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JAPAN INTERNATIONAL RESEARCH CENTER FOR AGRICULTURAL SCIENCES



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Japan International Research Center for Agricultural Sciences

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(April 2011-March 2012)

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Annual Report JIRCAS 2011

Message from the President



President
Dr. Masaru Iwanaga
(FY 2011-)

The Great East Japan Earthquake, which happened on the 11th of March 2011, was an unforgettable disaster for Japan. I was shocked and felt very sorry to hear the sad news and could only offer sympathy, not only to the victims but also to those who have been greatly affected by the aftermath of the earthquake itself. We, at Japan International Research Center for Agricultural Sciences (JIRCAS), have been trying to collect and present the necessary information to help restore the agricultural, forestry and fishery industries of the stricken areas.

The year 2011 was highly significant for JIRCAS since it was the first year of the new 5-year Medium-Term Plan. The Third Medium-Term Targets, which will guide research operations for the next five years (FY 2011-2015), were set by the government in March 2011; subsequently, the Medium-Term Plan for their implementation was initiated in April 2011. I would like to describe how JIRCAS will carry out the major activities that have been identified in the new plan, and likewise explain briefly the differences between the old and new organizational structures, as well as the rationale for the introduction of this new system.

Introduction of the new system: Background and Rationale

JIRCAS is an institute with a unique mission. The national law stipulates the purpose for its establishment, which is “to contribute to the improvement of technology for agriculture, forestry and fisheries in developing regions by performing technical trials and researches.” However, this aim seems too broad in terms of research targets for our organization - relatively small with only about 180 staff members - to be able to render an explanation that is easy to grasp as to what the focus will be. In particular, we need a clear understanding of why and for whom the “improved technologies for agriculture, forestry and fishery in the developing regions” are intended; and

furthermore, what kind of impact we intend to bring to society with the advanced technologies.

JIRCAS has been constantly reviewing this issue. The “Project” system was introduced to carry out both research budgeting and management under the responsibility of project leaders based on the annual work schedule for all of the JIRCAS research activities at the beginning of the Second Medium-Term Plan in 2006. Through that, we were able to achieve certain enhancements in the transparency of the relationship between costs (inputs) and outputs. However, detailing an explanation of what JIRCAS focused on was not easy as we had more than 30 research projects. In addition, there was a major problem as we had defined so many interlocking research subject layers such as two ‘research fields’, three ‘large issues’ and 21 ‘medium tasks’ in the last Medium-Term Plan, and the responsibilities of these “issues and tasks” as well as for the specific projects themselves were complicated. Thus, it was difficult to find a direct correlation between inputs and outputs as well as a logical alignment between external evaluation and internal project evaluation.

Therefore, we studied ways to manage our research projects more effectively and efficiently by establishing a working group in JIRCAS in 2009. As a result, since it was concluded that we must correlate our overall goals (vision) or mission with our research projects, it was deemed necessary to introduce “Programs” that could be used as effective framework linking institutional goals and project activities. The programs, embracing several projects within each program, will enable us to clarify our overall goals (Program objectives) that need to be achieved, and the manner by which we attempt to accomplish our research (Project activities). Moreover, Programs can be used as unit of evaluation.

Introducing the four Programs

The four Programs developed using the

aforementioned rationale are as follows:

- 1) Development of agricultural technologies based on sustainable management of the environment and natural resources in developing regions (Environment and natural resources management)
- 2) Technology development for increased productivity and stable production of agricultural products in the tropics and other unstable environments (Stable food production)
- 3) Technology development for income and livelihood improvement of the rural population in developing regions (Rural livelihood)
- 4) Information gathering, analysis, and dissemination of domestic and overseas data of the agricultural, forestry and fishery industries in developing regions (Information analysis)

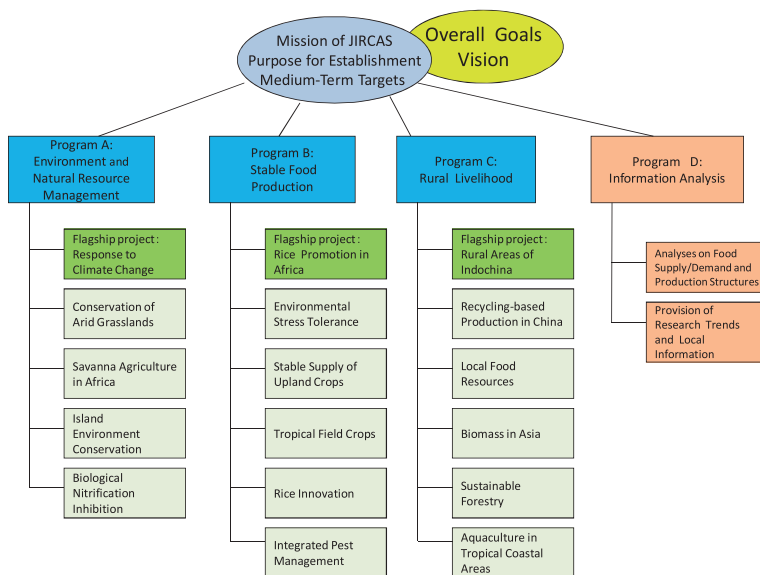


Fig. 1. Program-Project Research Framework

Program-based management

We now have 17 “Projects” that are placed under “Programs” (see Fig. 1). The programs will enable us to clarify our overall goals that need to be achieved and the manner by which we attempt to accomplish our research. Especially assigned Program Directors are in charge of budget, personnel, goal achievement management, and evaluation. Programs A to C have their own so-called flagship projects that represent the most important project in each program. Projects under each program collectively and coherently contribute to the major goal of their respective programs.

Matrix for staff management

Several disciplinary divisions have been created to house JIRCAS scientists. The divisions are dedicated toward the enhancement of the researchers’ specialties and staff management. Researchers, based on their research expertise, are assigned to one of these divisions under a Division Director. Scientists consider the division their home and they devote their staff time to one or a few projects. Such a

matrix system (Project x Division) has also been adopted by many international agricultural research institutes.

Strive for impacts

By introducing the program-based system for output development and delivery, JIRCAS shall be able to depict more succinctly, not only to taxpayers and Japanese citizens but also to people in developing countries, what it essentially does and for whom. Promotion of more efficient and accountable research will further be feasible. Accordingly, it is important for every researcher, manager and support staff to work together to produce well-considered outputs that will be deemed suitable, acceptable and adaptable for users. We will keep striving to take advantage of this new structure, with the undying passion of our 40-year-old “research for development” tradition, hoping to produce deliverables that will be used by our target beneficiaries.

N. Owaga

HIGHLIGHTS FROM 2011

JIRCAS International Symposium 2011

“Trends of International Rice Research and Japanese Scientific Contribution - Support to GRiSP and CARD”

The annual JIRCAS International Symposium was held at the Tsukuba International Congress Center (Epochal), Tsukuba City, Japan on November 14-15, 2011 with the theme, “Trends of International Rice Research and Japanese Scientific Contribution - Support to GRiSP and CARD.” It was attended by 174 guests and participants, and was organized by JIRCAS under the auspices of the Agriculture, Forestry and Fisheries Research Council (AFFRC) Secretariat of the Ministry of Agriculture, Forestry and Fisheries (MAFF), National Agriculture and Food Research Organization (NARO), National Institute of Agrobiological Sciences (NIAS), National Institute for Agro-Environmental Sciences (NIAES), Japan International Cooperation Agency (JICA), International Rice Research Institute (IRRI), Africa Rice Center (AfricaRice), and Japan Forum on International Agricultural Research for Sustainable Development (J-FARD).

Dr. Masa Iwanaga, President of JIRCAS, delivered the opening remarks. He stated the background and objectives and wished for a successful symposium. He expressed hope that it would provide an excellent opportunity to discuss the future of international rice research where new frameworks involving research initiatives such as the Global Rice Science Partnership (GRiSP) and the Coalition for African Rice Development (CARD) have emerged in the course of systemic reforms in international research as well as from the need for closer collaboration between agricultural development fields and research laboratories. He

was followed by Ms. Noriko Matsuda, Research Councilor of the AFFRC Secretariat, MAFF, who gave the welcome statement and emphasized the importance of cooperation among rice researchers in and out of the country.

Three keynote speeches were given: Dr. Achim Dobermann, Deputy Director of IRRI and Program Director of GRiSP, reported on the trends in global rice research and the roles of GRiSP; Ms. Concepcion Calpe, Senior Economist of the UN Food and Agriculture Organization (FAO), covered the most recent development and challenges of the world rice economy; and Dr. Marco Wopereis, Deputy Director of AfricaRice, explained the situation of rice research development in Africa through his presentation, titled “Realizing Africa’s Rice Promise.”

Three thematic sessions followed wherein researchers and experts from various organizations shared their experiences and opinions on rice research and development:

In Session 1, “From Genome Research to Rice Breeding”, presentations and discussions were made on collaborative researches in the field of molecular biology and information.

In Session 2, “Research Issues for African Rice Promotion”, speakers and participants reported on and discussed the progress of CARD as well as the current situation on the development of rice varieties for Africa. In addition, JIRCAS outlined the implementation of the rice project in Africa and described its collaboration with GRiSP.

In Session 3, “Researches for Environment-Friendly Rice Production in Asia”, the development of rice cultivation technologies in China and India were reported. Also discussed were rice production technologies designed to cope with climate change and recent developments in yield increasing theory



focusing on nitrogen use efficiency.

During panel discussion, the results of a questionnaire survey performed among rice scientists, mostly from domestic research institutes and universities, were reported. Valuable suggestions were obtained concerning the direction of human resource development for young researchers and the need for international collaboration on rice research.

Finally, in his closing remarks, Dr. Masami Yasunaka, Vice President of JIRCAS, summarized the discussions of the symposium and declared that JIRCAS will continue to work with international research organizations and contribute as a base for rice research.

“Rice innovation for environmentally sustainable production systems” 7th Asian Crop Science Conference and kickoff meeting of “Blast research network for stable rice production” Bogor, Indonesia

JIRCAS organized a symposium titled “Rice innovation for environmentally sustainable production systems” during the 7th Asian Crop Science Conference in Bogor, Indonesia on September 28, 2011. Around 50 scientists with advanced degrees in agronomy, breeding, pathology, physiology, and social science gathered from Japan, China, Vietnam, Laos, Thailand, the Philippines, Indonesia, and Bangladesh.

Several topics were discussed, including (1) the development of durable protection against blast disease through genetic diversity of rice varieties, (2) genetic and physiological improvement of nitrogen use efficiencies in rice, (3) the development of breeding materials for new plant and root types, and (4) social study for organic cultivation in Indonesia as one of the new inceptions for environment-harmonized cropping methods. The issues were examined and the topics discussed in order to promote environmentally sustainable rice cultivation systems in the near future.

International Workshop on "Sawah" Eco-technology and Rice Farming in Ghana, Nigeria, and Sub-Saharan Africa

Date: November 22-24, 2011

Venue: Golden Tulip Hotel, Kumasi, Ghana



JIRCAS International Symposium participants

Organizers: Kinki University, JIRCAS, Africa Rice Center, CSIR-CRI Ghana, and CSIR-SRI Ghana

Since 2008, JIRCAS has been conducting research on the Development of Improved Infrastructure and Technologies for Rice Production in Africa (DIITRPA), a project financially supported by the Ministry of Agriculture, Forestry and Fisheries of Japan.

To help the Coalition of African Rice Development (CARD) achieve its goal of doubling rice production in Africa within ten years (by 2018), JIRCAS conducted an analysis on the current state of irrigation facilities and rice-production infrastructures, and is currently performing validation studies in Ghana and Ethiopia. In Ghana, the Soil Research Institute (SRI) and the Crops Research Institute (CRI), both under the Council for Scientific and Industrial Research (CSIR) and the Ministry of Food and Agriculture (MOFA), work together as counterpart organizations of DIITRPA. JIRCAS accomplished the project goals by developing and evaluating new and best applicable methods of rice production while also improving infrastructure during the 4-year research period. JIRCAS also drafted a “Manual for Improving Rice Production in Africa”, which would be useful not only in Ghana, but also in other African nations.

About 70 participants from Benin, Indonesia, Japan, Nigeria, Togo and host country Ghana, including local extension officers, researchers, rice farmers and MOFA staff, took part in the workshop. Presentations and field visits were carried out to provide an overview of onsite activities by researchers and field application by farmers who are practicing paddy rice cultivation (using the Sawah System).

On the first day (November 22), the Minister

of Environment, Science and Technology and the Director General of CSIR gave speeches praising the project and the workshop. There were lively discussions and a number of suggestions were noted during the 19 presentations that highlighted the results of the Sawah System in each country. The field tour was carried out on the second day (November 23) with visits to JIRCAS study sites as well as other project sites. During the overall discussion session on the final day (November 24), farmer-participants shared, in their own languages, their observations and field experiences on related projects in their respective countries. The importance of technology transfer to further develop paddy fields was also discussed to improve rice cultivation in the future. On wrapping up, all the participants chanted, “Say Sawah,” as slogan for collaboration.

The Japan International Award for Young Agricultural Researchers

On November 14, 2011, the awarding ceremony of the 2011 Japan International Award for Young Agricultural Researchers was held at Tsukuba International Congress Center Epochal, Tsukuba City, Japan. The ceremony was well attended by many participants, including members of the Selection Committee and diplomats from the country embassies of the awardees.

This is the fifth time that the award was presented by the President of the Agriculture, Forestry and Fisheries Research Council to young foreign researchers with outstanding achievements to promote research and development of agricultural, forestry, fishery, and other related industries in developing regions. This year’s awardees and their research achievements are as follows:



2011 Japan International Award for Young Agricultural Researchers

Dr. Roel Rodriguez SURALTA (Republic of the Philippines)

Institute: Philippine Rice Research Institute
 Research Achievement: Significance of root plasticity in maintaining dry matter production in rice under fluctuating soil moisture stresses

Dr. Muhammad Abdul ALIM (People’s Republic of Bangladesh)

Institute: Bangladesh Agricultural University
 Research Achievement: Study on tick molecular biology with a view to development of novel control strategies for ticks and tick borne diseases

Dr. Jonne RODENBURG (Kingdom of the Netherlands)

Institute: Africa Rice Center
 Research Achievement: Developing socially acceptable weed management strategies for resource-poor rice farmers

NEW RESEARCH COLLABORATION

Global Rice Science Partnership (GRiSP)

The Global Rice Science Partnership (GRiSP) was officially launched in November 2010 as the first new CGIAR Research Program (CRP). JIRCAS participated in this program as a strategic partner together with three CGIAR research centers, namely, the International Rice Research Institute (IRRI), Africa Rice Center (AfricaRice), and the International Tropical Agriculture Center (CIAT), as well as advanced research institutes with international mandates, the French Agricultural Research Center for Development (CIRAD) and Research Institute for Development (IRD).

GRiSP is a unique global initiative which promotes rice research partnership among over 900 partner organizations worldwide. It consists of 6 main research themes -- genetic resources, breeding, agronomy, post-harvest, policy, and extension -- in which JIRCAS researchers, as well as scientists from various research institutes and universities in Japan, are able to make significant contributions.

In order to facilitate collaborative interactions between GRiSP and Japan, JIRCAS formed the GRiSP Coordinating Committee in Japan (GCCJ) in August 2011, bringing together major institutions involved in rice science and research. A JIRCAS-organized international symposium on rice and GRiSP was held in Tsukuba last November to encourage the exchange of information among rice researchers within and outside Japan.

JIRCAS contributes to this CRP by implementing several rice-related collaborative research projects with IRRI and AfricaRice. Conversely, GRiSP provides precious opportunities for Japanese researchers to work

globally through new competitive research funds, some of which have already been allocated to researchers in Japan. In addition, GRiSP serves as an excellent example for JIRCAS and Japanese researchers on how to face similar international research initiatives which will play major roles in global agricultural research for development.



Figure: Organization of the GRiSP Coordinating Committee in Japan (GCCJ)

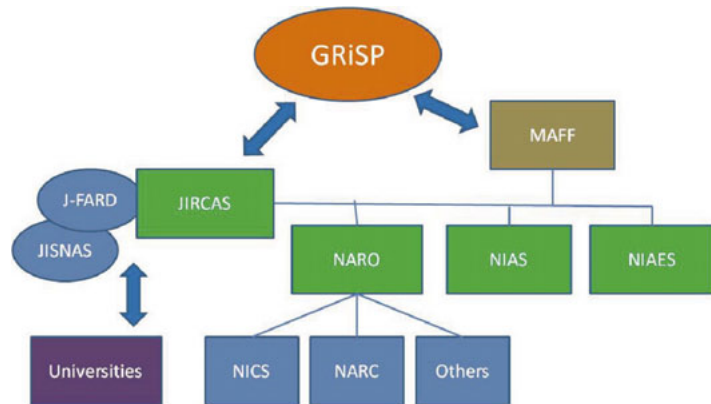


Photo: The first GRiSP Oversight Committee (OC) together with the Program Planning and Management Team (PPMT)

ACADEMIC PRIZES AND AWARDS

Research on “Innovative Utilization System for New Sugarcane Varieties” earns commendation award from MEXT

Dr. Akira Sugimoto received a commendation award in Science and Technology from the Ministry of Education, Culture, Sports, Science and Technology (MEXT)-Japan in 2011 for his research studies on new breeding techniques and innovative utilization system for new sugarcane varieties. Results of these studies will contribute greatly towards achieving global sustainable development by supplementing food (sugar) and energy (ethanol, electric power) production and by keeping the sugarcane industry in the southwestern islands of Japan in good condition. A summary of the research outcomes are described below:

1. Bred new sugarcane varieties, among them Ni22 and Ni23. These newly-bred varieties

can produce higher yields and have shown higher ratooning ability in low-yielding areas planted with leading varieties.

2. Developed a new way of sugarcane cultivation called “autumn harvesting method”, which improves ratoon crop yield and extends the harvesting period. New varieties such as Ni22, NiN24, and KY96T-547 can be harvested in Okinawa from October, about three months earlier than normal .
3. Proposed a new way of sugarcane utilization from producing only sugar to producing sugar, ethanol, and electric power. This method uses a new, high-yielding sugarcane cultivar with high ratooning ability but with higher fiber and lower sugar content. A model variety, KY01-2044, has been registered for further development of this new system.

International Contribution Award for Successful Reforestation CDM Project in Paraguay

Mr. Eiji Matsubara, Subproject Leader of the Rural Development Division, received the “International Contribution Award” from the Japanese Society of Irrigation, Drainage and Rural Engineering in September 2011 for his research project titled “Establishment and verification of a rural development model with Clean Development Mechanism (CDM).” Formulation of the reforestation CDM project involved the participation of two cities comprising 16 communities in Paraguarí Department, Paraguay, where many small-scale farmers live. The research project was realized and subsequently accepted by the CDM

Executive Board (EB) of the United Nations Framework Convention on Climate Change for registration. Carbon credits, also known as Certified Emissions Reductions, will be issued by the EB after confirming that the project’s monitoring activities have complied with the requirements. Carbon credits are equivalent to the net anthropogenic greenhouse gas removals by sinks achieved by the reforestation CDM project; it will be used to boost rural development in the project area. Likewise, this CDM project model will be applied to other low-income rural communities in Paraguay that have similar natural conditions.

Mr. Eiji Matsubara accepts the International Contribution Award from the Japanese Society of Irrigation, Drainage and Rural Engineering.

Certificate of Appreciation from the Government of Niger

A Certificate of Appreciation from the Republic of Niger's Ministry of Agriculture was presented to JIRCAS researchers for their contribution to overcome poverty and desertification in Niger through the project,



Certificate of Appreciation

"Growth promotion of dry season vegetables utilizing limited water resources". The certificate was presented to Mr. Kimio Osuga, Project Leader, by Mr. Illa Djimraou, General Secretary of the Ministry of Agriculture, in his office on November 1, 2011. A detailed instructional manual (in English and French) was the output of the study.



Mr. Djimaraou hands over the Certificate of Appreciation to Mr. Osuga.

Certificate of Appreciation from the Bureau of Soil and Water Management (BSWM), Department of Agriculture, the Philippines

JIRCAS and the Bureau of Soil and Water Management (BSWM), Department of Agriculture, the Philippines, conducted collaborative research on "Development of Environmental Management Technology for Sustainable Crop Cultivation in Tropical and Sub-tropical Islands" from 2006 to 2010. The BSWM, on the occasion of its 60th anniversary celebrations held last June 2011, presented a special citation/award to JIRCAS and to the project for its successful implementation.

A number of research studies were carried out in Luzon and Negros islands during the course of the 5-year project. In Luzon Island, runoff plot studies were conducted to evaluate water runoff and soil erosion in relation to different cropping techniques. In Negros Island, the effects of subsoiling on sugar cane yield and nitrogen use efficiency were examined. These research activities were conducted in close cooperation between JIRCAS and BSWM staff members. New research methodologies such as turbidity monitoring, continuous soil water measurement with time domain reflectrometer (TDR), root observation using rhizotron, natural

isotope N analysis, and so on, were applied. New knowledge and skills were transferred to BSWM members through the project. Six BSWM staff members were also invited to the Tropical Agriculture Research Front (JIRCAS-TARF) to conduct related collaborative studies during the period.

JIRCAS continues its close relationship with BSWM through a new project titled "Development of environment-friendly agricultural production technology in islands" launched in 2011.



Mr. Fujio Nagumo, on behalf of JIRCAS, receives the certificate from Mr. Samuel Contreras, Chief of Soil Conservation Management Division, BSWM, DA, the Philippines, last June 2011 at the BSWM Office.

The background of the page is a complex, organic pattern of swirling, marbled lines in various shades of purple, from light lavender to deep magenta. The lines are fluid and interconnected, creating a sense of movement and depth. A thin, solid black horizontal line is positioned above the text.

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 of 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 towards 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' Third Medium-Term Goals in FY 2011, including the enhancement of research efficiency and the improvement of the quality of research programs and financial performance. Based on the Third Medium-Term Goals, JIRCAS drafted and began to implement a detailed five-year plan, the Third Medium-Term Plan (FY 2011-FY 2015).

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 deemed necessary to the modifications of the operational and financing systems for subsequent fiscal years. To meet the requirements of the general guideline concerning evaluation of the national research and development (a decision of the Prime Minister in 2008) which require efficient evaluation, JIRCAS has modified the in-house evaluation system in the initial year of the Third Medium-Term Plan. The in-house evaluation in FY 2011 was carried out as follows:

- 1) Each Research Program evaluated its own research activity and prepared its own summary report.
- 2) These reports were then collectively evaluated at the meeting for the evaluation of research programs of the Medium-Term Plan by external reviewers (government officials from the Ministry of Agriculture, Forestry and Fisheries and specialists from other research institutes) and internal reviewers (the President, the Vice-President, an Executive Advisor and Auditor, the Program Directors and the Directors of each research division) in February 2012.
- 3) Comprehensive evaluation of all JIRCAS activities, which also include administrative operations, was performed by external reviewers of the JIRCAS External Evaluation Committee in March 2012.

The external reviewers 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 2012.

5. Medium-Term Plan

JIRCAS implements four programs for research activities under the Medium-Term Plan. Each program has several projects. Major accomplishments and research highlights of the programs in FY 2011 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 Third Medium-Term Plan (FY 2011-FY 2015)

Program	Project
A (Environment and Natural Resource Management)	5
B (Stable Food Production)	6
C (Rural Livelihood)	6
D (Information Analysis)	2

Third Medium-Term Plan (FY 2011 - FY 2015)

[Research Approach 1]

Research and development on agricultural, forestry and fishery technologies geared towards providing solutions to international food and environmental problems

Program A

Development of agricultural technologies based on sustainable management of environment and natural resources in developing regions

Projects:

1. Development of agricultural technologies in developing countries to respond to climate change
2. Development of resilient agro-pastoral systems against the risks of extreme weather events in arid grasslands in Northeast Asia
3. Development of technologies for sustainable agricultural production in the African savanna
4. Development of environment-friendly agricultural production technology in islands
5. Utilization of Biological Nitrification Inhibition (BNI) function for the development of breeding materials and application to cropping systems

Program B

Technology development for increased productivity and stable production of agricultural products in the tropics and other unstable environments

Projects:

1. Development of rice production technologies in Africa
2. Development of genetic engineering technologies of crops with environmental stress tolerance
3. Development of breeding technologies toward improved production and stable supply of upland crops
4. Evaluation and utilization of diverse genetic

- materials in tropical field crops
5. Rice innovation for environmentally sustainable production systems
6. Development of integrated pest management (IPM) techniques for stabilization of agricultural and livestock production in developing areas

Program C

Technology development for income and livelihood improvement of the rural population in developing regions

Projects:

1. Establishment of sustainable and independent farm household economy in the rural areas of Indochina
2. Design and evaluation of a recycling-based agricultural production system in upland farming areas of Northern China
3. Advanced application of local food resources in Asia
4. Development of biofuel and biomaterial production technologies using biomass resources in Southeast Asia
5. Development of forest management and conservation techniques through sustainable use in Southeast Asia
6. Development of aquaculture technologies for sustainable and equitable production of aquatic products in tropical coastal areas

[Research Approach 2]

Program D

Collection, analyses and dissemination of information for grasping trends of international agriculture, forestry and fisheries

Projects:

1. Collection and analysis of international food supply and demand as well as production systems
2. Dissemination of research trends and local information

6. Collaborative Research

JIRCAS is required to cover a wide range of research fields. Human resources at JIRCAS, however, are limited. This makes collaborative research with other institutes or universities necessary towards achieving JIRCAS' project objectives. Whenever JIRCAS and its collaborators reach an agreement on the commencement of collaborative research after exchanging ideas and opinions, a Memorandum of Understanding (MOU) or a Joint Research Agreement (JRAs) is usually concluded. JIRCAS developed the concept of JRAs in 2006. A JRA is a contract for collaborative research with a particular research subject and with a fixed term. A total of 93 MOUs or JRAs remained in force at the end of FY 2011.

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 has been playing an important role in promoting mutual understanding and collaboration between CGIAR and the Japanese government. It 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 2011, 156 JIRCAS researchers or administrators were dispatched abroad for a total of 15,677 days. Likewise, JIRCAS has been 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.

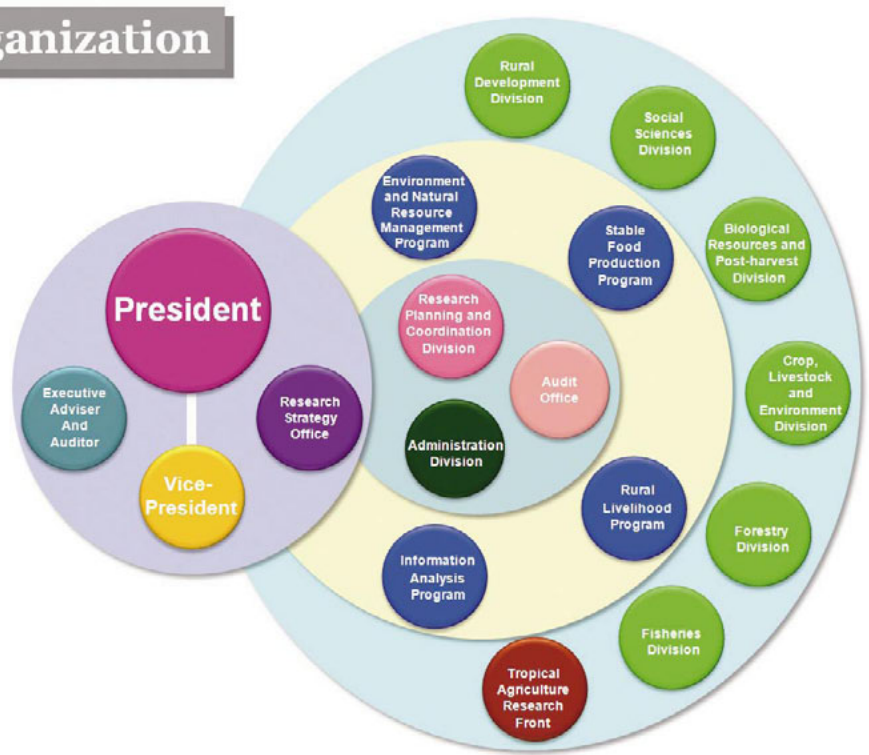
7. Organization of JIRCAS

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

Four Program Directors, whose positions were newly-established, are responsible for the implementation of individual programs during the Third Medium-Term Plan period. The directors of divisions, offices, and the Tropical Agriculture Research Front (TARF) are responsible for managing staff and enhancing the capabilities of researchers.

TARF (formerly the Okinawa Subtropical Station), located in Ishigaki Island in the southernmost part of Japan, is JIRCAS's sole substation. It focuses on agricultural, forestry, and fisheries research being carried out in overseas regions with highly similar climatic and geographic conditions as Okinawa, taking full advantage of its subtropical weather and geographic location.

Organization



MAIN RESEARCH PROGRAMS

PROGRAM A Environment and Natural Resource Management

“Development of agricultural technologies based on sustainable management of the environment and natural resources in developing regions”

The Environment and Natural Resource Management Program focuses on impact analyses and the development of adaptation and mitigation technologies to cope with progressing climate change. The program also deals with sustainable resource management and environmental conservation technologies in regions vulnerable to climate change.

With regard to climate change impact analysis, land suitability map for rice was generated in collaboration with Bangladesh Rice Research Institute (BRRI). This was done to create a land suitability analysis model. A stochastic supply-and-demand model to evaluate the impact of extreme events is being developed. Price and income elasticities of demand and price elasticities of supply of crops for each country were calculated based on the economic theory, and logistic yield functions were estimated targeting the development of a world food model for long-term outlook. Impacts of climate changes on rice market and production capacity in the lower Mekong River Basin were elucidated by using supply and demand models of rice (REMEW-Mekong).

Collaborative research on climate change adaptation technology is being conducted with the International Rice Research Institute (IRRI). With regard to the development of a seasonal weather forecasting system for rain-fed rice production, a bias correction method has been developed for downscaling the output of the Ocean-Atmosphere Coupled Model (SINTEX-F). In relation to climate-proof rice breeding, near-isogenic lines for spikelet number, days to heading, early morning flowering, and so on, have been developed. Field experiments for improving the effectiveness of fertilizer application have been initiated in central Java in Indonesia, in the south-central region in Laos, and the IRRI headquarters in the Philippines.

About the research on greenhouse gas (GHG) mitigation, installation of a head-cage respiration chamber for ruminants has been completed in Khon Kaen University, Thailand.

Regarding GHG emission reduction from paddy fields, the effectiveness of water-saving irrigation technology is being examined at Mekong Delta, Vietnam.

Clean development mechanism (CDM) project activities, which promote emission reduction and create sustainable rural communities, are being conducted in three countries. Afforestation and agro-forestry have been selected as the applicable CDM measures in Tigray, Ethiopia, where baseline survey on soil carbon has already been conducted. In Paraguay, afforestation CDM is being employed and technologies to improve eucalyptus growth were demonstrated. At Mekong Delta in Vietnam, a CDM project featuring a biogas digester is being established. CDM project design document has already been accepted and the registration requirements have been accomplished and submitted to the United Nations Framework Convention on Climate Change (UNFCCC) for approval.

Biological nitrification inhibition (BNI) is a plant-intrinsic phenomenon that allows them to control nitrification in upland crop soils. It is considered a high potential mitigation technology against global warming. Inhibition activities of various compounds against ammonia oxidation of nitrite-oxidizing bacteria were examined, and the chemical structure for the expression of inhibition activities and its type of inhibition were elucidated.

Resilient agro-pastoral projects that can withstand risks associated with extreme weather events are being implemented in Mongolia. Grazing intake of sheep is being measured from late summer through early winter in forest steppes. Up-to-date, regional-scale carrying capacity maps such as pasture yield maps and so on, will be produced using satellite image data. Procedures in producing such maps will be established. A new method in silage preparation using brewers' grains was also developed. It will serve as supplementary feed during winter season.

Regarding agricultural technology development in the African savanna, site preparation of multi-location liaison test fields was completed in Ghana and Burkina Faso. The possibility of introducing conservation agriculture at different agro-ecological regions -- from the tropical forest to the Sudan savanna region zone -- was examined. A manual for the promotion of dry-season vegetable cultivation utilizing limited water resources was published in Niger.

Meanwhile, in Nacala Corridor, Mozambique, technological development for a market-oriented agriculture was investigated. The region has been grouped into 4 zones according to meteorological data and soil analysis, with inland hills showing the highest potential for agricultural production.

Two projects concerning effective water use and conservation are being implemented. In Negros Province, the Philippines, a survey point was selected to identify the sources of groundwater contamination in the area. Basic data is being gathered to calculate soil surface nitrogen loads. In the Republic of the Marshall Islands, conservation studies were done on the freshwater lenses in the atoll islands. A manual describing the proposed monitoring methods for conserving freshwater lenses as water resources has been published.

TOPIC I

Manual for growth promotion of dry season vegetables utilizing limited water resources

The Republic of Niger is situated in an arid to semi-arid area at the southern end of Sahara desert; hence, water is a precious resource. However, these water resources are not fully utilized even though there are a number of seasonal streams and ponds. According to the Water Resources Development Master Plan (1999) report by the Ministry of Water Resources, Environment & Desertification Control, the country has more than 1,000 ponds of which 175 are distributed as permanent ponds. However, these ponds rarely undergo water utilization surveys and there is no clear strategy for its long-term development and use.

As a result, water utilization for dry season vegetable cultivation can be described as underdeveloped even as increased usage is expected in the future. For this reason, the authors recognized the need for the development and diffusion of cultivation methods to effectively promote cultivation of dry season vegetables despite limited water resources.

A questionnaire survey targeting farmers from 37 villages was conducted to identify the constraining factors associated with the growth promotion of dry season vegetables. Three major constraints were discovered from the questionnaire survey, namely (1) crop damages from feeding livestock, (2) difficulties in acquiring agricultural materials and equipment,

and (3) crop damages from diseases and harmful insects. In addition, the survey group also found two more problems from the survey result, specifically (1) the lack of seedling-rearing techniques, and (2) insufficient organizational efforts. Based on these findings, countermeasures were formulated, including: (1) support for the installation of fences to prevent feeding damages, (2) support for the introduction of purchase system for agricultural materials and equipment, (3) support for technical training on vegetable cultivation, and (4) organizational support (Fig.1). An experimental study of the target sites was subsequently conducted (Fig. 2).

This technical manual summarizes the results of an experimental study performed targeting the periphery of natural ponds which have not been fully utilized. Nevertheless, its contents can be applied not only to natural ponds but also to sites with water sources originating from dams, flood control basins and water wells.

Also, this manual was compiled hoping that it finds a high degree of utilization in the field. The contents were edited with inputs from a technical committee composed of interested departments and agencies of the Ministry of Agriculture in Niger. Concurrently, a repeat peer review in French was also conducted so that local agricultural extension workers can understand and for the manual to gain approval from the Department of Survey and Planning, Ministry of Agriculture.

Lastly, this manual is intended for use by those who provide support and guidance to farmers including extension workers and farmer-trainers employed by non-governmental and international organizations, with the aim of promoting vegetable farming in the dry season. It is necessary to properly implement the contents of this manual to effectively utilize the natural ponds and to promote the growth of dry season vegetables. However, prudence must be exercised when following the instructions contained herein. It must be in accordance with actual site conditions because some of the contents may have already been implemented or the manual may prove insufficient due to reasons that are particularly site-specific.

A total of 500 French-version copies of the manual have been distributed by the Ministry of Agriculture and relevant authorities to field agencies during a publication seminar; thus, providing tangible support to the vegetable cultivation domain and seminar participants.

(K. Oosuga, H. Dan, J. Yasuhisa, T. Shinohara, M. Charles, N. Kawano, H. Oomae)

Constraining factors of dry season vegetable cultivation

Countermeasures

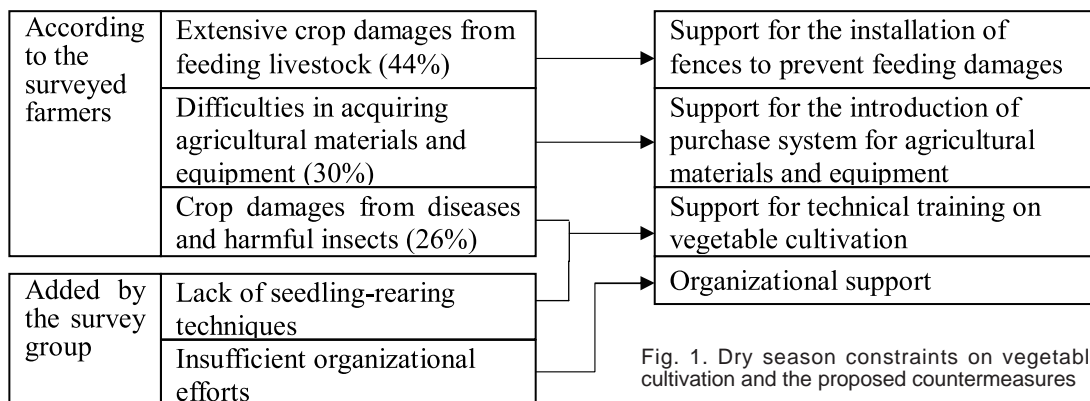


Fig. 2. Efforts undertaken at experimental study areas

- (left photo) Provision of assistance to organize water resource users. As for the selection of union executives, voting in a secret ballot was adopted so people can select from among multiple candidates and vote anonymously.
- (middle photo) With the farmers' consent and support, fences were installed to prevent crop damages from feeding livestock. Workers learned building fences, from design to construction, via on-the-job trainings.
- (right photo) Implementation of improved farming techniques. Vegetable cultivation training on diversified seedling-rearing techniques, crop disease and pest control measures and water irrigation techniques was provided.

TOPIC2

Impacts of climate changes through variations of evapotranspiration on rice market and production capacity in the lower Mekong River Basin region

Supply of water to farms will be varied by climate changes. On the other hand, per capita demand of rice will decrease in the lower Mekong River Basin, where two major rice exporting countries are situated and remarkable economic growth is taking place. Thus, supply and demand analyses of agricultural products are important in this region where fluctuating water supply and a decrease in per capita rice consumption is anticipated. In this study, the impacts of water supply fluctuations on the rice market are analyzed by using supply and demand models of rice including water variables. The results of this study will help in the preparation of agricultural policies and plans for the lower Mekong River Basin.

A supply and demand model of rice in the lower Mekong River countries was used for the analysis. The structure and the data of the model are written down in Furuya *et al.* (2010), and it can evaluate the impacts of climate change through variations in evapotranspiration.

The following two simulations were conducted: 1) base-line, 2) CC_B2 (Climate Change for scenario B2). Base-line simulations assume that the evapotranspiration in each province or region after 2000 is the average during 1995-1999 and that the population and gross domestic product (GDP) of each country follow B2 scenario of the Intergovernmental Panel on Climate Change (IPCC). The B2 scenario refers to the socio-economic scenario which prioritizes environment over economy and region over globe, with population and GDP projections deemed intermediate in the four scenarios. CC_B2 simulations assume that the evapotranspiration in each province or region follows the B2 scenario and population and GDP are same as those of the base-line scenario.

The evapotranspiration of CC_B2 to that of base-line in rainy season will increase in Laos and northeast Thailand at trans-planting season and will decrease in all regions at flowering season.

Based on model simulations, climate change will decrease wet season rice production in Cambodia (Fig. 1) and will decrease dry season rice production in Mekong Delta region (Fig. 2). Furthermore, climate change will increase farm prices of rice in Cambodia, Thailand, and Viet Nam (Fig. 3), and these price spikes will weigh on the living costs of consumers.

The gaps between the forecasted planted area of rice and irrigation area of the basin development plan of the Mekong River

Commission in 2030 were investigated for each province and region. The results suggest that planted areas of dry season rice on the west side of the Mekong River Basin and Mekong Delta region will reach the upper limit of the irrigation area for rice cultivation as shown by the yellow-colored regions (Fig. 4).

The results of this study (specifically, forecasting rice productions and farm price of rice, etc. for each province and region) will contribute to making a feasible agricultural production plan for the lower Mekong River Basin countries.

(J. Furuya and S. Kobayashi)

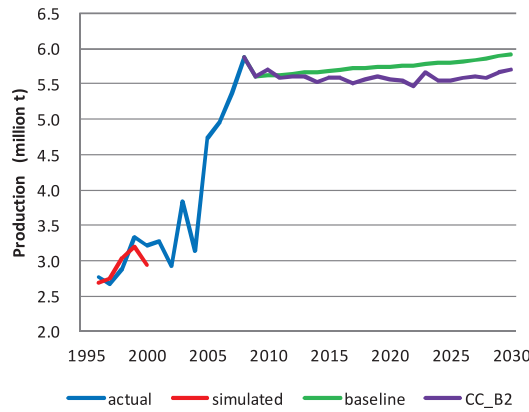


Fig. 1. Wet season rice production in Cambodia

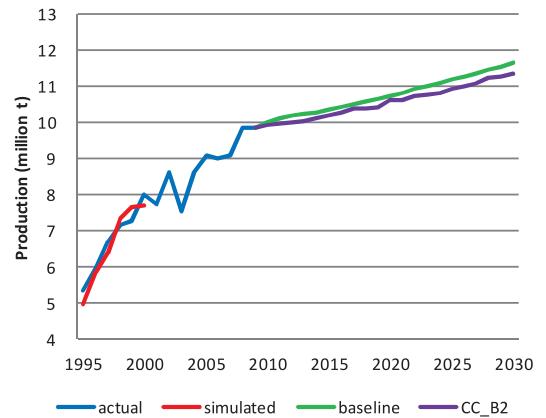


Fig. 2. Spring season rice production in Mekong Delta

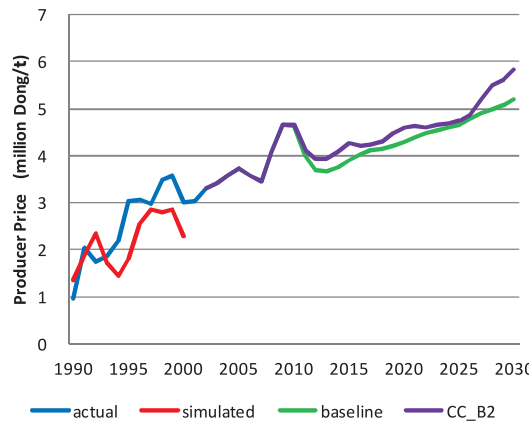


Fig. 3. Farm price in Viet Nam

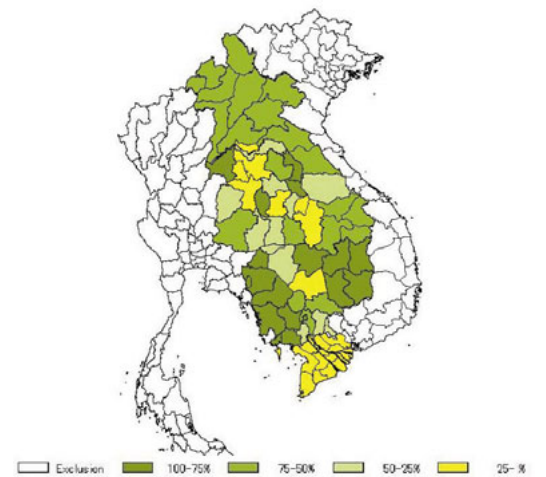


Fig. 4. Rice production capacity

Note: “ Simulated ” in Figures 1-3 shows estimation results of the model.

References

Furuya J, *et al.* (2010), Development of Supply and Demand Models of Rice in Lower Mekong River Basin Countries: REMEW-Mekong, JIRCAS Working Report 68.

Near-isogenic lines for days to heading with an Indica-type variety IR64 genetic background

IR64, recognized globally as a high quality rice variety, was first released by the International Rice Research Institute (IRRI) in 1985. To increase yield potential and broaden the adaptability of IR64, a set of near-isogenic lines (NILs) of IR64 with various days to heading (DTH) were developed using Japonica-type high-yielding varieties including new plant type varieties as donor parents.

A total of five NILs were developed through marker-assisted selection. Three NILs having quantitative trait loci (QTLs) from IR65600-87-2-2-3 (IR64-NIL7) and Hoshiaoba (IR64-NIL10 and IR64-NIL11) showed earlier heading by 5

days than IR64, while two NILs from IR65598-112-2 (IR64-NIL8) and IR69125-25-3-1-1 (IR64-NIL9) showed later heading by 10 days (Table 1). Three QTLs for short DTH were detected on chromosomes 8, 6 and 11, while two QTLs for long DTH were detected on chromosomes 6 and 11 (Fig. 1 and Table 1).

These lines are the first set of NILs carrying various QTLs for DTH suitable for tropical conditions. These NILs can be used to understand the genetic basis of DTH and the effects of a single QTL/gene by testing it under different environmental conditions. Furthermore, early heading NILs could be useful for avoiding abiotic stresses at the late growth stage, while late heading NILs could be useful as breeding materials to develop high yielding lines.

(T. Ishimaru, N. Kobayashi [NICS], D. Fujita [NICS/JSPS], Y. Fukuta)

IR64-NIL7 IR64-NIL8 IR64-NIL9 IR64-NIL10 IR64-NIL11

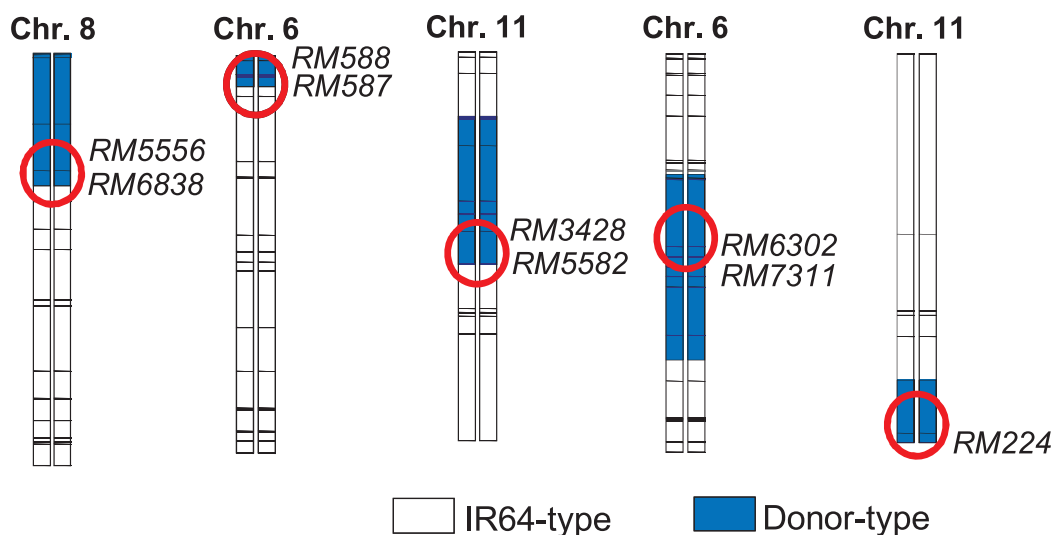


Fig. 1. Graphical genotypes of IR64-NILs' chromosomes which contain QTL regions for DTH (indicated by red circles) derived from donor parents

Table 1. Agronomic characteristics of near-isogenic lines of IR64 for days to heading

Variety/Line	QTL	Donor parent	Agronomic trait (average ± standard deviation)					
			Days to heading	Culm length (cm)	Panicle length (cm)	Leaf length (cm)	Leaf width (cm)	Panicle number
IR64	-	-	85.4 ± 1.2	78.6 ± 3.0	25.2 ± 1.5	38.2 ± 5.3	1.29 ± 0.1	18.0 ± 5.3
IR64-NIL7	<i>qDTH8</i> [yp1]	IR65600-87-2-2-3	80.5 ± 2.2*	71.8 ± 2.0*	22.3 ± 1.9*	36.1 ± 4.6	1.22 ± 0.0	21.1 ± 5.1
IR64-NIL8	<i>qDTH6</i> [yp3]	IR65598-112-2	95.6 ± 2.3*	85.6 ± 1.8*	26.6 ± 1.7	42.8 ± 4.5	1.41 ± 0.1*	18.5 ± 5.6
IR64-NIL9	<i>qDTH11</i> [yp6]	IR69125-25-3-1-1	93.4 ± 2.5*	83.6 ± 4.1*	25.7 ± 1.6	40.7 ± 3.0	1.38 ± 0.1*	26.6 ± 8.5*
IR64-NIL10	<i>qDTH6</i> [yp7]	Hoshiaoba	80.3 ± 2.5*	76.4 ± 6.0	26.7 ± 2.1	43.1 ± 5.1	1.30 ± 0.0	18.6 ± 3.3
IR64-NIL11	<i>qDTH11</i> [yp7]	Hoshiaoba	81.9 ± 2.2*	77.9 ± 2.6	26.8 ± 2.1	41.9 ± 6.2	1.36 ± 0.1	18.8 ± 5.3

Data was obtained in the IRRI experimental field (Los Banos, Philippines) during 2010 dry season (Jan — May) except for days to heading during 2010 wet season (Jun — Nov). Asterisks indicate significant difference with IR64 at the 5% level according to Dunnett's test.

PROGRAM B Stable Food Production Program

"Technology development for increased productivity and stable production of agricultural products in the tropics and other unstable environments"

The Stable Food Production Program is aimed at developing technologies that will improve and sustain productivity through collaborative research with local institutions and international research centers in specific research fields wherein Japan has shown predominant comparative advantage, especially for areas under adverse environments such as those found in tropical regions. Research outcomes are expected to contribute to global food security and help reduce starvation and malnutrition which remain serious problems in developing regions.

The program's flagship project, "Development of rice production technologies in Africa", will try to fulfill the main target of the Coalition for African Rice Development (CARD) to double rice production in Africa within ten years (by 2018). A "Manual for Improving Rice Production in Africa" has been posted on JIRCAS's website to serve as guide to farmers on the "Sawah System" of rice cultivation. This technical manual includes significant findings acquired through four years of validation studies in Ghana and Ethiopia. The manual focused on the following topics: site selection; organizing farmers' group; appropriate use of power-tiller or oxen; construction of small-scale irrigation facilities; leveling, puddling, and transplanting; adequate weeding and fertilizer application; and post-harvesting techniques. [Topic 1]

To expand rice cultivation in areas which used to be flood plains, researchers developed an improved method for selecting rice cultivars tolerant to submergence. A chlorophyll fluorescence meter with a modified, waterproofed probe can measure photochemistry reactions II in rice leaves under floodwater. Using this method, Fv/Fm can be measured in less than one minute per plant in air and underwater. These results are expected to become valuable screening tools for research and breeding programs toward improving submergence tolerance in rice. [Topic 2]

Indigenous organic resources produced in Ghana were evaluated and classified based on locality and fertilizer equivalent. The study recommended using local sources to reduce costs (i.e., fertilizer purchase, transport and

handling costs) associated with soil fertility management in rice systems. Animal excreta, for example, were found to be abundant in the Northern and Upper Regions where livestock are extensively raised. The use of these resources shall be optimized and utilized based on abundance and local distribution. Estimates showed that the organic resources would be enough to substitute for a significant part of consumed chemical fertilizer in these regions. [Topic 3]

A durable protection system against blast disease in rainfed lowland areas under tropical conditions was developed using genetic diversity of rice. A multiline variety consisting of nine isogenic lines targeting eight resistance genes with an elite Indica-type genetic background (IR49830-7-1-2-2) was developed in collaboration with the International Rice Research Institute (IRRI). [Topic 4]

Development of genetic engineering technologies as tools to improve crop cultivation in developing countries is important, especially in areas under unstable environments where drought or poor natural conditions affect stable crop production. The cis-acting elements that function in stress-responsive gene expression have been analyzed to elucidate the molecular mechanisms of gene expression in response to dehydration and low temperature. A core sequence of the ABRE was the most conserved in dehydration-inducible promoters of rice, soybean and *Arabidopsis*, suggesting that transcriptional regulation for dehydration-inducible genes is similar among these three species with the ABRE-dependent transcriptional pathway. [Topic 5]

AZF1 and *AZF2* genes encode C2H2-type zinc-finger proteins that are thought to function as transcriptional repressors. Functions of *AZF1* and *AZF2* that are induced by abiotic stresses were analyzed. The results indicate that *AZF1* and *AZF2* function as transcriptional repressors which regulate plant growth under abiotic stress conditions. [Topic 6]

In South America, soybean production is being threatened since the early 2000s by soybean rust caused by *Phakopsora pachyrhizi*. It is the most serious threat on stable soybean production along with drought. Three major resistance genes are being introduced into susceptible commercial varieties by marker-assisted backcross breeding. In Paraguay, backcrossing using Aurora as recurrent parent has proceeded to BC3F1 generation. [Topic 7]

To overcome abiotic stresses like salinity, tolerant breeding materials will be produced through the use of salt tolerance genes in a wide

range of genetic resources. Quantitative trait locus (QTL) for salt tolerance in soybean, *qNaCl3*, was cloned using map-based cloning method. Comparison of grain yields among three sets of near isogenic lines (NILs) in the salinized experimental field of Tohoku University revealed that *qNaCl3* is highly effective in enhancing salt tolerance.

Technological development in Central Asia (Uzbekistan) is aimed at reducing salinization in farmlands and improving agricultural productivity. Groundwater level and salinity were measured in two fields. It was noted that groundwater level in the fields had the tendency to decrease towards the drainage canal. It was also found that salinity increases with depth from the water table.

Yam (*Dioscorea* spp.), a traditional staple food crop, plays an important role in food security and income generation in West Africa. The genetics of yams is the least understood among staple food crops due to biological constraints and research neglect. In collaboration with the International Institute of Tropical Agriculture (IITA), researchers are developing and utilizing genomic information and molecular techniques to facilitate yam breeding to improve productivity. On the first year of the project, whole genome sequencing of a Guinea yam clone was started using Illumina GAIIx genome analyzer. Contigs obtained by paired-end sequencing were assembled and combined with mate-pair sequencing data. Generation of SSR markers and screening of markers for genetic diversity analysis are currently underway.

Cowpea (*Vigna unguiculata*) is an important protein and micronutrient source for the poor and a good cash crop for small farmers in Africa. To develop high-value cowpea varieties

with better nutritional value and commercial quality to meet markets'/consumers' preferences, researchers will examine genetic diversity and the effects of environmental factors to identify useful breeding materials and strategic breeding approaches in collaboration with the IITA. Based on passport data and major agronomic traits, a set of germplasm was selected for this study, and physico-chemical characterization and evaluation of genetic diversity of nutrient factors and quality-related traits were carried out. Varietal differences in basic nutrient factors and processing suitability were confirmed.

In the tropics and sub-tropics, marginally-productive agricultural lands are widely distributed. To relieve the tight supply of food and energy in such regions, researchers are developing breeding techniques and utilizing sugarcane wild relatives to produce sugarcane with higher biomass yield and wider adaptability to adverse environments. Out of the 400 seedlings from the crossings (sugarcane x *Erianthus*) in 2011, 21 genuine hybrids were identified using the 5S PCR test. Characterization and evaluation of the *Erianthus* germplasm collection of the Khon Kaen Field Crops Research Center in Thailand are also jointly underway.

Multi-purpose sugarcane (MPS), which was developed during JIRCAS's Second Medium-Term Plan period, is expected to help address global food and energy issues because it can be used for both food (sugar) and energy (ethanol) production purposes. However, sugarcane white leaf disease (SCWL) is an obstacle to field production in developing areas. Experimental fields have been established to further evaluate MPS, do epidemiological studies on SCWL, and improve cultivation technology for ratoon cane.

TOPIC I

Manual for Improving Rice Production in Africa

In Western African countries such as Nigeria and Ghana, a particular way of rice cultivation called the "Sawah" system, is being practiced on some rice fields. The "Sawah" system is technically defined as rice cultivation on a bunded, (i.e. leveed or embanked) well-leveled rice field with an inlet for irrigation and an outlet for drainage. Based on observations, the system reported remarkable results comparable

to traditional rice cultivation (i.e. on rice paddies without levees).

JIRCAS saw the need to develop the inland-valley areas where grass-roots support can be readily harnessed and developed for the local farmers to become skilled practitioners of the "Sawah" system. JIRCAS started the study through the Development of Improved Infrastructure and Technologies for Rice Production in Africa (DIITRPA) program in 2008, with financial support provided by the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan. The project was carried out by doing the following: (a) manual construction

of the levee or embankment, (b) leveling the land using a power tiller, and (c) delivering irrigation water through manmade canals.

As one of the outputs of the study, JIRCAS published a technical manual, an index of which is listed on Table 1. It includes many findings acquired through four years of validation studies in Ghana and Ethiopia, including (a) site selection, (b) organizing farmers' groups, (c) appropriate use of power-tiller or oxen (Fig. 1), (d) constructing small-scale irrigation facilities, irrigation canals and levees, (e) leveling, puddling and transplanting (Fig. 2), (f) adequate weeding and fertilizer application, and (g) post-harvesting techniques, among others.

On JIRCAS' recommendation, many charts and illustrations were used to make the manual easier to comprehend and help the target readers, particularly extension officials (EOs) and farmers, digest the contents easily. Any rice producer who uses the manual is expected to easily understand the steps to undertake on the first year and the following years (Fig. 3). Usually, the first year is most crucial as it is the time when land is initially developed for rice cultivation, with lighter work expected for the succeeding years.

Some difficulties were encountered during validation studies in Ghana due to the area's



Fig. 1. Land leveling by a power tiller (Ghana)



Fig. 2. Transplanting (Ghana)

natural conditions (i.e. topography and precipitation). To address the issue, JIRCAS recommended and shared the cost of constructing canals on a case-to-case basis to enable conveyance of irrigation water to the field. The availability of several types of irrigation facilities such as (1) dike and weir type, (2) canal type and (3) water-harvesting type in the capital city of Kumasi in the Ashanti Region allowed the study to overcome such difficulties. The validation studies showed that the proposed techniques are effective on paddy fields of bunded and leveled conditions similar to the traditionally-practiced paddy fields in

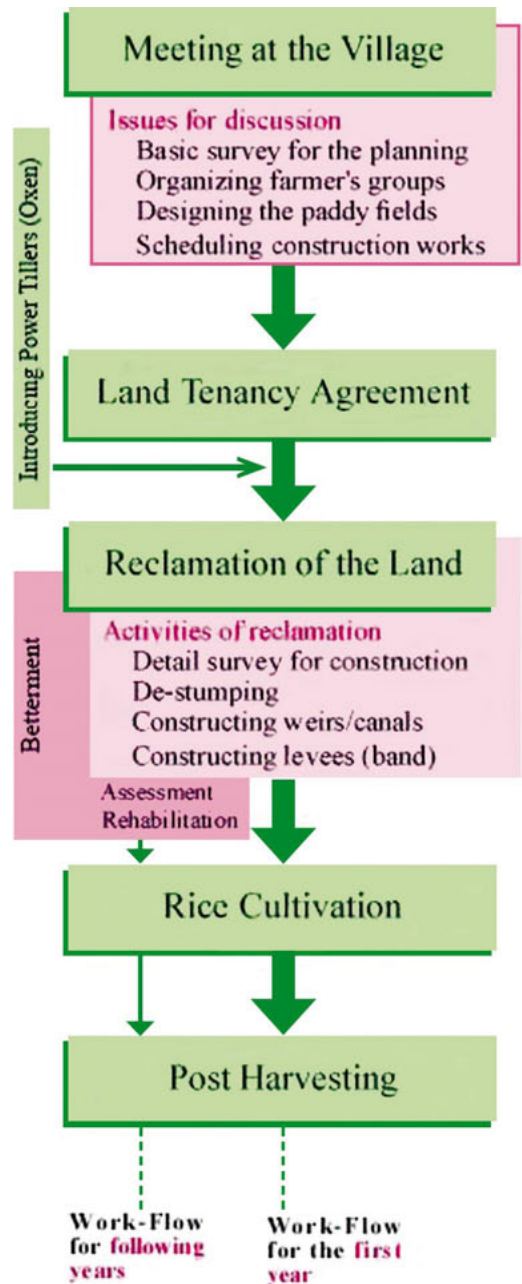


Fig. 3. Flow of Reclamation

Japan.

In addition, a guide for rehabilitating constructed irrigation facilities such as weirs and canals was also included in the technical manual for the first time—an invaluable information that was never contained in previous manuals.

JIRCAS recognized the importance to have the manual published in local language in order to reach the most number of its intended users. The first draft was compiled in 2009 and delivered to EOs as well as farmers within JIRCAS experimental plots to solicit comments and suggestions. The draft manual was then revised after further consultation with government officers, EOs and researchers.

In Ashanti Region, Ghana where the validation study by JIRCAS was conducted, some farmers have already enjoyed a twofold increase of rice yield to 4.2 ton/ha whereas traditional practice produced only 2.0 ton/ha (based on the Afari site, as reported by the Ministry of Food and Agriculture). Similar achievement can be expected in rain-fed inland valleys in Africa (around 4.5 million hectares,

according to estimates by the Coalition for African Rice Development or CARD) if farmers practice rice cultivation with the aid of the manual.

The role of EOs is very important as they could serve as catalysts in achieving the goal of increasing rice yield through effective transfer of technological information to the farmers. Thus, enhancing their roles and getting them more involved would be greatly beneficial to the program. Mechanization, however, is not as easily achievable in the short term (i.e. within the next few years) because power tillers are operated continually in a particular site and these machines require regular maintenance. Maintenance of these machines entail procurement of spare parts that may not be readily available, not to mention the need to have a standby mechanic and blacksmith for occasional repairs.

(N. Fujimoto, K. Osuga, M. Naruoka, M. Morishita, Ch. Hirose, N. Kawano, M. Hayata, A. Fukuo, I. Yamanaka, M. Uchimura [NIRE])

Table 1. Chapters and Sections of Manual for Improving Rice Production in Africa

Chapters	Sections
1. Introduction	(1) Background (2) Why JIRCAS Started the Study (3) The Study (4) Environmental Condition
2. Site Selection	(1) Feasibility (2) Planning
3. Farmers Organization	(1) Establishing Farmers' Organization (2) Advantages and Disadvantages of Group Activities, (3) Points of Concern for Group Activities (4) Land Tenancy
4. Land Development	(1) Clearing (2) Canal Construction (3) Effects of Slope Canal (4) Process of Canal Construction (5) Canal Construction Material (6) Plot-to-plot Irrigation (7) Drainage Canal (8) Intake (9) Division Work (10) Pond (11) Land Preparation (12) Maintenance of Irrigation Facilities (13) Repair of Broken Down Irrigation Facilities
5. Rice Farming	(1) Basic Knowledge of Rice Cultivation (2) Cropping Calendar (3) Paddy Field Preparation (4) Vegetative Stage (5) Reproductive Stage (6) Ripening Stage (7) Harvest (8) Post Harvest (9) Basic Rice Cultivation Problems
6. Power Tiller	(1) Advantages of Using the Power Tiller in Rice Cultivation (2) Operation of the Power Tiller (3) Maintenance of the Power Tiller (4) Common Usage of the Power Tiller by Farmer-Based Organization
7. ANNEXES	Land Tenancy Agreement, Power Tiller Lending Agreement, etc.

TOPIC 2

Simple and rapid measurements of photosynthetic activity in submerged rice by measuring chlorophyll fluorescence emissions

Submerged rice plants experience low oxygen and irradiance underwater, causing severe visible damages and photosynthesis inhibition. In recent years, the measurement of chlorophyll fluorescence emissions using a Pulse Amplitude Modulation (PAM) instrument has become a powerful tool for quick and non-invasive

evaluation of the photosynthetic activity and photoinhibition in plants. However, measurements of chlorophyll fluorescence in rice underwater have not been developed. Previous studies on photosynthetic activity of submerged rice plants technically involved only numerical values measured above water (i.e. aerobic conditions) as measurements were taken after the removal of plants from submergence instead of measuring it while submerged. By doing so, it discounted the effects of environmental changes from anaerobic to aerobic conditions. The objective of this study is to develop a method for evaluating

photodamage directly under water by analyzing chlorophyll fluorescence in leaves using a portable chlorophyll fluorescence meter with a waterproof probe.

Two rice (*Oryza sativa* L.) cultivars differing in their response to submergence were compared, namely: (1) a tolerance cultivar IR 67520-B-14-1-3-2-2 (IR67520), and (2) a susceptible cultivar IR72442-6B-3-2-1-1 (IR72442). Twenty-three-day-old seedlings were submerged in 80-cm-deep water for 14 days. The maximal quantum yield of PSII

(Fv/Fm) of the dark-adapted leaves was measured using a portable chlorophyll fluorometer (OS5p; Opti Sciences Inc., USA) with the probe wrapped tightly with polyolefin to become waterproof (Fig.1A). Dark-adaptation leaf clips were mounted on the leaves before readings were taken (Figs. 1B and 1C). During submergence, Fv/Fm of the submerged leaf decreased earlier in IR72442 than in IR67520 compared to control plant (Fig.2). Fv/Fm showed a significant positive correlation with chlorophyll content during submergence (Fig.

Fig.1. The measurement system of chlorophyll fluorescence in rice leaves underwater. (A) The portable chlorophyll fluorescence meter with a waterproof probe. (B) The leaf clip for dark adaptation can be attached to the leaf underwater. (C) Dark adaptation can be accomplished by closing the dark slide of the clip

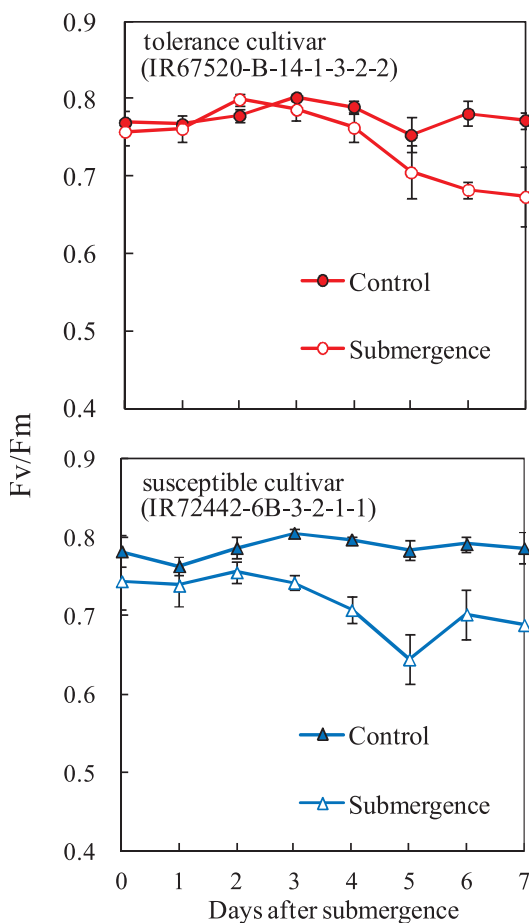
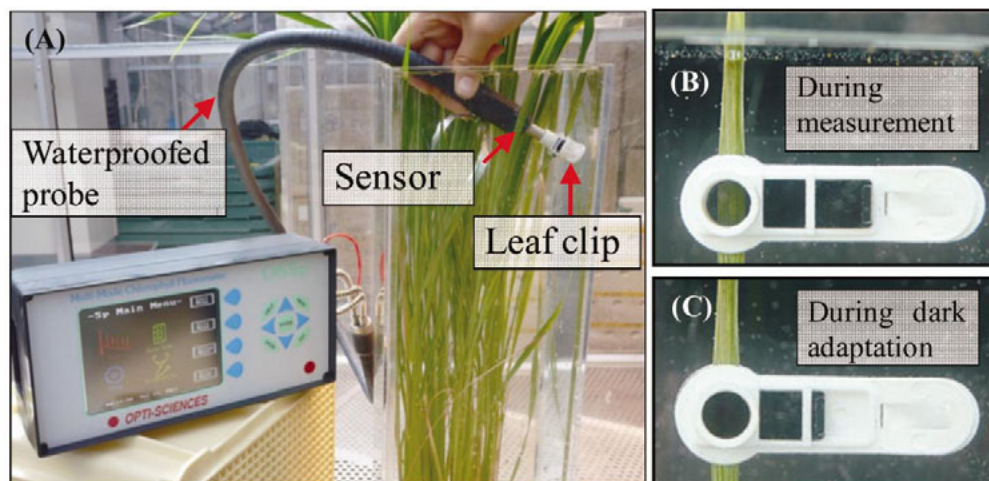


Fig.2. Changes of maximal quantum yield of PSII photochemistry (Fv/Fm) in rice leaves during submergence

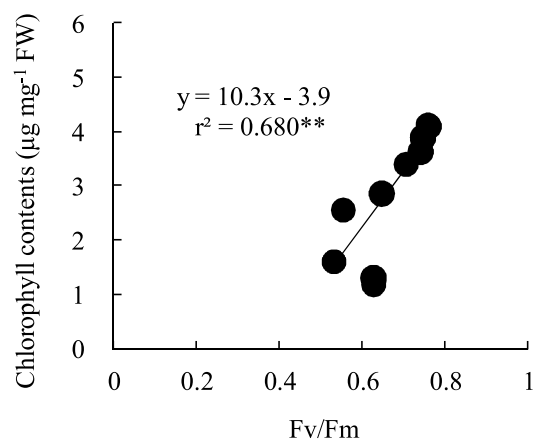


Fig. 3. Relationship between Fv/Fm and chlorophyll content of rice leaves during submergence of the tolerance and susceptible cultivars

3). At 14 days after submergence, the water in the tank was lowered to a 4-cm depth. Although Fv/Fm of the newly developed leaves during submergence in submerged IR67520 increased substantially from 2 days post-submergence, IR72442's decreased because of leaf chlorosis and all plants eventually died (data not shown). Therefore, it can be inferred that the tolerance cultivar coped with submergence by inhibiting photodamage and maintaining high chlorophyll content in the leaves.

The chlorophyll fluorescence meter with a waterproof probe can be utilized for the measurement of photochemistry reactions in rice leaves under floodwater. In our method, Fv/Fm can be measured in less than one minute per plant in air and underwater, with the results expected to become valuable screening tools for research and breeding programs for the improvement of submergence resistance in rice.

(J-I. Sakagami)

TOPIC3

Indigenous organic resources for improving soil fertility in rice systems in Sub-Saharan Africa

Low soil fertility in Sub-Saharan Africa (SSA) has resulted in a decrease in rice production. It was also found that small-scale farmers do not have enough purchasing power to afford sufficient amounts of commercial inorganic fertilizers to replenish soil fertility. Thus, to increase agricultural productivity without spending much on fertilizers, easily obtainable and low-cost indigenous resources were examined. This study was aimed to quantify the abundance of various indigenous organic resources, estimate the amount of fertilizer equivalent, and map the distribution of resources in Ghana, SSA. The survey was conducted to investigate the availability of indigenous organic resources for use in agriculture and determine the amounts of plant- and animal-derived nitrogen (N), phosphate (P), and potassium (K). Moreover, this study was aimed to improve rice productivity pursuant to the goal of the Coalition for African Rice Development (CARD).

It was found that various indigenous resources from agricultural wastes such as rice straws and rice husks could be used for rice systems in Ghana. These residues were abundant in Northern, Volta, Upper East, Western, and Eastern regions where large amount of rice was produced (Fig. 1). Total rice straw and husk produced as waste in Ghanaian rice systems was 430,000 tons. These contained N, P, and K elements with nutrient equivalent (in tons) of 2,530 N, 990 P₂O₅, and 5,460 K₂O, respectively (Table 1).

Various livestock excreta including dung and urine were also abundant, particularly from cows followed by excreta from goats. Amount of excreta differed among regions. Cow and pig

excreta were largely produced in Northern, Upper East, and Upper Western regions. Poultry manure was ample in Ashanti, Greater Accra, and in other municipalities and cities (Fig. 2). Livestock excreta produced in Ghana were calculated to contain 80,500 N, 44,500 P₂O₅, and 59,200 K₂O (total nutrient equivalent, in tons). Phosphate was found in all livestock dung (Fig. 3). (It should be noted that the calculated composition of fertilizer in each resource was based on previous documents and statistics data of the Ministry of Food and Agriculture of Ghana published in 2007.)

The estimated quantity of indigenous organic resources differed among regions; thus, resources should be optimized for use in the host areas. For example, in the Northern region where rice cultivation is most prominent, adding rice straw into the rice cultivation system would cover approximately 20 percent of N and P, and most K requirement of the soil compared to applied chemical fertilizers. Also, based on total estimated organic resources from livestock, if only 20 percent of these resources were utilized, it could replace the requirement for chemical fertilizer in rice cultivation system for the entire Northern region. Furthermore, development of composting techniques is required for sustainable and effective application of these organic resources. Meanwhile, it has been noted that grazing livestock excreta (dung and urine) were difficult to manage; hence, effective methods for its collection and transportation from the sources should be investigated prior to its use. In addition to the aforementioned observed resources in Ghana, other organic resources such as human excreta, sawdust, and oil palm shells are also available and may prove useful. Therefore, further studies on the abundance and usefulness of these resources should be considered.

(S. Tobita, R. N. Issaka [Soil Research Institute, Ghana], M. M. Buri [Soil Research Institute, Ghana], M. Fukuda, and S. Nakamura)

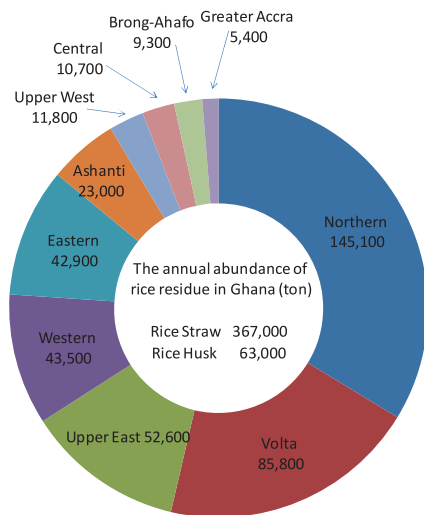


Fig. 1. Annual abundance of rice residues in Ghana (Issaka *et al.*, 2011)

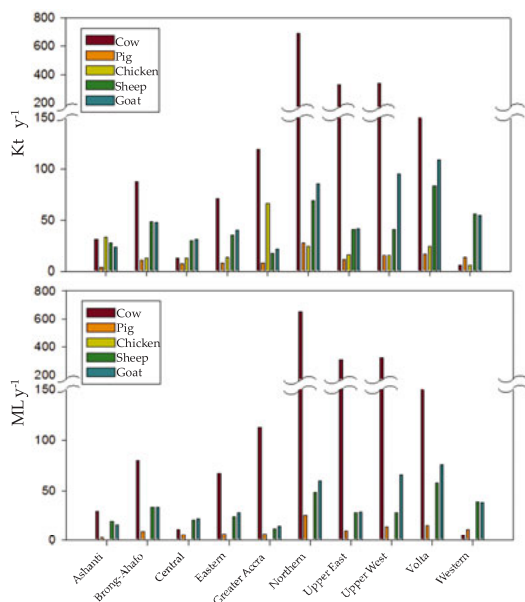


Fig. 3. Nutrient equivalent (N, P₂O₅, K₂O) of livestock excreta in Ghana

Table 1. Nutrient equivalent (in kt y⁻¹) of organic residues in Ghana

		N	P ₂ O ₅	K ₂ O	
Plant	Rice Straw	1.8	0.6	5.1	
	Souces Husk	0.7	0.4	0.3	
Sum		2.5	1.0	5.5	
	Cow	Dung	20.7	31.6	8.9
		Urine	21.1	0.2	23.6
	Pig	Dung	2.7	2.2	2.1
		Urine	0.4	0.1	1.1
Animal Souces	Chicken	Dung	5.8	3.1	2.9
		Urine			
	Sheep	Dung	8.8	3.2	3.2
		Urine	4.6	0.2	6.1
	Goat	Dung	10.8	3.9	3.9
		Urine	5.6	0.2	7.5
Sum		80.5	44.5	59.2	
Total		83.0	45.5	64.6	

Nutrient equivalent were calculated and based on various sources (from Dobermann and Fairhurst (2002), Buri *et al.*, (2004), MaCalla (1975), Mahimairaja *et al.* (2008)).

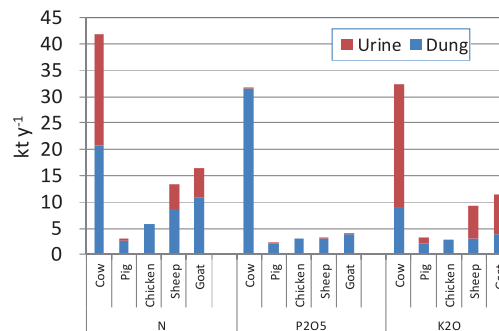


Fig. 2. Quantities of dung and urine excreted by five most common livestock in various regions

TOPIC4

Multiline variety for rainfed lowland rice variety

Rice blast, caused by *Pyricularia grisea* (Cooke) Sacc., is one of the most serious diseases affecting rice (*Oryza sativa* L.). It inflicts severe damage to rice production in temperate and tropical regions. The use of resistant varieties is the most economical and effective method to control blast disease (Yu *et al.*, 1991). However, the true resistance of

varieties governed by a major gene is often broken down due to the emergence of virulent races after only several years of use. Increasing host genetic diversity through the use of a multiline variety consisting of several isogenic lines (ILs) or varietal mixtures with different major genes is one of several useful strategies to avoid easy breakdown of resistance. The effectiveness of multilines or mixed varietal plantings in reducing blast disease has been demonstrated in Japan. However, multiline varieties for blast resistance have yet to be developed and released for use in the tropics.

Rice blast is particularly severe in rainfed lowlands that are prone to droughts. To produce the durable protection system against blast disease in the rainfed lowlands under tropical conditions using genetic diversity of rice variety, the multiline variety consisting of several isogenic lines with elite Indica-type genetic background was developed.

A set of near-isogenic lines (NILs) for blast resistance genes was developed by using an Indica-type elite rice variety, IR49830-7-1-2-2, as a genetic background suitable for rainfed lowland conditions in the tropics. Initially, it was revealed that IR49830-7-1-2-2 harbors five blast resistance genes - *Pia*, *Pib*, *Pik-s*, *Pita*, and *Pi11(t)* - by using a differential system involving 19 selected standard blast isolates from the Philippines. Based on this result, nine NILs were developed targeting eight resistance genes - *Pik*, *Pi7(t)*, *Pi3*, *Pi5*, *Pita-2*, *Piz-5*, *Pish*, and *Pi9* - by recurrent backcrossing. The introgression of each resistance gene in the NILs was confirmed by reaction patterns to the blast isolates, allelism tests, and DNA marker analysis. In addition, a genome-wide DNA marker survey revealed that most of the chromosome regions in each NIL were of the IR49830-7-1-2-2 type. The agricultural characteristics of most of the developed NILs were almost the same as those of IR49830-7-1-2-2. Moreover, with one exception, they showed submergence tolerance similar to IR49830-7-1-2-2. The developed NILs could be used as a multiline variety suitable for rainfed lowlands in the tropics.

(Y. Fukuta, Y. Koide, S. Yanagihara, N. Kobayashi [NICS], H. Kato [NICS], T. Imbe

[Kyushu-Okinawa ARC], H. Tsunematsu [NICS], Leodegario A. Ebron [IRRI], Mary Jeanie Telebanco-Yanoria [IRRI], M. Yokoo [University of Tsukuba], S. Maruyama [University of Tsukuba])

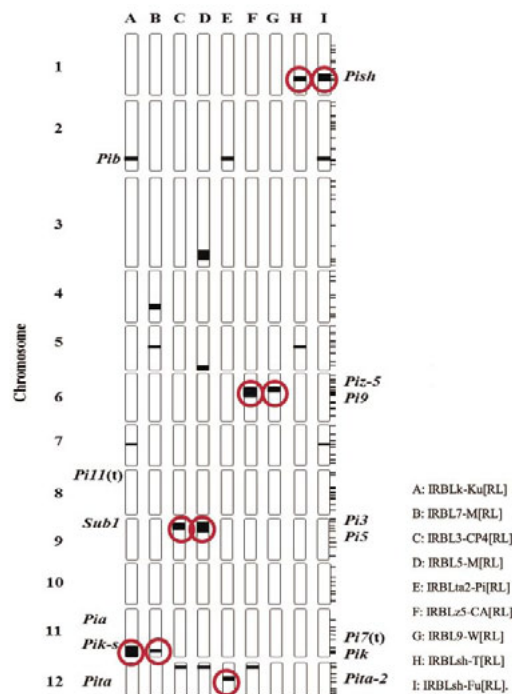


Fig.1. Graphical genotypes of nine near-isogenic lines (NILs) with IR49830-7-1-2-2 genetic background.

Blank regions on each chromosome indicate introgression from donor varieties and red circles show the locations of target resistance genes.

The gene symbols on the left side indicate the resistance and tolerant genes harboring in the genetic background of IR49830-7-1-2-2. The right side gene symbols indicate the introduced resistance genes into IR49830-7-1-2-2.

1-12: Chromosome number

TOPIC5

Identification of cis-acting promoter elements in cold- and dehydration-induced transcriptional pathways in rice, soybean and Arabidopsis

Low temperature and dehydration affect plant growth and productivity. Many genes respond to both stressors at the transcriptional level, and their gene products function in terms of stress tolerance and response. These genes include key metabolic enzymes, late embryogenesis-abundant (LEA) proteins, detoxification enzymes, chaperones, protein kinases, and transcription factors. The cis-acting elements that function in stress-responsive gene

expression have been analyzed to elucidate the molecular mechanisms of gene expression in response to these stresses. The dehydration-responsive element (DRE) containing the core sequence A/GCCGAC is a cis-acting element that regulates cold- and dehydration-responsive gene expression in Arabidopsis (*Arabidopsis thaliana*). The abscisic acid (ABA)-responsive element (ABRE) containing the core sequence ACGTGG/T is a cis-acting element that regulates dehydration- and high salinity-responsive gene expression in Arabidopsis and rice (*Oryza sativa*). ABA-responsive gene expression requires multiple ABREs or an ABRE with a coupling element as a functional promoter.

In this study, oligo microarrays were used to

identify cold- and dehydration-responsive genes in rice, soybean and Arabidopsis. The observed frequencies of all ($4^6 = 4096$) hexamer sequences in cold- and dehydration-inducible promoters were compared with standardized promoters to estimate conserved sequences and to determine representative cold- and dehydration-responsive transcriptional pathways in rice, soybean and Arabidopsis.

Microarray analyses were performed using the three species (rice, soybean and Arabidopsis) and the characteristics of identified cold- and dehydration-responsive genes were compared. Transcription profiles of the cold- and dehydration-responsive genes were similar among these three species, showing representative up-regulated (dehydrin/LEA) and down-regulated (photosynthesis-related) genes. All ($4^6 = 4096$) hexamer sequences in the promoters of the three species were investigated, revealing the frequency of conserved sequences in cold- and dehydration-inducible promoters. A

core sequence of the ABRE was the most conserved in dehydration-inducible promoters of all three species, suggesting that transcriptional regulation for dehydration-inducible genes is similar among these three species with the ABRE-dependent transcriptional pathway. In contrast, the highly conserved sequences in cold-inducible promoters of Arabidopsis are different from those of rice and soybean. DRE is the most conserved sequence in cold-inducible promoters of Arabidopsis, but not in those of rice and soybean. The novel sequence and ABRE are the most conserved sequences in cold-inducible promoters of rice and soybean, respectively. In cold-inducible promoters, the conserved hexamer sequences were diversified among these three species, suggesting the existence of diverse transcriptional regulatory pathways for cold-inducible genes among the species.

(K. Maruyama, K. Yamaguchi-Shinozaki)

Fig. 1. Molecular function of cold- and dehydration-responsive genes in rice, soybean and Arabidopsis. Heat maps of 27 up-regulated (red) or down-regulated (blue) molecular function classes indicating the frequency (%) in cold-treated (C) and dehydration-treated (D) plants.

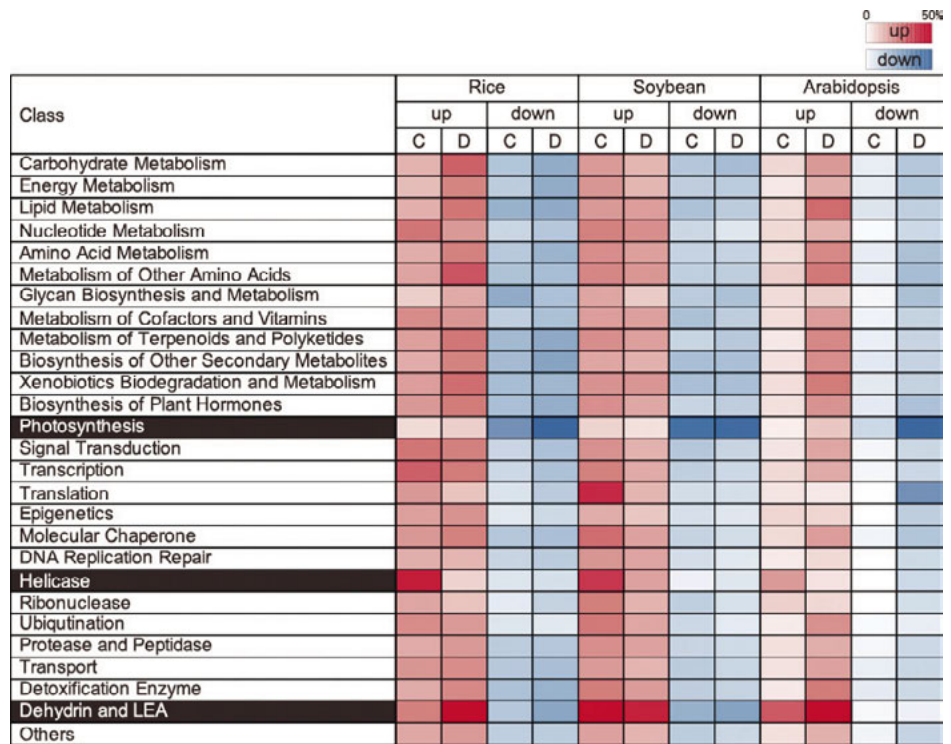
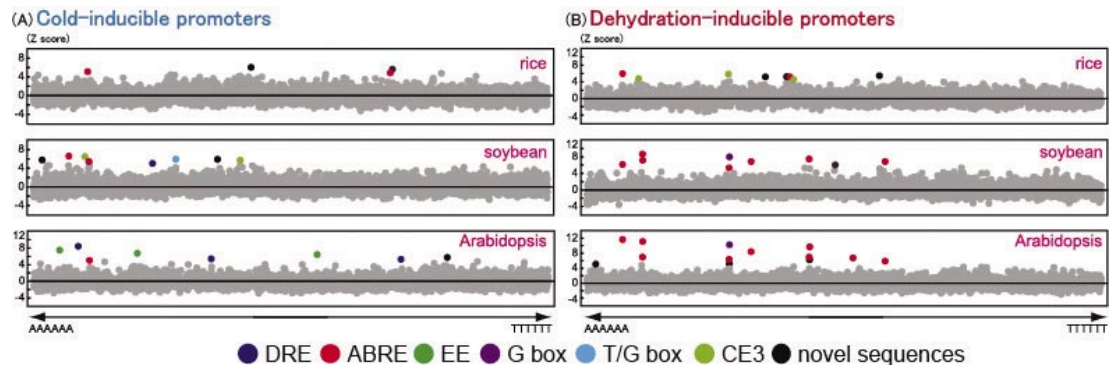


Fig. 2. Scatter plots showing Z-scores (y axes) for the observed frequencies of all hexamer sequences (x axes) in cold-inducible (A) and dehydration-inducible (B) promoters in rice, soybean and Arabidopsis compared to standardized promoters. The highly conserved sequences of DRE (blue), ABRE (red), EE (green), G box (purple), T/G box (light blue), CE3 (light green), and novel sequences (black) are shown.



AZF1 and AZF2 proteins regulate plant growth under drought and salt stresses

Plants are exposed to various environmental stress conditions, such as drought, high salt, and low temperature. In response to these stresses, plants regulate growth and development by altering gene expression. Previous reports suggest that overexpression of some stress-inducible transcription factors can increase stress tolerance, resulting in growth inhibition. However, little is known about how such stresses cause plant growth inhibition. This study is aimed to elucidate the mechanism involved in plant growth regulation under environmental stresses by analyzing the functions of two Arabidopsis C2H2-type zinc-finger transcription factors (AZF1 and AZF2) that are induced by abiotic stresses.

AZF1 and *AZF2* genes encode C2H2-type zinc-finger proteins that are thought to function as transcriptional repressors. Expression of these genes are induced by osmotic stresses such as drought and high salt, and a phytohormone abscisic acid. Subcellular localization studies using GFP (green fluorescent protein) fusion proteins showed that the AZF1 and AZF2 proteins are localized to the nuclei in roots under

control conditions, whereas the AZF2 protein accumulates in the nuclei of leaf cells under high-salinity stress. To analyze the functions of the AZF1 and AZF2 in plants, we generated transgenic Arabidopsis plants overexpressing *AZF1* and *AZF2* using stress-responsive promoters or a glucocorticoid-inducible promoter. These transgenic plants displayed dwarfed growth with smaller curled leaves (Fig. 1). It was also shown that overexpression of *AZF1* and *AZF2* enhances salt sensitivity in plants. Transcriptome analyses of the transgenic plants demonstrated that AZF1 and AZF2 repress the expression of various genes that are down-regulated by osmotic stresses and abscisic acid treatment. It is noteworthy that many “small auxin-up RNA (*SAUR*)” genes that may be involved in auxin-mediated cell elongation are down-regulated in the plants overexpressing *AZF1* and *AZF2* (Fig. 2). Moreover, gel mobility shift assays revealed that the AZF1 and AZF2 proteins directly interact with the SAUR promoter regions to repress the expression of these genes. Collectively, the results indicate that AZF1 and AZF2 function as transcriptional repressors which regulate plant growth under abiotic stress conditions.

The study’s findings suggest the possibility that the growth of plants can be artificially controlled under environmental stresses by adjusting the expression levels of some

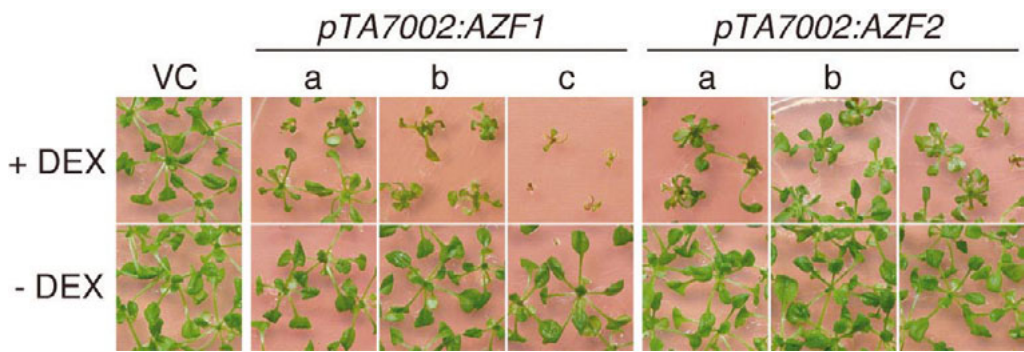


Fig. 1. Growth phenotypes of transgenic Arabidopsis plants overexpressing *AZF1* and *AZF2*. *pTA7002:AZF1*, *pTA7002:AZF2*, and vector control plants were grown for two weeks on GM agar plates supplemented with or without 1 μM DEX.

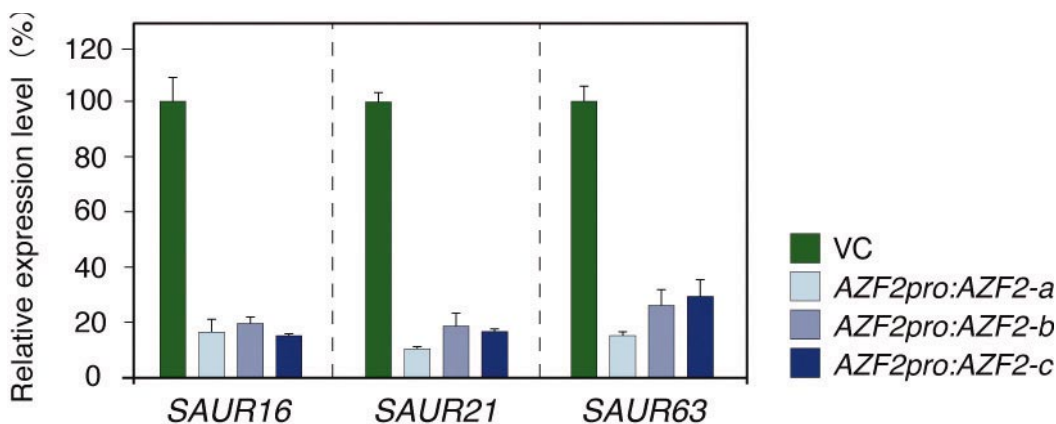


Fig. 2. Expression levels of some *SAUR* genes in transgenic plants overexpressing *AZF2*. The relative expression levels of the down-regulated genes were determined in the vector control and in three independent transgenic lines that were treated with 200 mM NaCl using qRT-PCR. The highest expression level of each gene was designated as 100.

transcription factors including AZF1 and AZF2. Further studies are required to confirm the functions of proteins similar to AZF1 and AZF2 in crops, such as rice and soybean, to develop a technique promoting optimum plant growth

under severe environmental conditions, thereby improving abiotic stress tolerance in crops and increasing crop yield.

(K. Kodaira, K. Maruyama, Y. Fujita, K. Yamaguchi-Shinozaki)

TOPIC7

Soybean line carrying multiple resistance genes against soybean rust

Sustainable soybean production in South American countries such as Brazil, Argentina, and Paraguay is very important because more than half of soybean in the world market is

produced in this region and because about 95% of soybean consumption in Japan is dependent on import. In the last 10 years, however, soybean rust has become one of the most serious threats to soybean production in this region causing large yield reduction. Thus far, five resistance loci to this disease have been identified and used for soybean breeding. However, some resistance alleles of these genes

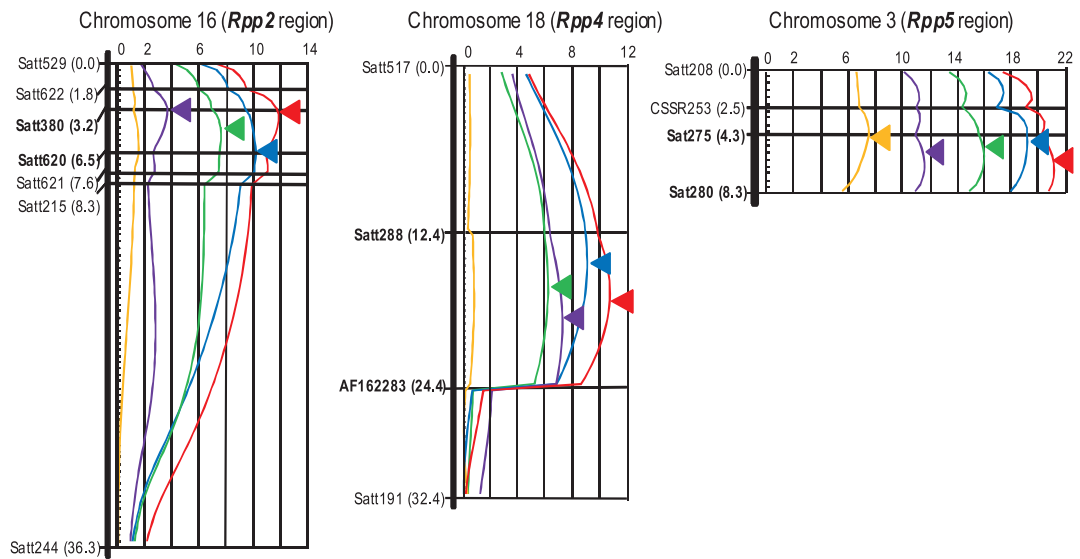


Fig. 1. Logarithm of odds (LOD) curves of the QTLs for five characters related to soybean rust resistance. LOD values and the peaks of graphs of the characters: lesion color (yellow); frequency of lesions with uredinia (green); number of uredinia per lesion (blue); frequency of open uredinia (purple); and sporulation level (red).

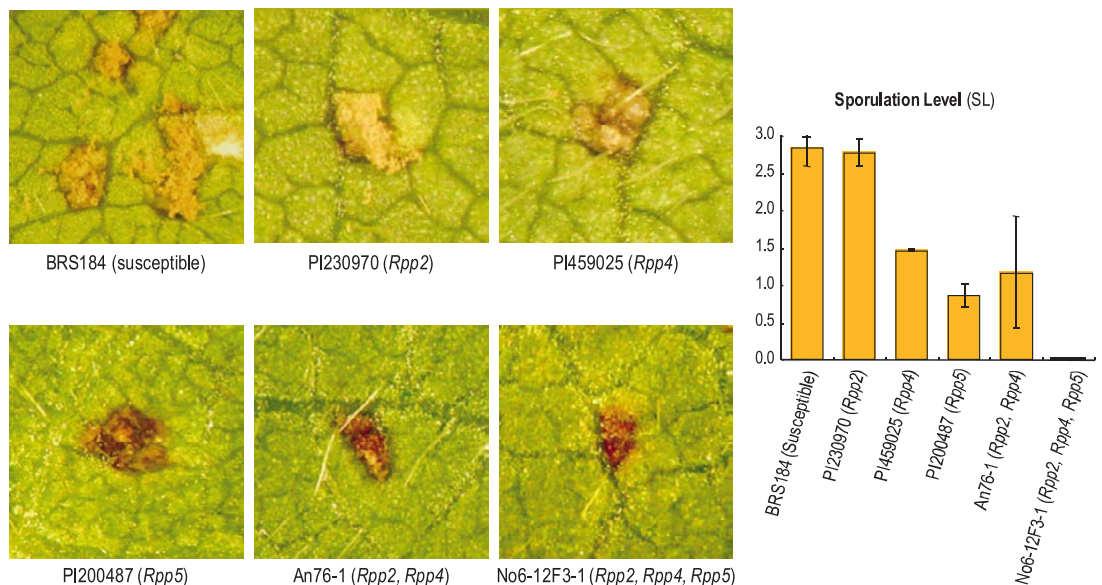


Fig. 2. Lesions and the frequency distribution of sporulation level in the soybean genotypes carrying Rpp2, Rpp4, and / or Rpp5. Pictures and phenotypic data were obtained by BRP-2 infection.

were reported to have broken down. The aim of this study was to clarify soybean-rust resistance by pyramiding these resistance genes and to develop soybean line carrying multiple resistance genes for marker-assisted breeding program in South American countries.

An F₂ population segregating Rpp2, Rpp4, and Rpp5, was infected with highly virulent Brazilian rust population-2 (BRP-2). Quantitative trait locus (QTL) analysis revealed that all three genes genetically contributed to the phenotypes of five resistance characters: lesion color; frequency of lesions with uredinia; number of uredinia per lesion; frequency of open uredinia; and sporulation level in a different manner (Fig. 1). Digenic and trigenic interactions were also detected among these three genes. A soybean line, No6-12F3-1, was screened and identified to carry these three resistant alleles as homozygous by means of marker-assisted selection. It was also identified to have higher resistance than its ancestors, PI230970 (No.3, Rpp2), PI459025 (Bing Nan, Rpp4), PI200487 (Kinoshita, Rpp5), and An76-1 (Rpp2 and Rpp4) by preventing uredinia and spore production in the infections of BRP-2 and its single-uredinia isolates, BRP-2.1, BRP-2.5, BRP-2.6, and BRP-2.49 (Fig. 2).

By using polymorphic DNA markers sandwiching each resistance locus, the presence of three kinds of resistance alleles were successfully identified in the line, No6-12F3-1. In addition, high resistance derived from candidate genetic interactions were observed in this line. Therefore, three resistance genes in this line can be introduced into susceptible soybean varieties in the marker-assisted backcross breeding to confer rust-resistance to susceptible varieties. When this line is used for breeding, however, we must consider that 1) polymorphic DNA markers will be chosen depending on susceptible recurrent parents, 2) high resistance is not always guaranteed because the degree of resistance could be changed by the pathogenicity of rust races and the genetic background of susceptible recurrent parents, and 3) the frequency of backcrossed progenies expected to carry three resistant alleles may be low because of the recombination between resistant loci and DNA markers.

(*N. Yamanaka, N. G. Lemos*)

PROGRAM C

Rural Livelihood Improvement Research Program

“Technology development for income and livelihood improvement of the rural population in developing regions”

The Rural Livelihood Improvement Program was launched to develop technologies that will promote practical use of local resources and help generate income, thereby improving the living conditions of rural populations in developing regions. Technological innovations will be applied to improve agricultural productivity and enhance the quality of agricultural products for added value. Creation of recycling-oriented societies committed to sustainable productivity and cognizant of diverse environments and cultures will also be encouraged.

The program comprises six projects designed to achieve the abovementioned targets. The program’s flagship project, titled “Establishment of Sustainable and Independent Farm Household Economy in the Rural Areas of Indochina”, will be described first, followed by the other five projects.

【Sustainable and Independent Farm Household Economy in Indochina Project】

This research project aims to develop new technologies that will help establish a stable and sustainable agricultural production not only for self-sufficiency and cash income, but also to improve living conditions in the rural mountainous areas in Lao PDR. Based on agricultural and ethnic conditions, a remote, low-income village located about 200 km northwest from Vientiane City, was selected as a common research site to systematize and demonstrate the newly developed technologies. Researchers assessed actual conditions by collecting basic and indispensable information on agricultural production, land-use, farm management methods and biodiversity. This will serve as a planning tool and as an effective guide for the development and evaluation of new technologies.

The JIRCAS-NAFRI (National Agriculture and Forestry Research Institute) Collaborative Project Launching Workshop, titled “Establishment of a Sustainable and Independent Farming System with Biodiversity Conservation”, was held on September 28, 2011 in Vientiane, with Ms. Junko Yokota, Japanese Ambassador, and Dr. Ty Phommasack, Vice Minister of MAF in Lao PDR in attendance (Photo). This is an interdisciplinary and

integrated research project and also the first collaborative endeavor with various specialized research institutes under NAFRI, as provided under the framework of an MOU signed on October 27, 2009. There are ten research subjects in the work plan, whose concerns include rice, upland crops, fishery, forestry, animal husbandry, fruits, and farm management. Its goal is to establish a sustainable and profitable farming system and to realize vital rural societies in harmony with biodiversity.

【Recycling-based Agricultural Production in China Project】

The prospect of mid- to long-term production and evaluation of the environmental load was started in order to develop a recycling-based agricultural production system in northern China. As a recycling-based production technology, experimental plans on using organic matters were evaluated, and methods on increasing the added value of agricultural products were examined for both the intensive cereal farming areas and the disadvantaged farming and livestock-raising regions.

【Food Resources Utilization Project】

The Food Research Network of Asia was designed and established for the efficient utilization of indigenous food resources. Recognizing common and important points on food production and processing is now possible through close communication among parties to the network. Furthermore, some laboratory methods for evaluating food-functionality and procedures for improving the quality of processed food were developed.

The network was formed during the “Research seminar on advanced application of local food resources in Asia 2012” held on March 1, 2012 at the Institute of Food Research and Product Development in Kasetsart University, Bangkok, Thailand. Twenty food scientists from JIRCAS, China Agriculture University, Kasetsart University, and Indonesian Institute of Science participated in the meeting.

Researchers’ groups exchanged information about traditional foods from their respective countries and discussed about possible research collaborations to solve common problems in the region. The groups reached an agreement to establish the Food Research Network of Asia at the meeting.

【Asia Biomass Project】

Microbial and enzymatic utilization technologies were improved to further promote efficient biofuel and bioplastic production technologies using tropical crop residues such as old oil palm trunks. In addition, sugar accumulation technology for old oil palm trunks was developed.

【Sustainable Forestry Production Project】

Technology development on sustainable management and conservation of forest resources was implemented. Growth condition was evaluated for indigenous tree species forests and actual usage of community forests was investigated in Thailand. Genetic soundness was evaluated and the production system of seeds and seedlings for regeneration assistance were investigated in a Malaysian hill dipterocarp forest where degradation is ongoing.

【Tropical Coastal Aquaculture Project】

Development of environment-friendly aquaculture technologies was conducted in coastal waters of Southeast Asia. In Thailand, candidate species among unexploited seaweed and benthic animals suitable for co-culture with black tiger shrimp were selected after field investigations and laboratory experiments. In the Philippines, field environmental monitoring of water and sediment qualities around a milkfish net cage was done to collect baseline information for the development of an IMTA (Integrated Multi-trophic Aquaculture). In Malaysia, the spatial distribution and abundance of planktonic larvae of dominant blood cockle and other bivalve larvae were investigated in relation to sediment conditions for spat settlements in culture areas along coastlines.



Group photo taken during the JIRCAS-NAFRI Collaborative Project Launching Workshop

Stock management of the fluvial shrimp *Macrobrachium yui* indigenous to northern Laos based on life-history characteristics

Many *Macrobrachium* species are found in Lao People’s Democratic Republic (Lao PDR). In particular, *Macrobrachium yui* indigenous to the northern mountainous areas is well known as local delicacy and is traded at a high price, making shrimp fishing an important source of income for the rural people. However, shrimp catch has decreased year by year due to overfishing and deterioration of aquatic environments. This has become a big problem in the villages surrounding the shrimp’s habitat. In this study, we examined species identification, migration pattern, breeding habitat and season, and early life-history of the shrimp in order to develop effective shrimp stock management techniques. The results are expected to contribute to the recovery and sustainable use of shrimp stock in the future.

Based on morphological characteristics, the species with the highest economic value was identified as *Macrobrachium yui*. Monthly sampling at fixed points showed that larger adults occur mostly in the cave stream; small-sized juveniles in the main river; and various-sized classes from the juveniles to the adults in the forest stream (Fig. 1). This suggests that the shrimp migrates among habitats of the three water bodies during its lifespan. Gonadosomatic index (GSI) of females greatly decreased from July through August and ovigerous females were found only from the inner part of the cave stream, indicating that females spawn in the inner part of the cave stream during the period (Fig. 2). The drifting larvae of the shrimp which had already settled to the bottom emerged from the cave stream from October through May. Based on rearing experiment in the laboratory, it was determined that the hatched larvae remained in the inner part of the cave stream for approximately one month (Fig. 3). In order to achieve recovery and sustain availability of the shrimp stock, prohibiting shrimp fishing at the cave stream during August was considered the centerpiece of fishery regulation. Fishery models were then created based on biological characteristics (i.e. female fecundity, seasonal change in the number of brooding females and growth patterns, etc.) of the shrimp to evaluate the effects of fishery regulation. The fishery model predicted that future shrimp catch increased by approximately 30% compared to

current catch when shrimp fishing at the cave stream during August was prohibited under the condition that actual fishing mortality is three times higher than the optimum fishing mortality (Fig. 4).

Backed by the prediction results of the fishery model, the fishery regulation was suggested to the local government. Based on Article 53 of the

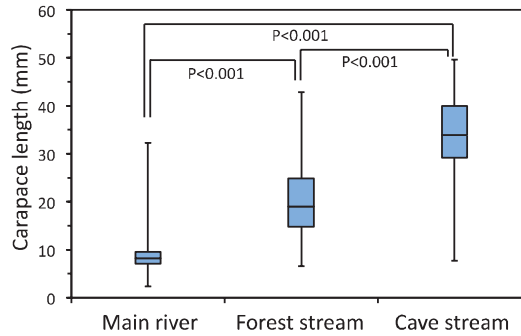


Fig. 1. Comparison of carapace length of the fluvial shrimp *Macrobrachium yui* (except the larvae), among habitats of the three water bodies

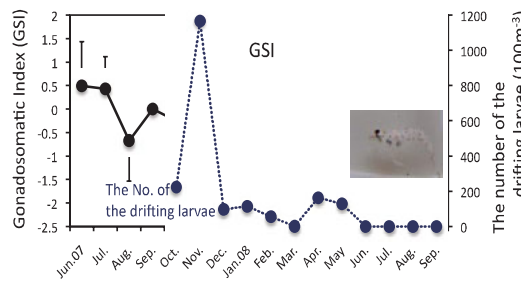


Fig.2 Monthly changes of gonadosomatic index (GSI) of females and the number of the drifting larvae in *M. yui*. The photo in the figure shows the drifting larvae which emerged from the cave stream after settling to the bottom.

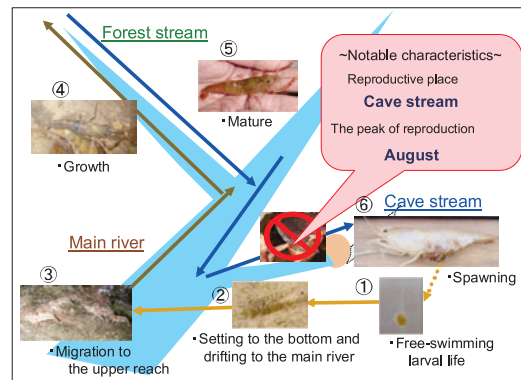


Fig.3 Life-cycle of *M. yui* and the fishery regulations established on the basis of its life-history characteristic.

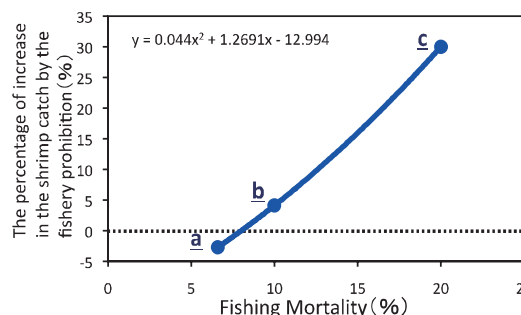


Fig. 4. The percentage of increase in the shrimp catch to fishing mortality resulting from the prohibition of the shrimp fishery in the cave stream in August
 a: optimal fishing mortality rate at present (6.6%)
 b: fishing mortality rate of approximately 1.5 times a (10%)
 c: fishing mortality rate of approximately 3 times a (20%).

Fig. 5. Newspaper article on the implementation of the shrimp fishery regulations in Pak-Xuang District, Luang-Prabang Province (Vientiane Times, dated 16 July 2011)



fishing regulations by the Ministry of Agriculture and Forestry in Lao PDR and at the initiative of the local government and villagers of Pak-Xuang District, Luang-Prabang Province, prohibition of shrimp fishery at the cave stream every August was adopted and enacted starting from year 2011 (Fig. 5).

(S. Ito, H. Yukio [FRA], K. Iguch [FRA], K. Omori [CMES Ehime University], Koun Thong Bang [LARReC], O. Lasasimma [LARReC], P. Soliyamath [PAFO, Luang-Prabang])

TOPIC2

Effect of natural fermentation on the textural improvement of traditional fermented rice noodles

Natural fermentation of whole polished rice grains (*Indica*) is a traditional processing method widely applied in southern China and Southeast Asia to improve the texture of rice noodles. Though it is common knowledge that rice starch is degraded during fermentation resulting in poor gel strength, little is known about the effects of fermentation on texture characteristics of starch-based foods; hence, its effect on rice noodles remains unclear. Therefore, exploring the merits of fermentation is crucial in enhancing the quality of fermented rice noodles. The objectives of the present study are (1) to isolate, identify and characterize the micro-organisms present during the natural fermentation process, (2) to determine the metabolites produced during fermentation and chemical component changes of raw milled rice grains, (3) to investigate their effects on rheological and sensory properties of rice noodles, and (4) to clarify the mechanism for improving the texture of fermented rice noodles.

A total of 170 lactic acid bacteria (LAB) and 96 yeasts were isolated from three local factories in Changde City, Hunan Province, China. *Lactobacillus plantarum* (32 strains) was more frequently isolated than other LAB species during the fermentation process. The number of *Lactobacillus strains* (83.5%)

suggested that *lactobacilli* predominated in the fermented rice noodle processing. The predominant yeast species was *Saccharomyces cerevisiae* (57 strains). Table 1 shows the chemical components of raw rice material, fermented rice grains, and fermented supernatant at 72 h in three factories. After fermentation, the contents of total starch, amylose, and reducing sugar increased, whereas the contents of starch damage, protein and lipid decreased. However, the changes on total starch and lipid were not significant ($P > 0.05$). Lactic acid was the dominant organic acid produced by fermentation.

Rice starch underwent slight hydrolysis during natural fermentation while its purity increased significantly. Treating the raw milled rice grains with trypsin, lipase or lactic acid (pH 4.0) could modify the rheological characteristics (Fig. 1) and improve the sensory properties of rice noodles. Removal of protein and lipid by physical extraction method confirmed the result of protease and lipase treatments, indicating that the purity of starch is an important factor in determining noodle texture. Low molecular weight sugars should be rinsed completely from rice grains immediately after fermentation to minimize their negative effects on the tensile and sensory properties of rice noodles.

In conclusion, fermentation of raw milled rice by LAB and yeasts decreased protein and lipid content and increased the purity of rice starch, thereby improving the texture of fermented rice noodles. However, the low molecular weight sugars produced during fermentation should be

removed for their negative effect on texture.

(E. Tatsumi, M. Saito, K. Kohyama [National Food Research Institute], Z. Lu, L. Li [China Agricultural University])

Table 1. Chemical components of rice grains and fermented supernatants

	Raw rice material	Fermented rice grains		
		Factory A	Factory B	Factory C
Rice grains				
Total starch (%)	89.1 – 0.9 ^a	90.3 – 1.1 ^a	90.7 – 0.2 ^a	89.9 – 0.7 ^a
Amylose (%)	20.6 – 0.7 ^a	21.6 – 0.3 ^b	21.1 – 0.6 ^b	21.9 – 0.5 ^b
Starch damage (%)	2.84 – 0.13 ^b	0.43 – 0.31 ^a	0.57 – 0.22 ^a	0.73 – 0.17 ^a
Reducing sugar (%)	0.35 – 0.01 ^a	3.11 – 0.11 ^b	3.64 – 0.2 ^b	3.77 – 0.13 ^b
Protein (%)	4.5 – 0.3 ^b	3.6 – 0.1 ^a	3.9 – 0.2 ^a	3.2 – 0.6 ^a
Lipid (%)	0.9 – 0.1 ^a	0.7 – 0.1 ^a	0.6 – 0.3 ^a	0.7 – 0.2 ^a
Reducing sugar of fermented supernatant(g/l)	0.12 – 0.01 ^a	3.50 – 0.03 ^b	3.47 – 0.11 ^b	4.09 – 0.07 ^b

Values within the same horizontal row followed by the same alphabetical letter are not significantly different (P>0.05).

Fermented rice grains were obtained from three local factories in Changde City, Hunan Province, China.

Raw rice material and tap water in all the local factories were from the same supplier.

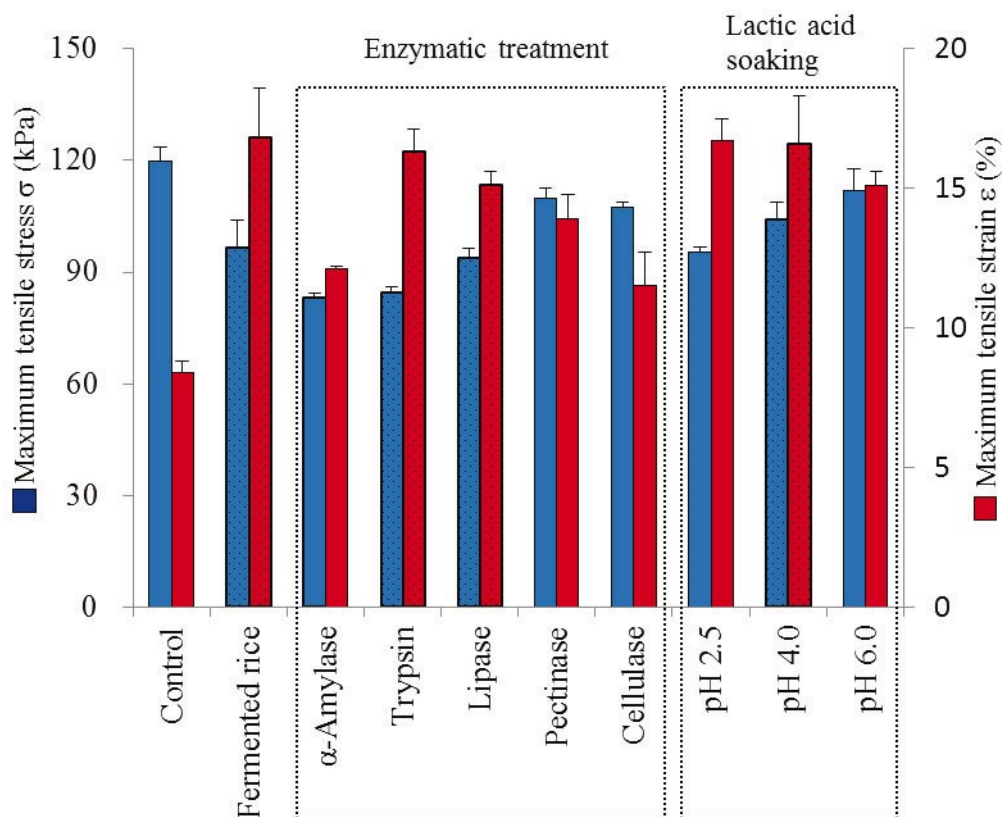


Fig. 1. Tensile properties of rice noodles derived from treated rice grains

Development of cellulose-degrading enzyme recycle system for reducing enzyme cost of saccharification

Lignocellulosic plant biomass is difficult to hydrolyze because cellulose is surrounded by a lignin that has covalent associations with hemicellulose, and cellulose has a tightly packed crystalline structure. Thus, the rate-limiting step in biomass degradation is the conversion of cellulose and hemicellulose polymers to sugars. Among cellulolytic microorganisms, *Clostridium thermocellum*, an anaerobic thermophilic bacterium, is the most potent cellulose degrading bacterium known to produce the cellulosome (2-3.5 MDa). The cellulosome structure of *C. thermocellum* consists of a large non-catalytic scaffolding protein (scaffoldin) named CipA of 197 kDa that is multi-modular and includes nine cohesins, and a family III cellulose binding module (CBM). The catalytic

units are non-covalently attached to scaffoldin via the type I interaction between dockerin domains borne by the catalytic units with the cohesins on the scaffoldin.

Recently, to isolate microorganisms that possess effective cellulose-degrading ability, new thermophilic cellulolytic strains were screened from agriculture residues in Thailand using microcrystalline cellulose as a carbon source. We isolated a new strain, *C. thermocellum* S14, which has higher cellulose-degrading ability than several type strains (1).

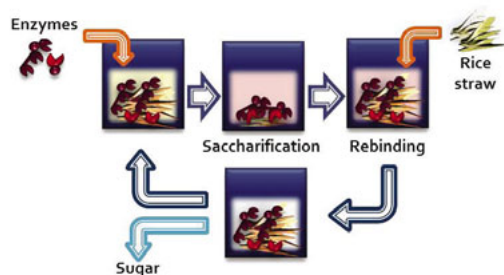
When rice straw treated by soaking in aqueous ammonia was hydrolyzed by the combination of β -glucosidase from *Thermoanaerobacter brockii* with the cellulosome from *C. thermocellum* S14, approximately 91% of glucan existing in the rice straw was hydrolyzed (2). On the other hand, enzyme recycling is desired to reduce costs of saccharification process (Fig. 1). In order to recycle the combination, CBM from CipA was fused to the β -glucosidase. When recycling tests were carried out against crystalline cellulose and ammonia-treated rice straw, combination of cellulosome and β -glucosidase-fused CBM could recycle at least 5 and 4 rounds, respectively, consistent with high saccharification rates. Based on these results, a recycle saccharification reactor system that can recover saccharified solution through an ultrafiltration membrane using a combination of the cellulosome and β -glucosidase-fused CBM was developed (Fig. 2). These results indicated that the combination of cellulosomes and β -glucosidase from thermophilic anaerobic microorganisms has great potential as an effective lignocellulose degradation system.

(Kosugi A, Waeonukul R [KMUTT], Tachaapaikoon C [KMUTT], Mori Y)

(1) Tachaapaikoon C, Kosugi A, Pason P, Waeonukul R, Ratanakhanokchai K, Kyu KL, Arai T, Murata Y, Mori Y. (2012) Isolation and characterization of a new cellulosome-producing *Clostridium thermocellum* strain. *Biodegradation*. 23(1):57-68.

(2) Waeonukul R, Kosugi A, Tachaapaikoon C, Pason P, Ratanakhanokchai K, Prawitwong P, Deng L, Saito M, Mori Y. (2012) Efficient saccharification of ammonia soaked rice straw by combination of *Clostridium thermocellum* cellulosome and *Thermoanaerobacter brockii* β -glucosidase. *Bioresource Technology* doi:10.1016/j.biortech.2011.12.126

Fig.1. Design of recycle system using a combination of cellulosome and β -glucosidase-fused CBM



Recycle saccharification system

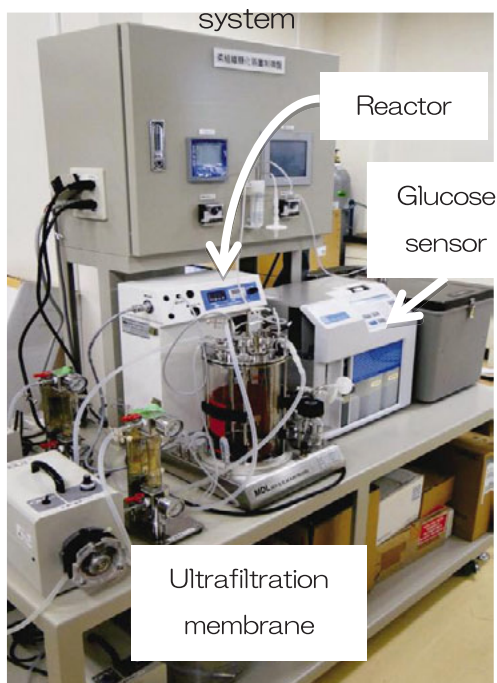


Fig 2. Recycle saccharification system using a combination of cellulosome and CBM-fused β -glucosidase

Production of biodegradable plastic from oil palm sap

Biodegradable plastics (or bioplastics) are commonly produced from corn starch and edible oil. However, the aforementioned raw materials are also important food components, which could lead to competition between the bioplastic and food industries for the same resources.

Palm oil is a common agricultural product in Southeast Asia. Its source--the oil palm trees--has an economic life span of approximately 20-25 years, after which old trees are felled and the farms, replanted. Meanwhile, the discarded oil palm trunks are suddenly available in large quantities, providing readily-available alternative sources for new products such as bioplastic. These renewable resources derived from agricultural wastes are also called "waste agricultural biomass" or "biomass resources."

From previous studies, it was shown clearly that ethanol and lactic acid were efficiently producible from oil palm sap using yeast and lactic acid bacteria. It was also found that the concentration of fermentable sugars in the trunk can be drastically increased within a suitable storage period. The polymer that was produced, called Poly-3-hydroxybutyrate (PHB), shows excellent heat resistance and biodegradability, and the expanding demand is expected along with polylactic acid. The objective of this study, therefore, is the development of cheap and efficient PHB-producing techniques from oil palm sap.

Poly-3-hydroxybutyrate (PHB) was produced from sugar in oil palm sap using *B. megaterium* MC1 for the first time (Fig. 1). Different sap sugar concentrations were added to the production medium to analyze its effect on PHB biosynthesis. Sap sugar concentration ranging from 1.0 to 2.5% w/v was tested. With 2.5% w/v sap sugar concentration, a maximal PHB concentration of 1.91 g/L was recorded at 12h of growth (Fig. 2). Nitrogen plays an important role in influencing the process of PHB accumulation in bacterial cells. Different nitrogen compounds were used in this experiment to study the effect of these nitrogen sources on *B. megaterium* MC1. Urea is efficient and economical to produce PHB as a source of nitrogen. Ratio of carbon and nitrogen

(C/N molar ratio) in medium has been seen as one of the important factors influencing the biosynthesis of PHB in cell. With a fixed amount of carbon, different C/N ratios were tested by varying the urea concentration. A maximal PHB concentration was obtained with a C/N ratio of 50. To enhance PHA production, *B. megaterium* MC1 was grown in optimum condition. PHB of 3.28 g/L was produced from the juice liquid containing sugar of 2.5 % after 16 hours (Fig. 3).

(Takamitsu Arai, Kosugi Akihiko, Mori Yutaka, Murata Yoshinori, B. E. Lokesh [Universiti Sains Malaysia], K. Sudesh [Universiti Sains Malaysia])

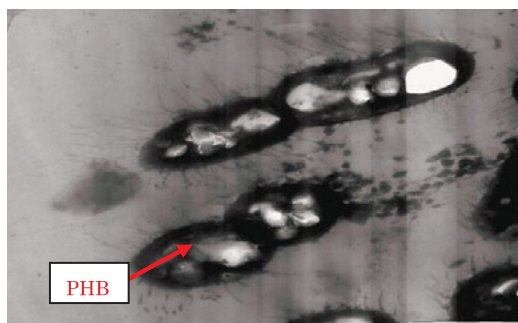


Fig. 1. Accumulation of PHB in *B. megaterium* MC1

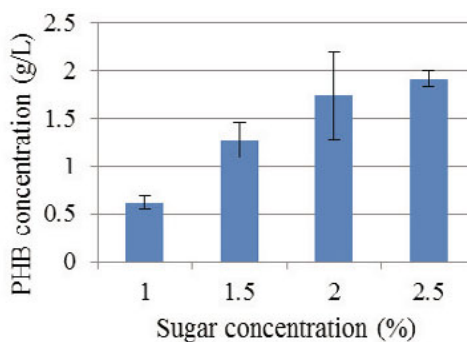


Fig. 2. Effect of sap sugar concentrations on growth and P(3HB) biosynthesis using *B. megaterium* MC1

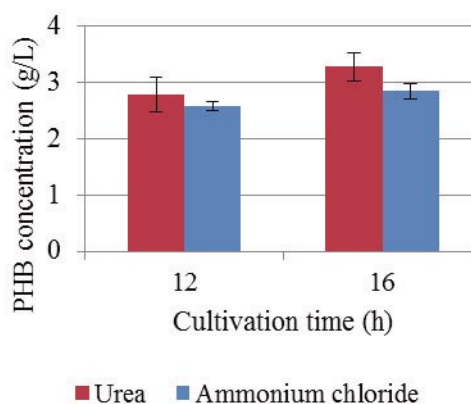


Fig. 3. Optimization of PHB production by *B. megaterium* MC1 using oil palm tree sap as sole carbon source

Analyzing pollen dispersal of seraya (*Shorea curtisii*) to promote healthy seed production to sustain forest regeneration

Trees of timber species larger than 50 cm in trunk diameter at breast height (dbh) are being harvested in ongoing selective logging operations in Malaysia. This is a critical issue as these activities often result to a reduced number of healthy seedlings due to poor seed dispersal across logged-over areas and unsuccessful cross-mating among remaining adult trees.

This research addresses the problem by applying genetic paternity analysis of seeds to identify pollen dispersal patterns and by studying the relationship between tree size (dbh) and male fecundity (i.e. pollen production). It was done in order to come up with a proposal

for forest management agencies in Malaysia to revise the selective logging criterion. The results of the study are expected to promote healthy seed production and consequently effect the development of a sustainable forest regeneration program.

Microsatellite genotypes were determined for all adult individuals in an undisturbed forest plot and seeds were collected in three synchronized flowering events for seraya (*Shorea curtisii*). Seraya is one of the major timber species in hill dipterocarp forests of Peninsular Malaysia where selective logging has been undertaken. Paternal donor of each seed was identified by comparing the genotypes of the seed, the mother tree and the paternal donor (paternity analysis). A model based on paternity analysis estimated pollen dispersal patterns. The average pollen dispersal distance was measured to be short at 60 m (Fig. 1).

The current harvesting criterion (dipterocarp trees larger than 50 cm dbh are felled) lowers the density and increases the distance between remaining adult trees, thereby decreasing the chances of pollen reaching other trees. Increasing remaining tree density helps promote cross-mating and improve the production of healthy seeds. Male fecundity of each adult tree estimated from the model based on paternity analysis showed that small-sized trees less than 50 cm in dbh left after selective logging seldom produced pollen (Fig. 2), resulting to fewer seeds produced from cross-mating. Selective logging simulation revealed that conserving the middle-sized trees (70-90cm dbh) ensured about 50% of outcrossing pollen produced to be retained, which was higher than the current logging protocol (5-15%, logging larger than 50 cm trees). This research established pollen dispersal patterns and studied the relationship between tree size (in dbh) and pollen production. The results will be compiled in support of the proposal to the Selangor Forest Department for a revised selective logging criterion to rejuvenate healthy cross-mating of seraya and consequently, sustain forest regeneration.

(Naoki Tani, Yoshihiko Tsumura [FFPRI], Yuriko Taguchi [FFPRI], Kaoru Niiyama [FFPRI], Tatsuya Otani [FFPRI], Tsutomu Yagihashi [FFPRI], Keita Fukasawa [NIES], Tomoyuki Kado [SOKENDAI], Soon Leong Lee [FRIM], Chai Ting Lee [FRIM], Norwati Muhammad [FRIM], Abdul Rahman Kassim [FRIM], Azizi Ripin [GFR])

Fig. 1. Pollen dispersal probability curves deduced from the mating process model. Model was based on paternity assignment of seeds conducted on a 6-hectare undisturbed forest plot in Semangkok Forest Reserve, Malaysia. Blue, red and black lines indicate pollen dispersal probabilities for the 1998, 2002 and 2005 flowering events, respectively.

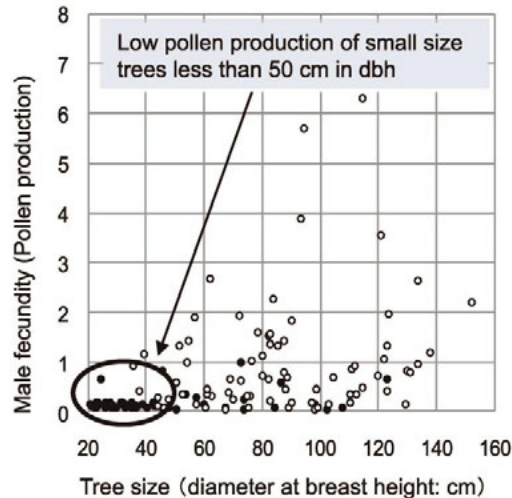
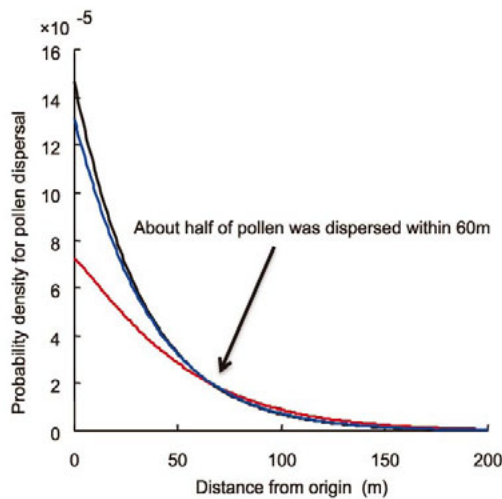


Fig. 2. Relationship between tree sizes in dbh and male fecundity of each adult tree in the plot (larger than 20 cm in dbh). Open and solid circles indicate flowering trees and non-flowering trees based on field observation, respectively.

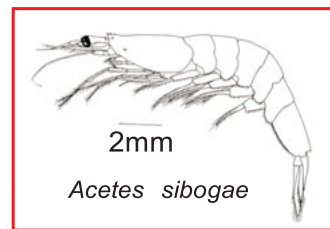
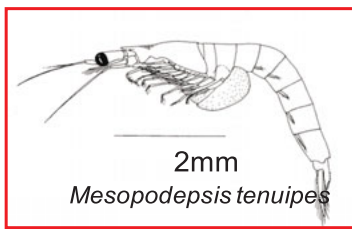
The importance of large scale mangrove estuaries as feeding grounds for commercially important juvenile fishes

Mangroves contribute substantially to coastal fisheries in terms of providing trophic and refuge support. Typically, the adults of many tropical fish species spawn in the offshore area, producing eggs that develop into planktonic larvae which move or are carried by currents into the inshore and mangroves. However, the mangrove areas surveyed in almost all studies are on the small scale mangroves of normally less than 1 km width, and there are few studies focusing on the large mangrove estuaries. The Matang Mangrove Forest Reserve (MMFR), situated on the northwestern coast of Peninsular Malaysia, is reputed to be the world’s best managed mangrove forest. The reserve is the largest single tract of mangrove forest in Peninsular Malaysia (40,151 ha), measuring 52 km between the extreme ends and 13 km wide in the middle, and has been managed as a sustainable production forest since 1905. In this study, stable carbon and nitrogen isotope ratios of juvenile John’s snapper *Lutjanus johnii* and Caroun croaker *Johnius carouna* collected from the estuaries of MMFR were measured to

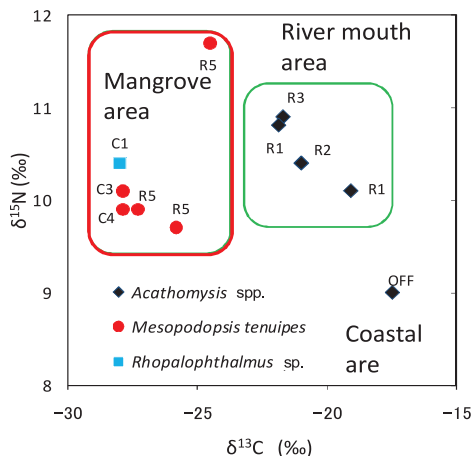
investigate 1) the ontogenetic migration of the juveniles into and within the large and complex mangrove estuaries, and 2) the fish’s dependence on the food sources provided in the mangrove nursery area.

Prey animals in MMFR showed distinctive $\delta^{13}\text{C}$ signatures between habitats and can be divided into two groups: one group with generally enriched $\delta^{13}\text{C}$ values closely associated with coastal and lower estuarine areas; the other group with more depleted $\delta^{13}\text{C}$ values captured in the upper mangrove areas (Fig. 1). Corresponding with the isotope values of these prey animals, juveniles of John’s snappers and Caroun croaker also had more enriched $\delta^{13}\text{C}$ values in the lower estuarine areas than in the upper mangrove areas. The remarkable differences observed in the isotope ratios between these sampling sites reflect the difference in food sources between the two habitat groups (Fig. 2, left).

Small individuals of John’s snappers caught from the lower mangrove station (S1) had higher $\delta^{13}\text{C}$ values that reflect the relatively higher $\delta^{13}\text{C}$ values of the prey animals collected in the coastal stations (Fig. 2, left). This suggests that the small fish had recently migrated into the lower mangrove from the coastal area. The $\delta^{13}\text{C}$ signature of larger juvenile John’s snappers collected from the upper mangrove areas showed more depleted



(A): Mysids



(B): Acetes

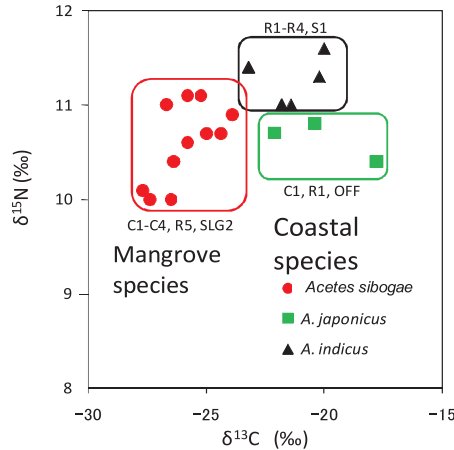


Fig. 1. Plot of $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ of prey crustacean animals in the Matang Mangrove Estuary

values with their growth (Fig. 2, left). These results indicate the ontogenetic migration of John's snappers spreading into the upper mangrove areas as far as 13 km from the river mouth after entering from the coastal areas (Fig. 2, right). On the other hand, Caroun croaker is a permanent resident in mangrove estuary both as adults and juveniles. The $\delta^{13}\text{C}$ signature of Caroun croaker collected from the lower estuary showed more enriched values with their growth, suggesting that the contribution of mangrove-associated prey animals is higher in the smaller juveniles.

These findings of the present study have

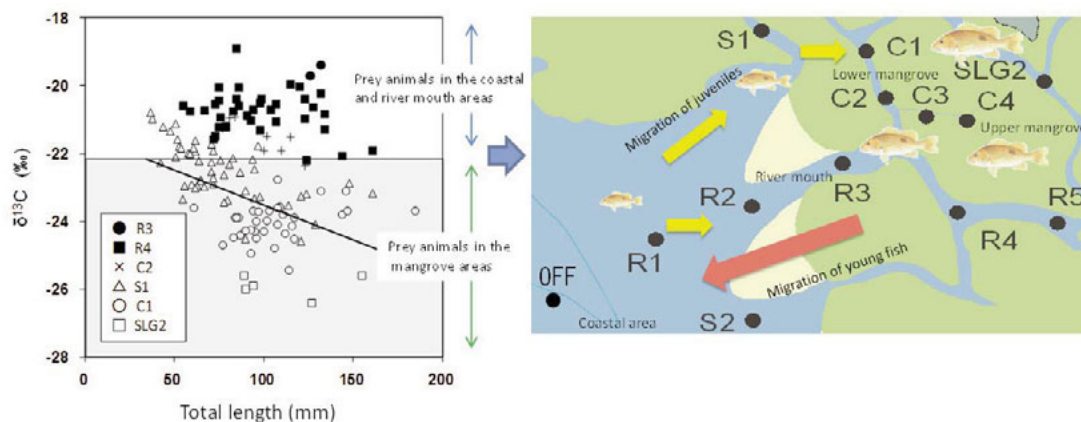


Fig. 2. Relationship between $\delta^{13}\text{C}$ values and total length of *Lutjanus johnii* in the Matang Mangrove Estuary (left) and the migration of juvenile and young *Lutjanus johnii* (right)

TOPIC 7

Size measurement and nutritional condition evaluation methods in sandfish (*Holothuria scabra* Jaeger)

Over 60 species of sea cucumbers are fished commercially and traded in Southeast Asian and Pacific countries, and great demand for these sea cucumbers has caused severe overfishing in these countries. Depletion of natural stocks with high commercial value has encouraged hatchery production, stock enhancement and aquaculture programs of sea cucumbers, especially sandfish, *Holothuria scabra* (Fig. 1), the most valued of tropical sea cucumbers.

High mortality and slow growth are problems in *H. scabra* hatcheries, and rearing techniques must be improved for stable production of the seeds. However, there is one fundamental methodological problem: there are no standard methods for size measurement and for evaluating nutritional condition of sea

important implications for the fishery management of juvenile fish in the mangrove estuary. This study shows the importance of conserving sufficiently large single areas of mangrove with their complex interconnected waterways (including estuary, river, rivulet and creek) as exemplified by the large MMFR, as habitat and feeding grounds for John's snapper and Caroun croaker.

(K. Tanaka, S. Watanabe [JIRCAS], Y. Hanamura, M. Kodama, T. Ichikawa [National Research Institute of Fisheries Science], Alias Man [Fisheries Research Institute, Malaysia], V-C. Chong [University of Maraya])

cucumbers including *H. scabra*. Without correct determination of size and nutritional condition, evaluation and improvement of technologies are difficult. The aims of this study, therefore, were to establish accurate size measurement and nutritional condition evaluation methods for *H. scabra*.

Anaesthetization is reported to improve size measurement accuracy in Japanese common sea cucumber, *Apostichopus japonicas*. Although 0.5% KCl and 0.05% MgSO_4 did not induce anesthesia, 2% - 4% menthol-ethanol in filtered seawater for 20 - 30 min was found effective and harmless. The anaesthetization significantly reduced the coefficient of variation of the mean body length and weight in repeated measurements by 68% and 43%, respectively (Fig. 2).

During starvation, body size and weight decreased concomitantly, resulting in unchanged condition factor (body weight / volume), suggesting that condition factor cannot be used as an index of nutritional condition unlike in

animals with axial skeletons or exoskeletons. Protein, cholesterol and carbohydrate concentrations in the body fluid (i.e. coelomic fluid and vascular fluid) were also analyzed to study the relationship with starvation. Since the protein and cholesterol concentrations initially increased and then decreased during starvation period, it is difficult to use them as indices of nutritional condition. The carbohydrate concentration showed a gradual two-fold increase during 10-day starvation (Fig. 3, left). Body fluid density (Fig. 3, right) and volume relative to body size gradually increased and decreased, respectively, during 20-day starvation. High correlation coefficients indicate that these factors may be used as proxies for nutritional condition.

The aforementioned methods may be used to correctly monitor the conditions of *H. scabra* in studies for improving aquaculture and stock enhancement techniques. However, further physiological studies to elucidate the mechanisms behind the observed tendencies must be conducted.

(S. Watanabe, J.M. Zarate, J.G. Sumbing, Ma. J.H. Lebata-Ramos, M.F. Nievaes)

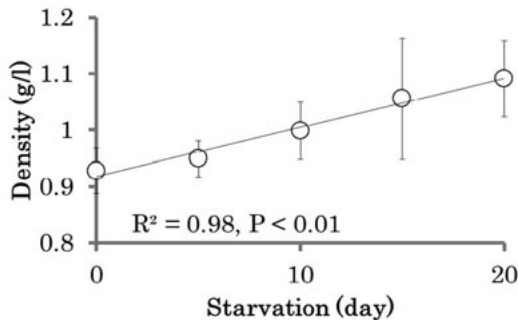
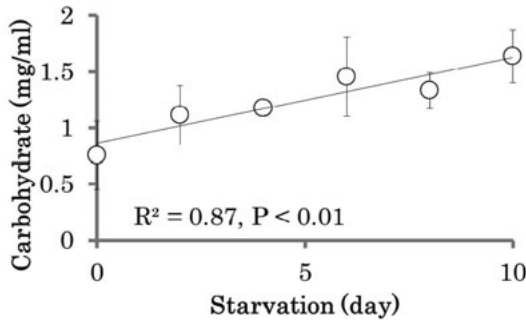


Fig. 1. Sandfish (*Holothuria scabra*)



Fig. 2. Coefficient of variation in body length and weight of juvenile *H. scabra* subjected to repeated measurements

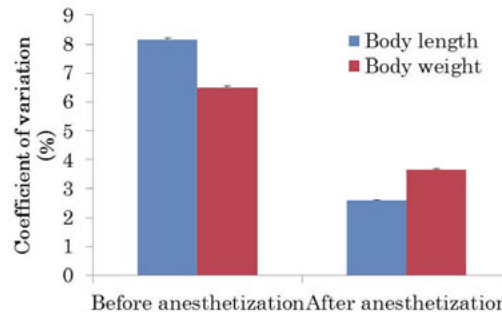


Fig. 3. Relationship between starvation day and carbohydrate concentration (left) and density (right) in body fluid of juvenile *H. scabra*

TOPIC8

Stock assessment and management of juvenile orange-spotted grouper (*Epinephelus coioides*) at a tropical mangrove brackish area in Peninsular Malaysia

Juvenile orange-spotted groupers (Fig. 1), the most commercially important fish in the tropics, are usually harvested from brackish waters for use as aquaculture seed, but the actual fishing situation is unclear. In this research, the actual fishing situation of juvenile grouper-species fish was clarified by collecting fishing statistics from the Merbok Mangrove brackish waters in the

northwestern coast of Peninsular Malaysia. Also, stock assessment of the juvenile orange-spotted grouper was conducted using fishing statistics and biological analysis. Furthermore, a stock management model for juvenile orange-spotted groupers was constructed and an effective strategy for a sustainable stock management system was proposed to relevant agencies of the Malaysian government.

An investigation on the actual fishing situation of juvenile orange-spotted groupers was conducted in the Merbok Mangrove brackish waters of Malaysia from January 2007 to March 2010. The results showed that they were dominant through all those years (Fig. 2). Spawning behaviour of juvenile orange-spotted

Fig. 1. Orange-spotted grouper (*Epinephelus coioides*)



Fig. 2. Species composition of juvenile groupers caught by sampling boat from January 2007 to March 2010

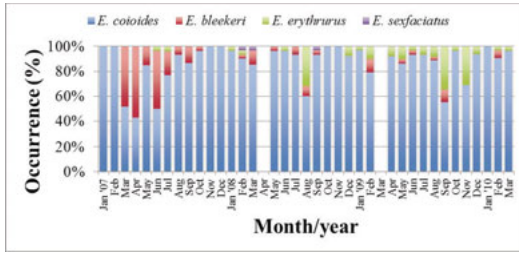
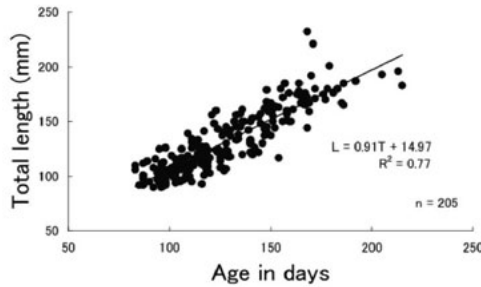


Fig. 3. Scatter plot showing the growth of the orange-spotted grouper (*Epinephelus coioides*) juveniles caught in the Merbok Mangrove area



groupers was determined based on otolith age-in-days analysis. It was observed that juvenile fish born in the sea migrated into the mangrove brackish waters at the age of two months, stayed there for three to five months, and then moved out to coastal regions by the age of seven months. The relationship between the age in days and total length of the juvenile orange-spotted groupers in the mangrove brackish waters is expressed in the following single regression formula, called the growth formula, where total length = $0.91 \times \text{age in days} + 15.0$ ($R^2=0.77$) (Fig. 3).

The results of the stock assessment conducted on the juvenile orange-spotted groupers in the Merbok Mangrove brackish waters showed that the fishing mortality coefficient (F) (coefficient expressing the size of the rate of decline of the number of stock with catching as the cause of death) of fish over four months old increased drastically from September 2008. It was affirmed that juvenile orange-spotted groupers in the same brackish waters were overexploited (Fig. 4). By contrast, stock recovery rate simulation results indicated that a reduction in fishing effort could help expectations for stock recovery. Additionally, the stock recovery rate increased quadratically in association with the reduction in the fishing mortality coefficient (Fig. 5).

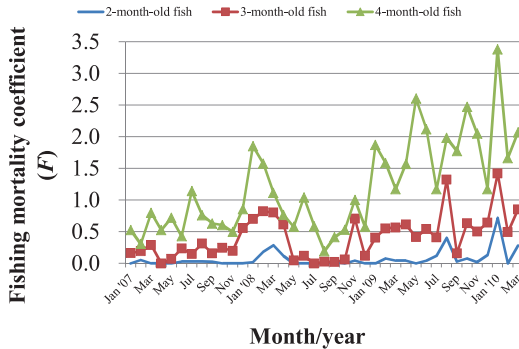


Fig. 4. Fishing mortality coefficient (F) by age (in months) of juvenile orange-spotted groupers caught in the Merbok mangrove area from January 2007 to March 2010

With this research, it was established that the mangrove brackish waters are habitats critical to the growth of juvenile orange-spotted groupers. Based on recovery rate model simulation, fishing prohibition would be the most effective method of stock management. If fishing prohibition measures are implemented, up to four times the current amount of juvenile fish could be supplied to the coastal regions. It was estimated that the number of out-migrating stock would be approximately 20,000 fishes per month. These results are expected to be used as fundamental data for stock management in Malaysia.

(T. Yamamoto, Y. Hanamura, Man Alias, P. E. Chee, S. Ryon [Fisheries Research Institute, Malaysia])

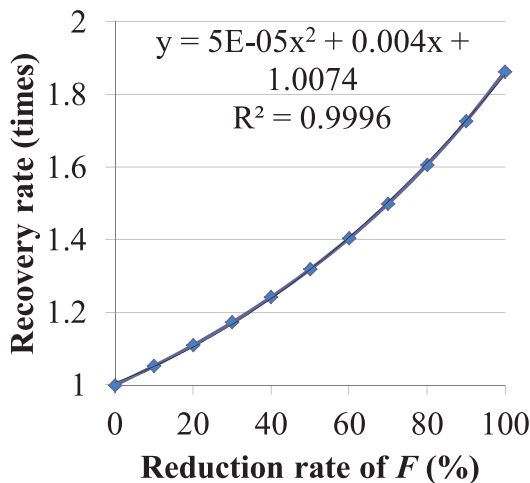


Fig. 5. Recovery rate of stock abundance in number of juvenile orange-spotted groupers in the Merbok mangrove area through arbitrary reductions of F percentage. The recovery curve of the stock number is expressed as a quadratic equation.

PROGRAM D Information Analyses

Under the Third Medium-Term Plan of JIRCAS, activities for the collection, analysis, and dissemination of information for identifying trends related to international agriculture, forestry, and fisheries were separately specified from other research and investigation activities. These activities were divided into two main subjects:

A) the analyses of the current situation and forecasts concerning food supply and demand and the production structure of agriculture, forestry, and fisheries in foreign countries, and B) the collection, analysis, and dissemination of information and materials related to the international food situation, to the agricultural, forestry, and fishery industries as well as to rural areas.

Subject A was made in order to contribute to the solution of global food and environmental problems. Subject B was made in order to formulate and conduct research and other projects related to agriculture, forestry, and fisheries in developing regions.

Information was collected in a regular, institutional, and systematic manner through collaboration with related organizations in Japan and overseas, and through the long-term dispatch of staff to priority areas of activities. The respective information and materials were provided to a broad range of researchers, government agencies, and private companies.

Evaluation of fiscal year 2011 accomplishments showed that Program D performed very well in comparison with the original annual implementation plan. Below is a summary of Program D's outputs, among others.

Under Subject A, country-based food supply and demand models were designed and related statistical data were compiled pursuant to a collaboration agreement with various institutions such as the UN FAO's Regional Office for Asia and the Pacific. Continuous efforts were also made to collect information on agricultural market projections as well as on food security, including that for the Chinese food market. In addition, several reports on water resources and agricultural water use were published.

Under Subject B, JIRCAS, as a unique national agricultural research institution, played a very important role, connecting various organizations, individuals, and initiatives related to international agricultural research for development. Activities included active participation in international forums such as the

G20 Conference on Agricultural Research for Development, the Science Forum of the CGIAR, the APEC Agricultural Technology Transfer Forum, the Tropical Agriculture Platform Design Meeting organized by FAO, the World Water Forum and so on. Information on current trends in agricultural research was collected by visiting various institutions such as the Global Forum of Agricultural Research (GFAR) Secretariat, the French Agricultural Research Centre for International Development (CIRAD), and research centers belonging to the Consultative Group on International Agricultural Research (CGIAR).

For rice research in particular, Program D played a pivotal role by connecting related national and international stakeholders in promoting two important international initiatives, namely, the Global Rice Science Partnership (GRiSP) and the Coalition for African Rice Development (CARD). JIRCAS organized an international symposium in November 2011 to address relevant issues and highlight the initiatives. Besides the above activities, JIRCAS continuously gathered local information on agricultural research priorities in Southeast Asia and Africa by maintaining liaison offices. Regional representatives also attended various meetings and events to exchange ideas on current and future collaborations.

TOPIC 1

Global food security analyses and formulation of a framework for a country-based food supply and demand study in Asia

It is important to do proper analyses of the current and future situation of food supply and demand in order to provide solutions to international food and environmental problems. Accordingly, JIRCAS observed the latest trends on global food markets and food security by participating in relevant international meetings, and proposed new methodologies that would analyze food and nutrition situations more easily and effectively. To obtain accurate trends in Asian food markets, a country-based model study was initiated in Laos and Cambodia where researches in this area had not been sufficiently developed. Also, a collaborative network aimed at enhancing analytical capacity in ASEAN countries was strengthened among relevant organizations. JIRCAS is expected to provide a

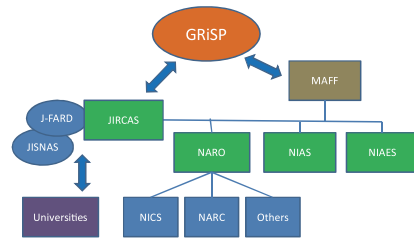
venue for continuous and practical research in the region.

TOPIC2

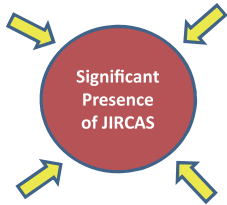
Grasping trends in international agricultural research and contribution to international research programs

Relevant information were collected and disseminated by creating and maintaining active relationships with international research networks in order to paint an accurate picture of the current status of agricultural technology development in developing regions. JIRCAS, as a strategic partner in the Global Rice Science Partnership (GRiSP), a Consultative Group on International Agricultural Research (CGIAR) research program, fulfills its role as a link between Japanese and overseas researchers, particularly in the field of rice research in which many Japanese researchers play lead roles. In addition, JIRCAS maintains its support to the Coalition for African Rice Development (CARD), a Japanese initiative for African Development. The above-mentioned activities were publicized through a homepage built by the MAFF-commissioned “Global Scale Issue-oriented International Research Network Project.”

GRiSP Coordinating Committee in Japan (GCCJ)



**JIRCAS International Symposium 2011
“Trends of International Rice Research and Japanese Scientific Contribution – Support to GRiSP and CARD”**



The Fourth General Meeting of the Coalition for African Rice Development (CARD)



**Global Scale Issue-oriented International Research Network Project
(Formation of International Research Network)**

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**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. Twenty-two individual visits to JIRCAS were made during FY 2011 under the Administrative Invitation Program. Invited administrators and their home institutions are listed below.

Administrative Invitations, FY 2011

Al-Hassan Imoro	Ministry of Food and Agriculture, Directorate of Crop Services, Ghana	Oct. 3-16, 2011
Daniel Ninson	Ministry of Food and Agriculture, Directorate of Crop Services, Ghana	Oct. 3-16, 2011
Stephen Amankwa	Ministry of Food and Agriculture, Atwima Nwabigya District Office, Ghana	Oct. 3-16, 2011
Mathew Asamoah Kyeremeh	Ministry of Food and Agriculture, Afafo Ano South District Office, Ghana	Oct. 3-16, 2011
Juan Boo Liang	Laboratory of Animal Production, Institute of Tropical Agriculture, Universiti Putra Malaysia (UPM), Malaysia	Oct. 13-20, 2011
Ralf Achim Dobermann	International Rice Research Institute (IRRI), Philippines	Nov. 13-16, 2011
Jagdish Kumar Ladha	India Office, International Rice Research Institute (IRRI), India	Nov. 12-16, 2011
Qian Qian	China National Rice Research Institute (CNRRI), P.R. China	Nov. 13-16, 2011
Marco Cletus Sebastiaan Wopereis	Africa Rice Center, Benin	Nov. 11-16, 2011
Parminder Singh Virk	International Rice Research Institute (IRRI), Philippines	Nov. 13-17, 2011
Maria Concepcion Calpe Moliner	Food and Agriculture Organization (FAO), Italy	Nov. 12-17, 2011
Hei Leung	International Rice Research Institute (IRRI), Philippines	Nov. 13-16, 2011
Inez Hortense Slamet-Loedin	International Rice Research Institute (IRRI), Philippines	Nov. 27-Dec.1, 2011
Manabu Ishitani	International Center for Tropical Agriculture (IITA), Colombia	Nov. 28-Dec.1, 2011

Carolina Saint Pierre	International Maize and Wheat Improvement Center (CIMMYT), Mexico	Nov. 28-Dec.1, 2011
David Bonnett	International Maize and Wheat Improvement Center (CIMMYT), Mexico	Nov. 28-Dec.1, 2011
Chen Yongfu	College of Economics and Management, China Agricultural University, P.R. China	Feb. 7-21, 2012
Suwarno	Indonesian Center for Rice Research (ICRR), Indonesia	Mar. 4-8, 2012
Dwinita Wikan Utami	Indonesian Center for Agricultural Biotechnology and Germplasm Resources Research and Development, Indonesia	Mar. 4-8, 2012
Norobsambuu Togtokhbayar	School of Biological Resources & Management, Mongolian State University of Agriculture (MSUA), Mongolia	Mar. 29-Apr. 2, 2012
Israel K. Dzomeku	Graduate School, University for Development Sciences (UDS), Ghana	Mar. 1-12, 2012
Roland Nuhu Issaka	CSIR Soil Research Institute, Ghana	Mar. 1-12, 2012

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. Thirty-one researchers were invited under this program during FY 2011. Invited researchers, their affiliated research organizations, and their research activities are summarized below.

Counterpart Researcher Invitations, FY 2011

Karri Ramu	RP Dryland Systems, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), India	Clarification of nitrogen dynamics in a sweet sorghum field	Apr. 24-May 21, 2011
Tahirou Abdoulaye	International Institute of Tropical Agriculture (IITA), Nigeria	Analysis of consumption and consumer preferences of cowpea in West Africa	Jun. 4-11, 2011
Feng Qin	Research Center for Molecular and Developmental Biology Institute of Botany, Chinese Academy of Sciences (CAS), P.R. China	Development of monocotyledonous crops with environmental stress tolerance	Jun. 5-Jul. 9, 2011
Odjo Theophile	Faculty of Agricultural Sciences, University of Abomey-Calavi, Benin	Genetic study of resistance to blast disease in rice germplasm of Africa	Aug. 7-Dec. 23, 2011
Safiah Jasmani	Institut Akuakultur Tropika Universiti Malaysia Terengganu, Malaysia	Use of organ culture techniques for the evaluation of hormones affecting yolk protein production	Oct. 17-Nov. 1, 2011
Junjarus Sermsathanaswadi	Enzyme Technology Laboratory School of Bioresources and Technology King Mongkut's University of Technology Thonburi (KMUTT), Thailand	Elucidation of function and structure of the xylanosome, a multicomponent enzyme (cellulase/hemicellulase) complex	Oct. 3, 2011-Aug. 3, 2012
Monica Isabel Heck	Annual Crops Department Estación Experimental Agropecuaria-Cerro Azul Instituto Nacional de Tecnología Agropecuaria (INTA-EEA Cerro Azul), Argentina	Development of soybean varieties resistant against soybean rust in Argentina	Jan. 21-Mar. 18, 2012
Nguyen Cong Thuan	College of Environment and Natural Resources Can Tho University, Vietnam	Analysis of fish pond water quality	Oct. 28-Nov. 13, 2011
Siriwan Tunkumthong	National Biological Control Research Center Central Regional Center, Thailand	Biological control of sugarcane borer	Sep. 25-Oct. 15, 2011
Namphueng Chomphookhiaw	National Biological Control Research Center Central Regional Center, Thailand	Biological control of sugarcane borer	Oct. 14-Nov. 5, 2011
Werapon Ponragdee	Khon Kaen Field Crops Research Center Department of Agriculture, Thailand	Development of new type of sugarcane with high biomass productivity under adverse agricultural environments by using wild relatives	Sep. 25-30, 2011
Nilubon Taweekul	Khon Kaen Field Crops Research Center Department of Agriculture, Thailand	Elucidation of risk factors of SCWL contamination and establishment of standard detection methods for SCWL aimed at the production and supply system of clean seed cane	Sep. 25-30, 2011

Kalbya Netkallayamit	Phitsanulok Agricultural Development Center Department of Agriculture, Thailand	Elucidation of risk factors of SCWL contamination and establishment of standard detection methods for SCWL aimed at the production and supply system of clean seed cane	Sep. 25-30, 2011
Joan Modupe Babajide	Department of Food Science and Technology University of Agriculture, Nigeria	Extraction and purification of yam tuber starches and analysis of their physico-chemical properties	Oct. 30, 2011-Jan. 29, 2012
Amelia Henry	International Rice Research Institute (IRRI), Philippines	To attend the 2011 Annual Meeting for MAFF-Funded Project "Development of Abiotic Stress Tolerant Crops by DREB Genes"	Nov. 27-Dec.1, 2011
Amelie Gaudin	International Rice Research Institute (IRRI), Philippines	To attend the 2011 Annual Meeting for MAFF-Funded Project "Development of Abiotic Stress Tolerant Crops by DREB Genes"	Nov. 28-Dec.1, 2011
Michael Gomez Selvaraj	International Center for Tropical Agriculture, Colombia	To attend the 2011 Annual Meeting for MAFF-Funded Project "Development of Abiotic Stress Tolerant Crops by DREB Genes"	Nov. 27-Dec.1, 2011
Inusah Yahaya	CSIR-Savanna Agricultural Research Institute, Ghana	To discuss the results and plans for the collaborative project and to have an understanding of the present state of rice research in Japan	Jan. 28-Feb. 8, 2012
Zenith Gaye Almeda Orozco	Southeast Asian Fisheries Development Center / Aquaculture Department (SEAFDEC/AQD), Philippines	Assimilation of amino acids and lipids from wastes of marine finfish by benthic organisms: Implication for integrated multi-trophic aquaculture	Jan. 17-31, 2012
Antonio Jose Lopez-Montes	International Institute of Tropical Agriculture (IITA), Nigeria	Progress and Planning Meeting of EDITS-Yam Project	Dec. 4-15, 2011
Gezahegn Girma Tessema	International Institute of Tropical Agriculture (IITA), Nigeria	Progress and Planning Meeting of EDITS-Yam Project	Dec. 4-15, 2011
Melaku Ayele Gedil	International Institute of Tropical Agriculture (IITA) Nigeria	Progress and Planning Meeting of EDITS-Yam Project	Dec. 4-15, 2011
Hidehiko Kikuno	International Institute of Tropical Agriculture (IITA), Nigeria	Progress and Planning Meeting of EDITS-Yam Project	Dec. 5-15, 2011
Mario Pacheco Velazquez	International Maize and Wheat Improvement Center (CIMMYT), Mexico	To attend the 2011 Annual Meeting for MAFF-Funded Project "Development of Abiotic Stress Tolerant Crops by DREB Genes"	Nov. 28-Dec.1, 2011
Miori Uno	Fundacion Nikkei-Cetapar (Cetapar), Paraguay	Development of soybean varieties resistant against soybean rust in Paraguay	Jan. 21-Mar.18, 2012
Mohammad Abul Monsur	Bangladesh Rice Research Institute (BRRI), Bangladesh	Pathogenicity of blast isolates from Bangladesh	Jan. 4-Mar. 31, 2012
Puvanewary Kaesavan	Ecobiomaterials Research Laboratory, School of Biological Sciences, Universiti Sains Malaysia (USM-SBS-ERL), Malaysia	Development of bioplastic production technology using sap from oil palm trunk	Jan. 9-Mar. 30, 2012
Cui Yanwei	Pratacultural Company, Grassland Research Institute, Chinese Academy of Agricultural Sciences (CAAS), P.R. China	Development of cultural practices with environmentally-sound material cycle for unfavorable locations	Feb.11-Mar. 24, 2012
Mohd Nor Azman Bin Ayub	Fisheries Research Institute, Penang, Malaysia	Development of a rapid inspection system by using new ELISA kit for paralytic shellfish poisoning toxins in Malaysia	Feb. 26-Mar. 10, 2012

Ponthep Meunpong	Silvicultural Research Division, Forestry Research and Development Bureau, Royal Forest Department (RFD), Ministry of Natural Resources and Environment, Thailand	Evaluation of carbon sequestration capacity and allowable forest products harvested from private plantations and community forests	Mar. 13-25, 2012
Saidou Simporé	Institute of Environment and Agricultural Research / Natural Resources Management and Production System Department, Burkina Faso	Development of conservation agriculture based cropping system and evaluation of its effects on soil conservation and productivity increase	Mar. 2-Apr. 1, 2012

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-eight researchers were invited and implemented their programs during FY2011 as listed below.

Project Site Invitations, FY 2011			
Nguyen Van Thu	Department of Animal Sciences Faculty of Agriculture and Applied Biology Can Tho University, Vietnam	To participate in the 3rd International Conference on Sustainable Animal Agriculture for Developing Countries (SAADC 2011), Thailand	Jul. 26-30, 2011
Elizabeth Wina	Indonesian Research Institute for Animal Production, Indonesia	To participate in the 3rd International Conference on Sustainable Animal Agriculture for Developing Countries (SAADC 2011), Thailand	Jul. 26-30, 2011
Pen Bunthoeun	Provincial Department of Agriculture of Siem Reap, Ministry of Agriculture Forestry and Fisheries, Cambodia	To participate in the 3rd International Conference on Sustainable Animal Agriculture for Developing Countries (SAADC 2011), Thailand	Jul. 25-30, 2011
Chalermpon Yuangklang	Department of Animal Science, Faculty of Natural Resources, Rajamangala University of Technology Isan, Sakon Nakhon Campus, Thailand	To participate in the 3rd International Conference on Sustainable Animal Agriculture for Developing Countries (SAADC 2011), Thailand	Jul. 25-29, 2011
Long Ruijun	International Centre for Tibetan Plateau Ecosystem Management, Lanzhou University, P.R. China	To participate in the 3rd International Conference on Sustainable Animal Agriculture for Developing Countries (SAADC 2011), Thailand	Jul. 25-30, 2011
Juan Boo Liang	Laboratory of Animal Production, Institute of Tropical Agriculture, Universiti Putra Malaysia (UPM), Malaysia	To participate in the 3rd International Conference on Sustainable Animal Agriculture for Developing Countries (SAADC 2011), Thailand	Jul. 25-30, 2011
Jitti Mungkalasiri	Life Cycle Assessment Lab. National Metal and Materials Technology Center, Thailand	To participate in the 3rd International Conference on Sustainable Animal Agriculture for Developing Countries (SAADC 2011), Thailand	Jul. 26-29, 2011
Kritapon Sommart	Department of Animal Science, Khon Kaen University, Thailand	To participate in the 3rd International Conference on Sustainable Animal Agriculture for Developing Countries (SAADC 2011), Thailand	Jul. 26-29, 2011
Anan Chaokaur	Faculty of Animal Sciences and Agricultural Technology, Silpakorn University, Thailand	To participate in the 3rd International Conference on Sustainable Animal Agriculture for Developing Countries (SAADC 2011), Thailand	Jul. 25-30, 2011
Budi Santoso	Department of Nutrition and Animal Feed, State University of Papua, Indonesia	To participate in the 3rd International Conference on Sustainable Animal Agriculture for Developing Countries (SAADC 2011), Thailand	Jul. 25-28, 2011
Nguyen Thi Lang	Cuu Long Delta Rice Research Institute (CLRRI), Vietnam	To participate in the kick-off meeting and workshop for the research project "Rice Innovation for Environmentally Sustainable Production Systems" at the Asian Crop Science Conference, Indonesia	Sep. 26-Oct.1, 2011
Nguyen Thi Thanh Thuy	Agricultural Genetics Institute (AGI), Vietnam	To participate in the kick-off meeting and workshop for the research project "Rice Innovation for Environmentally Sustainable Production Systems" at the Asian Crop Science Conference, Indonesia	Sep. 26-Oct.1, 2011
Loida M. Perez	Philippine Rice Research Institute (PhilRice), Philippines	To participate in the kick-off meeting and workshop for the research project "Rice Innovation for Environmentally Sustainable Production Systems" at the Asian Crop Science Conference, Indonesia	Sep. 26-Oct.1, 2011

Thelma F. Padolina	Philippine Rice Research Institute (PhilRice), Philippines	To participate in the kick-off meeting and workshop for the research project "Rice Innovation for Environmentally Sustainable Production Systems" at the Asian Crop Science Conference, Indonesia	Sep. 26-Oct.1, 2011
Chengyun Li	Yunnan Agricultural University, P.R.China	To participate in the kick-off meeting and workshop for the research project "Rice Innovation for Environmentally Sustainable Production Systems" at the Asian Crop Science Conference, Indonesia	Sep. 26-Oct.1, 2011
Jinbin Li	Agricultural Environment and Resources Research Institute, P.R.China	To participate in the kick-off meeting and workshop for the research project "Rice Innovation for Environmentally Sustainable Production Systems" at the Asian Crop Science Conference, Indonesia	Sep. 26-Oct.1, 2011
Cailin Lei	Institute of Crop Science, Chinese Academy of Agricultural Sciences (CAAS), P.R.China	To participate in the kick-off meeting and workshop for the research project "Rice Innovation for Environmentally Sustainable Production Systems" at the Asian Crop Science Conference, Indonesia	Sep. 26-Oct.1, 2011
Khay Sathya	Cambodian Agricultural Research and Development Institute (CARDI), Cambodia	To participate in the kick-off meeting and workshop for the research project "Rice Innovation for Environmentally Sustainable Production Systems" at the Asian Crop Science Conference, Indonesia	Sep. 26-Oct.1, 2011
Phoumi Inthapanya	Rice and Cash Crop Research Center, Lao PDR	To participate in the kick-off meeting and workshop for the research project "Rice Innovation for Environmentally Sustainable Production Systems" at the Asian Crop Science Conference, Indonesia	Sep. 26-Oct.1, 2011
Poonsak Mekwatanakan	Ubon Rice Research Center, Thailand	To participate in the kick-off meeting and workshop for the research project "Rice Innovation for Environmentally Sustainable Production Systems" at the Asian Crop Science Conference, Indonesia	Sep. 26-Oct.1, 2011
Md. Ansar Ali	Bangladesh Rice Research Institute (BRRI), Bangladesh	To participate in the kick-off meeting and workshop for the research project "Rice Innovation for Environmentally Sustainable Production Systems" at the Asian Crop Science Conference, Indonesia	Sep. 26-Oct.1, 2011
Antonio Juan Gerardo Ivancovich	Estación Experimental Agropecuaria Pergamino, Instituto Nacional de Tecnología Agropecuaria (INTA-EEA Pergamino), Argentina	Project annual meeting on "Monitoring <i>Phakopsora pachyrhizi</i> populations in South America" and "Development of breeding materials by marker-assisted selection" (at CNPSO), Brazil	Oct. 18-22, 2011
Javier Ramon Gilli	Estación Experimental Agropecuaria Marcos Juárez, Instituto Nacional de Tecnología Agropecuaria (INTA-EEA)-Marcos Juárez, Argentina	Project annual meeting on "Monitoring <i>Phakopsora pachyrhizi</i> populations in South America" and "Development of breeding materials by marker-assisted selection" (at CNPSO), Brazil	Oct. 18-23, 2011
Adrian Dario De Lucia	Estación Experimental Agropecuaria Cerro Azul, Instituto Nacional de Tecnología Agropecuaria (INTA-EEA)-Cerro Azul, Argentina	Project annual meeting on "Monitoring <i>Phakopsora pachyrhizi</i> populations in South America" and "Development of breeding materials by marker-assisted selection" (at CNPSO), Brazil	Oct. 19-22, 2011
Alicia Noelia Bogado	Centro de Investigación Capitán Miranda (CICM), Instituto Paraguayo de Tecnología Agraria (IPTA), Ministerio de Agricultura y Ganadería (MAG), Paraguay, Paraguay	Project annual meeting on "Monitoring <i>Phakopsora pachyrhizi</i> populations in South America" and "Development of breeding materials by marker-assisted selection" (at CNPSO), Brazil	Oct. 19-22, 2011
Agronomo Anibal Morel	Centro de Investigación Capitán Miranda (CICM), Instituto Paraguayo de Tecnología Agraria (IPTA), Ministerio de Agricultura y Ganadería (MAG), Paraguay, Paraguay	Project annual meeting on "Monitoring <i>Phakopsora pachyrhizi</i> populations in South America" and "Development of breeding materials by marker-assisted selection" (at CNPSO), Brazil	Oct. 19-22, 2011

Fabio Centurion	Fundacion Nikkei-Cetapar (Cetapar), Paraguay	Project annual meeting on "Monitoring <i>Phakopsora pachyrhizi</i> populations in South America" and "Development of breeding materials by marker-assisted selection" (at CNPSo), Brazil	Oct. 18-22, 2011
Miori Uno	Fundacion Nikkei-Cetapar (Cetapar), Paraguay	Project annual meeting on "Monitoring <i>Phakopsora pachyrhizi</i> populations in South America" and "Development of breeding materials by marker-assisted selection" (at CNPSo), Brazil	Oct. 18-22, 2011
Josephine Pokuaa Amo	Ministry of Food and Agriculture (MOFA); Atwima Nwabiagya, Ghana	The workshop and field visit for the study on development of improved infrastructure and technologies for rice production in Africa, Ethiopia	Oct. 31-Nov. 9, 2011
Alfred Amoh	Ministry of Food and Agriculture (MOFA); Atwima Nwabiagya, Ghana	The workshop and field visit for the study on development of improved infrastructure and technologies for rice production in Africa, Ethiopia	Oct. 31-Nov. 9, 2011
Mohammed Moro Buri	Soil Research Institute, CSIR, Ghana	The workshop and field visit for the study on development of improved infrastructure and technologies for rice production in Africa, Ethiopia	Oct. 31-Nov. 9, 2011
Joko Sulistyono	Research and Development Center for Biology, The Indonesian Institute of Science, Indonesia	Participation in the Research Seminar on Advanced Application of Local Food Resources in Asia 2012, Thailand	Feb. 29-Mar. 3, 2012
Li Lite	College of Food Science & Nutritional Engineering, China Agricultural University (CAU), P.R.China	Participation in the Research Seminar on Advanced Application of Local Food Resources in Asia 2012, Thailand	Feb. 29-Mar. 3, 2012
Xue Wentong	College of Food Science & Nutritional Engineering, China Agricultural University (CAU), P.R.China	Participation in the Research Seminar on Advanced Application of Local Food Resources in Asia 2012, Thailand	Feb. 29-Mar. 3, 2012
Yin Lijun	College of Food Science & Nutritional Engineering, China Agricultural University (CAU), P.R.China	Participation in the Research Seminar on Advanced Application of Local Food Resources in Asia 2012, Thailand	Feb. 29-Mar. 3, 2012
Chen Minghai	College of Food Science & Nutritional Engineering, China Agricultural University (CAU), P.R.China	Participation in the Research Seminar on Advanced Application of Local Food Resources in Asia 2012, Thailand	Feb. 29-Mar. 3, 2012
Cheng Yongqiang	College of Food Science & Nutritional Engineering, China Agricultural University (CAU), P.R.China	Participation in the Research Seminar on Advanced Application of Local Food Resources in Asia 2012, Thailand	Feb. 29-Mar. 3, 2012
Liu Haijie	College of Food Science & Nutritional Engineering, China Agricultural University (CAU), P.R.China	Participation in the Research Seminar on Advanced Application of Local Food Resources in Asia 2012, Thailand	Feb. 29-Mar. 3, 2012

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 2011, a total of eight researchers were invited to conduct research at JIRCAS HQ.

JIRCAS Visiting Research Fellowships at Tsukuba (October 2011 to September 2012)

Md. Abu Bakr Siddique	Agricultural Economics Division, Bangladesh Rice Research Institute (BRRI)	Econometric analysis of impacts of a cyclone disaster on rice farms in Bangladesh
Tsehaye Habtemichael Tesfamariam	Department of Agronomy, Hamelmalo Agricultural College (HAC)	Sorgoleone production and its relationship to BNI capacity in sorghum
Mekonnen Bekele Wakeyo	Agriculture, Environment and Rural Development Research Directorate, Ethiopian Development Research Institute (EDRI)	Study on adaptable irrigation water fee-collection mechanism for sustainable management of watering facilities in Africa
Hongmei Zhang	Institute of Vegetable Crops Jiangsu Academy of Agricultural Sciences (JAAS)	Identification of environmental stress tolerant genes in soybean and its application in soybean improvement
Lee Kok Chang	School of Biological Sciences Universiti Sains Malaysia (USM)	Development of an efficient degradation technology for parenchyma tissues of old oil palm trees
Prapassorn Rugthaworn	Biomass and Bio-energy Technology Division Kasetsart Agricultural and Agro-Industrial Product Improvement Institute (KAPI)	Development of a yeast appropriate for ethanol production from tropical biomass
Amornrat Watthanalamloet	Division of Biochemical Technology, School of Bioresources and Technology, King Mongkut's University of Technology Thonburi (KMUTT)	Study of functions and structures of cellulolytic enzyme complexes produced by novel thermophilic and alkaliphilic bacterium
Greuk Pakkad	Forest Restoration Research Unit Department of Biology, Faculty of Science, Chiang Mai University	Conservation priority of genetic resources and gene flow between landscapes in hill Dipterocarp forests

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 FY2011, four researchers were invited, one to Thailand and the other to the Philippines. 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 2011 to September 2012)

Zolzaya Sed-Ochir	School of Biological Resources and Management Mongolian State University of Agriculture (MSAU), Mongolia	Development of a technique for supplemental feeds processing in Mongolia
Mireille Wendkouni Yameogo	Cowpea Improvement, Institut del' Environnement et de Recherches Agricoles (INERA), Nigeria	Identification of environmental effects on seed nutritional value and quality of cowpea
Zenith Gaye Almeda Orozco	Aquaculture Department, Southeast Asian Fisheries Development Center (SEAFDEC/AQD), Philippines	Assimilation of amino acids and lipids from wastes of marine finfish by benthic organisms: Implication for integrated multi-trophic aquaculture
Jaruwan Songphatkaew	Department of Fisheries Science, Faculty of Agricultural Technology, King Mongkut's Institute of Technology Ladkrabang (KMITL), Thailand	The impact of the physical environment peculiar to shrimp-seaweed co-culture on <i>Penaeus monodon</i> development

Other Fellowships for Visiting Scientists

The Government of Japan sponsors a postdoctoral fellowship program and a researcher exchange program for 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 FY 2011 are listed below.

JSPS Postdoctoral Fellowships for Foreign Researchers (April 2011 to March 2012)

Pierfrancesco Nardi	Regional Agency of Agriculture Improvement and Innovation in Latium, Italy	Inhibition of soil nitrification from root exudates	Sep. 1, 2009 - May 26, 2011
Mary Jeanie Teleanco-Yanoria	International Rice Research Institute, Philippines	Development of IR64 multiline variety and identification of blast resistance genes from NERICA	Nov. 1, 2011 - Oct. 31, 2013

WORKSHOP

Local briefing session on the new shrimp fishing law in Luang-prabang, Laos.

An explanatory meeting on the new law regulating shrimp fishing was held on June 14, 2011 at Na-Pho village, Pak-Xeng district, Luang-Prabang, Laos. The purpose of the meeting, which was attended by more than 80 persons including villagers, local leaders, and central government officers, was to raise awareness about the new law governing stock management and conservation of indigenous shrimp. The presence of both district and national officials gave reassurance that the new regulation will be made known throughout the district and that the independence and authority of villages and local government officers on matters affecting fluvial shrimp fishery in the village will be respected and acknowledged.

The new law and regulation on shrimp fishing was based on the results and recommendations of the research activity, titled “Project on the Development of Sustainable Freshwater Aquaculture Technology Suitable for Southeast Asia.” By prohibiting shrimp fishing at the cave stream during August (spawning season), relative catch is expected to increase and stock sustainability is improved. If this new policy on stock management and conservation proves to

be successful in the village, the policy may eventually be applied to other regions. The enactment of the new fishing law in Luang Prabang has grabbed the attention of the national government as well as other local governments. The meeting was featured by a few media outlets, including the Vientiane Times, the Laos National TV and so on, indicating that people in Laos have high interest on the new fishing regulation and its potential benefits to local communities.



Greenhouse Gases (GHG) and Sustainable Animal Agriculture for Developing Countries

A symposium on “Greenhouse Gases (GHG) and Sustainable Animal Agriculture for Developing Countries” was held at Suranaree University of Technology, Nakhon Ratchasima, Thailand on July 28, 2011 as a satellite symposium of the International Conference on “Sustainable Animal Agriculture for Developing Countries (SAADC2011)”. Ten reports related to monitoring and mitigation of GHG emissions from the livestock sector were presented to a

total of 66 participants from 18 countries.

The symposium was concluded with the consensus that since large increases in livestock population are expected in developing countries, research network on this sector should be strengthened to mitigate the effects of climate change. At the end of the symposium, it was determined that the research network will be voluntarily established through the leadership of Dr. Kritapon of Khon Kaen University.



A public relations seminar

A public relations seminar on “Manual for promotion of dry-season vegetable cultivation utilizing limited water resources” was held in Niger on October 27, 2011. The comprehensive technical manual was the main output of the JIRCAS project conducted over a 5-year period. It is expected to contribute heavily to the



promotion of dry-season vegetable cultivation and production, which would hopefully lead to poverty reduction and desertification prevention in the country. The Ministry of Agricultural Development recognized this contribution and awarded JIRCAS a Certificate of Appreciation on November 1.



6th World Water Forum in Marseille, France

The 6th World Water Forum was held last March 12-17, 2012 in Marseille, France. Carried out every three years, this forum is a gathering of international and civil society groups aimed at sharing ideas and providing solutions to pressing global issues concerning water and sanitation..

There were more than 35,000 participants, including 15 heads of State and European Commissioners; 103 Ministers, Vice Ministers and Secretaries of State; and 3,500 NGOs and civil society representatives. The Ministerial Declaration was participated in by 170 national delegations and international organizations representing 173 countries in total. After six days of debates and exchanges, the participants put together 1,400 solutions on the sharing platform and pledged over a hundred commitments.

JIRCAS participated during the related sessions at the Japan Pavilion where poster presentations explaining five water usage-related research activities were exhibited. The topic titles were as follows:

“Difficulty in restoring salinized freshwater

lens, a valuable water resource of atoll islands”

“Developing low-cost irrigation facilities applicable to sub-Saharan Africa”

“Monitoring groundwater movement of salinized farmlands in Uzbekistan”

“Establishing low-cost land leveling technology for saving furrow irrigation water in Uzbekistan”

“Saving water and reducing GHG emissions for the ecological rice cropping culture in Viet Nam and the Philippines”

More than 500 visitors, mostly from European and African countries, dropped by the JIRCAS booth during the interactive forum to discuss the exhibit with JIRCAS researchers. Through the forum, JIRCAS conveyed the importance of water in agriculture by disseminating information on the latest technologies and advancements acquired through its research activities.

The 7th World Water Forum will be held in Daegu, South Korea in 2015.

International Symposiums and Workshops, FY2011

1	JIRCAS-CTU Plenary Meeting on the project "Development of agricultural technologies in Developing Regions to respond to climate change"	April 21, 2011	Can Tho, Vietnam
2	JIRCAS Meeting on business outcomes and succession	April 25, 2011	Tokyo, Japan
3	The 1st Annual Meeting of the CCARA project	May 5-6, 2011	Los Banos, Philippines
4	Local briefing on the enforcement of the new fishing regulation based on the ecological characteristics of the indigenous prawn, Macrobrachium	June 14, 2011	Luang Prabang, Laos
5	Startup Meeting and Signing Ceremony of the JIRCAS-Tigray Project	July 13, 2011	Addis Ababa, Ethiopia
6	JIRCAS Symposium on sustainable agriculture and greenhouse gas emissions for developing countries	July 28, 2011	Nakhon, Thailand
7	The 1st Steering Committee of the GrassRISK Project	September 9, 2011	Ulaanbaatar, Mongolia
8	Meeting on the sub-topic contents and the methodologies	September 19, 2011 September 22, 2011 October 6, 2011	Ulaanbaatar, Mongolia
9	JIRCAS-CTU Climate Change Project Workshop 2011	September 24, 2011	Can Tho, Vietnam
10	Sustainable Animal Husbandry with New Ecology	September 27, 2011	Ulaanbaatar, Mongolia
11	Workshop on "Rice innovation for environmentally sustainable production systems" at the 7th Asian Crop Science Conference and kickoff meeting of "Blast research network for stable rice production"	September 28, 2011	Bogor, Indonesia
12	Establishment of a Sustainable and Independent Farming System with Biodiversity Conservation (JIRCAS - NAFRI - NUOL Collaborative Project Launching Workshop)	September 28, 2011	Vientiane, Laos
13	Technical Seminar on DIITRPA (Development of Improved Infrastructure and Technologies for Rice Production in Africa)	October 6, 2011	Tsukuba, Japan
14	Workshop on Conservation and Management of Freshwater Lens	October 14, 2011	Majuro Atoll, Marshall Islands
15	Soybean Rust Project Meeting 2011	October 20, 2011	Londrina, Brazil
16	Research seminar on advanced application of local food resources in China 2011	October 26, 2011	Beijing, China
17	Seminar on the presentation of a manual for growth promotion of dry season vegetables utilizing limited water resources	October 27, 2011	Niamey, Niger

18	JIRCAS International Symposium 2011	November 14-15, 2011	Tsukuba, Japan
19	International Workshop on "Sawah" Eco-technology and Rice Farming in Ghana, Nigeria and Sub-Saharan Africa	November 22-24, 2011	Kumasi, Ghana
20	8th Biomass-Asia Workshop	November 29-December 1, 2011	Hanoi, Vietnam
21	Annual Project Meeting (EDITS-Yam) : Use of genomic information and molecular tools for yam germplasm utilization and improvement for West Africa	December 8, 2011	Tsukuba, Japan
22	SATREPS Research Group Unit "Development of Genetic Engineering Technology of Crops with Stress Tolerance against Degradation of Global Environment"	December 12, 2011	Tokyo, Japan
23	2nd Progress Meeting on the Project "Development of sustainable soil fertility management for sorghum and sweet sorghum through effective use of biological nitrification inhibition (BNI)"	December 12, 2012	Hyderabad, India
24	2012 Seminar for JIRCAS climate change project "Establishment of sustainable rural society with low GHG emission"	January 12-13, 2012	Tigray, Ethiopia
25	Field Seminar on effective teak silvicultural management for farmers	February 7, 2012	Nong Bua Lam Phu, Thailand
26	Field Seminar on disseminating farmers' effective teak plantation management for extension officers	February 8, 2012	Udon Thani, Thailand
27	Workshop on "Environmental conservative pest management of solanaceous crops"	February 27, 2012	Bangkok, Thailand
28	Research seminar on advanced application of local food resources in Asia 2012	March 1, 2012	Bangkok, Thailand
29	SATREPS Workshop "Tropical Tree Response to Climate Change"	February 29 - March 2, 2012	Kuala Lumpur, Malaysia
30	The 5th project seminar on rural development based on afforestation CDM	March 2, 2012	San Lorenzo, Paraguay
31	The 6th project seminar on rural development based on biogas-digester CDM	March 16, 2012	Can Tho, Vietnam

The background of the page is a complex, organic pattern of swirling, marbled lines in various shades of purple, from light lavender to deep magenta. The lines are fluid and interconnected, creating a sense of movement and depth. A thin, solid black horizontal line is positioned above the word 'APPENDIX'.

APPENDIX

PUBLISHING AT JIRCAS

OFFICIAL JIRCAS PUBLICATIONS

In English

- | | |
|---|--|
| 1) JARQ (Japan Agricultural Research Quarterly) | Vol. 45 No. 3, No. 4
Vol. 46 No. 1, No.2 |
| 2) Annual Report 2010 | |
| 3) JIRCAS Newsletter | No.61, No.62, No. 63 |
| 4) JIRCAS Working Report Series | No. 73 Biomass : Sustainable natural resource and innovation for a greener future
No. 74 Approach to Sustainable Forestry of Indigenous Tree Species in Northeast Thailand
No. 75 Sustainable Stock Management and Development of Aquaculture Technology Suitable For Southeast Asia
No.76 Ecology and Genetics of Hill Dipterocarp Forest -to aim sustainable forest management- |

In Japanese

- | | |
|--|----------------------------|
| 1) JIRCAS News | No.61, No.62, No. 63 |
| 2) JIRCAS International Agriculture Series | No.19, No.20, No.21, No.22 |

RESEARCH STAFF ACTIVITY 2011-2012

Refereed journal articles, book chapters, and monographs

- Ando, S., Sugiura, M., Yamada, T., Katsuta, M., Ishikawa, S., Terajima, Y., Sugimoto, A., Matsuoka, M. (2011) Overwintering ability and dry matter production of sugarcane hybrids and relatives in the Kanto Region of Japan. *JARQ*, 45(3): 259-267.
- Arai-Sanoh, Y., Ida, M., Zhao, R., Yoshinaga, S., Takai, T., Ishimaru, T., Maeda, H., Nishitani, K., Terashima, Y., Gau, M., Kondo, M. (2011) Genotypic variations in non-structural carbohydrate and cell wall components in rice, sorghum and sugar cane. *Biosci. Biotechnol. Biochem.*, 75(6): 1104-1112.
- Ashihara, A., Ohmori, H., Kobashi, Y., Tajima, K., Sasaki, K., Motoyama, M., Kawashima, T. (2011) Effects of Supplementation of Chocolate to Fermented Liquid Feed on Growth Performance, Carcass Characteristics and Quality of Pork in Finishing Pigs. *The Japanese Journal of Swine Science*, 48(2): 47-57.
- Baskaran, M., Hashim, R., Said, N., Salsabilah M. Raffi, Balakrishnan, K., Sudesh, K., Sulaiman, O., Arai, T., Kosugi, A., Mori, Y., Sugimoto, T., Sato, M. (2011) Properties of binderless particleboard from oil palm trunk with addition of polyhydroxyalkanoates. *Composites Part B*, DOI: 10.1016/j.compositesb.2011.10.008.
- Boukar, O., Massawe, F., Muranaka, S., Franco, J., Maziya-Dixon, B., Singh, B., Fatokun, C. (2011) Evaluation of cowpea germplasm lines for protein and mineral concentrations in grains. *Plant Genetic Resources: Characterization and Utilization*, 9: 515-522.
- Buri, M.M., Issaka, R.N., Wakatsuki, T., Kawano, N. (2011) Improving the productivity of lowland soils for rice cultivation in Ghana: The role of the 'Sawah' system. *Journal of Soil Science and Environmental Management*, 2(10): 304-310.
- Chen, CP., Frei, M., Pariasca-Tanaka, J., Kohno, Y., Wissuwa, M. (2011) Tropospheric ozone poses a rising threat to yield stability in rice: Tolerance mechanisms and underlying genetic factors. *Genes, Genomes and Genomics*, 6: 8-15.
- Chen, CP., Frei, M., Wissuwa, M. (2011) The OzT8 locus in rice protects leaf carbon assimilation rate and photosynthetic capacity under ozone stress. *Plant, Cell, Environment*, 34: 1141-1149.
- Chen, Y., Ma, G., Wu, P., Chien, H. (2011) Study on China's Swine Price Discovery Forming Mechanism-Empirical Analysis on the Relationship Between Interregional Price. *Scientia Agricultura Sinica*, 44(15): 3279-3288.
- Chin, JH., Gamuyao, R., Dalid, C., Bustamam, M., Prasetyono, J., Moeljopawiro, S., Wissuwa, M., Heuer, S. (2011) Developing rice with high yield under phosphorus deficiency: Pup1 sequence to application. *Plant Physiology*, 156(3): 1202-1216.
- Cong, K., Jiao, J., Nakamoto, K., Li, G. (2011) Invitation on Maize Planting Benefit in Heilongjiang Province. *Heilongjiang Agricultural Sciences*, 2011(10): 25-28.
- Ebitani, T., Hayashi, N., Omoteno, M., Ozaki, H., Yano, M., Morikawa, M., Fukuta, Y. (2011) Characterization of Pi13, a blast resistance gene that maps to chromosome 6 in indica rice (*Oryza sativa* L. variety, Kasalath). *Breeding Science*, DOI: 10.1270/jsbbs.61.251.
- Frei, M., Kohno, Y., Wissuwa, M., Makkar, HPS., Becker, K. (2011) Negative effects of tropospheric ozone on the feed value of rice straw are mitigated by an ozone tolerance QTL. *Global Change Biology*, 17(7): 2319-2329.
- Fujihara, Y., Oda, M. (2011) Monitoring of Ponding Water Depth in Paddy Fields Using Small Temperature Loggers. *IDRE Journal*, 273: 97-98.
- Fujihara, Y., Oda, M., Horikawa, N., Ogura, C. (2011) Hydrologic Analysis of Rainfed Rice Areas Using a Simple Semi-distributed Water Balance Model. *Water Resources Management*, 25(9): 2061-2080.
- Fujii, H., Suphanchaimat, N., Oda, M., Fujihara, Y. (2012) Impact of On-Farm Pond on Agricultural Diversification in Rainfed

Agricultural Area in Northeast Thailand. *IDRE Journal*, 277: 73-78.

- Fujita, D., Santos, R.E., Ebron, L.A., Fukuta, Y., Kobayashi, N. (2011) Characterization of quantitative trait locus for days to heading in near-isogenic lines with genetic background of Indica-type rice variety IR64 (*Oryza sativa*). *Plant Breeding*, 130: 526-532.
- Fujita, D., Tagle, A.G., Ebron, L.A., Fukuta, Y., Kobayashi, N. (2012) Characterization of near-isogenic lines carrying QTL for high spikelet number with the genetic background of an indica rice variety IR64 (*Oryza sativa* L.). *Breeding Science*, 62(1): 18-26.
- Fujita, Y., Fujita, M., Shinozaki, K., Yamaguchi-Shinozaki, K. (2011) ABA-mediated transcriptional regulation in response to osmotic stress in plants. *J. Plant Res*, 124(4): 509-525.
- Fukuta, Y., Konisho, K., Senoo-Namai, S., Yanagihara, S., Tsunematsu, H., Fukuo, A., Kumashiro, T. (2012) Genetic characterization of rainfed upland New Rice for Africa (NERICA) varieties. *Breeding Science*, DOI: 10.1270/jsbbs.62.27.
- Ha, S., Vankova, R., Yamaguchi-Shinozaki, K., Shinozaki, K., Tran, L.-S.P. (2012) Cytokinins: metabolism and function in plant adaptation to environmental stresses. *Trends in Plant Science*, DOI: 10.1016/j.tplants.2011.12.005.
- Hanamura, Y., Imai, H., Lasassima, O., Souliyamath, P., Ito, S. (2011) Freshwater prawns of the genus *Macrobrachium* Bate, 1868 (Crustacea, Decapoda, Palaemonidae) from Laos. *Zootaxa*, 3025: 1-37.
- Hashim, R., Said, N., Lamaming, J., Baskaran, M., Sulaiman, O., Sato, M., Hiziroglu, S., Sugimoto, T. (2011) Influence of press temperature on the properties of binderless particleboard made from oil palm trunk. *Material & Design*, 32(5): 2520-2525.
- Heidari, B., Sayed-Tabatabaei, B.E., Saeidi, G., Kearsy, M., Suenaga, K. (2011) Mapping QTL for grain yield, yield components, and spike features in a doubled haploid population of bread wheat. *Genome*, DOI: 10.1139/G11-017.
- Hendawy-El, S., Alboghdady, M., Sakagami, J., Schmidhalter, U. (2011) Saving water in arid and semi-arid countries as a result of application of crop evapotranspiration. *Evapotranspiration, Book2*. Intech publisher, DOI: ISBN 978-953-307-512-9.
- Hendawy-El, S., Hu, Y., Sakagami, J., Schmidhalter, U. (2011) Screening Egyptian wheat genotypes for salt tolerance at early growth stage. *International Journal of Plant Production*, 5(3): 283-298.
- Ikazaki, K., Shinjo, H., Tanaka, U., Tobita, S., Funakawa, S., Kosaki, T. (2011) "Fallow Band System," a land management practice for controlling desertification and improving crop production in the Sahel, West Africa: 1. Effectiveness in desertification control and soil fertility improvement. *Soil Science and Plant Nutrition*, DOI: 10.1080/00380768.2011.593155.
- Ikazaki, K., Shinjo, H., Tanaka, U., Tobita, S., Funakawa, S., Kosaki, T. (2011) Aeolian materials sampler for measuring surface flux of soil nitrogen and carbon during wind erosion events in the Sahel, West Africa. *Transactions of the American Society of Agricultural and Biological Engineering*, 54(3): 983-990.
- Ikazaki, K., Shinjo, H., Tanaka, U., Tobita, S., Funakawa, S., Kosaki, T. (2011) Field-scale aeolian sediment transport in the Sahel, West Africa. *Soil Science Society of America Journal*, DOI: 10.2136/sssaj2010.0416.
- Ikeda, S., Okubo, T., Takeda, N., Banba, M., Sasaki, K., Imaizumi-Anraku, H., Fujihara, S., Ohwaki, Y., Ohshima, K., Fukuta, Y., Eda, S., Mitsui, H., Hattori, M., Sato, T., Shinano, T., Minamisawa, K. (2011) The Genotype of the Calcium/Calmodulin-Dependent Protein Kinase Gene (CCaMK) Determines Bacterial Community Diversity in Rice Roots under Paddy and Upland Field Conditions. *APPLIED AND ENVIRONMENTAL MICROBIOLOGY*, 77: 4399-4415.
- Inagaki, M., Kamo, K., Miyamoto, K., Titin, J., Jamalung, L., Lapongan, J., Miura, S. (2011) Nitrogen and phosphorus retranslocation and N:P ratios of litterfall in three tropical plantations: luxurious N and efficient P use by *Acacia mangium*. *Plant*

- and Soil, DOI: 10.1007/s11104-010-0644-3.
- Ishigaki, G., Gondo, T., Suenaga, K., Akashi, R. (2012) Fertile transgenic *Brachiaria ruziziensis* (ruzigrass) plants by particle bombardment of tetraploidized callus. *Journal of Plant Physiology*, 169: 546-549.
- Ishizaki, T., Kumashiro, T. (2011) Investigations of copy number of transgene, fertility and expression level of an introduced GUS gene in transgenic NERICA produced by *Agrobacterium*-mediated methods. *In Vitro Cellular & Developmental Biology - Plant*, 47(3): 339-347.
- Kamiya, K., Nanami, S., Kenzo, T., Yoneda, R., Diway, B., Chong, L., Azani, M.A., Majid, N.M., Lum, S.K.Y., Wong, K.M., Harada, K. (2011) Demographic History of *Shorea curtisii* (Dipterocarpaceae) Inferred from Chloroplast DNA Sequence Variations. *Biotropica*, DOI: 10.1111/j.1744-7429.2011.00834.x.
- Kato, Y., Henry, A., Fujita, D., Katsura, K., Serraj, R., Kobayashi, N. (2011) Physiological characterization of advanced backcross lines derived from an indica rice variety IR64 adapted to water-saving agriculture. *Field Crops Research*, 123: 130-138.
- Kenzo, T., Yoneda, R., Matsumoto, Y., Mohamad Azani, A., Nik Majid, M. (2011) Growth and photosynthetic response of four Malaysian indigenous tree species under different light conditions. *Journal of Tropical Forest Science*, 23(3): 271-281.
- Kheder, A.A., Akagi, Y., Akamatsu, H., Yanaga, K., Maekawa, N., Otani, H., Tsuge, T., Kodama, M. (2012) Functional analysis of the melanin biosynthesis genes ALM1 and BRM2-1 in the tomato pathotype of *Alternaria alternata*. *Journal of General Plant Pathology*, 78(1): 30-38.
- Kheder, A.A., Akagi, Y., Takao, K., Akamatsu, H., Kodama, M. (2012) Fungal growth and in planta distribution of host-specific AAL-toxin in tomato plants infected with the tomato pathotype of *Alternaria alternata*. *Mycotoxins*, 62(1): 7-13.
- Kiari, S.A., Ajeigbe, H.A., Omae, H., Tobita, S., Singh, B.B. (2011) Potentials of cowpea (*Vigna unguiculata*) for dry season seed and fodder production in Sahelian sandy soil of Niger. *American-Eurasian Journal of Agriculture and Environmental Science*, 11(1): 71-78.
- Kim, J.S., Mizoi, J., Yoshida, T., Fujita, Y., Nakajima, J., Ohori, T., Todaka, D., Nakashima, K., Hirayama, T., Shinozaki, K., Yamaguchi-Shinozaki, K. (2011) An ABRE promoter sequence is involved in osmotic stress-responsive expression of the DREB2A gene, which encodes a transcription factor regulating drought-inducible genes in *Arabidopsis*. *Plant and Cell Physiology*, DOI: 10.1093/pcp/pcr143.
- Kobayashi, S., Furuya, J. (2011) Comparison of climate change impacts on food security of Bangladesh. *Studies in Regional Science*, 41(2): 419-433.
- Kobori, Y., Nakata, T., Ohto, Y. (2011) Estimation of Dispersal Pattern of Adult Asian Citrus Psyllid, *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae). *Jpn. J. Appl. Entomol. Zool.*, 55: 77-181.
- Kodaira, K., Qin, F., Tran, LSP, Maruyama, K., Kidokoro, S., Fujita, Y., Shinozaki, K., Yamaguchi-Shinozaki, K. (2011) *Arabidopsis* Cys2/His2 Zinc-Finger Proteins AZF1 and AZF2 Negatively Regulate Abscisic Acid-Repressive and Auxin-Inducible Genes under Abiotic Stress Conditions. *Plant Physiology*, DOI: 10.1104/pp.111.182683.
- Kodama, M., Watanabe, S., Yagi, H., Nadaoka, K., Suzuki, N., Furutono, T. (2011) Temporal Variability of Carbon and Nitrogen Stable Isotopes of Bivalves in Tamagawa River Estuary, Japan. *Journal of Japan Society of Civil Engineers*, 67(2): 961-965.
- Koide, Y., Leodegario, A., Ebron, Kato, H., Tsunematsu, H., Telebanco-Yanoria, M.J., Kobayashi, N., Yokoo, M., Maruyama, S., Imbe, T., Fukuta, Y. (2011) A set of near-isogenic lines for blast resistance genes with an Indica-type rainfed lowland elite rice (*Oryza sativa* L.) genetic background. *Field Crops Research*, 123(1): 19-27.
- Koide, Y., Telebanco-Yanoria, M.J., Fujita, D., Tagle, A.G., Fukuta, Y., Kobayashi, N. (2011) Fine mapping and identification of

tightly linked DNA markers of blast resistance gene *Pia* by using an introgression line. *Molecular Breeding*, 28: 359-366.

- Koide, Y., Telebanco-Yanoria, M.J., Pena, F.D., Fukuta, Y., Kobayashi, N. (2011) Characterization of rice blast isolates by the differential system and their application for mapping a resistance gene, *Pi19(t)*. *Journal of Phytopathology*, 159: 85-93.
- Komiyama, H., Chantsaldulam, R. (2011) Changes of Animal Husbandry and Crop Farming in Mongolia during Past Half a Century and the Future Perspective. *Journal of Arid Land Studies*, 21(1): 37-43.
- Kozai, N., Higuchi, H. (2011) Anatomical verification of Thai local classifications of durian (*Durio zibethinus* Murr.) floral development and vegetative conversion of the buds. *Tropical Agriculture and Development*, 55(4): 162-165.
- Kozai, N., Higuchi, H., Yonemoto, Y. (2012) Determination of the crucial floral morphogenesis stage leading to early flowering with paclobutrazol treatment of durian (*Durio zibethinus* Murr.). *Tropical Agriculture and Development*, 56(1): 35-37.
- Kuang, E., Nakamoto, K., Liu, F., Chi, F., Jiao, J., Zhang, J. (2011) Relationship of pH, EC and Composition of Salt of Sodic Soil in Heilongjiang Province. *Heilongjiang Agricultural Sciences*, 2011(5): 37-47.
- Le, D.T., Nishiyama, R., Watanabe, Y., Mochida, K., Yamaguchi-Shinozaki, K., Shinozaki, K., Tran, L.S. (2011) Genome-wide survey and expression analysis of the plant-specific NAC transcription factor family in soybean during development and dehydration stress. *DNA Research*, DOI: 10.1093/dnares/dsr015.
- Lemos, N.G., Braccini, A.L., Abdelnoor, R.V., Suenaga, K., Yamanaka, N., (2011) Characterization of genes *Rpp2*, *Rpp4*, and *Rpp5* for resistance to soybean rust. *Euphytica*, DOI: 10.1007/s10681-011-0465-3.
- Lokesh, B. E., Hamid, Z.A.A., Arai, T., Kosugi, A., Murata, Y., Hashim, R., Sulaiman, O., Mori, Y., Sudesh, K. (2012) Potential of Oil Palm Trunk Sap as a Novel Inexpensive Renewable Carbon Feedstock for Polyhydroxyalkanoate Biosynthesis and as a Bacterial Growth Medium. *Clean*, 40(3): 310-317.
- Maruyama, K., Todaka, D., Mizoi, J., Yoshida, T., Kidokoro, S., Matsukura, S., Takasaki, H., Sakurai, T., Yamamoto, Y.Y., Yoshiwara, K., Kojima, M., Sakakibara, H., Shinozaki, K., Yamaguchi-Shinozaki, K. (2012) Identification of cis-acting promoter elements in cold- and dehydration-induced transcriptional pathways in Arabidopsis, rice and soybean. *DNA Research*, DOI: 10.1093/dnares/dsr040.
- Matsubara, E., Izumi, T., Hirouchi, S. (2011) Rural Development Based on Clean Development Mechanism in Mekong Delta. *Water, Land and Environmental Engineering*, 79(10): 23-26.
- Matsuda, H., Higuchi, H., Kozai, N., Ogata, T. (2011) Effect of temperature on the time requirement of pollen tubes to penetrate into the embryo sac after pollination in cherimoya (*Annona cherimola* Mill.). *Tropical Agriculture and Development*, 55(4): 157-161.
- Matsuda, K., Hasegawa, E., Wilder, M.N. (2011) Analysis of composition and absorption maximum of visual pigment, and quantity of visual pigment at representative stages in the whiteleg shrimp *Litopenaeus vannamei*. *Nippon Suisan Gakkaishi*, 77(4): 682-684.
- Matsumoto, N., Paisanchoen, K., Mori, Y. (2011) Estimation of available biomass production of crop residues and food processing factories in Northeast Thailand. *Journal of the Japanese Agricultural Systems Society*, 27(4): 167-178.
- Mitsunaga, T., Shimoda, T., Mukawa, S., Kobori, Y., Goto, C., Suzuki, Y., Yano, E. (2012) Color and height influence the effectiveness of an artificial feeding site for a larval endoparasitoid, *Cotesia vestalis* (Haliday) (Hymenoptera: Braconidae). *Japan Agricultural Research Quarterly*, 46(2): 161-166.
- Mizoi, J., Shinozaki, K., Yamaguchi-Shinozaki, K. (2012) AP2/ERF family transcription factors in plant abiotic stress responses. *Biochimica et Biophysica Acta (BBA) -*

- Gene Regulatory Mechanisms, DOI: 10.1016/j.bbagr.2011.08.004.
- Mochida, K., Yoshida, T., Sakurai, T., Yamaguchi-Shinozaki, K., Shinozaki, K., Tran, L.S. (2011) In silico analysis of transcription factor repertoires and prediction of stress-responsive transcription factors from six major gramineae plants. *DNA Res*, 18(5): 321-332.
- Mori, M., Inagaki, M.N. (2012) Root Development and Water-uptake under Water Deficit Stress in Drought-adaptive Wheat Genotypes. *Cereal Research Communications*, DOI: 10.1556/CRC, 40.2012.1.6.
- Morioka, S., Cacot, P., Moteki, M., Thipvantong, V., Philavong, S., Pounvisouk, L., Chantasone, P., Thaphysy, V. (2012) Ontogenetic development during changeover from an endogenous to exogenous nutritional source in Laotian cyprinid *Cirrhinus microlepis* larvae. *Fisheries Science*, 78(2): 221-227.
- Morioka, S., Chanthasone, P., Phommachan, P., Vongvichith, B. (2011) Growth and morphological development of laboratory-reared larval and juvenile three spot gourami *Trichogaster trichopterus*. *Ichthyological Research*, DOI: 10.1007/s10228-011-0256-9.
- Muranaka, S., Fatokun, C., Boukar, O. (2012) Stability of *Striga gesnerioides* resistance mechanism in cowpea under high-infestation level, low soil fertility and drought stresses. *Journal of Food, Agricultura and Environment*, 9(2): 313-318.
- Nagasoe, S., Yurimoto, T., Suzuki, K., Maeno, Y., Kimoto, K. (2011) Effects of hydrogen sulfide on the feeding activity of Manila clam *Ruditapes philippinarum*. *Aquatic Biology*, 13: 293-302.
- Nakashima, K., Takasaki, H., Mizoi, J., Shinozaki, K., Yamaguchi-Shinozaki, K. (2012) NAC transcription factors in plant abiotic stress responses. *Biochimica et Biophysica Acta (BBA) - Gene Regulatory Mechanisms*, DOI: 10.1016/j.bbagr.2011.10.005.
- Nanjo, Y., Maruyama, K., Yasue, H., Yamaguchi-Shinozaki, K., Shinozaki, K., Komatsu, S. (2011) Transcriptional responses to flooding stress in roots including hypocotyl of soybean seedlings. *Plant Molecular Biology*, DOI: 10.1007/s11103-011-9799-4.
- Naruoka, M. (2011) Safety Net for the Agricultural Labourer in Uzbekistan. *Water, Land and Environmental Engineering*, 79(4): 279-283.
- Naruoka, M., Fujimoto, N., Hayata, M. (2012) Provision against Global Warming by Way of Agriculture and Rural Development in Ethiopia. *Water, Land and Environmental Engineering*, 80(3): 189-194.
- Naruoka, M., Hayata, M., Morishita, M., Fujimoto, N. (2011) Current Condition and Issue for Wet Meadow Rice Production in Ethiopia. *Water, Land and Environmental Engineering*, 79(5): 37-42.
- Nishihama, S., Yurimoto, T., Naito, T., Mori, Y., Fujii, A., Nasu, H., Kimoto, K., Maeno, Y. (2011) Trends in Population Density and Shell Length of the Planktonic Larva *Ruditapes philippinarum* in Ariake Bay. *Aquaculture Sci*, 59(2): 255-264.
- Nishiyama, R., Le, D.T., Watanabe, Y., Matsui, A., Tanaka, M., Seki, M., Yamaguchi-Shinozaki, K., Shinozaki, K., Tran, L.-S.P. (2012) Transcriptome analysis of a salt-tolerant cytokinin-deficient mutant reveal differential regulation of salt stress response by cytokinin deficiency. *PLoS One*, DOI: 10.1371/journal.pone.0032124.
- Nishiyama, R., Watanabe, Y., Fujita, Y., Le, D.T., Kojima, M., Werner, T., Vanková, R., Yamaguchi-Shinozaki, K., Shinozaki, K., Kakimoto, T., Sakakibara, H., Schmölling, T., Tran, L.-S.P. (2011) Analysis of cytokinin mutants and regulation of cytokinin metabolic genes reveals important regulatory roles of cytokinins in drought, salt and ABA responses, and ABA biosynthesis. *The Plant Cell*, DOI: 10.1105/tpc.111.087395.
- Noda, I., Himmapan, W. (2012) A cash flow model of coppicing for short rotation plantation management of teak (*Tectona grandis*) in Thailand. *Kanto Journal of Forest Research*, 63: 7-10.
- Nomura, S., Ueno, K., Muranaka, S., Mizutani, M., Takikawa, H., Sugimoto, Y. (2012)

Ent-20-epi-Orobanchol and Its Acetate, As Germination Stimulants for *Striga gesnerioides* Seeds Isolated from Cowpea and Red Clover. *Journal of Agriculture and Food Chemistry*, 59(1): 10485-19490.

Numata, S., Suzuki, R., Nishimura, S., Naito, Y., Komuma, A., Tsumura, Y., Tani, N., Okuda, T., Supardi, N., Noor, Md. (2011) Fruiting behavior of dipterocarps in two consecutive episodes of general flowering in a Malaysian lowland rain forest. *Journal of Forest Research*, DOI: 10.1007/s10310-011-0308-z.

Obara, M., Takeda, T., Hayakawa, T., Yamaya, T. (2011) Mapping quantitative trait loci controlling root length in rice seedlings grown with low or sufficient NH₄⁺ supply using backcross recombinant lines derived from a cross between *Oryza sativa* L. and *Oryza glaberrima* Steud. *Soil Science and Plant Nutrition*, 57(1): 80-92.

Oda, M., Hanboonsong, Y., Jamjanya, T., Srichompoo, K., Kotaki, T. (2012) Occurrence of Insect Pests in a Tomato Field under Pesticide-free Dry Season Water-saving Cultivation in Northeast Thailand. *Japan Agricultural Research Quarterly*, 46(1): 59-64.

Oda, M., Hosen, Y. (2011) Estimation of the Origin of Nitrogen in Tomato Cultivated under an Unfertilized Condition. *Japanese Journal of Crop Science*, 80(4): 457-461.

Ohtani, M., Ueno, S., Tani, N., Lee, L.S., Tsumura, Y. (2011) Twenty-four additional microsatellite markers derived from the expressed sequence tags of an endangered tropical tree *Shorea leprosula* (Dipterocarpaceae). *Conservation Genetics Resources*, DOI: 10.1007/s12686-011-9546-9.

Okuda, Y., Omori, K., Yamada, M., Marumoto, M. (2012) Construction and Extension of the Model Supporting Eco-Environment Rehabilitation and Living Improvement, Shanxi Province in China. *Water Land and Environ. Eng.*, 80(2): 27-30.

Okuda, Y., Onishi, J. (2012) Current Status and Problems of Farmland Damage from Salinization in Uzbekistan. *Journal of the Japanese Society of Irrigation, Drainage and Rural Engineering*, 80(2): 83-86.

Okutsu, T., Morioka, S., Shinji, J., Chanthasone, P. (2011) Growth and reproduction of the glassperch *Parambassis siamensis* (Teleostei: Ambassidae) in Central Laos. *Ichthyological Exploration of Freshwaters*, 22(2): 97-106.

Ozkilinc, H., Akamatsu, H., Abang, M., Thomas, K., Chilvers, M.I., Peever, T.L. (2011) Development, characterization and linkage analysis of microsatellite loci for the *Ascochyta* blight pathogen of faba bean, *Didymella fabae*. *Journal of Microbiological Methods*, 87(1): 128-130.

Polizel, A.M., Medri, M.E., Nakashima, K., Yamanaka, N., Farias, J.R.B., Neves de Oliveira, M.C., Marin, S.R.R., Abdelnoor, R.V., Marcelino-Guimarães, F.C., Fuganti, R., Rodrigues, F.A., Stolf-Moreira, R., Beneventi, M.A., Rolla, A.A.P., Neumaier, N., Yamaguchi-Shinozaki, K., Carvalho, J.F.C., Nepomuceno, A.L. (2011) Molecular, anatomical and physiological properties of a soybean genetically modified line transformed with rd29A:AtDREB1A for the improvement of drought tolerance. *Genetics and Molecular Research*, DOI: 10.4238/2011.October.21.4.

Qin, F., Kodaira, K., Maruyama, K., Mizoi, J., Tran, L.-S.P., Fujita, Y., Morimoto, K., Shinozaki, K., Yamaguchi-Shinozaki, K. (2011) SPINDLY, a negative regulator of GA signaling, is involved in the plant abiotic stress response. *Plant Physiology*, DOI: 10.1104/pp.111.187302.

Qin, F., Shinozaki, K., Yamaguchi-Shinozaki, K. (2011) Achievements and challenges in understanding plant abiotic stress responses and tolerance. *Plant and Cell Physiology*, DOI: 10.1093/pcp/pcr106.

Quinn, L., Stewart, J.R., Yamada, T., Toma, Y., Sato, M., Shimoda, K., Fernandez, F. (2011) Environmental tolerances of *Miscanthus sinensis* in invasive and native populations. *BioEnergy Research*, DOI: 10.1007/s12155-011-9163-1.

Rose, M.T., Rose, T.J., Pariasca-Tanaka, J., Widodo, H., Wissuwa, M. (2011) Revisiting the role of organic acids in the bicarbonate tolerance of zinc-efficient rice genotypes. *Functional Plant Biology*, 38: 493-504.

- Rose, T.J., Rose, M.T., Pariasca-Tanaka, J., Heuer, S., Wissuwa, M. (2011) The frustration with utilization: why have improvements in internal phosphorus utilization efficiency in crops remained so elusive? *Frontiers in Plant Nutrition*, DOI: 10.3389/fpls..
- Saidou, A.K., Ajeigbe, H.A., Omae, H., Tobita, S., Singh, B.B. (2011) Potential of cowpea (*Vigna unguiculata*) for dry season seed and fodder production in Sahelian sandy soil of Niger. *American-Eurasian Journal of Agriculture and Environmental Sciences*, 11(1): 71-78.
- Saint Pierre, C., Crossa, J., Bonnett, D., Yamaguchi-Shinozaki, K., Reynolds, M. (2012) Phenotyping transgenic wheat for drought resistance. *Journal of Experimental Botany*, DOI: 10.1093/jxb/err385.
- Sakagaichi, T., Terajima, Y., Terauchi, T., Hattori, T., Ishikawa, S., Matsuoka, M., Sugimoto, A., Ando, S., Harada, N. (2012) The Relationship between Growth and K/(Ca + Mg) Ratio in a Frage Sugarcane Variety, KRFO93-1. *Jpn. J. Crop Sci.*, 81(1): 71-76.
- Sakagami, J. (2011) Submergence tolerance of rice species, *Oryza glaberrima* Steud. *Evapotranspiration, Book2*. Intech publisher, DOI: ISBN 978-953-307-512-9.
- Sakagami, J., Kawano, N. (2011) Survival of submerged rice in flood-prone region of West Africa. *TROPICS*, 20(2): 55-66.
- Sakagami, J., Sone, C., Nakazono, M. (2012) Injury to Rice Plants by Floods and Resistance to Submergence. *Jpn. J. Crop Sci.*, 81(1): 1-9.
- Sakamoto, T., Hashiguchi, Y., Kurauchi, E., Imamura, Ishibashi, M. Y., Muranaka, S., Yuasa, T., Iwaya-Inoue, M. (2012) Causative factors of decreasing flower number in cowpea under drought stress during flowering stage. *Cryobiology and Cryotechnology*, 58(1): 81-85.
- Sasaki, Y., Tanaka, U., Ikazaki, K., Sinjo, H., Tobita, S. (2011) Livelihood of the Cultivators and Pastoralists in Sahelian Rural Area of West Africa Focusing on their Risk Management System. *J.JASS*, 27(4): 149-157.
- Shimoda, K., Horita, T., Hoshiba, K., Bordon, J. (2011) Evaluation of an Agropastoral System Introduced into Soybean Fields in Paraguay: Effects on Soybean and Animal Production under Intensive Grazing Systems. *JARQ*, 45(4): 397-404.
- Shinji, J., Okutsu, T., Jayasankar, V., Jasmani, S., Wilder, M. N. (2012) Metabolism of amino acids during hyposmotic adaptation in the whiteleg shrimp, *Litopenaeus vannamei*. *Amino Acids*, DOI: 10.1007/s00726-012-1266-2.
- Shuhuan, F., Lijun, Y., Rui, Y., Nirasawa, S., Gang, L., Yongqiang, C. (2011) Optimization of enzymatic conversion of flavonoids extracted from sea buckthorn leaves. *Nongye Jixie Xuebao*, 42: 127-132.
- Sone, C., Ito, O., Sakagami, J. (2012) Characterizing submergence survival strategy in rice via chlorophyll fluorescence. *Journal of Agronomy and Crop Science*, DOI: 10.1111/j.1439X.037X.2011.00494x.
- Subbarao, G.V., Sahrawat, K.L., Nakahara, K., Ishikawa, T., Kishii, M., Rao, I.M., Hash, C.T., George, T.S., Srinivasa Rao, P., Nardi, P., Bonnett, D., Berry, W., Suenaga, K., Lata, J.C. (2012) Biological nitrification inhibition A novel strategy to regulate nitrification in agricultural systems. *Advances in Agronomy*, 114: 249-302.
- Sugiura, T., Sumida, H., Yokoyama, S., Ono, H. (2012) Overview of recent effects of global warming on agricultural production in Japan. *Japan Agricultural Research Quarterly*, 46(1): 7-13.
- Sukchan, U., Caldwell, J. S., Oda, M., Suphanchaimat, N., Taweekult, N., Phaowphaisal, I., Sukchan, S. (2011) Process and results of integrated farming development by a farmer experimental group in rainfed Northeast Thailand. *International Journal of Technology Management and Sustainable Development*, 25(9): 236-213.
- Suzuki, K., Yurimoto, T., Koshiishi, Y. (2011) Valve Movement of the Pen Shell *Atrina lischkeana* in Relation to Burrowing and Creep-Out Behavior, 48(1): 19-24.
- Tachaapaikoon, C., Kosugi, A., Pason, P.,

Waeonukul, R., Ratanakhanokchai, K., Kyu, K.L., Arai, T., Murata, Y., Mori, Y. (2011) Isolation and characterization of a new cellulosome-producing *Clostridium thermocellum* strain. *Biodegradation*, DOI: 10.1007/s10532-011-9486-9.

Tagane, S., Ponragdee, W., Sansayawichai, T., Sugimoto, A., Terajima, Y. (2011) Characterization and taxonomical note about Thai *Erianthus* germplasm collection: the morphology, flowering phenology and biogeography among *E. procerus* and three types of *E. arundinaceus*. *Genet Resour Crop Evol.*, DOI: 10.1007/s10722-011-9717-2..

Tagane, S., Yasuda-Tagane, M., Ponragdee, W., Sansayawichai, T., Sugimoto, A. (2011) Cytological study of *Erianthus procerus* and *E. arundinaceus* (Gramineae) in Thailand. *Cytologia*, 76(2): 171-175.

Takahagi, Y., Iwabuchi, O., Sukegawa, S., Nakaebisu, T., Koshida, Y., Wakamatsu, J., Fujimura, T., Ishiguro, T., Murakami, H., Imura, Y., Kobayashi, Y., Morimatsu, F., Kawashima, T., Hishinuma, T. (2011) Effect of liquid straight whey feeding on reproductive performance, productivity and carcass characteristics of pigs in a commercial pig farm. *Nihon Chikusan Gakkaiho*, 82(3): 325-331.

Tanaka, H., Osakabe, Y., Katsura, S., Mizuno, S., Maruyama, K., Kusakabe, K., Mizoi, J., Shinozaki, K., Yamaguchi-Shinozaki, K. (2012) Abiotic stress-inducible receptor-like kinases negatively control ABA signaling in *Arabidopsis*. *Plant J.*, DOI: 10.1111/j.1365-313X.2012.04901.x.

Tanaka, K., Hanamura, Y., Chong, V.C., Watanabe, S., Man, A., Kassim, F., Kodama, M., Ichikawa, T. (2011) Stable isotope analysis reveals ontogenetic migration and the importance of a large mangrove estuary as a feeding ground for juvenile John's snapper *Lutjanus johnii*. *Fisheries science*, 77(5): 809-816.

Tangkanakul, P., Trakoontivakorn, G., Saengprakai, J., Auttaviboonkul, P., Niyomwit, B., Lowviton, N., Nakahara, K. (2011) Antioxidant Capacity and Antimutagenicity of Thermal Processed Thai Foods, *JARQ*, 45: 211-218.

Tani, N., Tsumura, Y., Fukasawa, K., Kado, T.,

Taguchi, Y., Lee, S.L., Lee, C.T., Norwati, M., Niiyama, K., Otani, T., Yagihashi, T., Azizi, R., Abd, R.K. (2011) Male fecundity and pollen dispersal in hill dipterocarps: significance of mass synchronized flowering and implications for conservation. *Journal of Ecology*, DOI: 10.1111/j.1365-2745.2011.01929.x.

Tatsukawa, K., Ohmori, H., Tajima, K., Tachikawa, H., Ijiri, S., Kawashima, T. (2011) Improvement of the Preservative Quality of Concentrated Rice Washing and Evaluation of its Feed Characteristics. *Jpn. J. Swine Science*, 48(4): 169-176.

Telebanco-Yanoria, MJ., Koide, Y., Fukuta, Y., Imbe, T., Tsunematsu, H., Kato, H., Ebron, L.A., Nguyen, T.M.N., Kobayashi, N. (2011) A set of near-isogenic lines of Indica-type rice variety CO 39 as differential varieties for blast resistance. *Molecular Breeding*, 27(3): 357-373.

Toriyama, K., Ando, H. (2011) Towards an understanding of the high productivity of rice with System of Rice Intensification (SRI) management from the perspectives of soil and plant physiological processes. *Soil Science and Plant Nutrition*, 57(5): 636-639.

Tri, M.V., Tan, H.V., Chau, N.M., Honsho, C., Ogata, T., Yonemoto, Y. (2011) Paclobutrazol Application for Early Fruit Production of Durian in Vietnam. *Tropical Agriculture and Development*, 55(3): 122-126.

Vaithanomsat, P., Songpim, M., Malapant, T., Kosugi, A., Thanapase, W., Mori, Y. (2011) Production of α -Glucosidase from a Newly Isolated *Aspergillus* Species Using Response Surface Methodology. *Int J Microbiol*, DOI: 10.1155/2011/949252.

Waeonukul, R., Kosugi, A., Tachaapaikoon, C., Pason, P., Ratanakhanokchai, K., Prawitwong, P., Deng, L., Saito, M., Mori, Y. (2012) Efficient saccharification of ammonia soaked rice straw by combination of *Clostridium thermocellum* cellulosome and *Thermoanaerobacter brockii* α -glucosidase. *Bioresource Technology*, DOI: 10.1016/j.biortech.2011.12.126.

Watthanalomloet, A., Tachaapaikoon, C., Lee, Y.S., Kosugi, A., Mori, Y., Tanasupawat, S., Kyu, K.L., Ratanakhanokchai, K. (2011)

- Amorocellulobacter alkalithermophilum* gen. nov., sp. nov. an anaerobic alkalithermophile, cellulolytic-xylanolytic bacterium isolated from soil in a brackish area of a coconut garden. *Int J Syst Evol Microbiol*, DOI: 10.1099/ijss.0.027854-0.
- Wu, L., Li, Y., Arakane, M., Ike, M., Wada, M., Terajima, Y., Ishikawa, S., Tokuyasu, K. (2011) Efficient conversion of sugarcane stalks into ethanol employing low temperature alkali pretreatment method. *Bioresour. Technol.*, 102(24): 11183-11188.
- Xu, D.H., Tuyen, D.D. (2012) Genetic studies on saline and sodic tolerances in soybean. *Breeding Science*, DOI:10.1270/jsbbs.61.000.
- Yamada, K., Kanai, M., Osakabe, Y., Ohiraki, H., Shinozaki, K., Yamaguchi-Shinozaki, K. (2011) The monosaccharide absorption activity of *Arabidopsis* roots depends on the expression profiles of transporter genes under high salinity conditions. *Journal of Biological Chemistry*, DOI: 10.1074/jbc.M111.269712.
- Yamada, R. (2011) Possibility and Challenges of Farming Diversification in Rainfed Lowland Areas of Laos. *Journal of Agricultural Development Studies*, 22(2): 51-58.
- Yamamoto, Y., Hirano, A., Uchida, S. (2011) Feature Abstraction of Plantation Farms in Indonesia by Object-based Classification. *J.JASS*, 27(4): 137-148.
- Yamanaka, N., Lemos, N.G., Akamatsu, H., Yamaoka, Y., Silva, D.C.G., Passianotto, A.L.L., Abdelnoor, R.V., Soares, R.M., Suenaga, K. (2011) Soybean breeding materials useful for resistance to soybean rust in Brazil. *Japan Agricultural Research Quarterly*, 45(4): 385-395.
- Yoshida, T., Ohama, N., Nakajima, J., Kidokoro, S., Mizoi, J., Nakashima, K., Maruyama, K., Kim, J.-M., Seki, M., Todaka, D., Osakabe, Y., Sakuma, Y., Schöffl, F., Shinozaki, K., Yamaguchi-Shinozaki, K. (2011) *Arabidopsis* HsfA1 transcription factors function as the main positive regulators in heat shock-responsive gene expression. *Molecular Genetics and Genomics*, DOI: 10.1007/s00438-011-0647-7.
- Zygalakis, K.C., Kirk, G.J., Jones, D.L., Wissuwa, M., Roose, T. (2011) A dual porosity model of nutrient uptake by root hairs in soil. *New Phytologist* Trust, 192(3): 676-688.

THIRD MEDIUM-TERM PLAN OF THE JAPAN INTERNATIONAL RESEARCH CENTER FOR AGRICULTURAL SCIENCES

The Japan International Research Center for Agricultural Sciences (JIRCAS) has been contributing to the improvement of technologies for agriculture, forestry, and fisheries, in tropical and subtropical areas as well as other overseas developing regions (hereinafter referred to as “developing regions”), by performing technical trials and research activities.

During the First Medium-Term Goal period (FY2001 to 2005), 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, taking into account both domestic and overseas situations, such as the adoption of the U.N. Millennium Development Goals for the eradication of poverty and hunger in the world.

During the Second Medium-Term Goal period (FY2006 to 2010), JIRCAS created a multilateral collaborative research system, promoted collaborative research with world-class research organizations led by the Consultative Group on International Agricultural Research (CGIAR), established a dynamic research system, and implemented major research activities as projects at JIRCAS. In fiscal 2008, JIRCAS took over international activities from the dissolved Japan Green Resources Agency and strengthened its field activities.

Based on the outcomes of JIRCAS’s research strategy and in accordance with the Basic Plan for Agriculture, Forestry and Fisheries Research (determined at the meeting of the Agriculture, Forestry and Fisheries Research Council on March 30, 2010), three research agendas have been identified over the course of this Medium-Term Goal period, namely: (1) the development of agricultural technologies in developing regions, based on sustainable management of resources, (2) the development of technology for increased productivity and stable production of agricultural products in the tropics and other unstable environments, and (3) the development of technology for income and livelihood improvement of the rural population in developing regions. Research resources will be allocated to these agendas on a priority basis, and a system that will allow the research results to be put into practice most effectively in developing regions will be established. To best understand the highly diverse subjects and goals of technological development in developing regions, JIRCAS will also strengthen its capability related to the collection, analysis, and dissemination of information on international agriculture, forestry, and fisheries.

Through this series of activities, JIRCAS is committed to fulfill its responsibilities as Japan’s only research institution mandated to carry out comprehensive international research in agriculture, forestry, and fisheries, and to contribute to the enhancement of food security in the country by solving global food problems.

I. MEASURES TO BE TAKEN TO ACHIEVE THE GOAL OF EFFICIENT BUSINESS MANAGEMENT

A) Cost reduction

1. Reduction in costs such as general and administrative expenditures

a) Administrative operations implemented by operational grants will be reviewed and efficiency will be further promoted. Average annual reduction targets are at least 3% with respect to the previous year for general and administrative expenditures (excluding personnel expenditures), and at least 1% with respect to the previous year for research expenditures. The general and administrative expenditures will be thoroughly examined and reviewed to determine whether there is any further room for cost reduction.

b) With regard to pay standards, the salaries including allowances for directors and staff will be carefully scrutinized in light of the general pay standards for government employees. As JIRCAS’s payment level for fiscal 2009 was 104.7 against a base figure of 100 for government employees (for administrative/technical personnel, age considered), its pay standards will be reviewed and reduced to the equivalent level for government employees by fiscal 2011; and in succeeding years the payment level will be in accordance with the pay regulations for government officials. The results of the assessment and progress of implementation will be made public. With regard to total personnel expenses, ongoing cost reduction efforts of more than 5% over a period of five years from fiscal 2006, according to the Act on Promotion of Administrative Reform for Realization of Small and Efficient

Government (Act No. 47 of 2006), are to be consistently maintained through fiscal 2011. The reduction target for JIRCAS's total personnel expenses for this fiscal year (excepting retirement allowances, welfare expenditures [legal and non-legal welfare expenditures], and salaries revised in accordance with the recommendation of the National Personnel Authority) is more than 6% with respect to the fiscal 2005 level. Based on the Treatment Related to Salary Revisions for Government Officials (determined at the Cabinet meeting on November 1, 2010), and in accordance with the government's personnel cost-cutting efforts, JIRCAS will conduct a rigorous review of its personnel expenses as part of the planned fundamental review of the incorporated administrative agency (IAA) system. Personnel expenses related to staff taken on from the Japan Green Resources Agency, which had already achieved a personnel expenses reduction of more than 5%, are not subject to the current personnel expenses reform, in accordance with the Treatment of Across-the-board Personnel Cost Cuts for Organizations such as Incorporated Administrative Agencies Which Cooperate in Accepting Staff from Dissolved Agencies (notice of June 9, 2008 from the Administrative Reform Promotion Office, and other government departments, to personnel in charge at the ministries).

Personnel expenses related to the following permanent staff are not included in the reduction targets:

- (i) Fixed-term staff employed by means of competitive or contracted research funds, or external funds from the private sector for collaborative work.
- (ii) Fixed-term researchers (a) employed by means of government commission fees or subsidies; or (b) engaged in important research agendas (strategically important science and technologies designated in the Third Basic Program for Science and Technology [determined at the cabinet meeting on March 28, 2006], in line with national policy), who are employed by means of operational grants; or (c) 37 years of age or younger as of the end of fiscal 2005.

2. Review of Contracts

- a) According to the Inspection and Review of Contracts of Incorporated Administrative Agencies (determined at the cabinet meeting on November 17, 2009) and other related policies, and based on the plan to review free contracts, a thorough review will be conducted on uncompetitive free contracts, and improvements will be made on biddings involving only one bidder/applicant in general competitive biddings.
- b) Contract methods (such as the use of multi-year vs. single-year contracts) will be reviewed from a cost-saving viewpoint, with reference to other IAAs.
- c) With regard to contracts with organizations deemed to be in close relation to JIRCAS, information provision will be reviewed to enhance transparency.

B) Implementation and feedback from evaluations and checks

1. To ensure work priority and transparency, JIRCAS will conduct evaluations and checks on its operations and research activities in a fair manner by utilizing external specialists prior to annual evaluation by the IAA Evaluation Committee. To allocate research resources on a priority basis, JIRCAS will clarify the basic policy and specific methods of supplying the respective results, along with the results from the IAA Evaluation Committee, to the administrative management. Research activities in particular will be reviewed on a flexible basis, with their necessity and progress taken into account. Evaluation and feedback results will be made available on JIRCAS's website.

2. For the purpose of evaluating research activities, a process sheet enumerating the annual goals will be prepared prior to the start of research. The process sheet is important for two main reasons: First, it ensures the improvement of technologies concerning agriculture, forestry, and fisheries in developing regions to address their food problems, thereby contributing to Japan's food security; Second, it becomes the basis for conducting evaluations at high international standards. Numerical goals and specific indicators will be set wherever possible. Research resource input and obtained results will be analyzed and utilized to evaluate research activities.

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 where necessary.

4. Based on third-party evaluation, including that of administrative departments, each of the 10 or more research outcomes which are useful to developing regions will be designated as a 'Major Outcome for Dissemination' within the Third Medium-Term Goal period. The dissemination and use of such designated and other research results will be understood, analyzed, and utilized for the improvement of administrative management.

5. JIRCAS will make performance evaluations of its personnel and appropriately integrate the results into their treatment.

C) Effective use, improvement, and upgrading of research resources

1. Research funds

a) Research activity evaluation results will be appropriated into budget allocations for the effective and efficient promotion of the Medium-Term Goals research programs supported by operational grants.

b) To further promote research and development, efforts will be made to obtain external funds, such as funds for commissioned projects and competitive funds, and to utilize them more efficiently.

2. Research facilities and equipment

Research facilities and equipment are classified into three categories based on their age-related condition and JIRCAS' research prioritization, as follows: (i) facilities that will not conduce to research promotion without renovation and upgrading, (ii) facilities that will hamper the progress of research without renovation due to their severe age-related condition, and (iii) facilities required to be renovated by law or regulations. Planned renovation and upgrading of facilities essential to research promotion will be implemented while the use of such facilities will be promoted to increase the rate of utilization. With regard to the Island Environment Technology Development Laboratories, which are open facilities located at Tropical Agriculture Research Front, research proposals will be made to other research centers and publicity activities will be augmented to encourage the use of the facilities.

3. Organization

To achieve the Third Medium-Term Goals, the administrative and research organizations will be reviewed in a flexible manner, based on research evaluation results, to promote collaborative work with other IAAs in the agricultural field.

4. Improvement of staff qualifications and development of human resources

a) JIRCAS will revise its human resource development program in accordance with the Act on Enhancement of Research and Development Capacity and Efficient Promotion of Research and Development by Advancement of Research and Development System Reform (Act No. 63 of 2008), as well as changes in the surrounding environment of research and development, and other factors.

b) Efforts will be made to improve the qualifications of researchers who play key roles in international collaborative research, by dispatching them abroad and conducting collaborative studies with invited overseas researchers.

c) JIRCAS 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, conduct effective personnel exchanges with other research organizations including IAAs, and promote various forms of human resource exchange with governmental departments. JIRCAS will also cooperate with other agricultural IAAs in developing the international skills of their staff.

d) JIRCAS will make efforts to improve its personnel's qualifications by mandating that administrative and technical staff actively participate in various training sessions organized and implemented by external organizations or other IAAs. Efforts will also be made to improve the system that allows technical staff to engage positively in research support.

e) The management ability and leadership of research project leaders will be improved through the implementation of various training systems.

D) Improvement, upgrading, and promotion of the efficiency of the research support sector

1. Research support work will be streamlined wherever possible by conducting work in conjunction with other agricultural IAAs, such as the joint implementation of training programs and joint creation of manuals.
2. The work of the General Affairs Section will be reviewed to ensure efficiency in the operational system. The efficiency of clerical management will be promoted by speeding up and simplifying clerical procedures.
3. JIRCAS will provide efficient local support to researchers dispatched abroad when they perform experimental and accounting work.
4. Efforts will be made to streamline, upgrade and enhance technical support activities by reviewing work and focusing on areas that require highly specialized technology and knowledge that meet the needs of advanced experimental and research work.
5. The Ministry of Agriculture, Forestry and Fisheries Research Network (MAFFIN) will be utilized to streamline, upgrade and enhance work on the collection and dissemination of research information; and efforts will be made, both to promote information-sharing across JIRCAS and to streamline operations, through the use of groupware.
6. Efforts will also be made to rationalize research support staffing by reviewing overall support work and continuing to promote outsourcing.

E) Promotion and enhancement of collaboration and cooperation between industry, academia, and government

1. To further promote collaborative research and researcher exchange, efforts will be made to improve information exchange and alliances with national and public research organizations, universities, and the private sector.
2. JIRCAS will actively support alliances and cooperation with other agricultural IAAs, including personnel exchanges, keeping in mind the division of roles.
3. Cooperation will be provided to the National Agriculture and Food Research Organization (NARO), as necessary, in implementing breeding research and other work.

II MEASURES TO IMPROVE THE QUALITY OF SERVICE AND EXECUTION OF OTHER DUTIES RELATING TO THE PUBLIC

A) Research and investigations

1. Priority research promotion

The research activities described in the attachment will be promoted on a priority basis.

- a) To fulfill JIRCAS's responsibilities as Japan's only research institution mandated to carry out comprehensive international research in agriculture, forestry, and fisheries for developing regions, efforts will be made to improve information exchange and alliances with related organizations in Japan, through close coordination with the Japan Forum for International Agricultural Research for Sustainable Development (J-FARD) and other organizations for sustainable development. JIRCAS will also actively strive to make international contributions, utilizing Japan's technology in these areas by collaborating with developing and developed nations, international research institutes, private organizations such as NGOs, and international research networks, to effectively promote international collaborative work. Questionnaires on joint research will be sent to related overseas research institutes

to further the effective performance of such activities.

b) To ensure the prompt and practical application of research results, JIRCAS 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 focusing on the utilization, diffusion, and commercialization of research results.

c) At least 525 collaborative researchers and research managers will be invited from agricultural, forestry, and fisheries research organizations in developing regions during the Third Medium-Term Goal period to conduct collaborative research or improve the capability of the researchers concerned. At least 85 effective Memoranda of Understanding (MOUs) will be maintained per year.

d) Collaborative research utilizing research resources owned by respective organizations will be promoted efficiently by further strengthening alliances with other IAAs in the field of agricultural research and development.

e) As a sub-bank in the NIAS Genebank Project implemented by the National Institute of Agrobiological Sciences (which serves as the central bank), JIRCAS will efficiently collect, store and characterize gene resources in close cooperation with the central bank.

2. Collection, analysis and dissemination of information for identifying trends related to international agriculture, forestry and fisheries

a) To help solve global food and environmental problems, JIRCAS will analyze the current situation and make forecasts concerning food supply and demand and the production structure of agriculture, forestry, and fisheries in foreign countries.

b) To contribute to research and other projects related to agricultural, forestry, and fisheries in developing regions, JIRCAS will collect, analyze, and disseminate information and materials related to the international food situation, to the agricultural, forestry, and fishery industries as well as to rural areas. It will be carried out in a regular, institutional, and systematic manner, through collaboration with related organizations in Japan and overseas, and through the long-term dispatch of staff to priority areas. The respective information and materials shall be provided to a broad range of researchers, government agencies, and private companies.

3. Flexible response to government needs

JIRCAS will flexibly respond to government needs that will arise during the Third Medium-Term Goal period, and carry out necessary research and development in a consistent manner.

B) Reinforcement of ties with government departments

1. JIRCAS will appropriately reflect the opinions of the departments of the Ministry of Agriculture, Forestry and Fisheries in its research activities and dissemination of research outcomes. At every stage during development, from research design to dissemination of outcomes and practical applications, JIRCAS will make efforts to seek a common awareness of issues with related governmental departments, through close exchange of information, and will welcome them to participate in annual meetings to examine research results and plans. Alliances with government departments will be assessed on a yearly basis with the respective departments' participation, and the results will be utilized to further strengthen ties.

2. Keeping in mind the division of roles with other IAAs, JIRCAS will provide technical information and dispatch experts to governmental departments and related committee meetings, including emergency response, and will hold symposiums and other forums.

C) Promotion of the release and dissemination of research results

1. Securing interactive communication with the public

a) To fulfill accountability to the public, JIRCAS and its researchers will make efforts to secure

interactive and continuous communication with the public by effectively utilizing various forms of information media.

b) The research staff will actively pursue community outreach activities such as open lectures for citizens, and their efforts will be conscientiously evaluated.

c) JIRCAS will seek the understanding of residents in areas where research is implemented, through cooperation with research partners and local governments concerned.

2. Promotion of utilization of research results

JIRCAS regards PR and the dissemination of new knowledge and technologies, along with their integration into government policy, as important activities. Researchers and related departments will make efforts to promote such activities.

In light of these aims, JIRCAS will first combine research results obtained during the Third Medium-Term Goal period with those already obtained in the previous Medium-Term Goal period, compile them in a database, and create manuals for proper utilization. At the same time, JIRCAS will conduct PR activities in countries where research facilities are located and actively promote the dissemination and utilization of research outcomes in developing regions by conducting collaborative research with international research or cooperation institutions.

3. Public relations and the release of research results

a) Research results will be released at academic meetings in Japan and overseas. At least 560 refereed papers will be published in academic journals and bulletins during the period covered by the Medium-Term Goals. In addition, at least 35 international symposiums and workshops will be held during that period, and the respective research results will be widely released in Japan and overseas.

b) Details of research results and other activities will be released on JIRCAS's website and through exhibitions. JIRCAS will also issue more than 11 press releases of major research results during the period covered by the Medium-Term Goals.

4. Acquisition of intellectual property rights and promotion of their utilization

a) JIRCAS considers important the generation of results beneficial to the entire world, transcending national and regional borders (global public goods). When promoting practical application and utilization of research results, special attention will be paid to find balance between contributing to the progress of developing regions and promoting Japan's industries, including agriculture.

b) JIRCAS will implement intellectual property management to promote research and development, with the ultimate aim of promoting practical application and utilization. Obtaining rights to research results and handling licenses will be carried out in an integrated manner, from the design stage of research and development onwards.

c) JIRCAS will aim to win patent rights in a strategic manner, including filing and licensing overseas, for possible patent licensing in the future or for the protection of research results. JIRCAS will file at least 20 patent applications in Japan and abroad during the period covered by the Third Medium-Term Goals.

d) JIRCAS will review its own patents, as needed, in light of licensing and the development of alternative technologies. It will waive rights to less important patents.

e) Bred materials applicable to Japan will be registered in the Registry of Plant Varieties to promote their dissemination and utilization.

f) JIRCAS will grant at least three licenses for domestic or international patents each year within the Third Medium-Term Goal period.

g) JIRCAS will actively provide information related to patent rights to outside parties, and strengthen efforts necessary for technological transfer.

h) JIRCAS will review its own Basic Intellectual Property Policy as necessary, in line with the Strategy for Agricultural, Forestry and Fisheries Intellectual Property (decided by the Agriculture, Forestry and Fisheries Research Council in March 2007).

D) Other social contributions in specialized fields

1. Analyses and appraisals

On request from the government, relevant organizations, or universities, JIRCAS will perform analyses and appraisals that require its highly specialized knowledge and/or are difficult for other organizations to carry out.

2. Training sessions and seminars

- a) JIRCAS will hold training sessions and seminars as often as possible, and actively cooperate in events sponsored by the government and other organizations.
- b) JIRCAS will actively welcome participants and trainees from other IAAs, universities, national and public institutions, and the private sector, to develop human resources, raise technical standards, and disseminate technical information. JIRCAS will also welcome trainees from abroad.
- c) JIRCAS will dispatch young researchers of universities to overseas countries, and promote the development of researchers engaged in international agriculture, forestry, and fisheries research.

3. Cooperation with international organizations and academic societies

- a) 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.
- b) JIRCAS will plan and hold international symposiums jointly with international organizations, with the aim of contributing to the development of agriculture, forestry, and fisheries in developing regions.
- c) JIRCAS will implement a commendation program for young researchers at agricultural, forestry, and fisheries research organizations in developing regions.

[Attachment] Directions related to research and investigations

1. Development of agricultural technologies based on sustainable management of the environment and natural resources in developing regions

To overcome current global environmental problems, as well as maintain and expand the agricultural, forestry, and fishery industries in developing regions, JIRCAS will aim to develop sustainable resource management and environmental conservation technologies in relevant areas through collaboration with local and international research centers. More specifically, the following priority research projects will be carried out:

- a) Projects addressing global warming including (1) the development of global warming mitigation technologies such as those for the reduction of greenhouse gas emissions from livestock and agricultural land and by soil carbon sequestration, (2) the development of adaptation technologies such as nutrient management technology to reduce stresses imposed by climate change, (3) the assessment and analysis of global warming impacts (and its countermeasures) on the food market by employing a global food supply and demand model, and (4) the development of a sustainable rural community model with low GHG emission by employing clean development mechanism (CDM) project activities.
- b) JIRCAS will establish a sustainable farming system for dry and semi-dry areas by developing antidesertification technologies and by optimizing soil and grazing management as well as employing a cropping system that conserves soil in agriculture (conservation agriculture) through the use of non-tilling farming and cultivation of cover crops suitable to the African Savanna. JIRCAS will also develop water-saving cultivation and groundwater resource conservation technologies on islands in developing regions which are highly susceptible to abnormal climate conditions caused by global warming.
- c) JIRCAS will strive to develop technologies that will enhance nitrogen use efficiency by utilizing the biological nitrification inhibition function of certain crops, thereby promoting sustainable agricultural systems and resource management.

2. Technology development for increased productivity and stable production of agricultural products in the tropics and other unstable environments

This program seeks to develop technologies to improve and sustain productivity through collaborative research with local institutions and international research centers, in specific research fields wherein Japan has shown predominant comparative advantage, focusing especially on adverse environments such as those found in tropical regions. The program also aims to reduce starvation and malnutrition, which remain serious problems in developing regions, and to contribute to food security in the world and in Japan. More specifically, the following priority research will be carried out:

- a) To help fulfill the goal of the Coalition for African Rice Development (CARD) to double rice production in Africa by 2018, JIRCAS, as the implementing institute for the flagship project “Development of rice production technologies in Africa”, will evaluate rice genetic resources, introduce biotic/abiotic stress tolerance into rice strains suitable to African environmental conditions, develop an Asian-type low life-cycle cost paddy infrastructure technology, and establish a cultivation system for low-input rice production in flood plains which have previously been considered unsuitable for rice production.
- b) Stable crop productivity shall be attained in unstable environments by overcoming adverse factors such as drought, submergence, salinity, diseases, and pests. This research will be done by (1) establishing genetic engineering technologies to develop crops suitable to developing regions, (2) developing breeding technologies and materials to secure sustainable production against factors that inhibit the production of main upland crops such as soybean, (3) developing technologies for the evaluation and utilization of diverse genetic materials and breeding lines in tropical field crops such as sugarcane, (4) improving Asian-type rice cultivation by utilizing low-input/high-yield cultivation technology and greater genetic diversity, and (5) developing integrated pest management techniques to stabilize agricultural and livestock production in developing regions.

3. Technology development for income and livelihood improvement of the rural population in developing regions

This program aims to improve income in rural areas by (i) promoting their appropriate development in line with the respective natural conditions and cultural background, and (ii) evaluating the multilateral values of various agricultural, forestry, and fishery products. To achieve this objective, JIRCAS will develop key production technologies for sustainable agriculture, forestry, fisheries, and rural development. JIRCAS will also develop modern processing, distribution, and storing technologies through collaborations with local and international research centers to effectively utilize the products. More specifically, the following priority research projects will be carried out:

- a) In rural areas in Indochina, JIRCAS will establish stable production systems for rice and field crops, livestock, forest, and fish culture, which can adapt to diverse geographical environments (forests, open fields, rice fields, and rivers), to encourage self-sufficiency, eradicate poverty, and enhance the economic independence of farmers.
- b) In East and Southeast Asia, where the structures of food supply/demand and rural communities are changing due to rapid economic growth, JIRCAS will examine and propose measures to support sustainable agriculture, forestry, and fisheries. The project aims to develop food processing technologies by utilizing varied traditional food resources in these areas, as well as biofuel production technologies that do not compete with food production by utilizing the unused biomass resources in Southeast Asia. To help boost the forestry and fisheries industries in Southeast Asia, JIRCAS will develop techniques for the sustainable use of forest resources by taking advantage of forest multifunctionality. JIRCAS will also develop sustainable aquaculture technologies while preserving habitats through co-culture techniques.

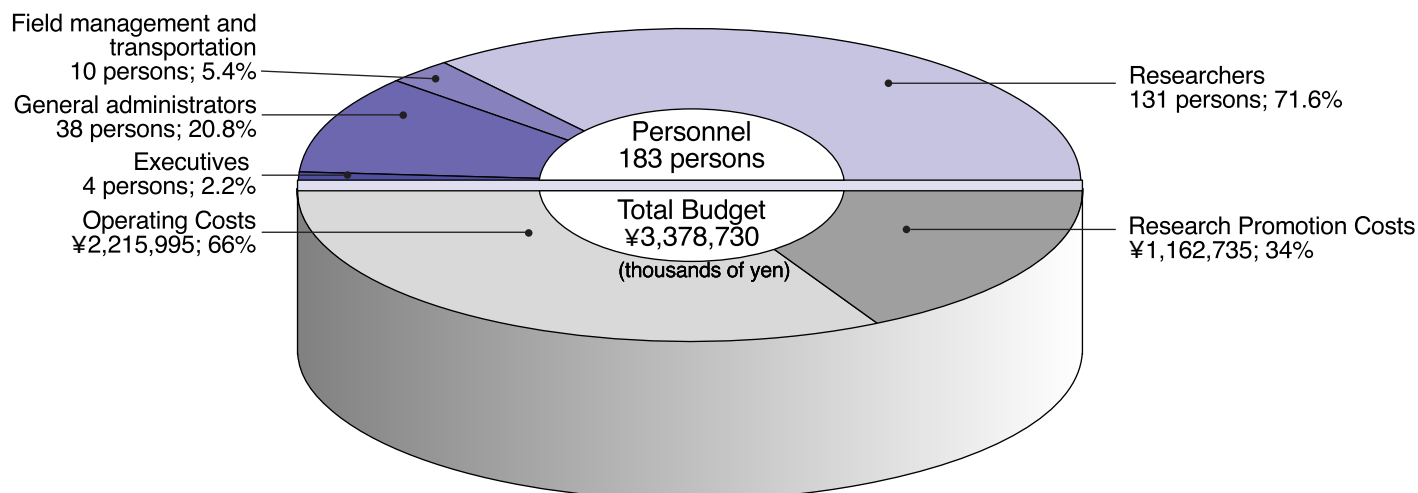
FINANCIAL OVERVIEW

Fiscal Year 2011

(thousands of yen)

TOTAL BUDGET	3,378,730
OPERATING COSTS	2,215,994
Personnel (183)	1,851,170
President (1), Vice-President (1), Executive Advisor & Auditor (2)	
General administrators (38)	
Field management (10)	
Researchers (131)	
* Number of persons shown in ()	
Administrative Costs	364,825
RESEARCH PROMOTION COSTS	1,162,735
Research and development	485,906
Overseas dispatches	204,827
Research exchanges/invitations	12,250
Collection of research information	85,869
International collaborative projects	359,676
Fellowship programs	14,207

Budget FY 2011 (Graph)



MEMBERS OF THE EXTERNAL EVALUATION COMMITTEE AND PROGRAM REVIEW MEETINGS

Members of the JIRCAS External Evaluation Committee

Hiroto ARAKAWA	Senior Special Advisor, Japan International Cooperation Agency
Kiyoko IKEGAMI	Professor, Graduate School of Social and Cultural Studies, Nihon University
Toshihiko KOMARI	Vice President, Corporate Strategy Division, Japan Tobacco Inc.
Keiko NATSUAKI	Professor, Faculty of International Agriculture and Food Studies, Tokyo University of Agriculture
Shin-ichi SHOGENJI	Professor, Graduate School of Bioagricultural Sciences, Nagoya University

JIRCAS STAFF in FY 2011

President

Masaru Iwanaga

Vice-President

Masami Yasunaka

Executive Advisor & Auditor

Shigeo Matsui

Hitoshi Yonekura

Research Strategy Office

Osamu Koyama, Director

Kazumi Yamaoka, Research Coordinator

Regional Research Coordinators

Tomohide Sugino, Representative of Southeast Asia Office (Thailand)

Tetsuji Oya, Representative of Africa Office

Researcher

Eiichi Kusano, Agricultural Economics

Program Director

Tomoyuki Kawashima, Program A: Environment and Natural Resource Management

Takeshi Kano, Program B: Stable Food Production

Masayoshi Saito, Program C: Rural Livelihood

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Yoshinobu Egawa, Director

Researcher

Yuzo Manpuku, Researcher

Research Planning and Evaluation Office

Hiroshi Komiyama, Head

Research Planning Section

Naruo Matsumoto, Head

International Relations Section

Koshun Ishiki, Head

Kazuo Ise, Senior Researcher

Mie Kasuga, Senior Researcher

Field Management Section

Takashi Komatsu, Field Operator

Toshimitsu Azuma, Field Operator

Research Support Office

Kenichi Hatsuse, Head

Research Coordination Section

Takahiro Sato, Head

Kazunari Iwafuchi, Assistant Head

Yoshihiko Sumomozawa, Coordination Subsection Head

Junichi Irino, International Relations Subsection Head

Research Support Section

Katsuhide Masumoto, Head

Takeshi Usuku, Budget Subsection Head

Takayuki Yamamoto, Support Subsection 1 Head

Genichiro Hanaoka, Support Subsection 2 Officer

Public Relations Office

Masanobu Ohura, Head

Technology Promotion Section

Ryo Miyazaki, Head

Publications and Documentation Section

Misako Nakao, Head

Hiromi Miura, Network Subsection Head

Akemi Sawata, Managing Subsection Head (Librarian)

Intellectual Property Expert

Akira Hirokawa

Administration Division

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Tadashi Hayakawa

General Affairs Section

Tamotsu Moriwa, Head

Koichi Iioka, General Affairs Assistant Head

Keiji Tanaka, Personnel Management Assistant Head

Katsunori Kanno, General Affairs Subsection Head

Kazuyo Kadowaki, Welfare Subsection Head

Gaku Takeda, Personnel Subsection 1 Head

Akemi Nomiya, Personnel Subsection 2 Head

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Kazuo Miyajima, Accounting and Examination Assistant Head

Hiroshi Mizufune, Procurement and Asset Managing Assistant Head

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Ryoichi Mise, Overseas Expenditures Subsection 2 Head

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Yasuhiro Onozaki, Procurement Subsection 1 Head

Yoshihiko Takahashi, Procurement Subsection 2 Head

Tsuneyoshi Sasaki, Supplies/Equipment

Subsection Head
Kuniaki Katsuyama, Facilities Subsection Head

Administration Section (Tropical Agriculture Research Front)

Takao Oga, Head
Tomohiro Yumiza, General Affairs Subsection Head
Shuji Hirose, Accounting Subsection Head

Audit Office

Ryoji Kudo, Head

Rural Development Planning Division

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Project Leaders

Naoya Fujimoto, Agricultural Water Management
Tsutomu Kobayashi, Rural Engineer

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Junichiro Yamada, Rural Development

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Hirofumi Iga, Grassland Management
Kimio Osuga, Rural Development
Takeru Higashimaki, Rural Development
Ryo Miyazaki, Rural Development
Yukio Okuda, Rural Engineering
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Toshihide Takeuchi, Irrigation, Drainage & Rural Engineering
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Hiroshi Ikeura, Irrigation
Kenichiro Kimura, Forest Chemistry
Katsumi Hasada, Rural Development
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Shigeki Yokoyama, Agricultural Economics
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Akihiko Kosugi, Molecular Microbiology

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Kazuo Nakashima, Plant Molecular Biology
Xu Donghe, Plant Molecular Genetics
Eizo Tatsumi, Food Chemistry
Satoru Nirasawa, Food Functionality
Yoshinori Murata, Applied Microbiology
Yasunari Fujita, Plant Molecular Biology
Hajime Akamatsu, Plant Pathology
Naoki Yamanaka, Plant Molecular Genetics
Kyonoshin Maruyama, Plant Molecular Biology
Takamitsu Arai, Molecular Microbiology
Norihito Kanamori, Plant Molecular Biology
Tsutomu Ishimaru, Plant Breeder

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(Kazuko Yamaguchi-Shinozaki, Plant Molecular Biology)

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Cai Yimin, Animal Science
Satoshi Nakamura, Insect Ecology
Satoshi Tobita, Plant Physiology and Nutrition
Masato Oda, Crop Management
Guntur V.Subbarao, Crop Physiology and Nutrition
Katsuhisa Shimoda, Grassland Management and Plant Ecology
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Tomoko Sugimoto, Wood Chemistry
Reiji Yoneda, Silviculture

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Satoshi Watanabe, Marine Ecology
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Yoshimitsu Katsuda, Public Relations Officer

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Shotaro Ando, Soil Science

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Satoru Muranaka, Plant Physiology

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

THE JAPANESE FISCAL YEAR AND MISCELLANEOUS DATA

The Japanese Fiscal Year and the Annual Report 2011

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) 2011 covers the period from April 1, 2011 through March 31, 2012. The

Annual Report 2011 summarizes the full extent of JIRCAS activities that occurred during this period. The subsequent Annual Report will detail events and programs from April 1, 2012, through March 31, 2013 (FY 2012).

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	10,766
Okinawa Tropical Agriculture Research Front	9,485
Total	20,251

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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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FOR AGRICULTURAL SCIENCES