietnam, Thailand, South America, and other regions		●
B. Research in to 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		

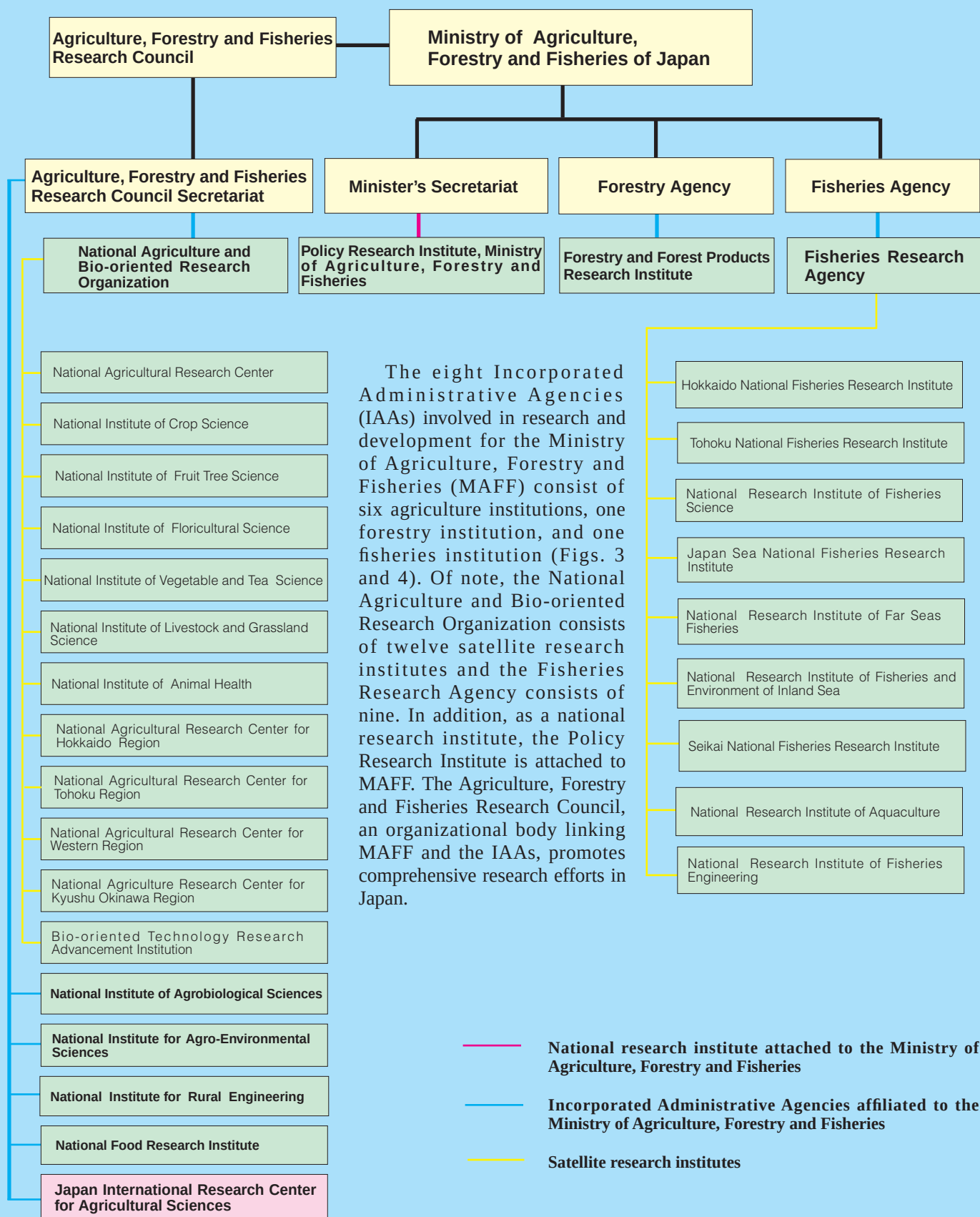
[illegible]

Table 1.

JIRCAS Mid-Term Plan (April 2001–March 2006) Experiments, research, and investigations	
	Soybean production and utilization in South America
(3) Uses for underutilized wood resources such as oil palm residue	
(4) Uses for underutilized 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 biodiversity 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 programs 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 generational advancement of rice, wheat, and other crops	

INTERNATIONAL COLLABORATIVE RESEARCH PROJECTS								MISCELLANEOUS PROJECTS		PROJECTS WITH OTHER GOVERNMENT AGENCIES	COMMISSIONED RESEARCH AND MAFF SPECIAL RESEARCH ALLOTMENTS
	Reducing postharvest losses of staples in Southeast Asia	Agroforestry technology for tropical forests	Production systems in brackish mangrove areas	Efficient use of water resources in rainfed agriculture	Improvement of soil fertility in West Africa	Stable food supply systems in China	Control of citrus HLB in Southeast Asia	DOMESTIC PROJECTS	DOMESTIC PROJECTS SUPPORTED BY MAFF		
								●		●	
								●		●	
								●	●	●	
								●	●	●	●
										●	
				●		●		●	●		
		●									
			●								
								●			
				●				●			
								●		●	
							●	●			
								●	●	●	
								●	●		

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 Agriculture and Bio-oriented Research Organization consists of twelve 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. 17)

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 served by a Chairman, Vice-Chairman, Editors-in-Chief, Editorial Committee, and Advisory Panel. (front row: Kunimasa Matsumoto, Fumio Yoshida, Masami Yasunaka, Marcy N. Wilder; back row: Ryuichi Yamada, Yoshinobu Egawa, Junji Hashimoto, Noriko Moriyama)



The background of the entire page is a marbled paper pattern. It features intricate, swirling, and veined designs in various shades of purple, from light lavender to deep, dark violet, set against a white or very light cream base. The pattern is organic and non-repeating, typical of traditional marbling techniques.

RESEARCH OVERVIEW

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 2004, JIRCAS was involved in eight comprehensive projects in the People's Republic of China; South America including Brazil, Argentina, and Paraguay; Southeast Asia including Malaysia, Thailand, Vietnam, and the Philippines; and West Africa including Niger. 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 Vietnam, Thailand, Malaysia, and the Philippines 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. 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, socio-economic studies are conducted to identify research priorities in counterpart countries. A complete listing of comprehensive projects undertaken by JIRCAS researchers can be found at the end of this section.

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

The soybean is an important staple crop, as it provides a major source of food, oil, and protein-rich livestock feed. Production of this valuable crop has increased substantially in the past three decades in comparison with major grains. At present, Brazil, Argentina, and Paraguay (MERCOSUR countries) account for half of global soybean production, placing them among the leading soybean export countries. Recent high market prices for soybeans have motivated farmers to engage in continuous soybean production and to rapidly expand soybean cultivation into areas with environmentally vulnerable conditions such as arid and acid soils characterized by low fertility. Continuous cropping may cause serious outbreaks of pests and diseases, and soil erosion may adversely affect future soybean production. Comprehensive and multinational research efforts to develop sustainable and more efficient systems of soybean production in South America are an important way of addressing these concerns.

The project framework consists of three primary themes: 1) Development of breeding

technologies for soybean and grasses, 2) Agro-ecological and physiological characterization in agro-pastoral systems, and 3) Improvement of agro-pastoral systems. These research themes have been implemented in collaboration with several South American (MERCOSUR) and Japanese research organizations, including the Brazilian Agricultural Research Corporation (EMBRAPA) in Brazil, the Ministry of Agriculture and Livestock (MAG) in Paraguay, the National Institute of Agricultural Technology (INTA) in Argentina, the Japan International Cooperation Agency (JICA), the National Federation of Agricultural Cooperative Associations for Colonization (JATAK), and other Japanese research institutes and universities.

Soybeans have been damaged by drought over two consecutive crop seasons, especially during 2003-2004 and 2004-2005. Development of a drought-tolerant soybean is one of the major targets of the project, and molecular biological and physiological studies of drought tolerance are now being carried out. In collaboration with the Centro Nacional de Pesquisa de Soja (CNPSo), EMBRAPA, several transformants using the DREB gene have been obtained with the aim of further molecular and genetic investigation of its expression in soybeans. On the other hand, to isolate soybean stress-inducible genes and stress-inducible promoters, approximately 20,000 full-length soybean cDNA clones have been sequenced from both the 5'- and 3'-ends. A microarray system will be developed using these sequence data.

Soybean rust has become the most serious disease of soybeans since the first outbreak in Paraguay and Brazil in 2001. Patho-ecological studies have continued in collaboration with CNPSo, which have identified further expansion of the disease and voluntary soybean and several wild-growing hosts susceptible to rust in the winter. A JIRCAS nematologist, based at Instituto Agronomico Nacional (IAN), MAG, Paraguay, reported the soybean cyst-nematode at several new sites but serious damage caused by cyst-nematodes, fortunately, remains limited.

A large-scale field experiment conducted at JICA's Centro Tecnológico Agropecuario en Paraguay (CETAPAR) resulted in a higher yield of soybeans in agro-pastoral plots than in continuous soybean cropping plots. The effect of soybean by-products used as winter supplements on the digestive function of grazing beef cattle and the effect of soybean

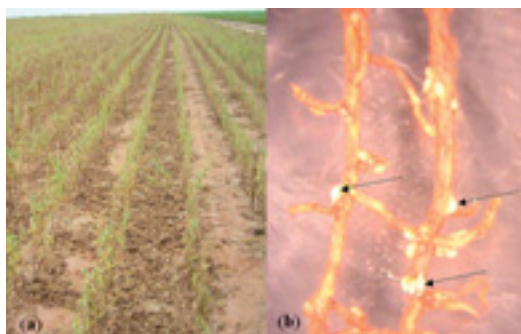


Fig. 1. (a) Severe soybean rust damage in Brazil and (b) cysts (arrows) on infested soybean roots in Paraguay.



Fig. 2. Beef cattle on an agro-pastoral farm system in Brazil.

silage on the milk yield of dairy cattle were examined in collaboration with INTA.

In FY2003, JIRCAS dispatched six long-term and seven short-term scientists to EMBRAPA, MAG, and INTA. One scientist from INTA and one from CETAPAR-JICA were each invited for collaborative studies for one month.

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

A five-year (2000-2004) project entitled "Development of low-input technology for reducing postharvest losses of staples in Southeast Asia" has been completed. This project was implemented to address the serious problem of the postharvest loss of staples, estimated at approximately 30% in Southeast Asia, due to improper drying and insect infestation under hot and humid climatic conditions. The project focused on the following four primary themes: 1) Survey of postharvest losses of rice and identification of factors effecting quality change; 2) Analysis of the annual incidence of major

insect pests found in stored products, sources of damage and possible prevention; 3) Development of low-input drying technology and biological control of insect pests using natural enemies and bioactive botanical substances; and 4) Development of environment-friendly technologies for reducing postharvest losses of staples. The project was conducted in collaboration with the Thai Department of Agriculture, Kasetsart University, King Mongkut's University of Technology, and Japanese institutions such as the National Food Research Institute and the National Agricultural Research Organization.

The major outcomes of the project as a whole were as follows: from Theme 1, 1) the effects of storage on physicochemical properties of rice and the quality of cooked rice and rice noodles were clarified; and 2) the effects of packaging and temperature on 2-acetyl-1-pyrroline content change in aromatic rice were clarified. From Theme 2, 3) 29 species (7 families) of parasitoids and 50 species (5 orders) of predators were collected, of which 6 parasitoids and 4 hemipteran species were concluded to have potential as biological agents against insect pests; 4) a diagram of the relationships among the pests and their natural enemies was developed; 5) mass rearing conditions and the efficacy of *Anisopteromalus calandrae* against maize weevils were clarified, and 6) a guidebook categorizing the natural enemies of insect pests in Thailand was compiled for the first time and published. From Theme 3, 7) pre-drying methods using a portable blower and various natural adsorbents were developed; 8) a total drying system comprising rapid drying at high temperatures with high air flow, fluidized-bed drying, in-store drying, and

drying with desiccant has been proposed; 9) the predatory ability of the predacious bugs *Amphibolus venator* and *Joppeicus paradoxus* was clarified, and patent applications were filed for technology using *J. paradoxus* as a new natural enemy of stored-product insect pests; 10) suppression effects of parasitoids including *Theocolax elegans* on maize weevil, *Sitophilus zeamais*, in drums of brown rice were clarified; 11) natural products such as citronella grass, lemon grass, pomelo peel, long pepper, dodders, and basils were found to have suppressant activities on weevils, the red flour beetle, and fungi; and 12) the bioactive components of natural products were purified and identified. From Theme 4, 13) effectiveness of cleaning of stores was clearly confirmed to prevent insect infestation of rice, especially during storage for as long as one month; and 14) the simultaneous use of bioactive botanicals and natural enemies appeared to be effective in suppressing insect pests. Those methods are inexpensive and thus thought to be affordable to small farmers in Southeast Asia.

MALAYSIA: Development of agroforestry technology for the rehabilitation of tropical forests

In Fiscal Year 2000, the Forestry Division initiated a joint research project entitled "Development of agroforestry technology for the rehabilitation of tropical forests," aiming to mitigate agriculture-forestry conflicts as well as to promote environmental conservation and sustainable management of forest resources. The project was implemented mainly in collaboration with the Forest Research Center (FRC) of the Forest Department of the State Government of Sabah, Malaysia.

The following four research topics have been the main focus of this project: technological development to enable the establishment of a favorable environment for agroforestry production; environmental evaluation in the context of agroforestry production; development of technologies to create efficient methods of growing both arboreal and non-arboreal crops under forest canopies; and finally, socio-economic analysis of agroforestry activities.

Since December 2001, three JIRCAS researchers specializing in silviculture, soil science, and mycology have been dispatched

Participants at the final evaluation meeting of the project.



on long-term assignments. All of them fulfilled their research assignments and have returned to JIRCAS; the next researchers specializing in silviculture and soil science have been on assignment since December 2003 and December 2004, respectively. During Fiscal Year 2004, JIRCAS dispatched six short-term researchers to the FRC. Two of them were dispatched in the field of silviculture in June and November 2004, one in soil science in March 2005, one to conduct chemical analysis of medicinal trees in February 2005, and the last two for the purpose of socio-economic analysis of agroforestry activities in March 2005. Mr. Jaffirin Lapongan, the head of the FRC's Plantation Laboratory, was invited to JIRCAS in March 2005 to exchange opinions and review progress made under the project. JIRCAS also invited Mr. Mohamed Bazain Bin Idris, the Sabah State Attorney-General, and Mr. Anuar Mohamad, the head of the Sabah Biodiversity Center, to Japan in February 2005 in order to discuss various issues relating to the development of agroforestry technology.

JIRCAS organized a workshop on December 1-2, 2004 in collaboration with the FRC to report on the progress of the project. Twelve researchers taking part in the project



reported the progress of their studies. More than 100 participants from various institutes attended, including the FRC, the Sabah Forestry Department, universities, logging companies, and timber industry associations. On the second day of the workshop, an excursion was arranged to the FRC's agroforestry experimental plots at its Kolapis Station. More than 30 participants took part and exchanged technical information related to agroforestry systems.

Agroforestry experimental plot at the Kolapis Station of the Sabah Forest Research Center in Malaysia.

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

Since the previous fiscal year, a second long-term researcher has joined this project, and is residing at the Fisheries Research Institute Malaysia (FRIM) in Penang. This participation is expected to greatly accelerate research on spatio-temporal abundance and trophodynamics of larvae and juveniles of economically important fish species in the Matang Mangrove. At the same time, an animal physiologist has been sent to Thailand replacing previous personnel, and will promote studies on the evaluation and improvement of aquaculture pond environments. The over-arching goal of this project is to deliver a new aquaculture system model upon its completion.

Viral nervous necrosis (VNN) disease, which induces mass mortality in fish following infection, causes serious damage to the aquaculture industry all over the world.

Losses are especially significant with the orange-spotted grouper and other economically important species in the Philippines. A Division researcher on a long-term assignment to the Southeast Asian Fisheries Development Center (SEAFDEC) in Ilo Ilo is working to develop rapid diagnosis methods based on cell culture and PCR that will allow the early detection of the disease and thus circumvent large-scale outbreaks. The results of this research this past year have revealed several areas that require subsequent attention. Most groupers were thought to be already infected with the virus, but further in-depth investigations will be required in order to elucidate the background infection rate. If this rate is very high, it may be necessary to develop virus-free broodstock; moreover, it may be necessary to develop better diagnostic methods. The sensitivity of the cell culture method was not yet sufficient for detecting the virus in minute quantities, and PCR methods also exhibited scope for improvement. At present, it is not possible to obtain samples without sacrificing fish, as the main infected



Scene from after the tsunami in Matang, Malaysia. Aquaculture facilities here were completely destroyed.

tissue consists of the central nervous system. To this end, we hope to develop non-destructive methods of viral analysis

In addition, several dominant species were identified by analysis of macro-benthic fauna in coastal areas and aquaculture ponds in Thailand from the viewpoint of developing or selecting appropriate shrimp feeds and improving aquaculture pond environments. Fluctuations in numbers of certain species during the experimental period suggest that they could be used as natural feeds. As a result of this research, it is expected that the relationship between living systems in aquaculture ponds and mangroves will be elucidated, and that useful data will be obtained for maintaining the environment of aquaculture pond environments.

On December 26, 2004, a destructive earthquake occurred off the north coast of Sumatra. The tsunami of unprecedented scale that resulted swamped coastal areas in Thailand facing the Indian Ocean. The death toll was estimated at more than 200,000, but it also caused massive damage to the fisheries industry, particularly in Thailand. One of our research sites, located in Matang, Malaysia as shown in the photo, was destroyed in entirety. Changes in the landform of the sea bottom caused by the earthquake may affect the stocks and migration routes of commercially important fish species such as grouper.

INDOCHINA: Increasing economic options in rainfed agriculture in Indochina through efficient use of water resources (Rainfed Agriculture)

Rainfed regions where agricultural production is totally or largely dependent on rainfall are widely distributed in the central part of the Indochina Peninsula. Erratic rainfall and lack of water in dry seasons are major constraints on increasing agricultural production in rainfed agriculture. To improve agricultural production in these regions, development of technologies for efficient utilization of water resources is essential. Technologies are needed not only to achieve better utilization of water resources, but also to integrate various technologies into farming systems that will increase economic options. Furthermore, in order for farmers to adopt new technologies, they need to be involved in their development through on-farm research conducted using a farmer-participatory approach. This project aims to develop specific technologies for the collection, storage, and distribution of water, together with crop and animal production technologies characterized by high water use efficiency. The target areas of the project are lowland-upland boundary zones spread over northeast Thailand and Laos where small-scale mixed farming is predominant. The project consists of three main themes: 1) Assessment of regional water availability and identification of factors limiting more efficient use of water in existing farming systems, 2) Development of crop production technologies for more effective water use, and 3) Adaptation and integration into farming systems of new technologies through participatory methods.

As in the previous year, the project was carried out through an Annual Planning Meeting at the start of the project year and an Annual Results Meeting at the end of the project year. The Planning Meeting was held this year on July 21 and 22, 2004 and the Results Meeting was held on February 24 and 25, 2005, with scientists from JIRCAS and counterpart organizations presenting and participating actively in both meetings.

One of the strategies adopted by the project from its start three years ago is the site-based approach, in which Nong Saen Village, 40 km south of Khon Kaen City, was chosen for multidisciplinary research. Some of the research highlights obtained are as follows. 1) In the catchment area where the

village is located, a considerable volume of groundwater resources is present in the deep soil layer (5-30 m). It was shown that the groundwater is recharged at elevations higher than 200 m above sea level and discharged into rivers and lakes at elevations lower than 170 m. 2) A hydrologic model was developed for estimating daily water movements in rainfed paddies. The model was combined with a rice yield sub-model to estimate the impact of water stress on rice production. It was applied to a 20 km² area and rice yields in 2002 and 2003 were estimated. The results showed that the estimated yield in 2002 was higher than that in 2003, which agreed with actual conditions. 3) Three programs were carried out as part of participatory technology development with farmers. i) The cultivation of tomatoes with reduced irrigation was tested by 10 farmers in 44 trials and 84% of them were managed with less than 30 mm of irrigation. Almost 50% of farmers succeeded in harvesting more than local average yields. ii) Pasture fields were established with cattle farmers, and feeding trials were conducted using forage from fields, sugarcane silage, or low quality roughage. Based on discussions with farmers and trial outputs in the village, the optimal type of sugarcane for providing roughage during the dry season was identified. iii) The integrated farming group was launched in the rainy season, when



vegetable prices are high but production is limited by excessive rain, erosion, and pond water competition with rice. Mesh (farmer-proposed) and clear plastic (researcher-proposed) roofs increased tomato, shallot, and coriander yield. For tomatoes, plastic had the highest rates of return of 39% at a price of 27.25 B*/kg (range 5-50 B/kg). Mesh had the highest rates of return of 55% for coriander at a price of 11 B/kg (range 7-15 B/kg) and 83% for shallots at a price of 25 B/kg (range 10-40 B/kg). The magnitude of the effect varied with the type of farmer management. (*B = Thai baht)

Participants at the Annual Results Meeting held on February 24 - 25 in Khon Kaen. Presentations and discussions were held on the research results from 2004-2005.

WEST AFRICA: Improvement of the fertility of sandy soils in the semi-arid zones of West Africa through organic matter management

The Sahel, the southern peripheral region of the Sahara Desert, is frequently afflicted by devastating drought and resulting famine. The sandy soils of the Sahel are very poor and infertile. To battle these harsh environmental conditions, close cooperation has developed among millet/sorghum-based farmers and cattle herders. Agro-pastoral practices form the basis of the agricultural systems in this region. However, current population growth and soil management that is not able to cope with climate change have affected the agro-environmental resources of the region, and are now endangering the sustainability of agriculture and the livelihood of the people.

The sandy soils in the Sahel contain a very small amount of clay, which acts as a nutrient-

retaining medium. This low nutrient capacity is an intrinsic limiting factor on agricultural production in the region. In such soils, organic matter (OM) plays an important role in soil fertility as both a source of nutrients and a medium for their retention. Even with sufficient use of chemical fertilizers, the maintenance of soil organic matter is important for the preservation of soil fertility. However, the mechanism and effectiveness of OM in sandy soils in semi-arid zones have not been sufficiently elucidated. Of greater concern, sources of OM, such as crop residues and manure, are in short supply, impeding the improvement of soil fertility through organic matter management. To address these problems, JIRCAS has initiated a five-year project that began in April 2003 at Niamey, Niger, with the additional collaboration of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and Kyoto University.

The goal of the project is to study the

Cassia mimosoides, an annual leguminous herb and a highly promising native plant with the ability to improve soil fertility, growing in fallow land in Niger.



structures and functions of organic-inorganic complexes in sandy soils under semi-arid conditions. Since pressing concerns, especially agriculture-related problems in Africa, have been forcing scientists to develop solutions within short periods of time, 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. It has recently been demonstrated that there is a wide variation among crop species in their ability to utilize different fractions of organic nitrogen in soils. Accumulating fundamental information and knowledge such as this could be useful in developing rational fertility management systems for the region. The project also implements systematic evaluation of plant genetic resources, with emphasis placed on the use of legume crops for efficient utilization in agricultural systems. Indigenous and exotic plant genetic resources will be evaluated from the viewpoint of soil fertility preservation, such as production of biomass as a source of OM, 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 sustainable management of natural resources to preserve soil fertility will be proposed and tested by means of on-farm trials with the close collaboration of ICRISAT, Kyoto University, and other research institutes in the region.

Now in its second year, the project has followed each research path set out in the overall work plan. The project has achieved several important findings for soil management. At the project site at Fakara

near Niamey, several villages were selected as monitoring spots, in which indigenous knowledge and information on agricultural practices and relationships between farmers and pastorals have been collected. Analyses of the soils sampled in this region have indicated that the activities of microorganisms in the sandy soil appear to be controlled mainly by the availability of carbon sources, rather than by water content, implying that fallowing and/or corraling have been playing important roles in releasing nutrients. Analysis of phosphate buffer-extractable organic nitrogen (PEON) has revealed that PEON is playing an important role as a major nitrogen donor for major crops such as pearl millet in this region. To select germplasm suitable for this region, more than 160 cowpea lines have been evaluated in the field, and several have been selected based on their abilities as a supplier of biomass. Based on analysis using stable isotopes ($\delta^{15}\text{N}$), we have identified several indigenous plant species that appear to contribute significantly to maintenance and improvement of soil fertility in this region.

CHINA: Studies on stable food supply systems for mitigating the fluctuations of production and markets in China

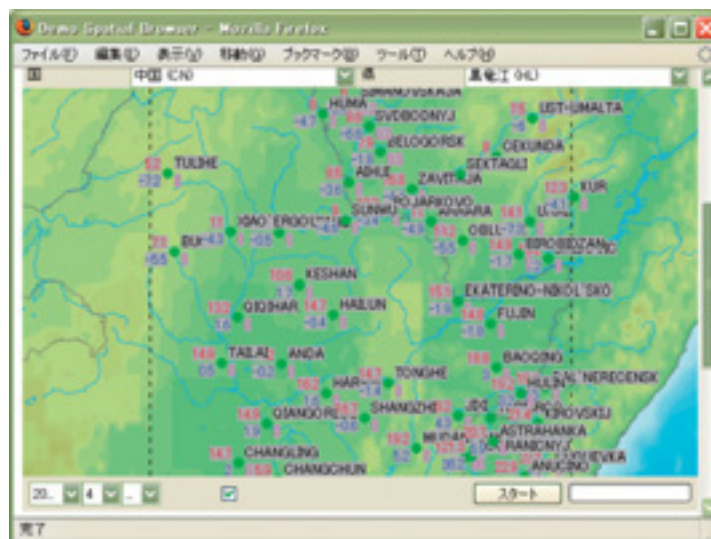
The specific objectives of this new five-year project are: 1) To develop early-warning systems for mitigating the risks caused by climatic disasters such as cool summers and droughts through technological enhancement of agro-meteorological monitoring and crop-model simulation, and 2) To propose alternative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

After a series of formal processes, i.e., a pre-evaluation meeting (June 2004), comprehensive agreement by the governments involved (July 2004), and signing of MOUs (September 2004), the various research programs were launched. The project is composed of two major research topics: one on the development of early warning systems, and the other on proposals of policy measures for rural economy stabilization. The first area is divided into five subsidiary topics and the second one into three. During the first year of implementation, collaborative research

activities commenced for seven subsidiary topics out of the eight. That corresponding to the establishment of early warning systems is still in the preparatory stages.

Several accomplishments have already been achieved up until the present. Under the first topic, a standardized data handling system for agro-meteorological data synthesized from various sources was developed, making it possible to convey full-scale climatic data directly to researchers' desks. Several field-servers (equipment used in real-time data acquisition) were also set up in experimental fields of Hebei Agricultural University in northern China.

Relating to the second topic, a workshop for the purpose of discussing the project outputs and exchanging views among participating researchers was held in Tsukuba in March 2005. A prototype of a farm household management model that deals with the economic risks inherent in climatic disasters was exhibited at the workshop, and in addition, survey results were published



showing that several types of producers' organizations are being established in rural China and are playing varying roles in raising farm incomes. It was also pointed out that studies on crop insurance systems would be relevant to the objectives of the project.

Demonstration of meteorological data conveyed from Heilongjiang Province.

VIETNAM: Development of new technologies for the control of citrus huanglongbing (HLB) in Southeast Asia

Citrus HLB, or citrus greening disease, is seriously threatening the productivity of citrus trees in tropical and subtropical regions in East and Southeast Asia. "Huanglongbing" (HLB) is the Chinese name of the condition, which means "yellow dragon disease."

The pathogenic bacterium (*Candidatus Liberibacter asiaticus*) of citrus HLB is transmitted by an insect vector, the Asian citrus psyllid, *Diaphorina citri*. HLB-free trees are easily infected through the sucking of young shoots by these viruliferous vectors. Eradication of the pathogen or vectors is impossible in severely affected areas where citrus orchards are continuously distributed. It is therefore essential that we develop technologies for controlling the vectors through investigation of psyllid ecology to reduce disease occurrence. For this purpose, JIRCAS has initiated a five-year project that started in April, 2004, in collaboration with Vietnam's Southern Fruit Research Institute (SOFRI).

The overall goals of the project are: (1) Disseminating practical disease-control methods in developing countries where HLB

is endemic and (2) Advising stakeholders to take measures to control the disease based on useful scientific information. The project's objective is to develop individual physical, chemical, or biological control methods for reducing infection of HLB in disease-free trees in citrus orchards by analyzing the behavior of citrus psyllids in the field. The sub-themes of the project are (1) Diagnosis of pathogenic bacteria of citrus HLB, (2) Control of psyllids in citrus fields in Vietnam, (3) Examination of the disease development mechanisms in citrus plants, and (4) Examination of the economic impact of HLB in farm management in the Mekong Delta region.

Two JIRCAS researchers, a plant pathologist (since May 2004) and an entomologist (since March 2005), have been dispatched on long-term assignments to SOFRI in Tien Giang, Vietnam. Several Japanese researchers were also dispatched on short-term assignments for promoting specific sub-themes and for discussing the contents of experiments.

The chief research activities in collaboration with SOFRI's researchers in Fiscal Year 2004 are as follows. Migrations of the pathogen in graft-inoculated trees were examined by quantitative PCR, and a new diagnostic method, loop-mediated isothermal



The JIRCAS-SOFRI International Workshop, "Steps toward mutual collaboration for controlling citrus HLB in Southeast Asia," was held in My Tho City, Vietnam, on November 15, 2004.

amplification (LAMP), was successfully applied to the detection of the pathogen in collaboration with the National Agricultural Research Center for the Kyushu-Okinawa Region, Japan. Nursery trees utilized in experiments on disease tolerance and rootstock performances were grown in screenhouses, and fields were set up in order to conduct experiments on psyllid ecology and rootstock performance.

At the JIRCAS Okinawa Subtropical Station, research programs have been implemented to support the overseas studies

in Vietnam. One is the development of marking methods for citrus psyllids, and another is the development of serological diagnostic methods for HLB. In the former, the dust-marking method, using fluorescent powder, can be used for the detection of psyllids for 40 days even in the rainy season and for longer durations in dry seasons. This methodology will contribute to ecological and ethological field studies of the psyllids (see also Topics, Okinawa Subtropical Station).

The JIRCAS-SOFRI International Workshop, "Steps toward mutual collaboration for controlling citrus HLB in Southeast Asia," was held in My Tho City, Vietnam, on November 15, 2004 in order to review the status of citrus HLB in relation to the promotion of this project. Following a keynote lecture by Dr. Hong-Ji Su, National Taiwan University, five country reports (Vietnam, Thailand, Indonesia, Japan, and Cambodia) were given covering the present situation of HLB problems in Southeast Asia. Four international projects that have been implemented at SOFRI were also introduced. We are certain that this workshop has contributed to the formation of a research network that will be effective in combatting this highly destructive disease in Southeast Asia.

INTERNATIONAL COMPREHENSIVE PROJECTS

All projects are handled by JIRCAS Research Divisions.

Time Frame	Project Title	Research Site
1997-2006	Comprehensive studies on soybean improvement, production and utilization in South America	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; Marcos Juarez Agricultural Experiment Station, the National Institute for Agricultural Technology (INTA), Argentina
2000-2004	Development of low-input technology for reducing postharvest losses of staples in Southeast Asia	Kasetsart University, King Mongkut's University of Technology, and 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 Malaysia (FRIM) 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, and Department of Livestock Development (DLD), Thailand
2003-2007	Improvement of the fertility of sandy soils in the semi-arid zones of West Africa through organic matter management	International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Niger
2004-2008	Studies on stable food supply systems for mitigating the fluctuations of production and markets in China	Research Department of Rural Economic Development, Research Center of the State Council, People's Republic of China; Heilongjiang Academy of Agricultural Sciences, People's Republic of China; Institute of Environment and Sustainable Development in Agriculture, Chinese Academy of Agricultural Sciences, Ministry of Agriculture, People's Republic of China; Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences, Ministry of Agriculture, People's Republic of China; Institute of Agricultural Economics, Chinese Academy of Agricultural Sciences, Ministry of Agriculture, People's Republic of China
2004-2008	Development of new technologies for the control of citrus huanglongbing (HLB) in Southeast Asia	Southern Fruit Research Institute (SOFRI), Vietnam

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 2004.

DEVELOPMENT RESEARCH DIVISION

The Development Research Division consists of 14 senior researchers who specialize in a variety of academic disciplines and conduct distinctive interdisciplinary research on a range of issues centering on technology development, resource management, and socio-economic concerns in developing countries. Overall, the Division aims to investigate and identify significant problems within these research themes by conducting surveys and analyses on both the micro (household and village) level and the macro (regional and national) level. These activities also focus on the research and development process by improving rural survey methods, farming-system research, information networks, remote-sensing and geographical information systems, and econometric/quantitative models.

To achieve the Division's goals, the following four research groups are formulated according to specific target areas: 1) the Research Strategy Group, 2) the Food

Supply/Demand Analysis Group, 3) the Farm Management and Farming Systems Group, and 4) the GIS and Information Systems Group. Many researchers at the Division are also involved in various comprehensive research projects and play key roles, particularly in socio-economic and interdisciplinary studies. The following are the results of our programs in FY2004.

The Research Strategy Group compiled the research output obtained during the past two years, and has issued a report entitled "Strategy for International Collaborative Research on Agriculture, Forestry and Fisheries: the Role of JIRCAS." This report will be used as a baseline for discussions on formulating JIRCAS's next mid-term plan, which will cover five years starting from FY2006. The Group has also identified research issues and priorities for various research fields such as resource management in arid/semi-arid areas and processes of agricultural diversification in Asia.

The Food Supply/Demand Analysis Group has continued to conduct econometric analyses handling the issue of global-scale climate and water-cycle changes to the food supply in Asia. The Group has also started a series of studies on agricultural institutional changes in China such as the development of producers' organizations, within the framework of a newly initiated China-Japan collaborative research project. The Farm Management and Farming Systems Group has elucidated the rationales of land use in northeast Thailand based on farm household surveys. The Group has also continued to improve methods of participatory research by conducting on-site trials, farmers' meetings, and the like at several research sites. The GIS and Information Systems Group has improved methodologies for monitoring land use and crop conditions on a large scale using remote sensing data at several project sites in West Africa, Laos, and northeast China. The Group has also developed a water circulation model that can be used for estimating rainfed rice yields in Thailand.

In addition, Division members played key roles in organizing seminars and workshops, including that of Secretariat at the World Rice Research Conference in November 2004.

A survey of daily activities in Mongolia.



Farmers’ ways of thinking and their information routes

The development of farm management methodology is influenced by both human and physical factors. One of the most important human factors is the way in which people think about farming. However, there has been little research in this area, especially with respect to developing countries. The research described below concerns the influence of human factors, examined in a project entitled “Increasing economic options in rainfed agriculture in Indochina through efficient use of water resources.”

A survey in the form of a questionnaire was carried out in two villages having similar agricultural conditions, located near Khon Kaen City. We firstly asked 100 farmers in each village about the sources of their agricultural information. The different types of information routes between the two villages are shown in Fig. 1. In N Village, 52% of the farmers receive information from only their family members, whereas 46% of those in K Village obtain information from farmers’ groups which are supported by NGOs. In short, farmers in N Village appear to be isolated information-wise, while the farmers in K Village have greater opportunity to obtain information though groups which have greater access to many different kinds of information.

Secondly, we asked the farmers to rank the five most important contributors to increased farm income. They were 1) price, 2) natural conditions such as rainfall and soil, 3) introduction of advanced technology, 4) their own efforts on the farm such as hard work and conscientiousness, and 5) cooperation with others. Table 1 shows that the farmers in both villages regard prices and natural conditions as the most important factors that affect their farm income. Farms in these rainfed areas do in fact suffer from erratic rainfall and price fluctuations, so it is easy to see why prices and natural conditions are important to the farmers. Unfortunately, these factors are difficult to control. Additionally, cooperation with others is regarded by farmers in both villages as least important. This would be an interesting topic to pursue in further research since it involves the fundamental character of Thai farmers. Excluding these three factors, it can be seen that several differences exist

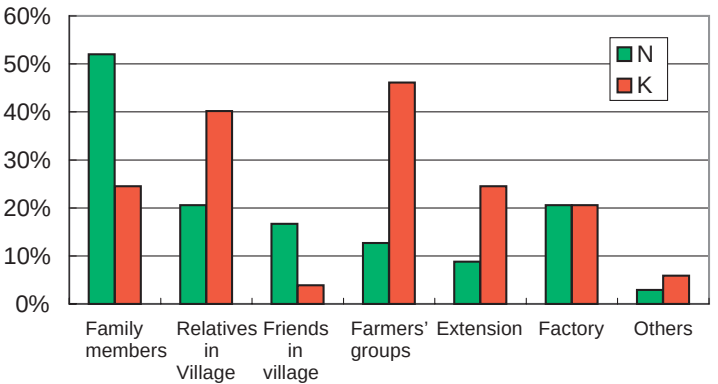


Fig. 1. Sources of agricultural Information.

between the two villages. That is, the introduction of advanced technology is regarded as more important in K Village, while farmers’ own efforts were more important in N Village. We cannot identify how farmers’ ways of thinking or behavior are influenced by the route by which they gain information, but it is clear that in K Village farmers are looking forward to the introduction of advanced technology in order to improve farming methodology and increase income levels through participation in farmers’ group activities.

Table 1. Ranking of the five factors that contribute to increased farm income.

	Price	Natural conditions	Advanced technology	Efforts	Co-operation
N	3.75	3.45	2.89	3.37	1.79
K	3.48	3.63	3.52	2.87	2.35
Level of significance	n. s.	n. s.	***	***	***

Note: 1) Each figure indicates average ranking score.
2) ***: p < 0.01

In developing countries, it is often the case that farmers do not have sufficient opportunity to obtain the information that would be of use to them, since they have poor access to information services and transportation, and extension service systems are not well established. Our study indicates that group activities have the potential to provide farmers with a means of obtaining better information and changing their ways of thinking, and that this is an important factor in the development of technology leading to improved farm management.

(M. Ando)

Farmers' rainfall and cropping calendars: a tool for understanding inter-annual and intra-annual rainfall variability and assisting crop planting decisions

Rainfed agriculture in the Sahelian region of West Africa is characterized by unstable production due to rainfall variability. Farmers are risk-averse, input use is low, and yield levels are low. One cause of risk-averse farmer behavior is spatial and temporal variability within the same year among farmers' fields, but the degree of this variability is not well documented. Better understanding of farmer cropping decisions in response to rainfall variability and the development of a decision-support system to help farmers make better decisions based on cropping calendars are needed. For this reason, we developed a participatory monitoring and decision-support system called "Farmers' rainfall and cropping calendars."

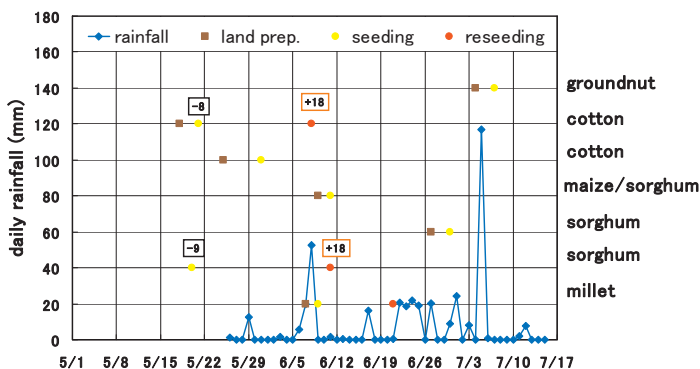
Farmers in each village were selected through the following four-step participatory process over one week to reflect land use and farmer risk robustness. 1) An all-village meeting was held in which farmers drew their own land use map and farmer categories for soils, topography, and land use were delineated. 2) Farmer risk indicators were elicited through open questions, free responses, and matrix ranking in focus groups. Since there was no single word to express the concept of risk in the local language, risk was explained as "difficulties that we cannot know in advance when they will occur." Characteristics which enable farmers to withstand such difficulties were elicited and used as indicators of risk robustness. These were written on the left-

hand side of a large sheet of paper using symbols and local words. Each farmer in a given focus group placed a stone by the indicator he or she considered most important, and overall ranking was obtained by summation. 3) A rapid survey of these risk robustness indicators was done for all the farmers in the village, and a typology of farmers based on risk robustness was developed. 4) A second all-village meeting was held to select participating farmers. Risk robustness farmer types were arranged in rows, land use was shown in columns, farmers' numbers from the census were placed in the intersecting cells, and farmers were selected proportionally. The entire village participated in selection, could see how the results were obtained, and so had a high sense of ownership of the selection process and results.

Rainfall measuring devices were then installed in the farmers' fields to record daily rainfall. Dates of seeding and other field activities were recorded once a week. From these data, farmer-level calendars were constructed with rainfall amounts indicated on the left vertical axis, time indicated as days on the x-axis, and crops placed horizontally from the right vertical axis. On each crop line, the dates of its activities were indicated by their position relative to the x-axis (Fig. 1). Village-level calendars were constructed from individual farmer-level calendars to show average planting dates in relation to average rainfall for the village (Fig. 2).

The above method was developed with 15 farmers in each of two villages in Mali over four years from 2001 to 2004, with the following results. 1) In the 800 mm annual rainfall semi-arid zone, in 2001, 57% of millet and sorghum parcels were seeded before there were two 10 mm rainfall events within 7 days, and 82% of these parcels required reseeded, such as with sorghum in Fig. 1. In 2002, farmers seeded 17 days later, with only 30% of the parcels seeded prior to the 2-event rainfall criteria, and reseeded decreased to 44%. 2) In the 1200 mm annual rainfall semi-humid zone, the rainy season is one month longer, so farmers traditionally waited several weeks later than the 2-event rainfall criteria to seed. Through the use of these calendars, over three years, farmers improved their seeding practices based on actual rainfall and thereby reduced unnecessary delays in seeding. Farmers were able to compare the village-level calendars with their individual farmer-level calendars (Photo 1) to gain an

Fig. 1. Example of a farmer's individual rainfall and cropping calendar (number of days seeded prior to the first 10 mm rainfall and number of days reseeded after the first failed seeding).



understanding of intra-annual and spatial variability.

In this research project, we used more expensive automated weather monitoring stations (about \$600 each), but in Mali, simple rainfall gauges are now locally manufactured. These cost only about \$30, including a stand, and the farmer can directly observe and measure the rainfall in the gauge. Through the use of this method based on “Farmers’ rainfall and cropping calendars,” farmers can build their own capability to monitor weather and cropping decisions. This can help farmers avoid reduced or delayed yields due to reseeding resulting from seeding too early or due to later-than-necessary seeding, and thereby contribute to more stable production under conditions of rainfall variability. This method is likely to be widely applicable throughout the Sahelian region of West Africa.

(J. Caldwell)



Photo 1. Farmers comparing individual calendars while listening to a presentation of the village-level calendar.

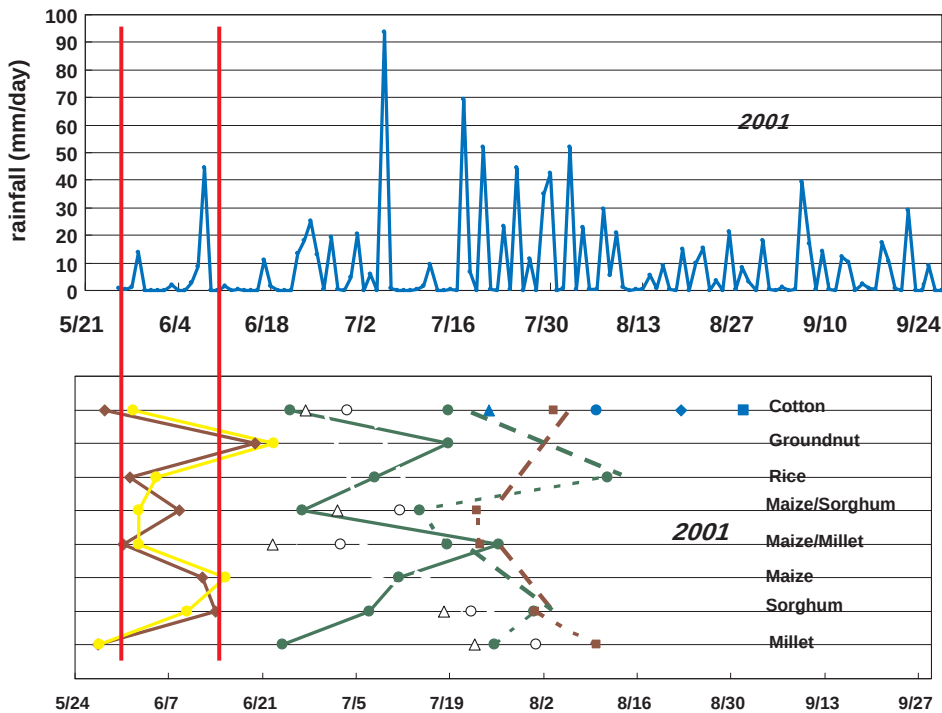


Fig. 2. Example of a 2001 village-level rainfall and cropping calendar, semi-arid rainfall zone village, Mali.

TOPIC3

Evaluation of functions of the agricultural social service system for stabilization of farm and rural management in China

This is a shared research project at the Agriculture Economic Institute of the Chinese

Academy of Agricultural Sciences. The project will be carried out from 2004 to 2008. The development of an agricultural social service system was designated as an important objective in the field of agriculture and rural areas set forth in the Decision of the 3rd Session of the 16th Congress of the Chinese Communist Party. The development of an agricultural social service system, along with direct subsidies and reduction and exemption

of agricultural taxes, will lead to specific measures for the realization of increased farming incomes, and has become an important policy issue. Therefore, in 2004, taking as an example the major grain production area in the west, Zigong City in Sichuan Province, and that in the east, Zhangjiagang City in Jiangsu Province, we will carry out an analysis of the actual state of development of the agricultural social service system and specify directions for improvement. The research results thus far are as follows:

1. An agricultural social service system means that social institutions provide, in various forms, agriculturalists with the various forms of economic and technical support required at different agricultural production stages. They include the following major components: (1) villagers' committees, (2) farmers' cooperative organizations (special associations and new cooperatives), (3) agribusiness organizations (leading enterprises), (4) agricultural technology popularization organizations, (5) rural economic support departments (supply and marketing cooperatives, rural credit cooperatives), and (6) others (agricultural insurance, and

the like)

2. Among the above components, farmers' cooperative organizations will play a major role in the areas of economy and technology in the future. The reasons are that farmers' cooperative organizations have no policy guarantees, so policy incentives have a greater effect and farmers' cooperative organizations can act as intermediaries between processing and circulating enterprises and widely distributed agricultural families, allowing "leading enterprises + farmers' cooperative organizations + agricultural families" to exert synergistic economic benefits.
3. We are studying the potential for assistance by leading enterprises that pursue an "agribusiness" policy with integration of production and distribution. Due to the widening of the gap between leading enterprises and agricultural families, the relationship between them shows a trend towards deadlock, in spite of it being possible for farmers' cooperative organizations to become the main hub of integration for production and distribution. Our investigation results show that Chinese agricultural production and distribution modes have the potential to

Fig. 1. Evolution of policies and major activity modes related to agricultural integration.

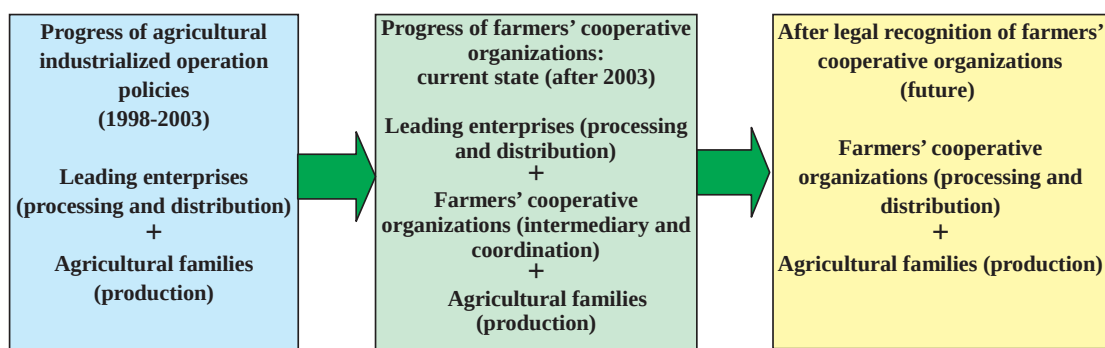


Fig. 2. Visit to extension service in Zigong City, Sichuan Province (township government).



change significantly if farmers' cooperative organizations are officially recognized as a result of legislative measures (Fig. 1).

4. The activities of agriculture and technology popularization organizations will be greatly affected by local government finance. In financially poor areas, the number of operation departments in popularization organizations (sales of production goods) has shown a tendency to increase. Ultimately, due to a widening gap between operations departments and technical direction departments, the financial status of the technical direction departments may further deteriorate.

5. In the eastern coastal areas, farmers' cooperative organizations frequently help to increase farming incomes by assisting the gaining of non-agricultural income from the real estate and distribution sectors. However, the following problems exist, whichever direction the regional economy heads: (1) laws and regulations are not updated, (2) dependence on the government remains unchanged, (3) there are not enough participants (the participation rate is only 3-6% of agricultural families), and (4) there are few organizations concerned with major grain crops.

(N. Yamashita)

TOPIC4

Development of a distributed hydrologic model for estimating rice production in northeast Thailand

Rainfed rice cultivation in northeast Thailand is unreliable and suffers low yields. To obtain watershed-level perspectives for rice production with efficient water use, specific analytical tools are required. The objective of this study is to develop a distributed hydrologic model to execute rice yield prediction in a watershed level under rainfed conditions.

Nong Saeng Village, located 30 km south of Khon Kaen City, was selected as the study site. At the study site, hydrologic observations, measurements of soil property, and interview surveys on rice cultivation were conducted for modeling purposes. Spatial data such as land use surface gradients and flow direction were processed via ASTER satellite imagery at a grid size of 1.5 m. The hydrologic model has three layers for storing water, and can calculate water movements among grid cells in three dimensions for inputting daily rainfall data.

The hydrologic model calculates, on a daily basis, the water budget in all the grid cells of the watershed. The modeling site was divided into 15 m grid cells. The water budget and movement in each cell is expressed using a three-story set of storage layers (Fig. 1). The surface layer storage represents ponding depths in paddy fields or depression storage depths under other types of land use. Topsoil layer storage represents soilwater content from 0 to 20 cm depth and subsoil layer storage represents the shallow groundwater

level from 20 to 100 cm depth. The model computes vertical water movements (infiltration, percolation, deep loss, and evapotranspiration (ET)) and horizontal water movements (overflow, seepage, and through-flow) in eight directions. The computations are executed from the upstream cells in the watershed.

The water conditions calculated in the hydrologic model are evaluated to predict rice yield in the rice yield sub-model. Rice yield is estimated from the yield reduction caused by water deficit at each growth stage. The sub-model estimates rice growth stages (vegetative, flowering, and yield formation) on the basis of the timing of transplanting. The heading date is more or less fixed, since farmers in northeast Thailand usually plant photosensitive rice cultivars; thus it can be estimated simply using an empirical equation. We assume a linear relationship between water deficits, namely, the ET ratio (actual ET/potential ET), and yield reduction in this sub-model. Because reduction of the growth period causes yield reduction, the period is also evaluated.

The parameter values were determined through simulation trials and field measurements; the same values were used for all calculations. Observed daily rainfall from April to December of each year at one station was used over the watershed as lumped input data in the calculations.

At the modeling site, we measured soil water content at 30 points in October 2003. The thus obtained data contributed to examining and deciding the parameters of the hydrologic model. From the water budget computed at the modeling site in 2002, runoff accounts for more than 50% of the water. These figures indicate that there is scope for improvement of water availability in the watershed.

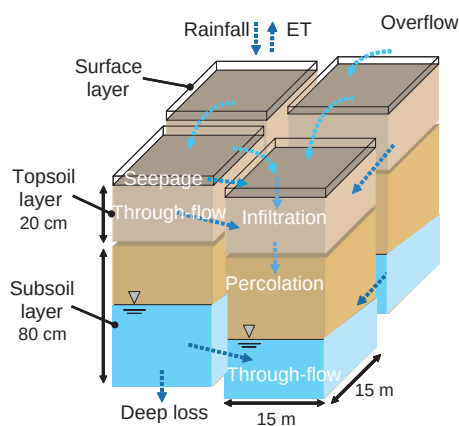


Fig. 1. Hydrologic model structure.

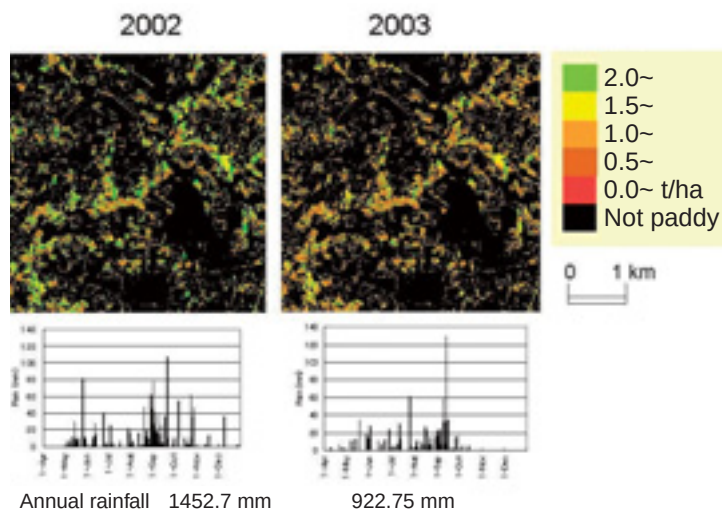


Fig. 2. Estimated rice yield at the simulation site.

The results of an interview survey were used for the parameters of the rice yield sub-model, such as requisites for transplanting (earliest date: July 1, latest: September 20, minimum ponding depth: 50 mm) and attainable yield under actual conditions (3.1 t/ha). The combined model was applied to the simulation site and the rice yield was estimated for 2002 and 2003 (Fig. 2). The results were in agreement with the actual status; the estimated yield in 2002 was higher than that in 2003. The proposed model proved to be an effective tool for analyzing the land and water resources of rainfed paddy fields. Although the model was developed specifically for the application site, it should be applicable to other similar watersheds in northeast Thailand.

(K. Suzuki)

BIOLOGICAL RESOURCES DIVISION

Biological resources have played an important role in meeting global challenges in the fields of food security as well as in 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.

In the last decade, there has been remarkable progress in plant science and molecular biology which has provided various technological tools for improved utilization and understanding of genetic diversity. For example, nearly all economically important crops are now amenable to transformation,

and the molecular mechanisms of biological function such as physical environmental stress are now much more clearly elucidated. As the outstanding achievement in the rice genome sequence clearly indicates, genome science is providing us with valuable information for understanding the functions of many genes and their potential use in plant improvement.

The Division is taking full advantage of this progress to tackle problems faced by developing countries, and is promoting the active use of genetic diversity to drive sustainable socio-economic development.

In collaboration with the International Rice Research Institute (IRRI) in the Philippines, a Division scientist has constructed a linkage map of a recombinant inbred line using 272 DNA markers. Chromosomal segment substitution lines have also been developed that cover approximately 80% of the rice genome. Through QTL analyses using recombinant inbred lines, many QTLs have been identified for important agronomic traits such as productivity. Moreover, lines have been developed with different individual resistance genes to rice blast. Using DNA markers, a precise position of the blast resistance gene *Pish* has been mapped on chromosome 1.

Working alongside the Africa Rice Center (WARDA), we have surveyed a large number of rice germplasms, including the core collections of IRRI and the National Institute for Agrobiological Sciences (NIAS), NERICA (New Rice for Africa), and *Oryza glaberrima*, for long root length which might have a high correlation with drought resistance in rice. In parallel to the evaluation of long roots in the field, a simpler evaluation method has been developed using a high-concentration agar medium in the laboratory that has potential for use in preliminary screenings of root length.

Aiming at the development of a wheat variety resistant to *Fusarium* head blight (FHB) caused mainly by *Fusarium graminearum*, a global platform has been established in the International Maize and Wheat Improvement Center (CIMMYT), in which a Division scientist has been closely involved. In parallel to activities in CIMMYT, the scientist investigated the mode of accumulation of resistant genes to FHB among wheat varieties developed in Japan using DNA markers in the chromosome regions where the QTLs for FHB resistance reside. As a result of decades of plant breeding, genes for resistance have been

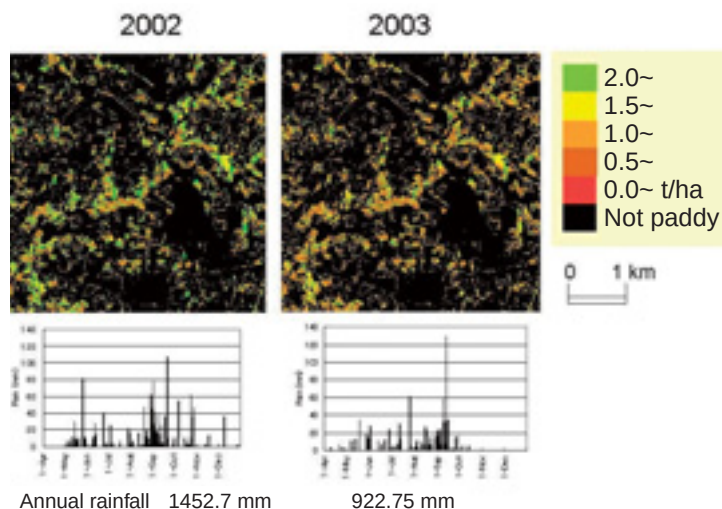


Fig. 2. Estimated rice yield at the simulation site.

The results of an interview survey were used for the parameters of the rice yield sub-model, such as requisites for transplanting (earliest date: July 1, latest: September 20, minimum ponding depth: 50 mm) and attainable yield under actual conditions (3.1 t/ha). The combined model was applied to the simulation site and the rice yield was estimated for 2002 and 2003 (Fig. 2). The results were in agreement with the actual status; the estimated yield in 2002 was higher than that in 2003. The proposed model proved to be an effective tool for analyzing the land and water resources of rainfed paddy fields. Although the model was developed specifically for the application site, it should be applicable to other similar watersheds in northeast Thailand.

(K. Suzuki)

BIOLOGICAL RESOURCES DIVISION

Biological resources have played an important role in meeting global challenges in the fields of food security as well as in 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.

In the last decade, there has been remarkable progress in plant science and molecular biology which has provided various technological tools for improved utilization and understanding of genetic diversity. For example, nearly all economically important crops are now amenable to transformation,

and the molecular mechanisms of biological function such as physical environmental stress are now much more clearly elucidated. As the outstanding achievement in the rice genome sequence clearly indicates, genome science is providing us with valuable information for understanding the functions of many genes and their potential use in plant improvement.

The Division is taking full advantage of this progress to tackle problems faced by developing countries, and is promoting the active use of genetic diversity to drive sustainable socio-economic development.

In collaboration with the International Rice Research Institute (IRRI) in the Philippines, a Division scientist has constructed a linkage map of a recombinant inbred line using 272 DNA markers. Chromosomal segment substitution lines have also been developed that cover approximately 80% of the rice genome. Through QTL analyses using recombinant inbred lines, many QTLs have been identified for important agronomic traits such as productivity. Moreover, lines have been developed with different individual resistance genes to rice blast. Using DNA markers, a precise position of the blast resistance gene *Pish* has been mapped on chromosome 1.

Working alongside the Africa Rice Center (WARDA), we have surveyed a large number of rice germplasms, including the core collections of IRRI and the National Institute for Agrobiological Sciences (NIAS), NERICA (New Rice for Africa), and *Oryza glaberrima*, for long root length which might have a high correlation with drought resistance in rice. In parallel to the evaluation of long roots in the field, a simpler evaluation method has been developed using a high-concentration agar medium in the laboratory that has potential for use in preliminary screenings of root length.

Aiming at the development of a wheat variety resistant to *Fusarium* head blight (FHB) caused mainly by *Fusarium graminearum*, a global platform has been established in the International Maize and Wheat Improvement Center (CIMMYT), in which a Division scientist has been closely involved. In parallel to activities in CIMMYT, the scientist investigated the mode of accumulation of resistant genes to FHB among wheat varieties developed in Japan using DNA markers in the chromosome regions where the QTLs for FHB resistance reside. As a result of decades of plant breeding, genes for resistance have been

accumulated and these have resulted in elevation of resistance levels; however, at the same time, the degree of genetic diversity in those new varieties has narrowed. To facilitate further gene mapping in wheat, we have identified the chromosomal positions of 123 EST markers. In a collaborative project with the International Center for Agricultural Research in the Dry Areas (ICARDA), a Division scientist has evaluated segregating populations derived from crosses between domestic durum wheat and *Aegilops squarrosa* for drought tolerance in ICARDA fields, and has selected four lines which show seed yields comparable to a control variety under normal conditions. In a JIRCAS project entitled "Comprehensive studies on soybean improvement, production and utilization in South America," Division scientists, in collaboration with INTA-Marcos Suarez (Argentina), have been working on the elucidation of sudden death syndrome (SDS), which is becoming a major threat to sustainable soybean production in MERCOSUR (*Mercado Comun del Sur*: Southern Common Market) countries. A Division scientist has identified the causal pathogen of this disease as *Fusarium tucumaniae*, which is different from the strain reported in the United States. We have developed an artificial inoculation method and have succeeded in inducing the typical symptoms of SDS in a greenhouse. However, an evaluation of resistance in a field heavily infested by this fungus gave somewhat variable response, even within individuals of the same genetic composition, indicating the need for experiments on more uniformly infested fields.

Soybean rust, caused by *Phakopsora pachyrhizi*, is another serious threat to soybean production. This disease was found in South America for the first time in 2000, and in this year, an outbreak of this disease was reported for the first time in the United States. In a joint project with the Brazilian Agriculture Research Corporation (EMBRAPA) in Brazil, we have investigated the life cycle of the pathogen, focusing especially on its mode of survival during the winter season in the southern hemisphere. We have found the preferred hosts during the winter season are volunteer soybeans that are found in harvested soybean and corn fields as well as on roadsides, and other leguminous species, such as *Neonotonia* and kudzu (*Pueraria lobata*). These host plants are most likely to affect and enhance the occurrence of

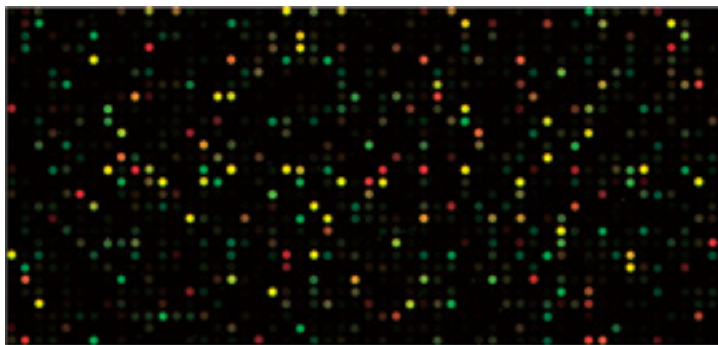
rust in soybeans.

With regard to the soybean-rust resistance genes found in large collections of soybean germplasm, we have prepared segregating populations harboring not only qualitative resistance but also quantitative resistance genes, aiming at the acquisition of DNA markers linked to these resistance genes. As a result, we have succeeded in finding a set of DNA markers linked to one qualitative resistance gene, *Rpp1*. In addition to a resistance gene to soybean rust, we have also identified DNA markers tightly linked to one of the genes controlling soybean flowering time.

To develop a drought-tolerant soybean variety using a transgenic approach, we have initiated transformation, via particle bombardment, of a standard Brazilian soybean variety with a construct consisting of the stress-inducible promoter rd29 and the transcription factor DREB1 gene.

In the field of vegetable germplasm, a Division staff member is working with the Asian Vegetable Research and Development Center (AVRDC) on the evaluation and use of traditional vegetable germplasm from South and Southeast Asia. Traditional vegetables are expected to contribute to improving the nutritional status of low-income populations in these regions, and offer new income-generation opportunities. We have so far evaluated a total of about 400 lines of *Amaranthus*, *Basella alba*, *Celosia argentea*, *Cleome gynandra*, *Corchorus*, *Eryngium*, *Ipomea*, and *Ocimum* for their contents of ascorbate, total phenols, and antioxidant ability. Based on evaluation of these nutritional traits and submerging tolerance which facilitates cultivation in wider areas in these tropical regions, promising germplasms consisting of 60 lines of *Amaranthus*, 15 of *Basella*, 15 of *Corchorus*, and 12 of *Ipomea* have been selected for further evaluation.

Under a project entitled "Improvement of the fertility of sandy soils in the semi-arid zones of West Africa through organic management," we are continuing a systematic evaluation of plant genetic resources, with emphasis on legume crops for efficient utilization in agricultural systems. Prior to the evaluation of legume germplasm, a Division scientist conducted a survey of farmers in the region to reveal the demand for an important legume crop, cowpeas. Based on the demand for new cowpea varieties, a large number of legume crops, including cowpeas, are being evaluated from the viewpoint of preservation



Analysis of gene expression under drought stress using an oligonucleotide microarray containing over 21,000 rice genes. Genes induced and repressed under drought stress are respectively shown as red and green signals.

of soil fertility, such as biomass production as a source of organic matter, prevention of soil erosion, and nitrogen-fixing ability. Through a primary screening, we have identified several promising cowpea lines which will be further evaluated in upcoming crop seasons.

The Molecular Biology Group of the Division has utilized biotechnological approaches to reveal the mechanism of tolerance to environmental stresses such as drought, salinity, and freezing in plants. In particular, the Group has made significant advances toward understanding the molecular mechanisms of plants' defenses against environmental stress, such as the dehydration-responsive element binding protein (DREB) of *Arabidopsis*, as well as toward developing methods for genetic manipulation of novel stress-tolerant plants.

This year, the Group has identified a promoter region that suppresses, under drought conditions, the activity of an oligosaccharide synthesis gene, one of the target genes of DREB1A. Through microarray analyses of transgenic plants overexpressing DREB1D, we have identified more than 60 target genes. Some of these genes were found to have no cis-element of DRE, suggesting that the DREB1 gene family might have functions other than stress tolerance. Furthermore, overexpression of another transcriptional factor, STZ, which is involved in suppression of transcription, resulted in elevation of stress tolerance. Molecular characterization of another transcriptional activator, DREB2, has identified a negative regulatory domain in its middle region. A constitutive active form of DREB2A was obtained by deletion of this negative regulatory domain, and its overexpression has been found to enhance drought tolerance but not cold tolerance in transgenic *Arabidopsis*.

AREB1 was shown to be a key positive regulator of ABA signaling in vegetative tissues under drought stress. Further

molecular characterization of AREB1 indicated that AREB1 directs the expression of stress-inducible genes such as LEA class genes that are involved in alleviation of water stress, and that protein kinase SnRK2 is possibly an activation factor of AREB1 through phosphorylation.

OsDREB isolated from rice (*Oryza sativa*) or DREB from *Arabidopsis* under control of a stress-responsive rice promoter, *lip 9*, have been introduced into japonica rice, and more than 70 independent transformed lines (at the T2 generation) have been obtained. These transformed lines have been confirmed to grow normally and show a higher level of drought tolerance. In the transformants in which OsDREB1F is over-expressed, the *rd29* gene was found to be activated, as in the case of the DREB gene from *Arabidopsis*. With regard to promoter isolation, a new class of stress-inducible promoters activated only by cold conditions has been successfully isolated, further broadening the range of application of transgenic strategies.

In December 2004, JIRCAS announced it would establish a new research group, the Group for the Development of Environmental Stress-Tolerant Crops, to further boost our commitment to stress tolerance. The Group consists of three teams as follows: 1) the Function Development Team, emphasizing the molecular elucidation of mechanisms of stress tolerance and isolation of candidate genes conferring stress tolerance; 2) the Material Development Team, conducting an evaluation of large numbers of existing germplasm for stress tolerance and identification of DNA markers tightly linked to this tolerance; and 3) the Trait Evaluation Team, focusing on the evaluation of tolerance at a practical level and on the development of simple and reliable evaluation protocols for various forms of stress. The ultimate mission of this Group is to develop novel breeding materials and powerful techniques which can be used directly to develop practical varieties for cultivation in developing countries.

TOPIC1

Overexpression of Cys2/His2-type zinc-finger transcription repressors improves environmental stress tolerance in *Arabidopsis*

Drought, high salinity, and low temperatures are adverse environmental

conditions that affect plant growth and markedly decrease crop productivity. To increase crop yields under stressed conditions, it is important to improve the stress tolerance of crop plants. Plants naturally respond and adapt to these stresses in order to survive. These stresses induce various biochemical and physiological changes, including growth inhibition, to achieve stress tolerance. A number of genes have been described that respond at the transcriptional level to stress. Although various genes are induced by these stresses, many stress-downregulated genes are also reported. Analysis of stress-downregulated as well as stress-upregulated genes is important to gain an understanding of molecular responses to abiotic stresses.

Some members of Cys2/His2-type zinc-finger transcription factors have been reported to be upregulated by abiotic stress in *Arabidopsis*. To characterize the role of these types of proteins, we analyzed the function of *Arabidopsis* genes encoding four different Cys2/His2-type zinc-finger proteins (AZF1, AZF2, AZF3, and STZ). Using gel-shift analysis, we found that all these proteins recognize A(G/C)T repeats within an EP2 sequence, known as a target sequence for some petunia Cys2/His2-type zinc-finger proteins. Using transient analysis, we showed that the EP2 sequence is a negative *cis*-element, and these four zinc-finger proteins act as transcriptional repressors mediated by

binding to this negative *cis*-element in *Arabidopsis* protoplasts.

Using RNA gel-blot analysis, we showed that among the four genes, *AZF2* and *STZ* were clearly in *Arabidopsis* plants induced by abiotic stresses such as drought, cold, and high salinity. Our results show that these proteins function under abiotic stress conditions. To gain further understanding of the function of these proteins, we generated transgenic *Arabidopsis* plants overexpressing *STZ* under the control of the constitutive CaMV 35S promoter. We analyzed two independent lines of *STZ* overexpressors. The growth of the *STZ* overexpressors on GM agar plates or in soil was compared with that of the wild-type plants. Both transgenic lines showed growth retardation (Figs. 1A and B), and the level of the growth retardation was correlated with that of *STZ* expression in the transgenic plants (Fig. 1C).

To examine whether overexpression of *STZ* affects tolerance to drought stress, the wild-type and transgenic plants grown in pots were not watered for two weeks. Almost all of the wild-type plants died within this two-week period, whereas nearly all the transgenic plants of both *STZ* lines survived this level of drought stress and continued to grow when re-watered (Fig. 1D). We also tried to explore the differences in recovery after desiccation using plants grown on agar plates. Wild-type and transgenic plants were removed from the agar

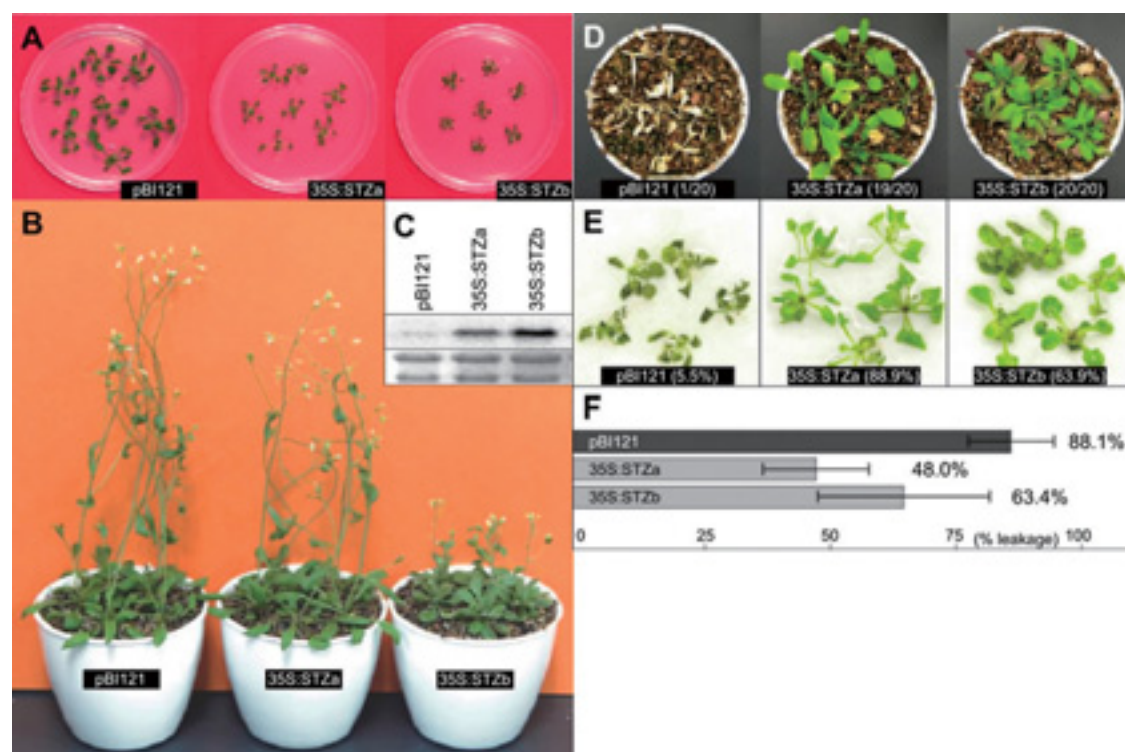


Fig. 1. Phenotypes and drought-stress tolerance of the 35S::STZ and wild-type plants (A) Transgenic and wild-type plants grown on agar plates for 21 days. We used plants transformed with vector pBI121 as controls. (B) Plants grown in soil pots for 36 days. (C) Expression of the STZ gene in the transgenic and wild-type plants. (D) Drought-stress tolerance of the transgenic and control plants. Both 35S::STZa and 35S::STZb plants were highly tolerant to drought stress ($P < 0.001$; χ^2 test). Number codes = number of surviving plants out of total number. (E) Difference in recovery after rehydration among the wild-type, 35S::STZa and 35S::STZb plants. Photographs show the plants dehydrated on dry plastic plates in air for 4 hours and then rehydrated overnight. (F) Electrolyte leakage was evaluated after dehydration treatment. A 17-day-old plant was used in each experiment. Plants were removed from the agar plates and dehydrated on dry plastic plates for 4 hours. The values are means of 15 independent samples. Statistical significance compared with the value of the control plants was determined by Welch's test ($p < 0.005$).

plates and kept on plastic plates for four hours, followed by rehydration overnight. Only 5.5% of the wild-type plants survived, whereas 88.9% and 63.9% of the transgenic plants survived (Fig. 1E). Leakage of electrolytes is a sensitive measure of loss of membrane integrity and it is commonly used to assay osmotic pressure-related injury. When plants were dehydrated for four hours, the ion leakage of the wild-type plants was 88.1%, whereas for the transgenic plants the ion leakage was 48.0% and 63.4%, (Fig. 1F). These results indicate that both *STZ* transgenic lines clearly showed higher tolerance to drought stress than control plants.

Since both independent lines of the *STZ* overexpressors showed growth retardation and tolerance to drought stress, the target downregulated genes might both promote plant tolerance and inhibit plant growth. Because the expression of *AZF2* was also induced by drought stress, *AZF2* might regulate similar target genes to those of *STZ*. By using microarray analysis, we have shown that many photosynthesis-related genes and genes for carbohydrate metabolism are downregulated under drought, high salinity, and cold stress conditions. Under stressed conditions, the energy balance changes and photosynthesis in plants is reduced. The expression of certain photosynthesis-related genes and genes for carbohydrate metabolism becomes unnecessary and is reduced at the transcription level under stressed conditions. Reduction of these proteins may lead to a better energy balance for plants under stressed conditions. Therefore, plant growth is inhibited and stress tolerance is increased. These photosynthesis-related genes and genes for carbohydrate metabolism may be the target genes of *STZ* and *AZF2*, and reduction of these proteins may increase stress tolerance in the *STZ* overexpressors. Further elucidation of the roles of these genes in relation to plant stress adaptation will show us a new way to improve plant tolerance to environmental stress conditions.

(K. Yamaguchi-Shinozaki)

TOPIC2

The *Pish* blast resistance gene of rice (*Oryza sativa* L.) is located on the long arm of chromosome 1

A resistance gene, *Pish*, to blast disease *Pyricularia grisea* (Cooke) Sacc. in rice

(*Oryza sativa* L.), was mapped between two DNA markers, *RM212* and *OSR3*, on the long arm of chromosome 1 at the distances of 7.9 and 15.2 cM, respectively.

The blast resistance gene *Pish*, which shows susceptibility to almost all blast isolates from Japan and moderate resistant to those from the Philippines, was found only in Japonica-type varieties. The location of this unique resistance gene on the rice chromosome has up to now not been identified.

In our analysis using a differential system employing Philippine blast isolates and based on gene-for-gene theory, a Japonica-type rice, Akihikari (AK), showed moderate resistance to almost all blast isolates from the Philippines, and was expected to harbor one of the four genes (*Pish*, *Piz*, *Piz-5*, and *Pi9*) whose reaction patterns to blast isolates were similar to each other. The reactions of Indica-type rice Milyang23 (M23) was specific to blast isolates but different from those of AK.

Fourteen quantitative trait loci (QTL) for Philippine isolates and 12 QTLs for Japanese isolates were detected in the 14 regions on nine chromosomes (1, 2, 3, 6, 7, 8, 9, 11, and 12) using recombinant inbred lines (RILs) derived from a cross between M23 and AK. Of these, two QTLs on the short arm of chromosome 1 and in the middle of chromosome 6, respectively, showed resistance to Philippine and Japanese blast isolates. The AK allele of the QTL on chromosome 1 and M23 of chromosome 6 showed resistance in each. Yu *et al.* (1991) reported that the *Piz* allele is located in the middle of chromosome 6. These results suggest that QTLs on chromosomes 1 and 6 correspond respectively to *Pish* and one of the *Piz* alleles.

Detailed mapping of the QTL on chromosome 1 was carried out using a hybrid population of heterogeneous inbred families (HIFs), derived from a M23/AK RIL progeny. The single-gene segregation of the QTL was confirmed in HIFs, and linkage analysis was carried out with eight DNA (simple sequence repeat: SSR) markers. The results mapped QTL (*Pish*) between the two DNA markers *RM212* and *OSR3* at the distances of 7.9 and 15.2 cM, respectively (Fig. 1).

The location of *Pish* was confirmed again using DNA markers and several isogenic lines (NIL), to which had been introduced *Pish* from Japonica-type donor varieties Kusabue, Shin 2, and BL 1, into an Indica-type rice, CO 39. The graphical genotypes of all NILs

showed the introgressions of Japonica-type segments from Japonica donor varieties on the long arm of chromosome 1 (Fig. 2).

This mapping information on *Pish* is the

first to be achieved, and can be utilized for map-based cloning and marker-assisted breeding for blast resistance in rice.

(Y. Fukuta)

Single gene mapping

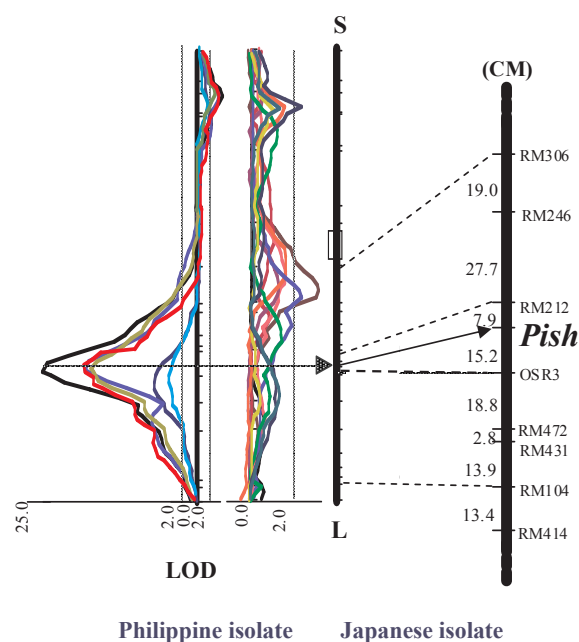


Fig. 1. Mapping of *Pish* using QTL analysis and linkage analysis in HIFs on the long arm of chromosome 1. Left: QTL mapping in M23/AK RILs using blast isolates from the Philippines and Japan. Right: Localization of *Pish* in HIFs.

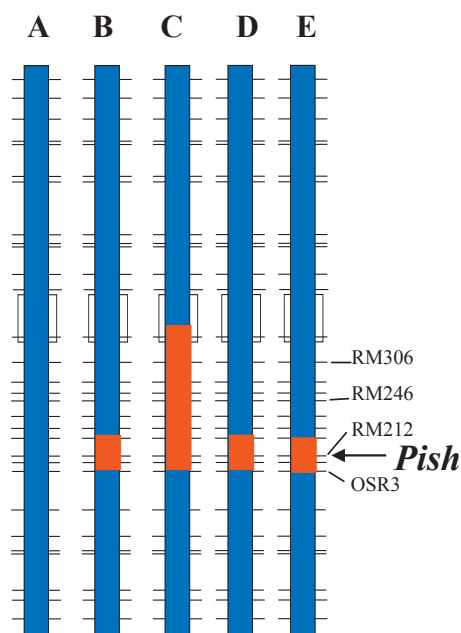


Fig. 2. Graphical genotypes of chromosome 1 in isogenic lines introgressed with *Pish* from Japonica-type donor varieties into an Indica-type rice, CO 39. A: CO39; B: IRBLsh-Ku/CO; C: IRBLsh-S/CO; D: IRBLsh-S/CO; E: IRBLsh-B/CO. Blue and red segments respectively indicate Indica and Japonica-type regions in chromosomes.

CROP PRODUCTION AND ENVIRONMENT DIVISION

Our goal is to develop sustainable agricultural production technologies based on the diversified functions of crops, microbes, and judicious utilization of natural resources. The Division consists of five research groups: material cycling, crop management, plant physiology and nutrition, water resource management, and plant protection. Nearly one-third of our scientists in the Division are dispatched to national and international organizations/collaborators on long-term assignments and are involved in working on various comprehensive projects organized or managed by JIRCAS.

The Division is responsible for three research themes along the lines of the Institute's Mid-Term Plan: 1) Evaluation of material cycling for nitrogen and

improvement of soil amelioration technology in diversified agro-ecosystems, 2) Development of crop production technologies featuring labor- and resource-saving for rice and upland crops in Thailand, Vietnam, Laos, and other countries in this region, and 3) Elucidation of the current status of occurrence of major pests and diseases of rice and soybeans in Southeast Asia and South America. Under these research themes are eight specific sub-themes. For Fiscal Year 2004, 24 of our research programs were carried out by 18 of our scientists in the Division.

Major highlights from each research theme are as follows. In Theme (1), research has been carried out by broadly dividing the target agro-ecosystems into two categories: those with intensive crop cultivation and those with low-fertility soil. As for the former, an index of global warming potential (GWP), the sum of emitted greenhouse gases (CO₂, CH₄, and N₂O), was introduced to develop soil

showed the introgressions of Japonica-type segments from Japonica donor varieties on the long arm of chromosome 1 (Fig. 2).

This mapping information on *Pish* is the

first to be achieved, and can be utilized for map-based cloning and marker-assisted breeding for blast resistance in rice.

(Y. Fukuta)

Single gene mapping

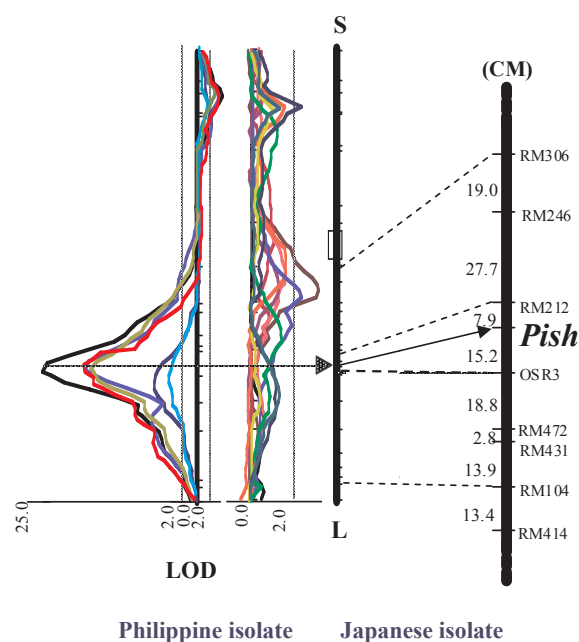


Fig. 1. Mapping of *Pish* using QTL analysis and linkage analysis in HIFs on the long arm of chromosome 1. Left: QTL mapping in M23/AK RILs using blast isolates from the Philippines and Japan. Right: Localization of *Pish* in HIFs.

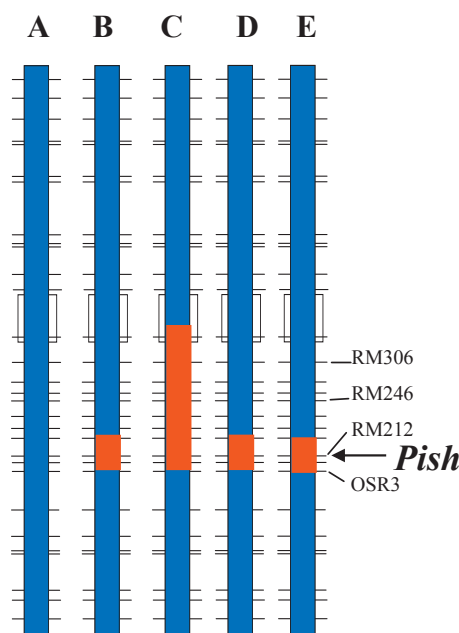


Fig. 2. Graphical genotypes of chromosome 1 in isogenic lines introgressed with *Pish* from Japonica-type donor varieties into an Indica-type rice, CO 39. A: CO39; B: IRBLsh-Ku/CO; C: IRBLsh-S/CO; D: IRBLsh-S/CO; E: IRBLsh-B/CO. Blue and red segments respectively indicate Indica and Japonica-type regions in chromosomes.

CROP PRODUCTION AND ENVIRONMENT DIVISION

Our goal is to develop sustainable agricultural production technologies based on the diversified functions of crops, microbes, and judicious utilization of natural resources. The Division consists of five research groups: material cycling, crop management, plant physiology and nutrition, water resource management, and plant protection. Nearly one-third of our scientists in the Division are dispatched to national and international organizations/collaborators on long-term assignments and are involved in working on various comprehensive projects organized or managed by JIRCAS.

The Division is responsible for three research themes along the lines of the Institute's Mid-Term Plan: 1) Evaluation of material cycling for nitrogen and

improvement of soil amelioration technology in diversified agro-ecosystems, 2) Development of crop production technologies featuring labor- and resource-saving for rice and upland crops in Thailand, Vietnam, Laos, and other countries in this region, and 3) Elucidation of the current status of occurrence of major pests and diseases of rice and soybeans in Southeast Asia and South America. Under these research themes are eight specific sub-themes. For Fiscal Year 2004, 24 of our research programs were carried out by 18 of our scientists in the Division.

Major highlights from each research theme are as follows. In Theme (1), research has been carried out by broadly dividing the target agro-ecosystems into two categories: those with intensive crop cultivation and those with low-fertility soil. As for the former, an index of global warming potential (GWP), the sum of emitted greenhouse gases (CO₂, CH₄, and N₂O), was introduced to develop soil

management technologies with low environmental impact. It was found that control of soil moisture during the fallow period greatly affected GWP. Research on the latter is mainly done as part of an international project focusing on soil fertility improvement in West Africa. It was demonstrated that 1) the dynamics of PEON (phosphate buffer extractable organic nitrogen) in sandy soils in West Africa are different from those in northeast Thailand, 2) fallow management contributes significantly to maintenance of soil fertility, and 3) soil microbial activities are restricted more by lack of carbon sources than by low soil moisture. It was also shown that salt accumulation in dry land could be reduced by inserting coarse materials below the soil layer. These appear to restrict the upward movement of groundwater that contains high concentrations of soluble salts. The prevention of salt precipitation by this method was estimated, using a model, to be 10-30% at 50°C and 40-50% at 70°C.

In Theme (2), research programs related to water issues, 1) from the viewpoint of agricultural engineering, the dynamics of surface water, soil water, and groundwater were analyzed for a small watershed in northeast Thailand in relation to land utilization, resulting in the proposal of measures for more efficient utilization of existing water resources; 2) in the area of crop physiology, screening criteria for drought tolerance applicable in the field were developed for rice and soybeans; and 3) for crop management, water-saving technology was developed for post-rice cropping to grow tomatoes up to harvest with considerably less irrigation than the conventional irrigation scheme adopted by local farmers in northeast Thailand. Concerning nitrogen nutrition and minimizing loss of soil nitrogen, it was revealed that nitrification inhibition activity in

the root exudates of *Brachiaria humidicola* could be induced by application of $\text{NH}_4\text{-N}$. Regarding the problems caused by clubroot disease in the tropical highlands, it was shown that solar sterilization using transparent plastic film is very effective in reducing damage.

In Theme (3), to reduce damage caused by insects and diseases, research has been carried out from the standpoints of 1) establishment of a cultivation method using tolerant genotypes, 2) biological control, and 3) elucidation of the ecology of insects and diseases and the actual status of their occurrence. From standpoint 1), a gene responsible for sucking inhibition of the whitebacked planthopper was precisely located on the 4th rice chromosome, leading to identification of a tolerant genotype by marker-aided selection. From standpoint 2), it was found that two species of tachira fly (*Drino zonata* and *Linnaemya longirostris*) that are natural enemies of the stem borer (*Helicoverpa armigera*) play a significant role in controlling the population density of *H. armigera*. A method for successive raising of these natural enemies was established. From standpoint 3), the ecological distribution of cyst nematodes in soybeans was investigated in various regions of Paraguay.

TOPIC1

Evaluation of the ability of vegetable crops to reduce clubroot damage using preceding crops in the West Java Highlands

Indonesia is typical of tropical island countries where it is difficult to cultivate temperate vegetables such as cabbage, Chinese cabbage, and cauliflower. These crops will grow only in highland areas, where they are cultivated throughout the year. Highland farmers favor cultivation of temperate vegetables due to their relatively good production levels compared to the lowlands and their high prices. This leads farmers to adopt continuous or very frequent cropping of *Cruciferae*, resulting in a high incidence of clubroot damage. There is an urgent need to develop environmentally friendly technologies that are able to reduce clubroot damage using less chemical input and having minimal environmental impact, and that are suitable for areas which are often steeply sloping but with good water resources.

Brachiaria humidicola grown in a JIRCAS field in Tsukuba (left) and its roots (right) that release a compound that inhibits nitrification.



Short-term crop rotation systems have been shown to be an environmentally friendly and effective technique for minimizing damage to cabbage production caused by clubroot infection. In order to enhance the efficacy of this technique and improve its convenience of use to farmers, the effects of planting several other vegetables and plants on the ability to reduce clubroot damage was evaluated. In an 8-month experiment, eleven vegetable plots and four fallow plots were set up in a severely infested field in what were previously continuous cabbage cropping plots. Two of the fallow plots were seeded with common local weeds: grasses (*Zoysia* sp.) and wild chrysanthemum, *Galinsoga parviflora*. The other fallow plots were simply kept clean by hand weeding or with silver mulching film. Long-term crops such as chili, peanut, and tomato were grown as a single crop for 8 months, and other short-term crops were grown two or more times to ensure continuous cultivation. For vegetables such as cabbages, carrots, and potatoes, 8 months corresponds to two growing seasons. After using the plots to grow the abovementioned vegetables, cabbage

plants were grown again in all of the plots and their productivities evaluated. Cabbage yields in plots planted after 8 months' cultivation of different kinds of vegetables are shown in Fig. 1. The yield before planting such vegetables was 0.11 and that of the continuous cropping plots was only 0.02 kg/plant mass. These yields are very low and the crops were practically worthless due to there being very few heads of marketable quality. In the formerly fallow plots, yield recovered to 0.6 kg/plant mass, showing that fallow treatment can markedly reduce clubroot damage. As shown in Fig. 2, there were both good quality individual plants and poor quality plants in the same plots. As a result, average head weight was rather low, but marketable heads were still produced. There were only minor differences between all the fallow conditions, suggesting that weed growth does not decrease the recovery effects, although it did reduce soil temperature. Silver mulching film, although it raised soil temperature, similarly did not enhance this effect.

The planting of lettuce showed the highest beneficial effects, followed by garlic,

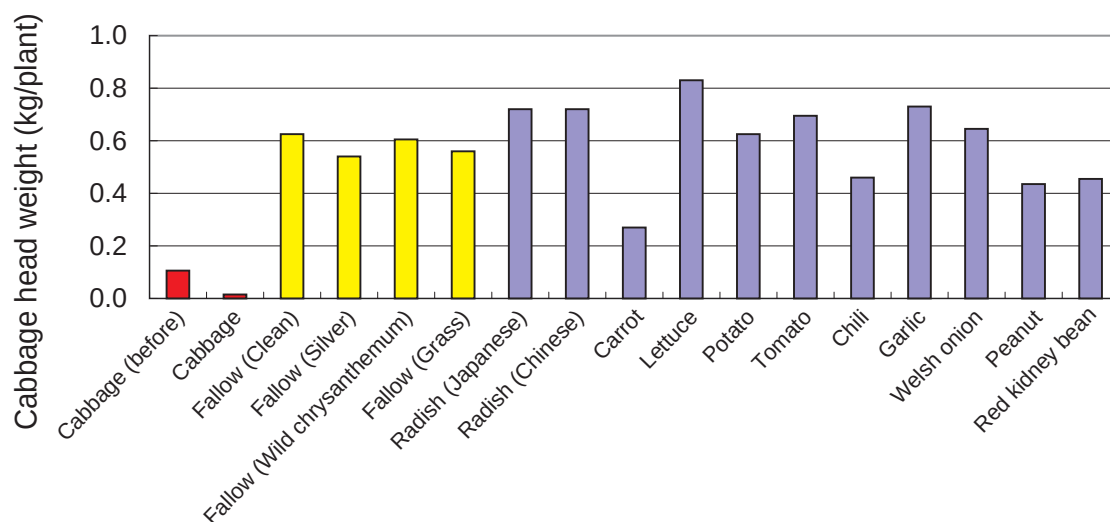


Fig. 1. Effect of crop cultivation on recovery from clubroot damage.

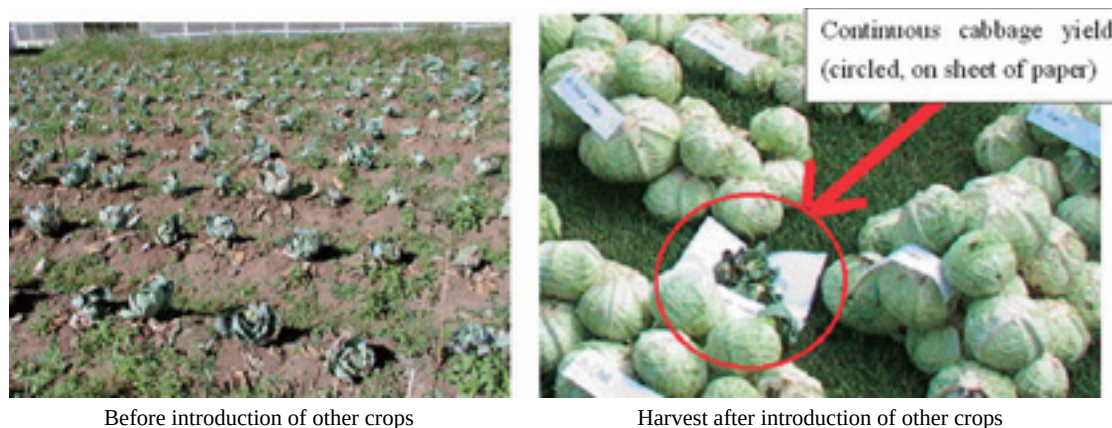


Fig. 2. Conditions in a severely infested field and recovery following cultivation of other vegetable crops.

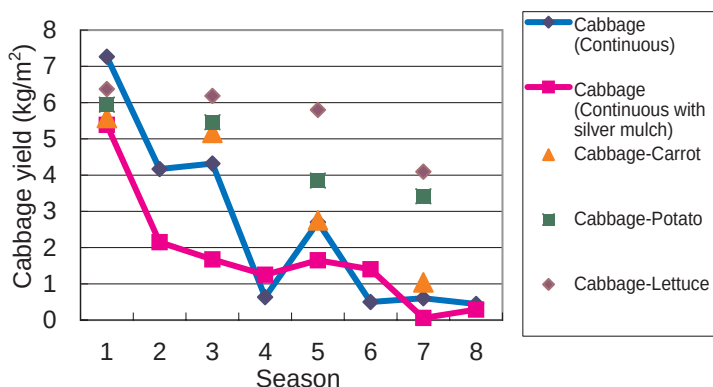


Fig. 3. Effects of very short-term crop rotation on clubroot damage reduction.

radishes, and tomatoes. Radish is known to be a clubroot decoy crop. This plant triggers the germination of clubroot spores but is resistant to them. As for lettuce, no information is available concerning the mechanisms of its anti-clubroot effects. Yields obtained by planting spring onions and potatoes were almost the same as those of the fallow treatment, suggesting that these vegetables have no special anti-clubroot effects.

Chili, kidney beans, peanuts, and carrots showed less efficacy than did the fallow treatment. Chili and peanuts are long-term plants, and shade the soil with their canopy for a longer time than other plants, with carrots providing the thickest cover.

Important crops were also evaluated in very short-term crop rotations with cabbage. For this purpose, evaluation of these vegetables in very short-term crop rotations (alternate cultivation) was conducted in plots where clubroot damage was very low. The results compared with continuously cropped cabbage plots are shown in Fig. 3. In the rotation plots, cabbage yields also decreased, but more slowly than those of the continuous cropping plots. The order of loss of yield was in agreement with the results of the former experiments, in that planting after lettuce showed the lowest clubroot prevalence, followed by potatoes. Combination planting with carrots showed the fastest decrease in yield. Although the period of use of plants for suppressing clubroot damage was only 4 months, damage-recovery effects could still be detected and the order of efficacy was the same in these two experiments. Although the planting of certain vegetables was less effective than the fallow conditions, they were still partially effective. Highland farmers have numerous vegetables to choose from as rotation crops to suit local economic and physical conditions if they are willing to adjust the period of the rotation cycle to optimize the speed of their recovery effects.

These results will be useful for farmers who wish to develop their own crop rotation systems.

(M. Yamada)

TOPIC2

Monitoring water infiltration through an unsaturated soil zone using bromide as a tracer in northeast Thailand

It is useful to be able to trace the infiltration of rainfall and the evaporation from the soil surface in order to achieve the effective use of soil water. We employed a method using bromide for this purpose. The conventional method is to collect soil water using a soil water collector which is placed underground; however, this method can be applied only under wet conditions. In this study, we conducted a tracer experiment using bromide in northeast Thailand where the soil mostly remains unsaturated, making it impossible to collect soil water using the conventional method.

We sprayed a solution of bromide (Br^- concentration: 0.5 g/L) on sandy soil in northeast Thailand on June 27, 2003. After the elapse of a fixed time, 100-mL core samples were collected at depth intervals of 10 cm. The soil samples were sent to a laboratory where the soil water was extracted using a centrifuge at a force of about 4000 rpm, corresponding to about pF 3.5. After extraction, the Br^- concentration was determined using an ion-chromatograph analyzer (Fig. 1).

In the soil samples collected on August 7, the Br^- peak concentration was at 0-10 cm, indicating that the Br^- had remained at the soil surface. Assuming that the total rainfall between June 27 and August 7, which amounted to about 170 mm, had all been lost through evaporation, the average rate of evaporation during this period was calculated as being about 4 mm/day (Table 1).

In the soil samples collected on September 10, the peak Br^- concentration appeared in the 30-40 cm deep layer, indicating that the Br^- had moved downward due to the piston flow induced by the infiltration of rainfall and with dispersion due to differences in the Br^- concentration. We inferred in this case that the amount of water in the soil above the depth of the peak concentration was equal to the amount of rainfall infiltration between August

7 and September 10. The total rainfall during this period was about 290 mm, so the amount of rainfall infiltration was calculated to be about 100 mm and the amount of evaporation about 190 mm (Fig. 2, Table 1).

In the samples collected on February 12, a proportion of the Br⁻ that had infiltrated into the soil returned to the surface, resulting in the accumulation of salts at the surface (Fig. 2, Table 1).

(H. Hamada)

Fig. 1. Application and collection of bromide.

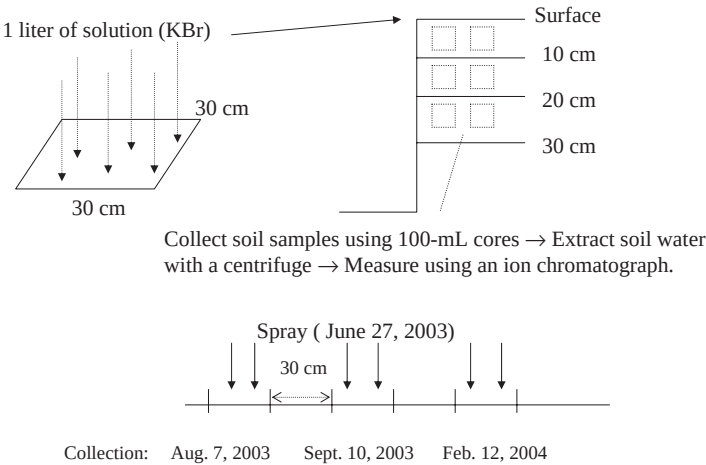


Table 1. Analytical results.

	Amount of soil water above the Br ⁻ peak (mm)	Analytical results	Cumulative rainfall since June 27, 2003 (mm)
Aug. 7	0 (Peak was 0 cm.)	Average evaporation was 4 mm/day.	170
Sept. 10	105 (Peak was 30-40 cm.)	Infiltration was about 100 mm, and surface runoff and evaporation was about 190 mm.	460
Feb. 12	83 (Peak was 50-60 cm.)	Some Br ⁻ rose up to the surface.	855

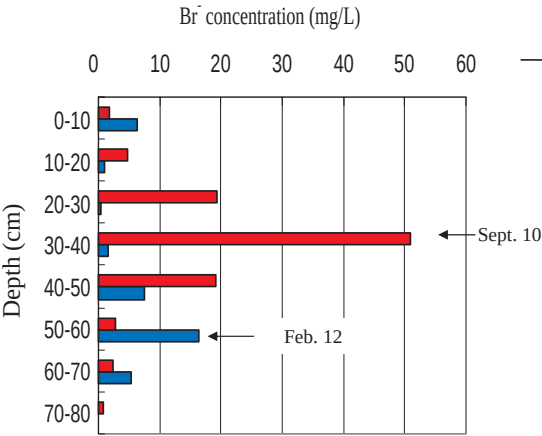


Fig. 2 Br⁻ concentration in soil water.

TOPIC3

Development and application of a simple apparatus to concentrate ²²²Rn for the measurement of ²²²Rn concentration in surface water

Radon-222 (²²²Rn) concentration in surface water is a good indicator for identifying where groundwater appears at the surface. However, it is necessary to concentrate ²²²Rn in order to measure it. This operation is painstaking and requires special equipment. In this study, we developed a simple method in which ²²²Rn is extracted from the sample water by passing air through the sample and then through toluene cooled with dry ice submerged in ethanol.

Since the origin of ²²²Rn is radium-226

(²²⁶Ra) underground, ²²²Rn concentration in groundwater is much higher than that in surface water. When groundwater appears on the surface, the ²²²Rn concentration in surface water increases markedly. We propose an apparatus for concentrating ²²²Rn in toluene cooled in ethanol/dry ice based on the characteristic of ²²²Rn that it dissolves very readily in cooled toluene (Fig. 1). The air is circulated for 60 min. After concentrating, the toluene is poured into a 20-mL glass vial and the radioactive rays from ²²²Rn and its progeny are counted using a liquid scintillation counter.

The relationship between ²²²Rn concentration and counting rate of the liquid scintillation counter was approximately linear, with the line passing through the origin of the coordinate axes, confirming the practicability of the method (Fig. 2).

Application of the method to a study site around Khon Kaen revealed that groundwater leaks into rivers and lakes in areas with elevations below 180 m, a result that agrees

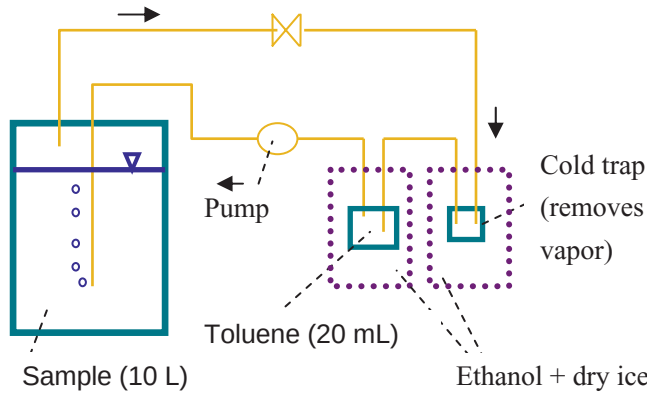


Fig. 1. Apparatus for concentrating ²²²Rn in water samples.

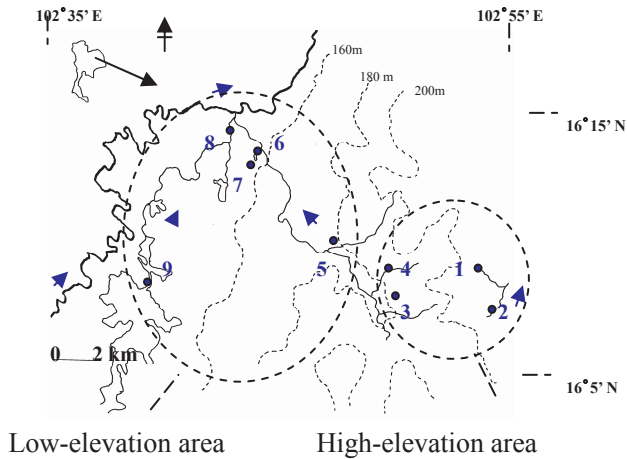


Fig. 3. Location of sampling water.

with the results from a simulation of groundwater flow (Fig. 3, Table 1).
(H. Hamada)

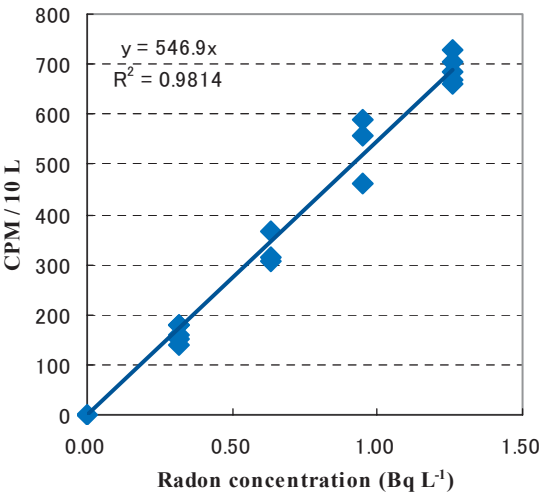


Fig. 2. Relationship between ²²²Rn concentration and count rate.

Table 1. Results of the investigation.

No.	²²² Rn C. (Bq/L) x 10 ⁻³
Elevations above 180 m	
1	17
2	25
3	26
4	20
Elevations below 180 m	
5	77
6	66
7	70
8	57
9	77

TOPIC4

Seasonal occurrence and natural enemies of *Helicoverpa armigera* (Lepidoptera: Noctuidae) larvae on pigeon pea in Kenya

In view of the recent interest in the use of sustainable and environmentally friendly methods to control crop pests, there is an increasing focus on using indigenous natural enemies to achieve biological control.

Helicoverpa armigera is one of most serious pests of vegetables, cereals, and cash

crops worldwide. Based on our several field surveys in Kenya, this species is also abundant in the fields, but is attacked by various natural enemies, including several species of parasitoids. We established an experimental field of pigeon pea (*Cajanus cajan*) at Nairobi in Kenya and conducted weekly collections of *H. armigera* larvae in order to obtain information on the pest and the occurrence of its natural enemies throughout the year. Collected larvae were kept individually, provided with an artificial diet, and observed for development and parasitization. Data on seasonal occurrence, percentage parasitism, and the host stage attacked were compiled

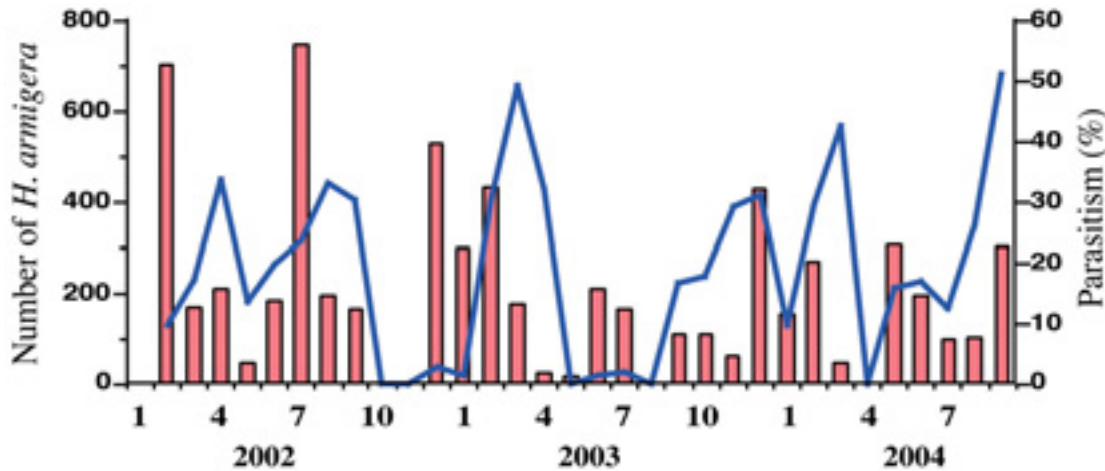


Fig. 1. Monthly changes in the number of *H. armigera* larvae collected in the field (bars) and total percentage parasitism by the two tachinid species *L. longirostris* and *D. zonata* (line) from February 2002 to September 2004.

between February 2002 and September 2004.

Our results showed the most important mortality factor of the collected *H. armigera* larvae to be parasitization by the gregarious *Drino zonata* and the solitary *Linnaemya longirostris*, both of which are parasitoid flies in the Tachinid family (Figs. 1 and 2). Parasitization of the two species peaked at different times of the year. Total parasitism per month and per week sometimes exceeded 50% (Fig. 1) and 75%, respectively.

Our laboratory experiments revealed that *D. zonata* required relatively high temperatures to develop: they could not survive at temperatures below 15°C, which might be one of the reasons for the decrease in percentage parasitism by this parasitoid between May and January (Fig. 2 (b)), as these months present minimum temperatures lower than 15°C.

Competition between the two species within a host was also investigated in the laboratory, since one species parasitized on the day-1 last instar larva of *H. armigera*, 48 hours before the other (clutch size was 1). We found no absolute winners in any cases or of unsuccessful parasitization, defined as both parasitoids dying within the host (Fig. 3).

Drino zonata showed high parasitization rates in early months of the year but *L. longirostris* showed the same rate all the year through. They did not exhibit scramble-type competition, but coexisted in the same environment. We conclude that these two parasitoid species are good potential candidates as biological control agents of *H. armigera*.

(S. Nakamura)

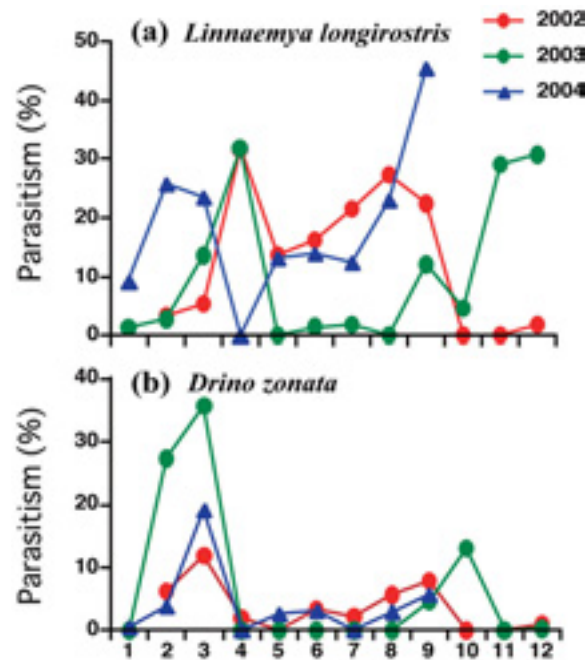


Fig. 2. Monthly changes in percentage parasitism of *H. armigera* by *L. longirostris* (a) and *D. zonata* (b) from February 2002 to September 2004.

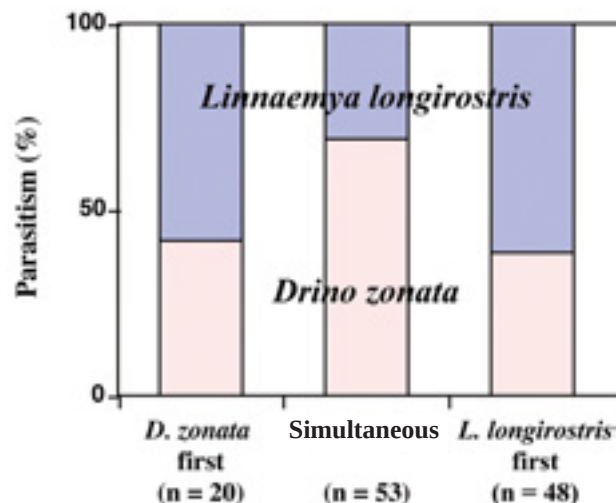


Fig. 3. Percentage adult emergence of tachinid flies (*L. longirostris* and *D. zonata*) when one tachinid species parasitized on the day-1 last instar larva of *H. armigera*, 48 hours before the other species (clutch sizes were normalized as one).

ANIMAL PRODUCTION AND GRASSLAND DIVISION

Domesticated animals provide essential commodities and services. Livestock supply not only meat, milk, wool, and hides that are essential to daily life and serve as important sources of income, but also contribute to efficient farming through nutrient recycling, in which less profitable biomass is converted into value-added products or processes and manure is used as a good organic fertilizer for infertile land. Thus, livestock form an essential part of the social fabric, especially in developing countries, where the demand for meat and milk is rapidly increasing. On the other hand, overgrazing and inappropriate management of livestock results in pollution, environmental degradation, and disease. To determine optimal methods of livestock management, the Animal Production and Grassland Division focuses on research into enhancing the productive capacity of natural resources, managing grasslands to secure feed resources, enhancing the utilization of agro-industrial by-products, controlling invasive animal diseases, and improving management practices in the world's developing regions.

During Fiscal Year 2004, the Division ran nine research projects and has sent five long-term dispatch researchers and five short-term dispatch researchers overseas. Cooperative work with the National Center for Research on Beef Cattle (CNPGC-EMBRAPA) in Brazil was carried out to develop a sustainable management method for soybean production

Head cage energy measurement system established at the Khon Kaen Animal Research Center. (Photo: T. Suzuki)



by means of an agro-pastoral system. Simultaneously, a joint research project with the National Institute of Agronomic Technology (INTA) in Argentina was conducted to improve the use of soybean by-products for animals and to investigate methods for processing soybeans into ruminant feed. Collaborative studies with Cantho University in Vietnam, as a follow-up to the JIRCAS project entitled "Development of new technologies and their practice for sustainable farming systems in the Mekong Delta (Phase II)," were conducted to improve the digestibility of swine feed based on rice bran supplemented with regional by-products in the Mekong Delta. In collaborative work with Kasetsart University in Thailand, an economical mass-culture method was developed for lactic acid-producing bacteria selected to make good quality silage. A joint research study with the Khon Kaen Animal Research Center and the Department of Livestock Development (DLD) in Thailand was carried out to evaluate the nutritional value of drought-tolerant forage crops such as *Erianthus* spp. and to improve animal performance and, moreover, to estimate the amount of methane emission from ruminants fed several types of local feed. A collaborative study with the International Livestock Research Institute (ILRI) in Kenya was carried out to clarify the difference between macrophages separated from cattle with different trypanosome sensitivity as measured by gene expression. Finally, domestic research at Tsukuba was conducted to identify the flora of nitrogen-fixing endophytes in gramineous plants using culture-independent techniques.

TOPIC1

A new group of nitrogen-fixing endophytic bacteria in rice plants

There are numerous reports on nitrogen-fixing endophytic bacteria that live symbiotically in gramineous plants. We have isolated many bacteria with nitrogen-fixing ability from gramineous pasture grasses and related plants and carried out phylogenetic analyses and inoculation tests on them. However, microorganisms in these ecosystems are not always culturable, although they are viable and their biological activities can be detected. We therefore analyzed communities of nitrogen-fixing endophytes using a culture-independent technique, employing rice as a

model plant. RNA-based studies (specifically mRNA) gave information on the activities of specific populations, while DNA-based studies provided information on community structures.

We amplified partial *nifH* genes by PCR and RT-PCR from DNA and RNA, respectively, extracted from the roots and stems of two rice cultivars (Sprice and Tetep) cultivated in a paddy field, followed by cloning to *E. coli* and sequencing of the insertions. We carried out a homology search of each NifH amino acid sequence translated from *nifH* nucleotide sequences, and constructed phylogenetic trees. Numerous NifH sequences without close relatives in known cultured diazotrophs were frequently recovered from the roots and stems of both rice cultivars and designated as “unknown independent Cluster X” (Fig. 1) since they were only distantly related to known diazotrophs. A comparison of roots and stems showed the ratios of Cluster X in stems to be higher than those in roots (Fig. 2). There are several clones belonging to Cluster X identified by PCR that amplify DNA (Fig. 2). Although we very frequently obtained NifH sequences belonging to clusters with *Klebsiella* (Cluster A), *Azospirillum* (Cluster B), and *Paenibacillus* (Cluster C), etc., by the culture method, the frequency of the above sequences recovered by RT-PCR was lower than those using the culture method. These results suggest that the diazotrophs in this new group are truly active and predominant components of nitrogen-fixing endophytes of rice plants and are different from currently known cultured bacteria.

(Y. Ando)

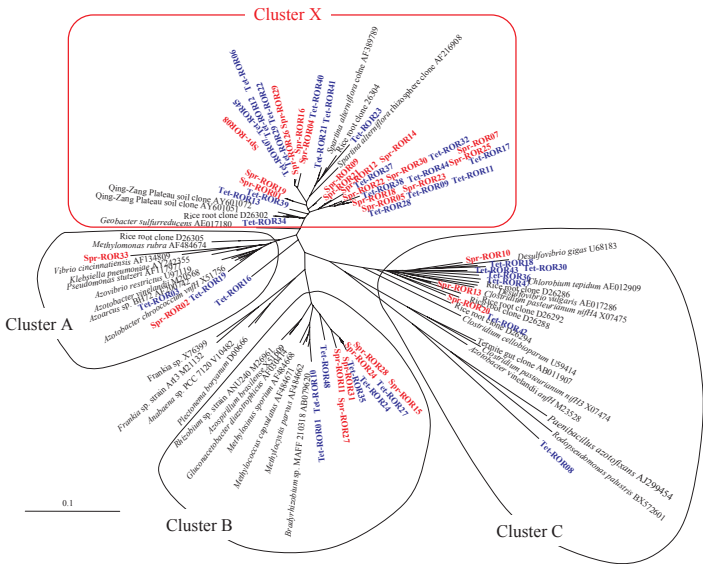


Fig. 1. Phylogenetic analysis (NJ method) of NifH amino acid sequences translated from *nifH* clones obtained from roots of rice cv. Sprice and cv. Tetep (Spr-RORxx, derived from cv. Sprice; Tet-RORxx, derived from cv. Tetep; xx is the clone number).

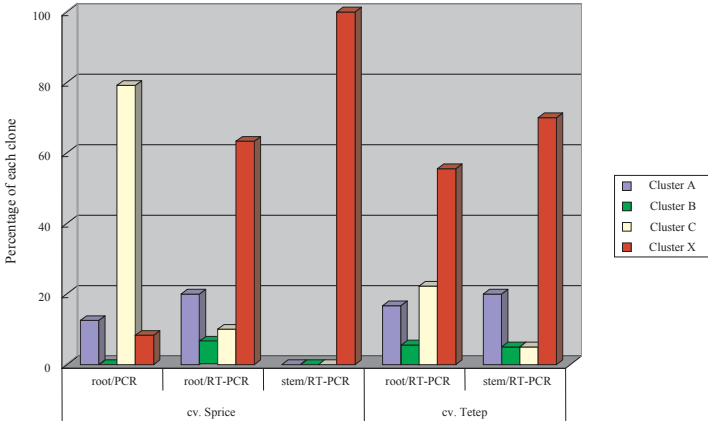


Fig. 2. Relative abundance of each phylogenetic cluster of NifH translated from *nifH* clones obtained from roots and stems of rice cv. Sprice and cv. Tetep.

TOPIC2

Effects of sugarcane syrup in pig diets on feed requirements and nutrient digestibility in the Mekong Delta region of Vietnam

In the Mekong Delta region, one of the two major grain-producing areas of Vietnam, a very high percentage of raw rice bran is used as pig feed. Farmers also use commercial feed to compensate for nutritional imbalances, but its high cost often places a financial burden on the producers. Hence, greater usage of locally available but underutilized feed

resources such as water spinach (*Ipomoea aquatica*) and water hyacinth (*Eichhornia crassipes*) is being encouraged. The results of our previous studies revealed that there is enough of each species to supply up to 5-6% of the diet on a dry matter basis and to replace commercial feed without any reduction in growth performance; and with lower feed costs and higher pork prices, feeding water plants to pigs proved beneficial in terms of both production rate and market value. An agricultural by-product, sweet potato (*Ipomoea Batatas* L.) vine (SPV), was also tested and showed positive results. On the other hand, sugarcane (*Saccharum officinarum*) by-products, such as molasses

and bagasse, are currently being used as animal feed. However, there is little study on sugarcane syrup (SCS), an intermediate product made from sugarcane juice by boiling for several hours to evaporate the water. SCS is as palatable to the animal as the juice, and can be stored for much longer periods than the juice. The present study focused on the efficiency of additional levels of the SCS and its combination effect with an excess amount of green feed, SPV, on feed requirements and nutrient digestibility of pigs.

Three experiments were conducted in a study using basal diet with a high percentage of rice bran. In the first two experiments, 0-8% of control diets were replaced by SCS to formulate treatment diets. In the third experiment, the treatment diets contained 10% SPV, or 10% SPV and 3% SCS. The results can be summarized as the following five points: first, the daily weight gain tended to increase or significantly increase as a result of supplementation with 2 or 4% SCS, respectively; second, there were no differences in feed intake among the diets in each of the three experiments; third, the feed requirement was improved by supplementation of 2-4% SCS, and tended to improve by supplementation of 6-8% SCS

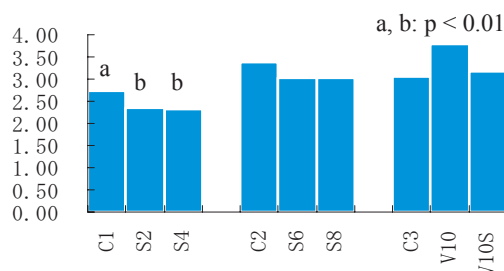
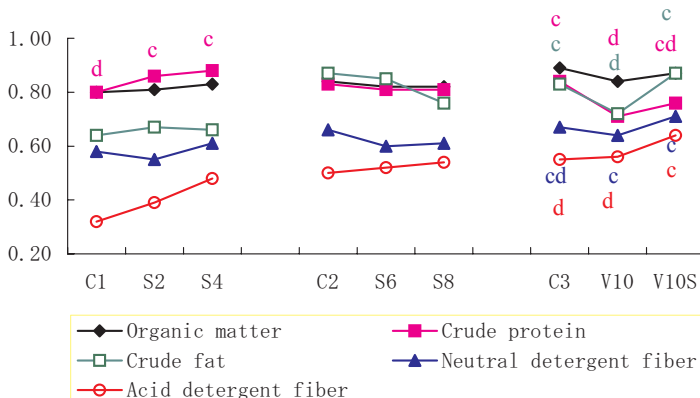


Fig. 1. Feed requirements (feed intake/weight gain)¹⁾.
¹⁾ C1-3: control diets in Experiments 1-3. S2-8: diets in which, in Experiments 1-2, 2-8% of control diets were replaced by sugarcane syrup. V10: diets in which, in Experiment 3, 10% of the control diet was replaced by sweet potato vine. V10S: diets in which, in Experiment 3, 10 and 3% of the control diet were replaced by sweet potato vine and sugarcane syrup, respectively.

Fig. 2. Digestibility (%)¹⁾.
¹⁾ See Fig. 1. c, d: p < 0.05.



(Fig. 1); fourth, the digestibility of crude protein (CP) was improved, and that of acid detergent fiber (ADF) tended to be improved by 2-4% SCS supplementation; fifth, 10% SPV supplementation tended to have a negative effect on weight gain and feed requirement compared with no supplementation, but these effects were counteracted by the addition of 3% SCS (Figs. 1 and 2). The same patterns were found for the digestibility of CP and crude fat (CF). Although the digestibility of neutral detergent fiber and ADF were not affected by the supplementation of 10% SPV, that of ADF was increased by the addition of SCS. Overall, 4% SCS in the diet was optimal to improve weight gain and satisfy the feed requirements of pigs. Furthermore, SPV could be used at up to 10% with no negative effects on weight gain, feed requirement, or digestibility of CP and CF, provided 3% SCS was also added to the diet. The presence of several effects of SCS on growing performance and digestibility was indicated, although it is not clear which nutritional ingredient affects which parameters. In addition, the application of SCS with higher percentage of green plants, such as water plants and agricultural by-products, in the diet is of great interest, since huge amounts of these green plants are available in the region, although the productivity of some of these shows seasonal changes.

(S. Yamasaki)

FOOD SCIENCE AND TECHNOLOGY DIVISION

There is increasing emphasis on the agri-food sector, which focuses on improving food quality and safety, storage, beneficial processing, product differentiation, marketing, and distribution, due to a number of emerging global trends that include urbanization, globalization, and rising consumer concerns about food quality and safety. The operations and processes conducted in the agri-food sector are now considered to be critical for the achievement of developmental goals for food security, poverty alleviation, and sustainable growth. The role of the Division is to contribute to the technological advancement of this sector in developing countries.

The Division is currently conducting research on the physiological functionalities

and bagasse, are currently being used as animal feed. However, there is little study on sugarcane syrup (SCS), an intermediate product made from sugarcane juice by boiling for several hours to evaporate the water. SCS is as palatable to the animal as the juice, and can be stored for much longer periods than the juice. The present study focused on the efficiency of additional levels of the SCS and its combination effect with an excess amount of green feed, SPV, on feed requirements and nutrient digestibility of pigs.

Three experiments were conducted in a study using basal diet with a high percentage of rice bran. In the first two experiments, 0-8% of control diets were replaced by SCS to formulate treatment diets. In the third experiment, the treatment diets contained 10% SPV, or 10% SPV and 3% SCS. The results can be summarized as the following five points: first, the daily weight gain tended to increase or significantly increase as a result of supplementation with 2 or 4% SCS, respectively; second, there were no differences in feed intake among the diets in each of the three experiments; third, the feed requirement was improved by supplementation of 2-4% SCS, and tended to improve by supplementation of 6-8% SCS

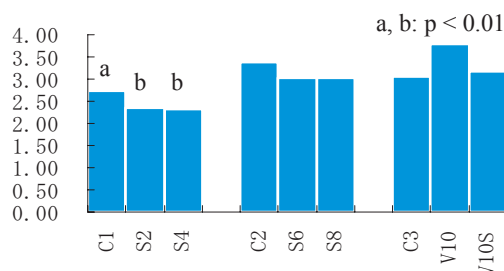
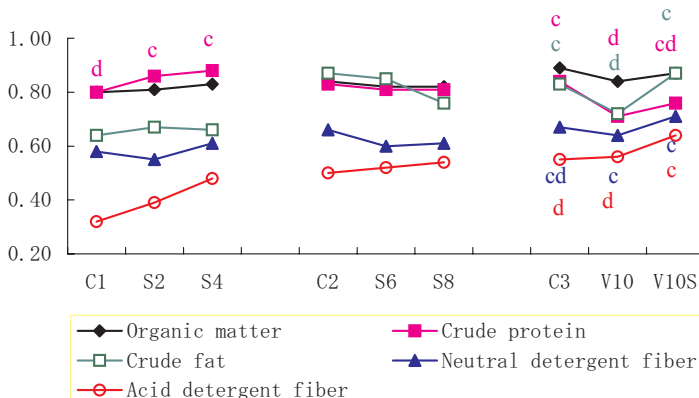


Fig. 1. Feed requirements (feed intake/weight gain)¹⁾.
¹⁾ C1-3: control diets in Experiments 1-3. S2-8: diets in which, in Experiments 1-2, 2-8% of control diets were replaced by sugarcane syrup. V10: diets in which, in Experiment 3, 10% of the control diet was replaced by sweet potato vine. V10S: diets in which, in Experiment 3, 10 and 3% of the control diet were replaced by sweet potato vine and sugarcane syrup, respectively.

Fig. 2. Digestibility (%)¹⁾.
¹⁾ See Fig. 1. c, d: p < 0.05.



(Fig. 1); fourth, the digestibility of crude protein (CP) was improved, and that of acid detergent fiber (ADF) tended to be improved by 2-4% SCS supplementation; fifth, 10% SPV supplementation tended to have a negative effect on weight gain and feed requirement compared with no supplementation, but these effects were counteracted by the addition of 3% SCS (Figs. 1 and 2). The same patterns were found for the digestibility of CP and crude fat (CF). Although the digestibility of neutral detergent fiber and ADF were not affected by the supplementation of 10% SPV, that of ADF was increased by the addition of SCS. Overall, 4% SCS in the diet was optimal to improve weight gain and satisfy the feed requirements of pigs. Furthermore, SPV could be used at up to 10% with no negative effects on weight gain, feed requirement, or digestibility of CP and CF, provided 3% SCS was also added to the diet. The presence of several effects of SCS on growing performance and digestibility was indicated, although it is not clear which nutritional ingredient affects which parameters. In addition, the application of SCS with higher percentage of green plants, such as water plants and agricultural by-products, in the diet is of great interest, since huge amounts of these green plants are available in the region, although the productivity of some of these shows seasonal changes.

(S. Yamasaki)

FOOD SCIENCE AND TECHNOLOGY DIVISION

There is increasing emphasis on the agri-food sector, which focuses on improving food quality and safety, storage, beneficial processing, product differentiation, marketing, and distribution, due to a number of emerging global trends that include urbanization, globalization, and rising consumer concerns about food quality and safety. The operations and processes conducted in the agri-food sector are now considered to be critical for the achievement of developmental goals for food security, poverty alleviation, and sustainable growth. The role of the Division is to contribute to the technological advancement of this sector in developing countries.

The Division is currently conducting research on the physiological functionalities

of tropical indigenous vegetables and traditional Chinese fermented foods. In 2004, we found that extracts of Chinese *douchi* (soy nuggets) strongly inhibited angiotensin I-converting enzyme activity, indicating high blood pressure-preventive activity. With its long history of developing and utilizing various kinds of fermented foods, wide variety of geographic conditions, and many ethnic groups, China has enormous potential as a “library” of traditional foods with powerful but as yet unknown physiological activities. We have also commenced a project on “Physiological functionalities of indigenous vegetables in Southeast Asia” for the main purposes of screening tropical vegetables with high physiological activity and developing cultivation conditions that promote higher activity. As for research into value addition to agricultural products, we have been working on a flavor component of aromatic rice, 2-acetyl-pyrroline, for quality improvement of aromatic rice as well as on the quality and characteristics of Japanese wheat in terms of its glutenin allele composition.

In addition to the above-mentioned studies, we have launched a three-year feasibility study project, named “ASEAN Biomass R&D Strategy,” in cooperation with six major Japanese institutes and the



Thai indigenous vegetables.
(Photo: K. Nakahara)

University of Tokyo. The aims of the study are: 1) to assess biomass resources in ASEAN countries, 2) to identify the relevant technologies to be applied, 3) to assess their possible environmental and economic merits, 4) to build a network of ASEAN biomass key players, and finally 5), to formulate a strategy for promoting the utilization of biomass in ASEAN countries.

Thus, the Division has been engaging in research into food quality, functionality and biomass utilization, mainly in Asia.

TOPIC1

Geographical diversity of the glutenin *Glu-D1f* allele (correlated with noodle-making quality) frequency in Asian common wheat (*Triticum aestivum* L.) and its transmission routes to Japan in common wheat

It is well known that common wheat (*Triticum aestivum* L., $2n = 42$, AABBDD) was present about 7,000 to 10,000 years ago in the Middle and Near East. It was then transmitted from its origin to Europe, Africa, southern Asia and China. Little is known, however, about the actual route of transmission of common wheat into Japan. The objective of this study was to analyze the distribution of alleles at the *Glu-D1* locus throughout Asia, then to determine the route by which common wheat reached Japan, the region most geographically remote from its origin. This study was predominantly on variation in the HMW-glutenin *Glu-D1f* allele

and the factors which affected its distribution in different parts of the world.

In this research, the allelic compositions of the high-molecular-weight (HMW) glutenin subunit from 131 Japanese improved cultivars, as well as 174 Japanese, 353 Chinese, 72 Korean, 150 Turkish, 3 Syrian, 6 Israeli, 4 Iranian, 1 Iraqi, 21 Afghan, 23 Indian, 15 Pakistani, 7 Bhutanese, 66 Nepalese, 1 Myanmar, 1 Filipino, 2 Thai, 3 Indonesian, and 46 Taiwanese landraces of common wheat were investigated. These were examined by sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE). Gels were made up to 10% (w/v) acrylamide and 0.2% (w/v) bis-acrylamide containing 1.5 M Tris-HCl at pH 8.8 and 0.27% SDS. Concerning the worldwide distribution of the *Glu-1* alleles, data on 1,380 published cultivars were available; the frequency of the HMW glutenin alleles was also available for Japanese wheat varieties. These data sets were compared to the results for 1,179 common Asian wheat varieties which were determined in this study. In total, 1,380 published cultivars from 21

countries and 1,179 Asian varieties were included in these comparisons. The frequency of the HMW glutenin *Glu-D1* alleles in Japanese, Chinese, and other Asian common wheat varieties was analyzed to investigate a possible transmission route for common wheat to Japan. Although the frequency varied among areas, the allele *Glu-D1f* was present in wheat from northern and southern Japan; Xinjiang, Nanjing, Zhejiang, and Beijing in China; the Korean Peninsula, and Afghanistan. However, a high frequency of the *Glu-D1f* allele was found predominantly in southern Japan. It was not detected in wheat from any other Asian region (Table 1). This distribution of an adaptively neutral character suggests two specific routes of transmission for common wheat to eastern China, the Korean Peninsula, and Japan. It was introduced from Afghanistan, carried to Xinjiang (in northwest China), Nanjing, Zhejiang (in southeast China), or via the Korean Peninsula, and then to southern Japan along the Silk Road (Fig. 1). It is believed that cultivated common wheat originated in the Middle and Near East and was carried along the Silk Road through China to the Far East and Japan. Japan is the most geographically remote region from the Middle and Near East, the origin of common wheat. During the

course of its long journey and its adaptation to diverse local environments, Japanese common wheat has developed a unique composition of glutenin *Glu-D1f* alleles. In this study, the specific distribution of an adaptively neutral characteristic (the *Glu-D1f* allele) suggests two transmission routes for common wheat into eastern China and the Far East, the Korean Peninsula, and Japan. The results presented here indicate that the *Glu-D1* allele analysis acted as a powerful tool for this investigation of the actual transmission route of common wheat across Asia and into Japan.

The quality of common wheat (*Triticum aestivum* L.) grain favored in bread and/or noodle making is strongly affected by the components of seed storage protein, particularly HMW glutenin subunits. The HMW glutenin 2.2 subunit controlled by the *Glu-D1f* allele, which is correlated with good *udon* noodle making quality, is frequently found in Japanese common wheat varieties and landraces. According to a study of the worldwide distribution of *Glu-1* alleles in common wheats, *Glu-D1f* is rare. The *Glu-D1f* allele is therefore one of the most important seed storage protein alleles in Japanese common wheat.

(H. Nakamura)

Table 1. Comparison of *Glu-D1f* allele frequency for Afghan, Chinese, Japanese, and other Asian common wheats (*Triticum aestivum* L.).

Country	Total number of varieties examined	Number of varieties carrying <i>Glu-D1f</i> allele	Frequency (%)	χ^2 -value
Other Asian areas	428	0	0.0	1.4**
Afghanistan	21	2	9.5	46.86**
China	353	5	1.4	-----
Korean Peninsula	72	5	6.9	21.61**
Japanese landrace	174	44	25.3	408.01**
Japanese improved variety	131	46	35.1	811.21**

Other Asian areas: Turkey, Syria, Israel, Iran, Iraq, India, Pakistan, Bhutan, Nepal, Myanmar, Philippines, Thailand, Indonesia, and Taiwan. ** Significant at the 0.01 probability level. *Glu-D1f* allele frequency of Chinese common wheats: the "expected" class.

Fig. 1. Possible transmission routes for common wheat (*Triticum aestivum* L.) into Japan. a: Middle and Near East (the origin of common wheat); b: Afghanistan; c: Xinjiang; d: Xian; e: Jiangsu; f: Zhejiang; g: Southern Japan; h: Northern Japan; i: Beijing.



TOPIC2

Growth-inhibitory activity against maize weevil and the antifungal activities of volatile compounds from citronella grass

Numerous aromatic plants are endemic to Southeast Asia. In addition to their use in food and cosmetics, they have long been

employed as mosquito repellants and antifungal household fumigants. This suggests that aromatic plants and their volatile components might be effective against certain postharvest pests. In fact, terpenes, which commonly occur in these aromatic plants, exhibit various biological effects on harmful living organisms. Natural products are generally regarded as safe and more environment-friendly than synthetic chemicals, and there is a little chance of the occurrence of resistant pests. Thus, by applying locally obtained aromatic plants, we aim to develop an alternative method for eliminating postharvest pests. First, we determined the growth-inhibiting effects of four selected aromatic plants, citronella grass (*Cymbopogon nardus*), lemon grass (*Cymbopogon citratus*), pomelo (*Citrus grandis*) peel, and fingerroot (*Boesenbergia pandurata*) rhizomes, against maize weevil (*Sitophilus zeamais*) and nine fungal strains that are sometimes detected in Thai rice. Of the four plants, citronella grass showed the highest effects against both weevils and fungi. In particular, the citronella oil completely inhibited all nine tested fungal strains at low doses. Citronella grass (*Cymbopogon nardus*) is a perennial grass growing mainly in South and Southeast Asia. The essential oil extracted from it, citronella oil, has a characteristic rosy and herbaceous-citrus aroma, and is used for several industrial purposes. Next, the active principles in the citronella oil were identified. The composition of steam-distilled citronella oil was analyzed by capillary gas chromatography and gas chromatography/mass spectrometry. The major volatile components in the sample, obtained in Bangkok, Thailand, were geraniol (35.7% of total volatiles), *trans*-citral (22.7%), *cis*-citral (14.2%), geranyl acetate (9.7%), citronellal (5.8%), and citronellol (4.6%). The growth-inhibitory activity of major components of citronella oil and structurally related compounds against weevils was determined using the following method. Two hundred and fifty randomly selected adult maize weevils were reared on polished rice (410 g) at 30°C and R.H. for 7 days. Ten-gram samples of this rice, on which these weevils had laid eggs, were then transferred into 0.57-liter glass containers and incubated for 8 weeks sealed shut. Each compound was directly dropped inside the container to give a concentration of 15.4 ppm at the beginning of the experiment. The inhibitory activity was evaluated by the number of emerged adult descendants. Nine

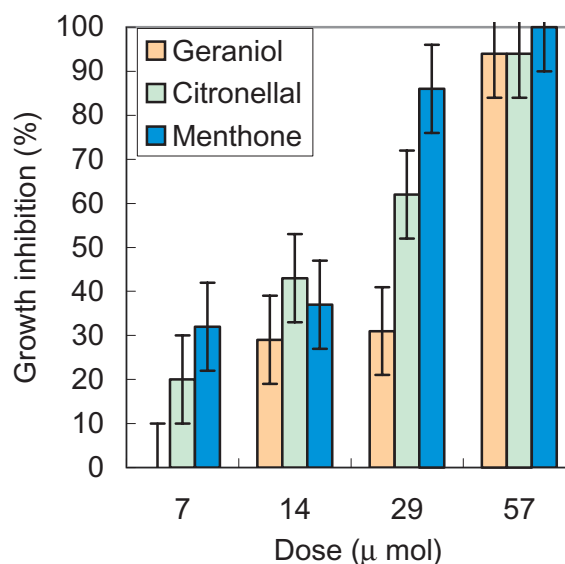


Fig. 1. Growth-inhibitory activity of geraniol, citronellal, and menthone against maize weevil.

out of the 19 compounds examined suppressed more than 50% of development of adult weevils from eggs. Notably, three monoterpenes (menthone, *trans*-geraniol, and citronellal) showed a strong inhibitory effect (Fig. 1). The antifungal activity of the components of citronella oil and related compounds was determined by the vapor-agar contact method as follows. Fungal spores (1.5×10^3) were incubated on potato-dextrose agar plate in a sealed chamber (capacity 300 mL) with volatiles. Antifungal activity was evaluated by measuring the diameter of the formed colonies. Two monoterpenes, citronellal and linalool, exhibited complete inhibition of the growth of all nine tested fungal strains at a dose of 112 ppm (Table 1). The terpenes that showed growth-inhibitory effects against weevil and antifungal activity have specific flavors, so there were concerns that the absorption of these substances into the rice grains would affect the palatability of the stored rice. Absorption tests and sensory evaluation tests showed that a large portion of citronellal adsorbed onto surfaces of rice grains could be removed by milling or simply leaving in the open air. Residual citronellal would decrease to below detectable levels during transportation and cooking. These results suggested that some aromatic plants and volatile components of aromatic plants, e.g., menthone, *trans*-geraniol, citronellal, and linalool, have potential as effective postharvest chemicals to protect stored food. (K. Nakahara, N.S. Alzoreky, G. Trakoontivakorn, Y. Hanboonsong, H.T.T. Nguyen, and T. Yoshihashi)

Table 1. Antifungal activity of selected volatile compounds as determined by the gaseous contact method.

Volatile compounds (112 mg/L)	Growth inhibition ^a								
	A. c. ^b	A. f. ^b	A. v. ^b	E. a. ^b	E. c. ^b	P. a. ^b	P. c. ^b	P. g. ^b	P. i. ^b
citronellyl acetate	-	-	-	-	-	-	-	-	-
geranyl acetate	-	-	-	-	-	-	-	-	-
α -terpineol	-	-	-	-	-	-	-	-	+
α -terpinene	-	-	-	-	+	-	-	-	-
limonene	-	-	-	-	-	-	-	-	-
isoeugenol	-	-	-	-	-	-	-	-	-
citronellal	++	++	++	++	++	++	++	++	++
citronellol	-	-	-	-	+	-	-	-	-
linalool	++	++	++	++	++	++	++	++	++
geraniol	-	-	-	-	-	-	-	-	+
citral	-	-	-	-	+	-	-	-	+
nerol	-	-	-	-	-	-	-	-	-
menthone	+	-	-	++	++	+	+	++	+
α -pinene	++	-	++	-	++	-	-	++	+
β -pinene	++	-	++	-	++	-	-	++	+
myrcene	-	-	-	-	-	-	-	-	-

^a ++ = potent activity (colony diameter < 1 mm), + = moderate activity (1-4 mm), - = weak or no detectable activity (> 4 mm); numbers in parentheses refer to vapor MID values (mg/L in air).

^b A. c. = *Aspergillus candidus*; A. f. = *A. flavus*; A. v. = *A. versicolor*; E. a. = *Eurotium amstelodami*; E. c. = *E. chevalieri*; P. a. = *Penicillium adametzii*; P. c. = *P. citrinum*; P. g. = *P. griseofulvum*; P. i. = *P. islandicum*.

TOPIC3

High angiotensin I-converting enzyme inhibitory activity of Chinese *douchi* (soy nuggets)

Angiotensin I-converting enzyme (ACE) plays an important role in the renin-

Table 1. Origin of production and microorganisms used for *douchi* fermentation.

Sample code	Origin of production	Major microorganism
1	Hunan	<i>Aspergillus</i>
2	Hunan	<i>Aspergillus</i>
3	Guangdong	<i>Aspergillus</i>
4	Guangdong	<i>Aspergillus</i>
5	Guangdong	<i>Aspergillus</i>
6	Shanghai	<i>Aspergillus</i>
7	Guizhou	<i>Aspergillus</i>
8	Sichuan	Bacteria
9	Chongqing	<i>Mucor</i>
10	Chongqing	<i>Mucor</i>
11	Sichuan	<i>Mucor</i>
12	Shangdong	Bacteria
<i>Hama-natto1</i>	Shizuoka, Japan	<i>Aspergillus</i>
<i>Hama-natto 2</i>	Kyoto, Japan	<i>Aspergillus</i>
<i>Itohiki-natto</i>	Kumamoto, Japan	<i>Bacillus natto</i>

angiotensin system that regulates the blood pressure and the blood circulatory system. Many types of Japanese fermented soybean foods are reported to exhibit a much stronger angiotensin I-converting enzyme (ACE)-inhibitory activity than their unfermented equivalents. Although these foods are believed to have originated in China, traditional Chinese fermented soybean foods such as *douchi* have not been systematically studied. *Douchi* are used as a seasoning or condiment in everyday Chinese dishes. During the more than 2,000-year history of *douchi* manufacture, a wide variety of types been produced in China. However, most manufacturing in China has been carried out by small factories using natural fermentation. We obtained 12 *douchi* samples from different regions of China and classified them by their dominant fermentation microorganism (Table 1). In this study, the ACE-inhibitory activities of *aspergillus*-type (7), *mucor*-type (3), and bacterial-type (2) *douchi* were determined and compared with Japanese *hama-natto* and *itohiki-natto*.

Fig. 1 shows the ACE-inhibitory activities of various *douchi* extracts compared with those of *hama-natto* and *itohiki-natto*, which are known to have strong inhibitory activity. All the samples except one showed similar

ACE-inhibitory activity to *itohiki-natto*. A *mucor*-type *douchi* from Sichuan province had about ten times higher activity than *itohiki-natto*. Studies on the identification of which microbes produce strong ACE inhibitors, and the relationship between their inhibitory activity and processing conditions are now in progress; the results will enable the development of an improved processing method for the production of highly functional foods.

(E. Tatsumi and M. Saito)

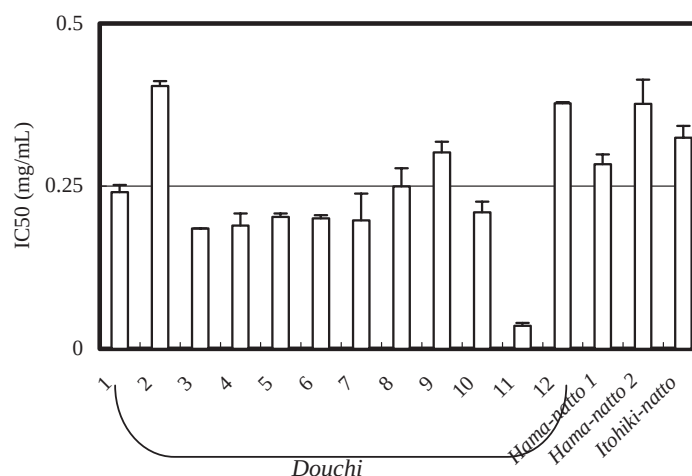


Fig. 1. Angiotensin I-converting enzyme (ACE) inhibitory activities of *douchi* and *natto* samples.

FORESTRY DIVISION

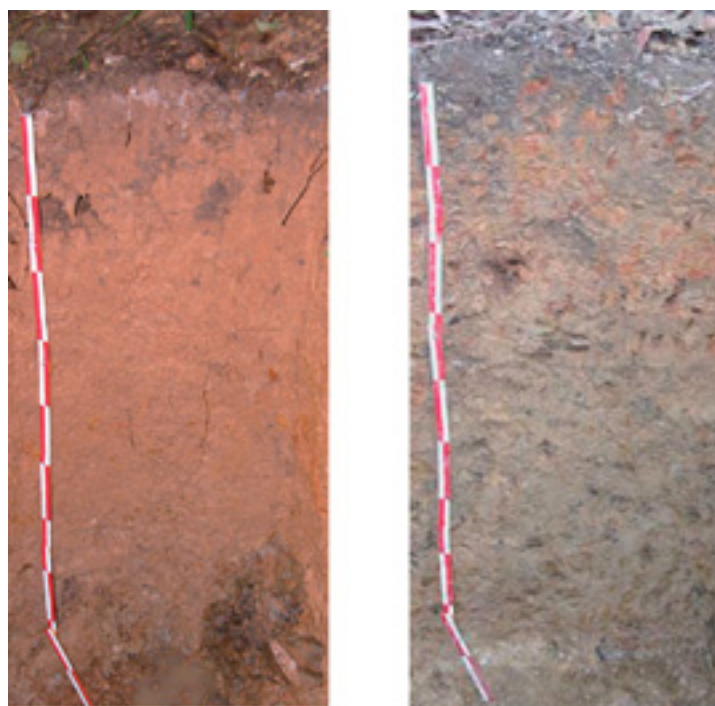
The increasing demand for food is compelling farmers to exploit larger areas of arable land, leading to the massive decline of natural forests, particularly in developing regions of the world. Forest degradation has generated serious economic and environmental problems, not only at the local level, but also on a global scale. The development of technology based on scientific data aimed to achieve the rehabilitation and sustainable management of forest areas therefore remains an urgent necessity. To halt forest decline, forest production systems and postharvest technologies need to be improved and refined.

The Forestry Division has focused on developing technologies for rehabilitation of degraded forest and grasslands and the sustainable use of forest products in Southeast Asia. Our programs and research goals for achieving the sustainable use of forest resources in the tropics were announced in JIRCAS's five-year Mid-Term Plan that commenced in 2001. Along these lines, we have established the following three themes through which we will attain these goals: 1) Development of regeneration technology in consideration of the preservation of forest environmental functions, 2) Development of technology for improvement of forest quality, and 3) Development of processing technology for effective use of unexploited forest resources.

In Fiscal Year 2004, the Division conducted four overseas projects, dispatching

a total of three researchers, of whom two were dispatched to the Forest Research Center (FRC) in Sabah State, Malaysia and the third to the Forest Research Institute, Malaysia (FRIM), on long-term assignments. Twelve researchers were also dispatched to the projects as short-term visiting scientists. Under the Administrative Invitation Program, the Division invited Mr. Mohamed Bazain Bin Idris, the State Attorney-General of Sabah, and Mr. Anuar Mohamad, the head of the Sabah Biodiversity Center, to discuss various aspects relating to the ongoing project in collaboration with the FRC in Sabah State,

Soil profiles of the agroforestry experimental plot established at an *Acacia mangium* 16-year-old man-made forest at the Kolapis Station of the Sabah Forest Research Center, Malaysia. (Left: Middle slope; Right: Upper slope) (Photo: M. Takahashi)



ACE-inhibitory activity to *itohiki-natto*. A *mucor*-type *douchi* from Sichuan province had about ten times higher activity than *itohiki-natto*. Studies on the identification of which microbes produce strong ACE inhibitors, and the relationship between their inhibitory activity and processing conditions are now in progress; the results will enable the development of an improved processing method for the production of highly functional foods.

(E. Tatsumi and M. Saito)

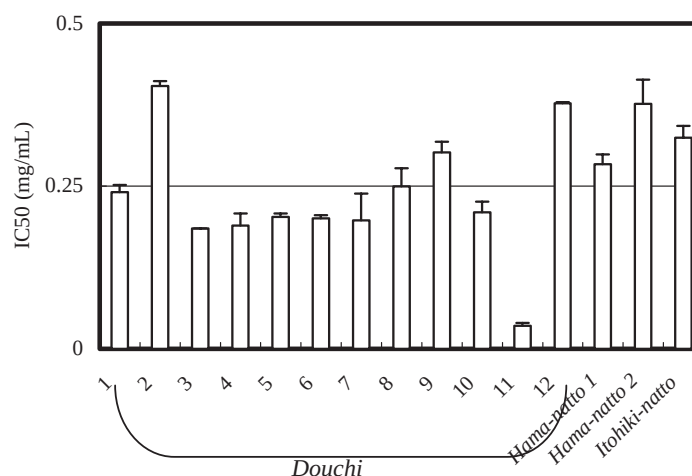


Fig. 1. Angiotensin I-converting enzyme (ACE) inhibitory activities of *douchi* and *natto* samples.

FORESTRY DIVISION

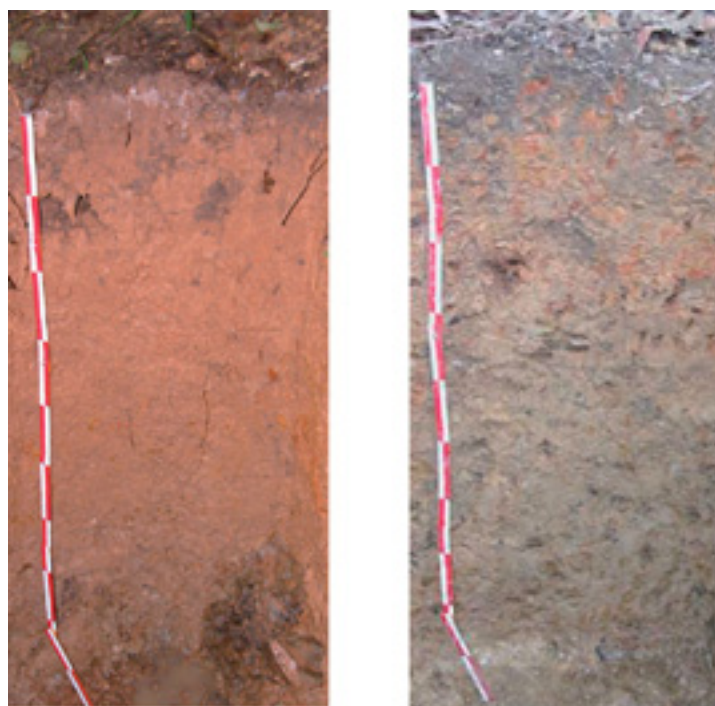
The increasing demand for food is compelling farmers to exploit larger areas of arable land, leading to the massive decline of natural forests, particularly in developing regions of the world. Forest degradation has generated serious economic and environmental problems, not only at the local level, but also on a global scale. The development of technology based on scientific data aimed to achieve the rehabilitation and sustainable management of forest areas therefore remains an urgent necessity. To halt forest decline, forest production systems and postharvest technologies need to be improved and refined.

The Forestry Division has focused on developing technologies for rehabilitation of degraded forest and grasslands and the sustainable use of forest products in Southeast Asia. Our programs and research goals for achieving the sustainable use of forest resources in the tropics were announced in JIRCAS's five-year Mid-Term Plan that commenced in 2001. Along these lines, we have established the following three themes through which we will attain these goals: 1) Development of regeneration technology in consideration of the preservation of forest environmental functions, 2) Development of technology for improvement of forest quality, and 3) Development of processing technology for effective use of unexploited forest resources.

In Fiscal Year 2004, the Division conducted four overseas projects, dispatching

a total of three researchers, of whom two were dispatched to the Forest Research Center (FRC) in Sabah State, Malaysia and the third to the Forest Research Institute, Malaysia (FRIM), on long-term assignments. Twelve researchers were also dispatched to the projects as short-term visiting scientists. Under the Administrative Invitation Program, the Division invited Mr. Mohamed Bazain Bin Idris, the State Attorney-General of Sabah, and Mr. Anuar Mohamad, the head of the Sabah Biodiversity Center, to discuss various aspects relating to the ongoing project in collaboration with the FRC in Sabah State,

Soil profiles of the agroforestry experimental plot established at an *Acacia mangium* 16-year-old man-made forest at the Kolapis Station of the Sabah Forest Research Center, Malaysia. (Left: Middle slope; Right: Upper slope)
(Photo: M. Takahashi)



Malaysia. From the FRC, FRIM, and the Royal Forest Department (RFD), Thailand, three counterparts were also invited to JIRCAS under the Counterpart Researcher Invitation Program.

In August 2004, JIRCAS and the RFD signed a memorandum of understanding (MOU). With the collaboration of the RFD, a project focused on identification of the sex pheromones of the mahogany shoot borer and teak beehole borer was conducted at the Forest Management and Forest Products Research Office and experimental sites in Supan Buri and Lampang. GC-EAD analyses of the volatile component of the female of the Mahogany shoot borer enabled us to detect several active peaks relating to sex pheromones.

Evaluation of the environmental impact of forest harvesting is a key research subject. Through cooperative work conducted at Bukit Tarek Experimental Watershed with the FRIM, we have tried to evaluate the water conservation function of logged-over forest.

The Forestry Division initiated a joint research project entitled "Development of agroforestry technology for the rehabilitation of tropical forests" in Fiscal Year 2000. The project was implemented mainly in collaboration with the FRC of the Forestry Department of Sabah State, Malaysia. JIRCAS organized a workshop, held on December 1-2, 2004 in collaboration with the FRC, to report on the progress of the project. Twelve researchers concerned with the project reported on the progress of their studies.

TOPIC1

Changes in soil conditions caused by thinning: an agroforestry experiment

Plantation forests that consist of non-

native, fast-growing species such as *Acacia* and *Eucalyptus* are increasingly prevalent in tropical regions. Some monoculture plantations are not exploitable for timber products due to their low market value, and also show very low biodiversity. A new intercropping system, in which domestic timber trees and selected cash crops such as medicinal plants are grown together, will enable the rehabilitation of tropical rainforest with higher biodiversity, while promoting the quality of life of local communities.

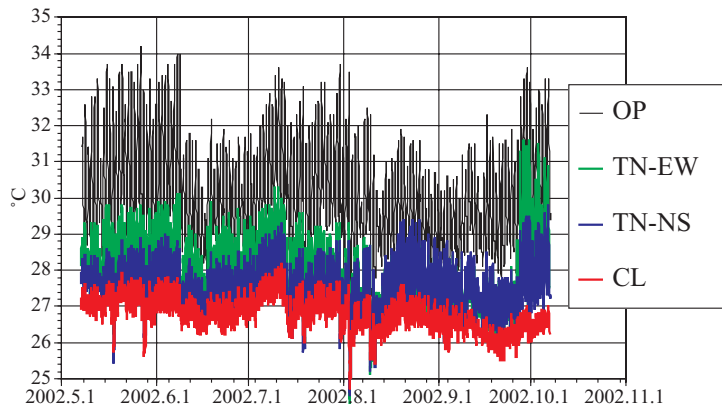
In an agroforestry project conducted in Sabah State, Malaysia, we are attempting to develop new techniques for promoting nurseries for timber, such as *Dipterocarpaceae*, and cash plants, such as fruits and local medicinal plants, inside plantation forests or secondary forests. As an initial step in developing this technique, thinning was conducted to improve the light conditions on the forest floor. In this sub-topic, we evaluated how the thinning treatment affected the soil and whether thinning is effective for the planned agroforestry system.

A 1.6 ha *Acacia mangium* plantation stand was selected as the agroforestry trial plot. We conducted one or two line-thinning treatments from east to west (TN-EW) and from north to south (TN-NS) in some areas, with the other areas remaining as the control (CL). Three soil temperature sensors and twelve soil moisture sensors (Delta-T; ADR Theta Probe) were installed in the plots. A soil temperature sensor was also installed in the nearest open area (OP).

The average soil temperatures at 10 cm depth in the CL, TN-EW, TN-NS, and OP sites were 26.8, 27.5, 27.8, and 30.1°C, respectively. Diurnal fluctuation at the OP site was higher than the others, peaking at 34°C (Fig. 1). On the other hand, diurnal fluctuation at the CL site was the lowest, reaching a maximum of 28°C. At the TN-EW and TN-NS sites, the shade effect by upper trees remained, giving a more suitable environment for nurseries than at the OP site.

Soil moisture increased very soon after rainfall, then decreased rapidly and continued to dry. The linear regression slope between drying period and soil moisture revealed a significant difference between the thinned and not-thinned plots. On the same plots, the regression slope was significantly lower at the thinned sites (TN-EW and TN-NS) than at the CL site (Fig. 2), showing that soil drying after rain was slowed by the thinning treatment. We assume this to be mainly due to the decreased

Fig. 1. Soil temperature at 10 cm depth after thinning treatment.



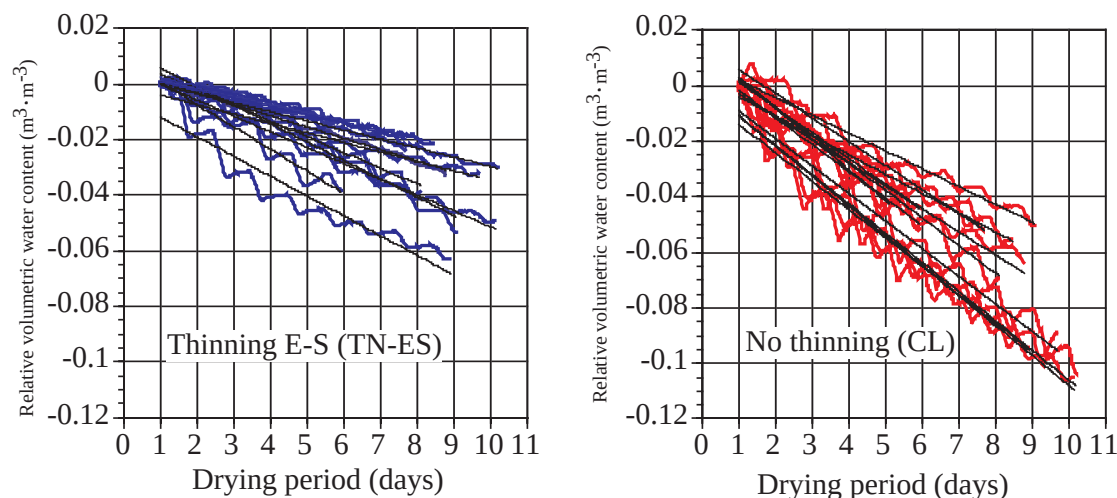


Fig. 2. Soil water decrease one day after rainfall. Relative volumetric water content refers to soil water content at one day after rainfall minus soil water content during drying period. Averages of slopes were -4.65×10^{-3} and -9.29×10^{-3} at TN-ES and CL, respectively. ($p < 0.01$)

rate of evapotranspiration resulting from the thinning treatment. Thinning appears to provide improved conditions for nurseries with respect to soil water content.

These results suggest that after thinning, temperature conditions 10 cm below the soil surface remain more stable and soil moisture is improved due to reduced water consumption by adult trees. We conclude that

the thinning treatment is a good procedure for establishing agroforestry sites. Large areas of non-native plantation forest, originally planted to cover bare ground after forest felling, remain in an unmaintained state. Our results are of potential use as fundamental data for policymakers when drawing up new forest management strategies.

(M. Inagaki)

FISHERIES DIVISION

Three new staff scientists joined the Fisheries Division in April 2004 and are now contributing to furthering the goals of fisheries research at JIRCAS. In addition, an Egyptian scientist affiliated to the Animal Production Department, Faculty of Agriculture of Cairo University was awarded a JIRCAS visiting research fellowship since December 2004 and is presently conducting studies on fish nutrition for a period of one year. The Division also dispatched a junior-level researcher to Thailand under a new postdoctoral system established by JIRCAS this fiscal year in order to support a long-term formal staff researcher conducting studies on seaweed under the project "Studies on sustainable production systems of aquatic animals in brackish mangrove areas."

Of particular interest, a new project entitled "Development of land-based recirculating aquaculture systems for the domestic production of whiteleg shrimp *Litopenaeus vannamei*" commenced in August 2004. This project is being carried out

with funding under the Bio-oriented Technology Research Advancement Institution (BRAIN) of Japan, a semi-governmental grant organization which provides support for new bio-based industrial initiatives. Japan is one of the world's major importers of shrimp and prawns, and the country's consumption amounts to 300,000 tons per year. However, Japan's production of shrimp based on aquaculture (only the kuruma prawn *Penaeus japonicus* is cultured) is only 2,000 tons per year, and production volumes are yet declining. Although a variety of species obtained through conventional fishing activities support Japan's domestic consumption, aquaculture taken together with capture fisheries production yields a self-sufficiency in shrimp of 10% at best. High production costs are thought to be one cause of the decline of the kuruma prawn culture industry in Japan, and in shrimp culture in general, frequent and serious outbreaks of particularly viral disease are always a significant concern. In this new project, it is aimed to develop land-based recirculating modes of shrimp culture that are cost-

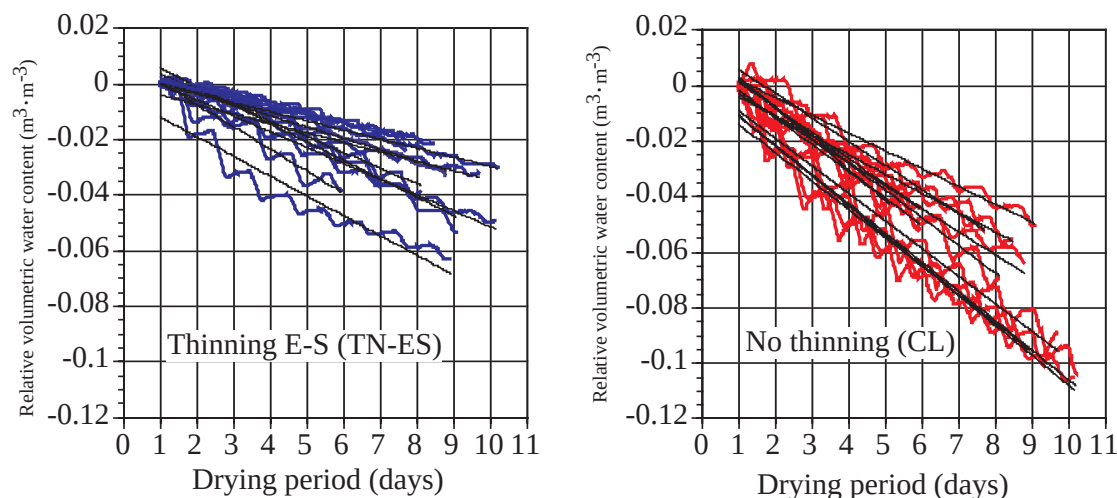


Fig. 2. Soil water decrease one day after rainfall. Relative volumetric water content refers to soil water content at one day after rainfall minus soil water content during drying period. Averages of slopes were -4.65×10^{-3} and -9.29×10^{-3} at TN-ES and CL, respectively. ($p < 0.01$)

rate of evapotranspiration resulting from the thinning treatment. Thinning appears to provide improved conditions for nurseries with respect to soil water content.

These results suggest that after thinning, temperature conditions 10 cm below the soil surface remain more stable and soil moisture is improved due to reduced water consumption by adult trees. We conclude that

the thinning treatment is a good procedure for establishing agroforestry sites. Large areas of non-native plantation forest, originally planted to cover bare ground after forest felling, remain in an unmaintained state. Our results are of potential use as fundamental data for policymakers when drawing up new forest management strategies.

(M. Inagaki)

FISHERIES DIVISION

Three new staff scientists joined the Fisheries Division in April 2004 and are now contributing to furthering the goals of fisheries research at JIRCAS. In addition, an Egyptian scientist affiliated to the Animal Production Department, Faculty of Agriculture of Cairo University was awarded a JIRCAS visiting research fellowship since December 2004 and is presently conducting studies on fish nutrition for a period of one year. The Division also dispatched a junior-level researcher to Thailand under a new postdoctoral system established by JIRCAS this fiscal year in order to support a long-term formal staff researcher conducting studies on seaweed under the project "Studies on sustainable production systems of aquatic animals in brackish mangrove areas."

Of particular interest, a new project entitled "Development of land-based recirculating aquaculture systems for the domestic production of whiteleg shrimp *Litopenaeus vannamei*" commenced in August 2004. This project is being carried out

with funding under the Bio-oriented Technology Research Advancement Institution (BRAIN) of Japan, a semi-governmental grant organization which provides support for new bio-based industrial initiatives. Japan is one of the world's major importers of shrimp and prawns, and the country's consumption amounts to 300,000 tons per year. However, Japan's production of shrimp based on aquaculture (only the kuruma prawn *Penaeus japonicus* is cultured) is only 2,000 tons per year, and production volumes are yet declining. Although a variety of species obtained through conventional fishing activities support Japan's domestic consumption, aquaculture taken together with capture fisheries production yields a self-sufficiency in shrimp of 10% at best. High production costs are thought to be one cause of the decline of the kuruma prawn culture industry in Japan, and in shrimp culture in general, frequent and serious outbreaks of particularly viral disease are always a significant concern. In this new project, it is aimed to develop land-based recirculating modes of shrimp culture that are cost-

effective, have zero impact on the environment, and are risk-free. One objective of this research will be to further Japan's domestic culture industry, but it is expected that many of the technologies developed under the project will have applications to developing regions as the culture of "vannamei" is rapidly spreading throughout Southeast Asia. Under the project, JIRCAS has formed a research consortium with an aquaculture engineering firm, International Mariculture Technology (IMT), Inc., an aquaculture feed company, Higashimaru, K.K., and the National Research Institute of Aquaculture.

Several successful rearing trials (requiring four months to grow shrimp to a marketable size of 20 g) have already been conducted using a commercial-scale recirculating facility on the Tsukuba premises of IMT. The system utilizes a species native to the western hemisphere but new to Japan, *Litopenaeus vannamei*, which is considered to have higher disease resistance and enhanced low-salinity tolerance. Prawn seed used in the trials were specific pathogen free (SPF) post-larvae imported from Hawaii, but during the course of the project over the next several years, it is planned to develop domestic-based methods of seed production for this species in order to establish a more stable means of culture.

The research topics being pursued under the project include analysis of osmoregulatory ability and the elucidation of mechanisms of salinity tolerance, elucidation of reproductive mechanisms, development of means of stress evaluation and stress reduction methodology, development of optimal feeds for *P. vannamei* under recirculating systems, and improvement of aquacultural engineering systems.

In addition to the above research, the project entitled "Development of sustainable production and utilization of major food resources in China," of which fisheries research was an important component, was concluded in March 2004. However,

Litopenaeus vannamei
("vannamei" shrimp) cultured
to market size in Tsukuba.



collaborative research continues with the Shanghai Fisheries University. The objective of this research is to produce fishmeal of high quality having a long shelf life from freshwater fish wastes such as viscera, skin, head, and bones. Interestingly, we found that the shelf life of fishmeal varies according to the fish species used. Meal from silver carp was in particular easily oxidized. It was suggested that the meal should be consumed as soon as it is produced, and/or mixed with meal from other species. Along these lines, these results will lead to the more effective utilization of biomass resources.

TOPIC1

Production of fishmeal from Chinese freshwater fish waste

Production from Chinese freshwater fisheries in 2002 was about 16 million tons, making China the world's leading freshwater fish producer. Most freshwater fish in China are cultured fish. They are sold live in large cities near the culture ponds, but are not available as processed products. Fishmeal is one of the most common fisheries products and is an effective use of fish waste. Thus far, little has been reported on fishmeal production from freshwater fish. Hence, as a trial, fishmeal was prepared from waste (including heads, viscera, bones, skin, and some meat) of silver carp and big-head carp (Fig. 1) on a laboratory scale.

Product recoveries of fishmeal (final dried product weight/raw material weight) were respectively 26% (silver carp) and 23% (big-head carp). The oxidative stabilities of the lipids in the two fishmeals were different. Quantities of polyunsaturated fatty acids (PUFAs) such as arachidonic acid (20:4n-6), eicosapentaenoic acid (20:5n-3), and docosahexaenoic acid (22:6n-3) in silver carp fishmeal drastically declined during storage for three months at room temperature (sum of 20:4n-6, 20:5n-3, and 22:6n-6 before storage: 11%; after storage: 1%), but those of big-head carp fishmeal decreased only slightly (sum of 20:4n-6, 20:5n-3, and 22:6n-6 before storage: 14%; after storage: 12%). The fatty acid composition of the two species was almost the same, but the polar lipid fraction of big-head carp fishmeal was more stable than that of silver carp fishmeal, suggesting that the difference in oxidative stability between the two fishmeals depends on the components of



Fig. 1. Sample fish. Left: silver carp; right: big-head carp.

their respective polar lipids.

Stick water is a by-product of fishmeal production and usually contains numerous water-soluble components. Some studies report that these components have various functions. In this study, we examined the antioxidative activity and the ACE-inhibitory activity of the stick water of silver carp. Antioxidative activity in silver carp stick water

was weak; however, we discovered that it had ACE-inhibitory activity. This activity was not detected in stick water from silver carp meat. ACE-inhibitory activity was concentrated in the low molecular fraction of the ultrafiltrate, so we assume the active components to be peptides.

(M. Kaneniwa)

OKINAWA SUBTROPICAL STATION

The Okinawa Subtropical Station was initially established in 1970 in Ishigaki City, Okinawa Prefecture, as a branch office of the Tropical Agricultural Research Center (TARC), the forerunner of the present JIRCAS. Ishigaki Island, one of the chief southernmost islands of the Ryukyu Islands, is located at 24°N, 129°E, and is surrounded by a variety of subtropical environments. The total area of the station is about 30 ha; 8 ha for buildings, facilities, and a windbreak forest surrounding the station, and 22 ha for experimental fields. The new facility, consisting of various types of lysimeters, and sloped experimental fields (2, 3.5, and 5 degrees), was built in the last fiscal year. The station takes full advantage of its natural conditions on an island of the subtropics to develop agricultural technologies suitable for the tropical and subtropical regions of the world.

Ongoing research subjects include 1) Elucidation of the factors responsible for unreliable crop production in the islands and development of technologies for reducing soil runoff and promotion of the efficient use of water and fertilizers; 2) Evaluation and utilization of the heat and salinity tolerance

traits of snap beans, paddy rice, and other crops; 3) Evaluation and utilization of useful genetic resources of sugarcane and tuber crops; 4) Development of basic technology for the evaluation of characteristics such as regulation of tree shape and taste of fruit as well as for mass production of tropical fruit trees; 5) Analysis of the ecological characteristics and occurrence of citrus greening disease in tropical and subtropical areas; and 6) Development of techniques for fixing variations in characteristics like heading traits in rapid generation advancement of paddy rice and other crops.

The Station comprises the International

Mangoes: A promising fruit for exportation from developing countries. High quality fruit can be produced by applying the "compact canopy tree training system," in which trees are kept compact and low-growing to simplify culture and maintenance.





Fig. 1. Sample fish. Left: silver carp; right: big-head carp.

their respective polar lipids.

Stick water is a by-product of fishmeal production and usually contains numerous water-soluble components. Some studies report that these components have various functions. In this study, we examined the antioxidative activity and the ACE-inhibitory activity of the stick water of silver carp. Antioxidative activity in silver carp stick water

was weak; however, we discovered that it had ACE-inhibitory activity. This activity was not detected in stick water from silver carp meat. ACE-inhibitory activity was concentrated in the low molecular fraction of the ultrafiltrate, so we assume the active components to be peptides.

(M. Kaneniwa)

OKINAWA SUBTROPICAL STATION

The Okinawa Subtropical Station was initially established in 1970 in Ishigaki City, Okinawa Prefecture, as a branch office of the Tropical Agricultural Research Center (TARC), the forerunner of the present JIRCAS. Ishigaki Island, one of the chief southernmost islands of the Ryukyu Islands, is located at 24°N, 129°E, and is surrounded by a variety of subtropical environments. The total area of the station is about 30 ha; 8 ha for buildings, facilities, and a windbreak forest surrounding the station, and 22 ha for experimental fields. The new facility, consisting of various types of lysimeters, and sloped experimental fields (2, 3.5, and 5 degrees), was built in the last fiscal year. The station takes full advantage of its natural conditions on an island of the subtropics to develop agricultural technologies suitable for the tropical and subtropical regions of the world.

Ongoing research subjects include 1) Elucidation of the factors responsible for unreliable crop production in the islands and development of technologies for reducing soil runoff and promotion of the efficient use of water and fertilizers; 2) Evaluation and utilization of the heat and salinity tolerance

traits of snap beans, paddy rice, and other crops; 3) Evaluation and utilization of useful genetic resources of sugarcane and tuber crops; 4) Development of basic technology for the evaluation of characteristics such as regulation of tree shape and taste of fruit as well as for mass production of tropical fruit trees; 5) Analysis of the ecological characteristics and occurrence of citrus greening disease in tropical and subtropical areas; and 6) Development of techniques for fixing variations in characteristics like heading traits in rapid generation advancement of paddy rice and other crops.

The Station comprises the International

Mangoes: A promising fruit for exportation from developing countries. High quality fruit can be produced by applying the "compact canopy tree training system," in which trees are kept compact and low-growing to simplify culture and maintenance.



Collaborative Research Section and five laboratories: the Islands Environment Management Laboratory, the Environmental Stress Laboratory, the Tropical Crop Breeding Laboratory, the Tropical Fruit Crops Laboratory, and the Plant Protection Laboratory, in addition to the Administration Office and Field Management Section. Japanese and invited overseas fellow researchers (total 38), administrative officers (5 personnel), field management staff (9 personnel) and part-time assistants (34 personnel), carry out the aims of the Station as a close-knit team.

An international symposium entitled "Problems and Research Perspectives of Agricultural Environment in the Tropical and Subtropical Islands," with the aim of developing new collaborative networks with island countries in the Pacific Ocean, was organized by the Station and held successfully in March 2005 in Ishigaki City. The Okinawa Subtropical Station is likely to play a key role as the center of the network.

TOPIC1

Foliar water spray reduces the after-effects of plant damage caused by short dry spells

Research into crop water stress has up to now chiefly focused on problems in the arid and semi-arid regions. Fewer studies have targeted minor water-stress problems in humid and semi-humid regions, since the problems experienced in these regions are the same as those in arid and semi-arid regions. One reason for the disproportionate effect of water stress during short dry spells in humid regions is that root growth and root quality are less extensive in a humid climate, resulting in slower water uptake during short dry spells. However, the aftereffects of short dry spells on plant productivity have not hitherto been

analyzed in detail.

Table 1 shows the results of a comparative analysis of tomatoes grown in coarse and fine soil in an open field. The delineator between coarse and fine soils is whether clods over 2 mm in size account for more or less than 85% of the dry weight of plowed soil. The same volume of water was supplied to every plant base. Leaf characteristics and soil water were measured from 33 to 40 days after transplanting, and harvesting continued over four months. In plants grown in coarse soil, leaf area and first half yield decreased, but leaf thickness, leaf water, and soil water in plowed soil increased. High leaf and soil water content indicate decreased water absorption due to stomatal closure. It is of particular significance that leaf thickness increased in plants grown in coarse soil. These plants' reaction to coarse soil appears to be xeromorphism, a response universally seen in CAM plants. Fig. 1 shows the time course of transpiration of sugarcane grown in the field with and without breakup of hardpan using a machine fork. Transpiration of the plants in the field without hardpan disruption was half that of plants grown in soil with broken-up hardpan. However, even after the end of the dry spell, this ratio did not recover for a month. The leaf water content of plants grown in the field without hardpan disruption was high in the humid season that followed the dry spell. These results were also a result of stomatal closure. We named this acute plant reaction to stomatal closure "xeromorphic reaction." Fig. 2 shows serious xeromorphic reaction in tomato. The reason for its appearance is mild but uninterrupted water stress. Coarse soil, hardpan plowing by machinery, excessive application of fertilizer, intense solar radiation, continuous wind, low air humidity, high air temperature, etc., all cause the xeromorphic reaction.

Plant production depends on water uptake, fertilizer uptake, and photosynthesis. Our finding is that reduction in the rate of

Table 1. Xeromorphic reaction seen in tomato plants grown in coarse soil.

	Coarse soil	Fine soil
Specific leaf area (cm ² /mg)	0.286 ± 0.001	0.393 ± 0.067
Maximum leaflet area (cm ²)	5.6 ± 2.9	15.1 ± 5.2
Relative leaf water content (%)	80.6 ± 1.5	75.0 ± 1.4
Soil water suction (kPa)	9.5 ± 3.3	32.4 ± 13.8
Yield in the first half period (kg/plant)	0.69 ± 0.13	1.52 ± 0.16
Yield in the latter half period (kg/plant)	1.53 ± 0.09	1.39 ± 0.13
	Mean ± SE	

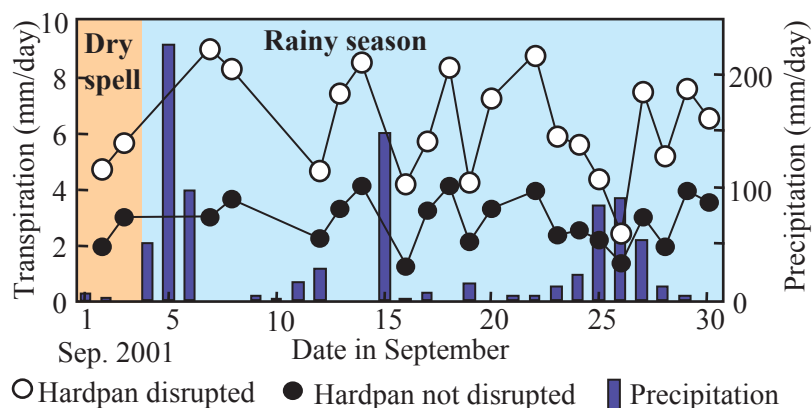


Fig. 1. Plants grown in undisrupted hardpan areas showed low transpiration even after the end of the dry spell.



Fig. 2. Severe xeromorphic reaction in tomato.

Table 2. Effects of foliar water spray timing on tomato yield.

Treatment	Yield (g/plant)
Not sprayed	2438±371
Sprayed at 09:00	2454±455
Sprayed at 12:00	2823±220
Sprayed at 15:00	3202±297
Copious watering	3061±303
Mean±SE	

Sprayed during 9 days after transplanting. Copious watering is defined as 14.4 liters in the first 45 days after transplantation; all other plants were given 5.7 liters.

photosynthesis due to stomatal closure caused by xeromorphic reaction is one of the major contributing factors. It has the same growth-limiting effect as a water shortage, even during wet periods following short dry spells. The effect appears to be caused by irreversible stomatal closure.

It is well known that rainfall opens stomata, even after the leaf surfaces have dried. Foliar water spray in the evening acted in the same way as rainfall to increase stomatal conductance. As shown in Table 2, tomato plants that received foliar water spray every day for 9 days at 15:00 after transplanting showed yields higher by 30% than those of unsprayed plants, equivalent to the yield of plants supplied with three times as much water. As shown in Fig. 3, two-year-old papaya plants grown in 80-liter pots using a drip fertigation system showed the xeromorphic reaction in spite of being supplied daily with nutrient solution. Foliar water spray at 16:00 increased stomatal

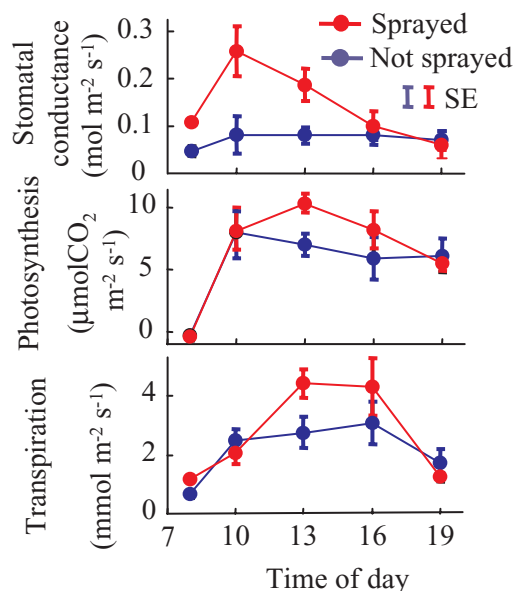


Fig. 3. Effect of foliar water spray on stomatal conductance, photosynthesis, and transpiration of papaya plants. Two-year-old papaya were grown in 80-liter pots in a greenhouse. Daily foliar water spray was applied at 16:00 from June 2, the end of the rainy season.

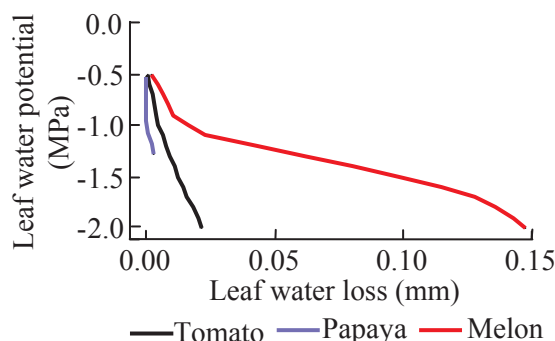


Fig. 4. Relation between leaf water loss and leaf water potential in tomato, melon, and papaya cut leaves.

Fig. 5. Sweet potato transplants with and without foliar water spray daily at 16:00 for 5 days.



conductance, photosynthesis, and transpiration up to 30 days after the end of the rainy season.

As shown in Fig. 4, in tomatoes and papayas for which foliar water spray is available, leaf water loss significantly decreases leaf water potential. Because plants increase their physical water uptake in response to decreased leaf water potential, water uptake ability in these plants increases as a result of increased leaf water loss. These plants can easily be told apart by comparing the root growth of individuals with and without daily application of foliar water spray, as shown in Fig. 5.

(K. Ozawa, H. Fukamachi, and S.M. Contreras)

TOPIC2

Genetic analysis of vernalization and photoperiod responses in one Australian and seven Japanese wheat cultivars

Earliness of heading is one of the most important traits aimed for in wheat breeding. Three physiological characters (vernalization response, photoperiod response, and earliness

per se) are responsible for conferring this quality. The major genes for vernalization insensitivity that convert winter wheat into spring wheat are *Vrn-A1*, *Vrn-B1*, *Vrn-D1*, *Vrn-D5*, and *Vrn-B4*. Photoperiod response is controlled by three major genes (*Ppd-A1*, *Ppd-B1*, and *Ppd-D1*), which make wheat insensitive to day length. It has been reported that wheat cultivars indigenous to Japan carry *Vrn-D1*, whereas the *Vrn* genotype of several important Japanese cultivars remains to be investigated. On the other hand, the *Ppd*

Table 1. Segregation of vernalization response in F₂ populations.

Cross combination	Segregation of growth habit			χ^2 for the expected ratio		
	Spring	Winter	Total	3 : 1	15 : 1	63 : 1
Zenkoujikomugi x Saitama 27	120	10	130	20.77 **	0.46	31.76 **
Zenkoujikomugi x TD(B)	122	8	130	24.63 **	0.00	17.82 **
Zenkoujikomugi x TD(E)	130	0	130	43.33 **	8.67 **	2.06
Zenkoujikomugi x TD(F)	123	7	130	26.68 **	0.17	12.35 **
Zenkoujikomugi x Norin 59	103	27	130	1.24	46.77 **	311.80 **
Fukuwasekomugi x Saitama 27	124	6	130	28.81 **	0.59	7.88 **
Fukuwasekomugi x TD(B)	117	13	130	15.60 **	3.12	60.17 **
Fukuwasekomugi x TD(E)	130	0	130	43.33 **	8.67 **	2.06
Fukuwasekomugi x TD(F)	123	7	130	26.68 **	0.17	12.35 **
Fukuwasekomugi x Norin 59	95	35	130	0.26	94.82 **	543.60 **
Schomburgk x Saitama 27	130	0	130	43.33 **	8.67 **	2.06
Schomburgk x TD(B)	121	9	130	22.66 **	0.10	24.29 **
Schomburgk x TD(E)	123	7	130	26.68 **	0.17	12.35 **
Schomburgk x TD(F)	122	8	130	24.63 **	0.00	17.82 **
Schomburgk x Norin 59	99	31	130	0.09	68.70 **	419.70 **

Saitama 27: *Vrn-A1*, TD(B): *Vrn-B1*, TD(E): *Vrn-D1*, TD(F): *Vrn-D5*, Norin 59: no major *Vrn* genes.

** Significant at the 1% level.

Table 2. Segregation of photoperiod response in F₂ and B₁F₁ populations.

Cross combination (F ₂ populations)	Segregation of sensitivity to short photoperiod			χ^2 for the expected ratio		
	Insensitive	Sensitive	Total	3 : 1	15 : 1	63 : 1
Haruhikari x Saitama 27	104	26	130	1.73	41.95 **	287.32 **
Haruhikari x Norin 61	96	34	130	0.09	87.90 **	511.13 **
Haruhikari x Zenkoujikomugi	96	34	130	0.09	87.90 **	511.13 **
Haruhikari x Schomburgk	94	36	130	0.50	102.01 **	577.08 **
Haruhikari x Norin 59	107	23	130	3.70	29.05 **	219.90 **
Haruhikari x Norin 67	96	34	130	0.09	87.90 **	511.13 **
Haruhikari x Fukuwasekomugi	126	4	130	33.32 **	2.23	1.94
Saitama 27 x Norin 61	130	0	130	43.33 **	8.67 **	2.06
Saitama 27 x Zenkoujikomugi	130	0	130	43.33 **	8.67 **	2.06
Saitama 27 x Schomburgk	130	0	130	43.33 **	8.67 **	2.06
Saitama 27 x Norin 59	130	0	130	43.33 **	8.67 **	2.06
Saitama 27 x Norin 67	130	0	130	43.33 **	8.67 **	2.06
Saitama 27 x Fukuwasekomugi	130	0	130	43.33 **	8.67 **	2.06
Cross combination (B ₁ F ₁ populations)	Segregation of sensitivity to short photoperiod			χ^2 for the expected ratio		
	Insensitive	Sensitive	Total	1 : 1	3 : 1	7 : 1
Haruhikari x (Haruhikari x Saitama 27)	26	29	55	0.16	22.55 **	81.37 **
Haruhikari x (Haruhikari x Fukuwasekomugi)	87	37	124	20.16 **	1.55	34.08 **

** Significant at the 1% level.

genotype has not been identified in any Japanese wheat cultivars or lines. In the present study, we analyzed the genotype for the response to vernalization and photoperiod in seven Japanese wheat cultivars, Haruhikari, Saitama 27, Norin 61, Zenkoujikomugi, Norin 59, Norin 67, and Fukuwasekomugi, and one Australian wheat cultivar (Schomburgk). Among the eight cultivars, the *Vrn* genotype of three cultivars, Haruhikari, Saitama 27, and Norin 61, have been identified as *Vrn-A1Vrn-B1*, *Vrn-A1*, and *Vrn-D1*, respectively, and two cultivars, Norin 59 and Norin 67, have a winter growth habit and therefore carry no major *Vrn* genes.

Allelism testing of the genes for vernalization response showed that three cultivars, Zenkoujikomugi, Fukuwasekomugi, and Schomburgk, carried *Vrn-D1*, *Vrn-D1*, and *Vrn-A1*, respectively (Table 1). It was found that the number of days to heading at 20°C under an 8-hour photoperiod after green vernalization at 5°C under an 8-hour photoperiod for 70 days indicated the degree of sensitivity to short photoperiod. Among the eight cultivars tested, Haruhikari was sensitive to short photoperiod, while the others were

insensitive. Segregation analysis of photoperiod response in F₂ and B₁F₁ populations showed that the cultivar Haruhikari carried no major *Ppd* genes for insensitivity to photoperiod. On the other hand, six cultivars, Saitama 27, Norin 61, Zenkoujikomugi, Schomburgk, Norin 59 and Norin 67, carried a single, identical *Ppd* gene for insensitivity, and the cultivar Fukuwasekomugi carried two *Ppd* genes for insensitivity (Table 2). This genetic information on vernalization and photoperiod response will be useful in wheat breeding. (M. Tanio, K. Kato, Y. Tamura, M. Sato, H. Takagi, and M. Matsuoka)

TOPIC3

Effective marking method using fluorescent powder for dispersal study of the citrus psyllid, *Diaphorina citri*

Asian citrus greening disease (CGD) is caused by *Candidatus Liberibacter asiaticus*, transmitted by the Asian citrus psyllid,



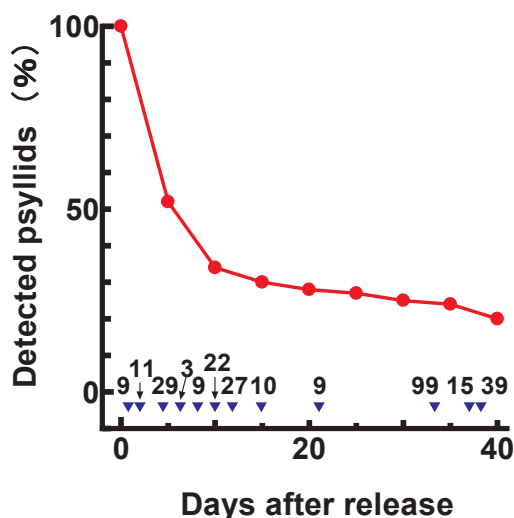
Fig. 1. Marked and non-marked psyllids on orange jasmine.

Diaphorina citri Kuwayama. No effective method of controlling this pathogen is currently available, so controlling the vector psyllids is more practical. However, lack of effective marking methods limits ecological/ethological field studies on this insect. We evaluated the effectiveness of a marking method for psyllids using fluorescent powder.

We examined the persistence of a pinkish fluorescent powder on the bodies of psyllids and its effects on their survival, fecundity, and flight activity in the laboratory. After confirming its effectiveness as a marking agent, its usefulness in the field was examined.

Equal numbers of marked and non-marked psyllids (Fig. 1) were released two meters in front of a light. The number of collected marked psyllids near the light was significantly lower than that of non-marked psyllids until four hours after the release. After five hours, no significant difference was observed. No significant differences were detected between the two groups, either in

Fig. 2. Proportion of detected psyllids after release. Proportion of marked psyllids released (100 at the beginning) in the field, and later detected visually on orange jasmine from February 18, 2005 to March 30, 2005. Inverted triangles (▼) and numerals placed above them indicate the occurrence of rainfall and the precipitation (mm), respectively.



mortality over 40 days or in number of eggs laid on orange jasmine, *Murraya exotica* L., for five days after marking. The marking on the psyllid body was confirmed visually in the laboratory to remain for 40 days. One hundred marked psyllids were released in an orange jasmine field (18 m x 18 m). During the experiment, total precipitation was 289 mm. These conditions were difficult for the psyllids and we suspected that the powder would wash off. However, the marked insects were visually identifiable. The proportion was 30% after 20 days and 20% after 40 days (Fig. 2).

These results indicate that our marking method using fluorescent powder does not affect the mortality or fecundity of psyllids, and that it can be used for approximately six weeks in the field. Thus, the dust marking method can be used for the detection of psyllids for 40 days, even in the rainy season, and for longer durations in the dry season. This method will thus contribute to the promotion of ecological and ethological field studies of the psyllids.

(T. Nakata)

TOPIC4

Eliminating weak panicle blast field resistant plants from a rice hybrid population during rapid generation advancement

Panicle blast can damage both the yield and grain quality of rice. It is therefore important to develop panicle blast field resistant varieties in an efficient manner. JIRCAS's Okinawa Subtropical Station has a Rice Rapid Generation Advancement Program in which rice hybrid populations are cropped two or three times per year. If it is possible to eliminate weak panicle blast field resistant plants from a rice hybrid population during rapid generation advancement, varieties with panicle blast resistance can be developed more efficiently. In the Station fields, panicle blast infection rates are unreliable, making it necessary to establish cultivation conditions that guarantee infection with panicle blast.

In the first crop in a double-cropping system, we researched the following three treatments in an attempt to ensure infection with panicle blast as follows: 1) The nitrogen content of the basal fertilizer of the treatment

field was raised to 2 kg/10 a more than the controls, and ammonium sulfate was additionally applied at rates 3-4 times the control, 2) water was sprinkled over the treatment field for about an hour every morning and evening, and 3) the treatment field was surrounded with cheesecloth.

In the treatment field, the panicle blast index of both tested varieties and the F_4 population was higher than in the control field (Table 1). Moreover, the percentage of ripening of both tested varieties and F_4 population was significantly lower than the controls (Table 1). The percentage of ripening of the tested weak varieties was lower than that of the moderate and strong varieties (Table 1). The F_5 population cultivated under the treatment conditions in F_4 showed fewer plants with high disease incidence than did the F_5 population cultivated under the control conditions in F_4 (Fig. 1).

The cultivation conditions were established to achieve reliable infection with panicle blast in the first crop of the double-cropping system. It was shown that cultivation of a rice hybrid population under conditions that make it more sensitive to panicle blast infection effectively allows identification and

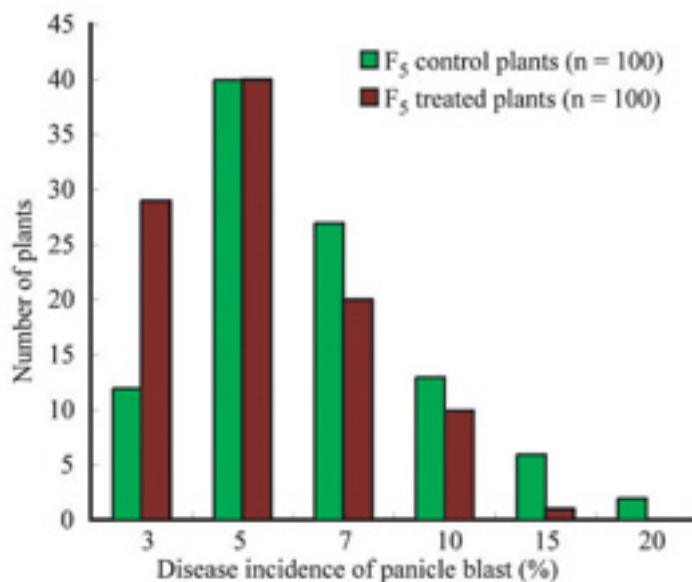


Fig. 1. Frequency distribution of disease incidence of panicle blast in F_5 plants cultivated from the F_4 hybrid population in control and treatment fields. (Data from the Rice Breeding Laboratory, National Agricultural Research Center for Tohoku Region)

removal of the weakly resistant plants before the next generation.

(Y. Tamura, M. Sato, M. Tanio, K. Ishiki, M. Matsuoka, M. Yamaguchi, and H. Takagi)

Table 1. Panicle blast index and percentage of ripening in the first crop of the double-cropping system.

Varieties	True resistant genes to rice blast	Field resistance to panicle blast	Panicle blast index				Percentage of ripening (Mean±S.D.)			
			2002		2003		2002		2003	
			Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment
Koshihikari	+	weak	3	5	1.5	4.5	82.8±13.1	67.1±17.8**	91.7±4.7	85.6±11.5*
Sasanishiki	<i>Pia</i>	weak	3	5	0.3	4.3	88.6±10.8	70.8±18.8**	93.3±5.5	79.5±18.0**
Aichiasahi	<i>Pia</i>	weak	-	-	1.2	5	-	-	93.0±4.4	71.2±23.3**
Inabawase	<i>Pii</i>	weak	3.5	5.8	1.3	4.3	82.2±9.8	70.7±19.5*	94.9±2.7	85.8±10.0**
Tohoku IL No. 3	<i>Pik</i>	weak	-	-	0	0	-	-	94.1±5.3	90.4±13.2
Akitakomachi	<i>Pia,Pii</i>	weak	3	5.3	1	4	89.9±5.1	71.5±20.0**	93.2±2.5	89.2±4.9**
Hinohikari	<i>Pia,Pii</i>	weak	3.5	5.8	0.4	3.7	84.1±10.2	76.1±14.2*	91.4±4.9	87.5±9.7
Kiyonishiki	<i>Pia</i>	moderate	1	2.5	0.5	2.5	87.9±12.6	78.4±17.8**	95.3±2.6	91.0±6.9*
Toyonishiki	<i>Pia</i>	semi-strong	2	2.8	0	1.5	92.8±6.7	80.3±12.2**	94.7±3.0	93.3±2.9
Todorokiawase	<i>Pii</i>	strong	1.5	2.3	0	1.7	91.1±5.5	80.9±11.3**	96.6±1.8	90.0±8.5**
F_4 population	-	-	-	-	0.3	2.2	-	-	92.0±3.6	84.8±10.6*

*: 5% level of significance, **: 1% level of significance

MISCELLANEOUS PROJECTS OUTLINE

In addition to international comprehensive projects, JIRCAS conducts a variety of miscellaneous projects that include projects conducted 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 the Environment, as well as other organizations, and special allotment projects.

OVERSEAS PROJECTS

Evaluation of environmental impact associated with the construction of logging roads

(At the Forest Research Institute of Malaysia, 2001-2004)

Innovation of cultivation technologies and agricultural systems to control clubroot disease in the West Java highlands

(At the Asian Vegetables Research and Development Center, 2003-2004)

Socio-economic research for the technological advancement of various agricultural systems

(At the Coarse Grains, Pulses, Roots and Tuber Crops in the Humid Tropics of Asia and the Pacific [CGPRT] Centre and the Center for Agro-Socioeconomic Research and Development [CASERD], 2003-2005)

Evaluation of rice gene resource properties and development of new varieties in West Africa

(At the Africa Rice Center [WARDA], 2003-2005)

Elucidation of production environment characteristics and foodstuff functionality of South and Southeast Asian vegetables

(At the Asian Vegetables Research and Development Center, 2003-2005)

Investigation of the roles of the TNF- α gene in trypanosomosis and elucidation of the mechanisms of infection and development of trypanosomosis

(At the International Livestock Research

Institute [ILRI], 2003-2005)

Investigation of the functionality and utilization of regional forage resources for pig farming in the Mekong Delta of Vietnam

(At the College of Agriculture, Cantho University of Vietnam, 2004)

Studies on molecular breeding of whitebacked planthopper-resistant japonica rice varieties suitable for the Changjiang River valley

(At the China National Rice Research Institute, 2004-2006)

Development of technologies related to high-level environmental stress resistance of wheat in arid areas

(At the International Center for Agricultural Research in Dry Areas [ICARDA], 2004-2006)

Elucidation of characteristics of, genetic improvement and development of sustainable cultivation techniques for beans in tropical and subtropical areas

(Asian Vegetable Research and Development Center [AVRDC], 2004-2006)

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 to support its international collaborative projects.

JIRCAS is further enhancing 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. 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 in which it can apply its strengths in research management and coordination, 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 is focused on the following themes: 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 the soil; 6) 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.

Research and development of highly functional food products using computer technology

(Food Science and Technology Division, 1997-2005)

Development of resistance to high-level environmental stresses to add practical value to farm products

(Biological Resources Division, 1999-2005)

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, reliable 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

RESEARCH PROJECTS WITH OTHER GOVERNMENT MINISTRIES AND ORGANIZATIONS

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

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)

Studies on genes and breeding techniques related to the deep-root characteristics of rice

(Biological Resources Division, 2003-2004)

Evaluation of tropical forest ecology and wood quality

(Forestry Division, 2003-2006)

In cooperation with the Ministry of the 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)

Fragility of Sahelian farming and soil degradation: a consideration of policy intervention

(Development Research Division, 2003-2005)

Development of greenhouse-gas sink/sources control technologies through the conservation and efficient management of terrestrial ecosystems

(Animal Production and Grassland Division, 2003-2007)

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)

Comprehensive strategy for ASEAN biomass research and development

(Food Science and Technology Division, 2004-2006)

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

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 the plant hormone ABA (abscisic acid) and its application to biotechnology

(Biological Resources Division, 2001-2005)

Development of land-based recirculating aquaculture systems for the domestic production of whiteleg shrimp *Litopenaeus vannamei*

(Fisheries Division, 2004-2008)

**In cooperation with the Japan Society
for the Promotion of Science**

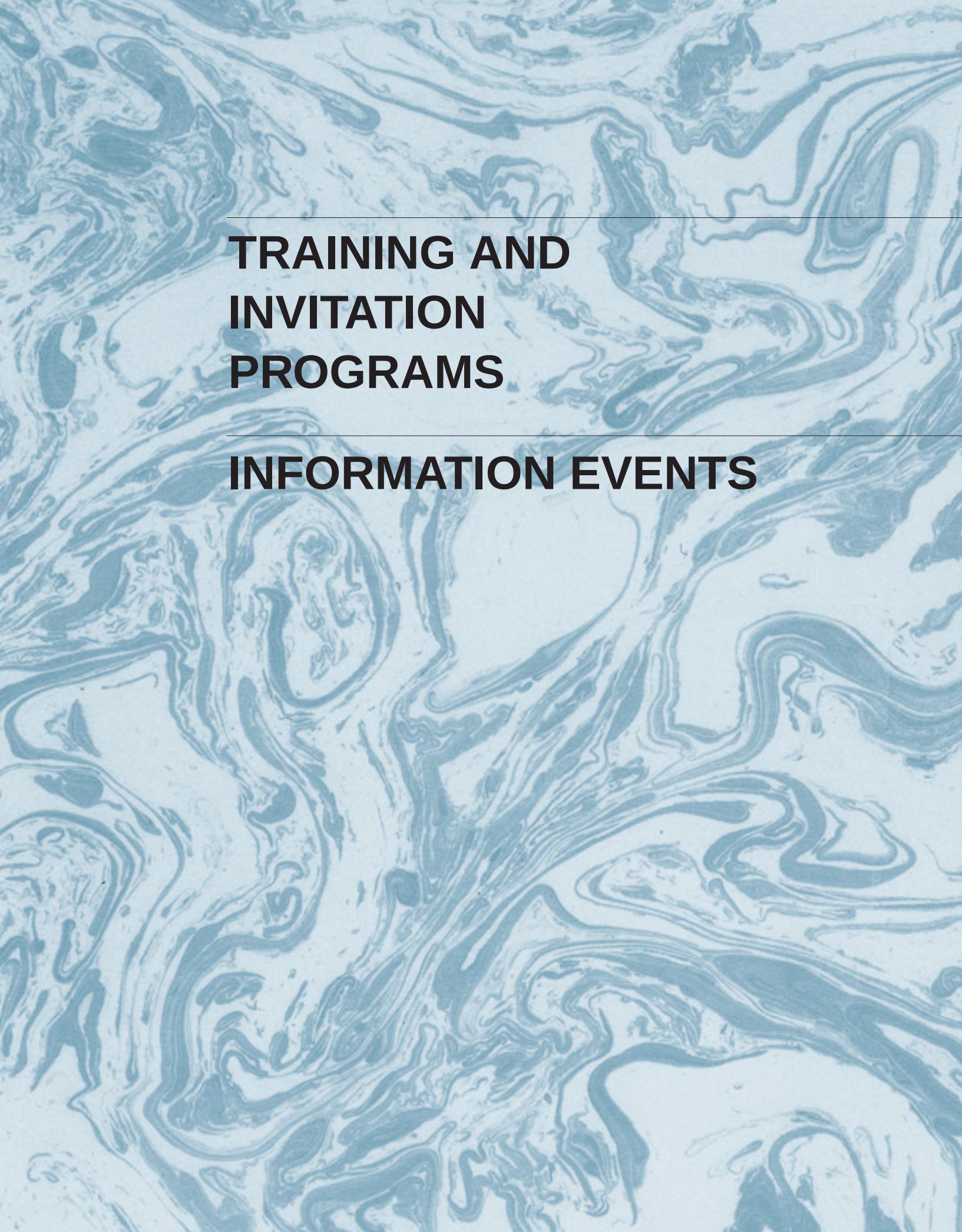
Development of a model reflecting the influences of increased atmospheric carbon dioxide on the environment

(Crop Production and Environment Division, 2003-2004)

**MAFF SPECIAL RESEARCH
ALLOTMENTS**

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)



**TRAINING AND
INVITATION
PROGRAMS**

INFORMATION EVENTS

INVITATION PROGRAMS AT JIRCAS

In keeping with its role as an international research center, JIRCAS has implemented several invitation programs for overseas 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 detail below.

1) Administrative Invitation Program

Under the Administrative Invitation Program, JIRCAS invites administrators from counterpart organizations to its Tsukuba premises to engage in discussions and review

ongoing research to ensure that collaborative projects run smoothly. In addition, the program shows administrators the 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. One hundred twenty-five individual visits to JIRCAS were made during FY2004 under the Administrative Invitation Program, including 92 invitations to the International Symposium. Invited administrators and their home institutions are listed below.

Administrative Invitations, FY2004		
Tang Huajun	Director Institute of Natural Resources & Regional Planning Chinese Academy of Agricultural Sciences (CAAS) People's Republic of China	June 27-July 1, 2004
Liu Zhongwei	Director Division of Asian & African Affairs Department of International Cooperation, Ministry of Agriculture People's Republic of China	June 27-July 1, 2004
Udin S. Nugraha	Director Indonesian Vegetable Research Institute (IVRI) Indonesia	July 12-17, 2004
Tran Than Thi Ngan Hoa	Information Specialist Information Centre for Agriculture and Rural Development (ICARD) Ministry of Agriculture and Rural Development (MARD) Vietnam	Aug. 8-13, 2004
Md. Akhtaruzzaman	Professor Dept. of Farm Power & Machinery Bangladesh Agricultural University Bangladesh	Aug. 8-13, 2004
Setyo Pertiwi	Associate Professor Faculty of Agricultural Technology Bogor Agricultural University Indonesia	Aug. 8-13, 2004

Ana Maria Sadir	Director Veterinary and Agronomic Sciences Research Center INTA Castelar Argentina	Aug. 29-Sept. 12, 2004
Chumpol Lilittham	Director Office of Soil Survey and Land Use Planning Land Development Department (LDD) Thailand	Oct. 3-Nov. 10, 2004
Wang Tao	Director General, Research Professor Cold and Arid Regions Environmental and Engineering Research Institute Chinese Academy of Sciences People's Republic of China	Oct. 6-13, 2004
Zheng Yuanrun	Deputy Director, Professor Ordos Sandland Ecological Station Institute of Botany, Chinese Academy of Sciences People's Republic of China	Oct. 6-13, 2004
Siti Subandiyah	Chief Laboratory of Agricultural Biotechnology Department of Plant Protection Faculty of Agriculture Gadjah Mada University Indonesia	Nov. 3-10, 2004
Wanphen Srithongchai	Head Plant Pathology Group Plant Protection Research and Development Office Department of Agriculture (DOA) Thailand	Nov. 3-10, 2004
Mohamed Bazain Bin Idris	State Attorney-General Sabah State Attorney-General's Chambers Malaysia	Feb. 21-27, 2005
Anuar Mohamad	Head Sabah Biodiversity Centre Malaysia	Feb. 21-27, 2005
Yont Musig	Dean Faculty of Fisheries Kasetsart University Thailand	Feb. 28-Mar. 6, 2005
Roland R. Platon	Chief Aquaculture Department Southeast Asian Fisheries Development Center (SEAFDEC) The Philippines	Mar. 3-20, 2005

Teodora U. Bagarinao	Head Training and Information Division Aquaculture Department Southeast Asian Fisheries Development Center (SEAFDEC) The Philippines	Mar. 3-20, 2005
Gassinee Trakoontivakorn	Senior Researcher, Deputy Director Research Department Institute of Food Research and Product Development Kasetsart University Thailand	Mar. 6-19, 2005
Plernchai Tangkanakul	Senior Researcher, Vice-Division Head Nutrition and Health Division Institute of Food Research and Product Development Kasetsart University Thailand	Mar. 6-19, 2005
Yupa Hanboonsong	Associate Professor Department of Entomology, Faculty of Agriculture Khon Kaen University Thailand	Mar. 6-10, 2005
Greg Johnson	Research Program Manager Australian Centre for International Agricultural Research Australia	Mar. 6-10, 2005
Warunee Varayanond	Director Institute of Food Research and Product Development Kasetsart University Thailand	Mar. 6-10, 2005
Somchart Soponronnarit	Professor School of Energy and Materials King Mongkut's University Thonburi Thailand	Mar. 6-10, 2005
Porntip Visarathanonth	Assistant Director Post-Harvest and Products Processing Research and Development Office Department of Agriculture (DOA) Thailand	Mar. 6-10, 2005
Aliki Turagakula	First Secretary Embassy of the Republic of the Fiji Islands (Japan) Fiji	Mar. 9-13, 2005
Jose D. Rondal	Chief Soil Conservation and Management Division Bureau of Soils and Water Management The Philippines	Mar. 9-13, 2005

Thierry Mennesson	General Manager Institut Agronomique Neo-Caledonien New Caledonia	Mar. 9-13, 2005
Yingyong Paisooksantivatana	Assistant Professor Faculty of Agriculture Kasetsart University Thailand	Mar. 13-19, 2005
Xu Xiaoqing	Deputy Director Department for Rural Economic Development Research Center of The State Council People's Republic of China	Mar. 27-April 1, 2005
Qin Fu	Vice Director Institute of Agricultural Economics Chinese Academy of Agricultural Sciences People's Republic of China	Mar. 27-April 1, 2005
Zhao Zhijun	Chief Technology Economics & Scientific Development Research Division Institute of Agricultural Economics Chinese Academy of Agricultural Sciences People's Republic of China	Mar. 27-April 1, 2005
Li Ninghui	Chief Agricultural Policy Division Institute of Agricultural Economics Chinese Academy of Agricultural Sciences People's Republic of China	Mar. 27-April 1, 2005
Guo Jianjun	Chief Department for Rural Economic Development Research Center of The State Council People's Republic of China	Mar. 27-April 1, 2005
International Symposium Invitees, FY2004		
Abdullah, R.	Universiti Kebangsaan Malaysia Malaysia	Nov. 3-11, 2004
Abeysekera, S.W.	Rice Research and Development Institute Sri Lanka	Nov. 3-11, 2004
Allard, J.L.	Syngenta Asia Pacific Pte. Ltd. Singapore	Nov. 3-11, 2004
An, G.	Pohang University of Science and Technology Korea	Nov. 3-11, 2004
Arunyanart, P.	Rice Research Institute Department of Agriculture (DOA) Thailand	Nov. 3-11, 2004
Athukorala, K.	Network of Women Water Professionals Sri Lanka Sri Lanka	Nov. 3-11, 2004

Azmi, M.	MARDI Rice Research Centre Malaysia	Nov. 3-11, 2004
Bagchi, B.	Directorate of Research India	Nov. 3-11, 2004
Bhattacharya, K.	Rice Research & Development Centre India	Nov. 3-11, 2004
Blum, A.	Plantstress.com Israel	Nov. 3-11, 2004
Boonlue, C.	Royal Irrigation Department Thailand	Nov. 3-11, 2004
Calpe, C.	Food and Agriculture Organization (FAO) Italy	Nov. 3-11, 2004
Champagne, E.	USDA ARS Southern Regional Research Center USA	Nov. 3-11, 2004
Chattopadhyay, P.	Post Harvest Technology Centre India	Nov. 3-11, 2004
Cheapun, K.	Pathumthani Rice Research Center Department of Agriculture (DOA) Thailand	Nov. 3-11, 2004
Cho, K.	Kyushu University Japan	Nov. 3-11, 2004
Choi, H.C.	National Institute of Crop Science Korea	Nov. 3-11, 2004
de Dios, J.L.	PhilRice The Philippines	Nov. 3-11, 2004
Deng, X.W.	Yale University USA	Nov. 3-11, 2004
Ge, S.	Institute of Botany People's Republic of China	Nov. 3-11, 2004
Groenfeldt, D.	Indigenous Water Initiative USA	Nov. 3-11, 2004
Gupta, R.K.	CIMMYT-India India	Nov. 3-11, 2004
Guy, T.	Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD) Thailand	Nov. 3-11, 2004
Hayashi, R.	Nihon University Japan	Nov. 3-11, 2004
Hidaka, K.	Ehime University Japan	Nov. 3-11, 2004

Horie, T.	Kyoto University Japan	Nov. 3-11, 2004
Hosaka, Y.	Satake Co., Ltd. Japan	Nov. 3-11, 2004
Hulbert, S.	Kansas State University USA	Nov. 3-11, 2004
Ikehashi, H.	Nihon University Japan	Nov. 3-11, 2004
Ito, S.	Tottori University Japan	Nov. 3-11, 2004
Iwabuchi, S.	Miyagi Prefectural Tajiri High School Japan	Nov. 3-11, 2004
Jelodar, N.B.	University of Mazandaran Iran	Nov. 3-11, 2004
Juliano, B.	PhilRice The Philippines	Nov. 3-11, 2004
Kim, S.C.	Yeongnam Agricultural Research Institute Korea	Nov. 3-11, 2004
Kiritani, K.	National Institute for Agro-Environmental Sciences Japan	Nov. 3-11, 2004
Kyuma, K.	Kyoto University Japan	Nov. 3-11, 2004
Lang, N.T.	Cuulong Delta Rice Research Institute Vietnam	Nov. 3-11, 2004
Lansigan, F.	University of the Philippines at Los Banos The Philippines	Nov. 3-11, 2004
Latiff, Md	Bangladesh Rice Research Institute Bangladesh	Nov. 3-11, 2004
Lee, D.B.	Honam Agricultural Research Institute Korea	Nov. 3-11, 2004
Li, C.	University of New Hampshire USA	Nov. 3-11, 2004
Li, N.	Institute of Agricultural Economics People's Republic of China	Nov. 3-11, 2004
Li, Y.	Jiangsu University People's Republic of China	Nov. 3-11, 2004
Li, Z.	Institute of Crop Science Chinese Academy of Agricultural Sciences People's Republic of China	Nov. 3-11, 2004

Liu, Y.	China Institute of Water Resources and Hydropower Research (IWHR) People's Republic of China	Nov. 3-11, 2004
Mae, T.	Tohoku University Japan	Nov. 3-11, 2004
Makino, A.	Tohoku University Japan	Nov. 3-11, 2004
Malik, S.	Rice Research Station India	Nov. 3-11, 2004
Manalili, R.	PhilRice The Philippines	Nov. 3-11, 2004
Maskey, S.L.	Nepal Agricultural Research Council Nepal	Nov. 3-11, 2004
Mataia, A.	PhilRice The Philippines	Nov. 3-11, 2004
Matsuoka, M.	Nagoya University Japan	Nov. 3-11, 2004
Mazid, M.	Bangladesh Rice Research Institute Bangladesh	Nov. 3-11, 2004
Mitra, S.	The Energy and Resources Institute India	Nov. 3-11, 2004
Mohapatra, P.	Sambalpur University India	Nov. 3-11, 2004
Mortimer, M.	University of Liverpool UK	Nov. 3-11, 2004
Murchie, E.	University of Sheffield UK	Nov. 3-11, 2004
Nakamura, R.	Nihon University Japan	Nov. 3-11, 2004
Naklang, K.	Surin Rice Research Center Thailand	Nov. 3-11, 2004
Ngoc Hung, N.	Cantho University Vietnam	Nov. 3-11, 2004
Nguyen, N. D.	Mie University Japan	Nov. 3-11, 2004
Nishizawa, N.	Tokyo University Japan	Nov. 3-11, 2004
Nyoman, W.	Indonesian Institute for Rice Research Indonesia	Nov. 3-11, 2004
Ohsugi, R.	Tokyo University Japan	Nov. 3-11, 2004

Olk, D.	Agricultural Research Service United States Department of Agriculture (USDA) USA	Nov. 3-11, 2004
Park, W.P.	National Institute of Agricultural Engineering Korea	Nov. 3-11, 2004
Pinheiro, B.S.	EMBRAPA Arroz e Feijao Brazil	Nov. 3-11, 2004
Raab, R.	Sustainable Development Learning Network Thailand	Nov. 3-11, 2004
Rangsan, P.	Kasetsart University Thailand	Nov. 3-11, 2004
Redona, E.	PhilRice The Philippines	Nov. 3-11, 2004
Saegusa, M.	Tohoku University Japan	Nov. 3-11, 2004
Sahrawat, K.	International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) India	Nov. 3-11, 2004
Sano, Y.	Hokkaido University Japan	Nov. 3-11, 2004
Sato, H.	Kyushu University Japan	Nov. 3-11, 2004
Shinozaki, K.	Tokyo University Japan	Nov. 3-11, 2004
Singh, Y.	G.B. Pant University of Agriculture & Technology India	Nov. 3-11, 2004
Smil, V.	University of Manitoba Canada	Nov. 3-11, 2004
Sriprasert, V.	Thai Rice Exporters Association Thailand	Nov. 3-11, 2004
Subbalakshmi Lokanathan, K.	Tamil Nadu Agricultural University India	Nov. 3-11, 2004
Sutawan, N.	Udayana University Indonesia	Nov. 3-11, 2004
Syaukat, Y.	Bogor Agricultural University Indonesia	Nov. 3-11, 2004
Taniguchi, H.	Industrial Technology Center of Wakayama Prefecture Japan	Nov. 3-11, 2004
Taniguchi, Y.	Akita Prefectural University Japan	Nov. 3-11, 2004

Tozawa, F.	Hanazono Farm, Akita Prefecture Japan	Nov. 3-11, 2004
Wailes, E.	University of Arkansas USA	Nov. 3-11, 2004
Wakatsuki, T.	Kinki University Japan	Nov. 3-11, 2004
Witt, C.	Southeast Asia Program of PPI/PPIC and IPI Singapore	Nov. 3-11, 2004
Wongpornchai, S.	Chiang Mai University Thailand	Nov. 3-11, 2004
Xie, G.	China Agricultural University People's Republic of China	Nov. 3-11, 2004
Yu, X.	Zhejiang Academy of Agricultural Sciences People's Republic of China	Nov. 3-11, 2004
Zhong, X.	The Rice Research Institute Guangdong Academy of Agricultural Sciences People's Republic of China	Nov. 3-11, 2004
Zhu, J.	Chinese Academy of Sciences People's Republic of China	Nov. 3-11, 2004

2) Counterpart Researcher Invitation Program

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 outside Japan and to facilitate exchanges between individual research staff. Nineteen researchers were invited under the Counterpart Researcher Invitation Program during FY2004. Invited researchers, their affiliated research organizations, and their research activities are summarized below.

Counterpart Researcher Invitations, FY2004

At JIRCAS and Okayama University, June 6-26, 2004

Somsak Sukchan	Soil Surveyor Soil Survey and Land Use Planning Land Development Department (LDD) Thailand	Analysis of variation of soil moisture in Northeast Thailand using HYDRUS
----------------	---	--

At JIRCAS, Tohoku University, and National Agricultural Research Center for Tohoku Region, June 14-Sept. 6, 2004

Alexandre Lima Nepomuceno	Senior Researcher Centro Nacional de Pesquisa de Soja (CNPSo) EMBRAPA Brazil	Molecular analysis of stress-inducible genes in soybean
------------------------------	---	--

Tozawa, F.	Hanazono Farm, Akita Prefecture Japan	Nov. 3-11, 2004
Wailles, E.	University of Arkansas USA	Nov. 3-11, 2004
Wakatsuki, T.	Kinki University Japan	Nov. 3-11, 2004
Witt, C.	Southeast Asia Program of PPI/PPIC and IPI Singapore	Nov. 3-11, 2004
Wongpornchai, S.	Chiang Mai University Thailand	Nov. 3-11, 2004
Xie, G.	China Agricultural University People's Republic of China	Nov. 3-11, 2004
Yu, X.	Zhejiang Academy of Agricultural Sciences People's Republic of China	Nov. 3-11, 2004
Zhong, X.	The Rice Research Institute Guangdong Academy of Agricultural Sciences People's Republic of China	Nov. 3-11, 2004
Zhu, J.	Chinese Academy of Sciences People's Republic of China	Nov. 3-11, 2004

2) Counterpart Researcher Invitation Program

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 outside Japan and to facilitate exchanges between individual research staff. Nineteen researchers were invited under the Counterpart Researcher Invitation Program during FY2004. Invited researchers, their affiliated research organizations, and their research activities are summarized below.

Counterpart Researcher Invitations, FY2004

At JIRCAS and Okayama University, June 6-26, 2004

Somsak Sukchan	Soil Surveyor Soil Survey and Land Use Planning Land Development Department (LDD) Thailand	Analysis of variation of soil moisture in Northeast Thailand using HYDRUS
----------------	---	--

At JIRCAS, Tohoku University, and National Agricultural Research Center for Tohoku Region, June 14-Sept. 6, 2004

Alexandre Lima Nepomuceno	Senior Researcher Centro Nacional de Pesquisa de Soja (CNPSo) EMBRAPA Brazil	Molecular analysis of stress-inducible genes in soybean
------------------------------	---	--

At JIRCAS Okinawa Subtropical Station, Sept. 7-17, 2004

Samuel M. Contreras	Chief Agriculturist Water Resources Management Division Bureau of Soils and Water Management The Philippines	Development of techniques to increase sub-soil stored water use
---------------------	---	---

At JIRCAS and JIRCAS Okinawa Subtropical Station, Aug. 30-Sept. 18, 2004

Abou Berthe	Chef du Programme Programme Systemes de Production Institut d'Économie Rurale (IER) Republique du Mali	Farming systems research (development of risk-reducing technologies for West African cereal-based cropping systems based on advanced weather modeling)
-------------	---	--

At JIRCAS, National Institute of Livestock and Grassland Sciences, and Kyoto Prefectural University, Aug. 22-Sept. 25, 2004

Jorge Carrillo	Researcher INTA-Castelar Argentina	Research techniques of physio-nutrition for application of agriculture by-products as animal feeds
----------------	--	--

At JIRCAS, Aug. 2-30, 2004

Seth Dominic Meyer	Research Assistant Professor Food and Agricultural Policy Research Institute University of Missouri-Columbia USA	Stochastic model analysis of supply and demand of rice in Laos
--------------------	---	--

At JIRCAS, Kobe University, and Kyoto University, June 30-Aug. 1, 2004

Ilyassou Oumarou	Senior Laboratory Officer ICRISAT-Sahelian Center Niger	Analytical improvement of organic and inorganic nitrogen in soil and plants
------------------	---	---

At JIRCAS and National Agricultural Research Center for Tohoku Region, Nov. 3-Dec. 1, 2004

Kent Hoshiba	Researcher Centro Tecnológico Agropecuario en Paraguay (CETAPAR-JICA) Paraguay	Analytical techniques for nitrogen flow in agro-pastoral systems
--------------	--	--

At JIRCAS, National Agricultural Research Center (NARC) for Western Region, NARC for Kyushu-Okinawa Region, NARC For Kyushu-Okinawa Region, National Institute of Crop Science, University of Tsukuba, and NARC Tsukuba, Sept. 15-Oct.15, 2004

Jose Tadashi Yorinori	Senior Researcher Centro Nacional de Pesquisa de Soja (CNPSo), EMBRAPA Brazil	Relationship between soybean rust and kudzu rust in Japan
-----------------------	---	---

At JIRCAS, Forestry and Forest Products Research Institute (FFPRI), FFPRI Tohoku Branch, FFPRI Kumamoto Branch, and Kyoto Institute of Technology, Sept. 28-Nov. 26, 2004

Krisana Chaikuad	Researcher Royal Forest Department (RFD) Thailand	Research techniques for analysis and evaluation of semiochemicals for forest pest insects
------------------	---	---

At JIRCAS, Dec. 7, 2004-Jan. 28, 2005

Bui Thi Bich Hang	Lecturer College of Aquaculture and Fisheries Cantho University Vietnam	Evaluation of technology to determine maturity levels in shrimp and prawns
-------------------	--	--

At JIRCAS, Feb. 14-Mar. 4, 2005

Seth Dominic Meyer	Research Assistant Professor Food and Agricultural Policy Research Institute University of Missouri-Columbia USA	Development of a stochastic supply and demand model for rice in Laos
--------------------	---	--

At JIRCAS, National Agricultural Research Center (NARC) for Hokkaido Region, and NARC for Tohoku Region, Feb. 7-Mar. 11, 2005

Men Ying	Research Assistant Crop Tillage and Cultivation Research Institute Heilongjiang Academy of Agricultural Science People's Republic of China	Development of a method to analyze agro-meteorological data for characterizing climatic disasters affecting rice
----------	---	--

At JIRCAS, National Agricultural Research Center (NARC) for Hokkaido Region, and NARC for Tohoku Region, Feb. 7-Mar. 11, 2005

Geng Liqing	Research Assistant Crop Tillage and Cultivation Research Institute Heilongjiang Academy of Agricultural Science People's Republic of China	Development of a rice crop-model applicable to early-warning systems for mitigating the risks caused by climatic disasters
-------------	---	--

At JIRCAS, National Research Institute of Fisheries Science, and National Research Institute of Aquaculture, Feb. 28-Mar. 31, 2005

Prapansak Srisapoom	Lecturer Faculty of Fisheries Kasetsart University Thailand	Health assessment of black tiger shrimps (<i>Penaeus monodon</i>) cultured in closed-system and mangrove-water treatment ponds using biological and molecular techniques
---------------------	--	--

At JIRCAS and Forestry and Forest Products Research Institute, Hokkaido Research Center, Feb. 27-Mar. 26, 2005

Tan Sek Aun	Researcher Forest Research Institute Malaysia (FRIM) Malaysia	Remote sensing applications for sustainable forest management in Peninsular Malaysia
-------------	---	--

At JIRCAS and National Research Institute of Aquaculture, Feb. 28-Mar. 31, 2005

Denny Ramos Chavez	Associate Researcher Aquaculture Department Southeast Asian Fisheries Development Center (SEAFDEC) The Philippines	Fatty acid composition of larval foods in hatcheries in the Philippines
--------------------	---	---

At JIRCAS, Forestry and Forest Products Research Institute (FFPRI), FFPRI Shikoku Research Center, and FFRRI Kyushu Research Center, Mar. 9-30, 2005

Jaffrin Lapongan	Head Plantation Laboratory Forest Research Centre (FRC) Sabah Forestry Department (SFD) Malaysia	Technological development for the establishment of a production environment in agroforestry
------------------	--	---

Xue Guixia	Associate Professor Institute of Agricultural Economics Chinese Academy of Agricultural Sciences People's Republic of China	Evaluation of functions of the agricultural social service system for stabilization of farm and rural management
------------	--	--

3) JIRCAS Visiting Research Fellowship Program at Okinawa

The Okinawa Visiting Research Fellowship Program was initiated in FY1992, 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. For FY2004, researchers focused on important issues relating to tropical agriculture in developing countries under 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 utilization of useful traits in sugarcane and sweet potato, 4) Evaluation and characterization of tropical and subtropical fruit trees, and 5) Development of new technologies for the integrated management of citrus huanglongbing (greening disease).

JIRCAS Visiting Research at Okinawa (October 2003 to September 2004)

Roland Nuhu Issaka	CSIR-Soil Research Institute Ghana	Effect of slope and tillage practices on soil erosion and soil properties
Meiru Li	South China Institute of Botany The China Academy of Sciences People's Republic of China	Transformation of <i>HANA</i> into rice via <i>Agrobacterium</i> -mediated methods
Ashok Kumar	CCS Haryana Agricultural University India	Plant water relations of snap bean (<i>Phaseolus vulgaris</i> L.) in high temperature stress environments
Mohammad Abul Kashem Chowdhury	Patuakhali Science and Technology University Bangladesh	Searching for an RAPD marker linked to wild spine trait in pineapples (<i>Ananas bracteatus</i> and <i>Pseudoananas sagenarius</i>)
Winarso Drajad Widodo	Institut Pertanian Bogor (IPB) Bogor Agricultural University Indonesia	Effect of low temperature and water stress on flower bud differentiation of "Irwin" mango trees in subtropical regions
Efendi	Faculty of Agriculture Syiah Kuala University Indonesia	Development of efficient transformation methods using sonication in sugarcane (<i>Saccharum</i> spp.) hybrids
Shuzhen Zhang	Chinese Academy of Tropical Agricultural Sciences People's Republic of China	Cloning and expression analysis of anthocyanin transcriptional activator genes of sweet potato
Azoy Kumar Kundu	Bangabandhu Sheikh Mujibur Rahman Agricultural University Bangladesh	Purification of citrus greening organism and analysis of pathogen-specific proteins
I. Made Sudiana	Research Center for Biology The Indonesian Microbiology Institute of Science Indonesia	Detection of diversity of citrus greening organisms by DGGE of 16s rDNA

Xue Guixia	Associate Professor Institute of Agricultural Economics Chinese Academy of Agricultural Sciences People's Republic of China	Evaluation of functions of the agricultural social service system for stabilization of farm and rural management
------------	--	--

3) JIRCAS Visiting Research Fellowship Program at Okinawa

The Okinawa Visiting Research Fellowship Program was initiated in FY1992, 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. For FY2004, researchers focused on important issues relating to tropical agriculture in developing countries under 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 utilization of useful traits in sugarcane and sweet potato, 4) Evaluation and characterization of tropical and subtropical fruit trees, and 5) Development of new technologies for the integrated management of citrus huanglongbing (greening disease).

JIRCAS Visiting Research at Okinawa (October 2003 to September 2004)

Roland Nuhu Issaka	CSIR-Soil Research Institute Ghana	Effect of slope and tillage practices on soil erosion and soil properties
Meiru Li	South China Institute of Botany The China Academy of Sciences People's Republic of China	Transformation of <i>HANA</i> into rice via <i>Agrobacterium</i> -mediated methods
Ashok Kumar	CCS Haryana Agricultural University India	Plant water relations of snap bean (<i>Phaseolus vulgaris</i> L.) in high temperature stress environments
Mohammad Abul Kashem Chowdhury	Patuakhali Science and Technology University Bangladesh	Searching for an RAPD marker linked to wild spine trait in pineapples (<i>Ananas bracteatus</i> and <i>Pseudoananas sagenarius</i>)
Winarso Drajad Widodo	Institut Pertanian Bogor (IPB) Bogor Agricultural University Indonesia	Effect of low temperature and water stress on flower bud differentiation of "Irwin" mango trees in subtropical regions
Efendi	Faculty of Agriculture Syiah Kuala University Indonesia	Development of efficient transformation methods using sonication in sugarcane (<i>Saccharum</i> spp.) hybrids
Shuzhen Zhang	Chinese Academy of Tropical Agricultural Sciences People's Republic of China	Cloning and expression analysis of anthocyanin transcriptional activator genes of sweet potato
Azoy Kumar Kundu	Bangabandhu Sheikh Mujibur Rahman Agricultural University Bangladesh	Purification of citrus greening organism and analysis of pathogen-specific proteins
I. Made Sudiana	Research Center for Biology The Indonesian Microbiology Institute of Science Indonesia	Detection of diversity of citrus greening organisms by DGGE of 16s rDNA

JIRCAS Visiting Research at Okinawa (December 2004 to November 2005)

Ashok Kumar	CCS Haryana Agricultural University India	Physiological study of heat tolerance in snap bean (<i>Phaseolus vulgaris</i>)
Jilin Tian	Laboratory of Soil Science and Plant Nutrition Environmental Sciences Research Institute People's Republic of China	Development of salt-tolerant rice by genetic engineering
Peruma Vidhana Arachchige Lal	Visiting Researcher Faculty of Agriculture University of the Ryukyus Sri Lanka	Study on the effectiveness of fertigation at different frequencies through drip irrigation system in sugarcane cultivation
Robert Bellarmin Zougmore	Department of Natural Resources Management INERA Burkina Faso	Effect of cover crops on soil erosion and soil fertility
Mustad Maulid Macha	Sokoine University of Agriculture Centre for Sustainable Rural Development Tanzania	Evaluation and characterization of promising tropical fruit tree cultivars
Bambang Sugiharto	Faculty of Natural Sciences and Mathematics University of Jember Indonesia	Development of efficient <i>Agrobacterium</i> -mediated transformation methods in sugarcane
Xueqin He	College of Agriculture Inner Mongolia Agricultural University People's Republic of China	Cloning of myc type anthocyanin transcriptional activator gene of sweet potato
Saleh Mahmoud Ismail	Soil and Water Department Faculty of Agriculture Assiut University Egypt	Development of techniques to increase sub-soil stored water use
Mohammad Abul Kashem Chowdhury	Genetic and Plant Breeding Patuakhali Science and Technology University Bangladesh	Cultivar identification of tropical fruit trees by using DNA markers

4) JIRCAS Visiting Research Fellowship Program at Tsukuba

A program similar to the Okinawa Visiting Research Fellowship Program has been implemented at 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. This fellowship program has two types: JIRCAS type (long-term) and NIAS type (short-term). Under the JIRCAS-type program, 10 researchers are invited to conduct research at JIRCAS's Tsukuba premises for a period of one year. Four researchers are similarly invited under the NIAS-type program to carry out five-month projects at the National Institute of Agrobiological Sciences (NIAS), also in

Tsukuba. Starting from October 2003, 18 researchers have been invited under the JIRCAS-type program: nine from October 2003 to September 2004 and nine from December 2004 to November 2005, as well as four researchers under the NIAS-type program from November 2004 to March 2005. The invitees and their research activities in FY2004 are listed below.

More information on the Okinawa and Tsukuba Visiting Research Fellowship Programs 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@ml.affrc.go.jp)

JIRCAS Visiting Research Fellowships at Tsukuba (JIRCAS type: October 2003 to September 2004)

Huoyan Wang	Institute of Soil Science The Chinese Academy of Sciences People's Republic of China	What triggers NI (nitrification inhibitory) activity in root exudates of <i>Bracharia humidicola</i> ?
Yin Lijun	China Agricultural University People's Republic of China	Production of functional materials by the control of enzymatic reaction during food processing
Xiuqing Wang	China Agricultural University People's Republic of China	Grain yield response to climatic factors in China (1985-2002)
A. K. M. Mohiuddin	Bangladesh Rice Research Institute Bangladesh	Development of biotechnology to improve abiotic stress tolerance using leading varieties of Japonica rice
Adel Elsayed Elbeltagy	Laboratory of Microbiology Botany Department, Faculty of Agriculture Minufiya University Egypt	Molecular analysis of endophytic nitrogen-fixing bacterial communities associated with rice plants
Oladimeji Idowu Oladele	University of Ibadan Nigeria	Impact of extension services on rice yield gap in Asia and West African countries
Kashfia Ahmed	Ibaraki University (Bangladesh)	Physiological and nutritional studies on important aquaculture species
Xu Hua	Institute of Soil Science The Chinese Academy of Sciences People's Republic of China	The effects of soil moisture on CH ₄ , CO ₂ , N ₂ O, and NO emission of paddies
Safiah Jasmani	JIRCAS Fellow (Malaysia)	The role of hormones in the control of meiotic resumption during oocyte maturation in <i>Macrobrachium rosenbergii</i>

JIRCAS Visiting Research Fellowships at Tsukuba (JIRCAS type: December 2004 to November 2005)

Mohamed Faize	Department of Environmental Chemistry National Institute for Agro-Environmental Sciences Morocco	Molecular analysis of symbiosis of endophytic nitrogen-fixing bacteria in rice plants
Subramaniam Gopalakrishnan	Department of Biology University College London UK (India)	Isolation and characterization of nitrification inhibitory activity of root exudates in <i>Bracharia humidicola</i>
Syeda Shahnaz Parvez	Food Science and Technology Division JIRCAS Bangladesh	Structural determination of natural antioxidants from some tropical vegetables
Ashraf Suloma Mahmoud	Animal Production Department Faculty of Agriculture Cairo University Egypt	Characteristics of fatty acid composition in tropical and subtropical aquatic organisms
Zhijie Wang	China National Engineering Research Center for Information Technology in Agriculture People's Republic of China	Development of a method to estimate yield level of winter wheat using remote sensing

Cemal Atici	Faculty of Agriculture Adnan Menderes University Turkey	Quantitative analysis of the long-term food and agricultural resources situation
Andrew Kalyebi	Biocontrol Unit Namulonge Agricultural and Animal Production Research Institute Uganda	Parasitoid flies for biological control of insect pests
Trimurtulu Nunna	Agricultural Research Station India	Mitigation of nitrous oxide emissions from cultivated soil
Feng Qin	Department of Biological Science and Biotechnology Tsinghua University People's Republic of China	Functional analysis of DREB genes encoding transcription factors involved in drought and salt stress response in plants
Sobrizal	National Atomic Energy Agency Center for Research and Development of Isotopes and Radiation Technology Indonesia	Germplasm enrichment for marginal land with DNA marker techniques as part of the CIMMYT-JIRCAS project
JIRCAS Visiting Research Fellowships at Tsukuba (NIAS type: November 2004 to March 2005)		
Qiang Fu	China National Rice Research Institute People's Republic of China	Genetic basis for the shift of <i>Nilaparvata lugens</i> to resistant rice varieties
Souvanh Thadavong	National Agriculture Research Center (NARC) Laos	Analysis of Laotian legume genetic resources
Tran Danh Suu	Vietnam Agricultural Science Institute Vietnam	Analysis of genetic diversity of the chromosomal region conferring field resistance to rice blast to reveal potentially novel alleles among Asian wild and cultivated rice
Ghulam Muhammad Ali	Pakistan Agriculture Research Council Pakistan	Proteomics approaches to analyze rice (<i>Oryza sativa</i> L.) for drought tolerance

5) JIRCAS Asia Biotechnology Study Program

Starting in 2001, JIRCAS initiated the Asia Biotechnology Study Program under a contract research arrangement with the Ministry of Agriculture, Forestry and Fisheries to address food production and utilization concerns in developing countries through human resources development and

capacity building. The program invites researchers from target countries for periods of up to six months to undergo training in the field of biotechnology. Thirteen researchers have participated in the program since its inception.

JIRCAS Asia Biotechnology Study Program (October 2004 to February 2005)

A. K. M. Mohiuddin	Bangladesh Rice Research Institute (BRRI) Bangladesh	Development of abiotic stress-tolerant elite japonica varieties of rice using genetic engineering
Jianrong Shi	Plant Protection Institute Jiangsu Academy of Agricultural Sciences People's Republic of China	Development of functional genomic markers for germplasm enrichment

6) 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). 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 2004, the

following visiting scientists resided at JIRCAS: Dr. Nguyen Van Dong (Vietnam) and Dr. Selina Ahmed (Bangladesh), Biological Resources Division; Dr. Nur Ahamed Khondaker (Bangladesh), Okinawa Subtropical Station; Hoi Xuam Pham (Vietnam), Biological Resources Division; and Vasilica Vasile Nastasa (Romania), Crop Production and Environment Division.

In addition, three Japanese fellows, Dr. K. Suzuki, Development Research Division; Dr. C. Oguchi, Crop Production and Environment Division; and Dr. M. Hayano, Okinawa Subtropical Station, have also conducted research at JIRCAS.

SYMPOSIA AND WORKSHOPS

1) INTERNATIONAL SYMPOSIA

Between 1979 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 11th JIRCAS International Symposium was held in November 2004, in conjunction with "The International Year of Rice," and the program appears below.

11th JIRCAS International Symposium WORLD RICE RESEARCH CONFERENCE 2004

In fiscal year 2004, JIRCAS served as the main organizer of the World Rice Research Conference 2004 held together with the International Rice Research Institute (IRRI), six research institutes in Japan, and the Ministry of Agriculture, Forestry and Fisheries of Japan (MAFF).

As many as 1,278 participants from 42 countries attended and shared ideas on diverse matters related to rice production, supply and demand, processing, environmental problems, and farm management.

Program:

Opening addresses

- Mr. Koichi Nishikawa, Director of the Agriculture, Forestry and Fisheries Research Council, Ministry of Agriculture, Forestry and Fisheries of Japan
- Dr. Nguu Van Nguyen, Executive Secretary of the International Rice Commission, FAO
- Dr. Keijiro Otsuka, Chairman of the Board of Trustees, International Rice Research Institute

Keynote lectures

- Prof. Vaclav Smil, Manitoba University
- Prof. Riota Nakamura, Nippon University
- Dr. Ronald Cantrell, Director General, International Rice Research Institute

Main themes

Innovative technologies for boosting rice production

Session 1: The genus *Oryza*, its diversity, evolution, and utility

Session 2: The structure and function of the rice genome

Session 3: The opportunities and challenges of transgenic rice

Session 4: Improving rice yield potential

Session 5: Broadening the gene pool and exploiting heterosis in cultivated rice

Session 6: Trends in crop establishment and management in Asia

Session 7: Improving efficiency through innovations in mechanization

Perspectives on the place of rice in a healthy lifestyle

Session 8: Improving rice quality

Session 9: Development of new uses for rice

Session 10 : Post-harvest technology for efficient processing and distribution of rice

Adaptable rice-based systems that improve farmers' livelihood

Session 11: Enhancing the multi-functionality of rice systems

Session 12: Conservation of soil, water, and the environment in rice cultures

Session 13: Farmers' participatory approaches to facilitating the adoption of improved technology

Session 14: Potentials for diversification in rice-based systems to enhance rural livelihoods

The role of rice in environmentally-sustainable food security

Session 15: The challenge of expanding rice production in unfavorable environments

Session 16: Pest management with minimal environmental stress

Session 17: Rice supply and demand

Session 18: The impact of globalization on rice farmers

Session 19: Climate change and rice production

Session 20: Improving rice productivity through IT

JIRCAS 2005 International Symposium in Ishigaki PROBLEMS AND RESEARCH PERSPECTIVES OF AGRICULTURAL ENVIRONMENT IN THE TROPICAL AND SUBTROPICAL ISLANDS

This international symposium, entitled “Problems and Research Perspectives of Agricultural Environment in the Tropical and Subtropical Islands,” was held on March 11, 2005, in Ishigaki City, Okinawa Prefecture. The Okinawa Subtropical Station was the sponsor of this first international symposium on Ishigaki Island, with invited representatives from the Pacific Ocean islands of the Philippines, Fiji, and New Caledonia. It was cosponsored by the Seikai National Fisheries Research Institute’s Ishigaki Tropical Station, the Okinawa Prefectural Agricultural Experiment Station, and the Research Institute for the Subtropics.

Japan’s subtropical islands are increasingly exposed to problems such as soil erosion resulting in possible damage to coral ecosystems; nitrate pollution of groundwater caused by chemical fertilizers and livestock excreta; high temperatures and drought in summer; and typhoon damage from strong winds, rainfall downpours, and salt-laden wind. The narrow diurnal range in temperature of the islands also causes problems relating to crop growth. These problems are also emerging in the tropical and subtropical islands of the Pacific Ocean.

In order to review these problems with and research perspectives on the agricultural environment in tropical and subtropical islands, nearly two hundred people, including the Station’s collaborative foreign researchers and citizens of Ishigaki Island, participated in the international symposium. Many of the discussions focused on the conflict between agricultural productivity and environmental conservation. Finally, all of the participants confirmed the need to set up a collaborative network.

In addition, an excursion around Ishigaki Island was held on March 12, 2005 as a post-symposium event, which included visits to the International Coral Reef Research and Monitoring Center and to sugarcane fields seriously damaged by soil erosion.

Program:

Opening addresses

- Dr. Mutsuo Iwamoto, President (former), Japan International Research Center for Agricultural Sciences (JIRCAS)
- Mr. Shigeru Motai, President, Agriculture, Forestry and Fisheries Research Council, Ministry of Agriculture, Forestry and Fisheries of Japan
- Mr. Takanobu Ohama, President, Yaeyama Branch of the Okinawa Prefectural Government



Symposium participants in Ishigaki, Okinawa Prefecture, on March 11, 2005.

- Session 1:** The characteristics of agricultural environments in tropical and subtropical islands
- Session 2:** Problems in agricultural environments on the islands of the Pacific Ocean and research perspectives (country reports)
- Session 3:** Research into countermeasures against problems in agricultural environments in tropical and subtropical islands
- Session 4:** General discussion: Research perspectives on agricultural environments in tropical and subtropical islands and the role of the JIRCAS Okinawa Subtropical Station

Closing address

- Dr. Shuichi Asanuma, Director, Okinawa Subtropical Station, JIRCAS

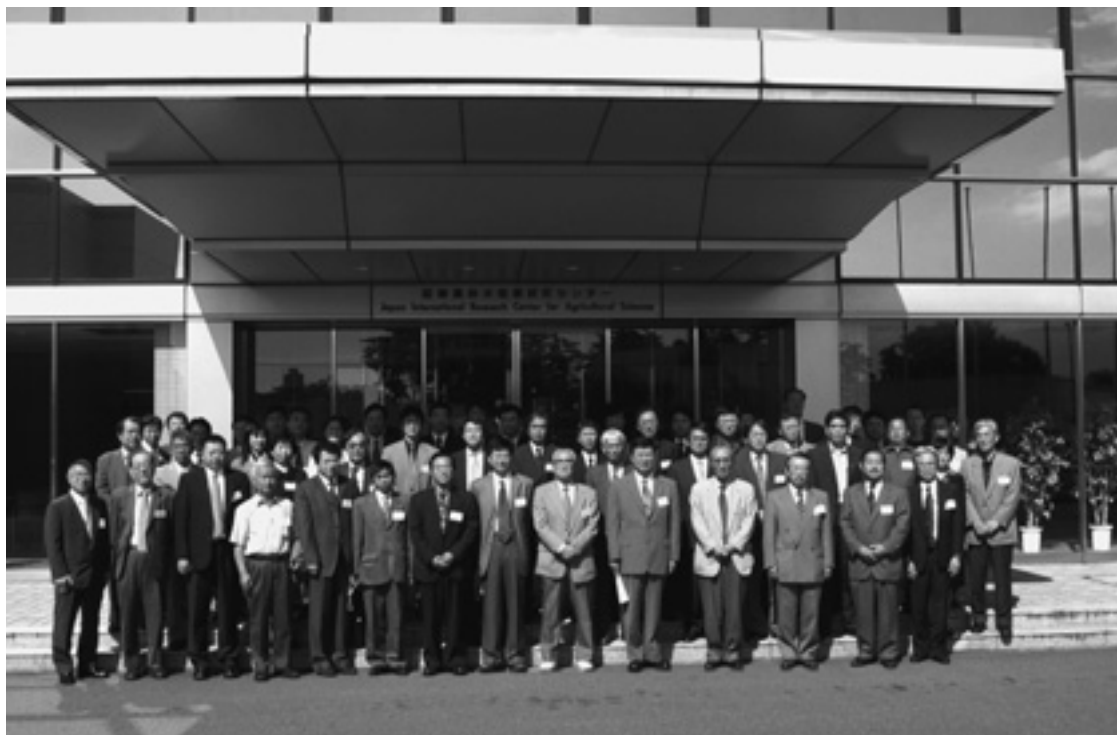
2) SPECIAL PROGRAMS

WORKSHOP ON THE CONTROL OF DESERTIFICATION OF DEGENERATED GRASSLANDS IN CHINA AND THEIR SUSTAINABLE USE

This workshop, cosponsored by the National Institute of Livestock and Grassland Science, was held at JIRCAS on October 7-8, 2004.

At present, 1.7 million km², or approximately 17% of the Peoples' Republic of China's total area, is comprised of desert or areas undergoing desertification. It is thought that about 400,000 km², more than the total area of Japan, has been desertified due to human activities such as overgrazing, the felling of trees for fuel, and inefficient water management. The speed of desertification particularly accelerated in the 1990s. The expansion of desertification in China not only impedes sustainable agricultural production and the development of the social economy,

but also causes the so-called "yellow dust" which reaches Japan in early spring and flooding in the Hwang Ho downstream region. In this way, the effects of desertification on the environment and social development are of serious concern. Moreover, the decline in agricultural productivity due to grassland degradation is greatly affecting the distribution of international feed resources, and that this will have inevitable negative effects on Japan cannot be overlooked. This workshop was held in order to gain a better understanding of the present state of desertification of China and to discuss directions for future research. Seventy-three Chinese and Japanese researchers participated in this workshop.



Participants in the workshop on "The control of desertification of degenerated grasslands in China and their sustainable use."

Program:**Opening addresses**

- Mr. Tatsuro Katsuyama, Director, International Research Section, Agriculture, Forestry and Fisheries Research Council
- Dr. Mutsuo Iwamoto, President (former), JIRCAS

Keynote lecture

- “The present situation of desertification in China and its countermeasures,” Dr. Wang Tao, Director General, Cold and Arid Regions Environmental and Engineering Research Institute, Chinese Academy of Sciences
- “Realizing sustainable use of Chinese grasslands,” Dr. Hiroshi Oikawa, former Head, Hokkaido Animal Research Center, Japan

Regional reports

- “Grassland recovery technology using Puccinellia in Jilin,” X.A. Kai, Director, Department of Livestock Science, Jilin Academy of Agricultural Sciences
- “Development of preparation and application techniques of by-product in Jilin,” A. Masahiro, Senior Researcher, National Institute of Livestock and Grassland Sciences
- “The situation of degenerated grassland in Inner Mongolia and strategies for its improvement,” W. Zongli, Director General, Grassland Research Institute of the Chinese Academy of Agricultural Sciences
- “Monitoring the grassland ecosystem in the Xilingol Steppe,” T. Akiyama, Professor, River Basin Research Center, Gifu University
- “Traditional knowledge and synthetic technology for vegetation restoration in Mu Us Sandy Lands,” Z. Yuanrun, Deputy Director, Ordos Sandland Ecological Station, Institute of Botany, Chinese Academy of Sciences
- “Vegetation recovery on the Loess Plateau in China,” N. Ichizen, Professor, Utsunomiya University
- “Livestock production on the Qinghai-Tibetan Plateau,” S. Ozawa, Professor, Yamaguchi University
- “Pastoral systems in the Altai region of Xinjiang,” M. Hanada, Associate Professor, Obihiro University of Agriculture and Veterinary Medicine

General Discussion chaired by Dr. Norihiro Shimizu, Deputy Director General, National Institute of Livestock and Grassland Sciences

Closing Address

- Dr. Kunio Yokouchi, Vice-President, National Agriculture and Bio-oriented Research Organization and Director General, National Institute of Livestock and Grassland Sciences

JIRCAS-SOFRI INTERNATIONAL WORKSHOP: “STEPS TOWARD MUTUAL COLLABORATION FOR CONTROLLING CITRUS HLB IN SOUTHEAST ASIA”

JIRCAS launched the international project entitled “Development of new technologies for the control of citrus huanglongbing (HLB) in Southeast Asia” in 2004 in cooperation with Vietnam’s Southern Fruit Research Institute (SOFRI). The workshop was held in My Tho City in Vietnam on November 15, 2004 in order to acquire fundamental information about citrus HLB in relation to the implementation of this project. Forty-two people took part.

After the keynote lecture by Dr. Su representing Taiwan, five country reports were given delineating the present status of HLB

problems in Southeast Asia. Four international projects that have been implemented at SOFRI were reviewed, of which the JIRCAS-SOFRI project and the CIRAD*-SOFRI project were discussed in detail.

We are certain that this workshop will contribute to the formation of a research network to address the problems associated with this highly destructive disease in Southeast Asia.

* Centre de Coopération Internationale en Recherche Agronomique pour le Développement

Keynote lecture

- Dr. Hong-Ji Su, National Taiwan University, (Food and Fertilizer Technology Center: FFTC): “Practical strategies for research and technology dissemination for citrus HLB control”

Session topics

- Severity of citrus HLB and its control in Southeast and East Asian countries (Vietnam, Thailand, Indonesia, Japan, Cambodia)
- Control of citrus HLB and introduction of ongoing projects (JIRCAS, CIRAD, SOFRI)
- General discussion

WORKSHOP ON DEVELOPMENT OF AGROFORESTRY TECHNOLOGY FOR THE REHABILITATION OF TROPICAL FORESTS

In December 2001, JIRCAS and the Sabah Forestry Department (SFD) of Malaysia signed a Memorandum of Understanding (MOU) in order to conduct a comprehensive research project entitled “Development of agroforestry technology for the rehabilitation of tropical forests,” aiming to mitigate agriculture-forestry conflicts and to promote environmental conservation and sustainable management of forest resources.

The researchers involved in this project have carried out studies for about three years since the signing of the MOU. The year 2004 marks the midway point of the planned duration of this project. In collaboration with the Forest Research Center (FRC) of the SFD, JIRCAS organized a workshop to report on the interim results of the project.

The workshop was held at the SFD in Sandakan, Sabah State, on December 1-2,

2004. At the opening ceremony, Dr. Shozo Nakamura, Director of JIRCAS’s Forestry Division, delivered an opening speech on behalf of JIRCAS, and Mr. Henry Solibun, the Deputy Director of the SFD, declared the workshop officially open. Thirteen presentations were delivered in three categories as listed below. More than 100 participants from various institutes attended, including those from the FRC, SFD, universities, logging companies, and timber industries. On the second day of the workshop, an excursion to the agroforestry experimental plots at the FRC’s Kolapis Station was held and more than 30 participants attended. During the two-day workshop, all participants exchanged information and discussed how to promote agroforestry practices aiming at the rehabilitation of forests in Sabah.

Session issues

- Re-establishment of a productive environment for agroforestry
- Development of agroforestry techniques with the utilization of shade trees
- Socio-economic evaluation of agroforestry



Group photograph of the workshop participants.

FINAL EVALUATION MEETING FOR THE “DEVELOPMENT OF LOW-INPUT TECHNOLOGY FOR REDUCING POST-HARVEST LOSSES OF STAPLES IN SOUTHEAST ASIA” PROJECT

JIRCAS held a final evaluation meeting for the research project entitled “Development of low-input technology for reducing post-harvest losses of staples in Southeast Asia” on March 7, 2005 at its Tsukuba premises. This project, launched in Fiscal Year 2000 and completed in FY2004, was conducted in cooperation with the Thai Department of Agriculture, Kasetsart University, King Mongkut’s University of Technology, Khon Kaen University, and Japanese institutions including the National Food Research Institute and the National Agricultural Research Organization, with the aim of addressing the serious problem of post-harvest losses of staples in Southeast Asia.

Dr. Yoshimi Hirose, Professor Emeritus,

Kyushu University; Dr. Tadashi Miyata, Professor, Nagoya University; Dr. Toshinori Kimura, Professor, the University of Tsukuba; and Dr. Greg Johnson, Program Manager of the Australian Centre for International Agricultural Research (ACIAR) were invited as external reviewers. Five Thai researchers and seven Japanese researchers representing each participating institute reported on the major outcomes achieved during the course of the project. Overall, the development of a total rice drying system suited to high-humidity and high-temperature tropical conditions was strongly encouraged, and low-cost environment-friendly rice storage methods using bioactive botanicals and natural enemies were proposed.

Program:

- Welcoming remarks by Dr. Mutsuo Iwamoto, President (former), JIRCAS
- Outline of the project by Dr. Yutaka Mori, Director of Food Science and Technology Division, JIRCAS

Session 1 : Survey of post-harvest losses of rice and identification of causes of quality change

Session 2 : Analysis of annual incidence of major stored-product insects and mechanisms of damage and possible prevention methods

Session 3: Development of low-input drying technology and biological control of stored-product insects using natural enemies and products

Session 4: Development of environment-friendly technologies for reducing post-harvest losses of staples

- General discussion
- Reviewers’ comments
- Closing remarks by Dr. Akinori Noguchi, Vice-President, JIRCAS

WORKSHOP AND SEMINAR ON “NEW TRENDS TOWARDS THE STABILIZATION OF THE CHINESE RURAL ECONOMY”

JIRCAS organized a workshop to accelerate socio-economic research under the collaborative research project entitled “Stable food supply systems for mitigating the fluctuations of production and markets in China,” which formally commenced in July 2004. The new project comprises two major objectives: the development of an early warning system to mitigate agro-meteorological disasters, and the drawing up of policy recommendations for the stabilization of rural economies. At the workshop, researchers involved in the latter subject from both countries discussed their study concepts and presented outcomes they

have achieved to date.

Eight presentations (four by Chinese researchers) were made dealing with three themes. Regarding the first theme of farm management, a prototype model assisting decision-making by farmers was presented and outlined. Field survey results regarding producers’ organizations conducted in two Chinese provinces were presented under the second theme which deals with various rural institutions. For the last theme which covers macro scale assessments, supply and demand analysis of japonica rice produced in northeast China was discussed.

On the following day, a seminar was

organized together with the Policy Research Institute of the Ministry of Agriculture, Forestry and Fisheries (MAFF) in Tokyo. After two presentations on current Chinese agriculture (market situation and policy

development) by invited speakers, a lively discussion took place among panel members and approximately eighty participants from universities and other related organizations.

Opening addresses

- Dr. Akinori Noguchi, Vice-President, JIRCAS
- Dr. Xiaoqing Xu, Deputy Director, Research Department of the Rural Economy, Development Research Center of the State Council, Peoples' Republic of China
- Dr. Fu Qin, Deputy Director General, Institute of Agricultural Economics, Chinese Academy of Agricultural Sciences, Peoples' Republic of China

Project outline

- Mr. Osamu Koyama, Director, Research Development Division, JIRCAS

Presentation themes

- Farm economy assessment on the risks of production fluctuation and the benefits of early warning systems
- Proposals of stabilization measures corresponding to nationwide distribution and farm-market integration
- Impact assessment of stabilization measures on national and international food markets

General discussion



Participants in the workshop on "New trends towards the stabilization of the Chinese rural economy."

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.

- June 28, 2004 Pre-Evaluation Meeting for 2004-2008
Collaborative research project on “Studies on stable food supply systems for mitigating fluctuations in food production and markets in China”
Attended by representatives of JIRCAS; external reviewers (Tokyo University and Mie University, Japan); Agriculture, Forestry and Fisheries Research Council Secretariat, MAFF, Japan; Ministry of Agriculture, China; Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences, China; Researchers from collaborative institutes (National Agricultural Research Organization, National Institute of Agro-Environmental Sciences, and Policy Research Institute of MAFF), Japan
- July 21-22, 2004 Annual Work Plan Meeting
Collaborative research project on “Increasing economic options in rainfed agriculture in Indochina through efficient use of water resources”
Attended by representatives of JIRCAS; Land Development Department (LDD), Thailand; Department of Agriculture (DOA), Thailand; Khon Kaen Animal Nutrition Research and Development Center (KKANDRC), Thailand; Khon Kaen University, Thailand
- October 7-8, 2004 Workshop on “Control of desertification of degenerated grasslands in China and their sustainable use” cosponsored by the National Institute of Livestock and Grassland Science
Attended by representatives of JIRCAS; Agriculture, Forestry and Fisheries Research Council of MAFF, Japan; Cold and Arid Regions Environmental and Engineering Research Institute, Chinese Academy of Sciences; Jilin Academy of Agricultural Sciences, China; Grassland Research Institute of the Chinese Academy of Agricultural Sciences, China; Institute of Botany, Chinese Academy of Sciences, China; Hokkaido Animal Research Center, Japan; National Institute of Livestock and Grassland Sciences, Japan; Gifu University, Japan; Utsunomiya University, Japan; Yamaguchi University, Japan; Obihiro University of Agriculture and Veterinary Medicine, Japan
- November 15, 2004 JIRCAS-SOFRI International Workshop, “Steps toward mutual collaboration for controlling citrus HLB in Southeast Asia” in My Tho, Vietnam
Attended by representatives of JIRCAS, Japan; Southern Fruit Research Institute (SOFRI), Vietnam; National Taiwan University, Republic of China; Department of Agriculture, Thailand; Gadjah Mada University, Indonesia; National Institute of Fruit Tree Science, Japan; Royal University of Agriculture, Cambodia; Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), France
- December 1-2, 2004 Workshop on “Development of agroforestry technology for the rehabilitation of tropical forests”
Attended by representatives of JIRCAS; Forest Research Center (FRC) and Sabah Forestry Department (SFD), Malaysia
- February 24-25, 2005 Annual Results Meeting
Collaborative research project on “Increasing economic options in rainfed

agriculture in Indochina through efficient use of water resources”
Attended by representatives of JIRCAS; Land Development Department (LDD), Thailand; Department of Agriculture (DOA), Thailand; Khon Kaen Animal Nutrition Research and Development Center (KKANDRC), Thailand; Khon Kaen University, Thailand

- March 7, 2005 Final Evaluation Meeting for 2000-2004
 Collaborative research project on “Development of low-input technology for reducing postharvest losses of staples in Southeast Asia”
Attended by representatives of JIRCAS; National Agricultural Research Center for the Hokkaido Region, National Food Research Institute, Japan; Department of Agriculture, Kasetsart University, Thailand; King Mongkut’s University of Technology, Khon Kaen University, Thailand
- March 15, 2005 Research Seminar on “Functionality and use of indigenous vegetables in Southeast Asia”
Attended by representatives of JIRCAS; National Institute of Vegetable and Tea Science, National Food Research Institute, Japan; Kasetsart University, Thailand
- March 28-29, 2005 Workshop and Seminar on “New trends towards the stabilization of the Chinese rural economy” in relation to the socio-economic research subjects of the Japan-China Collaborative Research Project
Attended by representatives of JIRCAS; Development Research Center, China; Institute of Agricultural Economics, Chinese Academy of Agricultural Sciences, China; Policy Research Institute of MAFF, Japan; National Agricultural Research Organization, Japan; general audience from universities and related organizations in Japan

4) INTERNATIONAL RESEARCH SEMINARS

International research seminars are held throughout the year, either on JIRCAS premises or overseas. The following twenty-two seminars were held in FY2004.

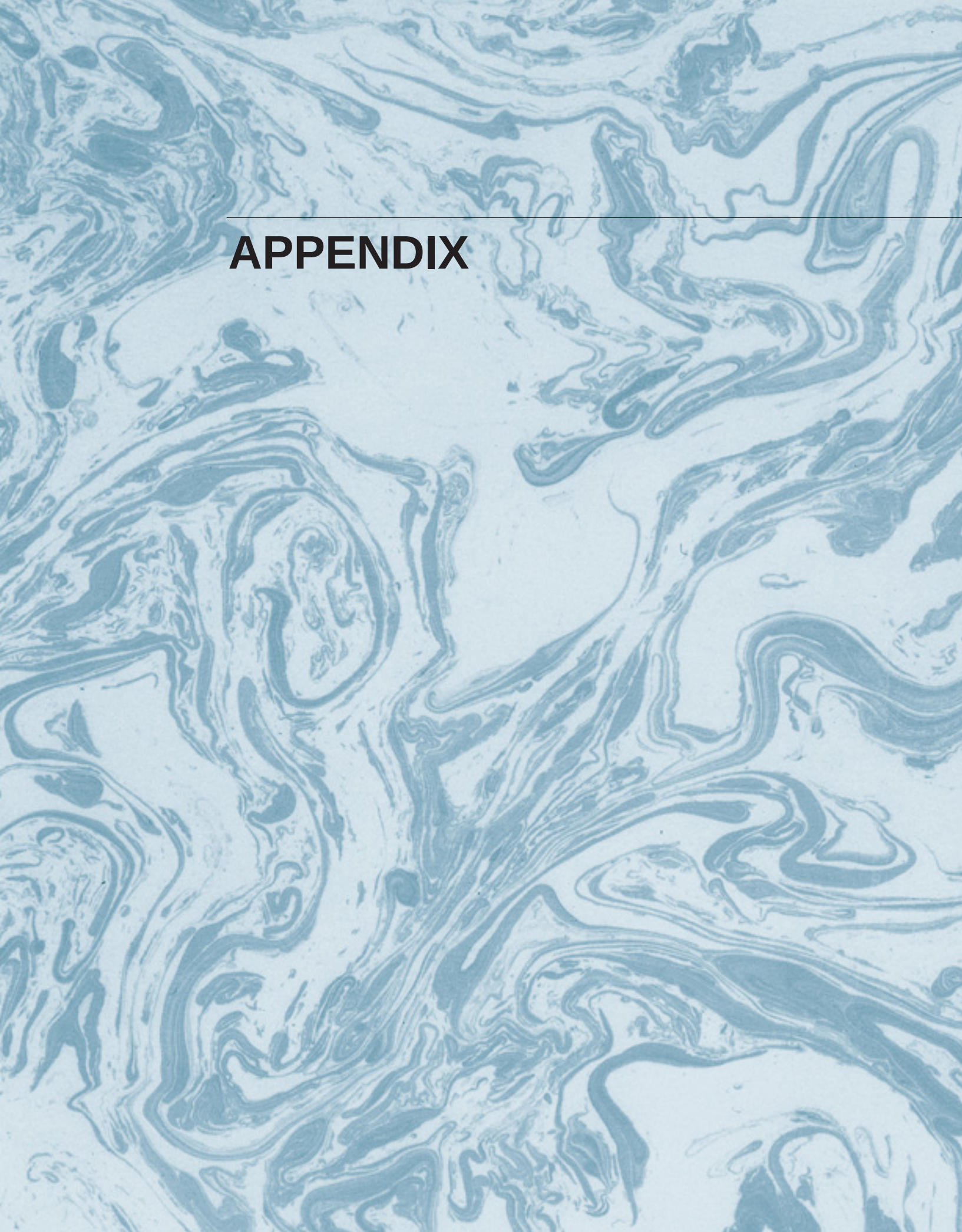
- May 28, 2004 Introduction of CIFOR research activities. *Markkun Kanninen*
- July 16, 2004 Transforming the dry land of West Africa: the New Sahel. *William Dar*
- July 26, 2004 CGIAR’s recent research trends. *Francisco Reifschneider*
- August 17, 2004 Global overview of GM crops and the activities of the ISAAA’s Global Knowledge Center with respect to crop biotechnology. *Clive James*
- August 23, 2004 Studies on gene expression during drought in soybean plants and soybean research in Brazil. *Alexandre Nepomuceno*
- August 27, 2004 Application of a stochastic process to the Laotian Rice Model. *Seth Dominic Meyer*
- September 17, 2004 Domestication and genetic diversity of the Old World camelids: a molecular genetic perspective. *Han Jianlin*
- September 17, 2004 Current status of progress in field evaluation of transgenic lines. *Manabu Ishitani*
- September 17, 2004 Current status of progress in field evaluation of transgenic lines. *Tathias Lorieux*
- October 14, 2004 An approach to hunger and poverty reduction for Sub-Saharan Africa. *Peter Hartman*
- October 25, 2004 Overview of the ongoing research project on HLB greening disease in Vietnam. *Frederic Gatineau*
- October 25, 2004 Overview of rice research at CIRAD. *Nourollah Ahmadi*
- November 8, 2004 Overview and perspectives on Cambodian agricultural research. *Men Sarom*
- November 8, 2004 Impact of extension services on the rice yield gap in West Africa and

November 17, 2004	Asia. <i>Oladele Idowu</i> Post-conflict rehabilitation of sustainable agriculture in West Asia. <i>Adel El-Beltagy</i>
February 22, 2005	Sadah Biodiversity Enactment 2000: its potential and benefits to industry and researchers. <i>Mohamed Bazain b. Idris</i>
February 22, 2005	Forest biodiversity and the role of the Forest Department in Sabah. <i>Anuar Hj Mohammad</i>
February 28, 2005	Development of functional genomic markers for germplasm enrichment. <i>Shi Jianrong</i>
February 28, 2005	Development of abiotic stress-tolerant elite japonica varieties of rice using genetic engineering. <i>AKM Mohiuddin</i>
March 10, 2005	Some basic research methods for analysis of agrometeorological data and future research plans in China. <i>Men Ying</i>
March 10, 2005	A prediction method for rice heading date and its application. <i>Geng Liqing</i>
March 11, 2005	New developments in organic matter utilization experiments. <i>Takeshi Watanabe</i>

5) JIRCAS RETURN SEMINARS

At JIRCAS, researchers returning from overseas dispatches or research projects give an oral presentation accompanied by a written summary of their 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. These seminars are ordinarily held twice per month, and each year approximately 30 scientists give presentations.

The background of the entire page is a traditional marbled paper pattern. It features intricate, swirling, and veined designs in various shades of blue, ranging from light sky blue to deep navy blue, set against a white or very light blue base. The pattern is organic and fluid, resembling natural stone or liquid swirls.

APPENDIX

PUBLISHING AT JIRCAS

OFFICIAL JIRCAS PUBLICATIONS

In English	
1) JARQ (Japan Agricultural Research Quarterly)	Vol. 38 - No. 2, No. 3, No. 4 Vol. 39 - No. 1
2) Annual Report	No. 10 (2003)
3) JIRCAS Newsletter	No. 39, No. 40, No. 41, No. 42
4) JIRCAS Working Report Series	No. 37 Collaborative Research for Fusarium Head Blight Resistance in Wheat and Barley No. 38 Optimal Water Management under Tank Cascade System of Sri Lanka No. 39 Lignocellulose: Materials for the Future from the Tropics No. 40 Stabilization of Rice Culture under Water Stress in the Tropics Using a Broader Spectrum of Genetic Resources No. 42 Development of Sustainable Production and Utilization of Major Food Resources in China No. 43 Evaluation of Vegetable-Based Farming Systems and Improvement of Vegetable and Fruit Cultivation in Highland Regions of West Java, Indonesia
5) JIRCAS International Agriculture Series	No. 13 Stored Rice Insect Pests and Their Natural Enemies in Thailand No. 14 A Guidebook for Sugarcane in Japan

In Japanese	
1) JIRCAS News	No. 39, No. 40, No. 41, No. 42
2) JIRCAS Working Report Series	No. 41 Studies on the Establishment of Direct- Seeded Rice Cultivation in the Muda Irrigation Scheme, Malaysia
3) JIRCAS Research Highlights	No. 11

LIBRARY ACQUISITIONS

April 1, 2004 - March 31, 2005

	Books			Periodicals (titles)			Materials (proceedings, maps and other)		
Language	Purchased	Gifts	Total	Purchased	Gifts	Total	Purchased	Gifts	Total
Japanese	116 (51)	15 (0)	131 (51)	48 (24)	97 (56)	145 (80)	18	203	221
Foreign	60 (2)	10 (0)	70 (2)	89 (13)	231 (21)	320 (34)	19	180	199
Total	176 (53)	15 (0)	191 (53)	137 (37)	328 (77)	465 (114)	37	383	420

() Indicates separate acquisitions of the Okinawa Subtropical Station

RESEARCH STAFF ACTIVITY 2004-2005

Journal articles, book chapters, and monographs

- Abe, H.** (2005). Present state and future prospects of research on wood anatomy and wood quality. *Journal of the Japan Wood Research Society*, 51(1): 7-9. (J)
- Awaji, M. and **Hamano, K.** (2004). Gonad formation, sex differentiation and gonad maturation processes in artificially produced juveniles of the abalone, *Haliotis discus hannai*. *Aquaculture*, 239: 397-411.
- Banzai, K. and **Shibano, K.** (2004). Water quality monitoring in streams of the rural basin and its database. *Inventory*, 3: 35-36. (J)
- Bordignon, J.R., **Nakahara, K.**, **Yoshihashi, T.** and Nikkuni, S. (2004). Hydrolysis of isoflavones and consumption of oligosaccharides during lactic acid fermentation of soybean milk. *Japan Agricultural Research Quarterly*, 38(4): 259-265.
- Chosa, T., Shibata, Y., Omine, M., **Toriyama, K.** and Araki, K. (2004). A study on yield monitoring system for head-feeding combines (Part 3) - Systemization of data acquisition, analysis and mapping. *Journal of the Society of Agricultural Machinery*, 62(2): 137-144. (J)
- Chosa, T., Watanabe, K., Tojo, S., Shibata, Y. and **Toriyama, K.** (2005). SSCM simulation using yield map. *Japanese Journal of Farm Work Research*, 40(1): 3-10. (J)
- Chu, H., **Hosen, Y.** and Yagi, K. (2004). Nitrogen oxide emissions and soil microbial activities in a Japanese Andisol as affected by N-fertilizer management. *Soil Science and Plant Nutrition*, 50(2): 287-292.
- Dai, L., Lin, X., Ye, C., **Ise, K.**, Saito, K., Kato, A., Xu, F., Yu, T. and Zhang, D. (2004). Identification of quantitative trait loci controlling cold tolerance at the reproductive stage in Yunnan landrace of rice, Kunmingxiaobaigu. *Breeding Science*, 54(3): 253-258.
- Doi, K., Nishizaki, Y., **Ohmomo, S.** and Ogata, S. (2004). Genetical analysis for the biodiversity of lactic acid bacteria associated with silage fermentation in south-east Japan. *Seibutsu Kogaku Kaishi*, 82(9): 436-437. (J)
- Ebron, L.A., Fukuta, Y., Imbe, T., Kato, H., Yanoria, J.M.T., **Tsunematsu, H.**, Khush, G.S. and Yokoo, M. (2004). Estimation of genes in blast resistance in elite Indica-type rice (*Oryza sativa* L.) varieties-bred at the International Rice Research Institute. *Breeding Science*, 54: 381-387.
- Elbeltagy, A. and **Ando, Y.** (2005). Phylogenetic analysis of nifH gene sequences from nitrogen-fixing endophytic bacteria associated with the roots of three rice varieties. *Journal of Food, Agriculture & Environment*, 3(1): 237-242.
- Fischer, U., Dijkstra, J.M., Iner, B.K., **Kiryu, I.**, Koppang, E.O., Hordvik, I., Sawamoto, Y. and Ototake, M. (2005). The ontogeny of MHC class I expression in rainbow trout (*Oncorhynchus mykiss*). *Fish and Shellfish Immunology*, 18: 49-60.
- Fujii, H.** (2004). Flood mitigation function of Tonle Sap Lake and its vicinities. *Journal of the Japanese Society of Irrigation, Drainage and Reclamation Engineering*, 72(7): 51-55. (J)
- Fujita, M., Fujita, Y., Maruyama, K., Seki, M., Hiratsu, K., Ohme-Takagi, M., Tran, L.-S.P., **Yamaguchi-Shinozaki, K.** and Shinozaki, K. (2004). A dehydration-induced NAC protein, RD26, is involved in a novel ABA-dependent stress-signaling pathway. *The Plant Journal*, 39(6): 863-876.
- Gao, C., Zhu, J.G., Zhu, J.Y., Gao, X., Dou, Y.J. and **Hosen, Y.** (2004). Nitrogen

(J) Denotes articles written in Japanese; (C) denotes articles written in Chinese; bold lettering indicates JIRCAS staff members.

Information regarding published proceedings, conference presentations, or other publications may be requested from the Publication and Documentation Section (pubj@ml.affrc.go.jp).

export from an agriculture watershed in the Taihu Lake area, China. *Environmental Geochemistry and Health*, 26: 199-207.

Hamada, H., Abenney-Mickson, S. and Komae, T. (2004). Influence of inundation of ground surface on ^{222}Rn concentration in shallow groundwater. *Radioisotopes*, 53(9): 469-475.

Hamada, H. and Kishi, S. (2004). Quantitative analysis of groundwater effluent and reservoir-water influent in a small pond using ^{222}Rn - and water-balance equations. *Japan Agricultural Research Quarterly*, 38(4): 253-258.

Hamada, H., Moroizumi, T. and Suphanchaimat, N. (2005). Opinions and questions of farmers in Nong Saeng Village, Northeast Thailand on results of soil and groundwater investigations. *Journal of the Japanese Society of Soil Physics*, 99: 95-101. (J)

Hamada, H., Sukchan, S., Moroizumi, T., Watabe, H. and Hasegawa, S. (2005). Use of bromide to trace infiltration of rainfall through sandy soil in Northeast Thailand. *Japan Agricultural Research Quarterly*, 39: 29-35.

Han, S.Y., Kitahata, N., Sekimata, K., Saito, T., Kobayashi, M., **Nakashima, K.**, **Yamaguchi-Shinozaki, K.**, Shinozaki, K., Yoshida, S. and Asami, T. (2004). A novel inhibitor of 9-cis-epoxycarotenoid dioxygenase in abscisic acid biosynthesis in higher plants. *Plant Physiology*, 135(3): 1574-1582.

Hanamura, Y. and De Grave, S. (2004). Mysid crustaceans (Mysidacea) from Palau, Northwestern Pacific. *Biogeography*, 6: 63-68.

Hanamura, Y. and Kase, T. (2004). *Heteromysoides* (Crustacea: Mysidacea: Heteromysini) from a submarine cave on Grand Cayman, the Caribbean Sea: description of a new and rare species. *Journal of Natural History*, 38: 2145-2152.

Hitsuda, K., Sfredo, G.J. and Klepker, D. (2004). Diagnosis of sulfur deficiency

in soybean using seeds. *Soil Science Society of America Journal*, 45: 1445-1451.

Hitsuda, K., **Yamada, M.** and Klepker, D. (2005). Sulfur requirement of eight crops at early stages of growth. *Agronomy Journal*, 97: 155-159.

Huong, D.T.T., Jayasankar, V., Jasmani, S., Saido-Sakanaka, H., Wigginton, A. and **Wilder, M.N.** (2004). Na/K-ATPase activity during larval development in the giant freshwater prawn, *Macrobrachium rosenbergii* and the effects of salinity on survival rates. *Fisheries Science*, 70: 518-520.

Imbe, T., Horisue, N., Akama, Y., Nakane, A., Ando, I., Suto, M., Hata, T., **Ise, K.**, Numaguchi, K., Furutachi, H. and Takadate, M. (2004). "Odorokimochi" –A multipurpose high-yield glutinous rice variety. *Bulletin of the National Institute of Crop Science*, 6: 19-35. (J)

Inoue, H., **Yonemoto, Y.**, Shimakawa, Y., Matsuda, N. and Onda, S. (2004). Effect of rootstocks on tree growth and flower bearing of Atemoya (*Annona cherimola* Mill. $\times$ *A. squamosa* Linn.) cv. Jeffner. *Japanese Journal of Tropical Agriculture*, 48(4): 265-269. (J)

Itani, T., Tamaki, M., Hayata, Y., **Fushimi, T.** and Hashizume, K. (2004). Variation of 2-acetyl-1-pyrroline concentration in aromatic rice grains collected in the same region in Japan and factors affecting its concentration. *Plant Production Science*, 7: 178-183.

Iwasaki, M., Ito, K., **Kawabe, K.**, Sugito, T., Nitta, T., Takigawa, S., Ito, K., **Nakata, T.**, Ogawa, Y., Hayano, Y. and Fukumoto, F. (2005). Evaluation of agronomic traits and environmental biosafety of a transgenic tomato plant expressing satellite RNA of cucumber mosaic virus. *Research Bulletin of the National Agricultural Research Center for Hokkaido Region*, 182: 51-63. (J)

Jasmani, S., Ohira, T., Jayasankar, V., Tsutsui, N., Aida, K. and **Wilder, M.N.** (2004). Localization of vitellogenin mRNA expression and vitellogenin uptake

- during ovarian maturation in the giant freshwater prawn, *Macrobrachium rosenbergii*. Journal of Experimental Zoology, 301A: 334-343.
- Jiang, L., Maoka, T., Komori, S., **Fukamachi, H.**, **Kato, H.** and Ogawa, K. (2004). An efficient method for sonication assisted Agrobacterium-mediated transformation of coat protein (CP) coding genes into papaya (*Carica papaya* L.). Shi Yan Sheng Wu Xue Bao, 37(3): 189-198. (C)
- Kim, Y.K., Kawazoe, I., Tsutsui, N., Jasmani, S., **Wilder, M.N.** and Aida, K. (2004). Isolation and cDNA cloning of ovarian cortical rod protein in kuruma prawn *Marsupenaeus japonicus* (Crustacea: Decapoda: Penaeidae). Zoological Science, 21: 1109-1119.
- Kiryu, I.**, Dijkstra, J.M., Sarder, R.I., Fujiwara, A., Yoshiura, Y. and Ototake, M. (2005). New MHC class Ia domain lineages in rainbow trout (*Oncorhynchus mykiss*) which are shared with other fish species. Fish and Shellfish Immunology, 18: 243-254.
- Kitin, B.P., Fijii, T., **Abe, H.** and Funada, R. (2004). Anatomy of the vessel network within and between tree rings of *Fraxinus lanuginosa* (Oleaceae). American Journal of Botany, 91(6): 779-788.
- Kobayashi, S., **Fukuta, Y.**, Yagi, T., Sato, T., Osaki, M. and Khush, G.S. (2004). Identification and characterization of quantitative trait loci affecting spikelet number per panicle in rice (*Oryza sativa* L.). Field Crop Research, 51: 53-56.
- Kohno, K.**, Ngan, B.T. and Fujiwara, M. (2004). Predation of *Dysdercus cingulatus* (Heteroptera: Pyrrhocoridae) by the specialist predator *Antilochus coqueberti* (Heteroptera: Pyrrhocoridae). Applied Entomology and Zoology, 39(4): 661-667.
- Komiyama, H.** (2005). Actual damage to Mongolian animal husbandry due to 2000-2002 Dzud disaster. Bulletin of Japanese Association for Mongolian Studies, 35: 73-85. (J)
- Kosugi, A.**, Amano, Y., Murashima, K. and Doi, R.H. (2004). Hydrophilic domains of scaffolding protein CbpA promote glycosyl hydrolase activity and localization of cellulosomes to the cell surface of *Clostridium cellulovorans*. Journal of Bacteriology, 186: 6351-6359.
- Lin, T., Lin, Y. and **Ishiki, K.** (2005). Genetic diversity of *Dimocarpus longan* in China revealed by AFLP markers and partial rbcL gene sequences. Scientia Horticulturae, 103 (4): 489-498.
- Liu, X.C., Chen, S.G., Chen, J.S., **Ishiki, K.**, Wang, W.X. and Yu, L.Q. (2004). Improvement of combining ability for restorer lines with the identified SSR markers in hybrid rice breeding. Breeding Science, 54 (4): 341-346.
- Luo, Y., Kuwahara, R., **Kaneniwa, M.**, Murata, Y. and Yokoyama, M. (2004). Effect of soy protein isolate on gel properties of Alaska pollock and common carp surimi at different setting conditions. Journal of the Science of Food and Agriculture, 84: 663-671.
- Maruyama, K., Sakuma, Y., Kasuga, M., Ito, Y., Seki, M., Goda, H., Shimada, Y., Yoshida, S., Shinozaki, K. and **Yamaguchi-Shinozaki, K.** (2004). Identification of cold-inducible downstream genes of the Arabidopsis DREB1A/CBF3 transcriptional factor using two microarray systems. The Plant Journal, 38(6): 982-993.
- Matsui, T., Nakaya, T., **Yagihashi, T.**, Taoda, H. and Tanaka, N. (2004). Comparing the accuracy of predictive distribution models. Japanese Journal of Forest Environment, 46(2): 93-102.
- Matsui, T., Shimada, K., **Yagihashi, T.**, Nakaya, T., Taoda, H. and Tanaka, N. (2005). Assessing potential distribution of beech (*Fagus crenata*) in Central Japan. Journal of Agricultural Meteorology, 60(5): 439-444.
- Matsunaga, R.**, **Ito, O.**, Johansen, C. and Rao, T.P. (2004). Varietal differences in carbohydrate accumulation in pigeon

pea stems in relation to reproductive development. Japanese Journal of Tropical Agriculture, 48: 63-69.

Matsunami, T., Kaihatsu, A., Maekawa, T., **Takahashi, M.** and Kokubun, M. (2004). Characterization of vegetable growth of a supernodulating soybean genotype, Sakukei 4. Plant Production Science, 7(2): 165-171.

Murai, M., Nagayama, A., Sato, S., Hari Bahadur, K.C., **Ise, K.** and Nishii, K. (2004). Yielding performance of a Japonica F₁ hybrid carrying undulate rachis-1 (Ur1) gene under a high-hill density condition. SABRAO Journal of Breeding and Genetics, 36(1): 39-43.

Murata, Y., Yokoyama, M., Unuma, T., Sata, N.U., Kuwahara, R., **Kaneniwa, M.** and Oohara, I. (2004). Occurrence of the sea urchin with pulcherrimine, a novel bitter amino acid. Developments in Food Science, 42: 289-300.

Nakamura, H. (2005). Relationship between protein content, amylose content, sensory viscoelasticity texture and Udon noodle-making quality in Japanese common wheat. Recent Research Developments in Plant Science, 2: 1-9.

Nakamura, K., Nur, A., Khondaker, Md., Rahman, K. and **Ozawa, K.** (2005). Is subsurface drip irrigation valuable for crop water use efficiency increase in dry season in humid area? Journal of Agricultural Meteorology, 60 (5): 403-407.

Nakayama, N., Hashimoto, S., Shimada, S., **Takahashi, M.**, Kim, Y., Oya, T. and Arihara, J. (2004). The effect of flooding stress at the germination stage on the growth of soybean in relation to initial seed moisture content. Japanese Journal of Crop Science, 73(3): 323-329. (J)

Noguchi, S., Rahim, N., Siti Aisah, S., Tani, M. and Sanmori, T. (2004). Evapotranspiration estimates of tropical rain forest, Bukit Tarek Experimental Watershed in Peninsular Malaysia, using the short-time period water-budget method. The Japan

Society of Hydrology and Water Resources, 17(5): 482-492.

Ogata, H., Emata, A.C., Garibay, E.S. and Furuita, H. (2004). Fatty acid composition of five candidate aquaculture species in Central Philippines. Aquaculture, 236: 361-375.

Ohmomo, S., Nitisinprasert, S., Kraykaw, D. and Hiranpradit, S. (2004). Modification of the pouch method to evaluate the ability of lactic acid bacteria strains for making good quality silage in Thailand. Japan Agricultural Research Quarterly, 38(2): 119-124.

Ohmomo, S., Nitisinprasert, S., Kraykaw, D., Laemkorn, P., Tanomwongwattana, S. and Hiranpradit, S. (2004). Evaluation of lactic acid bacteria isolates for silage fermentation inoculant in Thailand by using a modified pouch method. Japan Agricultural Research Quarterly, 38(3): 199-208.

Ohmomo, S., Odai, M., Pholsen, P., Nitisinprasert, S., Kraykaw, D. and Hiranpradit, S. (2004). Effect of a commercial inoculant on the fermentation quality of ABP silage in Thailand. Japan Agricultural Research Quarterly, 38(2): 125-128.

Ohta, Y., **Yamaki, K.**, Osawa, T. and Kawakishi, S. (2004). Effects of isothiocyanates on tumor necrosis factor- α production by J774A.1 (BALB/c macrophage) cells. Bioscience, Biotechnology and Biochemistry, 68(6): 1375-1378.

Ohtsuka, S., **Hanamura, Y.**, Nagasawa, K., Horiguchi, T. and Suzuki, T. (2004). First record of the occurrence of an ellobiopsid *Thalassomyces marsupii* Kane on a new host of hyperiid amphipod in Japanese waters. Plankton Ecology and Biology, 51: 110-112.

Okuda, H., Noda, K., Hirabayashi, T. and **Yonemoto, Y.** (2004). Relationship between floral evocation and bud dormancy in Satsuma mandarin. Scientia Horticulturae, 102: 213-219.

- Oladele, O. and **Sakagami, J.** (2004). SWOT analysis of extension systems in Asian and West African countries. *Journal of Food, Agriculture & Environment*, 2(2): 232-236.
- Oladele, O., **Sakagami, J.** and **Koyama, O.** (2004). Economic policies and the performance of agricultural extension services in Nigeria. *The Journal of Extension Systems*, 20(1): 96-106.
- Omae, H.**, Kumar, A., **Egawa, Y.**, **Kashiwaba, K.** and **Shono, M.** (2005). Genotypic differences in plant water status and relationship with reproductive responses in snap bean. *Japanese Journal of Tropical Agriculture*, 49: 1-7.
- Osakabe, Y.**, Shinozaki, K. and **Yamaguchi-Shinozaki, K.** (2004). Drought stress and abscisic acid signal transduction mechanisms. *Regulation of Plant Growth & Development*, 39(2): 158-166.
- Ota, T.**, **Nakamura, S.** and Itoya, Y. (2004). Effects of a selective cutting on the recruitment and survivorship of seedlings in a natural *Thujaopsis dolabrata* var. *hondai* forest. *Journal of Japanese Forestry Society*, 86(3): 265-270. (J)
- Pellegrineschi, A., Reynolds, M., Pacheco, M., Brito, R.M., Almeraya, R., **Yamaguchi-Shinozaki, K.** and Hoisington, D. (2004). Stress-induced expression in wheat of the *Arabidopsis thaliana* DREB1A gene delays water stress symptoms under greenhouse conditions. *Genome*, 47(3): 493-500.
- Qin, F., Sakuma, Y., Li, J., Liu, Q., Li, Y.Q., Shinozaki, K. and **Yamaguchi-Shinozaki, K.** (2004). Cloning and functional analysis of a novel DREB1/CBF transcription factor involved in cold-responsive gene expression in *Zea mays* L. *Plant and Cell Physiology*, 45(8): 1042-1052.
- Sadamoto, H., Sato, H., Kobayashi, S., Murakami, J., Aonuma, H., Ando, H., Fujito, Y., **Hamano, K.**, Awaji, M., Lukowiak, K., Urano, A. and Ito, E. (2004). CREB in the pond snail *Lymnaea stagnalis*: Cloning, gene expression, and function in identifiable neurons of the central nervous system. *Journal of Neurobiology*, 58: 455-466.
- Sakamoto, H., Maruyama, K., Meshi, T., Iwabuchi, M., Shinozaki, K. and **Yamaguchi-Shinozaki, K.** (2004). *Arabidopsis* Cys2/His2-type Zinc-finger proteins function as transcription repressors under drought, cold, and high-salinity stress conditions. *Plant Physiology*, 136: 2734-2746.
- Samejima, H., Kondo, M., **Ito, O.**, Nozoe, T., Shinano, T. and Osaki, M. (2005). Characterization of root systems with respect to morphological traits and nitrogen-absorbing ability in the new plant type of tropical rice lines. *Journal of Plant Nutrition*, 28: 835-850.
- Sasaki, R., **Toriyama, K.**, Shibata, Y. and Sugimoto, M. (2004). Effect of the suppression of tiller emergence on the relationship between seedling density and nodal position of the last visible primary tiller in direct seeding cultivation of rice. *Japanese Journal of Crop Science*, 73(3): 309-314. (J)
- Sato, M.** (2004). Relationship between the life cycle of dragonfly (*Usubakitonbo*, *Pantala flavescens*) and the paddy field of early-season rice culture in South Kyushu. Report of the Kyushu Branch of the Crop Science Society of Japan, 70: 111-113. (J)
- Satoh, Y., **Ozawa, K.**, Ishii, T. and Yui, S. (2004). Evaluation of cooking suitability of processing tomato cultivars for "cooking tomato." *Horticultural Research (Japan)*, 3(3): 307-312. (J)
- Shinomiya, Y., Torii, A., Inagaki, Y. and **Yamada, T.** (2004). Changes in the water holding capacity of abandoned terrace paddy fields following afforestation. *Journal of the Japanese Society of Soil Physics*, 98: 31-39. (J)
- Sogawa, K.**, Sun, Z., Qian, Q. and Zeng, D. (2004). Phenotypic expression of whitebacked planthopper resistance in the newly established japonica/indica doubled haploid rice population. *Rice*

- Suenaga, K.**, Khairallah¹, M., William, H.M. and Hoisington, D. (2005). A new intervarietal linkage map and its application for QTL analysis of “gigas” features in bread wheat. *Genome*, 48: 65-75.
- Takada, R., Ichikawa, T., **Yamasaki, S.**, Ohtsuka, M. and Amari, M. (2004). Effects of particle size phytase supplementation on nutrient digestibility in growing pigs. *Nihon Chikusan Gakkaiho*, 75(2): 199-204. (J)
- Takahashi, M., **Ota, T.**, Sugita, H., Oohara, H., Ota, T., Nagaike, T. and **Nakamura, S.** (2004). Structure and dynamics of tree populations within unsuccessful conifer plantations near the Shirakami Mountains, a snowy region of Japan. *Forest Ecology and Management*, 194: 389-401.
- Takahashi, S., Seki, M., Ishida, J., Satou, M., Sakurai, T., Narusaka, M., Kamiya, A., Nakajima, M., Enju, A., Akiyama, K., **Yamaguchi-Shinozaki, K.** and Shinozaki, K. (2004). Monitoring the expression profiles of genes induced by hyperosmotic, high salinity, and oxidative stress and abscisic acid treatment in *Arabidopsis* cell culture using a full-length cDNA microarray. *Plant Molecular Biology*, 56(1): 29-55.
- Takahashi, T. and **Toriyama, K.** (2004). Method to evaluate “uplandization” in converted field from a paddy based on crystallinity of free iron oxides. *Japan Agricultural Research Quarterly*, 38(3): 155-159.
- Takehisa, H., Shimodate, T., **Fukuta, Y.**, Ueda, T., Yano, M., Yamaya, T., Kameya, T. and Sato, T. (2004). Identification of quantitative trait loci for plant growth of rice in paddy field flooded with salt water. *Field Crops Research*, 89: 85-95.
- Tanaka, N., Matsui, T., Shimada, K., **Yagihashi, T.** and Taoda, H. (2005). Constructing vegetation databases useful for assessing impact of climate changes in Japan. *Journal of*
- Tasumi, S.*, Yang, W.-J., Usami, T., Tsutsui, S., Ohira, T., Kawazoe, I., **Wilder, M.N.**, Aida, K. and Suzuki, Y. (2004). Characteristics and primary structure of a galectin in the skin mucus of the Japanese eel, *Anguilla japonica*. *Developmental & Comparative Immunology*, 28: 325-335.
- Tran, L.S.P., **Nakashima, K.**, Sakuma, Y., Simpson, S.D., Fujita, Y., Maruyama, K., Fujita, M., Seki, M., Shinozaki, K. and **Yamaguchi-Shinozaki, K.** (2004). Isolation and functional analysis of *Arabidopsis* stress-inducible NAC transcription factors that bind to a drought-responsive cis-element in the early responsive to dehydration stress 1 promoter. *The Plant Cell*, 16(9): 2481-2498.
- Tsutsui, N., Saido-Sakanaka, H., Yang, W.-J., Jayasankar, V., Jasmani, S., Okuno, A., Ohira, T., Okumura, T., Aida, K. and **Wilder, M.N.** (2004). Molecular characterization of a cDNA encoding vitellogenin in the coonstriped shrimp, *Pandalus hypsinotus* and site of vitellogenin mRNA expression. *Journal of Experimental Zoology*, 301A: 802-814.
- Uchida, S.** (2004). Characterization of agricultural land use in developing countries using remote sensing data. In: *Remote Sensing for Agriculture and the Environment*. Stamatiadis, S., Lynch, J.M. and Schepers, J.S. (Eds.), Peripheral Editions, Larissa (Greece): 237-253.
- Ueda, S., Kimura, T., **Onuki, M.**, Hanada, K. and Iwanami, T. (2004). Three distinct groups of isolates of tomato yellow leaf curl virus in Japan and construction of an infectious clone. *Journal of General Plant Pathology*, 70: 232-238.
- Umezawa, T., Yoshida, R., Maruyama, K., **Yamaguchi-Shinozaki, K.** and Shinozaki, K. (2004). SRK2C, a SNF1-related protein kinase 2 protein kinase that improves drought tolerance by controlling stress-responsive gene expression in *Arabidopsis thaliana*.

Proceedings of the National Academy of Sciences of the United States of America, 101(49): 17306-17311.

Watanabe, N., Nakayama, A. and **Ban, T.** (2004). Cytological and microsatellite mapping of the genes determining liguleless phenotype in durum wheat. *Euphytica*, 140: 163-170.

Watanabe, S., Tajuddin, T.N., **Yamanaka, N.**, Hayashi, M. and Harada, K. (2004). Analysis of QTLs for reproductive development and seed quality traits in soybean using recombinant inbred lines. *Breeding Science*, 54: 399-407.

Wikantika, K., **Uchida, S.** and Yamamoto, Y. (2004). An evaluation of the use of integrated spectral and textural features to identify agricultural land cover types in Pangalengan, West Java, Indonesia. *Japan Agricultural Research Quarterly*, 38(2): 137-148.

Xu, D.H. and **Ban, T.** (2004). Conversion of AFLP markers associated with FHB resistance in wheat into STS markers with an extension-AFLP method. *Genome*, 47: 660-665.

Xu, D.H. and **Ban, T.** (2004). Mapping of TaHd1-1 gene, homologue of a rice heading date (Hd1) controlling gene, in wheat. *Wheat Information Service*, 99: 61-62.

Xu, D.H. and **Ban, T.** (2004). Phylogenetic and evolutionary relationships between *Elymus humidus* and other *Elymus* species based on sequencing of non-coding regions of cpDNA and AFLP of nuclear DNA. *Theoretical and Applied Genetics*, 108: 1443-1448.

Yamada, R. (2004). Design and technology selection of farming systems by AHP-methods in the Mekong Delta of Vietnam. *Journal of Rural Planning Association*, 23(2): 149-160. (J)

Yamada, T., Morisada, K., Sakai, A., Yoshinaga, S., Hirai, K., Kato, M., Yoshida, K., Iwagawa, O., Miura, S., Inagaki, Y., Shinomiya, Y., Takeuchi, I., Tabuchi, R., Sakai, T., Kuramoto, S., Mori, S., Ohguro, T., Kawasaki, T., Matsumura, N., Kodani, E., Yoshida,

M., Miyamoto, T., Tsuzuki, N., Yamada, S., Imatomi, Y., Mineo, K., Yamazaki, S., Inoue, T., Tabata, M., Abe, Y., Hirota, Y. and Kadota, H. (2004). Monitoring of acidic precipitation's effects on forest ecosystems - Monitoring of the rain and forest in the Hinoki stand in the Shikoku area. *Bulletin of the Forestry and Forest Products Research Institute*, 3(4): 365-407. (J)

Yamada, T., Yoshinaga, S., Sakai, T., Matsumura, N., Sakai, A., Tabuchi, R., Kodani, E., Inagaki, Y., Kuramoto, S., Miura, S., Shinomiya, Y., Tsuzuki, N., Imatomi, Y., Kadota, H. and Ohguro, T. (2004). Monitoring of acidic precipitation's effects on forest ecosystems - Monitoring of four old-age stands in the Shikoku area. *Bulletin of the Forestry and Forest Products Research Institute*, 3(4): 409-437. (J)

Yamagishi, K., Kimura, T., Suzuki, M., Shinmoto, H. and **Yamaki, K.** (2004). Elevation of intracellular cAMP levels by dominant active heterotrimeric G protein alpha subunits ScGP-A and ScGP-C in homobasidiomycete, *Schizophyllum commune*. *Bioscience, Biotechnology and Biochemistry*, 68(5): 1017-1026.

Yamaguchi-Shinozaki, K. and Shinozaki, K. (2005). Organization of cis-acting regulatory elements in osmotic- and cold-stress-responsive promoters. *Trends in Plant Science*, 10(2): 88-94.

Yamaki, K., Ide, T., Takano-Ishikawa, Y. and Shinohara, K. (2005). Comparative effects of non-gelatinized corn and rice starches on the life-span of ICR mice. *Bioscience, Biotechnology and Biochemistry*, 69(1): 13-18.

Yamamoto, R., Takahashi, R., Harada, K., **Takahashi, M.** and Shinji, S. (2004). Parentage analysis of supernodulating soybean cultivar "Sakukei 4." *Breeding Research*, 6(3): 149-151. (J)

Yamamoto, S., Inoue, H., **Yonemoto, Y.**, Higuchi, H. and Nawata, E. (2004). Isozyme analysis of dragonfruit in Okinawa. *Japanese Journal of Tropical Agriculture*, 48(2): 115-119. (J)

- Yamasaki, S.** Duugiin, N., Ishida, J. and Miyazaki, A. (2004). The management and logic of nursing/fostering lambs and kids in Mongolian pastoral systems. *Japanese Journal of Human Animal Relations*, 14: 50-57. (J)
- Yin, L., Li, L., Liu, H., **Saito, M.** and **Tatsumi, E.** (2005). Effects of fermentation temperature on the content and composition of isoflavones and beta-glucosidase activity in sufu. *Bioscience, Biotechnology and Biochemistry*, 69(2): 267-272.
- Yokota, Y.**, Okuda, H. and Kuboyama, H. (2004). Establishment of an interpretive guide system for the Shirakami Mountains—A case study of Hachimori Town, Akita Prefecture. *Tohoku Journal of Forest Science*, 9(2): 68-76. (J)
- Yonemoto, Y.**, Inoue, H., Majikina, M., Okuda, H. and Higuchi, H. (2004). Critical temperature leading to frost damage in young fruits of white sapote (*Casimiroa edulis* Llave & Lex.) cv. Florida. *Japan Journal of Tropical Agriculture*, 48(2): 88-93.
- Yonemoto, Y.**, Inoue, H., Majikina, M., Okuda, H. and Higuchi, H. (2005). Effect of temperature on floral induction and development of floral organs in white sapote (*Casimiroa edulis* Llave & Lex.) cv. “Florida.” *Japanese Journal of Tropical Agriculture*, 49(1): 8-13.
- Yonemoto, Y.**, Inoue, H. and Okuda, H. (2004). Effects of storage temperatures and oxygen supplementation on reducing titratable acid in “Ruby Star” passionfruit (*Passiflora edulis* × *P. edulis* f. *flavicarpa*). *Japanese Journal of Tropical Agriculture*, 48(2): 111-114.
- Yonemoto, Y.**, Matsumoto, K., Furukawa, T., Asakawa, M., Okuda, H. and Takahara, T. (2004). Effects of rootstock and crop load on sap flow rate in branches of “Shirakawa Satsuma” mandarin (*Citrus unshiu* Marc.). *Scientia Horticulturae*, 102: 295-300.
- Yoshihara, K.**, Nagata, R., Muneta, Y., Inumaru, S., Yokomizo, Y. and Mori, Y. (2004). Generation of multinucleated giant cells in vitro from bovine monocytes and macrophages. *The Journal of Veterinary Medical Science*, 66: 1065-1069.
- Yoshihashi, T.**, Nguyen, T.T.H. and Kabaki, N. (2004). Area dependency of 2-acetyl-1-pyrroline content in an aromatic rice variety, Khao Dawk Mali 105. *Japan Agricultural Research Quarterly*, 38(2): 105-109.
- Yoshihashi, T.**, Nguyen, T.T.H., Surojanametakul, V., Tungtrakul, P. and Varanyanond, W. (2005). Effect of storage conditions on 2-acetyl-1-pyrroline content in aromatic rice variety, Khao Dawk Mali 105. *Journal of Food Sciences*, 70(1): S34-37.
- Zuo, Y., **Hosen, Y.** and Chu, H. (2004). Effects of soil moisture on nitrification activities of a Chinese Chao soil and a Japanese Andisol. *Soil and Fertilizer*, 5: 21-24.

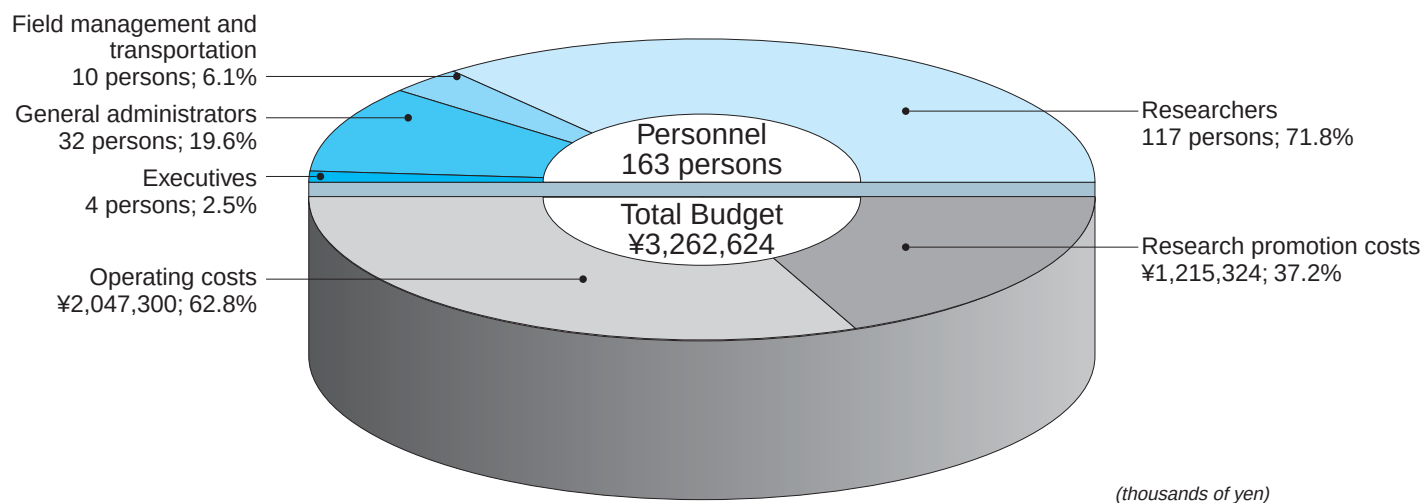
FINANCIAL OVERVIEW

Fiscal Year 2004

thousands of yen

TOTAL BUDGET	3,262,624
OPERATING COSTS	2,047,300
Personnel (163)	1,639,606
President (1), Vice-President (1), Executive Advisor & Auditor (2)	
General administrators (32)	
Field management and transportation (10)	
Researchers (117)	
*Number of persons shown in ()	
Administrative Costs	407,694
RESEARCH PROMOTION COSTS	1,215,324
Research Development	297,816
Overseas Dispatches	282,617
Research Exchange/Invitation	9,978
Research Information Collection	118,553
International Collaborative Projects	374,049
Fellowship Programs	132,311

Budget FY2004 (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 pathogens and insect pests
The characteristics of crops such as rice, wheat, and soybean related to disease and insect pest resistance will be elucidated for the purpose 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 biodiversity
 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 biodiversity 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 bean and rice
Through the evaluation of characteristics related to high-temperature stress tolerance in vegetable species such as 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 of rice and other crops through generation advancement
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 more than 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 more than 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 reviews will be conducted under the guidance of experts from outside organizations, as well as JIRCAS directors and administrators.
- B. Reviews 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 exchange of information and opinions concerning policy-making 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	President, Japan Food and Agriculture Organization (FAO) Association
Hiroshi Kakurai	Economic Analyst, formerly Commentator, Nippon Hoso Kyokai (NHK)
Sakue Matsumoto	Advisor, Japan Food and Agriculture Organization (FAO) Association
Kenji Iiyama	Professor, Tokyo University of Agriculture
Eiichi Tsutaya	Managing Director, Norin-Chukin Research Institute Co., Ltd.
Takeshi Hara	Senior Counselor, Japan Fisheries Resources Conservation Association

JIRCAS External Evaluation Committee

Haruo Inagaki	Counselor, Japan Food and Agriculture Organization (FAO) Association
Keiji Ohga	Professor, Department of Food Economics, College of Bioresource Sciences, Nihon University
Naoto Owa	Professor, Department of Applied Biological Chemistry, Faculty of Agriculture, Niigata University
Yoshinobu Yasunaga	Technical Advisor, Overseas Fishery Cooperation Foundation
Katumi Musiake	Professor, Faculty of Symbiotic Systems Science, Fukushima University
Seiichi Murayama	Professor, Vice-President, Faculty of Agriculture, University of the Ryukyus
Hiroko 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 Emeritus, Kyoto University

External Reviewers for International Collaborative Projects

Studies on stable food supply systems for mitigating the fluctuations of production and markets in China

Kazuhiko Kobayashi	Professor, Graduate School of Agriculture and Life Sciences, the University of Tokyo
Keisuke Sugenuma	Associate Professor, Faculty of Economics and Business Administration, Fukushima University
Koji Kameoka	Vice-President, Mie University

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	Former Professor, Food Resources Education and Research Center, Faculty of Agriculture, Kobe University
Shinji Sakai	Former 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, Tohoku University
Muneo Oikawa	Japan Grassland Agriculture and Forage Seed Association

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

Greg Johnson	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
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 Research 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; Visiting Professor, Ritsumeikan Asia Pacific University
Tawachai Na Nagara	Advisor and Former Director, Soil Science Division, Department of Agriculture, Ministry of Agriculture and Cooperatives, Thailand
Sakol Ooraikul	Agricultural Economics Specialist, Department of Agriculture, Ministry of Agriculture and Cooperatives, Thailand
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

Improvement of the fertility of sandy soils in the semi-arid zones of West Africa through organic matter management

Tomoki Takamura	Professor Emeritus, Kyoto University
Nteranya Sanginga	Director, Tropical Soil Biology and Fertility Institute of CIAT (TSBF-CIAT)
Lamourdia Thiombiano	Senior Soil Resources Officer, FAO Regional Office for Africa
Jun-ichi Yamaguchi	Professor, Graduate School of Agriculture, Hokkaido University
Shuhei Shimada	Professor, Graduate School of Asian and African Area Studies, Kyoto University

Development of new technologies for the control of citrus huanglongbing (HLB) in Southeast Asia

Tamotsu Murai	Professor, Department of Bioproductive Science, Faculty of Agriculture, Utsunomiya University
Meisaku Koizumi	Former Deputy Director, AVRDC-The World Vegetable Center
Nguyen Huu Huan	Deputy Director General, Department of Plant Protection, Ministry of Agriculture and Rural Development, Vietnam

JIRCAS STAFF FY2004

President

Mutsuo Iwamoto
[Shinobu Inanaga from April 1, 2005]

Vice-President

Akinori Noguchi

Executive Advisor & Auditor

Kunihiko Kato
[Kazuyuki Ito from April 1, 2005]
Akimi Fujimoto

Research Planning and Coordination Division

Masami Yasunaka, Director

Research Planning Section

Yoshinobu Egawa, Section Head
Takeshi Urao, Senior Researcher
Ryuichi Yamada, Senior Researcher

Research Coordination Section

Takahito Noda, Section Head

International Relations Section

Hideto Fujii, Section Head

International Research Coordinators

Satoru Miyata, SE-Asia Office Representative
Takeshi Kano, Plant Pathology
Kazuhiro Suenaga, Wheat Breeding

CGIAR Liaisons Coordinator

Masayoshi Saito, Senior Researcher

Public Information Officer

Toshihiro Uetani, Head

Publication and Documentation Section

Yoshiyuki Hamada, Section Head
Hiromi Miura, Librarian

Field Management Section

Haruo Tamura, Chief
Takashi Komatsu, Field Operator

Administration Division

Tokuzo Ono, Director
(Norio Kikuchi*, Director)

General Affairs Section

Masahiro Horiguchi, Section Chief
Shuichi Tsuchiya, Assistant Section Chief
Kaoru Watanabe, Personnel Overseer
Yasuhiro Onozaki, Section Manager
Masae Kudo, Section Officer
Isao Takahashi, Personnel Manager
Ryo Okamoto, Personnel Officer
Yukio Konuma, Social Affairs Head

Accounting Section

Moriji Uchino, Section Chief
Ryoichi Saito, Assistant Section Chief
Koichi Takada, Auditing Chief
Katsunori Kanno, Financial Manager
Takashi Kitami, Financial Officer
Yoshihiko Sumomozawa, Accounting
Manager
Takeshi Akiyama, Accounting Officer
Hideko Shimada, Auditing Manager
Koji Ito, Supplies/Equipment Manager
Naomi Yamamoto, Supplies/Equipment
Officer
Kuniaki Katsuyama, Facilities Manager

Overseas Staff Support Section

Satoko Ohuchi, Section Chief
Hiroshi Tanaka, Overseas Affairs Overseer
Mitsuyuki Saito, Overseer Stationed Overseas
Gaku Takeda, Overseas Operations Manager
Kazuo Miyajima, Overseas Expenditures
Manager
Atsuzo Nishino, Overseas Shipments
Manager

Development Research Division

Osamu Koyama, Director

Development Research Coordinators

Kazunobu Toriyama, Soil Science
Satoshi Uchida, Geographic Information
Systems

Research Staff

Masuo Ando, Agricultural Economics
John S. Caldwell, Horticulture and Farming
Systems
Hsiaoping Chien, Agricultural Economics
Jun Furuya, Agricultural Economics
Hiroshi Komiyama, Development Economics
Kazuo Nakamoto, Agricultural Economics

Tomohide Sugino, Development Economics
 Minoru Tada, Agricultural Economics
 Yukiyo Yamamoto, Geographic Information Systems
 Norihiro Yamashita, Agricultural Economics
 Kumi Yasunobu, Agricultural Economics

Biological Resources Division

Takashi Kumashiro, Director
 (Ryoichi Ikeda*, Director)

Research Staff

Tomohiro Ban, Wheat Breeding
 Yoshimichi Fukuta, Rice Breeding
 Yoshihisa Homma, Plant Pathology
 Masanori Inagaki, Wheat Breeding
 Kazuo Ise, Rice Breeding
 Yusuke Ito, Plant Molecular Biology
 Mie Kasuga, Plant Molecular Biology
 Masayasu Kato, Plant Pathology
 Nobuya Kobayashi, Physiology and Breeding
 Kyonoshin Maruyama, Plant Molecular Biology
 Ryoichi Matsunaga, Legume Breeding
 Kazuo Nakashima, Plant Molecular Biology
 Hidekazu Sasaki, Vegetable Physiology
 Motoki Takahashi, Legume Physiology
 Xu Tonghe, Plant Molecular Genetics
 Hiroshi Tsunematsu, Rice Breeding
 Naoki Yamanaka, Plant Molecular Genetics
 (Kazuko Yamaguchi-Shinozaki, Plant Molecular Biology)

Crop Production and Environment Division

Osamu Ito, Director

Research Staff

Hiromasa Hamada, Groundwater Hydrology
 Tamao Hatta, Mineralogy and Geology
 Keiichi Hayashi, Soil Management
 Yasukazu Hosen, Soil Chemistry
 Takayuki Ishikawa, Plant Physiology
 Naruo Matsumoto, Environmental Conservation
 Satoshi Nakamura, Insect Ecology
 Masato Oda, Crop Management
 Chikara Ogura, Agricultural Land Improvement
 Junichi Sakagami, Crop Improvement
 Zen-ichi Sano, Nematology
 Sachiko Senoo, Crop Science
 Guntur V. Subbarao, Crop Physiology and Nutrition
 Satoshi Tobita, Plant Physiology and

Nutrition
 Takeshi Watanabe, Soil Chemistry
 Mitate Yamada, Agronomy

Animal Production and Grassland Division

Shuichi Oshio, Director

Research Staff

Yasuo Ando, Plant Microbiology
 Hiroshi Kudo, Rumen Microbiology
 Sadahiro Ohmomo, Applied Microbiology
 Katsuhisa Shimoda, Pasture Management
 Tomoyuki Suzuki, Animal Nutrition
 Seishi Yamasaki, Animal Nutrition
 Kazuhiro Yoshihara, Immunology

Food Science and Technology Division

Yutaka Mori, Director

Research Staff

Tsutomu Fushimi, Food Analysis
 Akihiko Kosugi, Molecular Microbiology
 Kazuhiko Nakahara, Food Chemistry
 Hiro Nakamura, Cereal Chemistry and Plant Breeding
 Eizo Tatsumi, Food Science
 Koji Yamaki, Food Functionality
 Tadashi Yoshihashi, Food Evaluation

Forestry Division

Shozo Nakamura, Director

Research Staff

Hisashi Abe, Wood Science
 Shoji Noguchi, Forest Hydrology
 Takayuki Ohta, Silviculture
 Masahiko Tokoro, Entomology
 Tsutomu Yagihashi, Silviculture
 Tsuyoshi Yamada, Forest Soil Science
 Akihiko Yokota, Mycology
 Yasuhiro Yokota, Social Forestry

Fisheries Division

Koji Nakamura, Director

Research Staff

Yoshimi Fujioka, Coastal Ecology
 Kaoru Hamano, Physiology
 Yukio Hanamura, Ecology

Masaki Kaneniwa, Food Chemistry
Ikunari Kiryu, Fish Pathology
Hiroshi Ogata, Fish Nutrition
Marcy N. Wilder, Crustacean Biochemistry

Okinawa Subtropical Station

Shuichi Asanuma, Director
Kazuo Shibano, Associate Director for
Research

General Affairs Section

Hideki Ebata, Section Chief
(Mitsuyuki Saito*, Section Chief)
Fumihiko Hisada, Section Manager
Takao Ohga, Accounting Manager
Hisato Ohshima, Accounting Officer
Yoshiyuki Hoshinoya, Accounting Officer

International Collaborative Research Section

Yoshimitsu Katsuda, Section Head

Islands Environment Management Laboratory

Kiyoshi Ozawa, Agrometeorology, Head
Fujio Nagumo, Soil Science
Ken Nakamura, Soil Science

Environmental Stress Laboratory

Mariko Shono, Plant Physiology, Head
Koichi Kashiwaba, Plant Breeding
Hide Ohmae, Plant Physiology

Tropical Crop Breeding Laboratory

Hiroko Takagi-Watanabe, Plant Breeding,
Head
(Makoto Matsuoka*, Plant Breeding, Head)
Koshun Ishiki, Plant Breeding and Genetic
Resources
Mitsunori Sato, Sugarcane Breeding
Yasuaki Tamura, Rice Breeding
Masahiko Tanio, Wheat Breeding

Tropical Fruit Crops Laboratory

Yoshimi Yonemoto, Pomology, Head
Hiroshi Fukamachi, Pomology
Hidenori Kato, Plant Physiology

Plant Protection Laboratory

Masatoshi Ohnuki, Plant Virology, Head
Katsuya Ichinose, Entomology
Kunimasa Kawabe, Plant Virology
Tadafumi Nakata, Entomology

Field Management Section

Tadahiro Hayashi, Section Head
Masakazu Hirata, Machine Operator

Hirokazu Ikema, Machine Operator
Masahide Maetsu, Machine Operator
Yuho Maetsu, Machine Operator
Yasuteru Shikina, Machine Operator
Masato Shimajiri, Machine Operator
Masashi Takahashi, Machine Operator
Koji Yamato, Machine Operator

Researchers on Loan to Other Organization

Africa Rice Center (WARDA)

Ryoichi Ikeda, Rice Breeding

Part-time informal employees

Nearly 130 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, or retired during the Fiscal Year
covered by this Annual Report.

() Indicates previous position holder.

THE JAPANESE FISCAL YEAR AND MISCELLANEOUS DATA

The Japanese Fiscal Year and Annual Report 2004

The Japanese fiscal year is defined as the period of fiscal activity occurring from April 1 through March 31 of the following year. Thus, Fiscal Year (FY) 2004 covers the period from April 1, 2004 through March 31, 2005. Annual Report 2004 summarizes the full

extent of JIRCAS activities that occurred during this period. The subsequent Annual Report will detail events and programs from April 1, 2005 through March 31, 2006 (FY2005).

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	9,523
Total	20,272

Annual Report 2004

(April 2004-March 2005) No. 11 (Oct. 2005)

Published by

Incorporated Administrative Agency

Japan International Research Center for Agricultural Sciences

1-1 Ohwashi, Tsukuba, Ibaraki 305-8686, JAPAN

Tel. (029) 838-6330

Fax. (029) 838-6316

2005年（平成17年）10月14日発行

発行者 独立行政法人 国際農林水産業研究センター

理事長 稲永 忍

〒305-8686 茨城県つくば市大わし1番地1

電話：029-838-6330

FAX：029-838-6316

印刷 株式会社 高山

〒113-0034 東京都文京区湯島1-1-12



JAPAN INTERNATIONAL RESEARCH CENTER
FOR AGRICULTURAL SCIENCES