Japan International Research Center for Agricultural Sciences

Annual Report 2008

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CONTENTS

JIRCAS 2008 ANNUAL REPORT

Message from the President

President
Dr. Kenji Iiyama

Steep rises in food commodity and crude oil prices are slowing progress towards the United Nations Millennium Development Goal (UNMDG) of "eradicating extreme poverty and hunger," and have triggered popular protests in more than 30 countries in developing areas. These serious matters were discussed at the 4th Tokyo International Conference for African Development (TICAD IV) held on May 28-30, 2008 in Yokohama. They were also on the agenda of the High Level Conference on World Food Security: the Challenges of Climate Change and Bioenergy, organized by FAO (Food and Agriculture Organization of the UN) on June 3-5, 2008 in Rome, and the G8 Summit on July 7-9, 2008 in Hokkaido.

The Japan International Research Center for Agricultural Sciences (JIRCAS) was closely involved in these conferences, especially at TICAD IV. We organized a Round Table Meeting together with the Consultative Group on International Agricultural Research (CGIAR) and discussed strategies for research into agriculture, a core industry in developing countries especially in Africa, the day before TICAD IV in Tokyo. We also contributed to the establishment of the Coalition for African Rice Development (CARD), an initiative to support the efforts of African countries to increase rice production, and have expressed our readiness to become members of the CARD steering committee, together with the Alliance for a Green Revolution in Africa (AGRA), the Africa Rice Center (AfricaRice), the Forum for Agricultural Research in Africa (FARA), the New Partnership for Africa's Development (NEPAD), the International Rice Research Institute (IRRI) and the Japan International Cooperation Agency (JICA). CARD comprises a consultative group of bi- and multilateral donors, and regional and international organizations working in collaboration with rice-producing African countries. The headquarters of CARD will be located in Nairobi, Kenya this coming October, 2008.

The High Level Conference on World Food Security has issued a declaration that the participants from 180 countries, including heads of state and governments, ministers and representatives, will address the challenges of bioenergy and climate change. The current situation of soaring food prices is having an adverse impact on food security, particularly in developing countries and countries in transition, all the more because indicators are showing that food prices will remain high in the years to come. The declaration stated that the relevant United Nations agencies should be guaranteed the resources to expand and enhance their food assistance and support safety net programs to address hunger and malnutrition, where appropriate, through the use of local or regional purchases, as their urgent response. The declaration also urged the international community to act towards setting up investments in science and technology for food and agriculture. Increased efforts in international cooperation should be directed towards researching, developing, applying, transferring and disseminating improved technologies and policy approaches as medium and long-term measures.

Prior to the above international events, the Council for Science and Technology Policy advocated "The Promotion of Science and Technology Diplomacy" on April 24, 2007. It called for addressing the enhancement of cooperation in science and technology in Africa and other developing countries, and disseminating information on Japan's outstanding environmental technologies to the world. Furthermore, on June 1, 2007, the "Innovation 25" long-term strategic guidelines adapted by the Cabinet Council called for Japan to make international contributions on food, the environment and other issues. The policies set out a plan to realize a future for Japan full of hope and prosperity over a set time frame leading up to 2025. With the development of the policies and major changes anticipated in global agriculture, forestry and fisheries, as already apparent in the recent world food crises situation and emerging global warming, the Agriculture, Forestry and Fisheries Research Council, Ministry of Agriculture, Forestry and Fisheries (MAFF) formulated the "International Research Strategies: Targeting International Research Reflecting Recent Changes Surrounding Agriculture, Forestry and Fisheries" on May 20, 2008. These strategies first identified the recent developments in international research and then listed down important research topics to be tackled and crosscutting policies for promoting international research, mainly for those

developing countries being assisted by Japanese international agricultural research.

Thus, the missions of JIRCAS, which 1) undertakes comprehensive experimental research for the technological advancement of agriculture, forestry, fisheries and related industries in tropical and subtropical zones of developing regions; 2) collects, analyzes and publishes information on domestic and international research which are relevant to agriculture, forestry and fisheries as well as farming systems in these developing areas; and through the above, 3) seeks to contribute solutions to global food and environmental problems as well as to the stable supply of agricultural, forestry and fisheries products and resources, are becoming more and more important. To accomplish the above objectives, JIRCAS is promoting international collaborative research with more than 60 research institutions in 27 developing countries and inviting more than 100 researchers from developing countries.

The major projects extend over quite a wide area such as (1) developing an impact assessment model and formulation of a food supply stabilization plan, (2) elucidation of the impacts of global environmental changes on agriculture, forestry and fisheries and development of mitigating technologies, (3) development of management technologies of environmental resources and production systems for sustainable agriculture, forestry and fisheries, and (4) development of technologies to utilize biological resources for stable production and multi-purpose applications under adverse environments. Other research areas are: (5) improvement of abiotic stress tolerance of crops, (6) effective utilization of genetic resources in tropical and subtropical crops, (7) development of biomass utilization technologies suited to Southeast Asia, (8) developing pest control management technology for major pests in the tropics and subtropics, (9) identification of pathogenic races for important diseases and selection of resistant germplasm in major crops, (10) development of sustainable management technologies for tropical soils, (11) integrated management system for improved water utilization aiming at increasing economic options and reducing environmental impact, (12) sustainable utilization of tropical and subtropical marine resources and development of aquaculture technologies, (13) improvement of feeding technologies for livestock in the tropics and subtropics and establishment of sustainable agropastoral systems in Asian dry areas, (14) development of nurturing technologies for beneficial indigenous tree species in Southeast Asia, and (15) development of environmental management technologies for sustainable crop production in tropical and subtropical islands.

JIRCAS Main Building.

In addition, JIRCAS established the Rural Development Planning Division on April, 2008 during the handover of the overseas activities from Japan Green Resources Agency, which covers the role of disseminating technologies and promoting during the handover of the overseas activities from Japan Green Resources Agency, the formation of village communities in developing areas by cooperating with existing research divisions and independently. Thus, the activities of JIRCAS are expanding and entering a new stage.

All the scientific and technological activities for FY 2008 of JIRCAS are documented in this annual report. We sincerely hope that readers will find our activities in this booklet interesting and suggest further issues to be resolved in the fields of agriculture, forestry, and fisheries in developing areas.

HIGHLIGHTS FROM 2008

JIRCAS Contribution to TICAD IV

At the Fourth Tokyo International Conference on African Development (TICAD IV) held in Yokohama at the end of May, 2008, the issues on food and agriculture drew special attention from the participants. So far, JIRCAS has been making active contributions to this process through such related activities, wherein it organized an international symposium on priority-setting for African agricultural research and development in 2005 following the previous TICAD conference. This year also, it held a "Round Table Meeting on Agricultural Research for African Development", jointly with the CGIAR (Consultative Group on International Agricultural Research) Secretariat at Tokyo University on the 27th of May, a day before the start of TICAD IV. Besides Dr. Wang, the Consultative Group on International Agricultural Research or CGIAR Director and Dr. Ziegler, Director General of IRRI (International Rice Research Institute), many participants from CGIAR Centers in Africa as well as many Japanese experts from the Ministry, universities and research institutes gathered and exchanged or debated ideas and issues with so much enthusiasm and interest.

At the meeting, many constructive suggestions were made, particularly with regards to the ideal approaches of contributing to rice cultivation in Africa, strategic cooperation between research and related organizations, the need to appeal to the administration and the public, matching between the needs of international research centers and the interests of Japanese researchers, and opportunity or occasion for consultation on concrete proposals. At the end of the meeting, Mr. Azuma, President of J-FARD stressed the significance of the meeting which renewed the importance of agricultural research for African development.

JIRCAS also presented an exhibit of its research activities in Africa at the main conference venue. In addition, Dr. Iiyama, President of JIRCAS, made an announcement at the meeting for the "Coalition for African Rice Development (CARD), about this new framework initiated by Japan in support of the efforts to double rice production in Africa, stating that "JIRCAS would make an active contribution to CARD".

The APAARI-JIRCAS International Symposium

On October 21-22, 2008, in the Tsukuba International Congress Center (EPOCHAL-TICC) in Tsukuba City, Japan, 160 participants from 31 countries joined the "Symposium on Global Climate Change: Imperatives for Agricultural Research in the Asia Pacific,"

JIRCAS senior administrators pose for a group photograph at the JIRCAS lobby. Front row: Y. Mitomi, O. Koyama, K. Iiyama, S. Matsui, M. Nakatani, T. Kumashiro, Back row: M. Ando, H. Azechi, Y. Maeno, M. Yasunaka, T. Ohta, A. Takenaka.


Y. Egawa


A. Sugimoto


O. Ito


T. Gotoh


Y. Mori


H. Yonekura

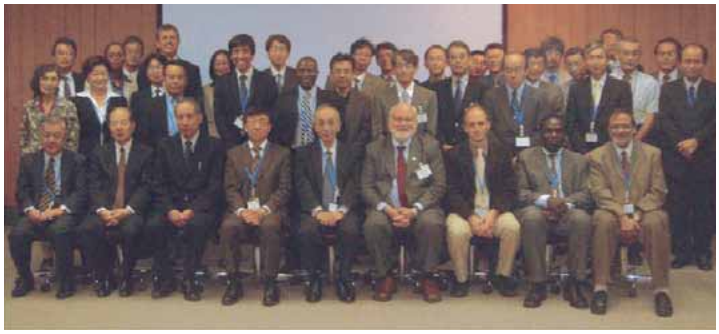
which was jointly sponsored and organized by the Asia-Pacific Association of Agricultural Research Institutions (APAARI) and the Japan International Research Center for Agricultural Sciences (JIRCAS). Other co-sponsoring international organizations were the Global Forum on Agricultural Research (GFAR), the International Maize and Wheat Improvement Center (CIMMYT), the International Center for Agricultural Research in Dry Areas (ICARDA), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the World Vegetable Center (AVRDC), under the auspices and support of domestic organizations such as the Agriculture, Forestry and Fisheries Council Secretariat, Ministry of Agriculture, Forestry and Fisheries (MAFF), the National Agriculture and Food Research Organization (NARO), the National Institute for Agro-Environmental Sciences (NIAES), the Forestry and Forest Products Research Institute (FFPRI) and the Japan Forum on International Agricultural Research for Sustainable Development (J-FARD).

After the Introduction and Welcome Remarks rendered by the APAARI Chairman, Dr. Raghunath Ghodake and the JIRCAS President, Dr. Kenji Iiyama, the Intergovernmental Panel on Climate Change (IPCC) Working Group II Co-Chair, Martin Parry, Professor of the Imperial College London, presented the Keynote Lecture on "The Implications of Climate Change for Agriculture: Globally and in the Asia-Pacific Region." Afterwards, three lead papers were presented by Takeshi Horie, President of the National Agriculture and Food Research Organization (NARO, Japan) on "Adaptation Opportunities to Global Climate Change in Agriculture in Asia-Pacific," by Professor Rattan Lal of Ohio University, U.S.A. on "Mitigation Potential and Opportunities in Asia-Pacific" and Professor Tim Wheeler of UK's Reading University on "Tools and Techniques for Adaptation and Mitigation."

In succession, Technical Session I introduced Research Strategies at the National Level: Selected Asia-Pacific Country Reports, while Technical Session II focused on Research Strategies at the International Level. During the Panel Discussion and the Plenary Session, there were vigorous exchanges of opinions and the following mutual agreements were reached in the so-called "Tsukuba Declaration on Adapting Agriculture to Climate Change," which will be presented to all concerned stakeholders and related organizations :

- In the Asia-Pacific region, agriculture plays a critical role; therefore, the adverse effects of climate change on the efforts to reduce poverty and other developmental targets are of a major concern.
- Water is the main limiting factor of food production in this region and enhancing its efficient use and maintenance is important.
- Among efforts to reduce poverty among the poor populations which are the most vulnerable to the effects of climate change, increase in local food production is the best solution, as well as continuous support for technological development towards the improvement of crop productivity and technological dissemination.
- The development of new genotypes of crops with tolerance to various stresses is important and all research institutions bear an important duty towards this endeavor.
- A reliable and timely early-warning system is useful for discovering potential hazardous areas and climatic risks. Advanced Research Institutions such as JIRCAS, etc. are expected to take on the leadership role in disseminating information with regards to climate change.
- The introduction of a weather/crop/livestock insurance system, etc. is effective towards mitigating the climatic risks faced by farmers from the frequent occurrence of floods and droughts.

The APAARI-JIRCAS International Symposium participants.



Participants of the Round Table Meeting.

- The governments in the region should strengthen mutual cooperation through the establishment of a common regional fund for improving climatic services and risk management programs, etc. for the effective enforcement of suitable adaptation and mitigation strategies towards climate change. Training and capacity-building programs for young professionals are also important.
- Carbon sequestration in the soils is possible through several approaches which are useful to improve food security. It is necessary to urge the introduction of economic incentives and rewards to small farmers for the adoption of new sustainable agricultural management techniques.
- In order to cope with the many aspects of climate change, regional cooperation is indispensable, hence APAARI which is responsible for stimulating regional collaboration for agricultural research with other international agricultural research centers and national research institutions, should continue its important role in facilitating such collaboration to ensure future sustainability in the region.

The Japan International Award for Young Agricultural Researchers

On November 11, 2008, the Commendation Ceremony of the Japan Award for Young Agricultural Researchers (sponsored by the Agriculture, Forestry and Fisheries Research Council) was held at the U Thant International Conference Hall in the United Nations University in Tokyo. In this Awarding Ceremony, which is being held for the second time this year, the Chairman of the Agriculture, Forestry and Fisheries Research Council extends his commendation to young foreign researchers who have distinguished themselves by achieving excellent performances in research and development in agriculture, forestry, fisheries and other related industries for developing countries. The winners and their achievements are as follows:

Xiaoyuan Yan (Institute of Soil Science, Chinese Academy of Sciences)
Developing greenhouse gases emission inventories for croplands and evaluating their environmental impacts

Maryam Ambundo Imbumi (Kenya Resource Centre for Indigenous Knowledge-KENRIK)
Promotion and research of African leafy vegetables for improved nutrition, health and incomes

Thuy Thi Thu Nguyen (Network of Aquaculture Centres in Asia Pacific-NACA)
Application of molecular genetics in aquaculture and fisheries management

The awardees and all concerned parties.

Lecture by the awardee.

NEW RESEARCH COLLABORATION

New JRA for a rice project with the Ministry of Food and Agriculture et al. in Ghana

A Joint Research Agreement (JRA) was signed in March 2009 between JIRCAS and three entities in Ghana i.e. Ministry of Food and Agriculture, Crop Research Institute and Soil Research Institute for the accomplishment of a project titled "Development of Improved Infrastructure and Technology for Rice Production in Africa".

This project was designed to explore ways to increase rice production in accordance with diverse forms of rice ecosystems in Africa, especially to improve farmland and facilities and develop farmers' cultivation skills in rain-fed lowland areas, by improving methods for rice field construction and cultivation management, introducing appropriate cultivars, and providing seeds as well as equipment and materials.

Based on a preliminary study conducted in 2008, it was decided to execute a verification study in rain-fed lowland areas in Ghana from 2009. The verification study is to be done with farmers at selected model sites in Ashanti Region in Ghana on the following topics: 1) establish construction methods of farmland and simple irrigation facilities suitable for topography and water resource, 2) select suitable varieties and improved cultivation techniques, 3) organize farmer groups to manage facilities, machineries and materials, 4) establish extension and support system to disseminate technologies, and 5) create an instruction manual for farmers' leaders to utilize according to local conditions. At the same time, on-the-job-training to the extension workers and irrigation engineers will be also carried out, and a technical manual for dissemination of the results of this study is to be made by consolidating the results. Last but not least, this study shares the same goal with CARD (Coalition for African Rice Development) in increasing rice production in Africa.

Rice transplanting in Ashanti Region in Ghana.

MOU with the Forest Research Institute Malaysia (FRIM)

The joint research project between JIRCAS and FRIM titled, "Regeneration processes following selective logging in hill dipterocarp forests" was initiated in 2005 on a two-year plan under the MOU signed in November 2002. Since this MOU expired in 2007, a new MOU was signed between both institutions in September 2008 to continuously implement the ongoing collaborative researches. Differing from the previous MOU directed at the collaboration on sustainable forest management, the new MOU provides a general framework for collaboration in the field of agricultural research.

Upon entering into the new MOU, study subjects collaboratively implemented so far were reorganized under a new project titled, "Improvement of selective logging techniques for the conservation of biodiversity in hill dipterocarp forests of the Peninsular Malaysia". The project aims at improving selective logging techniques in hill dipterocarp forests, based on the clarification of regeneration processes following selective logging and on the development of genetic guidelines for the conservation of genetic diversity of dipterocarp species.

In Malaysia, a selective logging system for valuable dipterocarp species has been historically employed for stable wood production. The regeneration of dipterocarp forests after logging is, however, not always successful. This may be due to the lowered density of mature trees in logged forests; they possibly fall into inbreeding in pollination. The inbreeding may cause various depressions such as poor fruition, low germination of seeds and insufficient growth of seedlings. To avoid such degradation, it is necessary to understand the minimum density of mature trees to ensure genetic flow among them and apply such a genetic guideline to the logging system.

The Malaysian Government recently has placed great importance on the conservation and management of nation's forests based on the principles of the sustainable management and the conservation of biological diversity and genetic resources. The project will also contribute to the regeneration of selective logging system matching the policies.

Forest Research Institute Malaysia (FRIM).

Collaboration with Other Institutions

Cooperation with CGIAR

Since its nomination as CGIAR's Focal Point Institution in Japan in 2004, JIRCAS has assumed a more active and prominent role in promoting and assisting the CGIAR's activities in Japan.

In September 2009, Dr. Ren Wang, Director of CGIAR Secretariat, came to Japan to attend a World Bank-sponsored seminar titled "***Food crisis and agricultural research- CGIAR commitment***", held in Tokyo. Dr. K. Iiyama, JIRCAS President, participated in the seminar as moderator. Dr. Wang also joined a meeting for an exchange of views with CGIAR friends, i.e. Japanese scientists who had previously served as either DG or Board Member of CGIAR Centers. This meeting was arranged and supported by JIRCAS.

JIRCAS provides support and assistance to CGIAR when it exhibits materials informing of its activities at the Global Festa Japan, an annual event held at Hibiya, Tokyo. For the Global Festa Japan 2008 held on October 4-5, JIRCAS arranged for the active participation and support of former Japan-CGIAR Fellows to the CGIAR exhibition. They happily obliged and introduced the various activities of CGIAR to the visitors, who were comprised mostly of students and young researchers. Photos of the CGIAR booth have been uploaded on the CGIAR web site (http://www.cgiar.org/meetings/hibiyapark2008%5Cindex.html).

CGIAR held its Annual General Meeting (AGM) in Maputo, Mozambique on December 1-3, 2008. Dr. Iiyama participated in this meeting and held discussions with Ms. Katherine Sierra, Chair of CGIAR, and other executives of the CGIAR Research Centers. Dr. Iiyama also exchanged views with them about the current organizational reforms being undertaken by CGIAR aimed at more efficient and effective management. During the AGM, JIRCAS promoted its activities using posters and handouts at a partner booth in the exhibition area.

Dr. Kenji Iiyama is shown meeting with Ms. Katherine Sierra, Chair of CGIAR, in the JIRCAS booth at the CGIAR AGM in Maputo, Mozambique.

ACADEMIC PRIZES AND AWARDS

Dr. Shintaro KOBAYASHI, Researcher of the Development Research Division, received the "Research Encouragement Award" for his collaborative study with Dr. Katsuhiro SAKURAI (Ocean Policy Research Foundation) and Dr. Takeshi MIZUNOYA (Wako University) from Japan Association for Planning Administration in September 2008. This award is given to an individual or a group of early career researchers who have published a high potential article in the field of planning administration.

The award-winning article is titled "Comprehensive Evaluation of Integrated Lake Basin Management Policy by System Simulation Analysis" and published in *Planning Administration*, Vol. 30, No. 3, 2007, pp. 70-78 (in Japanese). Ecosystems of closed water areas such as lake basins attract various kinds of human activities. In turn, degradation of ecosystems resulting from such activities can weaken the basis for riparian human life. As these interactions are complicated, basin management policies are expected to take into consideration several different purposes of management. The authors constructed an integrated simulation model including a regional economy, simple flows of nutrient salts, environmental and biomass technologies, and local finance. Using this model, the article reveals simulation results of spatial, financial, and technological priorities for basin-management policy of an objective area, aiming at compatibility between the environment and the economy.

Some challenges for the study remain in terms of both model elaborations and scenario extensions. However, it received recognition for potential effectiveness to policy evaluation and potential applicability to a lot of other regions.

RESEARCH OVERVIEW

OVERVIEW OF JIRCAS' RESEARCH STRUCTURE

1. History

The Japan International Research Center for Agricultural Sciences (JIRCAS) was first established in 1970 as the Tropical Agriculture Research Center (TARC), one of the research institutes of the Ministry of Agriculture and Forestry of Japan. TARC was reorganized into JIRCAS in 1993.

On April 1, 2001, JIRCAS became an Incorporated Administrative Agency (IAA) under the jurisdiction of the Ministry of Agriculture, Forestry and Fisheries (MAFF), in accordance with the administrative reforms by the Government of Japan to facilitate the reorganization of national government-affiliated research organizations.

2. Mission

Through research and development (R&D) and dissemination of information related to agriculture, forestry, and fisheries in developing regions, JIRCAS contributes to the improvement of the international presence of Japan and a secure and stable supply of food worldwide including Japan.

3. The IAA System

An IAA is an organization responsible for key public services that the government is not required to provide, but which the private sector is likely to neglect for various reasons. The IAA system was introduced in 2001, as part of central government reforms based on the scheme that the planning sectors and the implementing sectors should be separated. Under the IAA system, MAFF defined JIRCAS' Second Medium-Term Goals in FY 2006, including the enhancement of research efficiency and the improvement of the quality of research programs and financial performance. Based on the Second Medium-Term Goals, JIRCAS drafted and began to implement a detailed five-year plan, the Medium-Term Plan (FY 2006-FY 2010).

4. Evaluation

The performance and budgeting management of research activities conducted by JIRCAS undergo regular evaluation by the IAA Evaluation Committee established within MAFF. As for the activities of each fiscal year, the Committee investigates and analyzes the progress towards achieving the Medium-Term Plan, and the results of this evaluation shall be applied as necessary to the modifications of the operational and financing systems for subsequent fiscal years. To meet the requirements of this rigorous evaluation, JIRCAS has modified the in-house evaluation system in the initial year of the Second Medium-Term Plan. The in-house evaluation in FY 2008 was carried out as follows.

1) Each Project evaluated its own research activity and prepared its own summary report.
2) These were collectively evaluated at the meeting for the evaluation of sub-programs of the Medium-Term Plan by external reviewers (specialists from other universities or institutes) and internal reviewers (the President, the Vice-President, an Executive Advisor and Auditor, and Directors of each section) in February, 2009.
3) Comprehensive evaluation of all JIRCAS activities, which also include administrative operations, was performed during the External Reviewers' Meeting in March, 2009.

The external reviewers present at both of the above meetings are listed in the Appendix. The results of the in-house evaluation and a summary of all activities were submitted to the IAA Evaluation Committee established within MAFF in June, 2009.

5. Medium-Term Plan

JIRCAS is implementing four main programs for research activities under the Medium-Term Plan. Each main program has a number of sub-programs, each of which includes several projects. Major accomplishments and research highlights of the main programs in FY 2008 are described in the following sections. The contents of the Medium-Term Plan are also described in the Appendix.

Table 1. Number of Programs in the Second Medium-Term Plan (FY 2006-FY 2010)

Research Approach	Main Program	Sub-program (Total)
A	A-1	7
	A-2	7
	A-3	4
B	B	3

Second Medium-Term Plan (FY 2006-FY 2010)

[Research Approach A] Research and development on agricultural, forestry and fisheries technology geared towards providing solutions to international food and environmental problems

Main Program A-1
Development of technologies to utilize biological resources for stable production and multi-purpose applications under adverse environments

Sub-programs

1. Elucidation of the mechanism of tolerance to abiotic stress and production of tolerant crops
2. Improvement of abiotic stress tolerance of rice in Africa
3. Identification of pathogenic races for important diseases and selection of resistant germplasm in major crops
4. Development of biomass utilization technology suited to Southeast Asia
5. Elucidation of the functionality and quality parameters of traditional food and agricultural products in Asia and development of effective utilization technology
6. Effective utilization of genetic resources in tropical and subtropical crops
7. Sustainable utilization of tropical and subtropical marine resources and development of aquaculture technology

Main Program A-2
Development of management technologies of environmental resources and production systems for sustainable agriculture, forestry and fisheries

Sub-programs

1. Development of sustainable management technologies for tropical soils
2. Integrated management system for improved water utilization aiming at increasing economic options and reducing environmental impact
3. Improvement of feeding technology for livestock in the tropics and the subtropics and establishment of sustainable agropastoral systems in the Asian dry areas
4. Elucidation and exploitation of biological nitrification inhibition (BNI)
5. Development of environmental management technology for sustainable crop production in tropical and subtropical islands
6. Development of nurturing techniques for beneficial indigenous tree species in Southeast Asia
7. Development of productive low-input cultivation technology for fruit trees in the tropics

Main Program A-3
Elucidation of the impact of global environmental changes on agriculture, forestry and fisheries and development of mitigating technologies

Sub-programs

1. Developing an impact assessment model and formulation of a food supply stabilization plan
2. Utilization of Geographic Information System (GIS) for the development of a land information monitoring technology in developing regions
3. Formulation of agricultural development methodologies to tackle the environmental changes of global warming and desertification
4. Developing pest control management technology for major pests in the tropics and subtropics

[Research Approach B]

Main Program B

Collection, analyses and dissemination of information to grasp trends related to international food, agriculture, forestry and fisheries and rural areas

Sub-programs

1. Collection and dissemination of information related to global food, agriculture, forestry and fisheries
2. Elucidation of the direction of technology development in developing regions and analysis of socioeconomic conditions of the development in rural areas
3. Establishment of techniques and methodologies for the reconstruction of agriculture and rural communities affected by natural disasters, etc.

6. Collaborative Research

JIRCAS is required to cover a wide range of research fields. The human resources at JIRCAS, however, are limited. This makes collaborative research with other institutes or universities important towards achieving JIRCAS' project objectives. When JIRCAS and its collaborators agree on the beginning of collaborative research after exchanging ideas and opinions, a Memorandum of Understanding (MOU) or a Joint Research Agreement (JRAs) is usually concluded. We developed the concept of JRAs in 2006. A JRA is a contract for collaborative research with a particular research subject and with a set duration. A total of 105 MOUs or JRAs remained in force at the end of FY 2008.

In 2004, JIRCAS was given a Certificate of Recognition by CGIAR as a key partner and as the CGIAR focal point institution in Japan. JIRCAS is playing an important role in mutual understanding and collaboration between CGIAR and the Japanese government. JIRCAS has also been intensively implementing collaborative research with several CGIAR research centers.

JIRCAS has been regularly dispatching researchers and research managers to promote research in the developing regions. In FY 2008, 156 JIRCAS researchers or administrators were dispatched abroad for a total of 15,813 days. We have been also dispatching researchers from other institutes and universities to promote the effective implementation of JIRCAS' projects with the cooperation of such organizations. JIRCAS has likewise implemented several invitation programs for overseas researchers and administrators at counterpart organizations. These programs facilitate not only the promotion of international collaborative research but also related exchanges of information and opinions.

7. Organization of JIRCAS

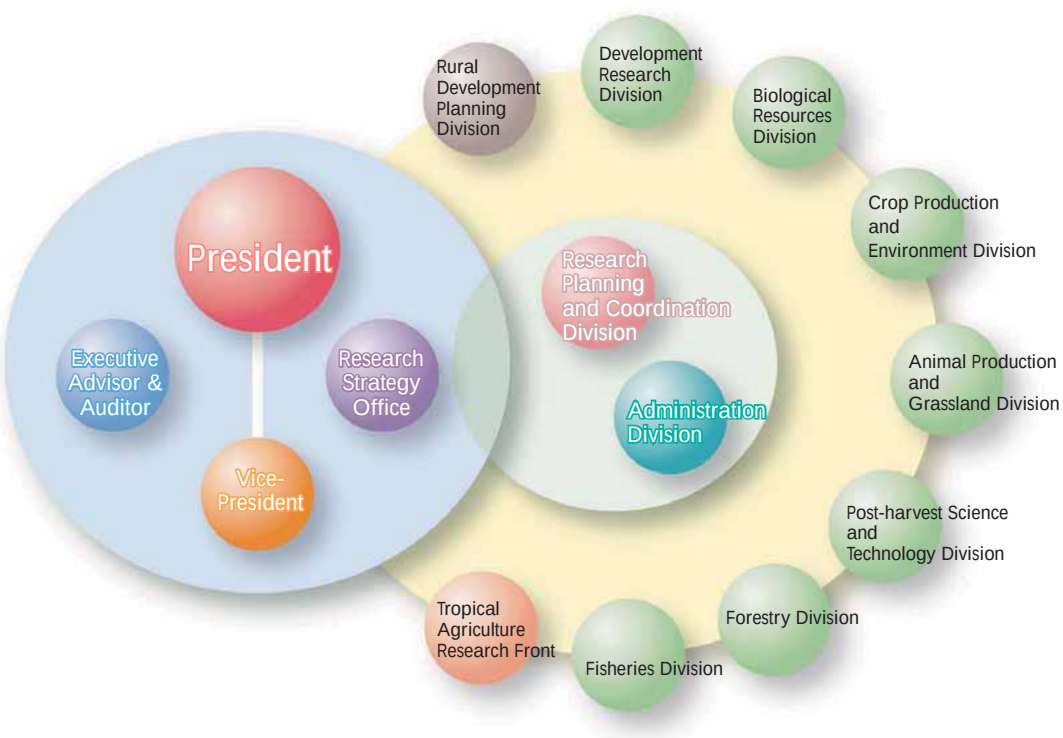
The organizational structure of JIRCAS in the Second Medium-Term Plan period is summarized in the figure below.

With the dissolution of the Japan Green Resources Agency on April 1, 2008, its overseas activities were transferred to JIRCAS. As a result, the following two new sub-programs were added to the second Medium-Term Plan.

1) Formulation of agricultural development methodologies to tackle the environmental changes of global warming and desertification (in Main Program A-3)
2) Establishment of techniques and methodologies for the reconstruction of agriculture and rural communities affected by natural disasters, etc. (in Main program B)

The newly established Rural Development Planning Division bears the responsibility for effecting the above two new sub-programs. This division deals with environmental issues such as global warming and desertification by developing technologies and methodologies that support sustainable agriculture and rural development in developing countries through on-site studies using a community-based participatory approach.

The directors of each research or planning division, including the Research Strategy Office and the Tropical Agriculture Research Front, hold the responsibility for the management of individual sub-programs in the Second Medium-Term Plan. JIRCAS' Tropical Agriculture Research Front (formerly the Okinawa Subtropical Station) focuses on agricultural, forestry, and fisheries research carried out in overseas regions with highly similar climatic and geographic conditions as Okinawa, taking full advantage of its subtropical weather and geographic location in Ishigaki Island, in the southernmost part of Japan.



Organization of JIRCAS.

MAIN RESEARCH PROGRAMS

Theme A-1 Development of technologies to utilize biological resources for stable production and multi-purpose applications under adverse environments

In developing regions where abiotic stresses such as drought and salinity, and biotic stresses caused by pests and diseases act as major constraints on agricultural production, there is an increasingly urgent need to develop technologies that enable not only stable but also sustainable production.

Theme A-1 aims at stable production of various agricultural products encompassing agriculture, forestry and fisheries. In this theme, research projects that include the elucidation of mechanisms of stress tolerance in plants, development of abiotic stress-tolerant crops using both conventional and molecular approaches, and development of technologies to utilize various biological resources in tropical and sub-tropical regions have been conducted.

The following items can be listed as the highlights among the many outputs of this research theme in the year 2008:

1. A molecular approach to elucidate mechanisms of abiotic stress tolerance has identified a unique protein interacting with DREB2A gene. Since DREB2A protein which is involved in drought and high temperature tolerance in plans is not stable by itself, we have previously constructed an active form of DREB2A gene. Through a study on the stabilization mechanism of the DREB2A protein, we have identified DREB2A interacting proteins (DRIP1, DRIP2). Overexpression of DRIP delayed the expression of DREB2A-regulated drought responsive genes, while a double mutant of DRIP1 and 2 enhanced gene expression of drought responsive genes.
   Meanwhile, an international collaborative project covering rice and wheat has been ongoing to find out to what extent the candidate genes for stress tolerance, such as DREB1, DREB2 and others, are effective in practical field conditions.

2. Our efforts to search chromosomal regions responsible for abiotic stress tolerance have successfully identified QTLs for salt tolerance of soybean as well as ozone tolerance of rice. Through continuous study on QTLs with strong effect on salt tolerance of soybean (*Glycine max*), including its wild species (*Glycine soja*), the QTL region has been narrowed down, rendering candidate DNA markers associated to the salt tolerance for breeding. For ozone tolerance of rice, a wide range of genetic variability has been found among rice germplasm. Using a mapping population between Nipponbare (sensitive) and Kasalath (tolerant), several QTLs associated with leaf bronzing and with biomass have been identified.

3. For biotic stresses, we have been dealing with rice blast and soybean rust, both of which are very destructive diseases for the respective crops. Inside the Rice Blast Research Network in which several Southeast Asian countries are participating, standardization in terms of evaluation for disease severity, nomenclature method and designation system for each race of blast fungus have been postulated using monogenic differential varieties with genetic background of LTH. In soybean rust, there are so many different races, which makes it difficult to develop a soybean variety with stable resistance. Inoculation of a set of standard varieties carrying several race-specific resistant genes with rust isolates from Japan and Brazil revealed quite different disease reactions, indicating the diversification of rust races between these two countries, as well as inside Brazil.

4. In the field of research on functionality of foods, a bacterial strain, Bacillus subtilis, derived from a Chinese traditional fermented "Okara" was found to exhibit a special activity which strongly inhibits α - glucosidase, the key enzyme in increasing blood glucose level. The active component for this inhibition was identified as 1-deoxynojirimycin based on the results of HPLC analysis and NMR.

5. In the area of biofuel research, JIRCAS scientist found that old oil-palm trunks contains more than 10% of fermentable sugar in the sap and furthermore, the sugar contents increased up to 16 % during the storage period of 60 days, confirming our earlier observations that oil palm trunks are potentially a good source for the production of bio-ethanol. Cassava pulp corresponding to 10 — 30% of original tuber contains a

large amount of starch. Using an arming yeast which displays two amylolytic enzymes and three cellulolytic enzymes, starch and fiber component in cassava pulp were saccharified, resulting in 10.5 g/l ethanol from 5% pulp.

6. In Laos, although local waters are rich in freshwater fishes, most of these fishes are not well utilized by inland communities. Moreover, the people of the region have recently been under pressure from environmental change and the impact of invading exotic species. However, production techniques for seed of important native food fishes, including the climbing perch *Anabas testudineus* and snakeskin gourami *Trichogaster pectoralis*, have now been developed by preventing cannibalism and improving feeding conditions. The application of advance technologies to the aquaculture of these species should shift local culture systems, which currently depend on exotic fishes, toward the sustainable production of indigenous species.

TOPIC 1

Genotypic variation in response to elevated surface ozone in rice and genetic factors contributing to tolerance

At current ozone levels, rice yield losses due to ozone are estimated to be between 5-10%, but with surface ozone concentrations expected to rise in many rice-producing areas of East and South Asia, yield losses as a result of exposure to elevated ozone will increase and could reach 20% in highly affected areas. Losses of that magnitude would threaten food security in East and South Asia, unless new rice cultivars with improved tolerance to ozone can be developed. The present study investigates whether genotypic variation for ozone tolerance exists in rice and subsequently identifies the quantitative trail loci (QTL) associated with tolerance.

The different responses to elevated ozone were evaluated in 23 rice genotypes of different origins and plant types that had been grown in open top chambers in a greenhouse. Ozone fumigation was done for 14 days from 9 am to 4 pm at a constant level of 100 ppb. Ambient air with ozone concentrations not exceeding 20 ppb was used as a control. Rice genotypes differed in their response to ozone with some genotypes such as Azucena or IR74 showing very strong leaf symptoms while others like Nipponbare or Milyang 23 showing reductions in biomass（Fig. 1）. Kasalath appeared to be the least affected by ozone.

QTL mapping based on the Nipponbare x Kasalath mapping population identified four QTLs for leaf bronzing and one QTL associated with biomass loss (Table 1). Of the four QTLs for leaf bronzing, the tolerant parent, Kasalath, contributed the tolerance allele in only one case, *OzT9* on chromosome 9. In three cases, tolerance alleles were derived from intolerant Nipponbare. In contrast, Kasalath contributed the tolerance allele at the only QTL associated with biomass reduction (*OzT8*). Chromosome segment substitution lines carrying small Kasalath inserts in a Nipponbare genetic background were used in comparison to recurrent parent Nipponbare to confirm the effects of QTLs *OzT3*, *OzT8* and *OzT9*. Kasalath introgressions at QTL *OzT9* (SL 41) reduced leaf bronzing but at QTL *OzT3* (SL15) increased bronzing (Fig. 2). Further analysis of leaf material from SLs indicated that genotypic differences in leaf bronzing are related to differences in leaf ascorbic acid content (data

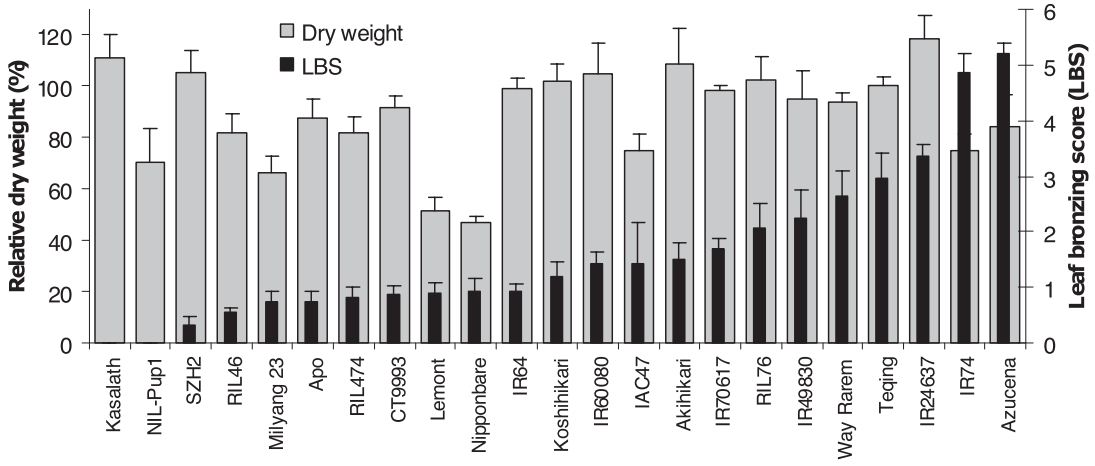


Fig. 1. Effect of 14 day-exposure to elevated ozone (100 ppb) on rice genotypes, evaluated in terms of leaf bronzing and relative dry weight (dry weight in the ozone treatment relative to ambient air control).

Table 1. QTL associated with tolerance to elevated ozone.

Chromosome	Marker interval	QTL	Position (cM)	LOD	R^2	Origin of tolerance allele
	Leaf bronzing					
3	R1925-R1927	*OzT3*	2	4.2	17.7	Nipponbare
4	R1427-C1016	*OzT4*	9	6.1	24.9	Nipponbare
5	C246-R521	*OzT5*	89	4.1	17.3	Nipponbare
9	C1454-G103	*OzT9*	18	3.3	14.5	Kasalath
	Relative dry weight					
8	R202 ñ R2676	*OzT8*	35	4.0	17.7	Kasalath

not shown). The reduction in plant biomass due to ozone exposure was high in Nipponbare (Fig. 3) but less in SL37 carrying a Kasalath introgression at QTL OzT8 and this was due to a less pronounced reduction in net CO_2 assimilation rate in SL37.

The genotypic variation in tolerance to elevated ozone present in rice appears sufficiently large to allow for improvements in rice ozone tolerance through breeding. The QTL identified and confirmed in this study could represent an important first step in the development of a breeding strategy to transfer tolerance loci from donors such as Kasalath to susceptible high-yielding cultivars.

(M. Wissuwa and M. Frei)

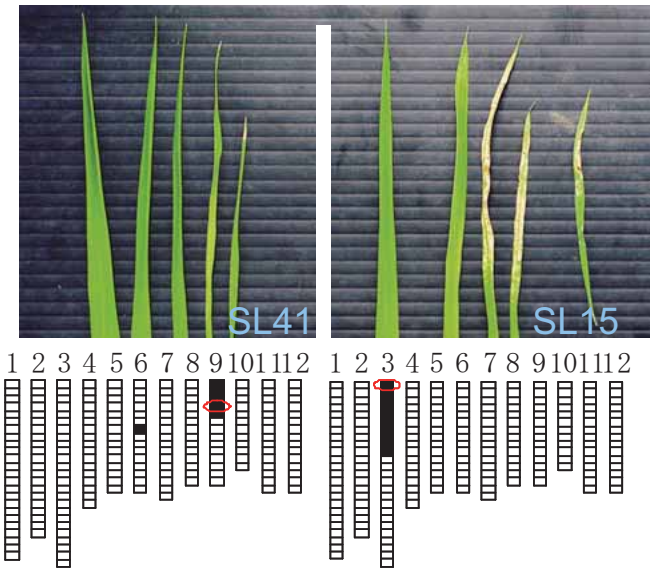


Fig 2. Differences in ozone-induced leaf bronzing between substitution lines SL41 and SL15 confirm the effect of both QTLs. Leaves are arranged from youngest leaf (left) to oldest leaf (right). Intolerant SL15 has already lost the three older leaves as a result of two week exposure to 100 ppb ozone whereas the effect of ozone exposure on SL41 is small.
Graphical genotypes show Kasalath introgressions (black bars) at QTLs OzT9 in SL41 (chromosome 9) and at QTL OzT3 in SL15 (chromosome 3).

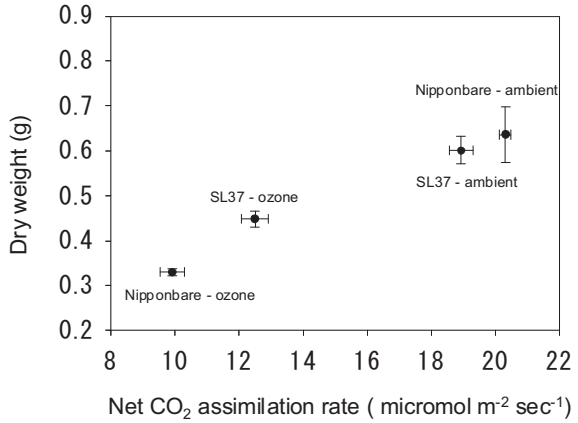


Fig.3. Photosynthetic efficiency (CO_2 assimilation) as affected by ozone in Nipponbare and derived line SL37 that carried Kasalath introgressions at QTL OzT8.

TOPIC 2

Identification of quantitative trait locus (QTL) for salt tolerance in soybean

Salt stress, which inhibits soybean germination, plant growth, nodule formation and seed yield, was often reported in soybean-producing areas, especially in the arid and semi-arid areas of developing countries. The agricultural lands are increasingly salinized through saltwater intrusion and use of poor quality irrigation water. Development of soybean varieties with high salt tolerance will provide an efficient way to improve soybean production in a salt stress environment. However, field evaluation and selection for salt tolerance in a soybean breeding program are very difficult because of its complicated genetic nature and the influence of environmental factors. The objectives of this study were: (1) to establish a simple and effective methodology for evaluating a larger number of soybean germplasm for salt tolerance, (2) to perform QTL (quantitative trait locus) analysis for salt tolerant, and (3) to develop DNA markers associated with salt tolerance QTL for marker-assisted selection in a soybean breeding

program.

In this study, a simple and effective methodology which enables the evaluation of a larger number of soybean germplasm for salt tolerance was established. Soybean seedlings were each planted in a 17 x 17 cm pot filled with upland field soil. After seven (7) days of emergence, the pots as well as the soybean grown in them were each transformed to large plastic containers (225 x 150 x 45 cm) containing 150 mM NaCl water solution for salt stress by introducing the salt solution into the pots through small holes at the bottom of the pots. The salt solution level in the containers was kept the same as the soil level in the pots to saturate the soil with salt solution, and the salt solution was constantly circulated by an air pump which applies oxygen to the growing soybean. Salt treatment was continued for about four weeks.

Using this evaluation method, more than 600 accessions of wild soybean (*Glycine soja*) and cultivated soybean (*G. max*) were evaluated. Several soybean genotypes, such as a Brazilian soybean cultivar, FT-Abyara and a Japanese wild soybean accession, JWS156-1, were identified with high salt tolerance.

QTL analysis with the mapping populations derived from a cross between FT-Abyara and a salt-sensitive cultivar C01 revealed a major salt tolerant QTL on the soybean linkage group N flanked by SSR markers Sat-91, Satt255, Satt339 and Satt237 (Fig.3). The QTL accounted for 44 % of the total variance for salt tolerance.

In the mapping populations derived from a cross between the wild soybean accession, JWS156-1 and the salt-sensitive cultivar, Jackson (P1548657), a major QTL which accounted for 68.7% of the total variance for salt tolerance was detected on the same genomic region on linkage group N. Our results indicated that the salt tolerance QTL is conserved in both wild and cultivated soybeans, and the DNA markers associated with the salt tolerance QTL might be used for marker-assisted selection in a soybean breeding program.

(D.H. Xu and A. Hamwieh)

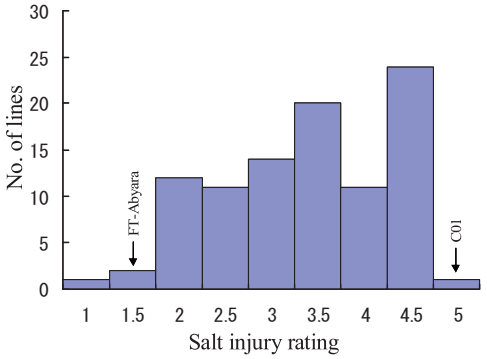


Fig. 1. Frequency distribution of salt injury rating of the 96 RILs derived from a cross between FT-Abyara (*G. max*) and a salt -sensitive cultivar C01 (*G. max*). The salt injury rating values ranged from 1 (normal healthy leaves) to 5 (complete death).

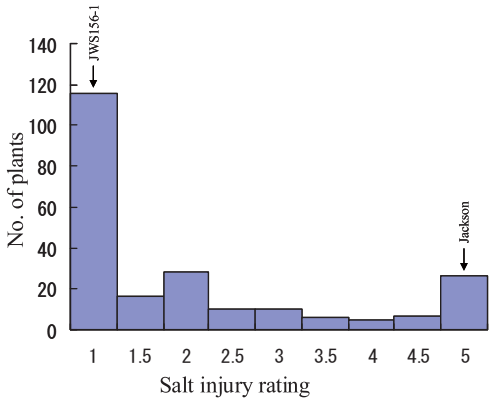


Fig. 2. Frequency distribution of salt injury rating of the 225 F2 plants derived from a cross between a salt-sensitive soybean cultivar Jackson (G. max) and the wild soybean accession JWS156-1 (G. soja). The salt injury rating values ranged from 1 (normal healthy leaves) to 5 (complete death).

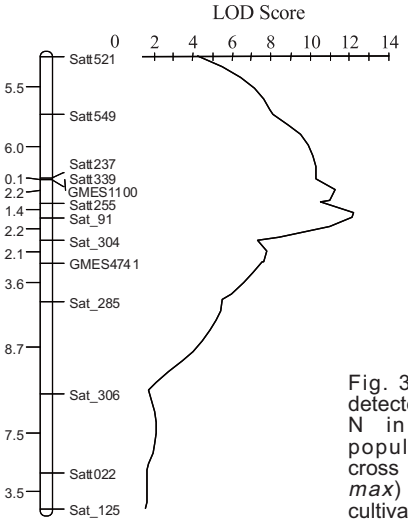


Fig. 3. Salt tolerance QTL detected on the linkage group N in the RIL mapping population derived from a cross between FT-Abyara (*G. max*) and a salt-sensitive cultivar C01 (*G. max*).

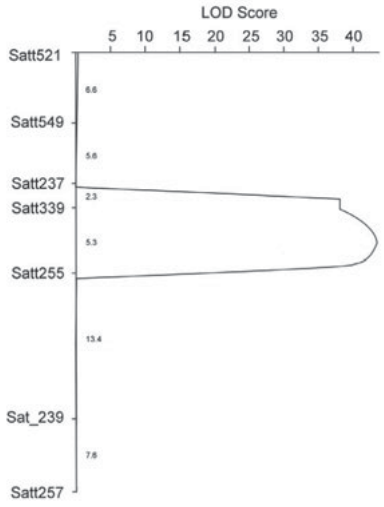


Fig. 4. Salt tolerance QTL detected on the linkage group N in the F2 mapping population derived from a cross between a salt-sensitive soybean cultivar Jackson (*G. max*) and the wild soybean accession JWS156-1 (*G. soja*).

Identification of two novel proteins which negatively regulate plant drought stress response

Environmental stresses, such as drought, salinity and extreme temperatures, are major limiting factors which hinder crops from reaching their yield potential. In response to abiotic stresses, plants have evolved a number of mechanisms to achieve an optimal adaptation to the adversities. Dehydration-Responsive Element Binding protein 2A (DREB2A) is identified as an important transcription factor involved in plant drought and high temperature stress tolerance. *DREB2A* gene expression can be induced by drought, high salinity and high temperature stresses. As a transcriptional activator, it can activate a number of stress-responsive gene expressions upon receiving stress stimuli. It is proposed that DREB2A gene would be of great value to improve plant stress tolerance by means of biotechnology. However, recent research found that the ectopically expressed DREB2A protein is not stable in plants. Only if it is stabilized, can the DREB2A-CA (a Constitutive Active form) protein be stably accumulated in plant cells. Transgenic plants overexpressing the DREB2A-CA protein exhibit significantly enhanced tolerance to both drought and high temperature stresses. It is of great importance to understand how the DREB2A protein is regulated in plant cells, so as to have a better manipulation of this gene in plants.

In order to identify the DREB2A interacting proteins, we carried out yeast two-hybrid assay or screening. As a result, two proteins DRIP1 and DRIP2 (DREB2A Interacting Protein 1 and 2) were isolated. They share a conserved C3HC4 RING domain in the protein N-terminals and a high homology in the protein C-terminals. DRIP1 was found to interact with the DREB2A protein in the nuclei. An in vitro ubiquitination assay showed that they function as E3 ubiquitin ligases and mediate DREB2A ubiquitination. Overexpressing *DRIP1* in *Arabidopsis* delayed the expression of DREB2A-regulated drought-responsive genes. On the contrary, the expression of many drought-inducible genes, such as *RD29A*, *RD29B*, *LEA14*, *RD17*, *AtGolS1/2*, was slightly enhanced in the single T-DNA mutants of *drip1-1* and *drip2-1*. Significantly enhanced gene expression was revealed in the *drip1 drip2* double mutant under dehydration stress. Moreover, the overproduced DREB2A protein was observed to be more stable in *drip1-1* than in the wild-type background. Collectively, these results suggest that DRIP1 and DRIP2 are novel negative regulators in drought-responsive gene expression by targeting DREB2A toward 26S proteasome proteolysis.

Drought stress tolerance was also compared among the wild-type, *drip1-1 drip2-1* and *drip1 drip2* plants, according to their survival rate in the soil after they stopped receiving water. When data were analyzed from several independent tests, 37.5% of the wild-type plants survived from the drought stress treatment and

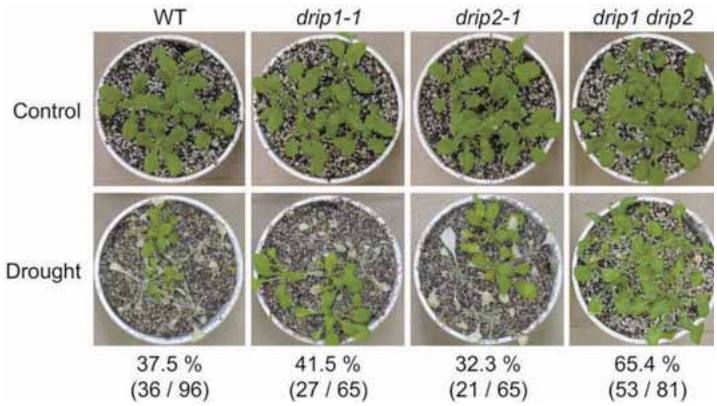


Fig. 1. Enhanced drought stress tolerance of drip1 drip2 double mutant compared with the wild-type and single mutant plants. Water was withheld from the soil-grown plants for two weeks. Survival rate was calculated one week after rewatering.

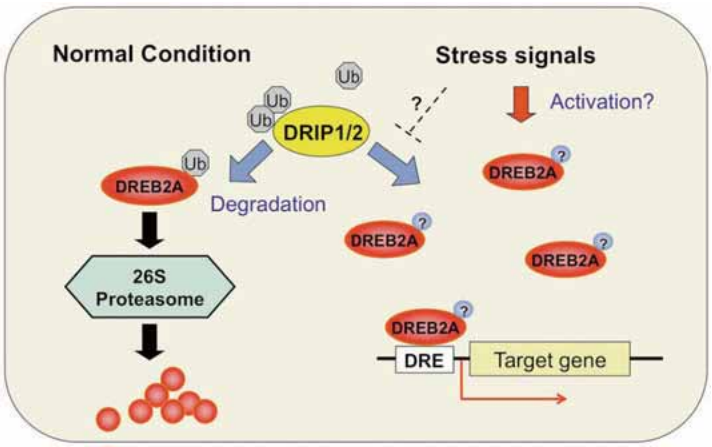


Fig. 2. A model of DRIP1/2 functioning in dehydration stress signaling by targeting DREB2A degradation. Under normal growth conditions, the ectopically expressed DREB2A protein is ubiquitinated and degraded by DRIP1 and DRIP2. Upon receiving stress stimuli, the protein degradation pathway is blocked and an activation modification might happen on DREB2A, so that plants are able to acquire a sufficient amount of effective DREB2A protein to activate downstream gene expression.

41.5% and 32.3% of *drip1-1* or *drip2-1* plants recovered from the stress after rewatering, respectively. The survival rate of the *drip1drip2* double mutant was 65.4%, which is significantly higher than that of the wild-type plants. It implies that disruption of both the *DRIP1* and *DRIP2* genes might be helpful to exaggerate drought-inducible gene expression, thus enhancing plant stress tolerance. Coupled with the enhanced drought stress tolerance, a remarkably elongated period of plant growth was observed in *drip1 drip2* double mutant plants, suggesting that *DRIP1* and *DRIP2* might also play a role in plant development.

(F. Qin, J. Mizoi and K. Yamaguchi-Shinozaki)

TOPIC 4

A new international system of differentiating races of blast disease by using LTH monogenic lines in rice

A new systematic, expandable method that allows easy understanding of the relationships between blast races and resistance genes is proposed for building up an international standard designation and classification system of blast races. Blast races were characterized by their reactions to 26 LTH (Lijiangxintuanheigu) monogenic lines used for targeting 23 resistance genes, which were divided into five groups, (1) LTH, IRBLa-A, IRBLsh-S, IRBLb-B, and IRBLt-K59, (2) three lines of *Pii* locus region, (3) seven lines of *Pik* region, (4) four lines of *Piz* region, and (5) seven lines of *Pita* region. Each group consists of one to three varieties, which were allocated with three differential lines (genes) in each and applied with codes 1, 2, and 4, for compatible reactions with blast isolates, respectively. Each blast race is characterized by the sum of codes in combinations of three varieties' reactions in each unit using the Gilmour method for plant pathogen nomenclature. In the case of all compatible reactions to differential lines, the race No. 73-i7-k177-z17-ta733 was designated.

Evaluation and selection of blast isolate to monogenic lines

The 26 monogenic representative lines for 23 resistance genes, *Pia*, *Pib*, *Pii*, *Pik*, *Pik-h*, *Pik-m*, *Pik-p*, *Pik-s*, *Pish*, *Pit*, *Pita*, *Pita-2*, *Piz*, *Piz-t*, *Piz-5*, *Pi1*, *Pi3*, *Pi5*(t), *Pi7*(t), *Pi9*(t), *Pi12*(t), *Pi19*(t), *and Pi20*(t), including LTH as a

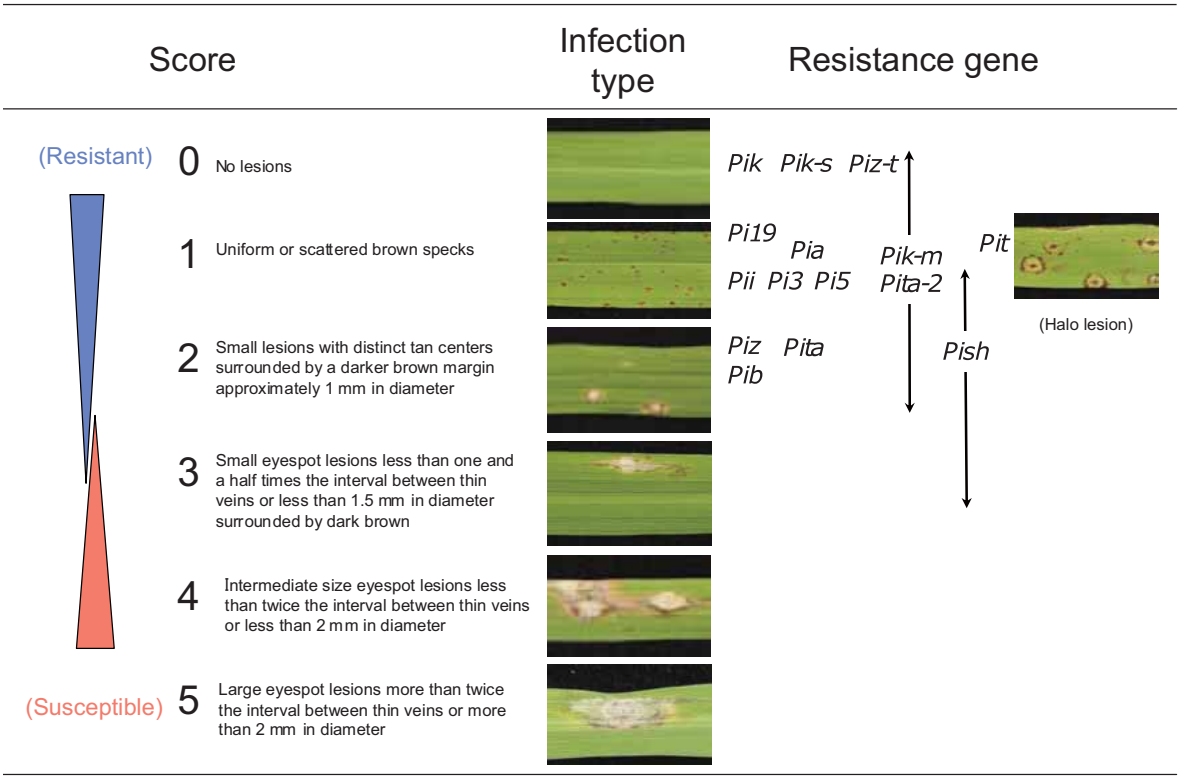


Fig. 1. Criteria for evaluating infection types of blast races.

susceptible check variety, were used. The responses of each LTH monogenic line to blast fungal isolates were recorded according to the infection type (generally, 0-2 resistant; 3-5 susceptible) in accordance with the IRRI *Standard Evaluation System* (SES, 1996) (Fig. 1).

Grouping of differential varieties

Twenty of the LTH monogenic lines are multiallelic genes in four genetic loci. The LTH monogenic lines, having genes presumed to be multiallelic or closely linked in the *Pii*, *Pik*, *Piz*, and *Pita* locus, were divided into groups, respectively, and arranged in accordance with the Gilmour method. Each race code number has the following five parts divided by a hyphen (i.e., 1st-2nd-3rd-4th-5th). The first part of the race code number has a two-digit number and is composed of LTH, and IRBLa-A in the ones place, and IRBLsh-S, IRBLb-B and IRBLt-K59 in the tens place. The second part has a one-digit number and is composed of IRBLi-F5, IRBL3-CP4, and IRBL5-M, which are multiallelic or closely linked. The third part has a three-digit number and is composed of IRBLk-Ka, IRBLkp-K60 and IRBL7-M in the ones place, IRBLkm-Ts, IRBL1-CL and IRBLkh-K3 in the tens place, and IRBLks-S, in the hundreds place, which are multiallelic or closely linked. The fourth part has a two-digit number and is composed IRBLz-Fu, IRBLz5-CA, and IRBLzt-T in the ones place, and IRBL9-W in the tens place, which are multiallelic or closely linked. The fifth part has a three-digit number and is composed IRBL19-A, IRBL20-IR24 in the ones place, IRBLta-K1, IRBLta-CP1 in the tens place, and IRBLta2-Pi, IRBLta2-Re, IRBL12-M in the hundreds place, which are multiallelic or closely linked.

Classifications

To clearly delineate the relationship between race code number and resistance gene, the system of nomenclature of blast fungus races employed the Gilmour's method. This nomenclature method is excellent in terms of regularity, flexibility and suitability for a differential system composed of many varieties. The selected LTH monogenic lines were divided into groups with three lines each, and each of the three lines was given the code numbers 1, 2, and 4, respectively. The total of the code numbers of the three LTH monogenic lines, which are compatible to blast fungus, show the race number.

Designation system

A race number is shown in the total of the code numbers of monogenic lines, which are compatible to a specific blast fungus. To indicate which of each part is the *Pii*, *Pik*, *Piz* and *Pita* locus, the symbols i, k, z and ta, which show the locus name, were marked in front of each multiallelic part, respectively. For example, when a blast isolate is pathogenic to all the differential varieties, the race number of the isolate is shown as "73-i7-k177-z17-ta773". This system offers sufficient range for regularity, flexibility and expansion to take in new resistance varieties to be identified in the future. Usually, when the number of differential varieties are increased along with the introduction of new resistance genes, extensibility is poor.

This study was conducted under the research projects "Blast Research Network for Stable Rice Production" funded by JIRCAS, and the IRRI-Japan Collaborative Research Project Phases IV and V, commissioned to IRRI by the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan.

(N. Hayashi and Y.Fukuta)

TOPIC 5

Reaction differences of soybean varieties against Brazilian and Japanese soybean rust isolates

South America, including Brazil, is one of the major soybean producers in the world. Thus, sustainable soybean production in South America is very important for Japan where more than 90% of soybean consumption is dependent on import. In the last several years, however, soybean rust has become one of the most serious threats to soybean production in Brazil by causing yield reduction of about 600 million US dollars in the 2006/2007 cropping season. On the other hand, many resistant varieties have already been identified or developed in Asia where this disease has been observed since ancient times. Information about virulence is necessary in order to know the usefulness of known resistant varieties/genes.

Three kinds of rust isolates used for inoculation were "bulk isolates", mixtures of spores obtained from multiple soybean leaflets infected with soybean rust. One isolate was collected at Kannondai, Tsukuba City, Ibaraki, Japan in September 2007 and the other two were respectively collected in January and August, 2008 at the National Soybean Research Center

of EMBRAPA, Londrina City, Paraná, Brazil. All three isolates showed typical symptoms of soybean rust; i.e. brown lesions are formed mainly on the leaves of susceptible soybeans, spores are produced, and yellowing and falling of leaves occur thereafter. The original classification criterion of resistance against soybean rust (Table 1) is based on four characteristics related to resistance: frequency of lesions having uredinia, number of uredinia per lesion, frequency of opened uredinia, and sporulation level (Fig. 1). A total of 13 Asian soybean varieties, including the varieties which possess one of five known resistance genes, were tested for resistance reaction against three kinds of isolates. Reaction differences between the Japanese and Brazilian isolates observed in these varieties were quite large, i.e. All varieties, except for one variety having *Rpp2* and two susceptible standard varieties, were found resistant against Japanese isolates. However, only four varieties were resistant against the two Brazilian isolates, respectively (Table 2). In addition, the resistant varieties and the degree of their resistance were different between the two Brazilian isolates.

We need to utilize multiple resistance genes for the breeding of resistance varieties.

Fig. 1. Standard for sporulation level of lesions of soybean rust.

Table 1. Classification of phenotypic traits associated with resistance and criteria to determine resistance of soybean varieties against rust. Each value is obtained from 30 lesions.

Resistance characteristics of lesions	Resistant phenotypes	Susceptible phenotypes
Frequency of lesions having uredinia (%)	$0.0 \leq x < 70.0$	$70.0 \leq x \leq 100.0$
Number of uredinia per lesion	$0.0 \leq x < 2.0$	$2.0 \leq x$
Frequency of opened uredinia (%)	$0.0 \leq x < 70.0$	$70.0 \leq x \leq 100.0$
Sporulation level	$0.0 \leq x < 2.0$	$2.0 \leq x \leq 3.0$

Resistance Categories	Criteria
Immune	No lesion formed
Highly resistant	Lesions formed but no uredinia and spores formed
Resistant	Resistant phenotypes observed in all four resistance characteristics of lesions
Slightly resistant	Resistant phenotypes observed in some of four resistance characteristics of lesions
Susceptible	Susceptible phenotypes observed in all four resistance characteristics of lesions

Table 2. Phenotypes of resistance against Japanese and Brazilian rust isolates in 13 standard varieties. 1-7: Varieties having one of known resistance genes (Names of genes in parentheses), 8-11: Varieties with identified resistance but yet unidentified genes, 12 and 13: Susceptible standard

Rust isolates \ Standard varieties	1. PI200492(Rpp1)	2.Tainung4(Rpp1)	3. PI230970(Rpp2)	4. PI417125(Rpp2)	5. PI462312(Rpp3)	6. PI459025(Rpp4)	7. Shiranui(Rpp5)	8. PI416764	9. PI587880A	10. PI587886	11. PI587905	12. TK5	13. Wayne
Japanese bulk isolates - 1	HR	HR	S	SR	HR	R	HR	HR	IM	SR	HR	S	S
Brazilian bulk isolates - 1	S	S	R	R	S	R	R	S	S	S	S	S	S
Brazilian bulk isolates - 2	S	S	S	S	SR	SR	SR	SR	S	S	(Mix)	S	S

IM :Immunity HR :Highly resistant R :Resistant SR :Slightly resistant S :Susceptible (Mix) :Mixed types of lesions

However, resistance genes and varieties used for soybean breeding in Brazil are limited. Because the classification criterion of resistance against soybean rust is based on a test using 63 varieties, a large number, it can also be used for determining the resistance of other soybean varieties. The resistance of varieties/lines being screened for breeding materials should be confirmed by rust isolates collected from a wide area of Brazil in order to take into consideration the yearly and regional differences in Brazil.

(N. Yamanaka)

TOPIC 6

Potential of old oil palm trunks as feedstock for Bioethanol

According to the statistical data of the US Department of Agriculture (USDA,2005), palm oil, a major edible vegetable oil along with soybean oil, is produced at 3.5 million tons per year. Oil palm trees have an economic life span of approximately 20-25 years, after which old trees are felled and replanted. Although some portions of the old felled trunks are utilized for plywood manufacturing, almost all of the other parts have no practical way of utilization and have become troublesome wastes.

In an attempt to develop a method for utilizing old oil palm trunks for the production of fuel ethanol and usable materials, we discovered that the felled oil palm trunks contain large quantities of sap and that abundant glucose and other fermentable sugars exist in the sap. Most significantly, the amount of fermentable sugars is nearly 10% in the sap collected from the inner parts of the trunk. To understand the mechanism of sugar accumulation in the trunks, the moisture and sugar contents were analyzed using sap collected from an oil palm trunk which was sliced at each 0, 1, 7, 15, 30, 60, 90, and 120th day. Surprisingly, the total sugar contents of the sap were drastically increased from 18.5% to 20.7% by storage for 30 to 60 days, although the moisture content of the trunk did not change during the total storage period. In addition, the fermentable sugars such as glucose, sucrose, and fructose contained in the sap were also increased by a maximum of 16.1% during the storage period of 30 to 60 days. These results indicate that the concentration of fermentable sugars in the trunk is able to be drastically increased within a suitable storage period. If oil palm trunks are processed within a suitable maturing or storage period, there is the possibility to produce ethanol in quantities ranging from 9.5 to 10.3 kL/ha from oil palm trunks, whereas only 4.5 to 7.2 kL/ha from sugarcane. Thus, the discarded old oil palm trunks that used to be troublesome and caused serious environmental pollution have the huge potential to become sustainable useful biomass resources rivaling sugarcane.

(A. Kosugi, Y. Murata, T. Arai, Y. Mori, R. Tanaka [Forestry and Forest Products Research Institute], H. Yamada [Tokyo University])

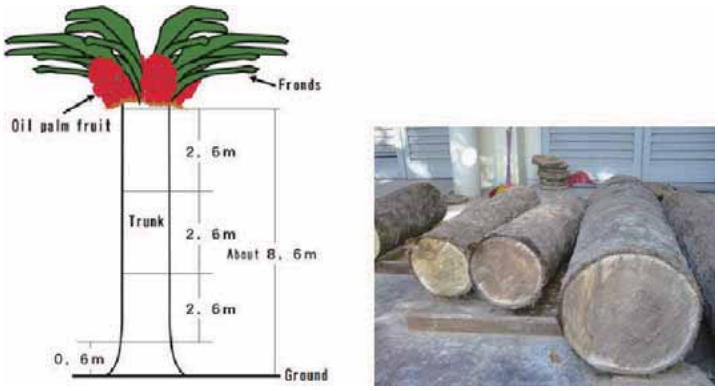


Fig. 1. Cutting and storage (maturing) tests of old oil palm trunks. Cross-section diagram of an oil palm trunk (left). Storage test of felled oil palm trunks (right). Diameter of the trunks varies from 30 to 60 cm.

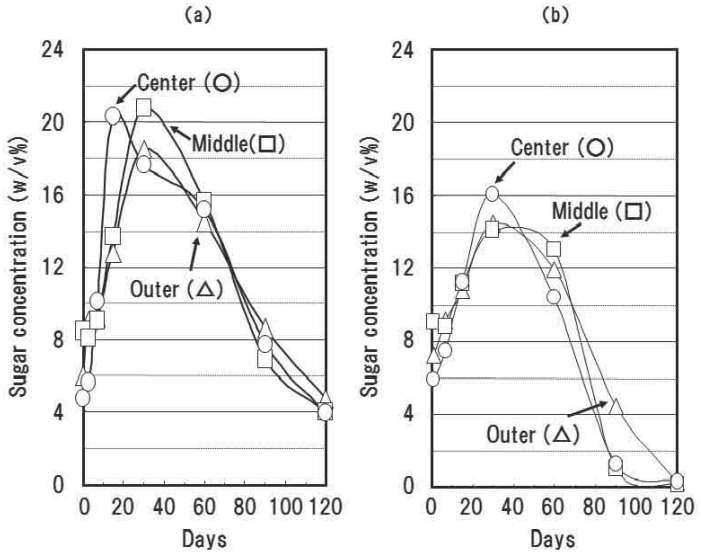


Fig. 2. Variation of total and fermentable sugars in the sap from old oil palm trunks during storage period. The sugar concentration was measured using phenol-sulfuric acid method and HPLC (High Performance Liquid Chromatography) analysis. Labels (a) and (b) indicate concentrations of total sugar and fermentable sugars, respectively.
Symbols: ○ - center part, □ - middle part; △ - outer part.

Table 1. Competition of ethanol productivity between old oil palm trunks and sugarcane.

	Sugar Cane	Oil Palm Trunk [a] (after proper maturing)		
		Center	Middle	Outer
Moisture content	70%	83%	75%	68% ×0.8
Sugar content in juice or sap	16%	16%	14%	15%
Amount of sugars contained	112g/kg	95.4g/kg ⇒ 107.8 kg/trunk		
Cane or trunk produced per area	60-90 ton/ha	154-168 ton/ha (136-148 trunks/ha)		
Possible ethanol yield [b]	4.5-7.2 kL/ha	9.5-10.3 kL/ha		

a) Old oil palm trunks are assumed to be with average diameter of 38 cm, length 10 m, and density 1.0.
b) The ethanol yield indicates the productivity level per year.

TOPIC 7

Direct ethanol production from cassava pulp using arming yeast co-displaying amylolytic, cellulolytic enzymes and β-glucosidase

Cassava (*Manihot esculenta Crantz*) which contains high starch concentration is a major raw material used in many industries in the tropical areas. When starch is extracted from cassava tubers in the tapioca starch processing, the grated cassava tubers are separated into starch granules and fibrous residual materials. These fibrous residual materials, named as cassava pulp, correspond to around 10% to 30% of original tubers as solid waste, and it contains a large amount of starch (about 60% dry base), high moisture (70-80%), and little cellulosic fibers. We tried to produce ethanol from cassava pulp using this arming yeast.

We constructed a yeast strain that displays two amylolytic enzymes (AM and GA) and two kinds of cellulolytic enzymes (EGII and CBHII) and BGL1 on the yeast cell surfaces by arming technology (utilizing the various proteins displayed on the cell surfaces using genetic engineering techniques) (Fig.1). These enzymes were co-displayed on the surfaces of the arming yeast cells, and because of this, the arming yeast can bring the activities of all the enzymes (Table 1). Five percent (5%) of cassava pulp that was pretreated with water at 150 ℃ for 60 min was directly fermented using the arming yeast.

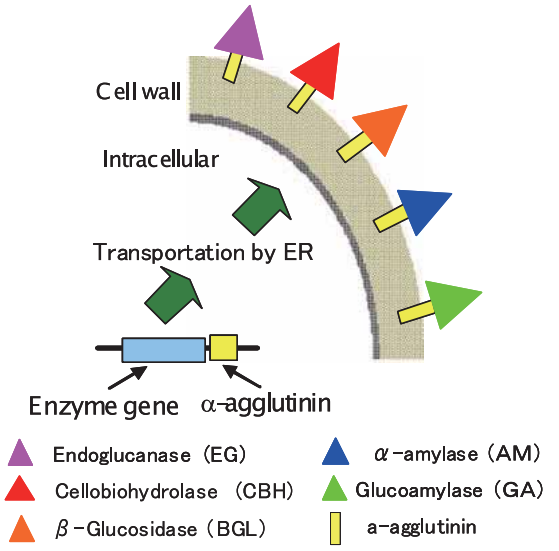


Fig. 1. Arming yeast that co-displays amylases, cellulases, and β-glucosidase on cell surfaces.

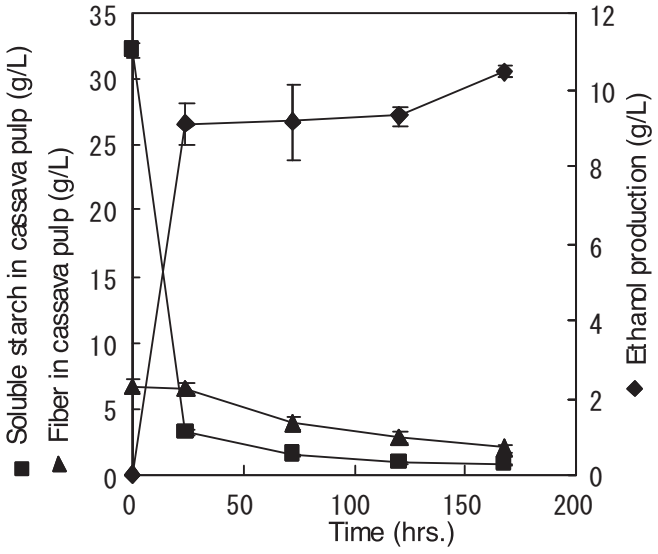


Fig. 2. The ethanol production from 5% cassava pulp as the sole carbon source by arming yeast.

Table 1. Competition of ethanol productivity between old oil palm trunks and sugarcane.

Enzymes	Substrates	Enzyme activities*
Cellobiohydrolase	PNP-β-D-cellobioside	3.0
Endoglucanase	Carboxymethyl-cellulose	0.5
β-Glucosidase	PNP-β-D-glucopyranoside	2.7
Glucoamylase	soluble starch	5.2
α-amylase	2-chloro-4-nitrophenyl 6^5-azide-6^5-deoxy-β-maltopentaoside	75.4

*enzyme activity; U/g [dry weight] of cell

Fermentation was performed at 30 ℃ in fermentation medium containing 50 g of cassava pulp per liter as the sole carbon source. Starch and fiber components in cassava pulp were saccharified by the arming yeast, and 10.5 g/L ethanol was produced from 5% cassava pulp (Fig. 2).

This arming yeast has five enzymes that are necessary to saccharify or breakdown starch and cellulose and it is able to produce ethanol without further enzymes addition during fermentation. Therefore, it is possible to contribute towards cost-cutting in ethanol production from biomass. The cells in flocs can be separated easily by sedimentation after fermentation, since this arming yeast is a flocculant yeast. On the other hand, the formation of cell flocs would reduce the effective concentration of the enzymes on the cell surfaces that can access the insoluble substrate such as cellulose for enzymatic reaction.

(Y. Murata, W. Apiwatanapiwat [Kasetsart University], A. Kosugi, R. Yamada [Kobe University], A. Kondo [Kobe University], T. Arai and Y. Mori)

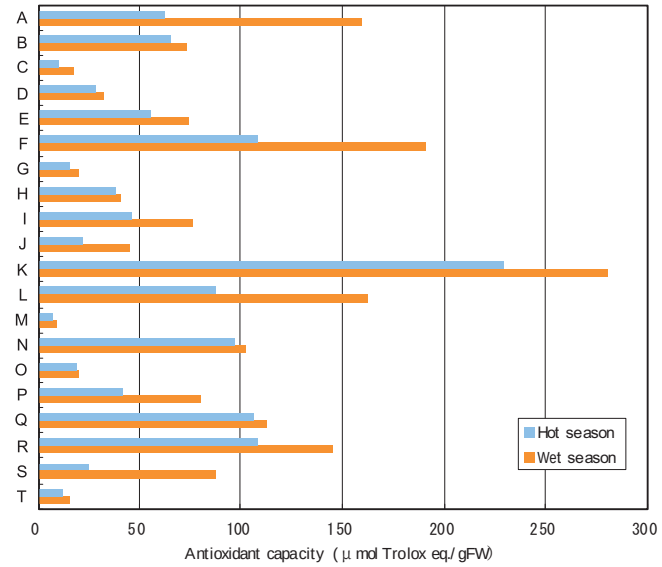


Fig. 1. Seasonal changes in antioxidant capacity of local Thai vegetables. Vegetables were cultivated in the experimental field of Kasetsart University (Nakhon Pathom, Thailand). Methanolic extracts of edible parts were used for the antioxidant assay (DPPH method). Each datum has an average of 15 measurements. Scientific names of vegetables are: *Ocimum sanctum* (A), *Ipomoea batatas* (B), *Clinacanthus nutans* (C), *Coleus amboinicus* (D), *Garcinia cowa* (E), *Eleutherococcus trifoliatus* (F), *Averrhoa carambola* (G), *Plumbago zeylanica* (H), *Oenanthe stolonifera* (I), *Polyscias fruticosa* (J), *Cassia siamea* (K), *Houttuynia cordata* (L), *Averrhoa bilimbi* (M), *Momordica cochinchinensis* (N), *Pandanus odorus* (O), *Piper sarmentosum* (P), *Tiliacora triandra* (Q), *Passiflora edulis* (R), *Ocimum basilicum* (S), and *Morinda citrifolia* (T).

TOPIC 8

Enhancing the antioxidant capacity of local vegetables by cultivation technique

Vegetables contain antioxidative vitamins and polyphenols that are essential for human health. And, the antioxidant capacity of vegetables is now being recognized as an important factor in quality evaluation. In the previous studies, we found that many of the local vegetables of Thailand exhibit high antioxidant capacity. However, at the same time, we noticed that there is a seasonal rise and fall in their antioxidant capacity. In the current study, we cultivated 20 kinds of local vegetables in Thailand in three different seasons, namely dry (November to February), hot (February to May) and wet season (May to October) under irrigated condition. The DPPH (1,1-diphenyl-2-picrylhydrazyl) free radical scavenging capacity values as indication of the antioxidant capacity of the methanolic extracts of fresh vegetables were compared. In most of the vegetables studied, crops cultivated in the dry season had a

higher antioxidant capacity than crops cultivated in the hot season (Fig. 1). In the central area of Thailand, solar irradiation in dry season is much higher than the other season, while the average temperatures in dry and hot seasons are not so different. Therefore, it was speculated that there would be a positive correlation between antioxidant capacity and solar irradiation. To validate this hypothesis, cultivation experiments with shading were performed using sweet basil (*Ocimum basilicum*) and holy basil (*Ocimum sanctum*) that are frequently consumed in Southeast Asia (Fig. 2). Antioxidant capacities of both basils dramatically decreased in shaded conditions (Fig. 3). We plan to provide this cultivation technique which enhances the antioxidant capacity of basils and other local vegetables to farmers in Southeast Asia.

(K. Nakahara, T. Vorapong [AVRDC], M. Suzuki [AVRDC], P. A.-C. Ooi [AVRDC])

Fig. 2. Sweet basil (above, *Ocimum basilicum*) and holy basil (below, *Ocimum sanctum*).

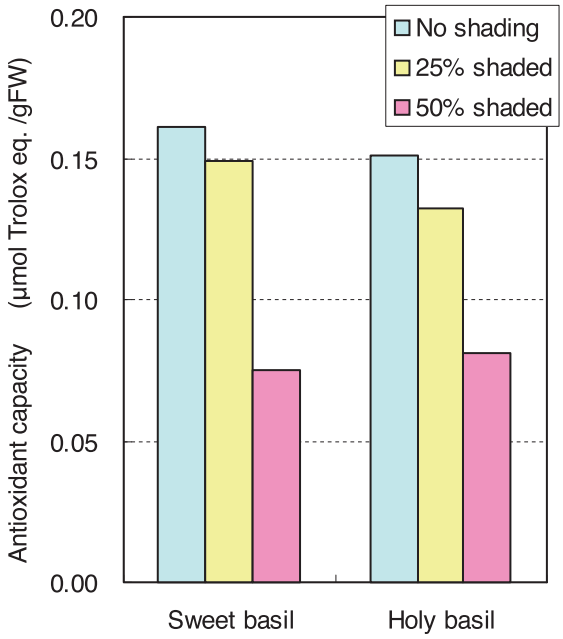


Fig. 3. Shading experiment.
Upper panel: Cultivation without shade (A), 25% shaded (B) and 50% shaded (C).
Lower panel: Antioxidant capacity of basils cultivated with each treatment.

TOPIC 9

Bacillus subtilis B2 derived from "Fermented Okara (a Chinese traditional food)" produce 1-deoxynojirimycin (an inhibitory compound on intestinal glucosidase).

Bacillus subtilis B2 derived from the Chinese traditional fermented okara exhibits a special activity which strongly inhibits α-glucosidase, the key enzyme in raising blood glucose level in metabolic materials. The main component has been identified as 1-deoxynojirimycin (DNJ), which is an imino sugar. Demands of health functionality for foods and farm products are increasing with the rise of interest in health concerns, not only in advanced nations but also in developing countries. Research and development on a food's health function is one of the effective methods for value addition. On the other hand, in many developing countries such as China, different nations are living under various climates and unique traditional food products develop in these countries. There is the thought that "medicines and foods come from the same source" in China, and from ancient times, it is well known there that a good meal is a way of keeping one's good health. Therefore, the existence of strong health functionality and newly discovered health functions are highly anticipated. Reducing the

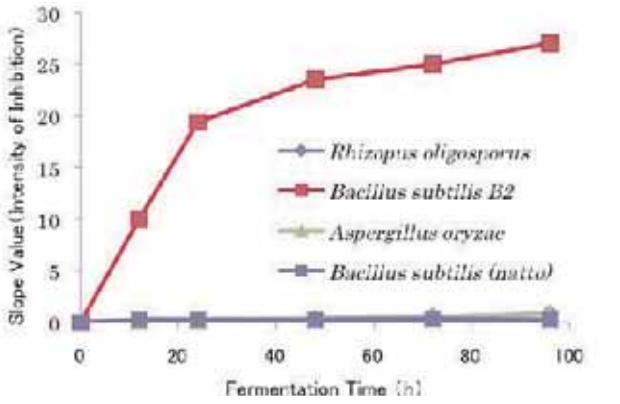


Fig. 1. α-Glucosidase inhibitory activity of culture fluid.
Various edible bacteria were cultured in Okara culture fluid and the reduction activity of the centrifugal supernatant was measured.

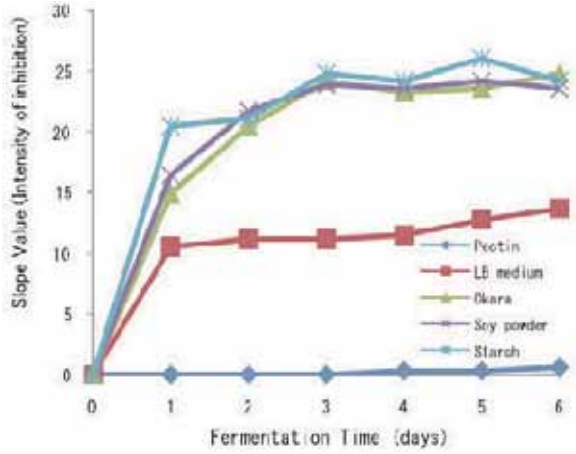


Fig. 2. Changes of the α-glucosidase inhibitory activity in various culture media.

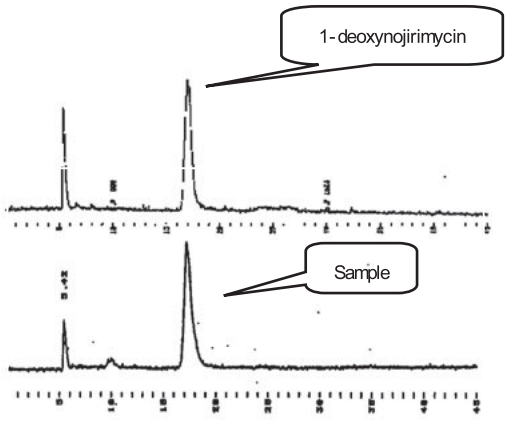


Fig. 3. HPLC Analysis.

rise of blood glucose levels using the Chinese traditional fermented food Okara was analyzed in the early stage of diabetes in this study. In the research, we confirmed that the Chinese traditional fermented food Okara has a strong α-glucosidase inhibitory activity.

The *Bacillus subtilis* (*Bacillus subtilis B2*) from the Okara produced an inhibitory activity of α-glucosidase in the culture supernatant (Fig.1). The Bacillus subtilis grew well even in soy flour and starch aside from Okara. And strong α-glucosidase inhibitory activity was shown in the medium which included the soybean component. Significantly, the α-glucosidase inhibitory activity became greatest at around 10% of ethanol fraction by liner gradient of 5 — 30 % ethanol on active charcoal column chromatography (Fig. 2). Furthermore, this active fraction was fractionated by cation exchange chromatography (CM - Sepharose) and the inhibitory activity fraction was greatest at about pH 3.7. The active component was identified as 1-deoxynojirimycin (DNJ) from the result of the HPLC (TSKgel amide-80, CH_3CN:H_2O) analysis of the standard compound (Fig.3). Also, as a result of the mass spectrometry performed on this active fraction, the molecular ion peak of molecular weight 164 was detected and the active compound identified as DNJ from the NMR data (Fig. 4). From the above results, the α-glucosidase inhibitor produced by B. subtilis B2 was positively identified as DNJ. The *Bacillus subtilis B2* derived from this Chinese traditional food is a type of bacterium that grows well on even a standard medium or starch only, and it is assumed that the action which reduces the activity of α-glucosidase is produced at the same time. The bacterium can be applied to other fermented foods and the development of anti-diabetic foods using the bacterium is being looked forward to.

(K. Yamaki, Y.-P. Zhu [China Agricultural Univ.], M. Ohnishi-Kameyama [National Food Research Institute] and T. Yoshihashi)

Sample

13C	1H	J (Hz)
78.894	3.530 t	9.3
70.454	3.611 t	10
69.632	3.796 m	
62.614	3.208	
60.35	3.955 dd	12.8 3.1
	3.895 dd	12.7 5.2
48.533	3.505 t	12.4
	2.982 t	12.1

DNJ

13C		1H	J (Hz)
79.008	C-3	3.515 t	9.9
70.65	C-4	3.592 t	9.9
69.837	C-2	3.782 m	
62.642	C-5	3.184 m	
60.547	C-6	3.953 dd	12.7 2.9
		3.878 dd	12.6 5.3
48.676	C-1	3.508 t	12.7
		2.959 t	12

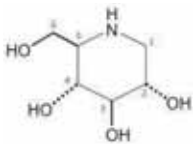


Fig. 4. Nuclear Magnetic Reasonance (NMR) Analysis (Sample, Standard DNJ).

Seed production technique of indigenous prawn *Macrobrachium yui* in Laos on the basis of primary life-history traits

An indigenous prawn, *Macrobrachium yui*, inhabits the tributaries of the Mekong River in Northern Laos, and is a major source of cash income for farmers living in the river basin. In the research, we developed a new seed production technique for the prawn *M. yui*. This species has the same free swimming zoeal larval stage as other amphidromous species and live in the cave streams throughout their larval stage. In our experiment, the floating larvae developed and started to settle on the aquarium bottom at a high survival rate under rearing water condition of 3.5ppt artificial seawater. After settling on the aquarium bottom, the larvae needed freshwater as culture water in order to maintain a high survival rate. This indigenous prawn constitutes a major source of cash income for farmers living in the river basin because of its being traded at a high market price. Recently however, a decline in prawn catch has decreased the cash income of the farmers. The development of a better aquaculture technique is expected to be one of the efficient stock conservation measures for this prawn. However, the biological and ecological characteristics of the prawn have only been scarcely revealed, not to mention that there has been little success in the development of an improved seed production technology. The observed migratory behavior of the adult prawn which migrates from the main river to the cave streams predicted the existence of specific characteristics at the larval stage, and has become a clue to the development of an improved seed production technique for this prawn. We performed the experiments on seed production of the prawn while trying to gain understanding of its life-history traits under artificial culture or rearing and natural conditions.

Although the males and females of the prawn *M. yui* were reared in the tank separately, the females were able to brood fertilized eggs, implying that the females had already mated with males. Therefore, we mainly brought females to our laboratory for the experiments on seed production. Although females brood eggs all year round under artificial culture condition, the percentage of oviferous females becomes highest in June-July and November-December. The clutch size and egg size of the prawn *M. yui* fall into the category of those of land-locked species (Fig. 1). However, the morphology of the larvae approaches that of the adult after metamorphosis through the free swimming larval stage (Fig. 2). This developmental pattern is the same as that of the amphidromous species. The water of the cave stream where the prawn lives in during its free swimming larval stage indicates high electric conductivity and contains slight salinity. Amphidromous prawns which have the same short zoeal stage as the prawn *M. yui* can successfully pass through its larval stage at 10ppt salinity concentration. On the basis of these observations, we carried out the experiments on culturing the larvae of the prawn *M. yui* using artificial saline water of four concentrations such as 10.5, 3.5, 1.7, and 0 ppt. Based on the results, when 3.5ppt artificial saline water was utilized as the culture water, the survival rate of the larvae was steadily high until they settled to the tank bottom (Fig. 3). When we continued using 3.5ppt artificial seawater as rearing water after the larvae of the prawn had already settled to the tank bottom, their survival rate decreased. However, if we changed the rearing water from 3.5ppt artificial seawater into freshwater after the larvae had settled down to the bottom, the larvae grew into juvenile prawns at a higher percentage (Fig. 2

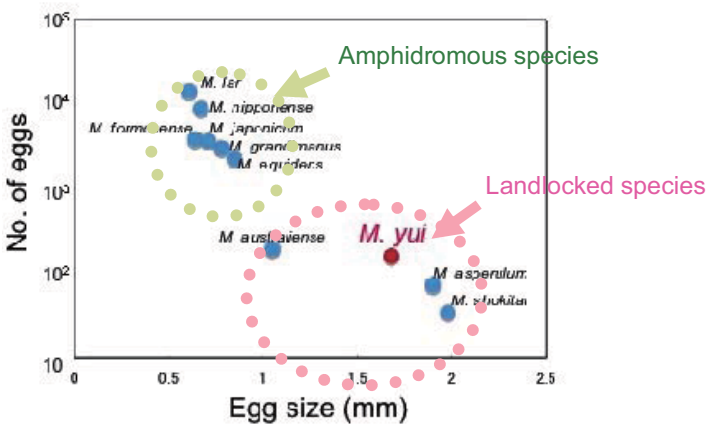


Fig. 1. Clutch size and egg diameter in *Machrobrachium* species. (Green dotted circle: amphidoromous species; Pink dotted circle: land-locked species).

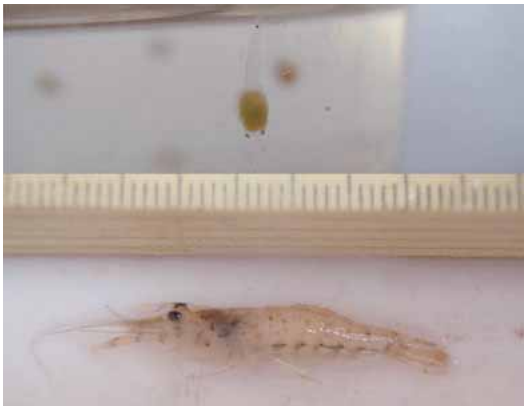


Fig. 2. (Above) Free swimming larva just after the hatching of the land-locked prawn *Machrobrachium yui*; (Below) Juveniles of the prawn *M.yui*, 180 days after hatching.

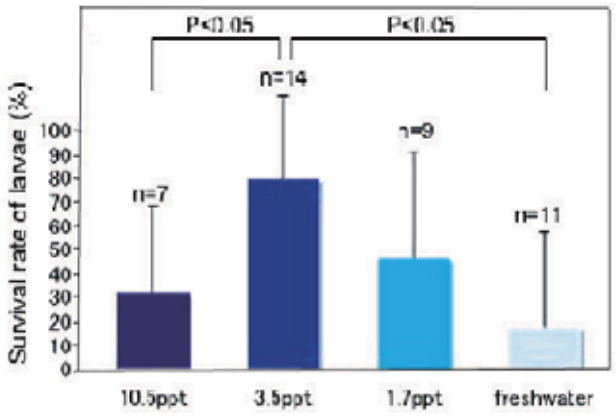


Fig. 3. Survival rate of the free swimming larvae (zoea) until they start to settle at the bottom under four salinity concentrations.

Fig. 4. Transition of the survival rates of the larvae (post-larvae) after settling to the bottom in the case where the rearing water was changed to freshwater and in the case where 3.5 ppt artificial seawater was maintained as culture water.

(lower picture), 4).

An intensive aquaculture of the prawn *M. yui* is not suitable for the farmers living in the river basin because of the backward infrastructure. On the possibility of a complete extensive aquaculture of the prawn, we should judge whether it is feasible or not on the basis of the characteristics of the aquatic ecosystem in the aquaculture site. The seed production technique of the prawn can be applied to the seed release activity of the prawn. Then, we should conduct the seed release in consideration of the impact to the natural population of the prawn. Moreover, we need to study the best growth stage for the seed release on the basis of its biological and ecological characteristics. The fertilized eggs of the prawn often drop down from the female abdomen during the brooding period. In order to get more larvae from one oviferous female, we need to develop a management technique for the parental prawn in the future.

(S. Ito, O. Lasasimma [Living Aquatic Resources Research Center, Lao PDR], P. Souliyamath [Na-Luang Fisheries Station, LuangPrabang Provine, LaoPDR])

TOPIC 11

Intensive seed production of two Anabantoidei indigenous freshwater fishes in Laos

In Laos, fish aquaculture has been recently promoted due to the necessity of enhancing the overall national food productivity, and its production relatively increased within the last decade. However, the majority (>80%) of aquacultural production is dependent on the alien fish species (e.g., the tilapia and African catfish), and their invasion of the environment is now a strong concern. Accordingly, the aquacultural utilization of indigenous fish species is further required in the aspects of conservation of regional fish diversity and sustainable development of aquaculture, but this has scarcely been undertaken except for limited species (e.g., *Barbonymus gonionotus*) in the country so far because of insufficient technical information and studies on larval rearing and mass-production of small zooplankton as initial diets for fish larvae. With this background, biological information, which includes sexual maturation and spawning of two Anabantoidei fishes (*Anabas testudineus and Trichogaster pectoralis*), that are highly in demand as edible fish resources in the region, has been investigated, and the mass-production of freshwater rotifer (*Brachionus* spp.) has been attempted in order to develop locally adaptable techniques for their seed production in the present study.

By injecting hormone into broodstocks, the fertilized eggs are semi-artificially obtainable in these two species. As initial diet for their larvae, the freshwater rotifer (*Brachionus* spp.) was artificially cultured in mass quantity using mono-cellular green algae (*Chlorella* spp.) as diet for the rotifer. The algae were also

artificially cultured using locally available common agricultural fertilizers (N:P:K = 15:15:15)(Fig. 1). In addition, it is considered that A. *testudineus* has a prolonged breeding potential almost throughout the year based on the results of the long-term breeding trial by hormone injection from May, 2007 to February, 2008 and the occurrence of wild juveniles almost throughout the year. The growth rates of the two species under laboratory condition and their morphological / behavioral changes in growth as investigated in the present study (Fig. 2) are the contributory information useful towards improving their seed productivity. In larval and juvenile *A. testudineus*, intensive cannibalism occurred when their size reached over 5 mm SL. At the onset of cannibalism, the difference in size between the preys and the predators became over 1 mm, and cannibalism is more intensive under poor feeding condition (Fig. 3). Based on these observations, the size-separated culture and feeding management techniques (maintaining high feed density) are efficient in reducing the incidence of cannibalism.

Since both species are air-breathing species, culture at high density without aeration is possible. This feature indicates the applicability of their aquaculture for small scale farmers that do not possess large -scale culture ponds. Although *A. testudineus* possesses the prolonged breeding potential, the most sustainable period for its seed production is considered to be from May to October because of its lower limit of water temperature requirement being approximately 22.0℃. The diet cost is expected to be higher in the aquaculture of *A. testudineus* due to the requirement of high protein level in its diet, since the species is highly carnivorous. Accordingly, the development of an economical diet is indispensable. By contrast, *T. pectoralis* is omnivorous and the low protein level requirement in its diet is useful. This difference in dietary cost suggests the latter to be more suitable for the extension of the aquaculture technique to small scale farmers.

(S. Morioka, B. Vongvichith and L. Phounvisouk, [Living Aquatic Resources Research Center, Laos])

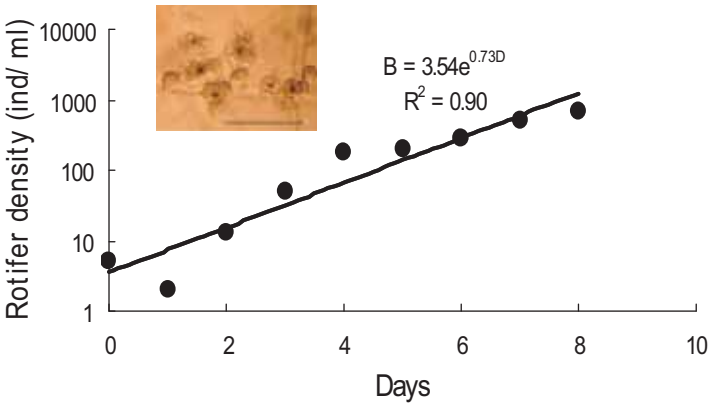


Fig. 1. Mass-cultured rotifer (Photo, scale bar: 0.5 mm, and increase in its density).

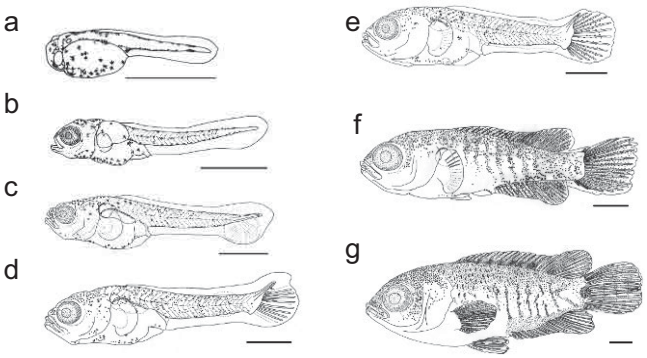


Fig. 2. Anabas testudineus larvae and juveniles of 0-day (a), 2-days (b), 5-days (c), 7-days (d), 11-days (e), 16-days (f) and 35-days (g) after hatching (scale bar: 1 mm).

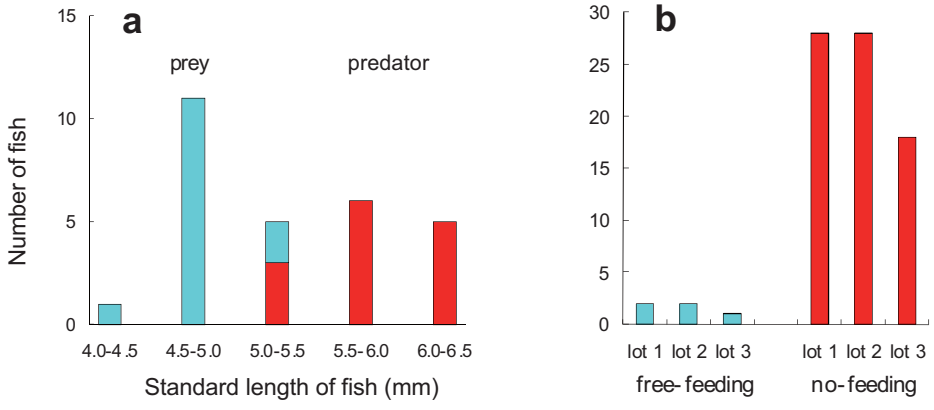


Fig. 3. a: Difference in sizes between prey and predator at onset of cannibalism (12-days after hatching, mean standard length 5.2±0.6 mm) in A. testudineus larvae, b: Difference in cannibalism incidences between free- and no-feeding conditions.

Theme A-2 Development of management technologies of environmental resources and production systems for sustainable agriculture, forestry and fisheries

The natural resources that are the foundation of agriculture and forestry have begun to show signs of deterioration worldwide due to inadequate management and excessive use of agricultural inputs. We therefore need to develop systems for production management that focus more on social and economic conditions, which would enable the systems to be adopted and utilized in the target countries; systems for controlling soil nutrients and water conditions to make them suitable for sustainable production in tropical, subtropical, arid, or semiarid regions; and systems for production management by combining agriculture and animal industry in various ways and by improving individual production methods. To accomplish the effective use of natural resources and development of systems for sustainable production management by combining various practices in agriculture, animal husbandry and forestry, we have launched studies on the optimization of soil, water, and crop management for agricultural, grazing, and forested lands as well as islands.

Major outcomes accomplished in 2008 include:

- In semi-arid regions of Africa with sandy soils, basic research for technology development using experimental fields is almost complete, and the project has moved to the stage of focusing more on demonstrations at the project site of the developed technology. In intensive agricultural areas in Southeast Asia, significant progress was made on simulation of yield and soil carbon using cumulative data from long-term field experiments.
- In water-saving rice cultivation, development of breeding materials and their genetic analysis using near-isogenic lines has further progressed, and the relationship between water and soil management under water-saving conditions has been evaluated. In rainfed agriculture, a simple tool that can be easily operated by local farmers has been developed to make an annual plan for utilization of water in a small pond for a variety of farm operations. This tool is anticipated to make a significant contribution to the project goal, which is diversification of cropping options through effective use of water resources.
- In a study on the development of a sustainable agropastoral system in dry areas of Northeast Asia, grazing experiments with ruminants were started in Mongolia, and investigations of livestock farming policies, economic conditions of herders' households, and the state of grassland usage, etc., were carried out in China and Mongolia. The metabolizable energy (ME) requirement of Brahman steers for maintenance in Thailand was estimated to be 456.8 kJ/kgBW0.75. This value is similar to that of Japanese black steers raised according to Japanese feeding standards.
- In research on biological nitrification inhibition (BNI), two BNI compounds excreted from sorghum roots were identified and genotypic differences in BNI activity in rice were further confirmed through improvement of analytical accuracy. It was also shown that BNI compounds from Brachiaria humidicola have little effect on the population of major microbes in soils.
- It was discovered that non-tilling cultivation reduced soil erosion on sloping fields in the Philippines, the same as on Ishigaki Island. We also found that the mangrove swamps surrounding the mouth of the Miyara River on Ishigaki Island retain 90% of the nitrogen and phosphate carried in the river water.
- Experimental results showed that the self-fertilization rates of the mother trees of Shorea curtisii were considerably higher in selective logged forest than those in natural forest. This evidence indicates that reduction of adult tree density by selective logging was the main factor in the increased self-fertilization rates of mother trees in the selective logged forest.
- We established that cut-back pruning and thinning of primary scaffold limbs in durian brings forward the fruit-bearing age, and girdling the trunks of mangosteen speeds flower bud emergence.

As a whole, the projects under this theme have progressed steadily as planned. Progress with the themes can be summarized by noting that installation of a monitoring system to measure the various items needed for the projects has been completed and accumulation of data has started. The most notable research highlights have been produced by projects related to soil and livestock management: specifically, the development of a method to estimate the available forms of soil organic nitrogen, a mega-database for the project site, a tool to capture soil blown in by wind erosion,

and estimation of the metabolizable energy requirements of Brahman steers.

TOPIC 1

Development of extension system and improvement of the fuel block utilizing livestock droppings and waste coal powder in Mongolia

Mongolian nomads traditionally use the droppings of large livestock, aside from wood, as fuel materials. But, as the number of livestock decreased in 2000 and 2001 due to cold weather damage, fuel scarcity occurred due to the shortage of the fuel material. And, widespread deforestation occurred due to the illegal cutting of trees for use as fuel source. Therefore, other supply resources for fuel material are needed. In addition, to increase the income of the nomads, the manufacture of the fuel block which utilizes large livestock droppings, coal powder and saw dust for trading in the market is suggested. But, the fuel block is not acceptable in the market due to its unstable quality and insufficient technology. Consequently, improvement of the fuel block as well as development of an extension system for its distribution are needed.

To increase the fuel block production, small animal droppings were substituted for the large livestock droppings which have become limited in availability as raw materials. The fuel block technology was improved by mixing with industrial waste coal powder and adding of cow droppings as adhesive. The remaining coal powder which can not be used up by the boiler is generated as industrial waste at 20 — 30% of total coal weight. The ideal compounding ratio of the small animal droppings and coal powder was determined to be 4,500 kcal/kg, since the gel stove in Mongolia has an average heat resistance performance of 5,000 kcal/kg.

To construct the fuel block with stable and suitable quality, a manual and introductory video of its manufacturing technology were created, and the distribution was carried out by the prefectural administration to residents in the districts and to the nomads. Then, the government devised a system wherein it provides the nomads with coal powder gratuitously and also purchases the fuel blocks directly. In the meantime, it became necessary to scrutinize the prices of fuel blocks in the area and to set up appropriate selling prices. This direct purchasing of the fuel blocks by the government resulted in demand only for small size storage spaces of the fuel block for self-sufficiency and the nomads no longer need large storage spaces. This system was introduced into the "FY 2009 Socio-Economic and Community Development Basic Plan" of Uvurkhangai Prefecture, and it is being carried out in schools in 7 villages, in a kindergarten for example, etc.

This system provides incentives to the government in the form of reduction in the amount of coal use since recycling of industrial waste coal powder can be implemented; improvement in the nomads' income and as countermeasure against illegal cutting of trees for use as fuel material resulting in forest preservation leading to environmental conservation.

(K. Kimura and T. Matsumoto)

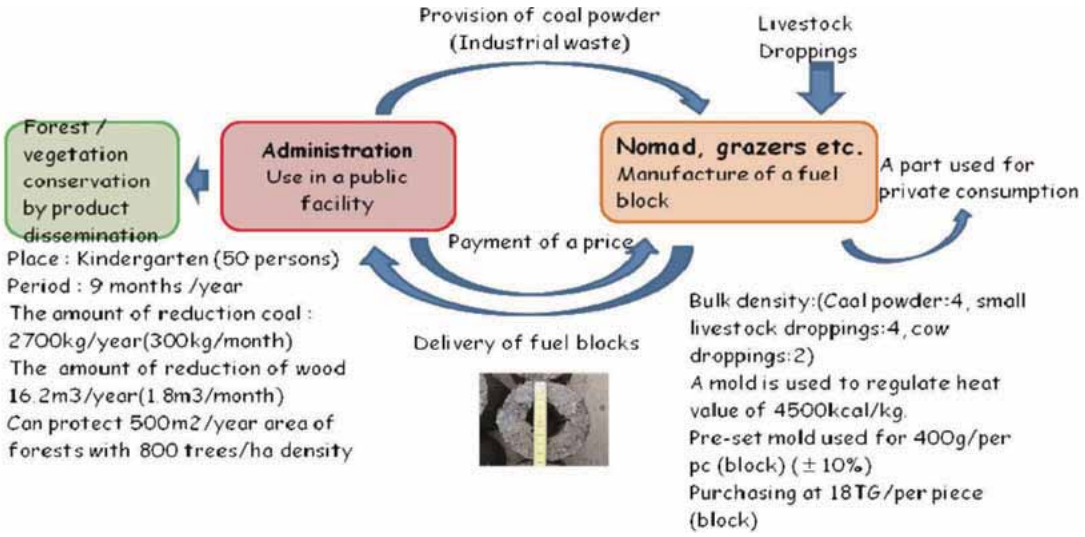


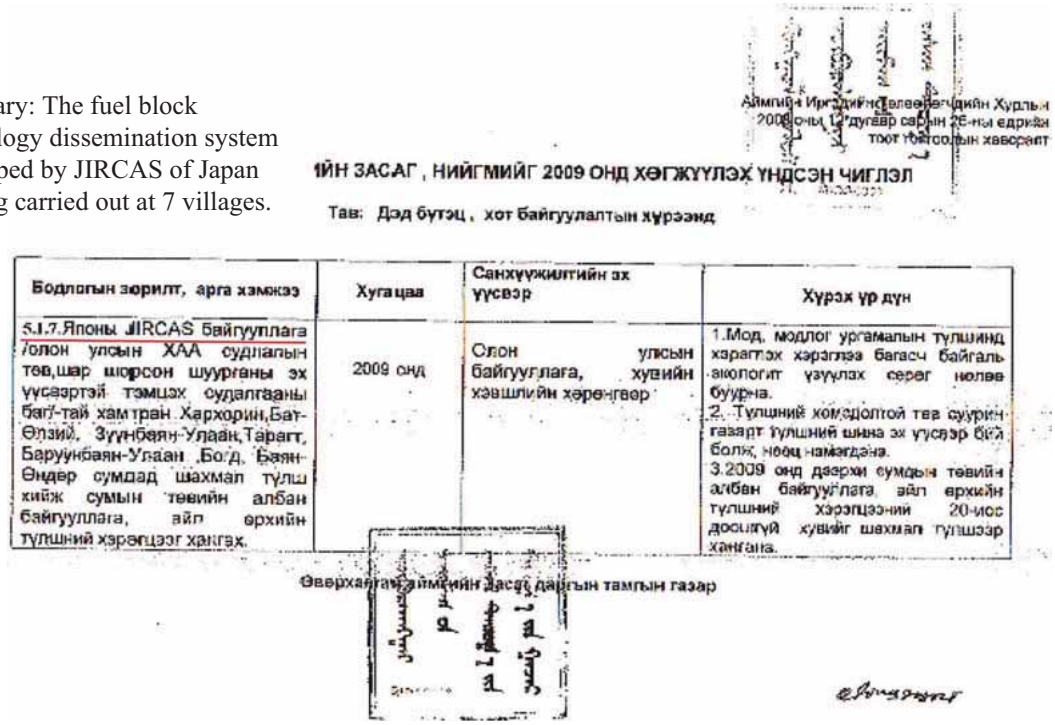
Fig. 1. Fuel block technology dissemination system concept.

Changes before and after the introduction of the system
Benefits for Nomads: 1) Income augmentation with an average of 20,000 TG, and 2) Stable maintenance of fuel supply.
Benefits for the Government/Administration: 1) Wood purchase expenses reduction of 120,000 TG/month (kindergarten) and 2) Reduction of coal powder disposal expense.

Photo 1. Before fuel block introduction.

Photo 2. After fuel block introduction.

Summary: The fuel block technology dissemination system developed by JIRCAS of Japan is being carried out at 7 villages.



Аймгийн Иргэдийн төлөөлөгчдийн Хурлын
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тогтоолын хавсралт

1ЙН ЗАСАГ , НИЙГМИЙГ 2009 ОНД ХӨГЖҮҮЛЭХ ҮНДСЭН ЧИГЛЭЛ

Тав: Дэд бүтэц , хот байгуулалтын хүрээнд

Бодлогын зорилт, арга хэмжээ	Хугацаа	Санхүүжилтийн эх үүсвэр	Хүрэх үр дүн
5.1.7.Японы JIRCAS байгууллага тэлон улсын ХАА судлалын төв,шар шорсон шуураны эх үүсвэртэй тэмцэх судалгааны бааз-тай хамтран Хархорин,Бат-Өлзий, Зүүнбаян-Улаан,Тараат, Баруунбаян-Улаан ,Богд, Баян-Өндөр сумдад шахмал түлш хийж сумын төвийн албан байгууллага, айл өрхийн түлшний хэрэгцээг хангах.	2009 онд	Олон улсын байгууллага, хувийн хэвшлийн хөрөнгөөр	1.Мод, модлог үрэмалын түлшинд хэрэглэх хэрэглээ багасч байгаль экологит үзүүлэх сөрөг нөлөө буурна. 2. Түлшний хомсдолтой төв суурин газарт түлшний шинэ эх үүсвэр бий болж, ноёц нэмэгдэнэ. 3.2009 онд дээрх сумдын төвийн албан байгууллага айл өрхийн түлшний хэрэгцээний 20-иос дооштүй хувийг шахмал түлшээр хангана.

Өвөрхангай аймгийн засаг даргын тамгын газар

Fig. 2 Uvurkhangai Aimag/ Prefecture "FY 2009 Socio-Economic and Community Development Basic Plan".

TOPIC 2

The "Fallow Band" System: A proposed new low-input technology option contributing both to the prevention of desertification and the increase of pearl millet yield in the Sahel, West Africa

Wind erosion is a major cause of the spreading desertification in the Sahel region of West Africa. Our previous studies showed that wind erosion induces the loss of a significant amount of relatively fertile materials from the surface of crop fields. We have also revealed that the wind-eroded soil materials can be captured by leeward herbaceous fallow vegetation. With application of these findings, we have developed a new agricultural practice, called the "Fallow Band" system, for combating the expansion of desertification in the Sahel.

The outline of the "Fallow Band" system in a temporal sequence of land use is shown in Fig. 1. (A) Five -meter-wide fallow bands are arranged at a right angle to the direction of erosive storms (East wind) in a cultivated field during the rainy season. Then fallow bands can be easily created by skipping the usual seeding and weeding. Crops (pearl millet) are cultivated in other areas of the field in a conventional way. The fallow bands are also maintained in the next dry season, so they are expected to catch wind-blown materials containing a lot of nutrients. (B) In the next rainy season, new fallow bands are

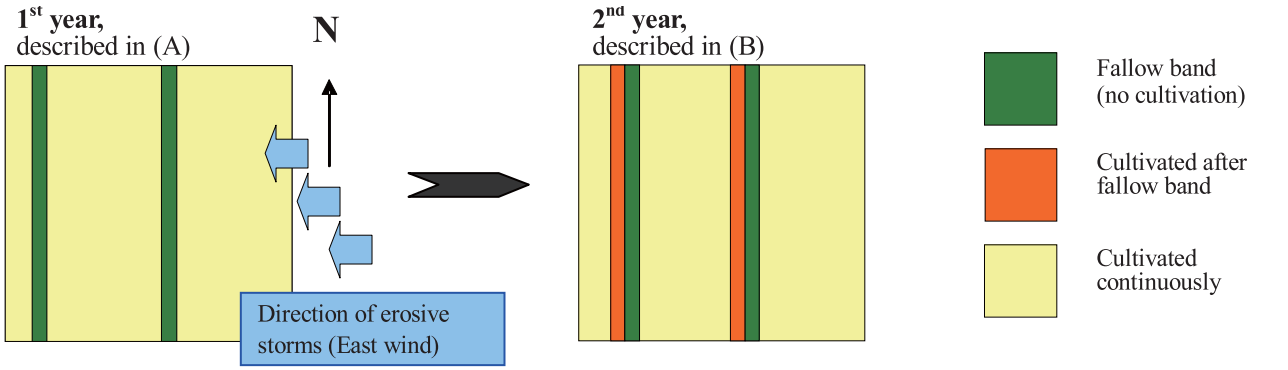


Fig. 1. Outline of the "Fallow Band" system with temporal sequence of the arrangement of fallow bands and cultivation areas.

made aside from the former bands toward the direction of the wind. Vegetation on the previous fallow bands are cleared away and crops are cultivated on it as well as in other areas of continuous cultivation. (C) Repeat (B) every year.

The "Fallow Band" system was actually applied to farmers' pearl millet fields in Katanga Village, Koro Prefecture, Niger (Photo 1), and its effects on prevention of wind erosion and on improving the millet yield were evaluated. The results were shown as below: i) The efficiency of a fallow band to capture wind-blown soil materials was estimated to be 74%. ii) Millet yield on the former fallow bands was higher when the spacing between the bands was widely arranged (Fig. 2). iii) The positive effect of fallow bands on millet yield continued at least two years after clearance of the vegetation (data not shown). iv) Based on the data described in i), ii) and iii), and assuming that the effect continues no longer after the third year, the ratio of yield increase was simulated as functions of the field size (E-W length) and the band spacing (Fig. 3). On a whole field basis, the yield was estimated to be increased by 36% (small field) to 81% (large field) as compared with the area not applied with the "Fallow Band" system. v)

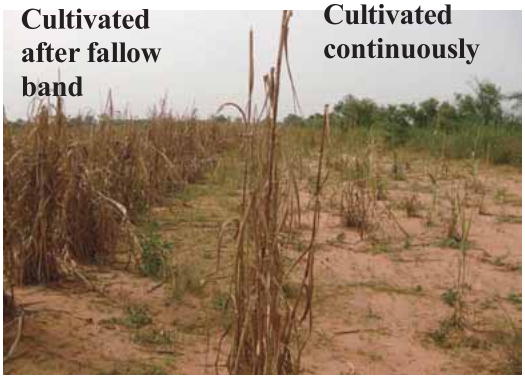


Photo 1. A view of the pearl millet field applied with the "Fallow Band" system at harvest. Left row: Cultivated after one year fallow band, Right row: Cultivated continuously.

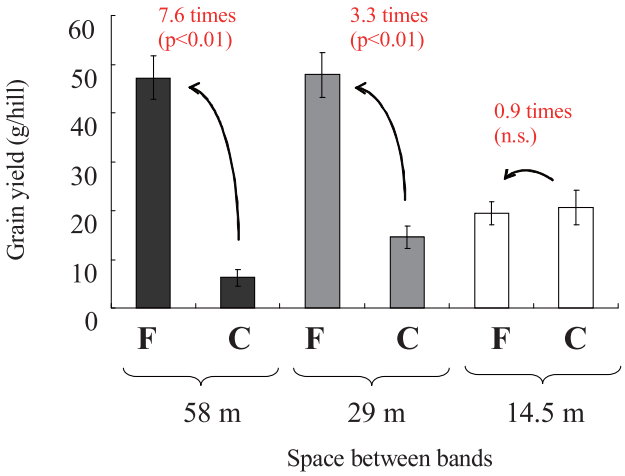


Fig. 2. Grain yield of pearl millet cultivated on the previous fallow bands (F) of different spacing, as compared with that cultivated continuously (C).

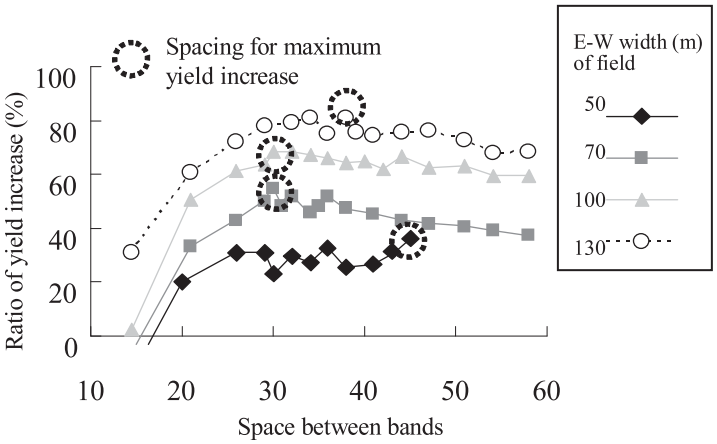


Fig. 3. Simulated results on the ratio of yield increase on a whole field basis as functions of the width of the field and the fallow band spacing applied. Theoretical maximum yield increase was indicated in each width of field.

Also, wind erosion was reduced by 52% (small field) to 80% (large field) on a whole field basis with application of the system (data not shown).

A quantitative evaluation showed that the "Fallow Band" system can be useful both for the prevention of desertification and the increase of pearl millet yield in the Sahel, West Africa. It is worthy to note that this novel practice does not impose any additional labor, resource or money requirements on the local farmers.

(K. Ikazaki, H. Shinjo, U. Tanaka and, S. Tobita)

TOPIC 3

Crotalaria is effective against nematode damage of chili in Southeast Asia

Production of chili or hot chili (*Capsicum spp*.) is widespread for greengrocery and processing purposes in tropical countries such as Thailand, which has a cultivation area of approximately 23,840 hectares, as of 2007. In the northeast part of Thailand, however, farmers suffer from considerable yield reduction because of the damage caused by the nematodes, *Meloidogyne incognita* (Fig. 1) and they are forced to plant other crops in their fields or stop growing the chili. We aimed at evaluating the effectiveness of crotalaria in order to formulate practical measures to mitigate the damage caused by *M. incognita* in tropical areas. Crotalaria has been proven to be effective in controlling nematode in temperate areas, but there is not enough evidence to show its effectiveness in tropical areas.

Fig. 1. Chili root system infected by the southern root knot nematode.

Concrete pots were filled up with nematode-contaminated soil and tomato was cultivated for two months to increase the number of nematode *Meloidogyne incognita*. In the rotation treatment, three species of crotalaria (*Crotalaria juncea*, *C. breviflora*, and *C. spectabilis*) were sown and incorporated into the soil after the flowering stage (50-60 days after seeding), and then one-month-old seedlings of chili were transplanted. In the mixed cropping treatment, the one-month seedlings of three crotalaria and chili were transplanted. In the fallow-chili treatment, one-month seedlings of chili were also transplanted. Results showed that crotalaria was highly effective for controlling nematode infection on chili. Each of the three species was proven equally effective. But, the mixed cropping of crotalaria and chili was not able to control the infection of nematode (Fig. 2).

The *C. juncea*, sesame, peanut, marigold and chili were incorporated into nematode-contaminated soil in concrete pots followed by the cultivation of tomato for two months, and then one-month-old seedlings of chili were transplanted. Results showed that crotalaria was the most effective to control the infection by the nematodes (Fig. 3).

In the field experiment at Ubon Ratchathani, *C. juncea* was found to be remarkably effective in controlling the nematode infection, since the number of root knot nematodes was reduced

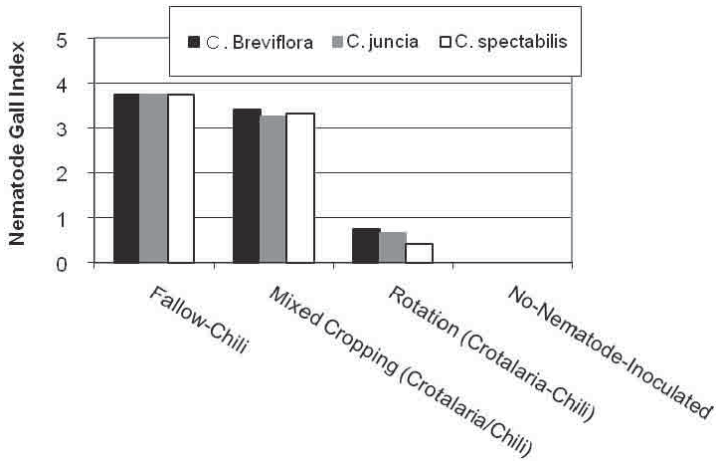


Fig. 2. Effect of crotalaria in suppressing the southern root knot nematode damage in chili plants.
Nematode gall index: no gall (0), a few galls per plant (1), galls in less than 1/4 of root system (2), galls in 1/4-1/2 of root system (3) galls in 1/2-3/4 of root system (4), and galls in more than 3/4 of root system (5).

(Fig. 4).

For use of this method, it is necessary to seed crotalaria in a relatively high density and grow it until the flowering stage to secure sufficient biomass. Although *C. juncea* is generally used as a green manure crop in Thailand, it is sometimes hard to obtain its seeds because of insect damage in the flowering period. In addition, both *C. breviflora* and *C. spectabilis* should only be utilized after their cultivation characteristics are fully confirmed.

Because crotalaria has high efficiency as green manure, it is expected not only to reduce chemical fertilizer use but will also lead to mitigation of nematode infection.

(S. Miyata, N. Tangchitsomkid and S. Maneckao)

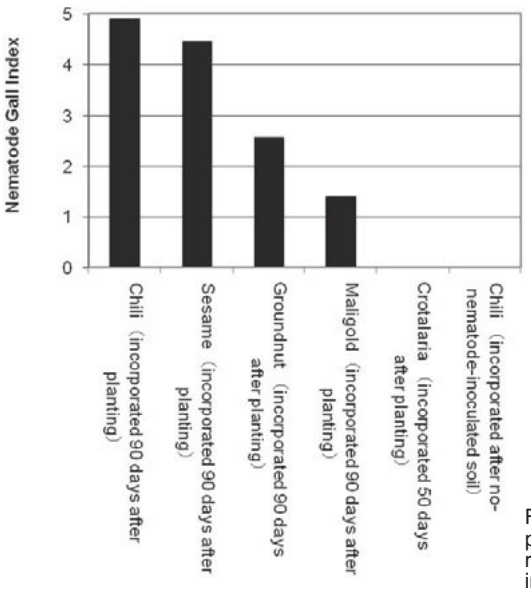


Fig. 3. Effects of various crops grown prior to chili in suppressing the southern root knot nematode damage (Gall indexes are the same as those in Fig. 2.).

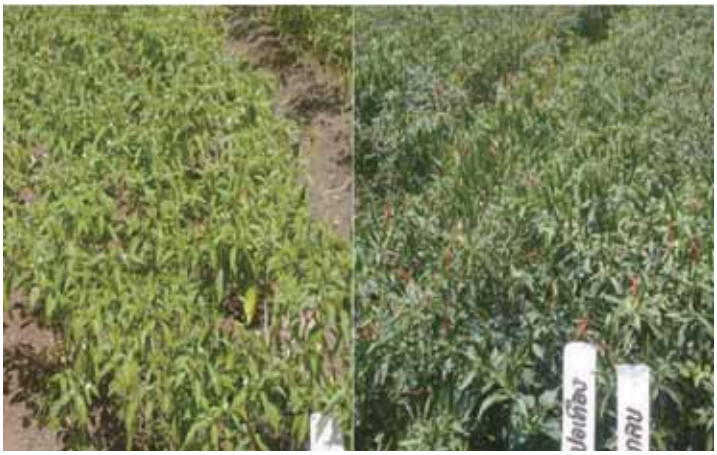


Fig. 4. Chili fields after fallowing (left) and growing and incorporating crotalaria plants (right).

TOPIC4

Fine mapping of a low tillering gene of rice

Tillering in rice is one of the most important traits related to yield and useful for understanding the plant's morphogenesis. In Japan, a low tillering variety, Aikawa 1, was developed and considered as a useful breeding material for yield improvement under certain conditions such as direct seeding cultivation. The low tillering characteristic in Aikawa 1 has been reported to be controlled by a single dominant gene, Ltn, on the long arm of chromosome 8. The objectives of this study were to develop a less tillering line with the genetic background of an elite tropical variety, IR64, by recurrent backcross breeding, and to find DNA markers tightly linked to Ltn for marker-assisted selection (MAS).

As a result of linkage analysis using 94 plants of BC_5F_2 population (IR64/Aikawa 1//5*IR64), genetic distances between ssr5816-3 and A4765, ssr5816-3 and the Ltn, and the Ltn and A4765 were ascertained as 6.9 cM, 1.7 cM, and 5.1 cM,

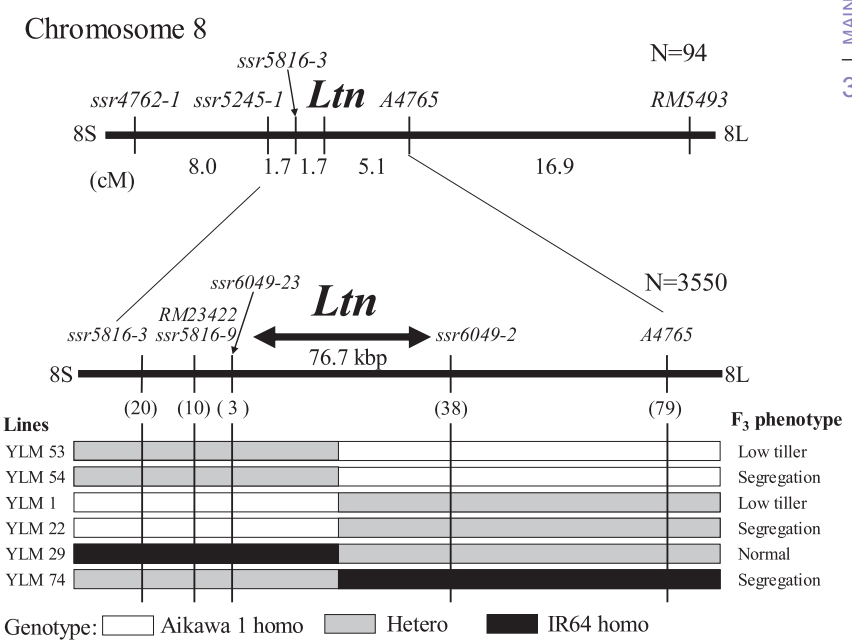


Fig. 1. High resolution mapping of a low tillering gene, *Ltn*, on the long arm of rice chromosome 8.
The numbers inside the parentheses indicate the number of recombinant plants between the marker and *Ltn*.

respectively (Fig. 1). Based on the results of high-resolution mapping using 3,550 plants of BC_5F_3 population, the candidate region of the Ltn was specified between ssr6049-23 and ssr6049-2 and was located at 76.7 kbp on the Nipponbare genome sequence. (Fig. 1)

This marker information is useful for conducting MAS for low tillering rice varieties. Low tillering lines with the genetic back ground of IR64 are useful breeding materials which are fully adapted to tropical conditions.

(N. Kobayashi, D. Fujita [IRRI], L. A. Ebron [IRRI], Y. Fukuta)

TOPIC 5

Abiotic factors cause gradual yield decline under continuous aerobic rice cultivation

The aerobic rice (AR) water-saving system, characterized by non-puddling, aerobic soil conditions and higher yield as compared to the conventional upland rice system, has been developed under the leadership of the International Rice Research Institute (IRRI). However, an underlying risk in continuous cropping which leads to gradual yield decline has been a major obstacle for dissemination. To cope with this, it has been examined mainly from the angles of disease and insect damages, but other cases that can not be explained only from these viewpoints have been observed. The phenomenon of the gradual yield decline was also found at field plots of the IRRI Farm where AR has been cultivated continuously for 10 cropping seasons and it did not appear to be due to any damage caused by diseases and insect pests. But it was unclear whether there existed significant abiotic factors in the phenomenon. Hence, we hypothesized that there existed abiotic factors causing the continuous cropping yield decline risk and examined the hypothesis through a pot experiment using the continuous AR cultivated soil from IRRI.

From field plots under the following two treatments, where only the water management had been modified for 10 cropping seasons since 2001, 0.2 m-deep undisturbed top soils were collected with PVC tubes (0.2-m i.d.). "Continuous cultivation" (CC): continuous AR-cultivation where the gradual yield decline (Fig. 1) was observed (with 50-mm irrigation when soil water tension at 0.15 m-deep soil dropped to -30 kPa during the cropping season, most especially higher to -10 kPa during the flowering period); "Incontinuous cultivation" (IC): incontinuous AR-cultivation where yield decline was not observed (a continuous flooding treatment during cropping seasons except those in year 2004). Immediately after soil collection, the PVC tubes were directly processed into cultivation pots, and then the soils received the following two treatments: 'Heat treatment' (HT): a 24-h heat treatment under 95-98 ℃; 'Chemical treatment' (CT): applied 3 and 1 mg carbofuran (a nematocide) and benomyl (a fungicide) per pot 7-day after transplanting (DAT), respectively. Three 14-day-old Apo seedlings were transplanted into the center of each pot and cultivated under the same AR cultivation environment (kept flooding for 12 DAT and 450-ml irrigation per pot every four days on and after 21 DAT; applied N, P, K and Zn at a rate of 157, 188, 126 and 16 mg per pot at -1 DAT, respectively, and N at a rate of 157 mg per pot at 33 DAT). All were performed with four replications. In terms of major soil properties (pH, organic C, total N, Olsen P, exchangeable K, CEC and texture), no significant difference ($P < 0.05$) was observed between the two soils at the beginning of both the field experiment and this pot experiment, except pH (7.1 + 0.0 and 6.8 + 0.2 (mean + SD) at CC and IC, respectively) and Olsen P (29.7 + 1.5 and 24.0 + 1.0 mg kg-1 at CC and IC, respectively) found at the beginning of this pot experiment. No disadvantage for plant growth was found in the soil-water conditions and inorganic N contents (Fig. 2) of the CC pot soils. At HT-CC, rice growth was promoted by the heat treatment due to the increase in the supply of nutrients such as inorganic N (Fig. 2), but it was significantly at a lower level as compared with that of non-treated IC (Fig. 3). The effect of CT, which is commonly

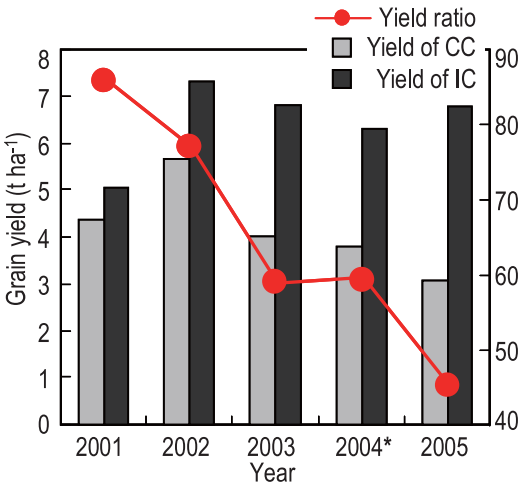


Fig. 1. Yield decline phenomenon observed at continuous aerobic rice (AR) cultivation plots (CC), IRRI. CC: continuous AR cropping; IC: incontinuous AR cropping with continuous flooding management except year 2004* when both dry season (DS) and wet season (WS) croppings were managed under aerobic rice conditions. Each bar indicates the mean value (n = 4) of a DS cropping. This field experiment had been performed since the DS 2001 and the soils for the pot experiment were collected at the harvest time of the WS 2005 after 10-season cropping with double rice cropping a year.

considered effective against nematode and fungi, was also not significant (Fig. 3). Hence, we concluded that some unidentified soil-borne abiotic factors affected the yield decline observed under the AR continuous cropping system.

It was indicated that studies from the viewpoint of healthy soil management are necessary for the practical use of AR. We can not deny the possibility of deficiency of other minerals apart from some micronutrients (Ca, Mg, Mo, B, Zn, Cu, Fe), P and K, that have been examined at IRRI, some mechanism that retards the uptake of N existing in the soil, and/or the effect of changes in soil physical properties, etc. A breakthrough in the dissemination of the AR System may be made possible if we can identify the abiotic factors and develop clear countermeasures using observed phenomena, such that it will lead to the sustainable yield of continuous AR cultivation plots partly restored with the insertion of appropriate submergence field management.

(Y. Sasaki [IRRI, Yamagata University], Y. Hosen)

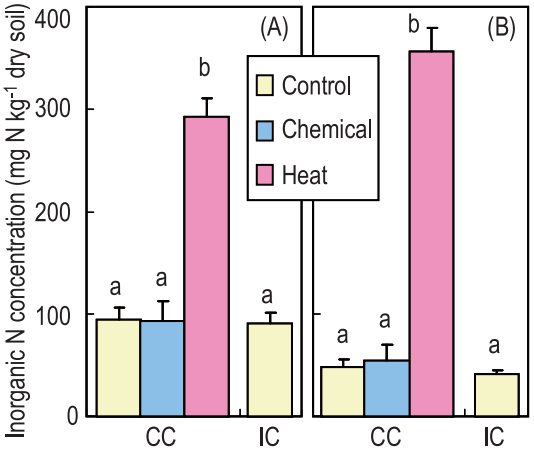


Fig. 2. Inorganic N concentration (ammonium N and nitrate N) in pot soils 17 (A) and 47 (B) days after transplanting. Control: no treatment; Chemical; applied 3 and 1 mg carbofuran and benomyl, respectively, per pot 7 days after transplanting; Heat: a 24-h heat treatment under 95-98 ℃; CC: soil from a continuous aerobic rice (AR) cropping field; IC: soil from an incontinuous AR cropping field. Error bars indicate SEs (n = 4). Means followed by a different letter are significantly different at P < 0.05 (LSD test).

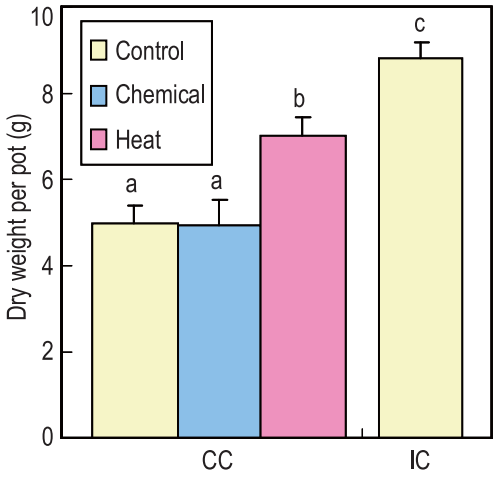


Fig. 3. Aboveground biomass observed 47 days after transplanting (at a panicle initiation stage). Error bars indicate SEs (n = 4). Means followed by a different letter are significantly different at P < 0.05 (LSD test). For abbreviations, see Fig 2.

TOPIC 6

Sustainable groundwater utilization map in the salt-affected area in Northeast Thailand

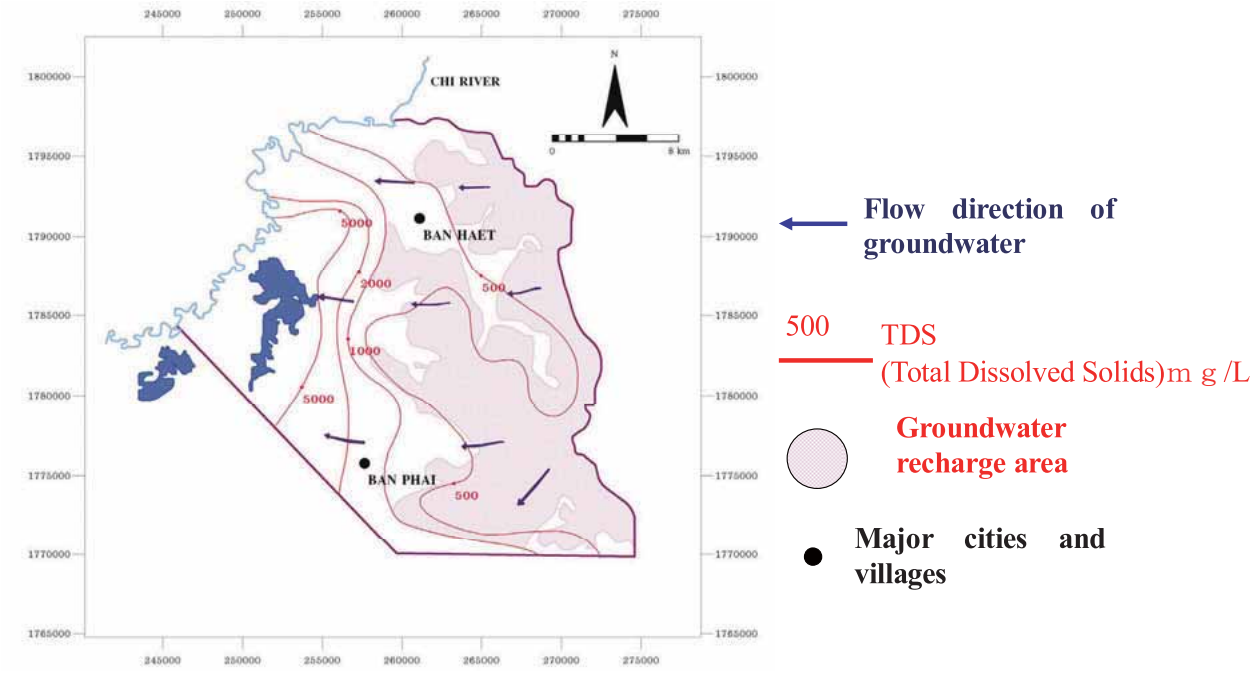
Promoting the alternative utilization of groundwater is among the methods available to mitigate water shortages. Such shortages are a major impediment to agricultural production in Northeast Thailand. In this study, we intended to conduct a survey on the level and quality of groundwater in the part of the Ban Phai Basin which is located in Khon Kaen Province and within which the village of Nong Saeng is located. We will develop a sustainable groundwater utilization map using the distributed groundwater flow simulation model. We hope that this will contribute to the formulation of guidelines for the utilization of groundwater for agriculture.

We selected the Ban Phai Basin in the Khon Kaen Province in Northeast Thailand as our test area. The altitude is high on the east side of the basin and decreases in a westward direction. We conducted our survey following three procedures: (1) Collection of information on soil, terrain, geology and land utilization in addition to the field study; (2) Measurement of the level and quality of the groundwater below the surface in the existing boreholes and newly constructed boreholes; and (3) Calculation of sustainable groundwater utilization using the distributed groundwater flow simulation model. Rainwater that infiltrates the plateau is the main source of groundwater in this area. Extensive amounts of groundwater flow from east to west. Where water discharges to the west, there is a salt-affected area in which the total dissolved solids (TDS) exceed 2,000 mg/L. It will be necessary to construct a system for complete drainage here to prevent salt deposits from accumulating in this area. The groundwater in this area serves only to supplement irrigation in the monsoon season and as cleaning water (Fig. 1). Using the distributed groundwater flow model, we can calculate the groundwater recharge for the entire basin as about 1.82×10^5 m^3 (from Oct. 2006 to Aug. 2007). We defined

usable sustainable groundwater as that which has a TDS below 2000 mg/L and maximum pump displacement below 5 m over the next 10 years. We classified the target basin into four areas based on sustainable groundwater utilization, namely, 0-100, 101-500, 501-1000, and 1001-1500 $m^3/d/km^2$. These cover areas of 108 km^2, 118 km^2, 87 km^2, and 24 km^2, respectively (Fig. 2). In the dry season between January and April, we can grow crops by excavating a well (34 m deep) in the farmland near Chi River (see Fig. 2 for excavation/drilling point of the test well). Areas with more than 500 $m^3/day/km^2$ of sustainable groundwater utilization exist in the central part of the basin. In these areas, groundwater is promising as an auxiliary water source for rice growing in the monsoon season, as well as the water source for other crops in the dry season and for other water uses of the local population.

It is reasonable to believe that if similar procedures of this study are followed, other areas would yield the same information as obtained in this test area. Therefore, our results are applicable as well to groundwater utilization all over the entire area of Northeast Thailand. We used the three-dimensional finite difference groundwater model software (MODFLOW) to

Fig. 1. Groundwater movement in Ban Pau Basin in Khon Kaen province, Thailand.



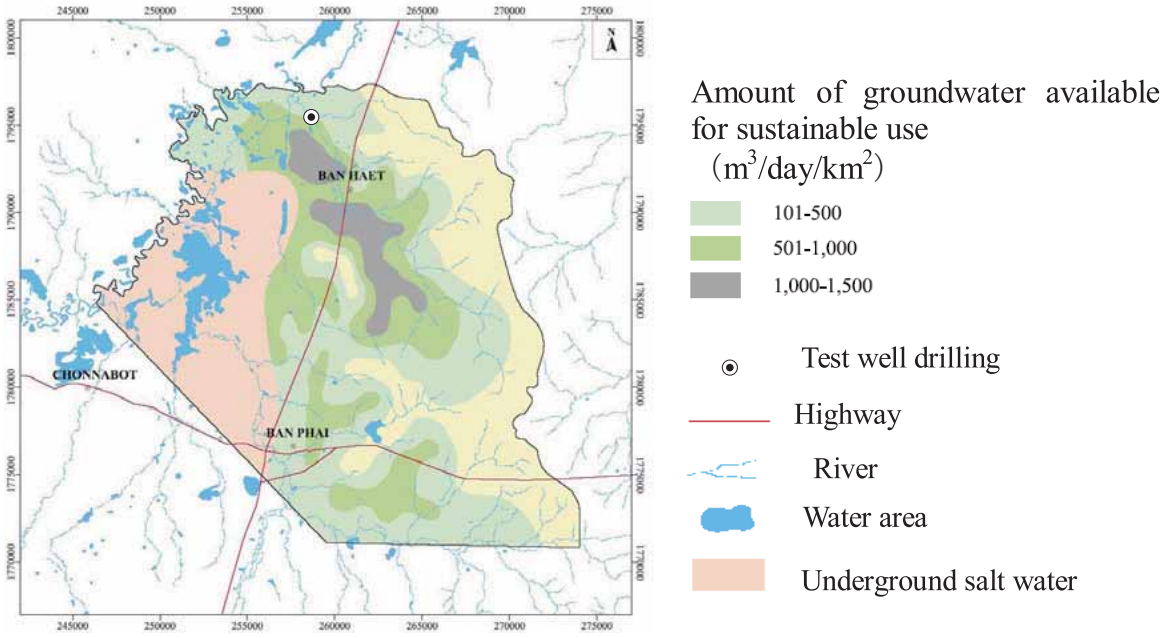


Fig. 2. Distribution of available groundwater for sustainable use in the research area.

calculate the groundwater distribution flow simulation model. The cause of the high TDS in the groundwater of the salt-affected area is believed to be the passage of underground water through the rock salt beds at about 100 m below the ground surface. Clarification of the detailed mechanism involved in this phenomenon is an issue for future research.

(K. Srisuk, P. Senchai, N. Suphanchaimat [KKU], H. Hamada, S. Sukchan [LDD])

TOPIC 7

Relationship between surface runoffs and water levels in farm ponds in the sandy, sloping farmlands of Northeast Thailand

The sandy soils which are widely distributed in Northeast Thailand have high permeability and rainwater is supposed to easily infiltrate into the underground. Nevertheless, there are many farm ponds for pooling and storing surface runoffs in this region. In this research, we intend to estimate quantitatively the occurrence of surface runoffs in the sandy, sloping farmlands in Northeast Thailand and analyze the relationship between their occurrence and the water levels of the farm ponds.

We selected the sandy, sloping lands of the village of Nong Saeng in the Khon Kaen Province of Northeast Thailand as the test area (Fig. 1). The lowlands in this area are used as paddy fields and the sloping lands are used to grow sugarcane. The gradient of the ground surface is about 3 degrees. As the groundwater

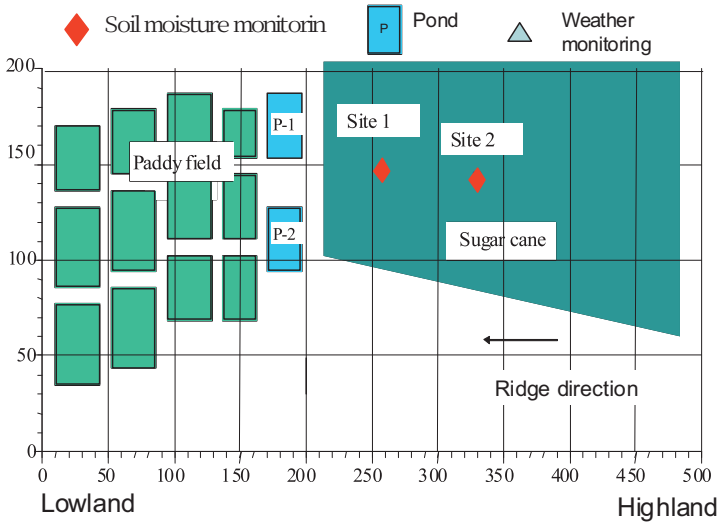


Fig.1. Overview of the study site. (N: 16°9′, E: 102°48′)

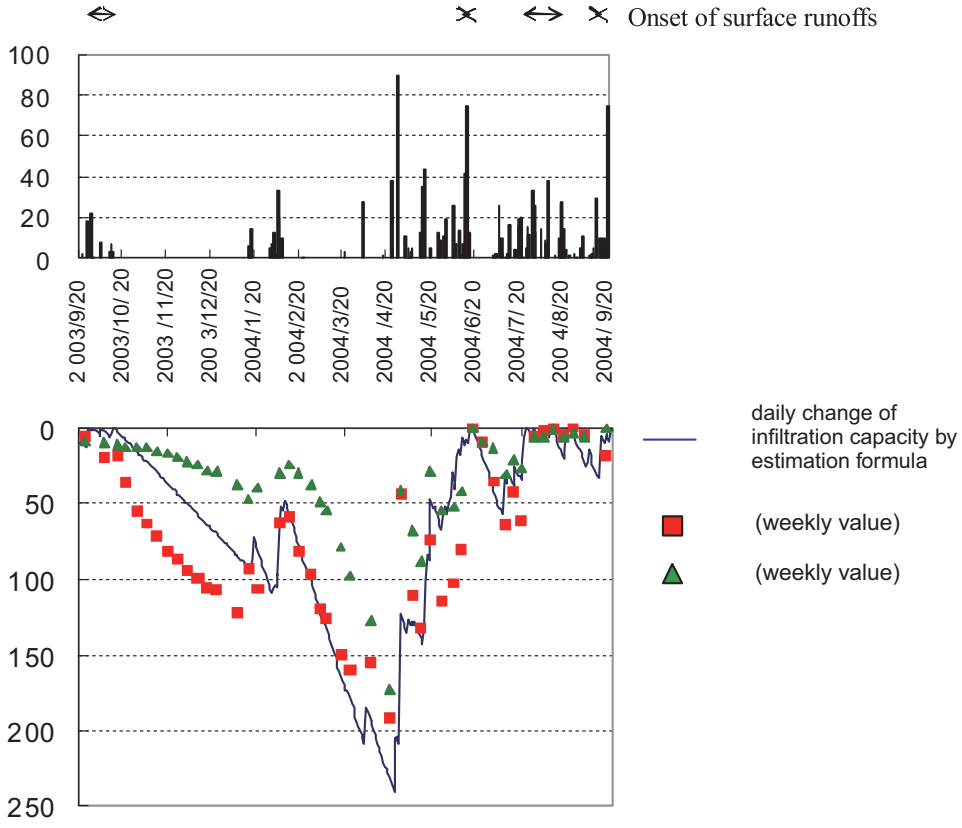


Fig. 2. Daily changes in infiltration capacity estimates. Site 1: Weekly values, Site 2: Weekly values
X: the day when surface runoff took place

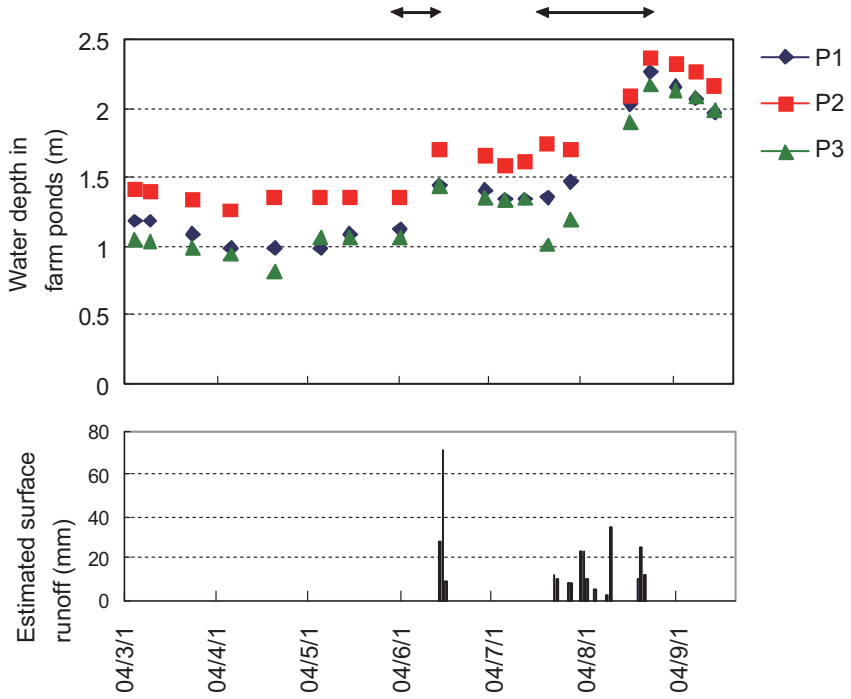


Fig. 3. Changes in water levels of the ponds and estimated surface runoff. P3 is a pond located close to the study site. ↔: the period when water level in the farm ponds rapidly rised.

level of the test area is lower than the bottom of the farm ponds, water in the farm ponds is unaffected by the groundwater. The soil of the test area is made up of an upper loamy sand (LS) surface layer with a depth of about 1 m (hereafter, referred to as LS layer). The hydraulic conductivity (HC) is in the order of 10^{-3}-10^{-4} cm/s. Beneath this is a sandy clay layer (hereafter, referred to as SC layer). The HC is in the order of 10^{-6} cm/s. The rainwater in the LS layer is retained there because of low HC in SC. When the LS layer reaches saturation point, the amount of water is defined as the infiltration capacity. Beyond this, a surface runoff will occur. Surface runoffs occurred between September 20 and October 20, 2003; on June 17, 2004; between July 20 and August 20, 2004; and on September 20, 2004. The surface runoffs that occurred during the measurement period were calculated to amount to 374 mm that is close to 30% (Fig. 2). On mid-June and most of August a remarkable rise in the water levels of the storage reservoir was recorded. This roughly corresponded with the periods when surface runoffs occurred. As expected, surface runoffs and the corresponding rise in the water levels of the storage reservoir, occurred when rainwater in the LS layer exceeded saturation point (Fig. 3).

Although the monsoon season begins in April in Northeast Thailand, the water levels of the farm ponds rise considerably in mid-August, when the second part of the monsoon season begins. During the first half of the monsoon season, the farm ponds have lower water levels and insufficient amounts of water are available for irrigation. It is therefore necessary to formulate and implement a strategy whereby groundwater can be utilized as an auxiliary water source during the first half of the monsoon season.

(H. Watabe, H. Hamada, T. Moroizumi, S. Sukchan)

TOPIC 8

Protein requirements for maintenance of native beef cattle in Northeast Thailand

In Thailand, the nutrient requirements of the cattle are based on information gathered from countries located in the temperate zones. Since the breed of cattle, climatic conditions, and available feed resources in Thailand differ from those in the temperate zones, the nutritional requirements of the cattle in Thailand may not be the same as those recommended. However, the protein requirements of native cattle have been measured to a limited extent. In Thailand, native and Brahman cattle are very popular for their beef. This time, we conducted feeding experiments in order to estimate the protein requirements for the maintenance of the native cattle.

Four Thai native heifers, with average 132±1.71kg of body weight, were used to determine

the protein requirement using a 4×4 Latin square design. The cattle were fed with diets containing 6.1, 9.4, 12.1 and 15.4% of crude protein (CP). The diets were prepared in a total mixed ration with rice straw as the roughage source. The results showed that Nitrogen (N) intake and retention significantly increased ($p<0.05$) when the dietary protein level was increased. Therefore, the protein requirement for the maintenance of Thai native heifers was lower than 6.1 % of dietary CP (Table 1).

Sixteen Thai native calves, with average 105±9.3 kg of body weight, were used to determine the protein requirement for maintenance. The calves were fed with diets containing 5.3, 7.1, 8.3 and 9.8 % of CP. The diets were prepared in total mixed ration with Mulato II grass hay (a hybrid of three lines of *Brachiaria*; *B. ruziziensis* × *B. brizantha* × *B. decumbens*) as a roughage source. The results showed that the negative N balance was found in the dietary CP content of 5.3 %, but the positive N balance was found in the dietary CP contents of 7.1 - 9.8 %. Therefore, the protein requirement for the maintenance of Thai native calves is between 5.3 and 7.1 % of dietary CP.

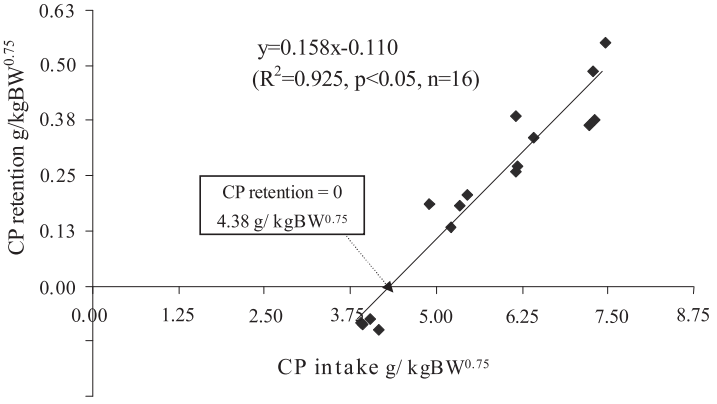


Fig. 1. Relationship between CP retention and CP intake in Thai native cattle.

Moreover, the prediction equation of N retention (Y, g/kg BW0.75) with relation to N intake (X, g/kg BW0.75) was obtained from simple linear regression (Figure 1). From the linear regression results, it can be estimated that the CP requirement for maintenance (Y = 0 or N retention = 0) of Thai native male calves is 4.38 gCP/kg BW0.75.

(M. Otsuka, K. Thummasaeng [Ubon Rajathanee University], A. Chantiratikul [Mahasarakham University])

Table 1. Effects of dietary protein levels on the growth performance and protein balance of Thai native heifers.

	Dietary CP (%DM)			
	6.1%	9.4%	12.1%	15.4%
Dry matter intake (kg/day)	2.75	2.67	2.76	2.66
Average daily gain (kg/day)	0.20	0.45	0.21	0.40
Crude protein intake (g/day)	176.1d	252.7c	340.9b	414.2a
Crude protein retention (g/day)	72.1d	116.5c	151.3b	194.3a

The a, b, c, and d values in rows with different superscripts are significantly different at $P<0.05$.

TOPIC 9

Improving the productivity of soybean and wheat by introducing the agropastoral system.

In the tropical savannas of South America, vast areas of croplands were developed during the "Brazilian Cerrado development" in the 1980's. However, in these croplands, the decrease in the productivity of crops and soil degradation pose a serious problem in long-term continuous cropping. Although the introduction of the agropastoral system is one of the solutions, a quantitative evaluation of the improvement effect on the productivity was not yet conducted. Then, the experimental fields in the continuous cropping fields of the soybean-wheat system in CETAPAR-JICA (Centro Tecnologico Agropecuario en Paraguay-Japan International Cooperation Agency) in Paraguay, which were converted into guinea grass pastures for seven years, were reconverted into cropping fields. We measured the whole yield of soybean and wheat in these fields and control fields (continuous cropping fields) for four years. Furthermore, we analyzed the chemical and physical properties of the soils in both fields, in order to clarify quantitatively the improvement effect on the soybean and wheat productivity and the chemical and physical properties of the soils.

The yields of soybean and wheat of the agropastoral fields were higher than those in the control fields, although their year-to-year variations are large every year (Fig. 2 & 3).

Moreover, since the highest yield of the soybean in this area before continuous cropping started to present a problem was about 3 ton/ha, it is deemed that the improvement effect on soybean productivity due to the introduction of the agropastoral system is high. This improvement effect will continue for about four years (Fig. 4). In the continuous cropping field which conducted non-tillage cropping, since phosphate accumulated on the soil surface when the soybean was only able to spread its roots on the surface, the adverse effect which is the decrease of tolerance to drought has become a problem. But, by introducing the agropastoral system, the accumulation of phosphorus and potassium was solved (Table 1). In addition, when the accumulation of soil organic matters was being promoted by the litter and roots of guinea grass, soil aggregation was also improved. From the above results, we can conclude that if an agropastoral system is introduced into any soybean-wheat field in which the overall productivity has been reduced due to continuous cropping, the productivity of soybean and wheat will also be improved with the enhanced physical and chemical properties of the soil due to the effects of the agropastoral use.

Although the investigation was conducted in Paraguay, it is likewise applicable in any tropical savanna area in South America, such as the "cerrados" of Brazil. It is necessary to reconvert the converted soybean-wheat fields into agropastoral fields periodically since the positive agropastoral effects will disappear in about four years.

(K. Shimoda, T. Horita, K. Hoshiba, J. Bordon [CETAPAR-JICA])

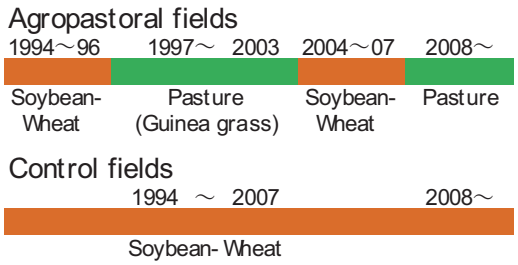


Fig. 1. Cultivation schedule.

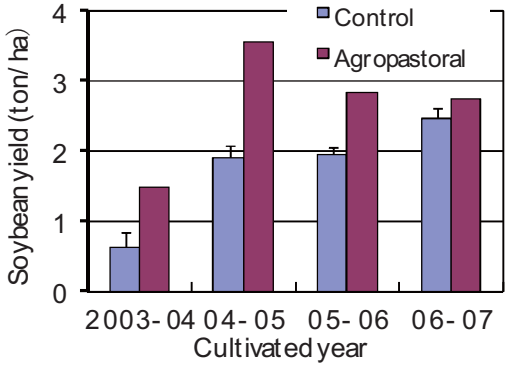


Fig. 2. Agropastoral effect on soybean yield.
Agropastoral fields（ Converted in November, 2003. Total: 3 ha.）
Control fields（ Total: 2.1 ha.）

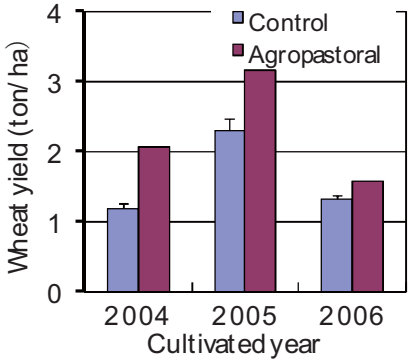


Fig. 3. Agropastoral effect on wheat yield.
Agropastoral fields（ Converted in November, 2003. Total: 3 ha.）
Control fields（ Total: 2.1 ha.）

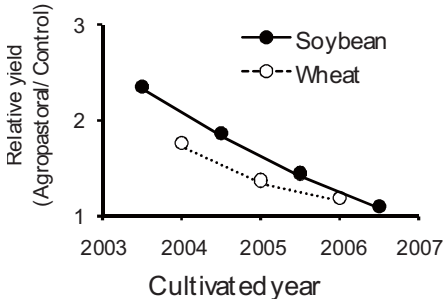


Fig. 4. Year-to-year variations of relative yields of soybean and wheat production.

Table 1. Chemical and physical properties of the soils in agropastoral and control fields.

Depth	P (ppm)		K (cmol/L)		Organic matter (%)		Depth	Aggregate≧0.25mm (%)	
(cm)	Agropastoral	Control	Agropastoral	Control	Agropastoral	Control	(cm)	Agropastoral	Control
0-10	3.40±3.05***	12.10±6.10	0.33±0.21***	0.70±0.38	3.76±0.55***	3.15±0.50	0-5	92.2±0.6***	85.1±1.5
							5-10	92.4±0.7*	89.1±1.6
10-20	0.45±0.39***	2.04±1.12	0.13±0.14***	0.38±0.29	2.75±0.51***	2.28±0.48	10-20	92.9±1.1*	89.2±2.1
20-40	-	1.05±1.16	-	0.30±0.25	1.99±0.59**	1.65±0.22	20-40	91.9±2.4	89.5±3.7
40-60	-	0.82±1.13	-	0.24±0.21	1.54±0.23**	1.39±0.14	40-60	91.4±0.9	89.5±3.0

P and K were analyzed by Mehlich-III method and organic matter was analyzed by Walkley-Black method.
Soil aggregates were measured using aggregate analyzer. (Daiki Rika Kogyo Co., Ltd.)
*:(P<0.05). **: (P<0.01). ***: (P<0.001) Sampling period: in November, 2003 at the start of the research period.

Efficient techniques for growing indigenous tree species in combination with fast-growing trees

Against the background of shortages of natural forest resources in tropical areas, the establishment of a cultivation method for indigenous tree species is an urgent matter. We improved on the existing silvicultural techniques by applying the two-storied forest management technique (Upper-story: fast-growing trees, lower-story: indigenous trees) in Northeast Thailand.

In the experimental plot, the dipterocarp indigenous tree, *Hopea odorata*, was planted in 1990 after three fast-growing tree species were planted with four different spacing regimes in 1987. To promote the growth of *H. odorata*, 50% of thinning was applied to the fast-growing trees in 1994. Then, we re-surveyed the experimental plot in 2007 and collected tree data and analyzed them together with the previous data. *Eucalyptus camaldulensis* and *Acacia auriculiformis* showed high growth rate recordings at 8.8－11.3 m^3/ha/year in terms of mean annual increment (MAI) in the stem volume, while *Senna siamea* showed only 1.0－1.3 m^3/ha/year. The survival rate of *H. odorata* was relatively high in the eucalyptus and acacia plantations but it decreased gradually by 2007 due to the shading by the canopy of the fast-growing trees. However, the survival rate of *H. odorata* remained high in the *S. siamea* plantation although it decreased rapidly in the beginning (Fig. 1). The growth of *H. odorata* was vigorous in the *S. siamea* plantation especially at the spacing of 2 m x 8 m (Fig. 2), exceeding the growth of the *H. odorata* trees planted in the open site (control plot). A negative relationship (trade-off relationship in ecological term) was observed between the basal area of fast-growing trees and those of *H. odorata* (Fig. 3). This result implies that the growth of H. odorata will be improved if fast-growing trees will be removed properly by thinning or clearcutting. We estimate that *H. odorata* will grow well even in a eucalyptus or acacia plantation, if the total basal area is limited to around 5 m^2/ha.

These findings suggest that *H. odorata* can grow well in combination with some fast-growing trees thereby providing different kinds of wood products in different periods, which will bring more profits for the forest planters (i. e. farmers). Moreover, planting dipterocarp tree species will bring another source of income for farmers such as the production of edible fungi which form mycorhiza in the roots of dipterocarp trees.

(A. Sakai, T. Visaratana, T. Vacharangkura [Royal Forest Department])

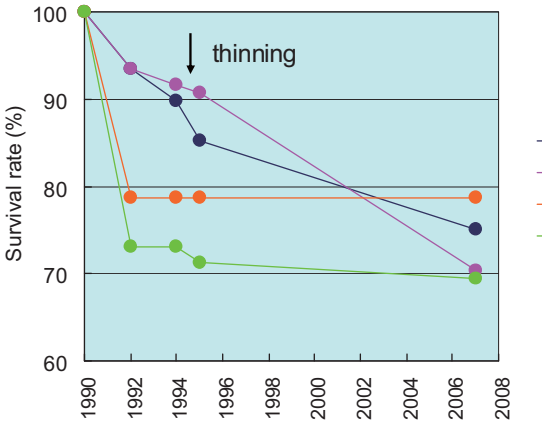


Fig. 1. Changes in survival rates of *Hopea odorata* planted in various fast-growing tree plantations. Ec: with *Eucalyptus camaldurensis*, Aa: with *Acacia auriculiformis*, Ss: with *Senna siamea*, Co: control (no fast-growing tree).

Fig. 2. A17-year-old *Hopea odorata* planted in the *Senna siamea* plantation.

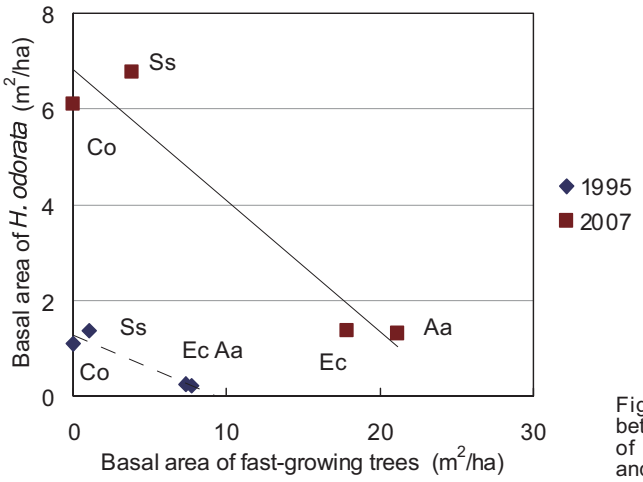


Fig. 3. Relationships between the basal area of fast-growing trees and those of *H.odorata*.

Theme A-3 Elucidation of the impact of global environmental changes on agriculture, forestry and fisheries and development of mitigating technologies

Global warming is predicted to cause disasters due to climate change and the spread of insect pests; there is also the risk of undermining the stability of agricultural production and shifting of suitable agricultural areas. This theme aims to clarify the phenomena of interdependence between global environmental changes such as water cycle changes and agricultural production activities, and to enhance the methodologies for estimating their influences on agriculture, as well as to clarify the damage caused to agriculture and forestry products by insect pests resulting from global warming, and to develop technologies to prevent them. In FY 2006, five projects were launched to study the interdependent influences of environmental changes with agricultural production, to develop GIS methodologies and supply and demand models of foods, and to develop institutional and technological measures for alleviating the detrimental effects on agriculture of climate change and harmful insects.

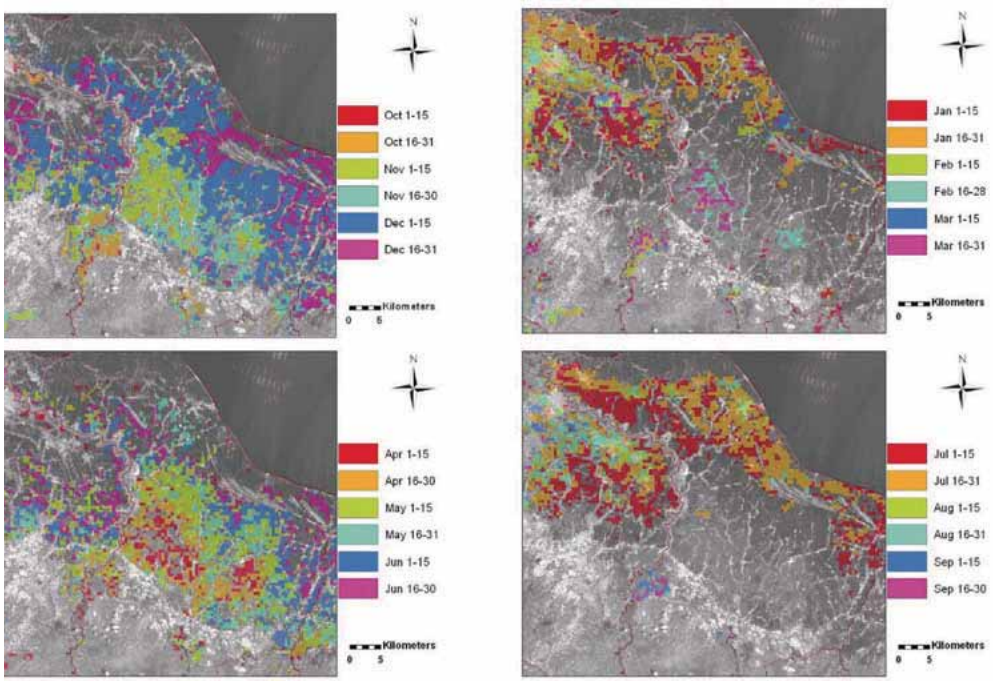
The main results are as follows.

■ **Enhancement of GIS applications for agricultural land information on local to regional scales**: We launched a research project on monitoring technology to capture changes in agricultural land use on a quasireal-time basis in collaboration with an agricultural land resources research institute in Indonesia. These technologies can be applied to assess the productivity of economically significant crops and also to estimate the spatial and temporal characteristics of hazardous conditions caused by agricultural disasters (See satellite imagery below).

■ **Stable food supply systems for mitigating the fluctuations in production and markets in China**: We established early warning systems on climatic natural disasters, incorporating mesh data on temperature and precipitation, in Heilongjiang Province, and developed a technology for ensuring that field servers operate reliably. In addition, a farm management model which incorporates risk factors was developed, and institutional approaches toward risk reduction were launched.

■ **Water supply fluctuations in Indochina:** We completed the construction of a supply and demand model of rice which incorporates water supply fluctuation as one of the factors affecting changes in rice production in Vietnam, Thailand, Laos, and Cambodia, allowing simulations to be based on various scenarios in natural environments and social conditions.

■ **Development of management techniques for citrus greening disease in severely affected areas:** Citrus greening disease (CG) is spreading worldwide, partly due to global warming. We launched an on-farm experiment in integrated pest management (IPM) of CG in Vietnam to establish techniques for managing the disease in severely infested areas. We also started field experiments to prove the efficacy of *Feronia limonia and Feroniella oblata* as



Monitoring transplanting time in rice production around Karawang District in the West Java Province of Indonesia, using MODIS data.

rootstocks resistant to CG. To reproduce the transmission process of CG by adult psyllids in a closed environment, we successfully grew adult psyllids which were carrying CG bacteria from eggs on infected citrus trees in a greenhouse environment.

■ **Development of biological control of invasive insect pests on coconut trees:** We completed a distribution map of *Brontispa longissima*, an insect pest of coconut trees spreading in Southeast Asia and the Pacific region, based on field surveys and information provided by overseas research institutes. This project also aims to develop a biological control method against the insect. We have embarked on the development of an artificial feeding method and are analyzing the insect's basic ecological behavior.

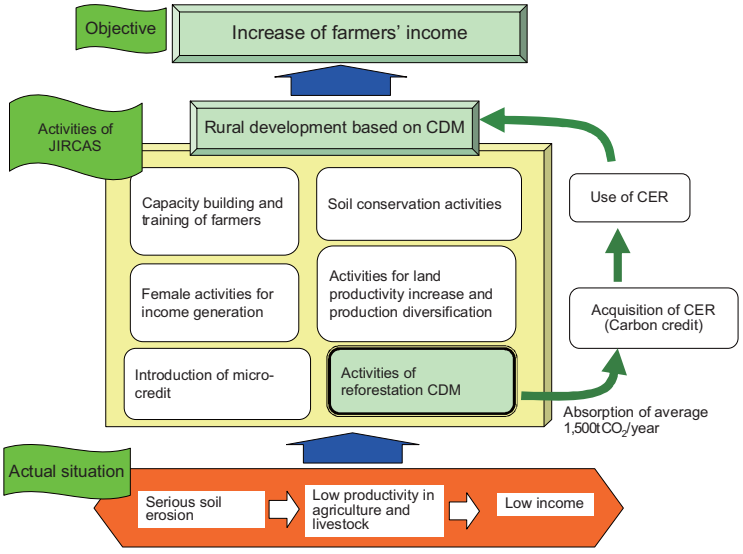


Fig. 1. Study concept.

TOPIC 1

The world's first rural development project based on Afforestation and Reforestation CDM

The Clean Development Mechanism (CDM) is a system which aims to reduce greenhouse gases through the implementation of emission reduction projects in developing countries and by converting the reduced emission volume into credits (Certified Emission Reduction: CER) to be sold to developed countries (Annex I countries in the Kyoto Protocol). The methodology, which practically applies the methods established by the United Nations Framework Convention on Climate Change (UNFCCC) in order to implement a small scale reforestation CDM project in Paraguay, and then registers the project with the UNFCCC CDM-EB (CDM Executive Board) in order to obtain CERs, has been developed in order to ensure the sustainability of rural development by introducing CDM as part of rural development activities.

The execution and registration of the Reforestation CDM project implemented in the selected two cities and 16 communities in Paraguarí Department, Paraguay, where plenty of small scale farmers live and which has the sixth lowest average income in the country, was realized within a series of activities such as: (1) Changing farmers' awareness through participative approach, (2) Preparation of the Farm Development Plan (plan integral de la finca: PIF) by the farmers themselves, (3) Organizing farmers' groups in every common income-generating activity described in the PIF, (4) Implementing income-generating activities with cost-sharing between JIRCAS and the farmers, (5) CDM activities by the Reforestation group, (6) Implementation of the CDM project, (7) Utilization of CERs for rural development.

In order to obtain the registration of the CDM project with the UNFCCC CDM-EB, it is necessary to fulfill all the requirements such as growth scenario of every planted tree species, baseline scenario (estimation of present and future growth of CO_2 stock in existing vegetation in the reforestation area), leakage (estimation of CO_2 emission from crops and livestock replaced by reforestation), land qualification (verification of reforestation in the land whether it complies with the definition of forest as defined in the host country and evidence to prove that the reforested land has had no forest since the end of 1989), Certificate of land ownership, proof of additionalities, appropriateness of monitoring method, etc. as well as appropriate governmental documents, results of on-site surveys and scientific literatures , then finally the facts and documents shall be verified through validation work conducted by the designated operational entity (DOE) accredited by the UNFCCC CDM-EB. For the Reforestation CDM project, data collection on the estimation of baseline scenario and leakage, proofs of land qualification and clarification of land ownership are extremely difficult to obtain due to the lack of basic data in the host country.

In compliance, JIRCAS has established a nursery, estimated the baseline scenario for every participant farmer, prepared the Reforestation Plan (tree species, planting year and interval /agroforestry method), acquired governmental documents (definition of forest,

declaration of low income communities, etc.), documentations of land ownership and agreements on the delineation of rights to the CO_2 absorbed through the study between JIRCAS and the individual farmers. In addition, JIRCAS has prepared the Project Design Document (PDD), trained farmers on reforestation technology and distributed seedlings to the farmers who planted these on their own. By 2008, JIRCAS has finished the reforestation, jointly with the farmers, of up to 215 ha in 240 plots owned by 167 farmers.

The prepared PDD was validated by the DOE and comments pointed out to be clarified or corrected by the DOE were resolved by supplemental surveys and document acquisition. Thereafter, JIRCAS obtained the Letter of Approval (LOA) from the Paraguayan Government in November of 2008 and from the Japanese Government in March of 2009. The issuance of the registration of the project with UNFCCC CDM-EB, as the first Afforestation and Reforestation CDM project in the world (AR-CDM) which contributes to rural development, is expected in September, 2009.

The extension of rural development based on AR-CDM is anticipated in other areas of Paraguay where serious soil erosion and soil

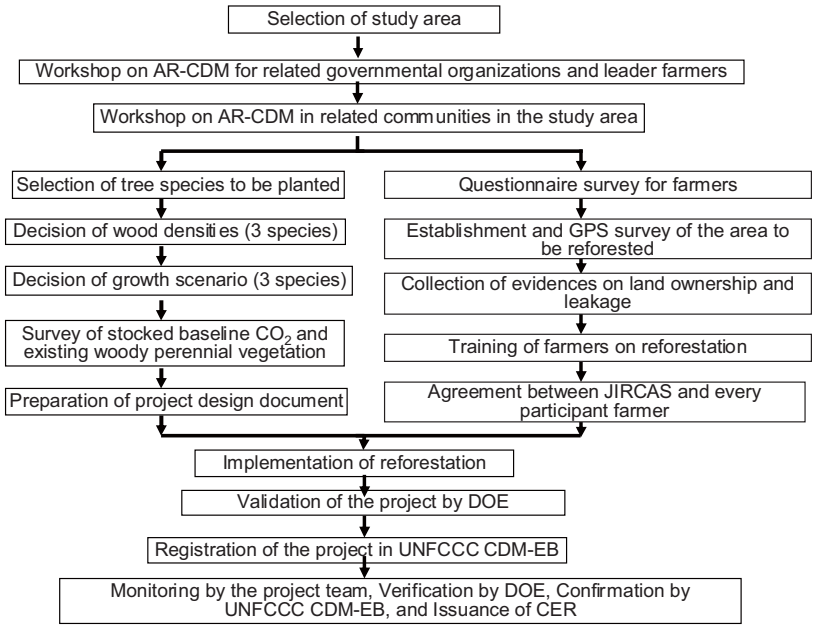


Fig. 2. Flow of the study.

1. Initiative of participant farmers
2. Land qualification (the land to be reforested did not have a forest before December 31, 1989)
3. Selection of tree species
4. Decision of growth scenarios and wood densities of selected species
5. Establishment of parcels to be reforested for every participant farmer
6. Establishment of the area to be reforested per stratum (species, planting year and planting interval)
7. Compatibility with forest definition (including the land below the forest definition and otherwise excluding the land)
8. Collection of evidences to prove the ownership of land and the right of CO_2 reduced by reforestation from every participant farmer
9. Evidence of additionality: The reason why the project will not be implemented without CDM
10. Baseline estimation (CO_2 volume stocked in existing vegetation in the parcels to be reforested)
11. Leakage estimation (stock volume of CO_2 displaced by reforestation activities)
12. Greenhouse gas emission from project activities
13. Estimation of environmental impact caused by reforestation to the present land use like impact to endangered species, if any, existing in the area to be reforested
14. Acquisition of governmental documents (declaration of low income communities, declaration of non ODA use, and letter of approval for the project)

Fig. 3. Requirements for small scale AR-CDM.

fertility deterioration are occurring due to agricultural overexploitation in spite of abundant land resources, as well as in areas of other South American countries which exhibit similar conditions as the project area, through the distribution of guidelines and manuals prepared in the study, in addition to the demonstration of the AR-CDM project in the experimental and demonstration farms of JIRCAS.

Follow-up of project activities during the project period is important because the CERs shall only be issued in accordance with the measured volume of accumulated CO_2 in the reforested areas after the completion of monitoring activities and verification of monitoring results by the DOE and UNFCCC CDM-EB.

(E. Matsubara, K. Kimura and T. Hanano)

TOPIC 2

Changes in distribution of paddy fields in the Heilongjiang Province of China detected using satellite data MODIS

The Heilongjiang Province is one of the major Japonica rice producing areas in China and the rice planted areas of this province have increased largely since the mid-1990s. In recent years, the acreage of rice-planted areas show considerable variation year by year based on the statistical data per province. However, distribution details could not be analyzed due to the lack of information in adequate spatial context. This study is aimed at the development of a methodology to estimate the distribution of rice planted areas in a wider range such as on a provincial scale and to produce a dataset for further analysis on the characteristics of spatial and temporal changes using earth observation satellite data. Because of a limitation in the coarse spatial resolution of satellite data which could have enabled us to observe the same site frequently, this study attempted to estimate the percentage of target land use area per pixel in order to obtain more accurate information about acreage. We applied the developed method to the data from the year 2003 to 2008 and analyzed the spatial and temporal features of rice planted areas in the Heilongjiang Province.

We processed the reflectance of Band 1, Band 2 and Band 7 of the MODIS (Moderate Resolution Imaging Spectroradiometer) data, with spatial resolution of 250, 250, 500 meters respectively and produced cloud-free images representing ground surface conditions from late May to early June, which was generally the rice transplanting period in the Heilongjiang Province. A new index, NDBSI (Normalized Difference Bare Soil Index) calculated from Band 1 and Band 7, was introduced to discriminate waterlogged areas effectively. We combined this with NDVI (Normalized Difference Vegetation Index) and then obtained an indicator to estimate the percentage of rice planted areas per pixel. In the scheme of estimating rice planted areas, we discriminated the potentially confusing items such as open waters by adopting the characteristics of the seasonal changes of NDVI.

Accuracy of estimation was assessed by

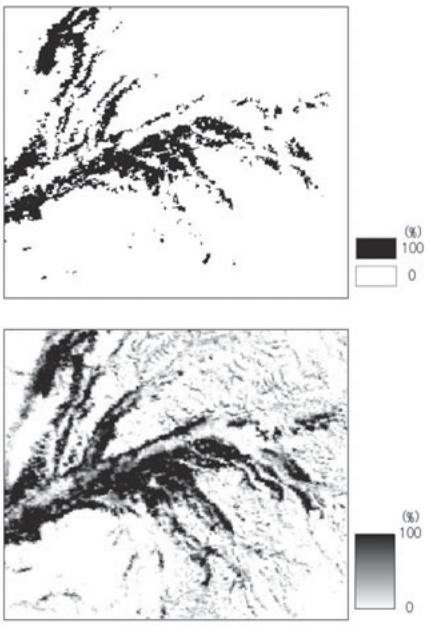


Fig. 1. Comparison of the extracted data of rice planted areas between the pixel-based classification (upper) and the newly developed method (lower).

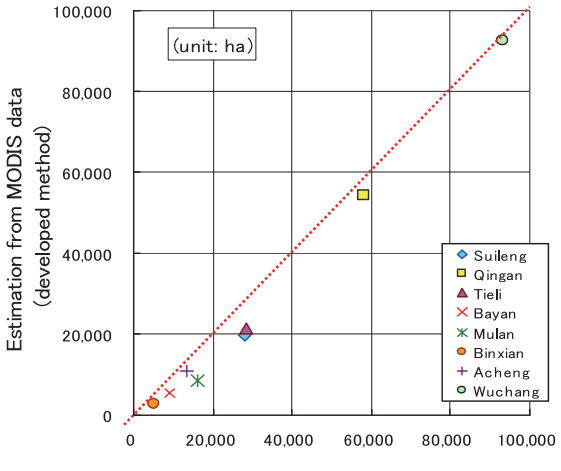


Fig. 2. Comparison of the acreage of rice planted areas per province between values obtained from Landsat data (horizontal) and the developed method (vertical).

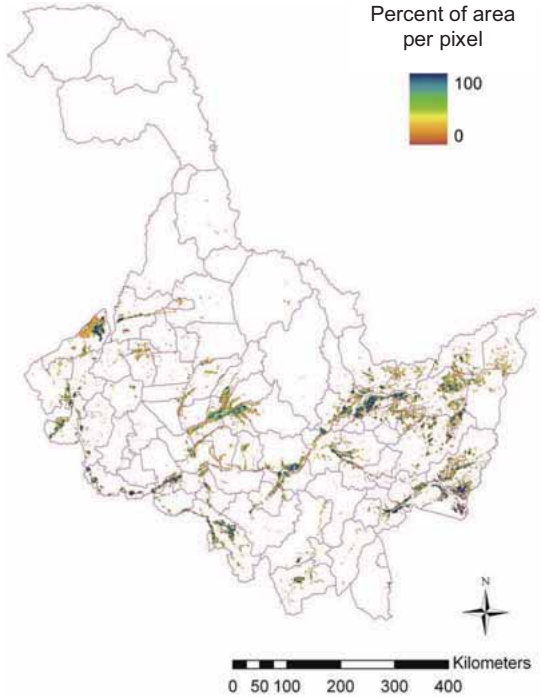


Fig. 3. Distribution map of rice planted areas in the Heilongjiang Province estimated using the developed method (2008 data).

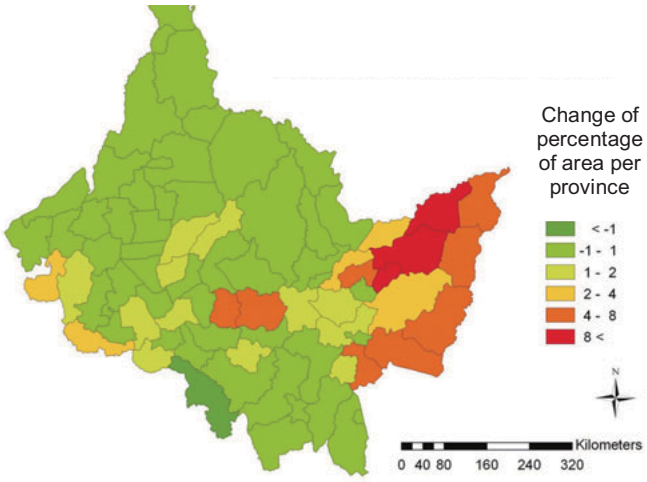


Fig. 4. Changes in the percentages of planted acreage of paddy fields in Heilongjiang Province for the period 2003 to 2007.

comparing the multi-level classification results of the satellite data with different spatial resolutions. The improvement in estimation accuracy was validated by the appearance of half tone parts in Figure 1, which could not be extracted from pixel-based classification. Comparison of aggregated acreages by province with the values obtained from Landsat data exhibited good correlation (coefficient of determination; R^2=0.976) as shown in Fig. 2.

We calculated the percentage of the acreage of rice planted areas per pixel for the whole Heilongjiang Province from 2003 to 2008. Fig. 3 shows the data of 2008. The distribution map indicated that the major rice planting areas are located in the portions along large rivers in the Central and Western side of the province as well as in the Sanjiang Plain in the Eastern side.

Several counties located in the Eastern and the Central parts showed higher rates of increases as measured by the changes of percentage per county for the period 2003 to 2007 (Fig. 4).

(S. Uchida)

TOPIC 3

Risk management of rice farmers against cool summer damage in Heilongjiang Province, China

Heilongjiang Province has the largest share of rice production in China. However, because of the relatively short history of rice cultivation in the area, a lot of farmers do not fully realize the impact of chilling injury or cold damage to their farm management operations. And, they believe that the risk of chilling injury does not threaten their own farming operations, with the average temperature rising because of global warming.

Based on the above, in order to clarify the risk attitude of rice farmers to chilling injury, four villages in Hulin City, which suffered huge cool summer damage due to floral impotency in 2002, were studied five years after in 2007 as to their rice varieties selection and cultivation practices (sample number: 163). The total yield of rice in Hulin City declined to 46.5% in 2002 as compared with the previous year, and this exceeded the decline rate of the hard-hit areas of the whole province in 1969, 1971, 1976 and 1981. However, from the statistics at the provincial level in 2002, we were unable to determine the severity of the cold damage. This is largely due to the recent expansion in the area of paddy fields throughout the province, the delayed growth of technological advances and the transformation of the type of cool summer damage from being a regional damage due to delayed growth into localized damage due to floral impotency.

It is difficult to implement deep water irrigation and cold damage countermeasure in Heilongjiang Province because of its severe water limitations. Thus, planting rice varieties with cold resistance is currently the effective

countermeasure as risk control against cold weather damage. Through a Cold Tolerance Test conducted at the flowering stage on the three main varieties with large cultivation areas in Hulin City (Kendao-12, Kendao-10, Kongyu-131), it showed that among the three varieties, Kendao-12 and Kendao-10 yielded higher profitability in the year under normal weather but their yield earnings dropped in low temperatures (Fig. 1).

Because of the declining rate of the cultivated area of the Kongyu-131, its yield was smaller when the chilling injury occurred in 2002; but beginning from the second year, there was a significant increase. However, only 7.4 percent of farmers surveyed planted Kongyu-131 in 2007. In addition, in answer to the most important factor when selecting varieties, only 3% of the farmers answered “cold resistance”, 39% answered "yieldability" and 30% answered "disease resistance"; hence, the gap is very obvious.

When showing Fig.1 to surveyed farmers, wherein variety names were replaced by code names and farmers selected their most desirable varieties, it showed that with a shorter history of planting rice for farmers, they were more inclined to select the varieties with higher risk even in areas severely affected at that time with the cold weather damage (Fig. 2). Under such condition wherein farmers failed to grasp the cold resistance of rice varieties, the decline in yield for the actual planted varieties, as compared with Fig.2, was greater in the presence of cold damage (Fig. 3).

Rice farmers’ vigilance towards reducing the risk of cold damage is weakening over time in Hulin City, Heilongjiang Province. In order to reduce the threat in rice production, risk management is an important factor and risk communication for effective damage control must be especially targeted as prioritized assistance to farmers lacking experience in rice cultivation.

(K. Nakamoto)

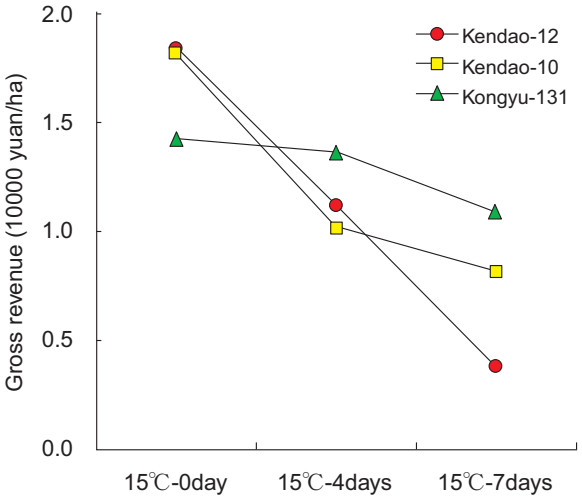


Fig. 1. Varietal differences in the Cold Tolerance test.

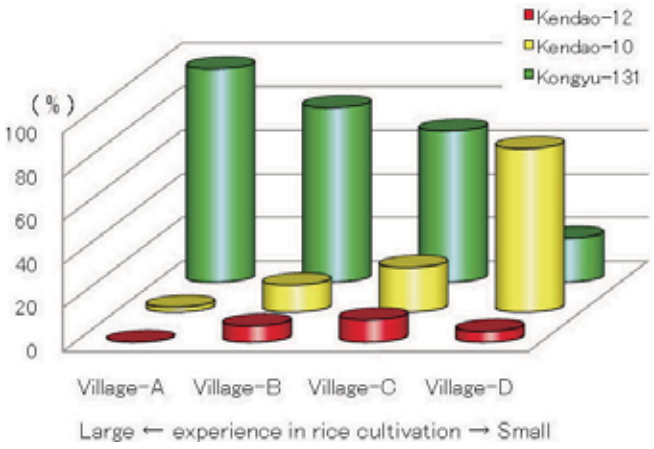


Fig. 2. Rice varieties which farmers intended to plant.

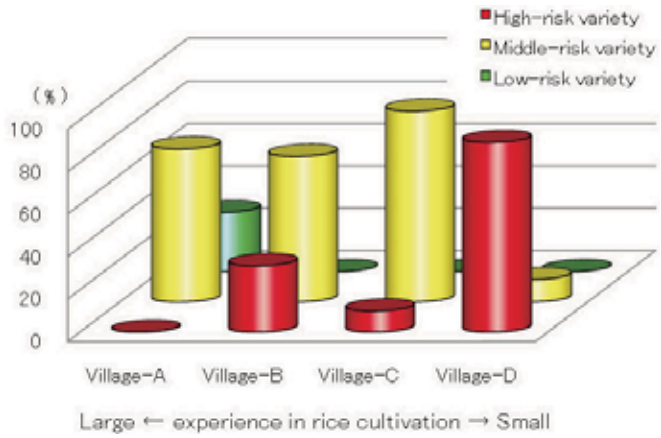


Fig. 3. Rice varieties which farmers actually planted.

Management for the reduction of young king mandarin trees infected by citrus greening disease in the Mekong Delta Region

Citrus greening disease is caused by the pathogen, *Candidatus* Liberibacter asiaticus, which is transmitted by the citrus psyllid, *Diaphorina citri*. Citrus trees in the Mekong Delta can grow throughout the year, giving opportunities for the pathogen to infect trees all year around. Citrus trees infected by the pathogen during the early or young stage (< 2 yr) are likely to yield little or no crop due to the disease, while trees infected in later stages would produce more or less some fruits. Hence, it is perceived that the management for the reduction of infection during the young stage is important for the stable culture of citrus. In Vietnam, it is recommended to apply systemic insecticides around tree roots (previously on the main trunk) once every two months. However, few or no studies have been carried out to address the efficiency of scheduling the planting season in accordance with the seasonal prevalence of the vector or the detectable changes in tree infection level after planting. Here, we supply a new management of citrus greening to optimize the planting season with the reduction in the infection risk of young citrus trees.

Psyllids increase their densities once a year, leading the infection of trees to be delayed by three to five months (Fig. 1). Taking the latent period of the disease into account, the infection risk is higher in the late dry season to early wet season and lower in other seasons. Neonicotinoids efficiently control psyllids 10 days after application, of which efficacy is maintained for two months (Fig. 2). These chemicals are proven sufficiently efficient to control the vector on young citrus trees planted in the early wet season when the infection risk is high. The planting of seedlings in November when the infection risk is low evidently reduces the occurrence of the disease even in non-chemically controlled blocks, and few trees were infected for the first year (Fig. 3). Combining the above observations, the following management can be recommended (Fig. 4): (1) Seedlings should be planted in the season when the infection risk is low; (2) Neonicotinoids should be applied 10 days before planting; (3) Either of these chemicals should be

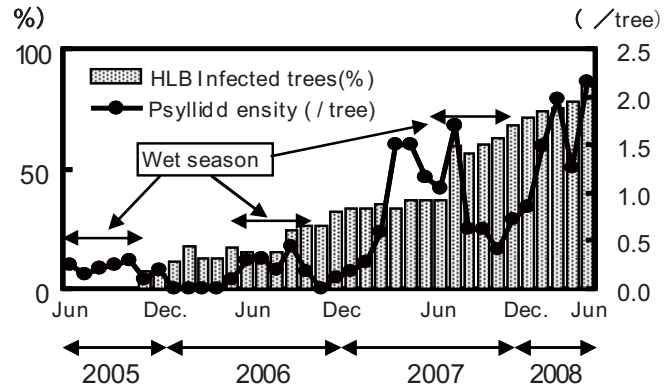


Fig. 1. Seasonal changes of citrus psyllids density and the disease progress of citrus greening in newly planted citrus groves (cv. 'king mandarin') in the Mekong Delta, Vietnam.

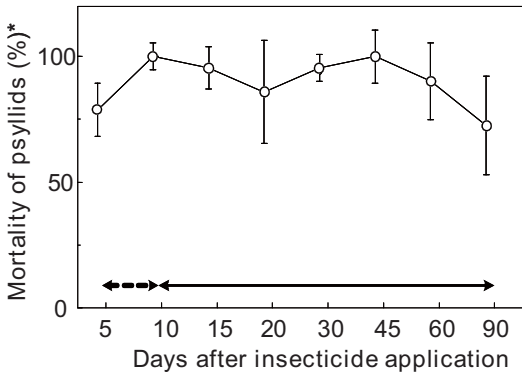


Fig. 2. Mortality of psyllids on seedlings of king mandarin applied with neonicotinoids
Error bars show standard errors of the mean.
Broken and solid lines show the culturing periods in a nursery and in an orchard, respectively.
* Corrected with the Abbott's formula

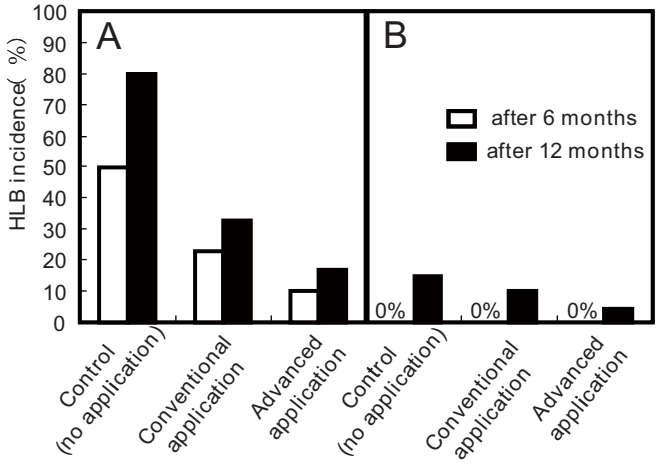


Fig. 3. Effects of the planting season and the timing of application of neonicotinoids on the incidence of Huanglongbing (HLB) in king mandarin orchards
A: Planted in May, 2007 (late in dry season: high psyllid population).
B: Planted in November, 2007 (late in wet season: low psyllid population).
Conventional application: Neonicotinoids were applied on soil around trees once every two months after the planting.
Advanced application: Neonicotinoids were applied 10 days before planting and as above thereafter.

used once every two months thereafter.

The above management should be extended to organisations or persons involved in citriculture in the Mekong Delta Region of Vietnam. In other countries, possible differences in psyllid ecology and the regulation of chemical uses may confine the application of this management.

(K. Ichinose and D. H. Tuan [Southern Fruit Research Institute of Vietnam])

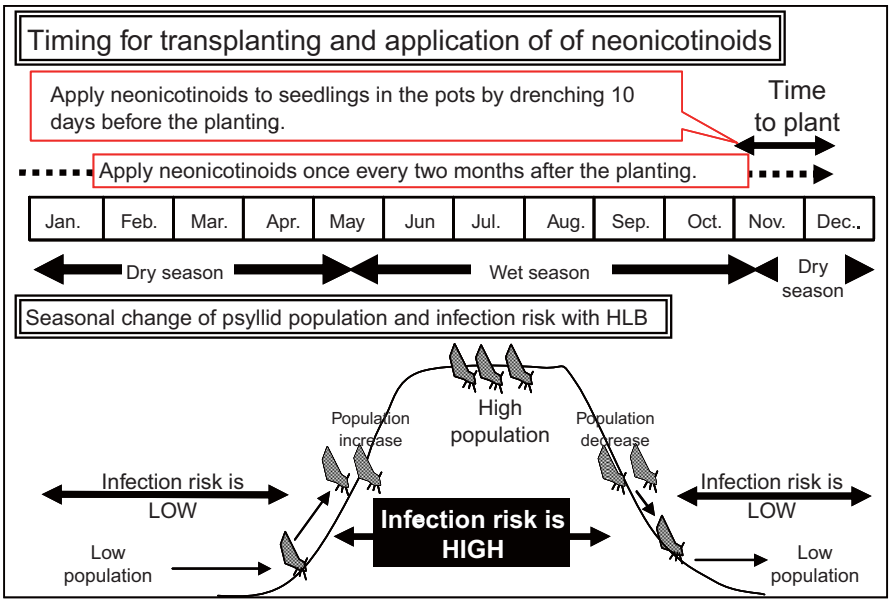


Fig. 4. Schematic diagram of the management of Huanglongbing for king mandarin trees in the early stage of growth in southern Vietnam.

B. Collection, analyses and dissemination of information to grasp trends related to international food, agriculture, forestry and fisheries and rural areas

Information relating to the middle- to long-term trends in global food supply and demand were collected and examined at meetings organized by international organizations. To formulate future plans for collaborative research in African regions, a strategic survey on key technologies for innovation in African agriculture was completed and a report published.

Recommendations for domestic collaboration and human resource development were compiled and issued to enhance agricultural research for international development in Japan, by organizing an international symposium entitled “Contribution of Japanese Agricultural Scientists towards the Millennium Development Goals.”

Regarding socioeconomic analyses of technology development and rural development, two projects—a study on the factors determining the adoption of new water management technologies in Southeast Asia, and a study on the impacts of regional and economic integration on agricultural structure and farm income—were continued. Meaningful results were presented as several case studies such as on corrective activities for irrigation systems in the Philippines and the role of foreign investment in cassava production in Indonesia.

A publication on key technologies for innovation in African agriculture.

TRAINING AND INVITATION PROGRAMS AND INFORMATION EVENTS

INVITATION PROGRAMS AT JIRCAS

In keeping with its role as an international research center, JIRCAS has implemented several invitation programs for foreign researchers and administrators at counterpart organizations. These programs facilitate the exchange of information and opinions on agriculture, forestry, and fisheries research, and their implementation and administration, and at the same time serve as an opportunity to strengthen research ties among scientists and administrators in participating countries, mostly in the developing regions. Current programs are described in detail below.

Administrative Invitation Program

Under the Administrative Invitation Program, JIRCAS invites administrators from counterpart organizations to its Tsukuba premises to engage in discussions and reviews of ongoing researches to ensure that collaborative projects run smoothly. In addition, the program exposes administrators to the current activities at JIRCAS and other MAFF-affiliated Incorporated Administrative Agencies (IAAs). Furthermore, 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 collaboration. Sixty-seven individual visits to JIRCAS were made during FY 2008 under the Administrative Invitation Program. Invited administrators and their home institutions are listed below.

Administrative Invitations, FY 2008

Yuanhong Fan	Yunnan Academy of Agricultural Sciences, P. R. China	May 11-16, 2008
Kun Luo	Yunnan Academy of Agricultural Sciences, P. R. China	May 11-16, 2008
Shanming Ding	Yunnan Academy of Agricultural Sciences, P. R. China	May 11-16, 2008
Jiarui Li	Yunnan Academy of Agricultural Sciences, P. R. China	May 11-16, 2008
Farid Waliyar	International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)-Niamey	May 22-Jun 1, 2008
Robin Buruchara	Coordinator for Sub-Saharan Africa and of Pan-Africa Bean Research Alliance(PABRA), Uganda	May 24-31, 2008
To Phuc Tuong	International Rice Research Center (IRRI), Philippines	Jun. 16-23, 2008
Bas A. M. Bouman	International Rice Research Center (IRRI), Philippines	Jun. 16-23, 2008
Achim Docermann	International Rice Research Center (IRRI), Philippines	Jun. 17-21, 2008
Sonthorn Wacharakuldilok	Royal Forest Department, Thailand	Aug. 2-10, 2008
Bopit Kietvuttinon	Royal Forest Department, Thailand	Aug. 2-10, 2008
Ratana Thai-ngam	Royal Forest Department, Thailand	Aug. 2-10, 2008
Thiti Visaratana	Royal Forest Department, Thailand	Aug. 2-10, 2008
Tosporn Vacharangkura	Royal Forest Department, Thailand	Aug. 2-10, 2008
Vitoon Luangviriyasaeng	Royal Forest Department, Thailand	Aug. 2-10, 2008
Wilawan Wichiennopprat	Royal Forest Department, Thailand	Aug. 2-10, 2008
Roy H. Doi	University of California, Davis, USA	Aug. 30-Sep 9, 2008
Kongkeo Phachomphon	National Agriculture Forestry Research Institute, Lao PDR	Sep. 23-30, 2008

Chen Guofu	Zhejiang Provincial Forestry Office, P. R. China	Oct. 5-12, 2008
Wang Zhangming	Zhejiang Provincial Forestry Office, P. R. China	Oct. 5-12, 2008
Jiang Ping	Forest Pest Control and Quarantine, Bureau of Zhejiang Province, P. R. China	Oct. 5-12, 2008
Li Tusheng	Zhejiang Forestry Ecological Project Management Centre, P. R. China	Oct. 5-12, 2008
Hong Zhaolong	Zhejiang Management Station of Forestry Seedlings, P. R. China	Oct. 5-12, 2008
Yuan Weigao	Zhejiang Forestry Institute of Science and Technology, P. R. China	Oct. 5-12, 2008
Supachai Udchachon	Department of Livestock Development (DLD), Thailand	Oct. 13-23, 2008
Philip Tuivavalagi	ACEO-Crops Division Ministry of Agriculture & Fisheries, Samoa	Oct. 17-25, 2008
Joell H. Lales	Department of Agriculture-Bureau of Agricultural Research, Philippines	Oct. 18-22, 2008
Tim Wheeler	Department of Agriculture,University of Reading, UK	Oct. 18-23, 2008
M. Harun-ur-Rashid	Bangladesh Agricultural Research Council (BARC), Bangladesh	Oct. 18-25, 2008
Kamlesh Chand Puran	Research Division, Ministry of Primary Industries , Fiji Islanda	Oct. 18-25, 2008
M. A. K. Sarvestani	Agricultural Research Education and Extension Organization (AREEO), Iran	Oct. 19-23, 2008
Rohan Rajapakse	Sri Lanka Council for Agricultural Research Policy (CARP), Sri Lanka	Oct. 19-23, 2008
Anil Kumar Bawa	Indian Council of Agricultural Research, India	Oct. 19-24, 2008
M. E. Tusneem	Planning Commission, Gavernment of Pakistan, Pakistan	Oct. 19-24, 2008
Pham Quang Ha	Institute for Agricultural Environmant (IAE), Vietnam Academy of Agricultural Sciences (VAAS), Vietnam	Oct. 19-24, 2008
Parashuram Lal Karna	Nepal Agricultural Research Council (NARC), Nepal	Oct. 19-26, 2008
Praphan Prasertsak	Department of Agriculture, Thailand	Oct. 20-23, 2008
Suwarno	Indonesia Rice Research Center, Indonesia	Oct. 26-31, 2008
Sobrizal	National Nuclear Energy Agency, Center for Application of Isotop and Radiation Technology, Indonesia	Oct. 26-31, 2008
Thiravong Khammone	Government permanent employee in Department of Agriculture and Forestry, Lao PDR	Oct. 26-31, 2008
Cailin Lei	Chinese Academy of Agricultural Scicences, P. R. China	Oct. 27-31, 2008
Jian-li Wu	The China National Rice Research Institute, P. R. China	Oct. 27-31, 2008
Luong Minh Chau	Cuu Long Delta Rice Reseaarch Institute (CLRRI), Vietnam	Oct. 27-31, 2008
Nguyen Thi Lang	Cuu Long Delta Rice Reseaarch Institute (CLRRI), Vietnam	Oct. 27-31, 2008

Fe dela Pena	Philippines Rice Research Institute, Philippines	Oct. 27-31, 2008
Cheng-Yun Li	Yunnan Agricultural University, P. R. China	Oct. 27-Nov. 2, 2008
Jena Kshirod Kumar	International Rice Research Center (IRRI), KOREA Office, Korea	Oct. 28-30, 2008
Muhammmad Dimyati	Ministry of Public Housing, Indonesia	Nov. 1-11, 2008
Yuan Xuezhi	Chinese Academy of Agricultural Sciences (CAAS), P. R. China	Nov. 18-23, 2008
Lei Maoliang	Institute of Animal Sciences, CAAS, P. R. China	Nov. 18-23, 2008
Guan Hui	Tobacco Research Institute, CAAS, P. R. China	Nov. 18-23, 2008
Li Shuyun	Department of International Cooperation, CAAS, P. R. China	Nov. 18-23, 2008
Wang Yuan	Feed Research Institute, CAAS, P. R. China	Nov. 18-23, 2008
Xue Guixia	Institute of Agricultural Economics and Development, CASS, P. R. China	Nov. 18-23, 2008
Joseph Tohme	International Center for Tropical Agriculture (CIAT), Colombia	Jan. 19-22, 2009
Manabu Ishitani	International Center for Tropical Agriculture (CIAT), Colombia	Jan. 19-22, 2009
Jagadish Rane	International Center for Tropical Agriculture (CIAT), Colombia	Jan. 19-22, 2009
Huixia Wu	International Maize and Wheat Improvement Center (CIMMYT), Mexico	Jan. 19-22, 2009
Carolina Saint Pierre	International Maize and Wheat Improvement Center (CIMMYT), Mexico	Jan. 19-22, 2009
Rachid Serraj	International Rice Research Center (IRRI), Phillipines	Jan. 19-22, 2009
Slament-Loedin, Inez-Hortense	International Rice Research Center (IRRI), Phillipines	Jan. 19-22, 2009
Md. Fakrul Islam	University of Rajshahi, Bangladesh	Jan. 31-Feb 7, 2009
Md. Akhtaruzzaman	Bangladesh Bank, Bangladesh	Jan. 31-Feb 7, 2009
Xue Guixia	Chinese Academy of Agricultural Sciences, P. R. China	Feb. 2-14, 2009
Alias bin Man	Fisheries Research Institute, Malaysia	Mar. 8-18,2009
Shamsudin Ibrahim	Forest Research Institute, Malaysia	Mar. 23-29, 2009
Norwati Muhammad	Forest Research Institute, Malaysia	Mar. 23-29, 2009

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 JIRCAS research staff. Counterparts conduct in-depth research at JIRCAS, at other MAFF-affiliated IAAs, at prefectural research institutes, or at national universities. This invitation program aims both to enhance the quality of research conducted overseas and to facilitate exchanges of individual research staff between JIRCAS and the counterpart institutions. Eighteen researchers were invited under this program during FY 2008. Invited researchers, their affiliated research organizations, and their research activities are summarized below.

Counterpart Researcher Invitations, FY 2008

Arunee Pusudsavang	Forest Management and Forest Products Research Office, Royal Forest Department, Thailand	Analysis of forest economics in combined management of agriculture and forestry	Jun. 2-27, 2008
Woraphun Himmapan	Forest Management and Forest Products Research Office, Royal Forest Department, Thailand	Analysis of forest economics in combined management of agriculture and forestry	Jun. 2-27, 2008
Bambang Heryanto	Indonesian Center for Agricultural Land Resources Research and Development, Indonesia	Review on agricultural land use mapping efforts in Indonesia for future disaster risk mapping	Jul. 7-Sep. 5, 2008
Bambang Sugiharto	University of Jember, Faculty of Mathematic and Natural Sciences, Indonesia	Confirmation of transgenic sugarcane by Southern blot analysis and construction of expression vector of SPS and SUT genes	Jul. 1-Sep. 28, 2008
Rogelio P. Creencia	Bureau of Soil and Water Management, Soil Conservation and Management Division, Philippines	Effects of no till farming on soil erosion	Jul. 7-Aug. 9, 2008
Patrick Benson B.Espanto	Bureau of Soil and Water Management, Soil Conservation and Management Division, Philippines	Effects of plow pan destruction on soil water dynamics	Jul. 7-Aug. 9, 2008
Terry Rose	University of Western Australia, Australia	Investigation into physiological mechanisms and molecular biology of P-deficiency tolerance in Rice	Jun. 14-Jul. 22, 2008
Nguyen Thi Ngoc Truc	Division of Biotechnology, Southern Fruit Research Institute, Vietnam	Development of techniques to attenuate dameges by citrus greening disease	Jul. 29-Aug. 12, 2008
Tan He	Cultivation and Planting Institute, Heilongjiang Academy of Agricultural Sciences , China	Evaluation of the benefits of early warning systems by farm planning model	Aug. 28-Sep. 29, 2008
Liyuan Li	Institute of Agricultural Economics and Development, Chinese Academy of Agricultural Sciences (CAAS), P.R. China	Evaluation of the benefits of early warning systems by farm planning model	Aug. 28-Sep. 29, 2008
Rafael Moreira Soares	Empresa Brasileira de Pesquisa Agropecuaria, Centro Nacional de Pesquisa de Soja (Embrapa Soja), Brazil	Isolation and maintenance of soybean rust races derived from single uredinia	Sep. 7-26, 2008
Loida M. Perez	Philippines Rice Research Institute, Philippines	Genetic classification of rice varieties in Philippines	Sep. 23-Oct. 31, 2008
Aris Hairmansis	Indonesia Rice Research Center, Indonesia	Genetic classification of rice varieties in Indonesia	Sep. 28-Oct. 31, 2008
Arnulfo Baris Gesite	Bureau of Soil and Water Management, Soil Conservation and Management Division, Philippines	Development of environmental management technology for sustainable crop production in Tropical and subtropical Islands	Sep. 23-27, 2008
Samuel M. Contreras	Bureau of Soil and Water Management, Water resources Management Division, Philippines	Development of environmental management technology for sustainable crop production in Tropical and subtropical Islands	Sep. 23-27, 2008
Krailert Taweekul	Department of Agricultural Extension, Faculty of Agriculture, Khon Kaen University, Thailand	Improvement of water use and diversification of agricultural production through a participatory approach in rainfed agricultural areas of Indochina	Oct. 21-Nov. 20, 2008
Xuan Yi	Economic Research Institute, Yunnan Academy of Social Sciences , China	Influence analysis of agricultural trade liberalization on crop intensity, preservation of forestry resources, inhabitant settlement and poverty	Nov. 26-Dec. 26, 2008
Dusit Aue-umneoy	King Mongkut's Institute of Technology Ladkrabang	Diversity and Abundance of Benthic Fauna in Giant Tiger Prawn and seaweed co-culture ponds	Mar. 1-28, 2009

Project Site Invitation Program

In FY 2007, JIRCAS launched this invitation program to invite researchers from developing countries to the project sites in developing countries where JIRCAS researchers are engaged in JIRCAS-funded collaborative research activities on various research themes relevant to the projects on site, and other countries where workshops or planning meetings are held. Under this program, thirty-two researchers were invited and implemented their programs listed below.

Project Site Invitations, FY 2008

Henny Mayrowani	Indonesian Center for Agriculture Socio Economic and Policy Studies, Indonesia	Participation in the project seminar "Impact Analyses of Economic Integration on Agriculture and Policy Proposals toward Poverty Alleviation in Rural East Asia", Thailand	Jun. 26-29, 2008
Kang Yunhai	Economic Research Institute, Yunnan Academy of Social Science, P. R. China	Participation in the project seminar "Impact Analyses of Economic Integration on Agriculture and Policy Proposals toward Poverty Alleviation in Rural East Asia", Thailand	Jun. 26-Jul. 6, 2008
Amporn Winotai	Plant Protection Research and Development Office, Department of Agriculture, Thailand	Invited Speaker of Workshop	Jun. 26-28, 2008
Sopon Uraichuen	National Biological Control Research Center, Thailand	Invited Speaker of Workshop, Vietnam	Jun. 26-28, 2008
Antonio Juan Gerardo Ivancovich	Estación Experimental Agropecuaria Pergamino, Instituto Nacional de Tecnologia Agropecuaria, (INTA-EEA Pergamino), Argentine	Workshop on evaluation for soybean rust resistance (at CNPSo), Brazil	Jul. 20-25, 2008
Hernán Russian	Estación Experimental Agropecuaria Pergamino, Instituto Nacional de Tecnologia Agropecuaria, Argentine	Workshop on evaluation for soybean rust resistance (at CNPSo), Brazil	Jul. 20-25, 2008
Wilfrido Morel Paiva	Centro Regional de Investigación Agrícola (CRIA), Ministerio de Agricultira y Ganaderia, Paraguay	Workshop on evaluation for soybean rust resistance (at CNPSo), Brazil	Jul. 21-25, 2008
Chhum Phith Loan	Royal University of Agriculture, Faculty of Animal Science and Veterinary Medicine, Cambodia	Workshop of Research Project for Establishment of Feeding Standard of Beef Cattle and Feedstuff Database in Indochina, Thailand	Aug. 5-7, 2008
Thongly Xayachack	Faculty of Agriculture, National University of Laos, Laos PDR	Results and Planning Meeting of Research Project for Establishment of Feeding Standard of Beef Cattle and Feedstuff Database in Indochina, Thailand	Aug. 5-7, 2008
Viengsakoun Napasirth	Faculty of Agriculture, National University of Laos, Laos PDR	Results and Planning Meeting of Research Project for Establishment of Feeding Standard of Beef Cattle and Feedstuff Database in Indochina, Thailand	Aug. 5-7, 2008
Daovy Kongmanila	Faculty of Agriculture, National University of Laos, Laos PDR	Results and Planning Meeting of Research Project for Establishment of Feeding Standard of Beef Cattle and Feedstuff Database in Indochina, Thailand	Aug. 5-7, 2008
Patcharin Namwong	Soil Physics Research Group, Department of Agriculture, Thailand	Good Soil Care Project Meeting	Aug. 31-Sep. 4, 2008
Somrutai Tancharoen	Soil Physics Research Group, Department of Agriculture, Thailand	Good Soil Care Project Meeting	Aug. 31-Sep. 4, 2008
Suphakarn Luanmanee	Department of Agriculture, Thailand	Good Soil Care Project Meeting	Aug. 31-Sep. 4, 2008

Rini Rosliani	Soil Division, Indonesian Vegetable Research Insitute, Indonesia	Good Soil Care Project Meeting	Aug. 31-Sep. 4, 2008
Diah Setyorini	Chemistry Division, Indonesian Soil Research Insitute, Indonesia	Good Soil Care Project Meeting	Aug. 31-Sep. 4, 2008
Praphasri Chongpraditnun	Soil Science Research Group, Agricultural Production Sciences Research and Development Office,Department of Agriculture, Thailand	6th International Conference on "Moving Organic Waste recycling towards Resource Management and for Biobased Economy in Wageningen, Netherlands	Oct. 12-18, 2008
Gen Suo	College of Economics and Management Inner Mongolia Agricultural University, P. R. China	Paper presentation and discussion at the "JIRCAS-MSUA-IMAU Joint Workshop on the Development of a sustainable agro-pastoral systems in Northeast Asia" held in Mongolia	Nov. 17-22, 2008
Du Fu Lin	College of Economics and Management Inner Mongolia Agricultural University, P. R. China	Paper presentation and discussion at the "JIRCAS-MSUA-IMAU Joint Workshop on the Development of a sustainable agro-pastoral systems in Northeast Asia" held in Mongolia	Nov. 17-22, 2008
Bounlerth Sivilai	Department of Livestock and Fisheries, Faculty of Agriculture, National University of Laos, Laos PDR	Workshop of Research Project for Establishment of Feeding Standard of Beef Cattle and Feedstuff Database in Indochina	Dec. 3-4, 2008
Kimsan Sophorn	Royal University of Agriculture, Faculty of Animal Science and Veterinary Medicine, Cambodia	Results and Planning Meeting of Research Project for Establishment of Feeding Standard of Beef Cattle and Feedstuff Database in Indochina, Thailand	Dec. 3-4, 2008
Khamula Phomsavath	National Agriculture Forestry Research Institute, Soil Survey & Land Use Planning Unit, Laos PDR	Development of water resources and efficient use of water in rural area in Laos, Thailand	Dec. 10-12, 2008
Bounsong Vonvichith	Aquaculture Unit, Living Aquatic Resources Research Center, Laos PDR	Attended the project workshop	Dec. 14-20, 2008
Latsamy Phounvisouk	Aquaculture Unit, Living Aquatic Resources Research Center, Laos PDR	Attended the project workshop	Dec. 14-20, 2008
Oulaytham Lasasimma	Aquaculture Unit, Living Aquatic Resources Research Center, Laos PDR	Attended the project workshop	Dec. 14-20, 2008
Somphanh Phanousith	Aquaculture Unit, Living Aquatic Resources Research Center, Laos PDR	Attended the project workshop	Dec. 14-20, 2008
Lieng Kamsivilay	Aquaculture Unit, Living Aquatic Resources Research Center, Laos PDR	Attended the project workshop	Dec. 14-20, 2008
Dusit Aue-umneoy	King Mongkut's Institute of Technology Ladkrabang , Thailand	Attended the project workshop	Dec. 14-20, 2008
Prapansak Srisapoome	Kasetsart University, Faculty of Fisheries, Thailand	Attended the project workshop	Dec. 14-20, 2008
Na-Nakorn Uthairat	Kasetsart University, Faculty of Fisheries, Thailand	Attended the project workshop	Dec. 14-20, 2008
Suriyan Tunkijjanukij	Kasetsart University, Faculty of Fisheries, Thailand	Attended the project workshop	Dec. 14-20, 2008
Mai Van Tri	Southeast Fruit Research Center, Vietnam	Development of Floral induction techiques on durian, mangosteen, etc.Thailand	Dec. 15-18, 2008

FELLOWSHIP PROGRAMS AT JIRCAS

JIRCAS Visiting Research Fellowship Program at Tsukuba and Okinawa

The current JIRCAS Visiting Research Fellowship Program has its beginnings in FY 1992 with the launching of the JIRCAS Visiting Research Fellowship Program at Okinawa under which researchers are invited to conduct research on topics relating to tropical agriculture for a period of one year at the Tropical Agriculture Research Front (formerly Okinawa Subtropical Station). Since October 1995, a similar program (JIRCAS Visiting Research Fellowship Program at Tsukuba) has been implemented at JIRCAS's Tsukuba premises, which aims to promote collaborative research that address various problems confronting countries in the developing regions. In FY 2006, these fellowship programs were modified and merged into one. In FY 2008, a total of thirteen researchers were invited to conduct research at JIRCAS HQ (11) and at TARF (2).

JIRCAS Visiting Research Fellowships at Tsukuba and Okinawa (October 2008 to September 2009)

Tsukuba		
Do Duc Tuyen	Department of Genetic and Plant Breeding, Cuulong Delta Rice Research Institute, Vietnem	Development of DNA markers associated with tolerance to environmental stresses in soybean
Widodo	Research Centre for Biotechnology, Gadjah Mada University, Indonesia	Characterization of genes responsible for efficient Zn uptake in rice
Chhun Tory	Research and Extension Division, Kampot Provincial Agriculture Department, Cambodia	Identification of genes that function in environmental stress tolerance and useful promoters in soybean
Santoso	Plant Pathology, Indonesian Center for Rice Research (ICRR), Indonesia	Genetic and pathological study for rice blast disease based on differential system
Noelle Giacomini Lemos Torres	Agronomy Department, Maringa State University, Brazil	Pyramidization of resistance genes against soybean rust and their quantitative evaluation
Rattiya Waeonukul	Biochemical Technology, King Mongkut's University of Technology Thonburi, Thailand	Efficient saccharification of lignocellulose using highly active microbial enzymes
Patthra Pason	Biochemical Technology, King Mongkut's University of Technology Thonburi, Thailand	Elucidation of function and structure of xylanosome, a multicomponent enzyme (cellulase/hemicellulase) complex
Do Thi Thu Huong	National Key Laboratory, Plant Cell Biotechnology, Agricultural Genetics Institute, Vietnam	Elucidation of 2-acetyl-1-pyrroline formation pathway in aromatic rice
Zhigao Zhou	Plant Nutrition and Fertilizer Science, Institute of Soil Science, Chinese Academy of Sciences, P. R. China	Biological nitrification inhibition by sorghum
Adel Mohamed Ghoneim	Agronomy and Soil Fertility, Egyptian Agricultural Center, Rice Research and Training Center (RRTC) , Egypt	Effectiveness of chemical compounds released from grasses and crops that inhibit ammonia oxidation in soil
Thi Tar Oo	Department of Entomology and Zoology, Yezin Agricultural University, Myanmar	Ecological studies on parasitoids for biological control
Okinawa		
Farid Abdel Aziz El-Sayed Hellal	Department of Plant Nurtrition, Agriculture and Biology Research Division, National Research Centre	Soil fertility management using leguminous crops in the conservation agriculture
Imelida Campion Genson	Water Resources Management Division, Bureau of Soils and Water Management	Evaluation of topsoil conservation measures for catchment by using simulation model

JIRCAS Visiting Research Fellowship Program at Project Sites

This fellowship program has been implemented since May 2006 at collaborating research institutions located in developing countries where collaborative researches are being carried out by JIRCAS researchers. It aims to promote the effective implementation of ongoing collaborative researches at the project sites through the participation of local research staff. Furthermore, through this fellowship program, JIRCAS intends to contribute to capacity-building of the collaborating research institutions. In FY2008, three researchers were invited to Thailand (2) and Niger (1). The fellows and their research subjects are listed below.

For inquiries on the JIRCAS Visiting Research Fellowship Program, please contact the International Relations Section (Tel. +81-29-838-6335; Fax +81-29-838-6337; e-mail: irs-jircas@ml.affrc.go.jp)

JIRCAS Visiting Research Fellowships at the Project Site (October 2008 to September 2009)

Saowalak On-Ming	Faculty of Fisheries, Kasetsart University, Thailand	Immunocompetence of black tiger prawn induced by co-culture with algae
Addam Kiari Saidou	Microbiology and Fertility of Soils, Institut National de Recherches Agronomiques du Niger (INRAN), Niger	Quantification and verification of nutrient budgets (C, N and P) in the cropping systems using double-purpose cowpea cultivars.
Natthamon Tangjitwattanachai	Department of Animal Science, Faculty of Agriculture, Khon Kaen University, Thailand	Analysis of the factors affecting variation of metabolizable energy of feeds for tropical beef cattle

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 host scientists, for terms of generally one month to three years. Fellowships can be undertaken in any of the ministries, and many fellows are currently working at various IAAs affiliated with MAFF. The visiting scientists that resided at JIRCAS in FY2008 are listed below.

JSPS Postdoctoral Fellowships for Foreign Researchers (September 2006 to October 2010)

FREI, Michael	University of Hohenheim, German	Physiological and genetic factors associated with tolerance of Zinc deficiency in rice	Jun. 25, 2007 - Jun. 24, 2009
PARVEZ, Syeda Shahnaz	Bangladesh	Bioavailability of antioxidative phenolics from selected edible plants consumed in Southeast Asia	Sep. 1, 2006- Aug. 31, 2008
ZHU, Yiyong	Nanjing Agricultural University, P.R.China	Role of plasma membrane H-ATPase in regulating the NI activity release from B. Humidicola	Oct. 1, 2006- Sep. 30, 2008
JAN, Asad	NWFP Agricultural University, Pakistan	Analysis of plant growth regulation under abiotic stress conditions	Oct. 11, 2006 - Oct. 10, 2008
ROSE, Terry James	University of Western Australia, Australia	Investigation into physiological mechanisms and molecular biology of P-deficiency tolerance in rice	Oct. 13, 2008 - Oct. 12, 2010
PEARS, Stuart James	University of Western Australia, Australia	Genetic exploitation of NI (nitrification inhibitory) activity from the roots of Leymus sp. And wheat - Determination of the physiological mechanisms and regulating factors for the release of NI activity in Leymus sp.	Oct. 25, 2006 - Oct. 24, 2008
QIN, Feng	JIRCAS Visiting Research Fellow, Japan	Functional analysis of DREB2 transcription factors involved in drought and salt stress in plants	Nov.30, 2007 - Nov. 29, 2009
CHEN, Charles P.	University of Illinois, USA	Characterization of the physiological mechanism and genetic basis of ozone tolerance in rice	Nov. 1, 2008 - Oct. 31, 2010

WORKSHOP

Workshop on Stable Food Supply Systems for Mitigating the Fluctuations of Production and Markets in China

Rice is a major grain food crop that is widely cultivated from tropical to cool climate zones. Heilongjiang Province, located in a cool climate zone, is one of the major rice production areas in China. Our project focuses on stable food supply systems for mitigating the fluctuations of food production and markets caused by both natural and economic phenomena. The project started in FY 2004 and finished in FY 2008. On October 28 and 30 2008, we held a final workshop of the project in Beijing and Harbin.

There were three sessions consisting of Early-warning system for mitigating the risk caused by climate disasters through technological approach, social issues of farm management risk, farmer-market integration and domestic and international market fluctuations, and general discussion. A total of 16 presentations were included. Among them, eight speakers from Japan, and another eight speakers from the Chinese Academy of Agricultural Sciences (CAAS), Development Research Center of the State Council (DRC) and Heilongjiang Academy of Agricultural Sciences (HLJAAS) attended. In Beijing 45 researchers and officers from CAAS, Ministry of Agriculture (MOA), DRC attended. In Heilongjiang, more than 50 researchers and extension workers were invited to workshop.

Program :

- Chaired by Dr.H.Chien, Project Leader

Opening Address

- Tang Huajun, Vice President of CAAS (Chinese Academy of Agricultural Sciences)
- K. Satake, Councilor of Japan Embassy in China
- O. Koyama, JIRCAS

Session 1 : Early-warning system for mitigating the risk caused by climate disasters through technological enhancement of resource monitoring and crop-model simulation

- Development of mapping method of paddy fields using MODIS data applied to Heilongjiang Province in China, S.Uchida, JIRCAS
- Analysis of reduction of rice yield caused by cool weather using MODIS data and SIMRIW model, Y. He, Y. Chen, H. Tang, IARRP,CAAS
- Application of Field Servers technology in China, M. Hirafuji, NARC
- Development of evaluation approach of agricultural disasters using mesh climate dataset, Y. Ishigooka, H. Toritani (NIAES), Y. Xu (IESDA, CAAS), J. Jiao, X.Xu (HAAS)
- Construction of mesh climate database in China for developing early warning system for agricultural disasters, Y.Xu, X. Zhao, Y. Zhang (IESDA, CAAS), H.Toritani, Y. Ishigooka (NIAES), H.Chien (JIRCAS)
- Development of rice farming in Heilongjiang Province and role of project, J.Jiao (HAAS), Y.Li (NEAU)
- Development of crop growth model in typical region, R. Samejima, NARCT
- Experiment of model of cool weather damage to rice yield, X. Xu, J. Bian, W. Li, Z. Wang (HAAS), K. Nakamoto (JIRCAS)
- An early warning system for predicting cool weather damage to rice production in Heilongjiang Province, E. Kanda, NARCT
- Explanation of use of the early warning system for cool weather damage to rice production in Heilongjiang Province, H. Tan, HAAS

Session 2 : Analysis on farm management risks, farmer-market integration and domestic and international market fluctuations

- Study on risk management of rice farming in Heilongjiang Province, China, K. Nakamoto (JIRCAS), J. Jiao (HAAS), X. Xu (ICPC, HAAS)
- Variety selection of rice farmer from the viewpoint of risk control for cool summer damage, L. Li (IAED, CAAS)
- Current situations and issues of grain production and circulation integration management in China, N. Yamashita (PRIMAFF)

- Theory and experiment of farmer specialty cooperatives in China, G. Xue (IAED, CAAS)
- Trend and estimate of rice supply and demand in Heilongjiang, H. Chien (JIRCAS), Y. Chen (CAU)
- Policy on food security in recent years, J. Guo, DRC

Session 3: General Discussion

- Commentator: Dr. K. Kobayashi, The University of Tokyo

Closing Address

- Mr. Lu Xiaoping, Deputy director, Department of International Cooperation, Ministry of Agriculture (MOA)

Village Workshop of Rainfed Agriculture Project

The workshop was held on December 9 at the meeting hall of Nong Saeng Village in Ban Haed District, Khon Kaen Province, Thailand. More than 120 people participated and there was active exchange among the people from various sectors according to reports by the mass media. The Rainfed Agriculture Project has been conducted in collaboration between JIRCAS and Thai research organizations such as the Department of Agriculture (DOA), Land Development Department (LDD) and Khon Kaen University (KKU) for the past seven years. The project is based at Nong Saeng village which is located about 40km south of Khon Kaen City and is producing various technologies for the village farmers to achieve more integrated farming operation through more efficient utilization of water resources. The project could never be successful without the active participation of the village farmers. So it was decided to organize a one-day workshop in order to disseminate major research achievements to farmers not only in Nong Saeng

Village, but also in neighboring villages.

The workshop consisted of morning and afternoon sessions. Three key technologies developed by the project were presented by Thai researchers together with the farmers in the morning session followed by a visit to farmers, fields in the afternoon where those technologies will be applied.

Workshop Program:

Opening Remarks

- OBOTO, KKU, DOA, LDD

Presentation

- Water use planning tool: Uchada Sukchan, International Training Center for Agricultural Development
- Groundwater use guideline: Kriengsak Srisuk, Khon Kaen University
- Water-saving technology: Praphasri Chongpradinun, Department of Agriculture

Field Trip

- Water saving vegetable cultivation at Mrs. Amporn's field
- Farming system of efficient water use at Mrs. Somjit's field
- Soil section in Nong Saeng village by trenching at Mrs. Somjit's field

Workshop on Integrated Management of Tropical Fruits, Durian & Mangosteen

Durian and mangosteen, the king and queen of fruits, respectively, are considered to be high-value fruits in producing countries and are expected to obtain high profits and income for growers. However, growing these fruits do not always lead to good results as there are many problems restricting yield and fruit quality.

This workshop was organized to identify current problems on the production and marketing of tropical fruits and to review the current progress of the JIRCAS Tropical Fruit Research Project. It was held at Chanthaburi Horticultural Research Center in Thailand on December 16-17, 2008 with more than fifty researchers, fruit growers and extension workers not only from Thailand and Japan but also from Vietnam.

At the workshop, one of the participants from a fruit marketing company pointed out that high quality fruits are essential for growers to obtain high profits. Fruit growers reported current problems such as the lack of information in regard to cultural practices, disease and pest control, and marketing. Researchers presented their achievements of the project. After much discussion, participants agreed on the importance of information exchange and further research.

A Field trip was held the following day to observe exemplary fruit growers. Participants were very interested in the advanced practices and eagerly exchanged information.

Program:

Session I Cultural practices report. Current problems & solutions.

- Tropical fruit marketing in Southeast Asia: J.Keida, TANIYAMA SIAM CO., LTD.
- Floral induction of durian in down land & upland Southern Vietnam: M.V. Tri, SEFRC Vietnam

Session II Recommendation for integrated management

－ Low tree height training session

- Evaluation of canopy size, vegetative growth, light intensity, and yield after cut back treatment in durian: N. Kozai, JIRCAS
- Some points to consider on low tree height training of fruit trees: T. Ogata, JIRCAS

－ High quality fruit production session

- Water dynamics and fruit flesh disorder of mangosteen: H. Higuchi, Kyoto University
- Fruits production by artificial pollination in the daytime hours based on the functional period of reproductive parts in durian: C.Honsho, University of Miyazaki
- Searching for effective pollinator of durian: M. Tsukada, Mie University

Field Trip

JIRCAS Workshop on the Sustainable Management and Aquaculture Technology Suitable for Southeast Asia

JIRCAS held an international workshop from December 15－17, 2008 at the Sheraton Langkawi Beach Resort, on Langkawi Island in Malaysia. The workshop was held as part of two research projects of the Fisheries Division of JIRCAS. One is "Research for Suitable Stock Management in Tropical and Subtropical Areas", which is run in collaboration with the Fisheries Research Institute (FRI) of Malaysia, the University of Malaya (UM), and the Fisheries Research Agency (FRA) of Japan. The other is "Development of Aquaculture Technologies Suitable for Southeast Asia", which is to run in collaboration with Kasetsart University (KU), King Monkut's Institute of Technology Ladkrabang (KMITL) in Thailand, and the Living Aquatic Resources Research Center (LARReC) of Laos. The workshop was organized to enable external reviewers to evaluate the research outcomes of the first half of these 5-year projects, to discuss promising directions, and to identify perspectives for the coming second half. Unfortunately, some of the expected oral presentations had to be replaced by poster presentations because the political instability in Thailand prevented some of the expected participants from Thailand and Laos from attending. Nevertheless, 12 oral presentations were submitted in the three sessions.

Programme:

1. Research for suitable stock management in tropical/subtropical areas

Session 1: Management of Matang Mangrove Estuary by an ecosystem－fisheries model

(Chaired by Dr. Alias Man, FRI)

- Coastal Mud Flats and Fisheries: What Connections?: Prof. Chong Ving-Ching (UM)
- Physical characteristics and microphytobenthic assemblages of Matang mudflats: Dr. Chai SinYin (UM)
- Distribution patterns of the macrobenthic community in the Matang Mangrove Estuaries: Dr. Ryon Siow (IFRC)
- Mangrove as a carbon source for the blood cockle (*Anadara granosa*) and juvenile fishes in the Matang Mangrove Estuary: Dr. Katsuhisa Tanaka (JIRCAS)
- Preliminary Ecopath model for the Matang mangrove estuary: Dr. Shingo Watari (FRA)

Session 2: Stock assessment and management of commercially important fishes

（ Chaired by Prof. Chong Ving-Ching,UM）

- Density and productivity of commercial fishes in Northwest coast of Peninsular Malaysia: Dr. Alias Man (FRA)
- Cage net trap study of grouper, *Epinephelus coioides*, for stock assessment and management: Dr. Toshihiro Yamamoto (JIRCAS)

・ Ecological characteristics of hyperbenthic crustacean in mangrove estuaries of NW Peninsular Malaysia: an overview: Dr. Yukio Hanamura (JIRCAS)

2. Development of aquaculture technology suitable for Southeast Asia

(Chaired by Mr. Ismail Ishak, FRI)

・ Policy of aquaculture development in Lao P. D. R.: Mr. Somphanh Phanousith (LARREc)
・ Importance of flood-plane small fishes: a case study on fundamental biology of two short-lived species, *Brachygobius mekongensis* and *Parambassis siamensis*: Dr. Shinsuke Morioka (JIRCAS)
・ A brief review of the freshwater prawn genus *Macrobrachium* Bate, 1868 (Crustacea: Decapoda, Palaemonidae) in northern Laos and its neighbouring areas: Dr.Yukio Hanamura (JIRCAS)
・ Review of tropical sea cucumber fisheries and aquaculture in Southeast Asia, prospective research plan: Dr. Satoshi Watanabe (JIRCAS)

Workshop: Sustainable Development and Dissemination of Lowland Rice and Paddy Fields in Inland Valleys of West Africa

Stable food production is one of the most important issues in combating poverty in Africa, where the recent increase in rice production suggests the presence of a large demand for rice. Since rice is considered a special important cereal with high potential within the region for increased production, gathering knowledge for this crop especially for inland valleys is clearly essential, because inland valleys got the major share of the potential in the region.

The workshop was held under the joint sponsorship of JIRCAS and the International Water Management Institute (IWMI) from February 24 to 25, 2009 at Accra in Ghana. It was organized to identify the possibilities of sustainable development of paddy fields and dissemination of rice to inland valleys in West Africa, and the constraints on the road ahead as well. Participants joined from international organizations, national agencies and development partners i.e. Forum for Agricultural Research in Africa (FARA), West Africa Rice Development Association (WARDA), Alliance for a Green Revolution in Africa (AGRA), JICA and many research institutions in Ghana, as well as the Japanese Embassy. They exchanged the experiences and achievements so far and discussed the way forward. Among them, JIRCAS presented 1) the results of the research on submerged rice and 2) a study on development of improved infrastructure and technology for rice production that is being conducted in Ghana.

Program:

- ***Opening Address*** by Dr. Akissa Bahri, Diector, International Water Management Institute (IWMI)
- ***Opening Address*** by Mr. Yutaka Nakamura, Charges d'Affaires, Embassy of Japan

Session 1 : TEIWRMT (Research on Transferring Effective Irrigation and Water-Resource Management Technique) Achievements
Session 2 : Experiences of IV Development in West Africa
Session 3 : Water Productivity by Rice Ecologies
Session 4 : Way Forward toward Dissemination of Lowland Rice in IV
Session 5 : General discussion

- ***Closing Remarks*** by Dr. Barry Boubacar, Head, International Water Management Institute (IWMI)

Symposium on Agricultural and Rural Development Contributing to Efforts Combating Global Warming

The symposium was held under the joint sponsorship of JIRCAS and JICA, and co-sponsorship of the Ministry of Agriculture, Forestry and Fisheries (MAFF), Ministry of Environment, National Institute for Agro-Environmental Sciences (NIAES) on March 15, 2009 at JICA Research Institute in Tokyo with 142 participants.

This symposium was aimed to understand and discuss the present situation and challenges for the measures against global warming caused by the increase of greenhouse gases (GHG) emitted through human activities, and tackled by the international cooperation field in the agricultural and rural development sector in Japan, which are especially centered on emission reduction

and GHG removals by sinks.

The speakers presented the topics on the GHG emission accompanied by the decrease of forests and the role of afforestation and reforestation CDM (AR-CDM) in the Kyoto Protocol, examples of MAFF's international contributions to the measures against global warming, new ODA program for mitigating and adapting to climatic change and sequestration of carbon to soil by the change of soil management.

In the session of Panel Discussion, after the presentation of the JIRCAS study in Paraguay and Vietnam on the rural development based on CDM, various ideas were exchanged. They were the methods to support rural areas in developing countries vulnerable to climatic change, rural development measures by farmers' participation, and problems on AR-CDM.

The results of a questionnaire survey conducted after the symposium indicated that 91% of respondents were satisfied to have been present and 97% expressed intention to participate in this kind of symposium again.

Program:

Keynote Session

- "The role of rural communities in developing countries expected in the Kyoto Protocol" Masahiro Amano, Waseda University

Session

- "International contribution to combating global warming through agriculture and rural development" Harumi Saito, Ministry of Agriculture, Forestry and Fisheries
- "Activities of JICA for combating climatic change" Junji Yokokura, JICA
- "Measures combating global warming and new master plan for food, agriculture and rural development" Yoshihiro Hayashi, Tokyo University

Panel Discussion

Chaired by Dr. Yoshihiro Hayashi

Panelists: Dr. Masahiro Amano, Dr. Harumi Saito, Dr. Junji Yokokura, Ms. Mari Yoshitaka (Mitsubishi UFJ Securities), Mr. Eiji Matsubara (JIRCAS)

- Presentation of JIRCAS study: "Development of rural development method based on clean development mechanism (CDM)" Eiji Matsubara, JIRCAS

Opening speech (President Dr. Iiyama, JIRCAS).

Panel discussion (Question from a participant).

Presentation of JIRCAS study (Mr. Matsubara).

Panel discussion (Panelists).

International Symposiums and Workshops, FY2008			
1	Symposium on Agricultural Development in Africa: Current Situation in Agriculture in Africa and Japan's Cooperation	Apr. 24, 2008	Tokyo, Japan
2	JIRCAS Contribution to TICAD IV	May 27, 2008	Tokyo, Japan
3	Workshop on development of environmentally - friendly Water-saving Technologies for Rice	Jun. 18, 2008	Tsukuba, Japan
4	Conservation Agriculture (CA) Workshop	Jun.23 & 25, 2008	Nanyuki, Kenya
5	Workshop on remote sensing and GIS technology for suitable utilization of agricultural resources in Indonesia	Jun. 25, 2008	Bogor, Indonesia
6	Brontispa longissima: Current situation and control measures in Southeast Asia	Jun. 27, 2008	Ho Chi Minh, Vietnam
7	Impact analysis of economic integration on agriculture and policy proposals toward poverty alleviation in rural east Asia	Jun.27-28, 2008	Bangkok,Thai,
8	JIRCAS Challenges: Biomass production, conversion and refinery system in conjunction with sustainable global environment and economy	Jul. 1, 2008	Bangkok, Thai
9	International Symposium on “Feeding Standard and Database for Improvement of Beef Cattle in Indochina Peninsula”	Aug.6-7, 2008	Khon Kaen, Thai
10	JIRCAS Seminar: Value addition of Thai agricultural products through improvement of food functionality	Sep. 10, 2008	Bangkok, Thai
11	The APAARI-JIRCAS International Symposium	Oct.21-22, 2008	Tsukuba, Japan
12	Workshop on stable food supply systems for mitigating the fluctuations of production and markets in China	Oct. 28, 2008	Beijing, China
13	Identification and characterization of blast race and resistance gene based on differential system	Oct. 29, 2008	Tsukuba, Japan
14	Workshop on stable food supply systems for mitigating the fluctuations of production and markets in China	Oct. 30, 2008	Harbin, China
15	JIRCAS-MSUA-IMAU Joint workshop for the development of sustainable agro-pastoral system in Northeast Asia	Nov. 19, 2008	Ulaanbaatar,Mongolia
16	Seminar on the Field Manuals for the Prevention of Desertification in East Africa	Nov. 12, 2008	Melkassa
17	JIRCAS/CTU Seminar: 1st Seminar on Clean Development Mechanism (CDM) and Rural Development	Nov. 28, 2008	Ethiopia
18	Fifth Biomass-Asia Workshop	Dec.3 & 5, 2008	Can Tho University, Vietnam
19	Village Workshop of Rainfed Agriculture Project	Dec. 19, 2008	Guangzhou, China

20	Integrated management of tropical fruits, durian and mangosteen	Dec.16-17, 2008	Khon Kaen, Thai
21	JIRCAS Workshop on the Sustainable Management and Aquaculture Technology Suitable for Southeast Asia	Dec.15-16, 2008	Chanthaburi, Thai Langkawi, Malaysia
22	The Seminar for Verification Study on Integrated Agricultural and Rural Reconstruction Support through Participatory Approach in Tsunami Affected Area	Jan. 29, 2009	Matara, Sri Lanka
23	Workshop on Sustainable Development and Dissemination of Lowland Rice and Paddy Fields in inland valleys of West Africa	Feb.24-25, 2009	Accra, Ghana
24	2nd Seminar on Rural Development based on Small Scale Afforestation and Reforestation Clean Development Mechanism (CDM)	Mar. 6, 2009	Asuncion, Paraguay
25	Workshop on development of techniques for nurturing beneficial indigenous tree species and combined management of agriculture and forestry in the Northeast of Thailand, tropical monsoon regions	Mar. 10, 2009	Bangkok, Thai
26	Symposium on Agriculture and Rural Development Contributing to Combating Global Warming	Mar. 15, 2009	Tokyo, Japan
27	International Seminar on Measures against Farmland Damage from Salinization	Mar. 23, 2009	Tashkent, Uzbekistan
28	JIRCAS/CTU Seminar: 2nd Seminar on Rural Development based on Clean Development Mechanism (CDM)	Mar. 27, 2009	Can Tho, Vietnam

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 and dispatch assignments. These seminars are ordinarily held twice per month, and each year 25 scientists give presentation.

APPENDIX

PUBLISHING AT JIRCAS

OFFICIAL JIRCAS PUBLICATIONS

In English

1) JARQ (Japan Agricultural Research Quarterly)
   Vol. 42 No. 2, No. 3, No. 4
   Vol. 43 No. 1
2) Annual Report 2007
3) JIRCAS Newsletter — No. 54, No. 55, No. 56
4) JIRCAS Working Report Series
   - No. 60 Development of Agroforestry Technology for the Rehabilitation of Tropical Forests
   - No. 61 Technical Report and Manual of Seed Production of the Climbing Perch Anabas testudineus
   - No. 62 Human Values, Social Capital and Sustainable Development: A cross-country Analysis from Asia
   - No. 63 Development and Characterization of Blast Resistance Using Differential Varieties in Rice
   - No. 64 Establishment of a Feeding Standard for Beef Cattle and a Feed Database for the Indochinese Peninsula
5) JIRCAS International Agriculture Series
   - No. 17 Local Vegetables of Thailand: Color illustrated

In Japanese

1) JIRCAS News — No. 54, No. 55, No. 56
2) JIRCAS Working Report Series — No. 59 Sustainable Development of Rice Cultivation and Related Issues in Heilongjiang Province
3) JIRCAS Research Highlights — No. 15

RESEARCH STAFF ACTIVITY 2008-2009

Journal articles, book chapters, and monographs

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Bhandari, H. and **Yasunobu, K.** (2009) Human values, social capital and sustainable development: A cross-country analysis from Asia. JIRCAS Working Report 62 : 1-106.

Chaokaur, A., **Nishida, T.,** Wijitphan, S., Pattarajinda, V. and Sommart, K. (2009) Metabolizable energy and crude protein requirement for maintenance of Brahman cattle offered varying levels of feed intake under tropical conditions. JIRCAS Working Report 64 : 37-39.

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Chein, H., Kang, Y., Tada, M. (2008) Farm household economy in the border areas and the effect of free trade. Japanese Journal of Rural Economics, Special Issue 2008 : 463-469.(J)

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Elbeltagy, A. and **Ando, Y.** (2008) Expression of nitrogenase gene (NIFH) in roots and stems of rice, *Oryza sativa*, by endophytic nitrogen-fixing communities. African Journal of Biotechnology 7 (12) : 1950-1957.

Farooq, M., **Kobayashi, N.,** Wahid, A., **Ito, O.** and Basra, S. M. A. (2009) Strategies for producing more rice with less water. Advances in Agronomy 101 : 351-388.

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Second Medium-Term Plan of the Japan International Research Center for Agricultural Sciences

The Japan International Research Center for Agricultural Sciences (JIRCAS) was established in April, 2001 as an Independent Administrative Agency (IAA) of the Ministry of Agriculture, Forestry and Fisheries (MAFF), for the purpose of contributing to the improvement of technologies related to agriculture, forestry, and fisheries in tropical and subtropical areas as well as other overseas developing regions (hereinafter referred to as "developing regions") by conducting research and development in these areas.

During the First Medium-Term Goal period, JIRCAS worked on research and development (R&D) for the sustainable development of agriculture, forestry, and fisheries as well as on the expansion of international research exchanges and networks by taking both domestic and overseas situations into account, such as the adoption of the U.N. Millennium Development Goals and the announcement of the Policy for the Promotion of International Agricultural Research (decided by the Agriculture, Forestry and Fisheries Research Council in September 2003). In managing its operations, JIRCAS took advantage of its new status as an IAA and embarked on making flexible changes in its organization and system, and promoted the improvement of the quality of research and support work and their efficiency.

During the Second Medium-Term Goal period, JIRCAS plans to contribute to improving technologies for agriculture, forestry and fisheries in the developing regions through "Research and development on agricultural, forestry, and fisheries technology geared towards providing solutions to international food and environmental problems" and "Collection, analysis and dissemination of information to grasp trends related to international food, agriculture, forestry, fisheries and rural areas." To make these global contributions smooth and stable, JIRCAS further promotes operations such as the creation of a multilateral collaborative research system, promotion of collaborative research with world-class research organizations led by the Consultative Group on International Agricultural Research (CGIAR), establishment of a dynamic research system, strategic development of human resources, and enhancement of public relations.

Optimized allocation of research resources and improvement of various systems are implemented to carry out these activities efficiently and effectively, and to generate high-quality outputs for the international community. Major researches at JIRCAS are implemented as projects, and all the necessary budgets for achieving results are allocated on a project basis. Efforts will also be made to improve the system for overseas activities and to simplify administrative procedures.

For efficient and effective promotion of these operations, exchange activities are enhanced by utilizing the Japan Forum for International Agricultural Research for Sustainable Development (J-FARD), which was initiated by JIRCAS and others in 2004 to build a new partnership between Japan's international researchers and organizations in agriculture, forestry and fisheries, and to promote cross-organizational cooperation and collaboration nationwide. JIRCAS also aims to build flexible personnel and business management systems.

With the dissolution of the Japan Green Resources Agency on April 1, 2008, its international activities were transferred to JIRCAS which is smoothly executing these activities.

Through this series of activities, JIRCAS is committed to making international contributions and promoting national interests by fulfilling its responsibilities as Japan's only research institution mandated to carry out international researches in agriculture, forestry, and fisheries comprehensively.

I. Measures to be taken to achieve our goal of efficient business management

As for administrative operations implemented by operational grants, operations are reviewed and efficiency is further promoted. General and administrative expenditures are cut by at least 3% from the previous year and research expenditures by at least 1% from the previous year during the Medium-Term Goal period each year.

In line with the key policy of administrative reform (decided at the Cabinet meeting on December 24, 2005), personnel expenditures will be cut by more than 5% over the next five years (except for retirement allowances and welfare expenditures (but not applying to legal and non-legal welfare expenditures) and part of salaries revised in accordance with the recommendation by the National Personnel Authority). Necessary reviews of salaries of personnel in managerial positions are also made by taking into account the structural reform of salaries of government officials.

1. Implementation and feedback from evaluations and checks

(1) JIRCAS will use external specialists and experts to ensure its objectivity and reliability; and operations and research are evaluated and reviewed by JIRCAS itself prior to releasing its Annual Report to the IAA Evaluation Committee established within the Ministry of Agriculture, Forestry and Fisheries (MAFF).

(2) Numerical goals and indicators for major research projects are set as concretely as possible, and inputs of research resources and obtained results are analyzed from the viewpoint of ensuring their contribution to the improvement of technologies concerning agriculture, forestry, and fisheries in the developing regions. JIRCAS will also make efforts to diffuse its research achievements and monitor the status of their utilization.

(3) JIRCAS will endeavor to streamline and upgrade its evaluation methods by ensuring the mutual utilization of data needed for a multiple evaluation system. It will also improve this evaluation system when necessary.

(4) To allocate research resources on a priority basis, JIRCAS will clarify basic ideas and concrete methods of feeding evaluation and feedback the results of the in-house evaluation to the administrative management along with the evaluation results from the IAA Evaluation Committee.

(5) JIRCAS will make comprehensive performance evaluations of its research personnel, all the while ensuring the fairness and transparency of the evaluation items and standards. The results will be appropriately fed into the priority allocation of research resources and the treatment of research personnel.

(6) A new evaluation system will be introduced to assess the performance of general administrators in light of the need to revitalize the organization and achieve better results.

2. Effective use of research resources and their improvement and upgrading

(1) Research funds

1) Evaluation results are appropriately fed through to budget allocations, and the effective use of operational grants for administration is promoted.

2) The planning system for acquiring competitive funds is enhanced. Efforts will be made to increase research funds and accelerate research activities by positively applying for external funds useful for achieving our Medium-Term Goals.

(2) Research facilities and equipment

1) Research facilities and equipment will be shared to ensure their efficient utilization. Information on machinery available for joint use and open laboratories will be widely disclosed via the internet.

2) Planned renovation and upgrading of old facilities essential for research promotion laid out in the Medium-Term Plan will be implemented in line with JIRCAS's research prioritization.

(3) Organization

1) JIRCAS will be reorganized as necessary to gain optimal insight into problems in the developing regions.

2) A leader will be assigned to each research project. Responsibility and authority is given to the leader concerning the management of the progress of the research and the allocation of research resources in the project.

3) The functions of the local offices are strengthened in regions such as Southeast Asia where research activities are concentrated.

(4) Improvement of staff qualifications and development of human resources

1) We will create a program aimed at developing human resources, including young researchers, to enable us to nurture personnel and improve their qualifications in a well-planned manner.

2) Efforts will be made to improve the qualifications of researchers who play a key role in international collaborative research through their dispatch abroad or by collaborative studies with invited overseas researchers.

3) We will create a competitive and cooperative environment for research personnel, provide them with effective incentives, develop their career path by utilizing a range of employment systems and conduct smooth personnel exchanges with research organizations, including other IAAs.

4) We will make efforts to improve our personnel's qualifications by having the administrative and technical staff actively participate in various training sessions needed for the pursuit of their duties and help them acquire qualifications useful for their jobs. Efforts will also be made to improve the system that allows technical staff to engage positively in research support.

5) The management ability and leadership of research project leaders will be improved utilizing

various training systems.

3. Promotion of efficiency, improvement, and upgrading of research support sector
(1) Maintenance of facilities and machinery will be outsourced depending on the type of job.
(2) Details of work at the General Affairs Section will be reviewed to ensure an efficient implementation system and to promote the efficiency of clerical management work by speeding up and simplifying clerical procedures.
(3) JIRCAS will provide efficient local support to researchers dispatched abroad for their experimental and accounting work.
(4) Efforts will be made to streamline, upgrade, and enhance research support by reviewing and focusing the jobs of the technical personnel onto areas that require highly specialized technology and knowledge to meet needs for advanced experimental and research work.
(5) Efforts will also be made to rationalize staffing for research support by reviewing overall support work and promoting outsourcing as much as possible.
(6) The Ministry of Agriculture, Forestry and Fisheries Research Network (MAFFIN) will be utilized to streamline, upgrade, and enhance work on the collection and provision of research information along with efforts to promote information-sharing across JIRCAS and streamline operations by utilizing groupware.

4. Promotion and enhancement of collaboration and cooperation between industry, academia, and government
(1) While taking into account our sharing of roles with other IAAs, we will positively pursue collaborative research and alliances, including personnel exchanges and cooperation between other IAAs and JIRCAS.
(2) To promote collaborative research and researcher exchange more actively, efforts will be made by utilizing J-FARD to improve information exchanges and alliances with national and public research organizations, universities, the private sector, overseas organizations, international organizations, and the Japan International Cooperation Agency (JICA).
(3) Opinions will be exchanged with related IAAs, the government departments concerned, and national and public research institutes concerning the forms that alliances and cooperation should ideally take in carrying out research projects undertaken by JIRCAS.
(4) To move ahead with research projects efficiently, we will seek alliances with the government.
(5) Cooperation will be provided to the National Agriculture and Food Research Organization (NARO) as necessary in implementing comprehensive research that features a fusion of expert knowledge in diversified fields.

II. Measures to achieve the goals of improving the quality of services and other duties provided to the public

1. Research and investigations
(1) Promotion of international collaborative research and international contributions
1) To promote collaborative research and researcher exchange more actively, efforts will be made by utilizing J-FARD to improve information exchange and alliances with national and public research organizations, universities, the private sector, overseas organizations, international organizations, and JICA.
2) To contribute to problem-solving in developing regions and the improvement of technologies for agriculture, forestry, and fisheries, more than 1,000 researchers and research managers, mainly from JIRCAS but including those from other IAAs and universities, will be dispatched to research organizations in the developing and developed countries and international research organizations affiliated with the CGIAR during the Second Medium-Term Goal period to promote smooth international collaborative research and to actively participate in international contributions.
3) Research managers will be invited from research organizations in the developing regions to enhance collaboration and cooperation through consultation on the course of collaborative research promotion.
4) More than 500 collaborative researchers and research managers will be invited from agricultural, forestry, and fisheries research organizations in the developing regions during the Second Medium-Term Goal period to conduct collaborative research or improve the capacity of the

researchers concerned.

5) At least 80 effective Memoranda of Understanding (MOUs) and other similar contracts on research implementation between JIRCAS and overseas research organizations will be constantly maintained during the Second Medium-Term Goal period.

6) In an effort to contribute to the promotion of international collaborative research in agriculture, forestry, and fisheries, a project will be launched through tie-ups with the government sector to provide financial incentives to researchers at agricultural, forestry, and fisheries research organizations in the developing regions.

(2) Direction of research promotion

In line with the course of research indicated in "the Promotion Policy of International Agricultural Research" and the "Basic Plan for Agriculture, Forestry and Fisheries Research" (decided at the meeting of the Agriculture, Forestry and Fisheries Research Council on March 30, 2005), JIRCAS will carry out the following priority research projects by utilizing J-FARD and taking into account the "Strategy for International Collaborative Research [JIRCAS's role]", summarizing the results of JIRCAS international symposia and researches with overseas research organizations, and the opinions of external experts.

1) Research projects targeting the developing regions will be launched to help reduce by half the world's hungry population, as indicated in the U.N. Millennium Development Goals. For this purpose, crops tolerant to unfavorable environmental conditions that make crop production unstable, such as drought, salinity, and disease, will be jointly developed by research organizations affiliated with CGIAR.

2) Many problem-solving research projects will be enhanced, with a focus on the utilization of biological resources, environmental resources management, and measures to address environmental and food problems in Asia, designated as an area in which the strategic alliance in science and technology needs to be strengthened according to a new "Science and Technology Basic Plan."

3) JIRCAS will support international contributions to Africa as indicated in the Progress Report by the G8 Africa Personal Representatives on implementation of the Africa Action Plan at the Gleneagles G8 summit (held in July 2005) in the field of research and development. Technologies related to crops and the soil will be developed to increase crop production in Africa.

4) To contribute towards achieving the target of CO2 reductions imposed by the Kyoto Protocol, research into biomass will be undertaken by JIRCAS in Southeast Asia as a research institute capable of developing a technology for biomass utilization on-site.

5) There are many large and small islands in the Asia-Pacific area. They are vulnerable to environmental changes, and production activities tend to affect their surrounding environment. Concerning the protection and sustainable utilization of environmental resources on the islands, JIRCAS will also tackle problems with the production environment on such islands by making the most of the geographical advantages of the Tropical Agriculture Research Front and by working in line with the collaborative action plan adopted at the Third Pacific Islands Leaders' Meeting (PALM) (held in May 2003).

A. Research and development on agricultural, forestry and fisheries technology geared towards providing solutions to international food and environmental problems

(1) Development of technologies to utilize biological resources for stable production and multi-purpose applications under adverse environments

1) Elucidation of the mechanism of tolerance to abiotic stress and production of tolerant crops

This project aims at developing an evaluation method for tolerance to abiotic stress such as drought, screening of a wide range of germplasms of rice, wheat, and soybean to identify tolerant germplasms, and acquiring DNA markers linked to this tolerance that can be efficiently used in breeding programs. In parallel with these conventional approaches, we will search for new genes through elucidation of the molecular mechanisms of stress tolerance, and will introduce these candidate genes into crops. The resultant transformants will be evaluated for their adaptability to adverse environments and their agronomic performance.

2) Improvement of drought and submergence tolerance of rice in Africa, including NERICA

To improve the drought and submergence tolerance of rice varieties in Africa such as NERICA (New Rice for Africa), a wide range of rice germplasms will be evaluated for such tolerances to select tolerant types, and then from these, DNA markers linked to the tolerance will hopefully be

acquired. The selected tolerant germplasms and the DNA markers can be used in breeding programs to improve their tolerance. As a molecular approach to drought tolerance, genes which confer abiotic stress tolerance, such as DREB, will be introduced into a NERICA variety.

3) Identification of pathogenic races of important diseases and selection of resistant germplasm in major crops

To deal with rice blast, which is extensive in tropical Asia; Fusarium head blight of wheat and soybean rust, which is currently spreading in South America, a system to identify the predominant races of each pathogen and sources of resistance in the host crops will be built, novel resistant germplasms will be identified, and breeding materials will be developed.

4) Development of biomass utilization technology suited to Southeast Asia

We will develop a system to efficiently produce ethanol fuel from unutilized biomass, such as cassava residues and the wastes of oil palm trees mass grown in East Asia, as well as a technology for producing useful material such as biodegradable composites.

5) Elucidation of the functionality and quality parameters of traditional food and agricultural products in Asia and development of effective utilization technology.

We will clarify the functionality of the antioxidization and antimutagenic characteristics of traditional Asian foods and tropical farm products such as vegetables and their quality factors, including texture. We will also develop a process technology that allows the improvement and effective utilization of such functionality and quality.

6) Effective utilization of genetic resources in tropical and subtropical crops

To improve the productivity of crops in tropical and subtropical areas such as sugarcane and beans, and to promote their diverse utilization, we will evaluate the characteristics of extensive crop genetic resources, including wild relatives, and develop a technology to utilize valuable genetic resources and produce breeding materials. We will also cooperate with the project of the National Institute of Agrobiological Sciences Genebank, which has been set up as the central national gene bank.

7) Sustainable utilization of tropical and subtropical marine resources and development of aquaculture technology

In Southeast Asian waters, we will make a trophodynamic analysis, clarify the biological characteristics of target fish species such as their maturity and growth, as well as their interaction with other living organisms; estimate stock abundance of commercially important fish and propose stock management policies suited to the region. We will also develop aquaculture technologies for fish, crustaceans, and algae suitable for current conditions in the developing regions.

(2) Development of management technologies of environmental resources and production systems for sustainable agriculture, forestry and fisheries

1) Development of sustainable management technologies for tropical soils

We will analyze the main materials applied to soils such as organic matters and fertilizers in the agropastoral areas in the Sahel region of West Africa, where production of organic matters is low, and will clarify the dynamics of key elements such as nitrogen in the soil-plant ecosystem. In Southeast Asia, which has a higher production of organic matters, we will also clarify soil nutrient dynamics, physical properties and changes in the biota of soil in response to the input of organic materials. Based on the results of this analysis and clarification, we will develop a technology for improving the fertility of tropical soils through proper management of organic matter.

2) Integrated management system for improved water utilization aiming at increasing economic options for farmers' incomes

In the rain-fed farming areas of Indochina, we will develop a management technology for catchment and drainage that can be adopted efficiently and widely in existing cultivation systems for cash crops through a farmer-participatory approach. We will also propose technical guidelines for increasing farmers' incomes by diversifying and combining farming business operations through the efficient utilization of water resources and effective application of local resources. In addition, we will develop rice breeding materials suitable for water-saving cultivation in the irrigated paddy fields that stretch across Asia, and propose an environmentally sound technology for soil and crop management under conditions of reduced water availability.

3) Improvement of feeding technology for livestock in the tropics and the subtropics and the establishment of sustainable agro-pastoral systems in Asian dry areas

We will identify the nutrient demand of beef cattle in tropical and subtropical areas and develop rational management technologies for feeding aimed at the effective utilization of local feed resources. We will also shed light on land degradation and the actual conditions of farming to prevent the advance of desertification due to excessive cultivation and overgrazing in the arid and semi-arid regions from Northeast Asia to West Asia, and create a sustainable agro-pastoral production system. We will also develop technologies for sustainable management of farmland and grassland, effective utilization of water resources, and advanced utilization of little-used feed resources. A model of sustainable farming will be produced by combining all these efforts to raise farmers' incomes. A study will likewise be conducted to establish adaptable and effective technologies for water resource utilization and vegetation restoration and to present a method to enhance the capacities of local government personnel and the local people to formulate a management plan for rangelands, as countermeasures for yellow sand in Southeast Asia.

4) Elucidation and exploitation of biological nitrification inhibition (BNI)
Biological nitrification inhibition (BNI) is a natural phenomenon in which certain plant species have the capability to control nitrification in soils by releasing inhibitory compounds from their roots. The development of next-generation crop/pasture varieties that have a built-in ability to self-regulate nitrification through inhibition will have a dramatic impact on minimizing nitrogen losses that are associated with nitrification. We aim to (a) develop the genetic and physiological tools necessary for genetically exploiting the BNI attribute in crops and pastures and assess inter- and intra-specific variability of BNI, (b) characterize the physiological and biochemical mechanisms of BNI and isolate BNI compounds followed by the elucidation of their biosynthetic pathways, and (c) clarify their interaction with environmental factors, particularly soil conditions, and its effect on modulating the functionality of BNI.

5) Development of environmental management technology for sustainable crop production in tropical and subtropical islands
We will develop a technology for effective utilization of water resources and fertilizer and an environmental management technology for reducing soil loss. These technologies are essential for sustainable crop production in the context of the environmental systems on tropical and subtropical islands. We will also produce prediction models of environmental pollution such as those of river soil loss and nutrient salt loss, and then evaluate the effectiveness of the environmental management technology scheduled for development.

6) Development of nurturing techniques for beneficial indigenous tree species in Southeast Asia
We will propose a combined management of agricultural and forestry operations based on the utilization of useful indigenous tree species, while at the same time developing a technology for tree cultivation needed to promote the production of timber from useful indigenous trees in the tropical monsoon regions of Southeast Asia where forests have decreased sharply. We will also propose a method for selective logging while maintaining the genetic diversity of useful indigenous tree species in natural dipterocarp forests on tropical hills.

7) Development of productive low-input cultivation technology for fruit trees in the tropics
We will develop a cultivation technology for low-tree-height cultivation aimed at low input and effective prevention of diseases such as rot disease in the production of tropical fruits, including durian, in Southeast Asia. We will also develop a technology for high-quality, high-yield production, including improved pollination efficiency and fertilizer management.

(3) Elucidation of the impact of global environmental changes on agriculture, forestry, and fisheries and development of mitigating technologies

1) Developing an impact assessment model and formulation of a food supply stabilization plan
To conduct medium- and long-term evaluations of how environmental changes, such as changes in water supply and global warming, affect the supply and demand of major agricultural products in East and Southeast Asia, we will improve the world food supply and demand model, and create a scenario of measures for food production such as rice aimed at minimizing the impact of such environmental changes. We will also develop early warning systems to mitigate damage to agriculture from meteorological disasters and clarify specific measures to stabilize food supply.

2) Utilization of Geographic Information System (GIS) for the development of a land information monitoring technology in developing regions
We will obtain past history data on land utilization, cropping, and growth patterns of agricultural products, land degradation, and the occurrence of disasters to gain an understanding of spatial environmental changes in the developing regions and to quantitatively clarify the relationship

between such changes and agricultural production. We will also develop technologies to monitor the phenomena of various spatial scales using geographic information such as satellite data to gain a better understanding of environmental changes in quasi-real time.

3) Formulation of agricultural development methodologies to tackle the environmental changes of global warming and desertification

We will conduct a field study and develop a methodology that combines different techniques of soil erosion prevention on farmlands or hillsides as well as techniques of water use and management to prevent desertification by soil degradation or salt accumulation in developing areas. Likewise, we will establish a methodology for rural development in a guideline that will meet the needs of rural people in developing countries such as livelihood improvement by applying the international mechanism of greenhouse gas emission reduction trading.

4) Development of management technology for major pests of tropical and subtropical crops

We will develop management techniques for major pests to stabilize crop production in the tropics and subtropics. We will focus our efforts on the development of a control technology to prevent citrus greening disease, which hampers sustainable production of citrus fruits in Southeast Asia and other regions.

B. Collection, analyses and dissemination of information to grasp trends related to international food, agriculture, forestry and fisheries and rural areas

(1) Collection and dissemination of information related to global food, agriculture, forestry, and fisheries

By strengthening ties with related organizations at home and abroad and through on-site investigations, we will collect extensive information on supply and demand trends in food and agricultural, forestry, and fisheries products worldwide, including the developing regions; and on research and development, institutions, and policies, as well as industrial structures, relating to agriculture, forestry, fisheries, and their associated industries. The information collected will be provided to the public through the expansion of databases, symposia and other means.

(2) Elucidation of the direction of technological development in developing regions and analysis of socioeconomic conditions influencing development in rural areas

We will clarify the direction of technology development necessary for developing regions through managerial and social evaluation of the selection, introduction, and establishment of technologies such as those for rice cultivation in Asia. We will also clarify the socioeconomic conditions and development methods that will encourage effective rural development in Asian countries where rapid changes are taking place in trade and distribution.

(3) Establishment of techniques and methodologies for the reconstruction of agriculture and rural communities affected by natural disasters, etc.

We will undertake a farmers' participatory study on techniques and methodologies for the reconstruction of agricultural and rural communities affected by natural disasters, etc, and present the supporting reconstruction method as a guideline.

2. Promotion of the release and dissemination of research results

(1) Securing interactive communication with the public

1) We will hold wherever possible open seminars and workshops on international collaborative research projects, disclose research results collected and analyzed through multi-media information , publish the results of research evaluations, engage in interactive communication with the public regarding collaboration on international research projects implemented by JIRCAS, and ensure public understanding and transparency of JIRCAS' activities.

2) The research staff will work positively on outreach activities via open lectures for citizens. Their efforts will be conscientiously evaluated.

3) We will establish a system for receiving and answering questions from the public on our Web site.

4) We will conduct questionnaire-based surveys of our collaborative research partners to identify research needs and exchange information.

5) We will adopt a participatory approach in international collaborative research projects to incorporate the needs of local residents and seek their understanding of and cooperation with our research activities.

(2) Promotion of utilization of research results

1) To ensure the prompt and practical application of research results, we will make efforts to

encourage the beneficiaries of technologies and research results to participate in research projects from the planning stages, and to conduct such research activities by focusing on the utilization, diffusion, and commercialization of research results.

2) To promote the dissemination of our research achievements, we will hold symposia related to the research projects on site.

3) To implement agricultural development effectively and efficiently in developing areas, we will establish and publish the method of collaborative technology transfer performed by local government organizations, local and international NGOs, universities, etc.

4) Of the research results concerned with international research on agriculture, forestry and fisheries, we will select at least 20 research results that can be transferred to the developing regions for diffusion based on external evaluations within the period covered by the Second Medium-Term Goals.

(3) Public relations and the release of research results

1) Research results will be released at academic meetings and symposia in Japan and overseas. At least 560 refered papers will also be published in academic journals and bulletins during the period covered by the Medium-Term Goals. At least 30 international symposiums and workshops will also be held during that period, and research results will be widely released in Japan and overseas.

2) Details of research results will be released on Web sites and through exhibitions. To publicize the roles of JIRCAS in solving problems facing world food and agriculture, we will also actively take advantage of the mass media by making more than 30 press releases of major research results during the period covered by the Medium-Term Goals.

3) We will prepare various manuals and brochures for research results, and conduct public relations on such research achievements in the developing regions through international collaborative research activities.

(4) Acquisition of intellectual property rights and promotion of their utilization

1) In our efforts to acquire intellectual property rights, we will file at least 20 patent applications in Japan and abroad during the period covered by the Second Medium-Term Goals, and will aim to win patent rights in consideration of the potential for patent licensing. We will also endeavor to widen the scope of patent licensing, stressing the practicality and utility of intellectual property such as patents.

2) We will review registered patents as needed in the light of licensing revenue, and the development and invention of alternative technologies. If necessary, we will waive the patent rights.

3) Breeding research results which are applicable in Japan will be positively applied to the registration of varieties based on the Seed and Seedling Law to promote their dissemination and utilization.

4) We will provide information on the intellectual property rights of JIRCAS through the internet, and promote their utilization through the Technology Licensing Organization (TLO) certified by the Ministry of Agriculture, Forestry and Fisheries.

3. Other social contributions in specialized fields

(1) Analysis and appraisal

1) On request from the government, various organizations, and universities, JIRCAS will perform analyses and appraisals that will require the highly specialized knowledge it possesses and which are difficult for other organizations to carry out.

(2) Training sessions and seminars

1) We will hold training sessions and seminars as often as possible, and actively cooperate in events sponsored by the government and other organizations.

2) We will actively welcome trainees from other IAAs, universities, national and public institutions, as well as the private sector to develop human resources, raise technical standards, and transfer technical information. We will also actively welcome trainees from abroad.

3) We will, when commissioned by the government, promote the nurturing of researchers engaged in international agriculture, forestry, and fisheries research.

(3) Collaboration with the government

We will send our staff to government committee meetings and conferences, and provide domestic and overseas technical information upon request. We will also help with international cooperation and exchanges on scientific technology provided by the government.

(4) Cooperation with international organizations and academic societies

As an organization that carries out comprehensive research on agriculture, forestry, and fisheries, JIRCAS will dispatch its staff to committee meetings and conferences held by related international organizations and academic associations. It will also provide domestic and overseas technical information on request.

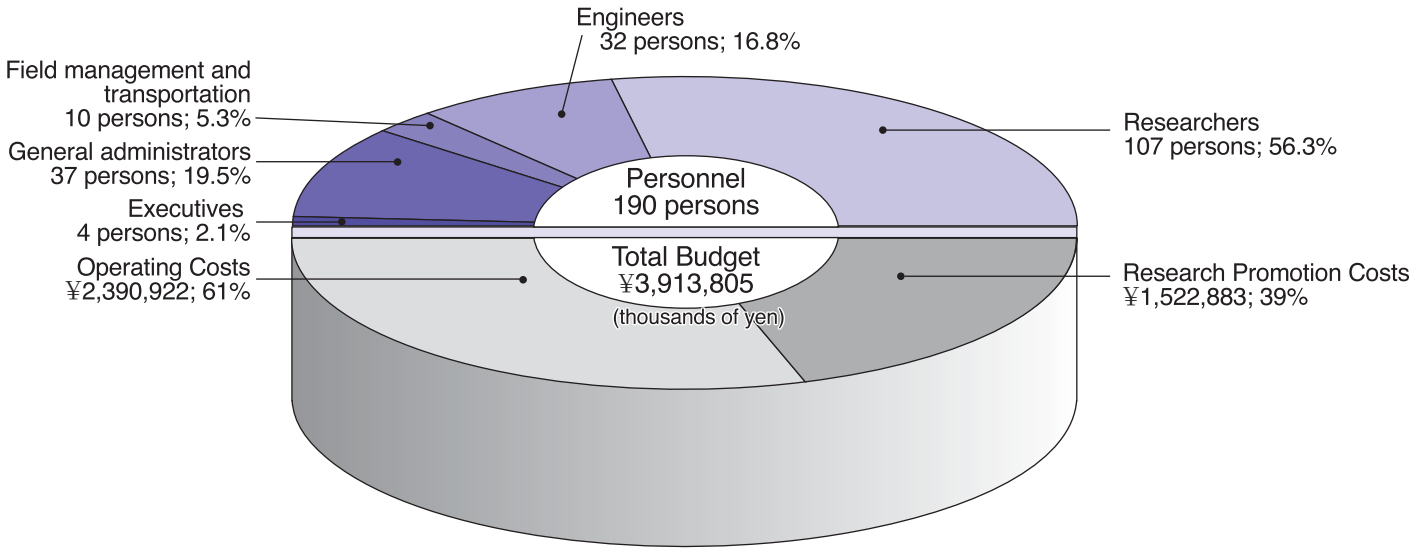
FINANCIAL OVERVIEW

Fiscal Year 2008

(thousands of yen)

TOTAL BUDGET	**3,913,805**
OPERATING COSTS	**2,390,922**
Personnel (190)	1,984,113
President (1), Vice-President (1), Executive Advisor & Auditor (2)	
General administrators (37)	
Field management and transportation (10)	
Engineers(32)	
Researchers (107)	
* Number of persons shown in ( )	
Administrative Costs	406,809
RESEARCH PROMOTION COSTS	**1,522,883**
Research and development	798,946
Overseas dispatches	217,664
Research exchanges/invitations	22,554
Collection of research information	93,188
International collaborative projects	356,479
Fellowship programs	34,052

Budget FY 2008 (Graph)



MEMBERS OF THE EXTERNAL EVALUATION COMMITTEE AND PROGRAM REVIEW MEETINGS

Members of the JIRCAS External Evaluation Committee

Haruo INAGAKI	Chair of the Committee Former Counselor, Japan Food and Agriculture Organization Association
Toru MITSUNO	Professor, Department of Environmental Management, Tottori University of Environmental Studies
Haruyuki MOCHIDA	Professor, Graduate School of Life and Environmental Sciences, University of Tsukuba
Keiko NATSUAKI	Professor, Department of International Agriculture Development, Tokyo University of Agriculture
Fumio TAKASHIMA	Former President, Tokyo University of Marine Science and Technology
Kunio TSUBOTA	Deputy Director/Professor, Asia Center, Kyushu University

External Reviewers for the JIRCAS Program Review Meetings

[Agro-environment]

Kenji HATA	Professor, Center of Field Sciences, Faculty of Bioresource Sciences, Akita Prefectural University
Toshiaki IMAGAWA	Principal Research Coordinator, National Institute for Agro-Environmental Sciences
Shigeru KAMEYA	Director General, Ishigaki Branch, Okinawa Prefectural Agricutural Research Center
Masanori SAITO	Professor, Environmental Crop Science, Graduate School of Agricultural Science, Tohoku University

[Crop Production]

Hiroaki INOUE	Professor, Graduate School of Bioresources Sciences, Nihon University
Nozomu MINAGAWA	Research Manager, National Agriculture Research Center for Kyushu Okinawa Region, National Agriculture and Food Research Organization

[Agro-biological Resources]

Ikuo ANDO	Head, Biotechnology Laboratory, Department of Rice Research, National Institute of Crop Sciences, National Agriculture and Food Research Organization
Tatsuhito FUJIMURA	Professor, Graduate School of Life and Environmental Sciences, University of Tsukuba
Kyuya HARADA	Team Leader, Soybean Genome Research Team, Division of Genome and Biodiversity Research, National Institute of Agrobiological Sciences
Hitoshi NAKAGAWA	Director, Institute of Radiation Breeding, National Institute of Agrobiological Sciences

[Animal Production & Grassland]

Toshiaki IMAGAWA	Principal Research Coordinator, National Institute for Agro-Environmental Sciences
Hitoshi NAKAGAWA	Director, Institute of Radiation Breeding, National Institute of

	Agrobiological Sciences
Fuminori TERADA	Director, Livestock Research Support Center, National Institute of Livestock and Grassland Science, National Agriculture and Food Research Organization

[Fisheries]

Yukimasa ISHIDA	Director, Project Management Division, Tohoku National Fisheries Research Institute, Fisheries Research Agency
Takashi MINAMI	Professor, Graduate School of Agricultural Sciences, Tohoku University
Toshio TAKEUCHI	Professor, Graduate School of Marine Science and Technology, Tokyo University of Marine Science and Technology

[Development Research]

Kazuhiko KOBAYASHI	Professor, Graduate School of Agriculture and Life Sciences, the University of Tokyo
Takashi KUROSAKI	Professor, Institute of Economics, Hitotsubashi University
Keishiro ITAGAKI	Professor, Faculty of International Agriculture and Food Studies, Tokyo University of Agriculture

[Post-harvest Science & Technology]

Yoshiaki KITAMURA	Director, Food Engineering Division, National Food Research Institute, National Agriculture and Food Research Organization
Tojiro TSUSHIDA	Director, Food Function Division, National Food Research Institute, National Agriculture and Food Research Organization

[Biomass Utilization]

Mitsutoshi NAKAJIMA	Professor, Graduate School of Life and Environmental Sciences, University of Tsukuba
Koichi YAMAMOTO	Principal Research Coordinator, Forestry & Forestry Products Research Institute

[Forestry]

Naoto MATSUMURA	Professor, Graduate School, Faculty of Bioresources, Mie University
Akira SATO	Professor, Faculty of Regional Environment Science, Tokyo University of Agriculture

[Rural Development]

Tetsuro MIYASATO	Principal Research Coordinator, Japanese Institute of Irrigation and Drainage
Yoshihiko NISHIMURA	Professor, Graduate School of International Development, Nagoya University
Yasutami SHIMOMURA	Professor, Graduate School of Environmental Management, Hosei University

JIRCAS STAFF in FY 2008

President

Kenji Iiyama

Vice-President

Toshihiro Senboku
[Masami Yasunaka from April 1, 2009]

Research Strategy Office

Osamu Koyama, Director
Kensuke Okada, Senior Researcher
Hiroshi Inoue

Executive Advisor & Auditor

Shigeo Matsui
Hitoshi Yonekura

Research Planning and Coordination Division

Masami Yasunaka, Director
[Makoto Nakatani from April 1, 2009]

Tadahiro Hayashi, Senior Researcher
Toshihiro Uetani, Senior Researcher

Research Planning and Evaluation Office
Takeshi Kano, Head

Research Planning Section
Naruo Matsumoto, Head
Kazuhiro Suenaga, Senior Researcher
Tsutomu Kobayashi

Research Evaluation Section
Hiroko Takagi, Head
Kazuo Ise, Senior Researcher
Naoko Oka

Field Management Section
Haruo Tamura, Chief Field Operator
Tsugio Tokushuku, Field Operator

Research Support Office
Kenichi Hatsuse, Head

Research Coordination Section
Tokichi Kojima, Head
Kazunari Iwafuchi, Assistant Head
Takeshi Usuku, Coordination Subsection Head
Junichi Irino, International Relations Section Head

Research Support Section
Hatsui Yashiro, Head
Takao Oga, Support Subsection 1 Head
Ryoichi Mise, Support Subsection 2 Head
Chikako Hirose, Support Subsection 3 Head
Hiroyuki Watari, Budget Subsection Head
Shinichi Yamada, Intellectual Property Expert

Public Relations Office
Takahito Noda, Head

Public Relations Section
Tamao Hatta, Head
Mie Kasuga, Senior Researcher
Shinji Hirouchi

International Relations Section
Kazunobu Toriyama, Head
Kunimasa Kawabe, Senior Researcher

Publications and Documentation Section
Misako Nakao, Head
Hiromi Miura, Network Subsection Head
Noriko Yatabe, Managing Subsection Head (Librarian)

Regional Research Coordinators
Satoru Miyata, Representative of Southeast Asia Office (Thailand)

Administration Division

Osamu Nakamura, Director
[Yuichi Mitomi from April 1, 2009]

General Affairs Section
Hideo Miyauchi, Head
Kaoru Watanabe, General Affairs Assistant Head
Koichi Takada, Personnel Management Assistant Head
Yoshihiko Sumomozawa, General Affairs Subsection Head
Yukio Konuma, Social Affairs Chief
Katsunori Kanno, Welfare Subsection Head
Gaku Takeda, Personnel Subsection Head
Keisuke Takada, Personnel Officer

Accounting Section
Shigeyoshi Sumita, Head
Nobuhiko Nakamura, Accounting and Examination Assistant Head
Takaaki Shimura, Procurement and Asset Managing Assistant Head
Koichi Fuse, Financial Subsection Head
Shinji Ishizaka, Accounting Subsection Head
Toshiki Kikuchi, Overseas Expenditures Subsection Head
Yoshinori Kawasaki, Audit Subsection Head
Toshiaki Sato, Procurement Subsection Head
Takashi Kitami, Procurement Officer

Tsuneyoshi Sasaki, Supplies/Equipment Subsection Head
Kuniaki Katsuyama, Facilities Subsection Head

Administration Section
(Tropical Agriculture Research Front)
Hiroshi Jutori, Head
Tetsuya Hirono, General Affairs Subsection Head
Yasuhiro Onozaki, Accounting Subsection Head
Osamu Oikawa, Accounting Officer

Rural Development Planning Division

Takeshi Ohta, Director

Principal Engineer
Takeru Higashimaki
Hirofumi Iga
Tsutomu Kobayashi
Nobuki Marumo
Mitsuru Marumoto
Eiji Matsubara
Ryo Miyazaki
Kunihiko Naitou
Kimio Osuga

Senior Engineer
Akira Hirokawa
Shinji Hirouchi
Hiroshi Inoue
Kazuhisa Kouda
Takeshi Matsumoto
Yasuyuki Nakanishi
Michio Naruoka
Yukio Okuda
Koichi Takenaka

Chief Engineer
Haruyuki Dan
Katsumi Hasada
Taro Izumi
Kenichiro Kimura
Yuzo Manpuku
Masaki Morishita
Naoko Oka
Keisuke Omori
Junya Onishi
Shutaro Shiraki
Toshihide Takeuchi
Mamoru Watanabe
Masakazu Yamada

Development Research Division

Masuo Ando, Director

Project Leaders
Hsiaoping Chien, Agricultural Economics
Jun Furuya, Agricultural Economics
Satoshi Uchida, Geographic Information Systems
Shigeki Yokoyama, Agricultural Economics

Senior Researchers
Akira Hirano, Geographic Information Systems
Hiroshi Komiyama, Development Economics
Kazuo Nakamoto, Agricultural Economics
Shunji Oniki, Agricultural Economics
Tomohide Sugino, Development Economics
Ryuichi Yamada, Agricultural Economics
Toru Hisazome, Agricultural Economics
Yukiyo Yamamoto, Geographic Information Systems

Researcher
Shintaro Kobayashi, Agricultural Economics

Biological Resources Division

Takashi Kumashiro, Director

Project Leaders
Yoshimichi Fukuta, Rice Breeding

Senior Researchers
Soh Akamatsu, Plant Pathology
Xu Donghe, Plant Molecular Genetics
Yasunari Fujita, Plant Molecular Biology
Masanori Inagaki, Wheat Breeding
Nobuya Kobayashi, Physiology and Breeding
Kazuo Nakashima, Plant Molecular Biology
Hiroshi Tsunematsu, Rice Breeding
Naoki Yamanaka, Plant Molecular Genetics
Seiji Yanagihara, Rice Breeding (Tropical Agriculture Research Front)

Researchers
Takuma Ishizaki, Plant Molecular Biology (Tropical Agriculture Research Front)
Norihito Kanamori, Plant Molecular Biology
Kyonoshin Maruyama, Plant Molecular Biology

(Kazuko Yamaguchi-Shinozaki, Plant Molecular Biology)

Crop Production and Environment Division

Osamu Ito, Director

Project Leaders
Satoshi Nakamura, Insect Ecology
Satoshi Tobita, Plant Physiology and Nutrition

Senior Researchers
Yoichi Fujiwara, Hydrology

Hiromasa Hamada, Groundwater Hydrology
Keiichi Hayashi, Soil Management
Yasukazu Hosen, Environmental Soil Science
Takayuki Ishikawa, Plant Physiology
Masato Oda, Crop Management
Hide Omae, Crop Science
Junichi Sakagami, Crop Improvement
Guntur V. Subbarao, Crop Physiology and Nutrition
Takeshi Watanabe, Soil Chemistry
Matthias Wissuwa, Physiology and Genetics

Researcher
Sachiko Namai, Crop Science

Animal Production and Grassland Division

Shuichi Oshio, Director
[Akio Takenaka from April 1,2009]

Project Leaders
Kazuhiro Suenaga, Genetics and Breeding
Kazunobu Toriyama, Soil Science

Senior Researchers
Yasuo Ando, Plant Microbiology
Makoto Otsuka, Animal Nutrition
Kazumasa Shindo, Pasture Management
Seishi Yamasaki, Animal Nutrition

Food Science and Technology Division

Yutaka Mori, Director

Project Leader
Kazuhiko Nakahara, Food Chemistry

Senior Researchers
Tamao Hatta, Mineralogy and Geology
Akihiko Kosugi, Molecular Microbiology
Yoshinori Murata, Applied Microbiology
Koji Yamaki, Food Functionality
Tadashi Yoshihashi, Food Evaluation

Researcher
Takamitsu Arai. Molecular Microbiology

Forestry Division

Tadao Gotoh, Director

Senior Researchers
Naoyuki Furuya, Forest Management
Fumio Kawamura, Forest Chemistry
Tatsuya Otani, Forest Ecology
Atsushi Sakai, Silviculture
Masaharu Sakai, Forest Soil Science
Naoki Tani, Forest Genetics
Akihiko Yokota, Forest Products

Fisheries Division

Shoji Kitamura, Director
[Yukio Maeno from April 1,2009]

Project Leader
Marcy N. Wilder, Crustacean Biochemistry

Senior Researchers
Kaoru Hamano, Aquatic Animal Physiology
Yukio Hanamura, Marine Biology
Sayaka Ito, Aquatic Ecology
Shinsuke Morioka, Fish Biology
Katsuhisa Tanaka, Marine Chemistry
Satoshi Watanabe, Marine Ecology
Toshihiro Yamamoto, Fish Ecology

Researchers
Tomoyuki Okutsu, Aquatic Animal Physiology

Tropical Agriculture Research Front

Yoshinobu Egawa, Director

Yoshimitsu Katsuda, Public Relations Officer

Islands Environment Management Group
Group Head, Project Leader
Kiyoshi Ozawa, Agrometeorology

Senior Researchers
Fujio Nagumo, Soil Science
Ken Nakamura, Soil Science

Researcher
Yoshiko Iizumi, Water Management

Crop Genetic Resources Group
Stress-Tolerant Vigna Project Team
Group Head, Project Leader
Mariko Shono, Plant Physiology

Sugarcane Improvement Project Team
Project Leader
Koshun Ishiki, Plant Breeding and Genetic Resources

Crop Production and Protection Group
Tropical Fruits Production Project Team
Group Head, Project Leader
Yoshimi Yonemoto, Pomology

Senior Researchers
Tatsushi Ogata, Pomology
Shinsuke Yamanaka, Molecular Biology

Citrus Greening Disease Management Project Team
Project Leader
Yasuo Ohto, Plant Pathology

Senior Researchers
Katsuya Ichinose, Entomology
Tadafumi Nakata, Entomology
Youichi Kobori, Entomology

Technical Support Section
Tsutomu Fushimi, Head
Yuho Maetsu, Machine Operator
Koji Yamato, Machine Operator
Hirokazu Ikema, Machine Operator
Masato Shimajiri, Machine Operator
Takashi Komatsu, Machine Operator
Masakazu Hirata, Machine Operator
Yasuteru Shikina, Machine Operator
Masashi Takahashi, Machine Operator

Principal Plant Breeder
Akira Sugimoto, Plant Breeding

Researchers on Loan to Other Organizations

Japan Internationa Cooperation Agency (JICA)
Hiroshi Ikeura

THE JAPANESE FISCAL YEAR AND MISCELLANEOUS DATA

The Japanese Fiscal Year and the Annual Report 2008

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) 2008 covers the period from April 1, 2008 through March 31, 2009. The Annual Report 2008 summarizes the full extent of JIRCAS activities that occurred during this period. The subsequent Annual Report will detail events and programs from April 1, 2009, through March 31, 2010 (FY 2009).

Buildings and campus data

Land	(units: m^2)
Tsukuba premises	109,538
Okinawa Tropical Agriculture Research Front	294,912
Total	404,450

Buildings	(units: m^2)
Tsukuba premises	10,749
Okinawa Tropical Agriculture Research Front	9,474
Total	20,223

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About JIRCAS' symbol mark (shown on front/back cover): The mark was conceived by Takayuki Ishikawa of 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' aim 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.

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