Japan International Research Center for Agricultural Sciences

Annual Report 2012

(April 2012-March 2013)

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Annual Report JIRCAS 2012

Message from the President

President
Dr. Masa Iwanaga
(FY2011-)

We all vividly recall the food price crisis of 2007 - 2008. It affected millions of people especially those in resource-poor communities in developing regions. It unfortunately pushed up the total number of hungry people worldwide who were denied access to food due to high prices. The world community, since then, experienced two more major food price spikes: in 2011 and in 2012.

The FAO Food Price Index has remained high to this day. The index in 2012 was 213; it means food prices in 2012 was 213% higher than the average prices for 2002 - 2004. It is so high that access by poor people is a daily battle.

Can we produce enough food sustainably and at a price affordable to all? The 2012 Global Hunger Index (GHI), published jointly by the International Food Policy Research Institute and others, showed that progress in reducing the proportion of hungry people in the world has been tragically slow.

Recent events around the world—droughts (such as seen in the US in 2012), land rush (investing in foreign farmlands), and shocks in energy supplies and prices—underline the scarcity of resources we depend on to produce the world's food supply. It is increasingly clear that sustainably feeding an ever-increasing number of people requires a much more careful and integrated approach to the use of land, water, and energy than we currently apply. It is an absolute must that we start now to produce more food using fewer resources and to use the harvest more efficiently. Demographic changes, rising incomes and associated consumption patterns, and climate change, alongside persistent poverty and inadequate policies and institutions, are all placing serious pressure on the natural resource base that support current and future societies.

The year 2012 was highly significant for JIRCAS because it was the second year of the new 5-year Medium-Term Plan. We have started seeing verifiable evidence of successful implementation of the Projects under our four newly formed Programs (Figure 1). This annual report describes how JIRCAS has carried out the major activities that have produced proud moments and highlights.

Let me recap the main points of our Program-based management and strategy:

Introducing the four Programs

The four Programs developed using the mission-based principles 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)

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.

Partnership is the center of our activities

Most of our activities are carried out together with our partner institutions around the world. Effective partnership makes it possible for us to conduct joint research activities that would be of value for social impact for our target beneficiaries in developing regions. The map (Figure 2) shows locations of our current activities based on formal institutional Memorandums of Understanding. We value such partnerships and place it as our organization's core value.

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 tax-payers 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 42-year-old "research for development" tradition, hoping to produce deliverables that will be used by our target beneficiaries.

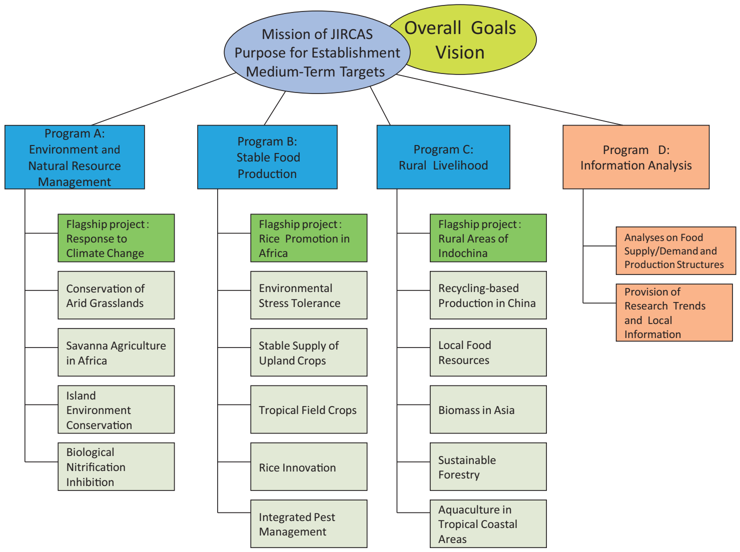


Fig. 1. Program-Project Research Framework

Fig. 2. Locations of our current activities based on 95 MOUs with partner institutions

HIGHLIGHTS FROM 2012

JIRCAS International Symposium 2012

JIRCAS International Symposium 2012, entitled "Resilient Food Production Systems: The Role of Agricultural Technology Development in Developing Regions," was held Nov. 28 and 29 at Tsukuba International Congress Center, Epochal Tsukuba, with 152 participants in attendance.

On behalf of the symposium organizers, the President of JIRCAS opened the gathering with an explanation for choosing 'resilience' as symposium theme. The Research Councilor of the Ministry of Agriculture, Forestry and Fisheries then followed with a welcome statement. He emphasized the importance of exchanging information regarding resilience in view of the current situation where decreased crop yields have manifested due to climate change and food security issues related to an expanding global population.

There were two keynote speeches, *Building Resilient Food Systems: Policies and Technologies* and *Resilience of Social-ecological Systems for Food Security*, followed by four thematic sessions.

The first session, *Resilience in the Livestock Sector*, featured "Damage from Dzud and countermeasure in Mongolia," "Medium- to long-term action for Drought in the Horn of Africa," and "Managing the risk of drought-related livestock mortality with Index-Based Insurance in the Greater Horn of Africa"; the second session, *Resilience in Upland Crop Production*, explained "Conservation Agriculture in Africa," "Conservation Agriculture in China," and "Drought and Salt Damage in Uzbekistan"; the third session, *Resilience in Paddy Rice Production*, presented "Response to Cyclone damage in Bangladesh," "Weather Index Insurance," and "Climate Change and Irrigation Management"; the fourth session, *Risk Recognition and Monitoring System*, discussed "Preventative control for Desert Locust Pest in Africa: Experiences of Mauritania," "Migration Prediction and Insecticide Resistance Monitoring for Rice Planthoppers," and "Early-warning system against cool weather damages in rice production."

A panel discussion entitled "Role of Technological Development and Japan's Contribution" was conducted by noted specialists in soil, weather, agricultural economy, and biodiversity studies. The discussion revolved around the importance of dynamic and diversified approaches considering profitability, and was concluded with a consensus that the present symposium marked an impotant milestone in resilience-themed research activities.

JIRCAS President Masa Iwanaga opens the symposium.

JIRCAS International Symposium 2012 participants

Panel discussion

Anniversary workshop at the JIRCAS-Africa Liaison Office in Ghana

JIRCAS organized a workshop titled “Collaborative Research Activities of JIRCAS in Ghana -Technologies to enhance rice production and to improve Savanna agriculture in Africa with various approaches-” on 27th September 2012 to celebrate the third anniversary of the JIRCAS-Africa Liaison Office in Accra, Ghana. The workshop began with a presentation outlining its main research activities, followed by the introduction of individual research activities by JIRCAS and other related projects in Ghana. It was attended by many researchers from JIRCAS as well as from related organizations based in Ghana.

JIRCAS has implemented four research projects in Ghana during these three years of collaboration (from July 2009) with African countries. These projects are as follows: (i) Development of improved infrastructure and technologies for rice production in Africa (DIITRPA); (ii) Improvement of soil fertility with use of indigenous resources in rice systems of Sub-Saharan Africa; (iii) Development of low-input rice cultivation system in flood-plains in Africa (FPR, as a feasibility study) and (iv) Development of fish farming in Africa.

Two research projects were launched in Ghana starting from fiscal year 2011, the first year of the 3rd mid-term research plan of JIRCAS. The first was titled “Development of rice production technologies in Africa (DeriptA),” a JIRCAS flagship project under Program B (Stable food production); the second was “Development of technologies for sustainable agricultural production in the African savanna,” a conservation agriculture (CA) sub-project under Program A (Development of agricultural technologies based on sustainable management of the environment and natural resources in developing regions).

The workshop was divided into two sessions in order to generate effective and meaningful discussion for each project. In Session #1, Program A was outlined and CA research activities were explained; in Session #2, Program B was outlined and DeriptA sub-projects were explained.

DeriptA-related projects by other organizations were also presented. Research efforts to improve tolerance to phosphorus deficiency in rice and to define the components of the research study on rain-fed lowlands in Africa, namely, (a) Development of low-cost irrigation facilities applicable to Africa, (b) Farm mechanization, (c) DIITRPA, (d) Soil fertility management, and (e) Agricultural water management, were reported.

Many questions were raised and it inspired fruitful discussions among the participants. They found the research activities in Ghana interesting and they related deeply to the presentations. It is hoped that the workshop outcome and recommendations would be applied by participants and related staff in Ghana in the near future.

The workshop highlighted JIRCAS’s research accomplishments in Ghana.

Workshop participants listened attentively to the presentation.

International Workshop on IITA-Japan Collaboration on Research for Development for Africa

A one-day international workshop titled "IITA-Japan Collaboration on Research for Development for Africa: Current Perspective and Beyond" was held on 14 February 2013 at the JIRCAS International Conference Room, Tsukuba, Japan.

JIRCAS and the International Institute of Tropical Agriculture (IITA) are currently implementing international collaborative research projects on two key traditional crops — yam and cowpea — in West and Central Africa. The workshop was held to provide an overview of the JIRCAS-IITA projects and also report on other ongoing crop-related IITA-Japan projects supported by the Ministry of Agriculture, Forestry and Fisheries (MAFF) and Tokyo University of Agriculture. More than 55 participants attended the workshop including scientists from IITA, the Institut de l'Environnement et de Recherches Agricoles (INERA)-Burkina Faso and Japanese research institutes and universities; graduates and post-graduate students; NGO personnel; and officers from MAFF.

The IITA contingent was led by Director General Nteranya Sanginga, who presented a keynote speech on "Refreshed Strategy and Perspective: IITA's Research for Sustainable Development in sub-Saharan Africa."

In addition to the reporting of ongoing joint research activities, prospective collaborations between IITA and JIRCAS as well as further Africa-Japan cooperation in agricultural research in general were also discussed. The discussion focused on these key topics: "How to emphasize the linkage of Japanese scientific capacities to African agriculture research and development", "What could be the roles of international centers such as JIRCAS and IITA?" and "How to transfer technologies effectively from research to the development stages."

To amplify the discussions, Mr. Teruyoshi Kumashiro, Director General of the Department of Rural Development, Japan International Cooperation Agency (JICA), was invited from the development sector. Prof. Shuichi Asanuma, of the International Cooperation Center for Agricultural Education (ICCAE), Nagoya University, represented the capacity building sector in agricultural sciences and addressed their activities and future prospects.

Dr. Masaru Iwanaga, President of JIRCAS, successfully concluded the workshop, saying, "It is very clear that IITA-JIRCAS or Africa-Japan have lots of opportunities to work together in many areas beyond rice, currently a major area of Japan's international contribution for African agriculture development. It will be a good opportunity to move one step further to strengthen collaboration on Research for Development for Africa."

Participants of the IITA-Japan Workshop

Discussion during the workshop

Dr. N. Sanginga, Director General, IITA

Dr. M. Iwanaga, President, JIRCAS

The Japan International Award for Young Agricultural Researchers

On November 28, 2012, the Awarding Ceremony of the 2012 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.

This is the sixth 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 recipients of the award and their research achievements are as follows:

Dr. Sudisha Jogaiah
Nationality: Republic of India
Institute: University of Mysore
Research Achievement: Antimildew compounds from wood rot fungi and sequence characterized amplified region markers associated with downy mildew disease resistance in pearl millet

Ms. Kanokwan Srirattana
Nationality: Kingdom of Thailand
Institute: Suranaree University of Technology
Research Achievement: Improvement of reproductive biotechnology techniques for livestock and endangered species

Dr. Lijun Yin
Nationality: People's Republic of China
Institute: China Agricultural University
Research Achievement: Development of technology for quality and functionality improvement of traditional foods, and application of novel emulsifying technology for new processing system

Awardees, members of the Selection Committee and other officials

NEW RESEARCH COLLABORATION

New global partnership initiatives to accelerate agricultural research

The G20 conferences held in France in 2011 discussed many new initiatives relating to agricultural research. Following the G20 Conference on Agricultural Research for Development, a place of opinion exchange among national representatives of agricultural research, the Meeting of the G20 Agricultural Chief Scientists (MACS), was held in Mexico in 2012. President Masa Iwanaga of JIRCAS attended on behalf of Japan. Also, JIRCAS represents Japan in the Wheat Initiative (WI), a forum of coordination in global wheat research launched in 2011, with solid support from France. WI aims to facilitate communication among G20 research institutes and other groups and organizations worldwide, complimenting existing frameworks such as the CGIAR Research Programs. International organizations and private companies are also participating as members. JIRCAS, as a member of WI, acts as the focal point in Japan by communicating with domestic research institutions engaged in wheat research.

Table: Public research organization members of WI as of May 2013

Member	Institution
Argentina	Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET)
Australia	Grains Research and Development Corporation (GRDC)
Canada	Agriculture and Agri-Food Canada
France	National Institute for Agricultural Research (INRA)
Germany	Federal Ministry of Food, Agriculture and Consumer Protection (BMELV)
Italy	Ministero delle politiche Agricole Alimentari e Forestali (MiPAAF)
Japan	Japan International Research Center for Agricultural Sciences
Turkey	General Directorate of Agricultural Research and Policy (GDAR)
UK	Biotechnology and Biological Sciences Research Council (BBSRC)
USA	US Department of Agriculture (USDA)
International	International Maize and Wheat Improvement Center CIMMYT
International	International Center for Agricultural Research in the Dry Areas (ICARDA)

In addition, a G20 initiative called the Tropical Agriculture Platform (TAP) was officially launched at the MACS in Mexico. The basic idea was approved during the G20 meetings in 2011, prior to an informal stakeholder meeting which determined the framework defining its roles. TAP provides a mechanism for fostering linkages among relevant existing multi-partner initiatives in capacity development and knowledge sharing for improved agricultural production in the tropics. FAO will serve as the Secretariat while France, China and others will provide the necessary funds. JIRCAS is currently the sole partner-member of TAP from Japan, and will provide necessary information on capacity building and knowledge sharing in Japan.

In October 2012, the second Global Conference on Agricultural Research for Development (GCARD) was held in Uruguay, South America. It was especially important for setting global research targets because most of the stakeholders were gathered during the event. JIRCAS actively participated by providing personnel support to the Global Forum of Agricultural Research (GFAR), the secretariat of the conference. There were discussions about the mechanisms for partnership, capacity building and information sharing to achieve global and regional research targets.

Figure: List of TAP Partners

OPEN RESEARCH FACILITIES (Lysimeters)

Open research facilities (lysimeters) were constructed and installed at the Tropical Agricultural Research Front in 2003 in order to accelerate activities on reducing soil and water quality deterioration and to increase water use efficiency in island environments. The facilities consist of outdoor weighing and non-weighing lysimeters as well as indoor non-weighing lysimeters, artificially prepared sloping fields and artificially constructed waterways. These are used for analyzing evapotranspiration, fertilizer and water release, water use by plants, the extent of soil erosion, water quality, etc.

The lysimeters are attached to a sump for capturing drained water and nutrients, and to irrigation pipes from the bottom to supply water. Rhizotrons were constructed to observe rooting behavior, and the latest sensors and instruments were installed to measure environmental conditions under the ground. The equipment for water observation, soil physics analysis, water quality and root development measurement, transpiration and soil erosion estimation as well as plant water measuring operation are also linked to the lysimeter system.

The facilities are open to researchers interested in the environmental conservation of agricultural ecosystems. JIRCAS Newsletter No.64 (September 2012 issue) highlighted our recent research projects using the facilities. Collaborative research programs were also carried out with outside research organizations. In 2012 four universities and one private sector entity utilized the facilities under this program. In addition, two universities utilized the facilities for their own research purposes.

We hold operating committee meetings four times a year to discuss effective utilization and extensive publicity campaigns for the facilities. We have started collecting fees for the use of equipment (free of charge to joint researchers) in accordance with the operating regulations revised in 2012.

Panoramic view of the Environmental Technology Development Complex (Open Lab)

ACADEMIC PRIZES AND AWARDS

"Encouragement Award for Young Scientists" from the Japanese Society of Soil Science and Plant Nutrition

Dr. Mitsuhiro Obara, Researcher of the Biological and Post-harvest Division, received the Encouragement Award for Young Scientists from the Japanese Society of Soil Science and Plant Nutrition in April 2012. This award was given for his research achievement titled "Studies on nitrogen utilization in rice."

Dr. Obara has studied nitrogen utilization of rice using physiological and genetic approaches for a decade. His studies focused on the genetic variation of candidate enzymes which play central functions in nitrogen remobilization, the characterization of genetic factors affecting protein content, and the identification of genes responsible for nitrogen uptake upon successful establishment of precise growth condition.

Dr. Obara receives the award during the 20th Annual Meeting of the Japanese Society of Soil Science and Plant Nutrition (JSSSPN).

"International Contribution Award" for the development and verification of an autonomous well rehabilitation and maintenance system by local herders in Mongolia

Mr. Takeshi Matsumoto, Senior Researcher of JIRCAS together with Mr. Isamu Yamanaka, Senior Engineer of NTC INTERNATIONAL Co., Ltd. received the "International Contribution Award" from the Japanese Society of Irrigation, Drainage and Rural Engineering in September 2012 for their research and activities for the development and verification of an autonomous well rehabilitation and maintenance system by local herders in Mongolia.

Water wells are the main water sources for livestock across a wide range of pastures in Mongolia; however, inventory revealed that the wells were in an advanced state of disrepair such that it had become difficult to use effectively and sustainably. The reasons for the water wells' conditions include poor maintenance due to lack of knowledge on repair techniques, non-existence of a well maintenance system, and insufficient budget.

Their activities have led to the development of a new mechanism in Mongolia that allows local herders to maintain and repair pasture wells by themselves through combined application of the following: 1) the formation of a herders' group in the region to clarify each other's responsibilities in maintaining water wells, 2) the creation of competent "well repair teams" within local governments to ensure that technical support for maintaining/repairing wells is accessible throughout the region, and 3) the establishment of the "sheep fund" to raise money for maintaining/repairing wells. This mechanism was promoted and actually expanded through demonstrations at the local levels.

Not only has this mechanism been actively adopted by local herders and local governments in the demonstration regions, but has also been spreading steadily in the surrounding regions. It is expected to be practiced over wide areas of Mongolia in the future.

"Young Scientist Award" from the Crop Science Society of Japan

Dr. Chiharu Sone, Research Assistant of the Crop, Livestock and Environment Division, received the "Young Scientist Award" from the Crop Science Society of Japan in October 2012. This award was given for her research summarized below:

<u>Growth inhibiting factors in NERICA cultivars grown on infertile saline soil</u>

Salinity tolerance in an interspecific progeny NERICA1 derived from the cross of WAB56-104 (*O. sativa*) and CG14 (*O. glaberrima*) decreased with an increase in shoot sodium concentration. Also, shoot sodium accumulation under salt stress was quicker and higher in nutrient-poor soils than in paddy soils. Therefore, to cultivate NERICA1 in saline and nutrient-poor soils, application of nitrogen and phosphorus is necessary. Nitrogen is essential for cultivation while phosphorus (applied in combination with nitrogen) is vital in enhancing plant dry matter production.

Developing an evaluation system of submergence resistance in rice by measuring photosynthetic activity

To clarify the mechanism of submergence tolerance in rice, a quick and easy method to evaluate photodamage directly underwater was developed using a pulse amplitude modulation chlorophyll fluorescence meter with a waterproof probe. Photosynthetic maximum quantum yield (Fv/Fm) of the submerged leaves showed significant positive correlation with chlorophyll content, though it decreased earlier in the susceptible cultivar. The suppression of photodamage and chlorophyll breakdown in the leaves of tolerance cultivars would help enhance post-submergence recovery.

Certificate of Appreciation for collaborative research on shrimp biology in northern Laos

In January 2007, JIRCAS, together with the Living Aquatic Resources Research Center (LARReC), started collaborative research on stock management of the indigenous shrimp, *Macrobrachium yui*, in northern Laos. At the beginning of the project, there was not much biological information on the fluvial shrimp. Therefore, after undertaking species identification, we studied its biological characteristics by ecological and molecular genetic approaches. As a result, we were able to verify that *M. yui* reproduce only in cave streams within the river system where they were born.

Based on *M. yui's* biological characteristics and at the initiative of the villagers, shrimp fishing in cave streams at the peak of the breeding season (August) was prohibited. Two months after enforcement began in August 2011, larval shrimp emerged as usual in October and peaked in November. Remarkably, the number of larval shrimp was maintained at a high level for a few months, with the total number recorded for the year equivalent to three times the average (Figure).

Because the number of larval shrimp increased sharply even though the number of adult shrimp migrating into the cave stream was normal, we judged that it was probably due to shrimp fishing prohibition. The villagers who heard this result approached district officials to extend their thanks to JIRCAS. Subsequently, the Pak Xuang district government, in a simple ceremony, expressed their gratitude by presenting JIRCAS a Certificate of Appreciation for its collaborative research activities that have improved shrimp stock recovery to long-term sustainable yield levels (Photo).

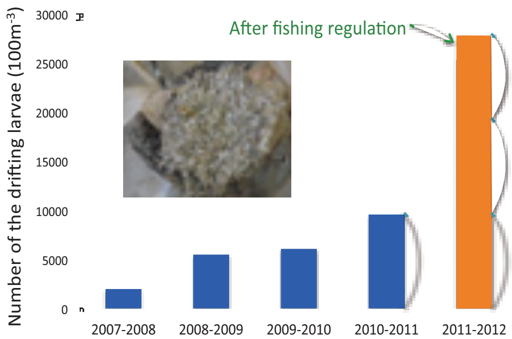


Figure: Comparison of larval shrimp abundance before and after enforcement of the shrimp fishing prohibition

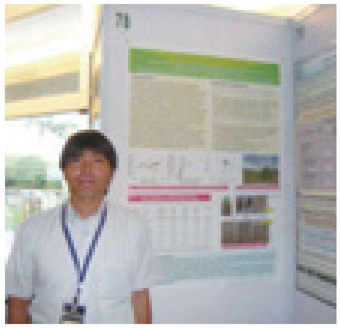
Photo: Dr. Ito, on behalf of JIRCAS, received the Certificate of Appreciation from Mr. Kerjajoengtour, head of Pak-Xuang district, at Na-Pho village on 30 July 2012.

"Best Poster" Prize at the International Symposium on New Paradigms in Sugarcane Research

Mr. Yoshifumi Terajima, Senior Researcher of JIRCAS-TARF, received the "Best Poster" prize during the "International Symposium on New Paradigms in Sugarcane Research" in October 2012 for his research titled ''Characteristics of inter-generic hybrids between sugarcane and *Erianthus* spp.''.

Erianthus, a wild relative of sugarcane, is a high biomass yielding perennial grass that has high adaptability to adverse environments because of its big and deep root system. Through his poster, Mr. Terajima showed the possibility of improving sugarcane root systems using *Erianthus* as breeding materials.

JIRCAS has been undertaking a collaborative research project titled ‘’Development of new type of sugarcane with high biomass productivity under adverse agricultural environments by using wild relatives’’ with the Khon Kaen Field Crops Research Center in Thailand since 2011. Researchers in this project have been evaluating and utilizing *Erianthus* to develop good breeding materials for generating a new type of sugarcane in Northeast Thailand.



Mr. Terajima and his prize-winning poster

Souvenir and certificate of appreciation from the Governor of Uvurkhangai in Mongolia

Mr. Yasuo Kamiya had participated in the implementation of three rural development and grassland conservation projects in Uvurkhangai Prefecture for over seven years. His first project in Uvurkhangai was titled “Development of planning methods for a participatory management of rangelands to combat yellow dust outbreaks at source area” (abbreviated: Rangeland Management Project); his second was named “The urgent study of *Dzud*” (cold season disaster by snow and cold); and his third was called “Development of resilient agro-pastoral systems against the risks of extreme weather events in arid grasslands in Northeast Asia (abbreviated designation: Grass Risk).”

‘Rangeland Management Project’ was conducted in order to prevent and control dust and sandstorm (DSS) by building the capacity of local nomads and government officers, and by implementing a regional grassland management program through preservation and recovery of natural resources.

Commemorative photo. (From left: Mr. Kunihiro Doi, JIRCAS Director for Rural Development; Mr. Togtokhsuren, Uvurkhangai Governor; Mr. Kamiya; Mr. Gaubold, Chief of Staff, Governor’s Office; Mr. Tsedenbaljir, Food and Small Business Manager; and Mr. Yondonsanbu, Livestock Manager)

The publication of guidelines (for rangeland utilization planning) and technical manuals (for vegetation recovery) were formulated as outputs of the project. The guidelines and technical manuals have been used not only in Uvurkhangai Prefecture but in the whole country of Mongolia. Furthermore, Mr. Kamiya’s research activities addressed some technical challenges through the manufacture of fuel blocks and the development of water wells using the ‘sheep fund.’ These solutions will be implemented throughout the entire Uvurkhangai Prefecture.

In recognition of his efforts for over seven years, Mr. Kamiya was honored by the Governor of Uvurkhangai Prefecture with a souvenir and a certificate of appreciation on March 11, 2013.

Mr. Kamiya receives the souvenir and certificate of appreciation from Uvurkhangai Governor Togtokhsuren.

Memorabilia and testimonial from the Uvurkhangai Governor

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 2012 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 2013.
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 2013.

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 2013.

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 2012 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 95 MOUs or JRAs remained in force at the end of FY 2012.

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 2012, 149 JIRCAS researchers or administrators were dispatched abroad for a total of 602 duties. Likewise, we have 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.

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.

【Analysis of climate change impacts】

The impact of climate change is being analyzed by modeling. A method to estimate rice production in 1km mesh in Bangladesh using multiple regression analysis and GIS was developed. Basic data for probabilistic analysis was obtained in order to develop a country-level crop supply-and-demand model that can incorporate the effect of extreme events. This basic data include a new category looking at the cause of disasters instead of their results, and comprises statistics on agricultural damage covering various damage items. A crop model was incorporated into a rice supply-and-demand model for the development of a world food model for long-term outlook. Datasets were prepared and parameters were set for the world food model.

【Adaptation measures to climate change】

Bias correction of seasonal forecast was applied to the Ocean-Atmosphere Coupled Model (SINTEX-F) and it was confirmed that temperature and rainfall at the project site in Laos can be predicted with high accuracy. Near-isogenic lines of IR64 introduced with QTLs, which can increase the number of spikelets per panicle, was developed in a series of activities for the development of climate-proof rice.

【Mitigation measures】

Baseline data on methane emission from ruminants was measured using the respiration analysis systems installed in Khon Kaen, Thailand and Can Tho, Vietnam. Maintaining yield despite reductions in water supply allocations and methane emission from paddy fields was demonstrated by applying a water-saving irrigation technology during a year-long trial at a private farm in Mekong Delta, Vietnam.

【Development of models for sustainable rural communities with low GHG emissions through CDM project implementation】

A demonstration farm was set up in Tigray, Ethiopia and experiments on reforestation, agroforestry (i.e., incorporating crops with trees), soil and water conservation technology, and soil fertility recovering technology (green manure) have been initiated. In Paraguay, a forestry CDM project monitoring activity was conducted and CDM programmes of activities were initiated. A CDM project introducing biogas digesters in Vietnam was registered with the UNFCCC CDM Executive Board.

【Biological Nitrification Inhibition】

It was shown that there are hydrophilic and hydrophobic compounds in the roots of sorghum; this latter compound was identified as Sorgoleone. A new method to evaluate Sorgoleone production was developed. Root exudates collected from acidity-tolerant sorghum genetic stocks showed lower nitrification activities.

【Resilient agro-pastoral sytems in Northeast Asia】

Resilient agro-pastoral systems against the risks of extreme weather events are being developed in Mongolia. A prototype pasture yield map was developed by adjusting the pasture yield estimation equation with spectroscopy data. The effectiveness of brewer's grains silage supplementation was demonstrated in animal production. Based on farm economy surveys, extreme weather events did not seriously affect cash income but the effects on consumption lasted longer. Regarding the sedentarization project for pastoralists in Xinjiang, China, guidelines and technical manuals for technological support for the settled pastoralists were published based on the technical knowhow obtained from pilot projects.

【Sustainable agricultural production in the African savanna】

Experiments on the effect of conservation agriculture on sloping fields and multi-location trials of maize or sorghum with relayed leguminous crops were initiated in Ghana and Burkina Faso. Evaluation of soybean/maize inter-cropping systems in the Nacala Corridor of Mozambique, the Southern African savanna regions, revealed that its Land Equivalent Ratio (LER), when late varieties of soybean and maize were sown at the same time, can be improved in comparison with mono-cropping systems. For the western regions such as Mali and Niger where natural resources are deteriorating, guidelines and technical manuals on natural resource management technologies were published to protect arable land and vegetation, and to attain agricultural sustainability in Mali and Niger.

【Island environment conservation】

Freshwater lenses exist near the ground surface in the Republic of the Marshall Islands. The hydraulic parameters of these aquifers were calculated by stage pumping test to develop the technology for the effective use of water resources in the islands. As for the development of the solar desalination device, it was determined that not only could the heat absorption rate in heat collector be improved, lightening the weight of the whole device could also be accomplished.

TOPIC 1

Estimation of rice production in 1km mesh in Bangladesh using multiple regression analysis and GIS

Impact assessments and countermeasures to global climate change are urgently required in developing countries vulnerable to environmental fluctuations. Agricultural systems in developing countries significantly depend on natural conditions, hence principal production areas are likely to be established in areas where meet adequate land and climate conditions for cultivation. Potential land suitability maps independent from climate condition are necessary in order to assess the impact of climate change to principal production areas, i.e., suitable areas, spatially and quantitatively.

To this end, a method to estimate rainy and dry season rice production in 1km mesh in Bangladesh was developed using multiple regression analysis and GIS with fundamental geospatial dataset. This proposed model (Fig.1) employed several combinations of six land factors representing Slope (3 categories), Land Type (5 categories), Soil Texture (5 categories), Drainage (6 categories), Soil Permeability (3 categories), and Soil Salinity (4 categories) derived from Bangladesh Country Almanac (BCA) Ver.3. The BCA, prepared and provided by CIMMYT-Bangladesh, is a national geospatial dataset containing sub-district level information.

The distributed areas of 26 attributes, representing six land factors in 463 sub-districts (or Thana), were assumed as explanatory variables while the productions of rainy and dry season rice in 2002-2003 were respectively assumed as response variable and then, a multiple regression analysis was executed. Adjusted coefficients of determination (adjusted R^2) of the multiple regression equations for rainy and dry season rice were significantly high at 0.903 and 0.823, respectively.

The partial regression coefficients were assigned into attribute tables for six land factor maps, and then rice production per 1 km x 1 km mesh was estimated by map calculation in GIS (Figs. 2 and 3). The total amount of map calculation compiled by new and old provincial boundaries showed high correlation with rice productions in the statistics, and the mean error in each province was within 23-33% (Table 1). This implied that the distribution of production for each mesh was accurate.

The estimated rice production in 1-km mesh is available for "baseline," i.e., the initial value under current climate condition for climate change impact assessment. When statistics and map data are available, categorical data can be manipulated as quantitative variables in such a manner that the area of each attribute is applied for explanatory variables. It provides scalability and versatility for model development. However, this method is intended only for estimating production by the combination of attributes, not for determining the contribution of each attribute.

(Y. Yamamoto, S. Kobayashi, J. Furuya, Md. S. Kabir [Bangladesh Rice Research Institute])

Supposing that:

- ➢ Production in T district = Σ (Production in each mesh)
- ➢ Production in the mesh which has same combination of attributes are same

Production in T district $=\Sigma(\alpha_i \bullet Ma_i)+\Sigma(\beta_i \bullet Mb_i)+\bullet\bullet\bullet+\Sigma(\varepsilon_i \bullet Mf_i)$

where

α_i, $\beta_i \bullet\bullet\bullet$ ε_i : coefficients of attribute i in factor α, b,••• f

Fig. 1. Concept of the model

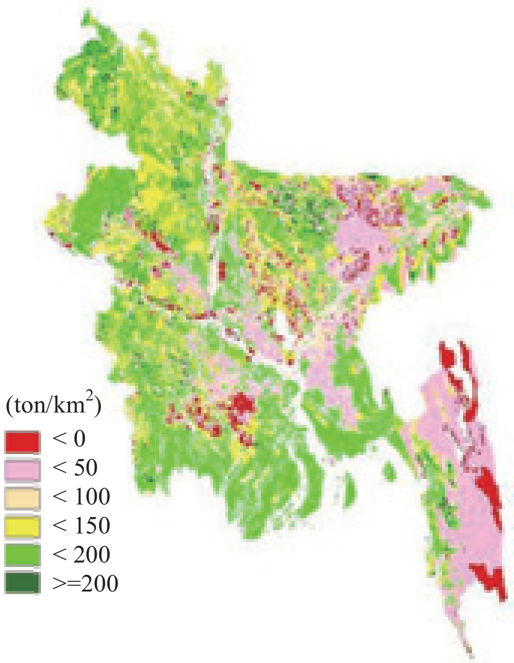


Fig. 2. Estimated production map for rainy season rice

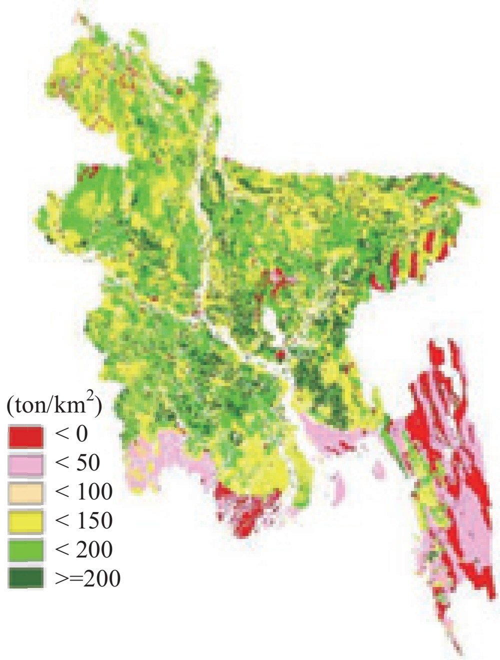


Fig. 3. Estimated production map for dry season rice

Table 1. Accuracy of estimation to statistics of 21(old) / 64 (new) provinces

Target	Accuracy	21 Provinces	64 Provinces
Rainy season rice	Correlation to statistics	0.827	0.925
	Mean error (%)	23.2	31.3
Dry season rice	Correlation to statistics	0.806	0.867
	Mean error (%)	28.6 [a]	33.3 [b]

[a] Excluded one prefecture in which production was under 2,000 tons

[b] Excluded four prefectures in which production was under 20,000 tons

A projection method to estimate global warming impacts on vegetable production

Projecting future impacts of climate change is important in considering appropriate coping and adaptation measures. The importance of projections also applies to agriculture and food supply, and many have already been generated to predict future trends. However, most projections are limited to cereals with only a few studies focusing on vegetables.

One reason why vegetables are less focused on is that the number of items and varieties of vegetables are too many to develop respective crop models used for projections. Another reason is that vegetables are considered less important than cereals in terms of food security. However, there are some regions whose economies depend largely on vegetable production. For such regions, projecting climate change impacts on vegetable production is more important. Therefore, the purpose of this study is to consider a projection method for vegetables as an alternative to crop model.

There are some countries, including Japan, where vegetables are cultivated all year round, using both open fields and horticultural facilities like greenhouses, and following product standards. In such countries, production costs of vegetables grown during unfavorable seasons are likely to be higher than those grown during favorable seasons due to the use of adaptation technologies. Therefore, assuming that average air temperature during cultivation period is a representative index of meteorological condition, we hypothesized that production costs increase when the average temperatures of cultivation environments are higher or lower than the optimal temperature ranges, and that the costs make downward-convex curves (Fig. 1).

To investigate the hypothesis, regression analysis was applied to data on production costs and cultivation environments of 15 vegetable types in Japan. Regression analysis showed that: some items have relatively high determination coefficients and follow the convex curves of the hypothesis (Fig. 2); other items have relatively high determination coefficients but do not include the interior minimum points of the convex curves (Fig. 3); and others have low determination coefficients. These three patterns are summarized in Fig. 4.

Relatively high determination coefficients imply that vegetable cultivation at temperatures below or above optimal range has introduced some adaptation methods, which vary production cost. To ascertain the substance of adaptation methods, regression analysis between temperature and itemized production costs was employed. Results show that the cost of fertilizers, chemicals, energy and power, seedlings, and management are sensitive to temperature, and that they are thought to be closely related to adaptation methods. Of the vegetables whose curves have interior minimum points (Fig. 2), some have minimal cost points lower than optimal temperature ranges for plant growth. Investigation of itemized production cost data of the vegetables reveals that costs for quality preservation after harvesting, e.g., cleaning, shipping preparation, and packing costs, can reach high values even within optimal temperature ranges. This implies that temperature ranges optimal for plant growth are not necessarily optimal in terms of production cost.

The impact of temperature change on vegetable production due to climate change can be projected by measuring the change in production cost along the estimated production cost curve (Fig. 4). The data used for this analysis was derived from main production areas. If data can also be derived from small production areas whose temperatures are warmer, anticipated dot-lines in Fig. 4 can be estimated. In order to deal with many vegetables, this study adopted only average air temperature during cultivation period as the explaining variable, and did not distinguish varieties of a vegetable. Use of variables suitable for each vegetable and varietal analysis are expected to improve the statistical significance of the regression analysis.

(S. Kobayashi, J. Furuya, and Y. Yamamoto)

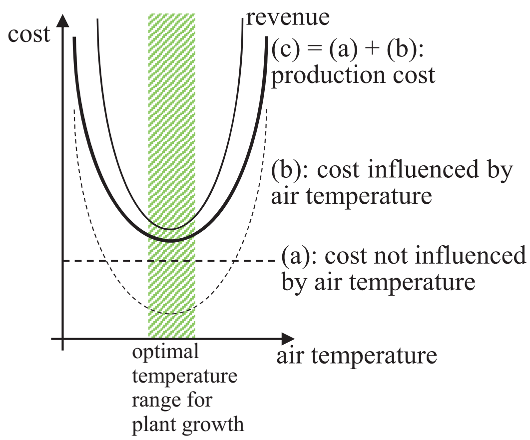


Fig. 1. Hypothesis of vegetable production cost

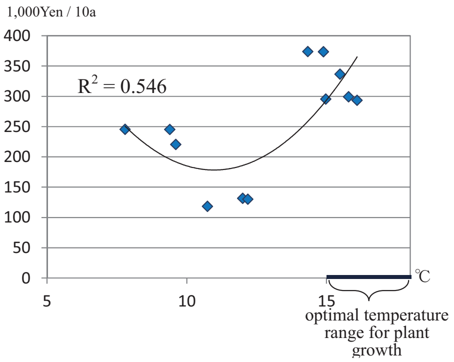


Fig. 2. Production cost curve similar to the hypothesis (spinach). Shishito pepper and eggplant reveal the same pattern. They are summarized as pattern (i) in Fig. 4.

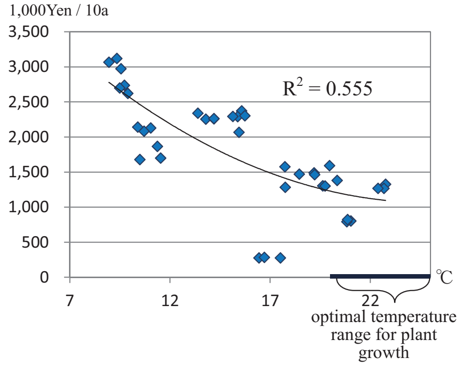


Fig. 3. Production cost curve without interior minimal point (tomato). Cucumber and watermelon reveal the same pattern. They are summarized as pattern (ii) in Fig. 4.

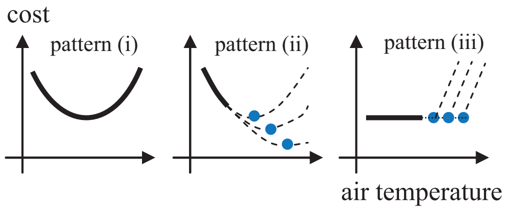


Fig. 4.Auxiliary hypothesis of vegetable production cost. Dot-lines in patterns (ii) and (iii) cannot be observed from the data used for this analysis, but they are believed to exist. Pattern (iii) includes green onion, carrot, and Chinese cabbage. In Japan, they are usually cultivated not in horticultural facilities but in open fields. Differences in temperature have the possibility of influencing not only production cost but also land productivity. Additional analysis for pattern (iii) may be required.

TOPIC 3

Near-isogenic lines carrying QTL for high spikelet number with the genetic background of IR64, an Indica-type rice variety

IR64, recognized globally as a high quality Indica-type rice variety, was first released by the International Rice Research Institute (IRRI) in 1985. To improve the yield potential of IR64, a set of near-isogenic lines (NILs) of IR64 with increased total spikelet number per panicle (TSN) was developed using New Plant Type (NPT) varieties as tropical Japonica-type donor parents.

A total of five NILs derived from different donor parents were developed through marker-assisted selection. Regardless of the donor parents, Quantitative Trait Locus (QTL) for high TSN was detected on common region of the long arm of chromosome 4 (Table 1, Fig. 1). We designated this QTL as *qTSN4*. Marker information linked to *qTSN4* is shown in Table 1. NILs have 196-239 spikelets per panicle (i.e., 40-70% greater TSN than IR64), which is attributed to the increase in larger number of spikelets on the secondary and ternary rachis branches. Variation in TSN was observed among NILs; the number of spikelets was greatest in IR64-NIL2 (IR65564-2-2-3 as donor parent) and in IR64-NIL4 (IR66215-44-2-3 as donor parent).

In this study, we succeeded in developing five NILs for high TSN with a rice variety (IR64) genetic background by employing molecular marker-assisted selection. The materials are expected to be useful for enhancing the yield potential of rice varieties. These NILs are also available for understanding the genetic basis of TSN and the effects of single QTL/gene by testing it under different environmental conditions. Further investigation is required to determine if the variation in panicle architecture is simply due to the allelic effects or not.

(Nobuya Kobayashi, Daisuke Fujita [NICS/JSPS], Analiza G. Tagle [IRRI], Leodegario A. Ebron [IRRI], Yoshimichi Fukuta, Tsutomu Ishimaru)

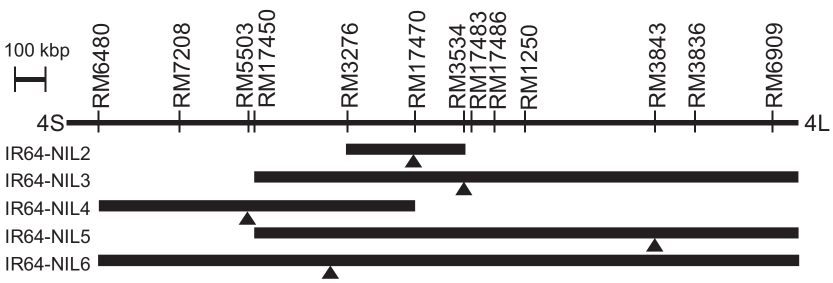


Fig. 1. The location of QTLs for spikelet number per panicle on the long arm of chromosome 4. Arrowheads indicate the location of peak LOD score.

Table 1. Marker information on QTLs and panicle structure of IR64 and its NILs for high TSN

Variety/Line	Donor parent (NPT variety)	Marker[A]	Total spikelet number per panicle[B]	Number of rachis per panicle[B]		
				Primary rachis	Secondary rachis	Ternary rachis
IR64	-		141.2±17.8 c	9.2± 0.4 c	28.6± 4.0 c	1.3± 1.1 c
IR64-NIL2	IR65564-2-2-3	*RM17470* - *RM3534*	233.9±22.6 a	10.6± 0.8 ab	46.8± 4.7 a	11.2± 3.2 a
IR64-NIL3	IR69093-41-2-3-2	*RM3534* - *RM17486*	196.4±19.1 b	11.3± 0.7 a	37.2± 3.5 b	1.9± 2.3 c
IR64-NIL4	IR66215-44-2-3	*RM6480* - *RM5503*	239.4±36.4 a	10.9± 0.7 a	46.2± 6.4 a	6.8± 4.3 b
IR64-NIL5	IR68522-10-2-2	*RM3843* - *RM1113*	197.6±19.6 b	10.8± 0.8 ab	39.4± 3.8 b	2.3± 1.5 c
IR64-NIL6	IR66750-6-2-1	*RM17450* - *RM17470*	213.5±25.3 ab	9.8± 0.9 bc	43.1± 5.3 ab	6.9± 1.8 b

A) Flanking markers for qTSN4. Underlines show the nearest marker.
B) Data was obtained in the dry season of 2009 in IRRI (values are indicated as average ±SD). Different letters (a, b and c) indicate significant difference at 5% by Tukey-Kramer's test.

Fig. 2. Panicle architecture of IR64 and its NILs for increased spikelet number

TOPIC 4

Identification and characterization of biological nitrification inhibition (BNI) substances in sorghum root

Nitrification, one of several pathways in the soil-N cycle, results in the microbiological conversion of relatively immobile NH_4^+ into highly mobile NO_3^- (which is susceptible to losses through leaching [NO_3^- leaching]), and gaseous N emissions (N_2O, NO and N_2) by denitrification. The price of nitrogen fertilizer has been rising in recent years. Controlling nitrification through suppression of nitrifier activity is thus critical to improving nitrogen use efficiency (NUE) of agricultural production systems. Suppressing soil nitrification through the release of nitrification inhibitors from plant roots is termed 'biological nitrification inhibition' (BNI). This present study aims to characterize BNI function in sorghum, in particular the production of inhibitors, their chemical identity, functionality, and factors regulating their release.

Sorghum roots release two types of nitrification inhibitors: hydrophilic-BNIs and hydrophobic-BNIs. The former were those released into water-based collection medium while the latter are those released by washing the roots for 30s with dichloromethane (DCM), which has high affinity for hydrophobic compounds.

Three nitrification inhibitors -- MHPP (methyl 3-(4-hydroxyphenyl) propionate), sakuranetin (5,4'-dihydroxy-7-methoxyflavanone) (isolated from hydrophilic BNI activity), and sorgoleone (2-hydroxy-5-methoxy-3-[(8'Z,11'Z)-8',11',14'-pentadecatriene]-*p*-benzoquinone)(isolated from hydrophobic BNI activity) -- were isolated from the inhibitory activity released from sorghum roots (Fig. 1). The release of nitrification inhibitors required the presence of NH_4^+, whose stimulatory effect lasted 24h, in the root environment (Fig. 2). The release of hydrophilic-BNIs declined at rhizosphere pH > 5.0. Nearly 80% of hydrophilic-BNI released was suppressed at pH ≥7.0 (Fig. 3). A bioluminescence assay using recombinant *Nitrosomonas europaea* was employed to determine BNI activity. The ED_{80} (effective dose for 80% inhibition Nitrosomonas function) for sakuranetin, sorgoleone, and MHPP was 0.6 μM, 12.0 μM, and >120 μM, respectively (Fig. 4).

These results are useful as fundamental knowledge towards utilization research of BNI in sorghum. We should clarify the field conditions in which sorghum BNI is the most efficient and investigate the BNI activity of each substance in the soil. We need to establish reliable screening techniques and selection criteria for breeding.

(G. V. Subbarao, K. Nakahara, H. A. K. M. Zakir, T. Ishikawa, T. Yoshihashi, Y. Ono [National Food Research Institute], M. Yoshida [National Food Research Institute])

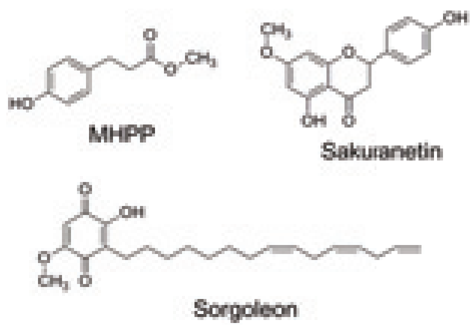


Fig. 1. BNI compounds from sorghum root

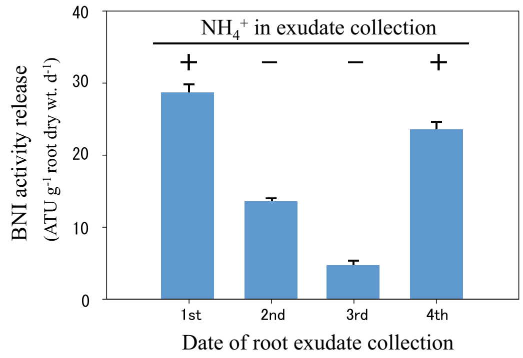


Fig. 2. Influence of NH_4^+ in the root exudate collection solutions on BNI activity release from sorghum roots; root exudate was collected every day by exchanged collection solution using one plant.

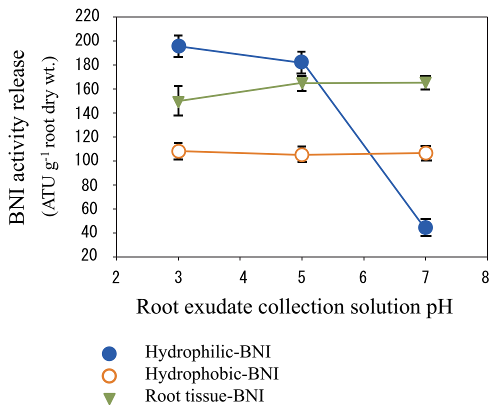


Fig. 3. Influence root exudate collection solution pH on the BNI release in sorghum

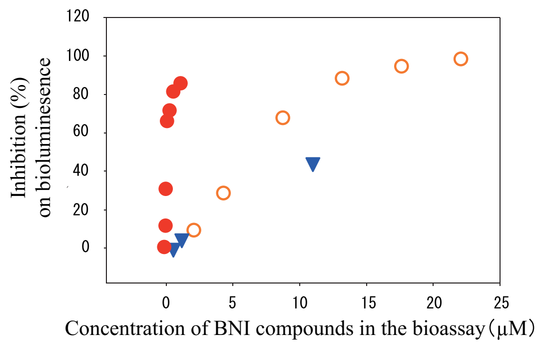


Fig. 4. Relative effectiveness of sakuranetin (●),sorgoleone (○) and MHPP (▼) in inhibiting *Nitrosomonas* activity *in vitro*

TOPIC 5

Registration of a biogas CDM project in Viet Nam with the UNFCCC CDM Executive Board (CDM-EB)

The Clean Development Mechanism (CDM) is a system which aims to reduce emission of greenhouse gases (GHGs) through the implementation of emission reduction projects in developing countries. The reduced emission is converted to credits (Certified Emission Reduction: CER) and traded in developed countries (Annex I countries in the Kyoto Protocol).

In Viet Nam, a CDM project that reduces GHG emission and contributes to rural development was established, expecting that the methodology developed from the research study would be used as basis for similar future projects. Biogas digesters (BDs) for treating farm wastes, sewage, etc. were introduced to low-income communities to produce biogas, a renewable fuel that can be used as fuel wood and LP gas substitutes for heating and cooking purposes.

In formulating a CDM project in rural areas of developing countries, the most important thing is to establish an organized system, from selecting beneficiary households in small and wide areas, to introducing GHG emission reduction technologies, monitoring, and obtaining carbon credits. In this CDM project, 34 farmer leaders (called "Key Farmer: KF") from three districts were trained and developed to serve as promoters and provide guidance to beneficiary households in installing, operating and maintaining BDs, as well as in monitoring emission reduction.

After introducing BDs to individual households, the volume of GHG emission reduction was estimated. JIRCAS and Can Tho University (CTU) researchers conducted studies and experiments to quantify the following: 1) woody biomass stock in Can Tho City, 2) fuel demand in rural area, 3) fraction of non-renewable woody biomass, 4) reduction of nonrenewable fuel use which will be substituted by BD and 5) number of participant households. Annual GHG emission reduction by the project was 1,203 t-CO_2, with 961 households participating (Tables 1 and 2).

The above-mentioned CDM project, titled "Farm Household Biogas Project Contributing to Rural Development in Can Tho City," was registered on 15 August 2012 with the UNFCCC

CDM-EB after approval by the governments of Japan and Viet Nam (Fig. 1). This project, introducing an economical plastic type BD (Fig. 2), was the first biogas CDM project formulated by a Japanese entity to directly benefit low-income households (by contributing to livelihood improvement) as well as the environment (by emission reduction of GHG).

In order to use the BDs continuously, appropriate pig-raising techniques and maintenance of BDs should be conducted based on the technical manuals prepared by JIRCAS and CTU.

Small-scale CDM projects like this one has scale demerit (i.e., the cost of project formulation, registration, subsidy of materials, technical support, validation and verification may not be covered by its advantages). The expectation is that private companies will participate in the project and purchase carbon credits, taking into account the expected co-benefits such as compliance to CSR (Corporate Social Responsibility), creation of BOP (Base of the pyramid) business opportunity to low income communities, and provision of additional fund to cover the shortfall.

(E. Matsubara, T. Izumi, A. Taminato, Y. Iizumi)

Table 1. Data for estimating the volume of GHG emission reduction

Item	Value	Remarks	
① Woody biomass in Can Tho City			
Average biomass	18.82 tC/ha	a	Baseline survey
Area of forest and orchard	14,592.82 ha	b	Can Tho City
Total biomass in forest and orchard	274,637 tC	c=a*b	
Annual growth rate of woody biomass	12.38 %	d	IPCC
Annual incremental woody biomass	34,000 tC/yr	e=c*d	
② Fuel demand in rural area			
(Fuel wood)	1.58 t/yr	f	3.8 persons / household
Rural population	563,326 人	g	2008, Can Tho City
Fuel wood use in rural area	233,799 t/yr	h=f/3.8*g	
Carbon volume	116,900 tC/yr	i=h*0.5	Carbon fraction: 0.5 (IPCC)
(LPG)	17.8 kg/yr	j	
③ Fraction of non-renewable woody biomass			
	70 %	k=1-e/i	
④ Substitution of fuel use with renewable biogas			
	Based on monitoring activities, it is confirmed that fuel for cooking was fully substituted with biogas from BD installed at households.		
⑤ Number of participant households			
	961 hh	l	

Table 2. Volume of GHG emission reduction

Present GHG emission		
Fuel wood	Fuel wood demand per household	1.58 t/yr
	Fraction of non-renewable woody biomass	70%
	non-renewable woody biomass demand per household	1.11 t/yr
	GHG emission from fuel wood use per household	1.41 tCO_2/yr
LPG	LPG demand per household	17.80 kg/yr
	GHG emission from LPG use per household	0.05 tCO_2/yr
Total	GHG emission from cooking per household	1.46 tCO_2/yr
	GHG emission from cooking per 961 households	1,403 tCO_2/yr
GHG emission reduction by CDM project		
Year 1	Unit in operation: 241	352 tCO_2
Year 2	Unit in operation: 721	1,053 tCO_2
Year 3	Unit in operation: 961	1,403 tCO_2
Year 4	Unit in operation: 961	1,403 tCO_2
Year 5	Unit in operation: 961	1,403 tCO_2
Year 6	Unit in operation: 961	1,403 tCO_2
Year 7	Unit in operation: 961	1,403 tCO_2
Total		8,420 tCO_2
Average		1,203 tCO_2

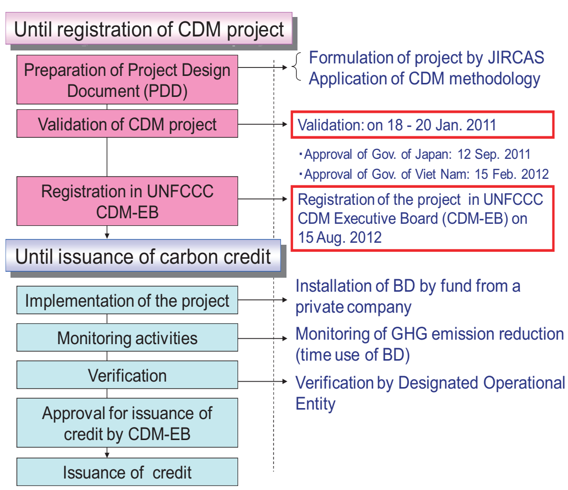


Fig. 1. CDM project implementation procedure

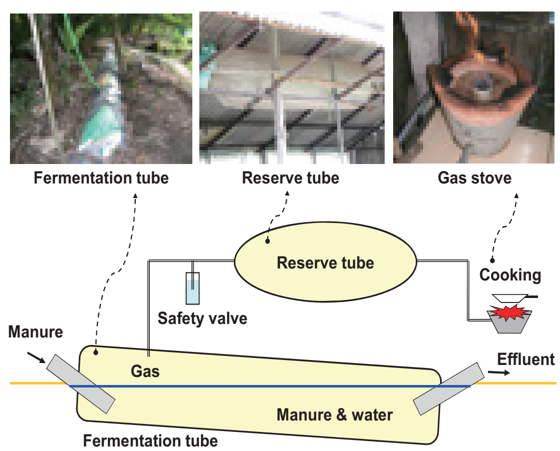


Fig. 2. Plastic type biogas digester system

Development of a guideline for the conservation and management of natural resources in Mali and Niger

Arable lands in the Sahel region in semi-arid West Africa are being degraded through intensive land use activities such as exploitative farming, extensive animal husbandry, and excessive fuelwood collection. Hence, it is necessary not only to introduce conservation techniques against degradation of soil and vegetation, but also to facilitate and get the villagers involved in conservation efforts. In this way, villagers become part of the solution. In addition, it is essential to have a regional or local support system to encourage and guide the villagers in tackling natural resource management issues.

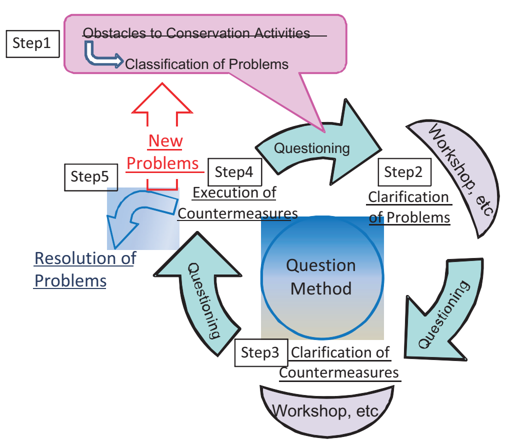
Against this backdrop, JIRCAS implemented the "Study on the Establishment of Methods of Management and Conservation of Resources for Agricultural Production" with the Institute of Rural Economy in the Republic of Mali and the Ministry of Agriculture in the Republic of Niger. This study was subsidized by the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan from 2008 to 2012.

Four villages in Mali and two villages in Niger were selected as target areas for verification. Conservation activities (e.g. erosion control, reforestation, and soil fertility improvement) were carried out at these villages using approaches and techniques to clarify the constraints and to emphasize and reinforce the role of villages and relevant organizations. All applied approaches were compiled to form the guideline and technical manuals.

In the guideline, problems are resolved by applying the 'question method'. The question method brings existing problems to light, hastening the problem-solving process with the cooperation of villagers (Fig. 1). The method lets local government officers act as facilitators, thereby allowing wide participation and enabling the villagers to clarify and solve the problems by themselves. In addition, the approach focuses on land management policy (COFO system, Fig. 2), which was developed based on Niger's Rural Code (Code Rural du Niger, 1993). It is designed to enhance the establishment, management, financing and implementation capabilities of the village organization (COFOB) responsible for the conservation of natural resources, and it strengthens cooperation among relevant organizations. This approach thereby improves the ability of villagers to solve every problem they could face during implementation of conservation activities.

The approach used in the guideline is widely applicable because it contains detailed procedures and examples that local government officers in agriculture, forestry and environment can carry out during conservation activities with villagers. The guideline has already been certified by the Ministry of Agriculture in Niger and the Institute of Rural Economy, Ministry of Agriculture in Mali. Likewise, the technical manuals which were presented in 10 separate volumes including one on forest conservation, have been highly appreciated by officials from relevant agencies in Mali and Niger because these technical manuals clearly illustrate the information and procedures needed by local government officers to guide and advice villagers.

(T. Higashimaki, K. Takenaka, M. Yamada, T. Takeuchi, C. Hirose, T. Kobayashi, R. Miyazaki, N. Shimizu, J. Yasuhisa, K. Suzuki, T. Shinohara)



【Procedures】

Step1. Facilitators classify the problem which interferes with the progress of activity.

Step2. Clarify the problem through 5W3H* asking, and share with villagers.

Step3. Embody the appropriate measures with villagers through 5W3H asking.

Step4. Implement the measures, or identify the constraining factors if activity is not smoothly conducted.

Step5. Problem is solved, or back to Step1 if problem is not solved or new problem shows up.

* 3H: How to + How many + How much

Fig. 1. Problem resolution through questioning

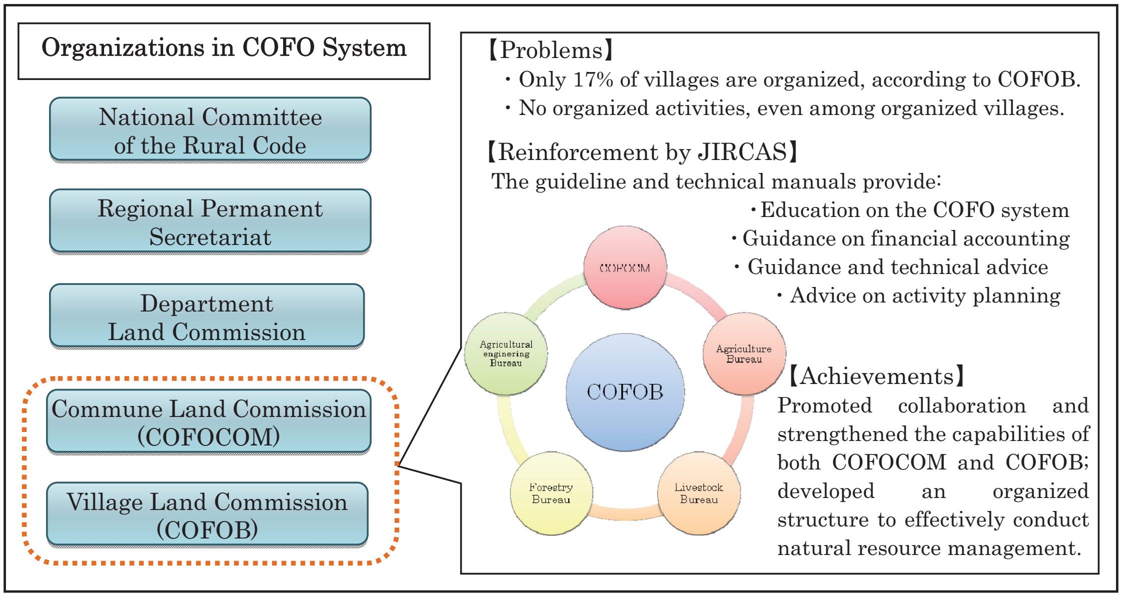


Fig. 2. Reinforcement of COFO system (local policy for land management) in Niger

TOPIC 7

Local government-led support measures and technical assistance to settled nomads in Xinjiang Uygur Autonomous Region

In order to mitigate the intense degeneration of winter pasture, the local government of Xinjiang Uygur Autonomous Region developed a policy on grazing prohibition and grazing rest by combining stall-feeding during winter with grazing at natural pasture during summer. This policy is aimed at providing the nomads a stable life while protecting and restoring natural grassland. It requires the nomads to form settlements and promotes a new mode of agricultural management.

Thus far, results have been unsatisfactory owing to the settled nomads' lack of experience in planting forage and feeding livestock. In addition, the distribution of technical guidance documents from the county level to the settled nomads had to pass through several local administrative divisions.

Therefore, there is a need to demonstrate a comprehensive and systematic technical assistance program, in accordance with the development policy of the village, to enable the nomads to cope with the transition as soon as possible.

Through the first half of the pilot project, we were able to confirm that the township government played an important role in improving the infrastructure of the villages for settlement and for providing technical guidance to settled nomads. Therefore, enhancing the administrative skills of township government officials is very important towards the stable management of villages for settlement.

At the second half of the pilot project, the technical capabilities of field extension workers were strengthened in order to promote cooperation with local officials. We also gave the nomads directions and on-the-job trainings to get them more actively involved in the settlement project.

The outcome of this research was the publication (in Chinese) of a guidebook and several field-specific manuals, whose contents came from ideas obtained from work and technical problems confronted by the pilot project. All aforesaid books and manuals have graphs or pictures that are easy to understand.

The guidebook, titled "Stable management of the settled nomads,"provides extensive, knowledge-based information to technical personnel tasked to help the nomads. It gives ideas on how to deal with problems over time, through negotiations and dialogues. Manuals on planting and livestock-raising were also published for the Kazakh nomads who cannot read Chinese.

The autonomous government may begin enforcing the nomads' settlement policy, for example, by building new settlement sites around the two demonstration villages, in the hopes of accelerating the dissemination of the new policy and the results of this study. The local (city) and county science bureaus who participated in the management and operation of the pilot project at the two demonstrative villages are currently making plans for its widespread implementation.

This project was carried out with JICA as implementing agency.

(Hirofumi Iga, Keisuke Omori, Katsumi Hasada, Tsutomu Kobayashi, Mitsuru Marumoto, Seiichi Chiba [private individual])

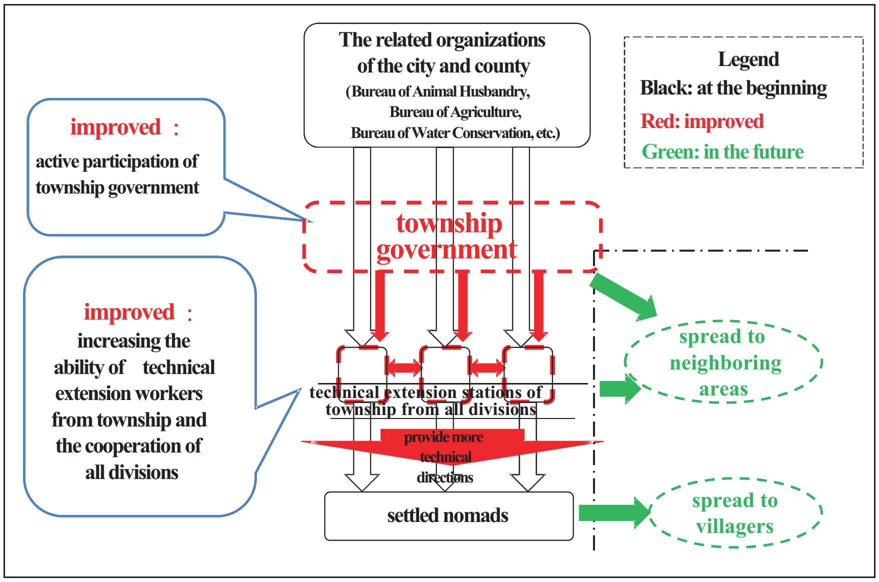


Fig. 1. Strengthening the role of township government and technical extension stations in support of the settled nomads

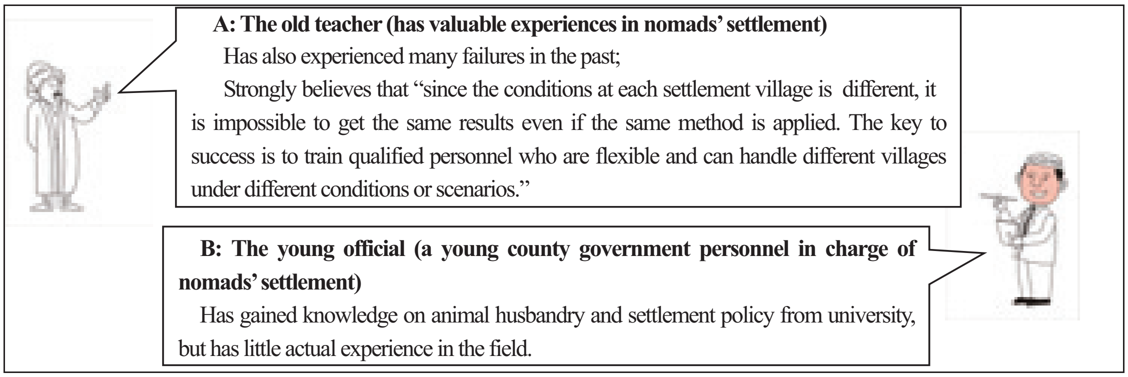


Fig. 2. The characters in the guidebook, titled "Stable management of the settled nomads"

Contents of the technical manual

1. Grassland management
2. Planting of forage crops
    - 2-1. Guidance for alfalfa planting and use
    - 2-2. Guidance for planting and use of corn as silage
    - 2-3. Guidance for making fully ripe compost
    - 2-4. Guidance for ammonia (urea) treatment
3. Rearing management of dairy cattle
4. Management, market sales, and household
5. Water use and conservation, salt injury, and water management
6. Brief introduction to making cheese

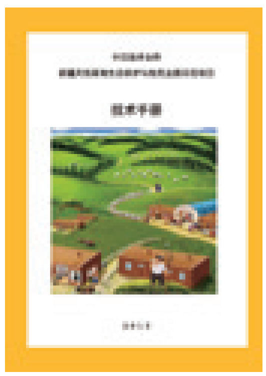


Fig. 3. The contents of the technical manual

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 total of 18 DNA markers were selected based on their capability to differentiate upland NERICA varieties. This information can be used for quality control in seed production of upland NERICA varieties and their further utilization in breeding [Topic 1].

The construct, lip9::*DREB1C*, was introduced into NERICA1 by *Agrobacterium*-mediated transformation. We demonstrated that *DREB1C* improves both drought resistance and traits relating to yield of NERICA1 [Topic 2].

African canals are often lined by earth, making it vulnerable to natural disasters. A simpler and easier way to measure the hydraulic gradients of earth canals is therefore necessary. For this purpose, the laser rangefinder (LR) was found suitable and convenient [Topic 3].

To develop low-cost rice-farming systems that require no large-scale irrigation or land reclamation, it is important to select suitable areas where water for rice farming can be obtained naturally; floodwaters offer promise for this purpose. A flood probability assessment map was produced by integration of the estimated submergence frequency and flood extent simulation [Topic 4].

It was found that in the floodplain ecosystem, extension of rice cultivation areas near reservoirs can be regarded productive in terms of both water availability and soil fertility. Internal (soil-derived) and external nitrogen can be efficiently utilized for rice production by supplementing S-containing forms of fertilizer [Topic 5].

A low-input and environment-friendly variety of rice and a new cultivation technology in Asia that ensures stable productivity in poor environmental conditions will be advanced. Regarding tolerance to phosphate deficiency etc., the project will pursue elucidation of the genetic factors and evaluation of breeding materials. The major quantitative trait locus for P deficiency tolerance, *Pup1*, was identified in the traditional rice variety Kasalath. *Pup1*-specific molecular markers revealed that the putative protein kinase gene (*OsPupK46-2*) was closely associated with tolerance to P deficiency in stress-adapted germplasm. This result was confirmed by qRT-PCR and thus the gene was named as Phosphorus starvation tolerance 1 (*OsPSTOL1*) [Topic 6].

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. Drought causes growth reduction in plants. Although drought changes the expression of a variety of genes, the physiological and molecular mechanisms for plant growth restriction during drought conditions remain unclear. In this study, we identified a gene for OsPIL1, which acts as a key regulator of reduced internode elongation in rice under drought conditions [Topic 7].

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 to stable soybean production along with drought. Fifty-nine rust samples from Argentina, Brazil, and Paraguay in 3 cropping seasons of 2007–2010 were evaluated for pathogenicity using 16 soybean differentials. The results indicated substantial pathogenic variation in the South American rust populations. Except for a pair of samples from Paraguay, none of the rust samples collected in the same season showed identical pathogenicity to each other. Rust samples collected at the same location but from different seasons differed in their pathogenicity [Topic 8].

Technological development in Central Asia (Uzbekistan) is aimed at reducing salinization in farmlands and improving agricultural productivity. Detailed research studies and experiments in the farmers' fields have been conducted to propose necessary measures. Technical background on mitigating measures as well as cost-benefit analysis through assumed model farms are described intelligibly and simply in the guideline [Topic 9].

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 neglects. In collaboration with the International Institute of Tropical Agriculture (IITA), we are aiming at developing technologies using genomic information and molecular techniques to facilitate yam breeding to improve productivity and favorable traits to meet regional needs. Pasting properties of starch-water suspension upon heating was analyzed for a total of 30 varieties of five yam species (*D. routundata, D. cayenensis, D. alata, D. dumetorum and D. bulbifera*) cultivated in Africa. Varietal differences in the gelatinization patterns were observed. Peak and final viscosity of starch of the so-called good-tasting variety tends to be higher than other varieties.

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-valued cowpea varieties with better nutritional value and commercial quality to meet markets'/consumers' preferences, we are investigating genetic diversity and the effects of environmental factors to identify useful breeding materials and strategic breeding approaches in collaboration with the IITA. Among twenty varieties analyzed for quality-related traits, gelatinization patterns of seed powder were classified into four types and it was found that processing properties were different among the types. Based on sensory tests of boiled seeds, two varieties were identified as being sweeter than other varieties.

To utilize the germplasm collection of tropical fruits at the Tropical Agriculture Research Front, JIRCAS in Ishigaki Island, characterization and evaluation of germplasm are ongoing. Genetic diversity studies of *Annona* trees (cherimoya and atemoya) were conducted and useful SSR markers to classify species and varieties were selected.

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, we are developing breeding techniques and utilizing sugarcane wild relatives to improve sugarcane for higher biomass yield and wider adaptability to adverse environments. Through characterization of intergeneric hybrids between sugarcane and *Erianthus*, it was found that all F_1 hybrids obtained had hairs at the basal part of leaves as *Erianthus*. This morphological trait would be a handy criterion for screening real intergeneric hybrids from seedlings.

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, a phytoplasma disease, sugarcane white leaf (SCWL), is an obstacle to field production in developing areas. Sequence analyses revealed that partial *secA* gene had higher variation among isolates than the 16S-23S rDNA intergenic spacer region, indicating an improved resolution for differentiation of phytoplasma isolates.

[Topic 10] is a research result from the project "Development of biological control against invasive insect pests on coconut trees" during JIRCAS' Second Medium-Term Plan Period.

TOPIC 1

Molecular markers enable identification of upland NERICA varieties

Upland NERICA (New Rice for Africa) was developed by Africa Rice Center (AfricaRice, former name: West Africa Rice Development Association or WARDA) to meet increasing demand for rice in Africa. It originated from combinations between each of following three Asian rice (*Oryza sativa* L.), WAB 56-50, WAB 56-104, and WAB 181-18, and one African rice (*Oryza glaberrima* Steud), CG 14, comprising 18 varieties.

Although some varieties have identical seed morphological characters, most of them have to be observed in the field (plant morphology) to enable identification of each variety. However, plant morphology is sometimes affected by environmental factors specific to each cultivation area, making identification of varieties difficult. JIRCAS has been characterizing upland NERICA varieties based on various aspects such as agricultural traits, components and distribution of chromosome segments derived from parents or others, tolerance to abiotic stresses, and resistance to biotic stresses. The purpose is to evaluate their potential and develop new breeding materials. A survey of chromosome segments of upland NERICA varieties revealed that 18 microsatellite markers (SSR markers) enable classification of NERICA into varieties or groups.

The original seeds consisting of 18 upland NERICA varieties were provided by AfricaRice and multiplied at JIRCAS field (Tsukuba, Japan). Each variety was tested to confirm the uniformity of the plants. A total of 295 SSR markers distributed in whole genome chromosomes were used to genotype upland NERICA varieties, of which 243 markers showed polymorphism among CG 14, WAB56-104 and 18 upland NERICA varieties. The polymorphisms were derived not only from the difference between CG 14 and WAB56-

104, but also from an unknown provenance. After comparing their chromosome components, 18 markers were finally selected based on their capability to differentiate upland NERICA varieties. The NERICA varieties were classified by those markers as follows: upland NERICA1, 5, 6, 7, 10, 14, and 17 were classified by their respective single markers; upland NERICA2, 12, 13, and 18 were classified by combining more than one marker (Table 1). On the other hand, the following varieties did not show any polymorphisms: upland NERICA3 and 4, upland NERICA8, 9 and 11, upland NERICA15 and 16 (Table 1). Thus, they were identified as three separate groups. This information can be used for quality control in seed production of upland NERICA varieties and their further utilization in breeding.

(Seiji Yanagihara, Yoshimichi Fukuta, Sachiko Namai, Ayumi Fukuo, Kunihiko Konishyo, Hiroshi Tsunematsu, Takashi Kumashiro)

Table 1. Differential markers for the 18 upland NERICA varieties and their differentiation capabilities

	DNA markers (Chromosome)	WAB-56-104	CG 14	NERICA																	
				1	2	3	4	5	6	7	8	9	11	10	12	13	14	15	16	17	18
a	RM7187(4)	A	B	C	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
b	RM3471(4)	A	B	A	C	A	A	C	A	A	A	A	A	A	A	A	A	A	A	A	A
c	RM7318*(1)	A	A	A	A	A	A	C	A	A	A	A	A	A	A	A	A	A	A	A	A
d	RM7356(8)	A	B	A	A	C	C	A	C	A	A	A	A	A	A	A	A	A	A	A	A
e	RM5704*(11)	A	B	A	A	A	A	A	C	A	A	A	A	A	A	A	A	A	A	A	A
f	RM7318*(1)	A	A	A	A	A	A	C	A	A	A	A	A	A	A	A	A	A	A	A	A
g	RM5704*(11)	A	B	A	A	A	A	A	C	A	A	A	A	A	A	A	A	A	A	A	A
h	RM566(9)	A	A	A	A	A	A	A	A	C	A	A	A	A	A	A	A	A	A	A	A
i	RM406(2)	A	B	A	A	A	A	A	A	A	C	C	C	A	A	A	A	A	A	A	A
j	RM3392(3)	A	B	A	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A
k	RM1347(2)	A	B	A	A	A	A	A	C	A	A	A	A	A	A	C	A	A	A	C	A
l	RM6948(8)	A	B	A	A	A	A	A	A	A	C	C	C	A	B	B	C	A	A	A	A
m	RM5481(7)	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	B	A	A	A	A
n	RM7383(1)	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	A	B
o	RM5599*(11)	A	B	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	B
p	RM6335(12)	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	A
q	RM5599*(11)	A	B	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	B
r	RM5704*(11)	A	B	A	A	A	A	A	C	A	A	A	A	A	A	A	A	A	A	A	A

WAB 56-104 : One parent for upland NERICA 1-8. CG14 : Common parent among upland NERICA varieties.
A: WAB 56-104 type. B: CG 14 type. C: Other types
Polymorphism patterns enclosed by heavy lines are the unique patterns used to differentiate NERICA varieties.
∗indicate markers which show more than one band.

TOPIC 2

Improvement of drought resistance of upland New Rice for Africa (NERICA) by expression of *DREB1C*

The demand for rice in Africa is increasing, and the need to improve rice production is urgent. In this context, one group of cultivars, called New Rice for Africa (NERICA), has become the focus of high expectations, and is becoming increasingly popular in Africa. Since the majority of rice production in Africa relies on rainfall, drought resistance is one of the most important traits for further improvement. The dehydration-responsive-element–binding protein 1 (*DREB1*) gene is one of the best-characterized candidate genes for conferring tolerance to abiotic stresses, including drought. Here, we introduced *Arabidopsis DREB1C* under the control of a stress-inducible rice lip9 promoter (lip9::*DREB1C*) into NERICA1, which is one of the most popular upland NERICA cultivars. We investigated survival under severe drought, and vegetative growth performance and several agronomic traits under moderate drought.

The constructs, lip9::*DREB1C*, was introduced into NERICA1. by *Agrobacterium*-mediated transformation. T_3 plants carrying the transgene as a single homozygous copy were used for analysis. We evaluated the ability of plants to survive under rapid drying. Seeds were sown on soil in

50-mL conical tubes with a hole at the bottom (1 seed/tube), and the tubes were immersed in water. After 3 weeks, tubes with plants were taken out of the water and left unwatered for 10 days. The withering plants were then returned to water, and their recovery was recorded 1 week later. The survivors were considered to be the plants that were expanding new leaves. Transgenic lines had greater survival than the non-transgenic plants (Table 1). We also investigated the growth of plants under long-term moderate drought. Fourteen-day-old seedlings were planted on saturated soil in 4-L pots and then the soil was allowed to dry naturally. When the volumetric content dropped below about 15%, we added enough water to keep it at around 15%. Control plants were grown in permanently flooded soil. Each pot held 2 transgenic plants and 2 non-transgenic plants for comparison. First, we measured dry weight at the late vegetative growth stage (2 months old). The transgenic plants tended to have higher dry weights under moderate drought than non-transgenic plants, and 3 of those differences were significant (Fig. 1). Then we replanted transgenic lines 476, 482, and 749, which had higher shoot dry weights than non-transgenic plants under moderate drought, to investigate heading time, number of spikelets, number of filled grains, and dry weight of straw. All 3 transgenic lines headed significantly earlier than non-transgenic plants (Table 2). The culm length of transgenic plants was significantly shorter than that of non-transgenic plants in most cases. Transgenic plants tended to have more spikelets per plant (an indicator of sink capacity) and more filled grains per plant (an indicator of yield ability) than non-transgenic plants under moderate drought, line 482 significantly so. Under flooding, all 3 transgenic lines had significantly more spikelets than non-transgenic plants, and lines 476 and 749 also had significantly more filled grains than non-transgenic plants. Transgenic plants had significantly less straw than non-transgenic plants under flooding.

We demonstrated that *DREB1C* improves both drought resistance and traits relating to yield of NERICA1. In the case of successful field trials, the selected transgenic lines can be potentially used in a number of arid regions in Africa.

(T. Ishizaki, K. Maruyama, M. Obara, A. Fukutani, K. Yamaguchi-Shinozaki, Y. Ito, T. Kumashiro)

Table 1. Survival of NERICA1 lines transformed with lip9::DREB1C under severe drought

Line [z]	No. of plants tested (A)	No. of plants survived (B)	% survival (B/A) [y]
408	67	52	77.6^{b}
465	61	48	78.7^{b}
466	53	25	47.2^{a}
482	42	35	83.3^{b}
713	58	48	82.8^{b}
724	58	52	89.7^{b}
749	65	56	86.2^{b}
Non-transgenic	58	16	27.6^{a}

[z] 408 - 749 are lines transformed with lip9::*DREB1C*.
[y] Different letters denote significant differences at P < 0.05 by Tukey's test.

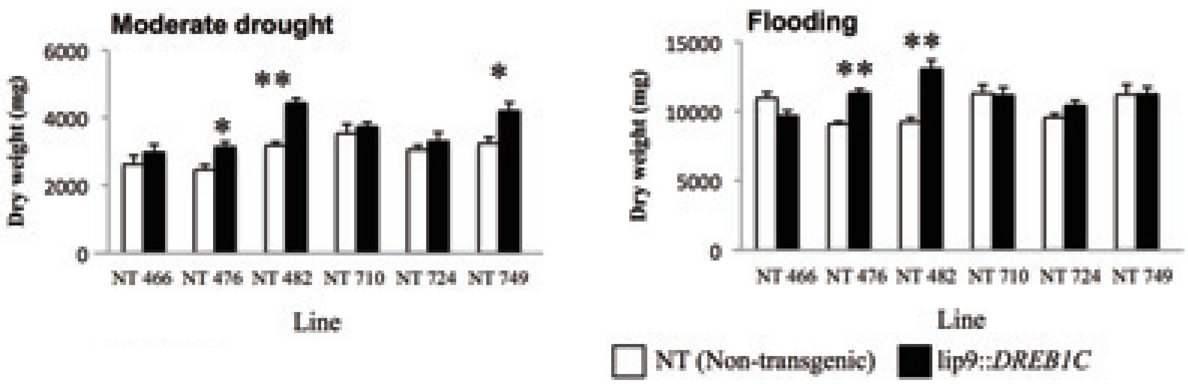


Fig. 1. Growth of lip9::DREB1C transgenic plants in pots. *Asterisks* denote significant differences at * *P* < 0.05 or ** *P* < 0.01 by *t* test. *Bars* represent SEM (n = 5).

Table 2. Agronomic traits of NERICA1 lines with lip9::*DREB1C* grown under flooding or moderate drought [z].

Growth condition	Line	Days to heading	Culm length (cm) [y]	No. of spikelets/ plant [y]	No. of filled grains/ plant [y]	Dry weight of straw (mg) [y]
Moderate drought	476	60.7 ± 0.4	67.7 ± 2.0	112.3 ± 9.0	72.0 ± 4.4	2565 ± 205
	Non-transgenic	65.5 ± 0.7	80.1 ± 2.3	94.0 ± 5.9	58.1 ± 5.4	2446 ± 171
	P value [x]	<0.01	<0.01	0.13	0.08	0.67
	482	59.6 ± 0.6	67.6 ± 3.1	122.4 ± 4.6	71.3 ± 3.9	2734 ± 70
	Non-transgenic	66.9 ± 0.5	77.5 ± 1.1	81.4 ± 6.4	52.2 ± 4.6	2349 ± 151
	P value [x]	<0.01	0.02	<0.01	0.01	0.05
	749	60.9 ± 0.4	71.3 ± 1.9	97.0 ± 5.2	62.5 ± 3.5	2280 ± 214
	Non-transgenic	65.7 ± 0.7	78.9 ± 3.3	88.4 ± 3.7	52.9 ± 4.0	2507 ± 185
	P value [x]	<0.01	0.08	0.21	0.11	0.44
Flooding	476	63.3 ± 1.0	87.3 ± 0.5	308.1 ± 8.2	170.8 ± 4.9	5312 ± 135
	Non-transgenic	71.1 ± 0.2	97.8 ± 0.5	178 ± 9.4	143.7 ± 8.6	6004 ± 230
	P value [x]	<0.01	<0.01	<0.01	0.03	0.03
	482	61.7 ± 1.0	84.1 ± 0.6	298.1 ± 2.1	165.5 ± 3.2	5342 ± 121
	Non-transgenic	69.8 ± 0.5	98.0 ± 0.9	232.6 ± 14.9	170.9 ± 8.1	6901 ± 190
	P value [x]	<0.01	<0.01	<0.01	0.55	<0.01
	749	62.3 ± 0.4	87.5 ± 1.9	312.1 ± 8.6	198.8 ± 7.4	5633 ±115
	Non-transgenic	69.7 ± 0.3	97.7 ± 1.3	239.1 ± 3.4	173.7 ± 4.0	6940 ± 217
	P value [x]	<0.01	<0.01	<0.01	0.02	<0.01

[z] Values are mean ± SEM (n = 5).
[y] Measured 1 month after heading.
[x] Determined by *t* test.

TOPIC 3

Measuring the hydraulic gradient using a laser rangefinder

African paddy fields are lined by earth canals which are often vulnerable to natural disasters; hence, appropriate measures based on knowledge of local weather, landform and soil conditions are necessary. To validate the effectiveness of the measures and to evaluate earth canal functions, hydraulic gradients (surface water gradients) have to be measured. In contrast with concrete canal beds, earth canal beds accumulate sediments (soil and sands), making bed level measurements inaccurate. Traditionally, surface water levels are measured directly using metal tapes (Fig. 1); however, this method is difficult for the following reasons:

i) At least two people are needed in order to confirm by visual inspection whether the edge of the metal tape is in contact with the water surface.
ii) An accurate surface water level cannot be measured if the staff does not have good estimation skills, as surface water levels often fluctuate.
iii) Bench marks set on the shoulder of the canal hinder farming activities.

Therefore, a simpler and easier way to measure the hydraulic gradients of earth canals was developed. For this purpose, the laser rangefinder (LR) was found suitable and convenient. Measurements are carried out as follows:

1. The hydraulic gradient is easily measured by taking the height (h2) from the water surface at two different points on the canal (Fig. 1, right; Fig. 2). Measurement accuracy depends on the resolution of the instrument (resolution of LR is around ±2mm).
2. LR is a device that measures distances in a noncontact manner by measuring the phase difference between the laser emitted from the instrument and the laser reflected from the object. Depending on the object, some improvised device may be necessary for the laser to be reflected exactly from the object (surface water in this case) to the LR.
3. For this purpose, a tube is made by cutting the top and bottom of a PET bottle after which it is stuck into the earth canal. A float (e.g., a styrofoam board) is placed inside the tube so that the LR can catch the reflected laser light from the water surface.
4. Holes or slits are made to the tubes in order to synchronize the water levels inside and outside the tubes. There are two ways to make holes: one is to make a circle (punch a hole); the other is to cut a slit. There are no significant differences in measured data using both methods; however, the 'punched hole' method is deemed harder, and consequently, better.
5. Measurement accuracy is higher in cases where the cross-section of PET bottles are rectangular.
6. The sides of the PET bottle are set parallel to the stream (Type 2) (Table 1, Fig. 3).

The roughness coefficient (i.e., a representative value indicating resistance to flow) of a canal can be calculated by measuring its hydraulic gradient. Not only does it help in developing irrigation plans, but it can also be utilized as an index in evaluating an earth canal's deterioration. This method can be applied to earth canals of different types, widths, and sizes.

Also, if combined with a rotating laser (the setup consists of an apparatus for generating a level laser beam and the receiving instrument), the relative height (h1) of LR can be measured by oneself (i.e., unassisted). However, the use of rotating lasers is not yet widespread in developing countries. Thus, if local governments or consultants decide to use this method, they will need two or several people and a leveling device to obtain measurements.

(Shinji Hirouchi, Haruyuki Dan, Chikako Hirose)

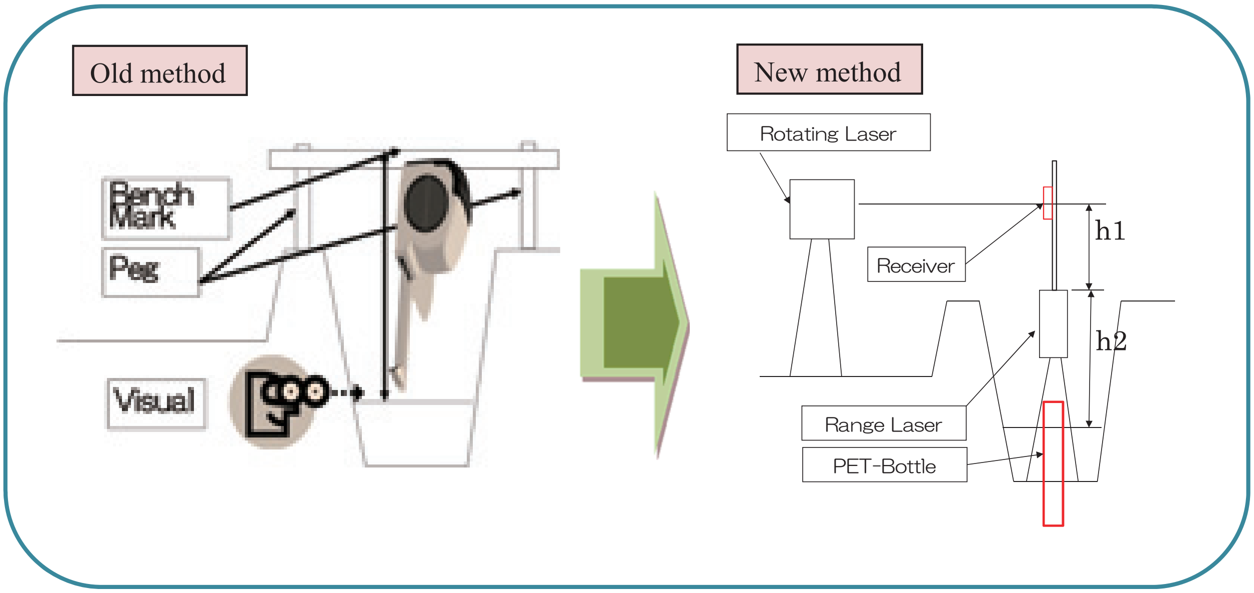


Fig. 1. Observation system

Fig. 2. Observation setup

Table1. Measured values of h2, by installation type

	A		b	
	Type 1	Type 2	Type 1	Type 2
Maximum	940	934	1, 047	1, 041
Minimum	935	926	1, 042	1, 032
Difference	5	8	5	9
Average (A)	938	931	1, 044	1, 038
SD	1. 4	1. 8	1. 5	2. 0
Observed (O)	929		1, 037	
(O) - (A)	9	2	7	1

Notes: (units in mm; a, b: observation points)

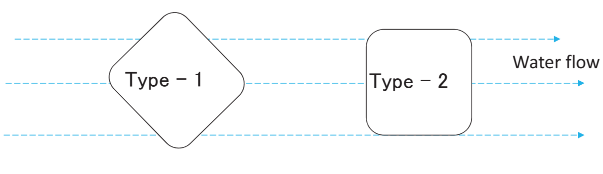


Fig. 3. PET bottle installation types. (Type 1: PET bottle sides not parallel to canal wall; Type 2: parallel)

Assessing the probability of land submergence for lowland rice cultivation in northern Ghana

Sub-Saharan African countries are being strongly urged to enhance their rice production, because their rice consumption and importation rates have been rapidly increasing in recent years. Areas planted to rice in Africa are classified agro-ecologically into rainfed upland, rainfed lowland, and irrigated. Rainfed lowland includes extensive areas of unexploited land that has great potential for the promotion of rice-growing. To develop low-cost rice-farming systems that require no large-scale irrigation or land reclamation, it is important to select suitable areas where water for rice-farming can be obtained naturally; floodwaters offer promise for this purpose. Here, we propose a method of assessing flood probability from submergence frequency, as estimated from satellite imagery and geospatial data.

ALOS/PALSAR images acquired in May, June, August, and September 2010 were used to classify land and water, and then a submerged-area map was produced. In the study site, submergence frequency (y) was approximated by distance from reservoirs (x):

$$y = -1.281\ln(x) + 9.0566 \quad (R^2 = 0.9415) \quad \text{(Fig. 1)}$$

Flood extent derived from reservoirs was simulated using Digital Elevation Model (DEM) and the flood simulation program "SimFlood," which was developed during the study. The results implied that the submerged areas identified by PALSAR were distributed in areas where flood water inflow exceeded 20 times (Fig. 2).

A flood probability assessment map was produced by integration of the estimated submergence frequency and flood extent simulation (Fig. 3). Validation of results using field monitoring data obtained in September 2011 confirmed the adequacy of the estimation (Table 1). Thus the possibility of floodwater use in the study area could be adequately determined.

The flood simulation program "SimFlood" is available for distribution in executable form. When DEM and water resources map can be prepared, the probability assessment of land submergence in other similar areas would be possible.

All-weather microwave sensors that can penetrate clouds have substantial advantages, particularly in identifying the extent of water resources during rainy season. ALOS/PALSAR has been inactive since April 2011, however, archived data are available for analysis.

(Y. Yamamoto, Y. Tsujimoto, Y. Fujihara [Ishikawa Prefectural University], J. Sakagami, M. Fosu [Savanna Agricultural Research Institute])

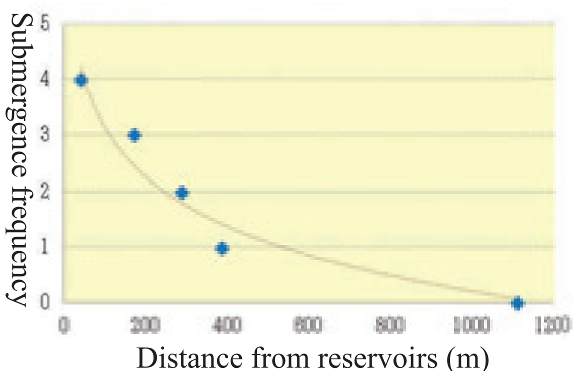


Fig. 1. Relationship between submergence frequency and distance from reservoirs

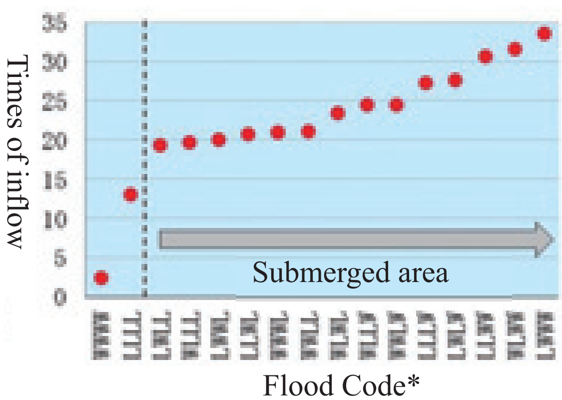


Fig. 2. Times of inflow by flood water in submerged areas
* The results of classification in May, June, August, and September (from bottom to top). W: submerged; L: not submerged.

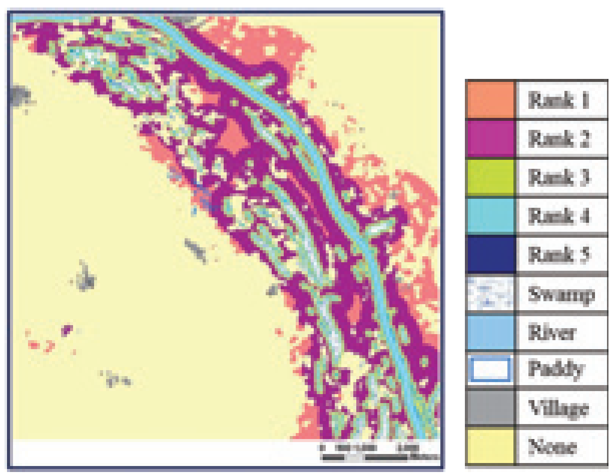


Fig. 3. Flood probability map assessed by geospatial features

Table 1. Soil moisture* by flood probability assessment rank

Flood probability rank	Soil moisture*
None	0.776
Rank 1	0.786
Rank 2	0.819
Rank 3	0.856
Rank 4 & 5 (water boundaries)	0.879

* Average values measured using a portable soil moisture meter equipped with a voltage sensor (DIK-311K, Daiki Rika Kogyo Co.).

TOPIC 5

Topographic distribution of the soil total carbon content and sulfur deficiency for rice cultivation in a floodplain ecosystem of the Northern region of Ghana

River floodplains, consisting of wide and flat alluvial plains bordering rivers, are expected to support a large expansion in the rice cultivation area and production, the major share of which is currently unexploited in West Africa. An understanding of the spatial variation in soil fertility is fundamental for developing appropriate fertilizer management practices and extending rice cultivation in this floodplain ecosystem. This study focuses on a floodplain along the White Volta River in the Northern region of Ghana, the major rice-producing region of the country. Here, we proposed a topographic distribution model to estimate the total carbon contents of soils, and then identified specific nutrient deficiencies in growing rice by combining satellite imagery analysis, soil chemical analysis, and phytometric pot experiments.

The total carbon (TC) contents of soils (0-15 cm in depth) largely differed from 2.0 to 40.2 g kg^{-1}, among 89 samples in the target floodplain. In the analysis using the four different topographic parameters, i.e., 'Elevation', 'Distance to the White Volta river', 'Distance to reservoirs', and 'Slope angle', the single logarithmic model of the 'Distance to reservoirs' was selected for estimating the soil TC contents with the greatest determination coefficient at 0.54 (Fig. 1). The estimation model depicted the distribution map of soil TC contents as shown in Fig. 2, where we can find non-cultivated areas with high soil TC contents relatively close to the village compound. The soil TC contents showed close correlation with the N uptakes of rice grown under non-fertilized pot experiments (Fig. 3). This result indicated that soil TC content can be used as an appropriate parameter of the soil N-supplying capacity for rice in the target ecosystem. Limited sulfur concentrations in plant tissues and a significant response to S application indicated that inherent sulfur deficiency restricted rice growth (Table 1). Therefore, fertilization of N, P, and K without S should increase only the concentration levels of these elements in rice plants but not biomass production. The effect of sulfur application on rice growth was greater with increased proximity to reservoirs.

The distribution of soil TC contents corresponded to the length of waterlogging period, which also logarithmically increased with proximity to reservoirs, as estimated by satellite imagery images. This corresponding pattern indicated that extension of rice cultivation areas near reservoirs can be regarded productive in terms of both water availability and soil fertility. Internal (soil-derived) and external nitrogen can be efficiently utilized for rice production by supplementing S-containing forms of fertilizer (e.g., ammonium sulfate). The potential risks of complete submergence should be further studied for extending rice production in this floodplain ecosystem.

(Y. Tsujimoto, Y. Yamamoto, K. Hayashi, T. Hatta, J. Sakagami, Y. Fujihara [Ishikawa Prefectural University], M. Fosu [Savanna Agricultural Research Institute], Y. Inusah [Savanna Agricultural Research Institute], A. I. Zakaria [Savanna Agricultural Research Institute])

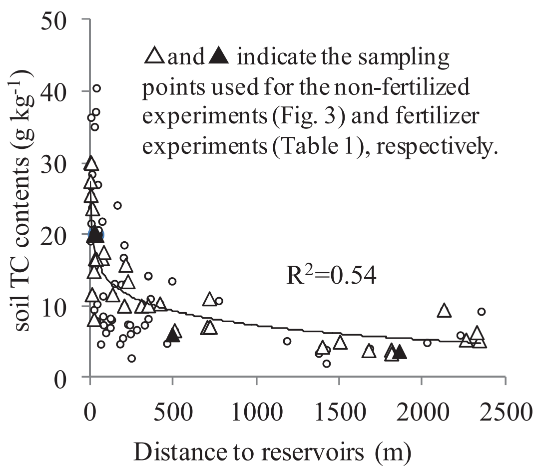


Fig.1. Relationship between soil total carbon (TC) contents and distance to water resources (river and backswamp)
The approximate equation is 'soil TC=29.28-3.3 x ln (Distance to reservoirs)'. The main Volta River, backswamps, and ponds were extracted as 'reservoirs' by visual classification of the Quickbird image captured at the beginning of the dry season in November 2009.

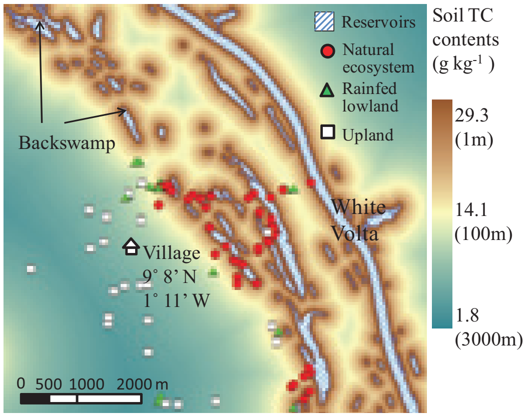


Fig.2. Spatial distribution in the soil total carbon (TC) contents within the floodplain using the model equation in the Fig. 1
Based on interviews with local farmers, the sampling points are classified into ● natural ecosystem with no cropping history, ▲ rainfed lowland, and □ upland.

Table1. Top dry matter yields and N:S concentration ratios as affected by soils and fertilizer treatments.

	Distances to reservoirs (river and backswamps) of the 3 experimental soils		
	Near(40m)	Middle(501m)	Far(1870m)
Fertilization	Dry matter g pot^{-1} (N:S conc. ratio)		
control	14.7 (29.2)	23.5 (13.0)	12.7 (12.9)
N	12.4 (**51.6**)	27.0 (25.4)	10.1 (**47.9**)
P	14.6 (27.8)	22.2 (11.3)	12.8 (14.7)
K	18.6 (26.9)	17.1 (12.5)	11.5 (14.9)
NP	10.7 (**45.0**)	24.5 (**31.6**)	9.3 (**50.4**)
NK	14.6 (**57.1**)	20.3 (**34.0**)	7.9 (**50.8**)
NPK	16.5 (**51.8**)	16.5 (**43.8**)	5.9 (**47.1**)
NPKSi	18.9 (**49.6**)	25.2 (**33.6**)	12.0 (**48.3**)
NPKZn	19.5 (33.7)	**12.0** (**44.6**)	**3.2** (**56.5**)
NPKS	**95.2** (13.4)	**71.2** (6.6)	**42.4** (7.1)

Bold numbers are significantly different from control at 5%.
Nutrient rates are N=0.70g, P=0.22g, K=0.36g, Si=1.87g,Zn=0.05g, S=0.23g per pot.

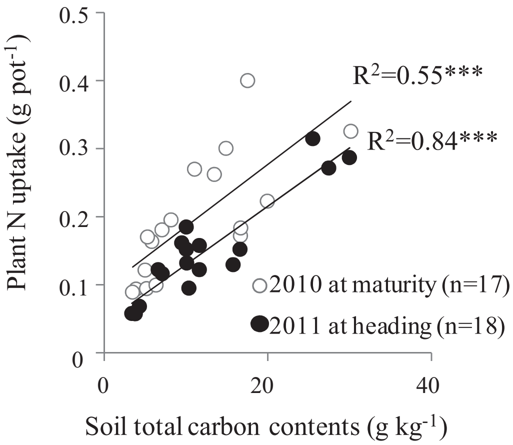


Fig.3. Relationship between soil total carbon contents and plant N uptakes under non-fertilized treatments.

TOPIC 6

The protein kinase PSTOL1 from traditional rice confers tolerance of phosphorus deficiency

In Asia, around 60% (29 Mha) of the rain-fed lowland rice is produced on poor and problem soils that may be naturally low in P or P fixing (Fig. 1). Resource-poor farmers have limited access to increasingly expensive P fertilizer, and this situation may further aggravate given that phosphate rock, the source of P fertilizer, is a finite and non-renewable resource. The development of rice varieties with high productivity under low P is therefore a valid and necessary approach to improve yield and enhance food security.

The major quantitative trait locus for P deficiency tolerance, *Pup1*, was identified in the traditional *aus*-type rice variety Kasalath. *Pup1*-specific molecular markers revealed that the putative protein kinase gene (*OsPupK46-2*) was closely associated with tolerance to P deficiency in stress-adapted germplasm. This result was confirmed by qRT-PCR and thus the gene was named as Phosphorus starvation tolerance 1 (*OsPSTOL1*). An in-vitro phosphorylation assay confirmed that *OsPSTOL1* is a functional Ser/Thr protein kinase.

Phenotypic analyses of transgenic lines with constitutive overexpression (OX) of the full-length *OsPSTOL1* coding region (35S::*OsPSTOL1*) in varieties IR64 (*indica*) and Nipponbare (*japonica*) showed that high expression of the *OsPSTOL1* transgene (OX high) enhanced grain yield by about 30% under low P conditions (Fig. 2). The superior performance of IR64 OX-high lines was due to higher root dry weight and subsequent experiments in nutrient solution showed that total root length and root surface area were significantly higher in transgenic seedlings. This was confirmed for near isogenic lines (NILs) in an IR64 background: IR64-NILs +*Pup1* showed significantly enhanced root growth (Fig. 3).

Transgenic IR64 plants expressing the GUS-reporter gene under the control of the native *OsPSTOL1* promoter were used to analyze the *OsPSTOL1* expression (Fig. 4). Specific GUS staining was detected in stem nodes (crown roots) of young seedlings, while within nodes, GUS staining was restricted to crown root primordia and parenchymatic cells located outside of the peripheral vascular cylinder. No GUS staining was observed in older, emerging crown roots or in the initial (seminal) seedling root. Taken together our data suggest that *OsPSTOL1* is a regulator of early crown root development and growth in rice.

Pup1-rice varieties developed by marker-assisted breeding will be beneficial not only under low P conditions but in a wider range of rice environments, since plants with vigorous root may show improved crop establishment and weed competitiveness. This may contribute to food security and to establishing more sustainable rice production systems.

(M. Wissuwa, J. Pariasca-Tanaka, R. Gamuyao, J.H. Chin, S. Catausan, C. Dalid, I. Slamet-Loedin, S. Heuer, P. Pesaresi, E.M. Tecson-Mendoza)

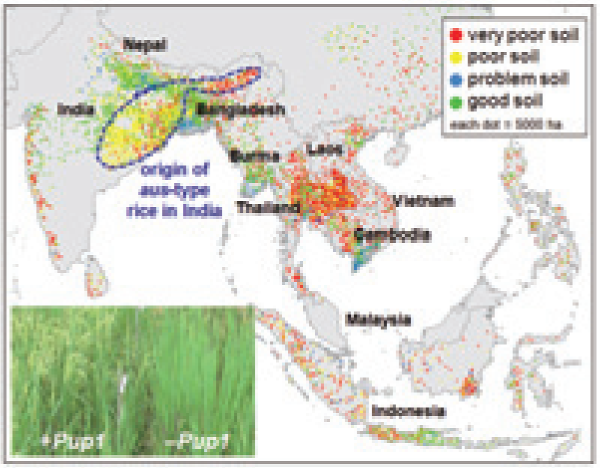


Fig. 1. Problem soils in Asia and origin of stress-tolerant *aus*-type rice varieties

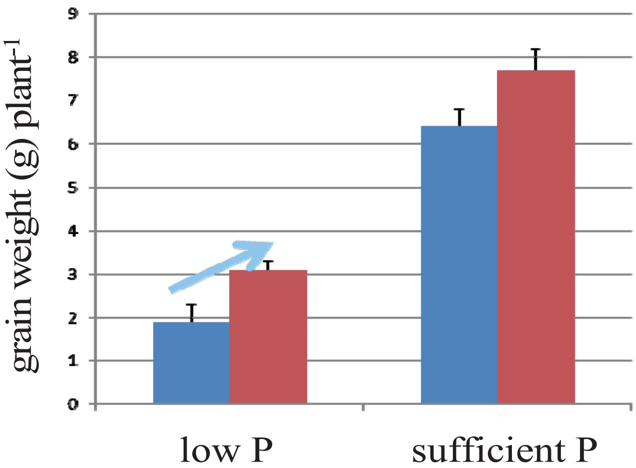


Fig. 2. Grain weight of *PSTOL1*-overexpressing IR64 and corresponding null plants.
Error bars indicate SEM.
Blue: null; red: OX high

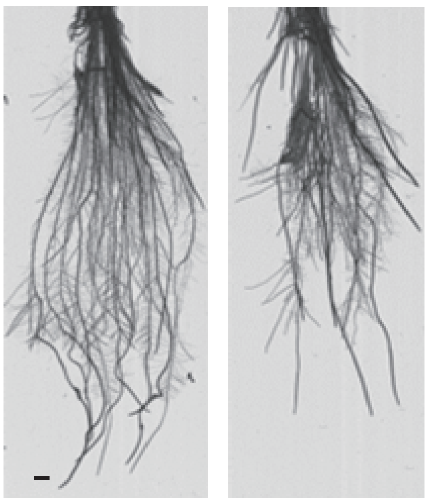


Fig. 3. Representative root of a IR64-NIL +*Pup1* (left) compared to parental IR64 –*Pup1* (right), grown under low-P in nutrient solution

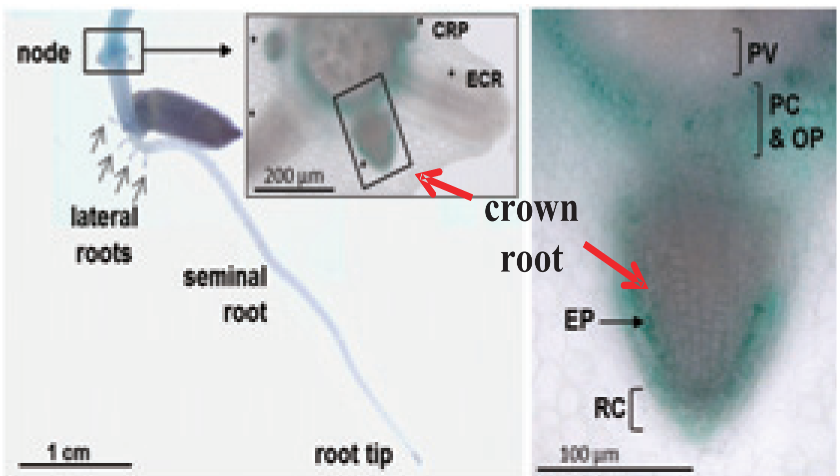


Fig. 4. GUS expression driven by the native *PSTOL1* promoter in young IR64 seedlings is observed in parenchyma (PC) and outer parenchyma (OP) cells adjacent to the peripheral vascular (PV) cylinder of the coleoptilar node and in crown root primordia (CRP; indicated by asterisks), but not in emerging crown roots (ECR; arrows). RC, root cap.

Reference : Gamuyao et al., 2012. Nature **488**, 535–539.

Identification of a gene that regulates growth under drought conditions in rice

Drought causes growth reduction in plants. Although drought changes expression of a variety of genes, the physiological and molecular mechanisms for plant growth restriction during drought conditions remain unclear. In this study, we identified a gene for a phytochrome (phy)-interacting basic helix-loop-helix transcription factor (PIF)-like protein, OsPIL1, which acts as a key regulator of reduced internode elongation in rice under drought conditions.

The level of *OsPIL1* mRNA in rice seedlings grown under non-stressed conditions with light/dark cycles oscillated in a circadian manner with peaks in the middle of the light period (Fig. 1). When drought started in the middle of the dark period, expression of *OsPIL1* was not elevated during the light period. When drought started early in the light period, the *OsPIL1* expression was drastically decreased to a level similar to that observed in the dark period (Fig. 1). We found that *OsPIL1* was highly expressed in the node portions of the stem using promoter-GUS analysis. Transgenic rice plants overexpressing *OsPIL1* (*OsPIL1*-OXs) showed promoted stem elongation, resulting in a strikingly tall plant (Fig. 2). This was mainly due to increased elongation in each internode. In contrast, transgenic rice plants with a chimeric repressor (*OsPIL1*-RDs) displayed short internode sections. The internode cells of *OsPIL1*-OXs were larger than those of non-transgenic control plants. Smaller internode cells were found in *OsPIL1*-RDs. The transcriptome analysis identified 1396 genes up-regulated (FCA > 2.0) and 1358 genes down-regulated (FCA < 2.0) in the 1st node portion of *OsPIL1*-OXs. Expression of more than half of the up-regulated genes was decreased under drought conditions (790/1396 genes), and expression of large numbers of the down-regulated genes was increased by drought (480/1358 genes), suggesting that these were down-stream genes for *OsPIL1*. The up-regulated gene set in *OsPIL1*-OXs was enriched for cell wall related genes responsible for cell elongation. Using the transient assay system, we verified that *OsPIL1* could activate expression of the cell wall related gene via the G-box element. These data suggest that *OsPIL1* functions as a key regulatory factor of reduced plant height via cell wall related genes in response to drought (Fig. 3).

The regulatory system by *OsPIL1* may be important for morphological stress adaptation in rice under drought conditions. We think that the *OsPIL1* gene has great potential to produce crops with good growth even under drought conditions.

(D. Todaka, K. Nakashima, K. Maruyama, Y. Fujita, K. Yamaguchi-Shinozaki)

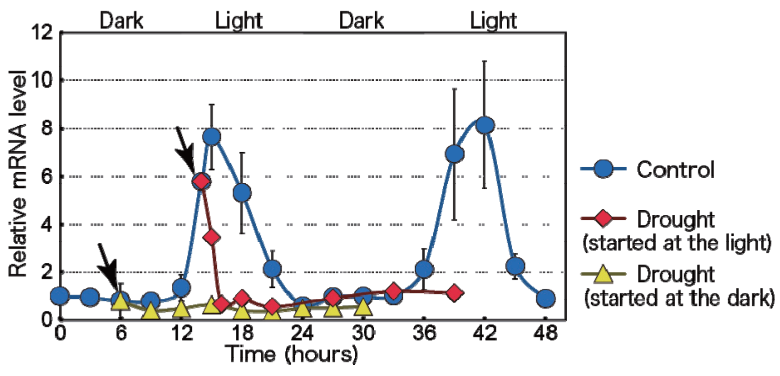


Fig.1. Expression analysis of *OsPIL1* under non-stress (Control) or drought (Drought) conditions by quantitative RT-PCR. Arrows indicate the starting point of the stress treatment.

OsPIL1-OX Control

Fig. 2. Plant heights of transgenic rice plants overexpressing *OsPIL1* (*OsPIL1*-OX) and vector control plants (Control).

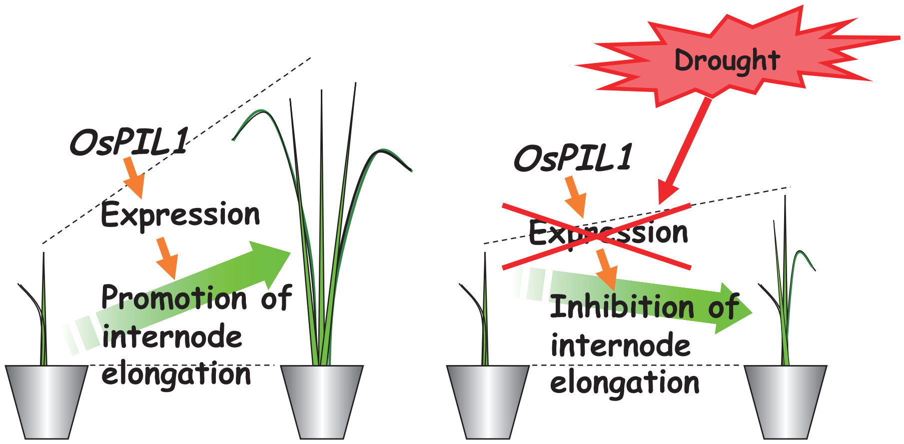


Fig. 3. A model for the plant height regulatory system of OsPIL1. The *OsPIL1* expression promotes internode elongation. Drought decreases the *OsPIL1* expression, resulting in inhibition of internode elongation. Consequently, the plant shows a dwarf phenotype.

TOPIC 8

Pathogenic variation of soybean rust in South America

Soybean [*Glycine max* (L.) Merrill] is an economically important crop and is a valuable source of oil and protein worldwide as well as of food products traditional to the Orient. South American countries are the largest soybean producers in the world, with production centered in Brazil, Argentina, and Paraguay. Soybean rust, caused by *Phakopsora pachyrhizi* Sydow & P. Sydow, is one of the most destructive and economically important diseases of soybean. Understanding the pathogenicity of indigenous fungal populations is useful for identifying resistant plant genotypes and targeting effective cultivars against certain populations. The objective of this study was to investigate pathogenicity of *P. pachyrhizi* infecting soybean in the 3 South American countries in 2007–2010, and to compare the rust pathogenicity geographically and temporally.

Soybean rust samples were collected in Argentina, Brazil, and Paraguay in the 3 cropping seasons of 2007/2008, 2008/2009, and 2009/2010. For comparative analysis of soybean rust pathogenicity between South America and Japan, rust samples were collected in Japan in 2007 and 2008. A total of 16 soybean genotypes including cultivars and lines (Table 1) were selected as a differential set to test soybean rust populations from South American countries. Nine differentials were reported to carry *Rpp* (resistance to *P. pachyrhizi*) genes (Table 1): *Rpp1* in Plant Introduction (PI) 200492, PI 368039, PI 587880A, and PI 587886; *Rpp2* in PI 230970 and PI 417125; *Rpp3* in PI 462312; *Rpp4* in PI 459025; and *Rpp5* in Shiranui. Sixteen soybean differentials were grown at 24°C with a 14 h photoperiod under rust-free conditions in a growth chamber and inoculated with *P. pachyrhizi* urediniospore suspension using a paintbrush or a glass atomizer. Two weeks after inoculation, lesion appearance [presence (+) or absence (−) of lesions] and sporulation level (SL) on the differential set were determined macroscopically. SL was rated using a 0–3 scale: 0, none; 1, little; 2, moderate; 3, abundant (Fig. 1). A few soybean leaves for each differential were detached from the inoculated plants, and the number of uredinia per lesion (NoU) formed on the abaxial side of the leaves were counted under a stereomicroscope. The NoU was calculated from 30 lesions per genotype. Data for the 3 parameters, (i) presence (+) or absence (−) of lesions, (ii) SL, and (iii) NoU, were collected for all rust populations and converted into infection types caused by the rust populations (Table 2). Infection types without lesions (immune) and with lesions showing SL 0 or 1 and NoU <1.5 were classified as resistant (R) indicated in red, whereas those with lesions showing SL 2 or 3 and NoU ≥1.5 were classified as susceptible (S) indicated in blue. When lesions with SL 2 or 3 and NoU <1.5 or SL 0 or 1 and NoU ≥1.5 were observed, the infection types were classified as intermediate (IM) indicated in yellow.

Fifty-nine rust samples from Argentina, Brazil, and Paraguay in 3 cropping seasons of 2007–2010 were evaluated for pathogenicity using 16 soybean differentials (Table 3). In the South American populations analyzed, only 2 pairs of populations yielded identical pathogenicity profiles in the 16 differentials: BE4-2 and PA5-3 from Brazil and Paraguay, respectively, and PC1-1 and PA9-1 from Paraguay, indicating substantial pathogenic variation in the rust populations. Each of the rust samples with identical pathogenicity profiles was collected from different locations, suggesting no association between pathogenicity and geographical origins of the samples. Comparative analysis of 59 South American and 5 Japanese samples revealed that pathogenic differences were not only detected within South America but also distinct between the *P. pachyrhizi* populations from South America and Japan. In addition, pathogenic differences were observed among South American *P. pachyrhizi* populations with the same geographical origin but different temporal origins. Thus, yearly changes in rust pathogenicity were detected during the sampling period. The differentials containing resistance genes *Rpp1*, *Rpp2*, *Rpp3*, and *Rpp4*, except for PI 587880A, displayed resistant reaction to only 1.8%–14%, 24%–28%, 22%, and 36% of South American *P. pachyrhizi* populations, respectively. In contrast, PI 587880A (*Rpp1*), Shiranui (*Rpp5*), and 3 *Rpp*-unknown differentials, PI 587855, PI 587905, and PI 594767A showed resistant reaction to 78%–96% of all populations. This study demonstrated pathogenic diversity of *P. pachyrhizi* populations in South America and that the known *Rpp* genes other than *Rpp1* in PI 587880A and *Rpp5* have been less effective against recent pathogen populations in the countries studied.

(H. Akamatsu, N. Yamanaka, Y. Yamaoka [University of Tsukuba], A. J. G. Ivancovich [Instituto Nacional de Tecnologia Agropecuaria], R. M. Soares [Empresa Brasileira de Pesquisa Agropecuária], W. Morel[Instituto Paraguayo de Tecnología Agraria], A. N. Bogado[Instituto Paraguayo de Tecnología Agraria])

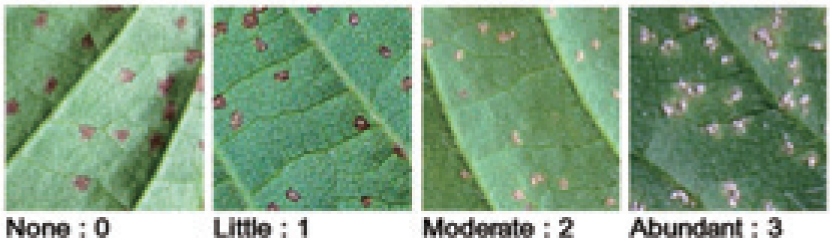


Fig. 1. Assessment of fungal sporulation on *Phakopsora pachyrhizi*-inoculated soybean leaves

Table 1. Soybean differential genotypes used for the evaluation

Differential		Resistance gene [a]	Origin
1	PI 200492	*Rpp1*	Japan
2	PI 368039	*Rpp1*	Taiwan
3	PI 230970	*Rpp2*	Japan
4	PI 417125	*Rpp2*	Japan
5	PI 462312	*Rpp3*	India
6	PI 459025	*Rpp4*	China
7	Shiranui	*Rpp5*	Japan
8	PI 416764	ND	Japan
9	PI 587855	ND	China
10	PI 587880A	*Rpp1*	China
11	PI 587886	*Rpp1*	China
12	PI 587905	ND	China
13	PI 594767A	ND	China
14	BRS 154	ND	Brazil
15	TK5	ND	Taiwan
16	Wayne	ND	USA

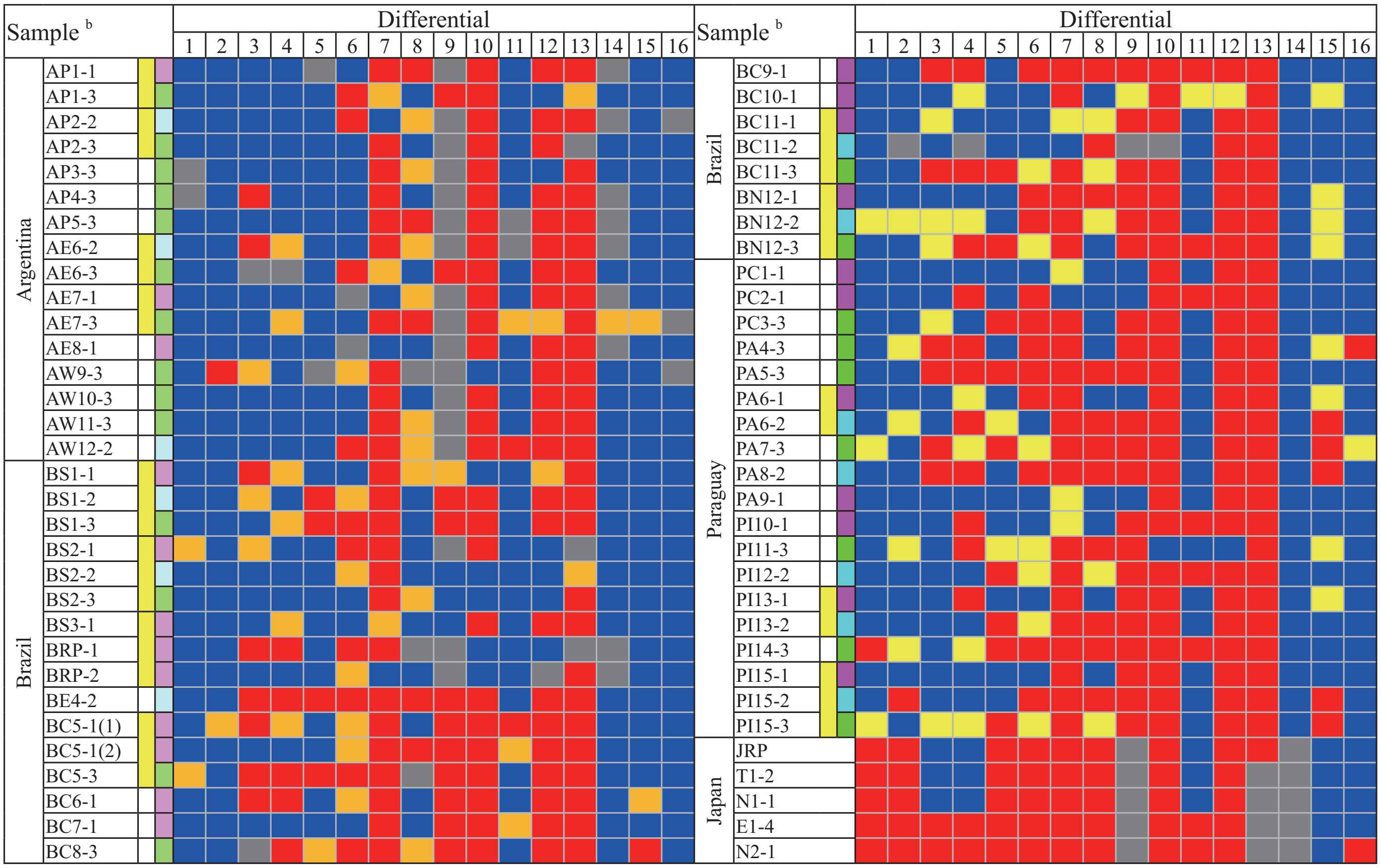
[a] *Rpp1–Rpp5* have been mapped to different loci.
ND: not determined

Table 2. Classification of infection types produced by soybean rust

Lesion	Sporulation level	No. of uredinia [a]	Infection type
Absence	-	-	Resistant
Presence	0 or 1	<1.5	Resistant
Presence	2 or 3	<1.5	Intermediate
Presence	0 or 1	1.5 or more	Intermediate
Presence	2 or 3	1.5 or more	Susceptible

[a] No. of uredinia per lesion was calculated from 30 lesions per differential

Table 3. Infection types of *Phakopsora pachyrhizi* samples from South America collected in 2007–2010 on the 16 differentials [a]



[a] Infection types were classified according to Table 2. The column with grey ■ indicates that infection type was not determined because of preparation failure.
[b] AP: Pampa region; AE: Northeast region; AW: Northwest region; BS: South region; BE: Southeast region; BC: Central-West region; BN: North region; PC: Canindeyú prefecture; PA: Alto Paraná prefecture; PI: Itapúa prefecture. The following numbers represent sampling locations in each country (1–12, 1–12, and 1–15) and sampling season (1: 2007/08 ■; 2: 2008/09 ■; 3: 2009/10 ■). Samples with the same location number were derived from the same location. Samples derived from the same location were indicated in yellow ■ in each location. BRP-1, BRP-2, and BS3-1 were collected from the same location and season.

TOPIC 9

Guideline on "On-farm mitigation measures against salinization under high groundwater level conditions"

Excessive irrigation raises the groundwater table and causes water-logging. In arid or semi-arid zones, salts carried by river water or groundwater accumulate, resulting to decreased crop yields and abandonment in the case of highly salinized agricultural fields.

In order to mitigate rising groundwater levels and solve this issue, governmental organizations in Uzbekistan have improved irrigation facilities, maintained drainage systems and recommended saving water to farmers. However, field conditions have not improved much despite government's efforts. The salinization issue could not be solved fundamentally until the farmers understand the need to save water and improve drainage.

For this reason, JIRCAS, in cooperation with Uzbekistan's Ministry of Agriculture and Water Resources (MAWR) and the Farmers' Council (formerly Farmers' Association), formulated a guideline for farmers to implement practical on-farm measures in Uzbekistan, which, according to reports, has the largest salinized land area in Central Asia.

Detailed research studies and experiments in farmers' fields have been conducted to come up with necessary measures. Technical background on mitigating measures as well as cost-benefit analysis through assumed model farms are described intelligibly and simply in the guideline. The contents are as follows:

First, the mechanism of salinization is explained to recognize the relationship among its causes and its influence on farming activities. Monitoring results are displayed visually to help farmers understand the scope of the problem (Fig. 1).

Second, water-saving irrigation methods such as simple surge flow method, alternative dry furrow (ADF) method and land leveling are proposed. The effects of these methods are compared with conventional method (Fig. 2). Also, a low-cost land leveling method is proposed by combining farmers' prior leveling work with laser land leveling.

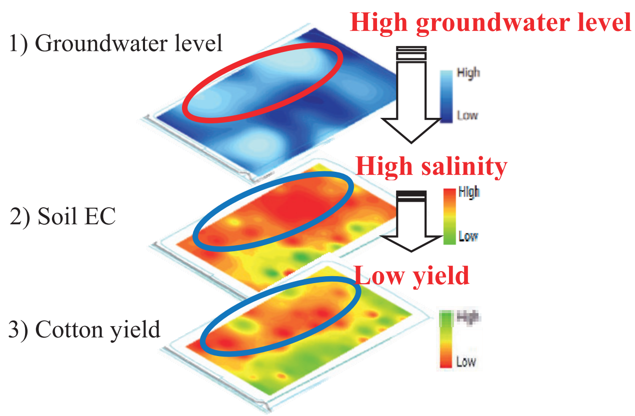


Fig. 1. Field monitoring results

Third, a drainage maintenance system is suggested, where the farmers themselves can cooperate with the government to check drainage canals or sub-surface drainage.

Fourth, improved crop rotation is proposed through cultivation of cotton, wheat, summer crop and green manure. The extra income that will be generated will help provide the necessary budget for the measures.

Finally, the costs and benefits of introducing stepwise measures are calculated from the assumed farm models (Fig.3).

The guideline, which has been approved by the MAWR, is available in Russian and Uzbek languages. Furthermore, a popular edition of the guideline is being prepared for greater content accessibility by farmers in the field.

(Y. Okuda, H. Ikeura, J. Onishi, N. Nitta, A. Fukuo, K. Shiga, M. Naruoka, T. Oya, I. Yamanaka, Y. Shirokova[Irrigation and Water Problem Research Institute of Uzbekistan])

Fig. 2. Excessive irrigation (left photo) and countermeasure technologies against salinization (center and right photos)
(Left) Excessive irrigation : Flooding the furrows results to increased infiltration loss.
(Center) ADF irrigation method : Irrigation water is distributed alternately, limiting water losses.
(Right) Accurate laser land leveling : Water-saving effect is increased by minimizing undulation.

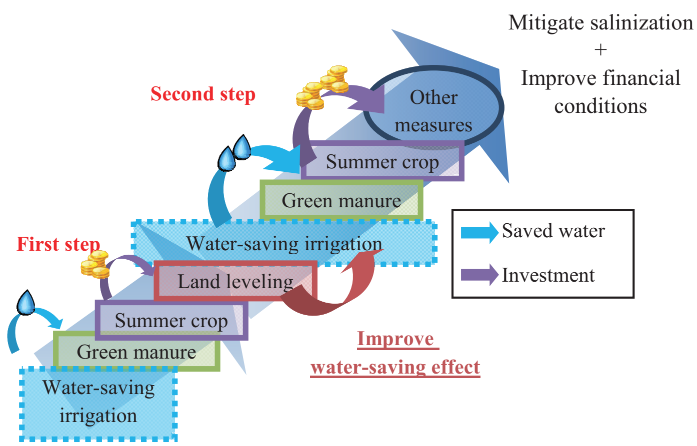


Fig. 3. Proposed stepwise measures

TOPIC 10

Two cryptic species in the coconut hispine beetle, *Brontispa longissima*

The coconut hispine beetle, *Brontispa longissima*, is a serious invasive pest of coconut palm, *Cocos nucifera*. It has recently invaded Southeast Asia and further expansion of risk areas (e.g., into India, Sri Lanka, or Africa) is of great concern. This insect is difficult to control with just chemical pesticides because it stays in young unopened coconut fronds that locate the crown, and coconut trees are too tall for growers to spray pesticides. Moreover, coconut trees are grown near houses and pesticide pollution is a concern; therefore, an alternative to pesticides (i.e., biological control) is necessary.

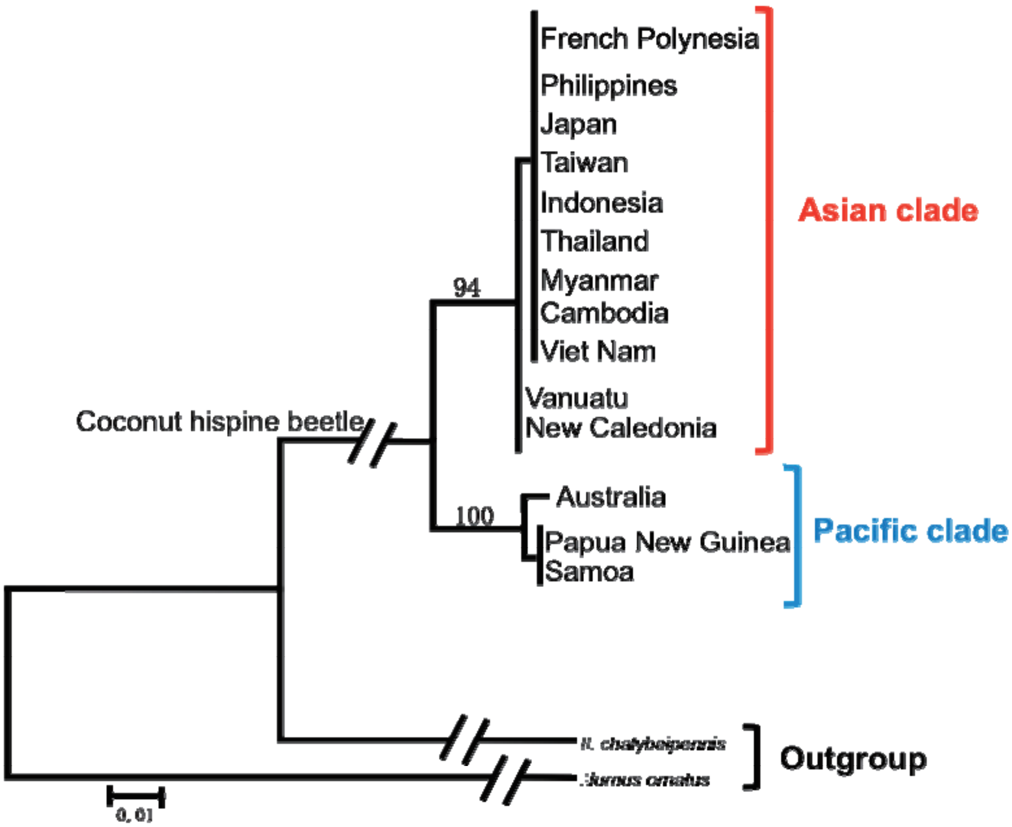
The larval parasitoid, *Asecodes hispinarum* (Hymenoptera: Eulophidae), was introduced to Southeast Asia from Papua New Guinea (via Samoa) through a FAO project. To study genetic variation in this species and to determine the place of origin or distribution pathways of *B. longissima*, we compared partial mitochondrial cytochrome oxidase subunit I gene (*COI*) sequences of specimens obtained from Pacific, Southeast Asian, and East Asian countries. Because our phylogenetic analysis based on the mtDNA sequences showed that *B. longissima* comprises two well-defined monophyletic and allopatric groups, we compared life-history traits between the two groups for effective biological control.

Results of our study show that there are two monophyletic groups: one distributed over a limited area (Australia, Papua New Guinea, Samoa, and Sumba Island; referred to as the Pacific clade) and the other dispersed over a wide area of Asia and the Pacific region (referred to as the Asian clade) (Figs. 1 and 2).

Recent invasions and outbreaks have been reported only in areas where the Asian clade has been found. The Asian clade has a significantly longer life span and produces more eggs than the Pacific clade, suggesting that the former has advantageous life-history traits with the potential to become serious pests. To support further study of geographic distribution and effective control, we developed a PCR–RFLP method for differentiating the two clades. Digestion of the PCR product of a 1,014-bp region within the *COI* with *Bsl*I resulted in clade-specific patterns.

The native habitat of *A. hispinarum* is considered to be Papua New Guinea suggesting that the original host of this parasitoid belongs to the Pacific clade, whereas beetles that invaded Southeast Asia belong to the Asian clade. Another potential natural enemy of the beetle, *Tetrastichus brontispae* (Hymenoptera: Eulophidae), which originated from Java, Indonesia, is distributed where the Asian clade exists. Therefore, we believe that we should study *T. brontispae*, which is rather useful as a "real" natural enemy of the beetle in Southeast Asia. We recommend that when *B. longissima* happens to invade new areas, the clade of the beetle should be examined using our technique before introducing a natural enemy.

(S. Nakamura, R. Ichiki, S. Takano, M. Murata, N. T. Huong, A. Mochizuki [NIAES], K. Takasu [Kyushu Univ], K. Konishi [NARO], J. C. Alouw [ICOPRI], D. S. Pandin [ICOPRI])



・Bootstrap values (>50%) (1,000 replications) are indicated near the branches.

Fig. 1. Neighbor-joining phylogenetic tree (modified from Takano et al. (2011)).

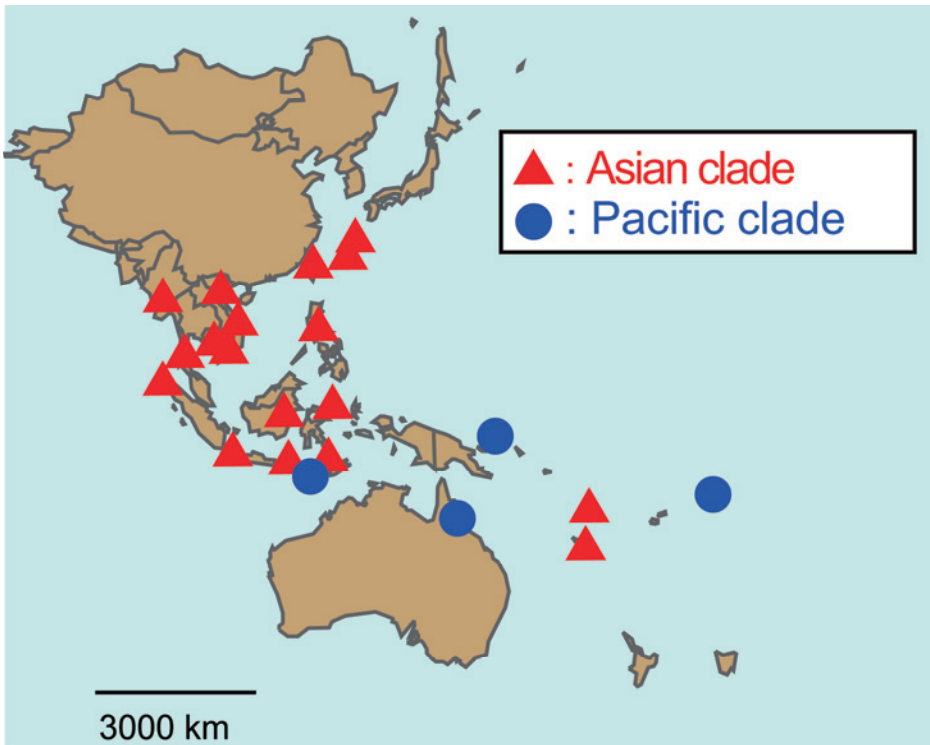


Fig. 2. Geographical distribution of the two cryptic species in *Brontispa longissima* (modified from Takano et al. (2011)).

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 has been developing technologies that promote practical use of local resources and help generate income, thereby improving the living conditions of rural populations in developing regions. The program comprises six projects, whose main achievements this year are as follows.

【Sustainable and Independent Farm Household Economy in IndoChina Project】

There exists a significant gap in farmland possessions among villagers in Nameuang Village, Vientiane Province, Laos (the main focus of the project). New migrants tend to possess smaller farmlands with less paddy fields compared with early settlers. This wide disparity has made it difficult for farmers to sustain their livelihoods.

We targeted the small farm households as the main beneficiaries of this project and conducted several surveys and trials in Nameuang Village as follows: Concerning lowland systems, surveys and interviews were conducted to identify the constraints to rice production. It was revealed that water shortage was the most critical factor to delayed transplanting. Soil surveys in lowlands indicated low soil fertility and soil acidification, which are not critical to rice cropping but detrimental to the growth of upland crops. Rice-fish culture in paddies and cage culture in reservoirs proved applicable after several trials. Meanwhile, soil analysis in upland areas showed extreme acidity (pH between 4.1-5.1) and low Ca and Mg content, suggesting difficulty in producing cash crops such as maize. Forage grass (*Brachiaria* hybrid *cv. Murato II)* and several kinds of fruit trees including mango, sapoddila, lime and rambutan were planted to determine their suitability and performance at the main project area. The survey on the forest sector clarified that there were 150 different types of non-timber forest products (NTFPs) for self-consumption but the villagers now has to go farther compared to five years ago to collect those products.

An annual meeting was held on November 21 and 22, 2012 at the National Agriculture and Forestry Research Institute (NAFRI) in Vientiane, Lao PDR to exchange information on research activities among members involved in the project. In addition, the future direction of the project was discussed at the steering committee meeting held on March 19, 2013 also at NAFRI.

Steering committee at NAFRI (March 2013)

【Recycling-based Agricultural Production in China Project】

The influences of climatic factors and input factors on maize yield were clarified based on multilevel model analysis of farmer-household survey data in Hebei Province, which is a major maize-producing province in China. The balance of the nutritional components of soil was also measured, and the long-term influential factors for yield change were estimated. Furthermore, technological developments have been made on a minimum-tillage wheat cropping system under reduced irrigation frequencies without yield decrease in intensive farming regions, and on a drip irrigation system in semi-arid regions as well.

【Food Resource Utilization Project】

JIRCAS together with its Asian counterpart organizations agreed to launch the 'Food Research Network of Asia' for the efficient utilization of indigenous food resources. Members of the network started to keep close communication and shared their knowledge on major issues concerning food research, particularly food processing technology and physiological functionality of traditional food resources. A group of researchers from JIRCAS, Kasetsart University (Thailand) and Laos University elucidated the regional differences and time-dependent transition of bacterial and fungal species (e. g. lactic acid bacteria) living in fermented fish produced in Indochina by analyzing DNA via denaturing gradient gel electrophoresis (DGGE) method. On the subject of food processing, researchers from JIRCAS and China Agricultural University developed a new and efficient coagulant agent to produce a Chinese-style tofu. Electron spectroscopic characterization of sticky rice from Japan and Thailand was carried out to understand the properties of water-soluble polysaccharides, which are expected to be used for various food processing techniques.

<u>Symposium on Advanced Application of Local Food Resources in China</u>

JIRCAS organized a symposium in Zhengzhou, Hunan, China on July 17, 2012. About 30 participants from Japan, Thailand, and China including students, local officers, and technical experts in the private sectors attended the symposium.

In the first session, several research topics were discussed through poster presentations, including (1) bioactivities (functionalities) of local food resources, (2) unique processing mechanisms of traditional foods, and (3) benefits of microorganisms in the production of traditional fermented foods. The following session reviewed present activities and problems of advanced application of local food resources in China. In the closing session, all the participants agreed on the importance of the research network for promoting research cooperation, information exchange, and mutual technology transfer to attain its ultimate goals of utilizing local food resources and improving income in rural areas.

Participants of the symposium in China (July 2012)

【Asia Biomass Project】

In order to develop biofuel and biomaterial-producing technologies from agricultural residues, we successfully isolated an anaerobic alkalithermophilic, cellulolytic-xylanolytic bacterium. In addition, thermotolerant yeasts were characterized to carry out fermentation without a cooling process. We also developed a bioplastic production technology using sap from old oil palm trunks and characterized its properties as an adjuvant for slow-release fertilizers.

【Sustainable Forestry Production Project】

Technology development on sustainable management and conservation of forest resources was implemented. A soil suitability map for teak plantation in the Northeast of Thailand was produced to promote and further the objectives of sustainable farm forestry management. In Malaysia, genetic divergence was evaluated and the effects of different cutting intensities on stand structure were investigated. Key success factors for enrichment planting in hill dipterocarp forests, where overcutting has brought land degradation, will be proposed.

<u>Workshop on Biomass Utilization in Tropical Asia -Summary of the Researches between JIRCAS and Universiti Sains Malaysia (USM)-</u>

This workshop was held at the School of Industrial Technology, USM, in Penang, Malaysia on February 4 and 5, 2013. Thirteen researchers (8 from JIRCAS and 5 from USM), including former project members, gathered for the workshop. Nine presentations were delivered by participants under the following sessions:

Importance of tree plantation resources;

Functional chemical components from tropical biomass;

Challenge on better utilization of oil palm waste; and

Advanced materials made from tropical woody resources.

The research outputs were summarized under the project on the development of methods for the use of under-utilized timber resources in the tropics since 1995.

Participants of the workshop at USM (February 2013)

【Tropical Coastal Aquaculture Project】

Development of environmentally friendly aquaculture technologies in coastal waters of Southeast Asia was conducted. In Thailand, the effects of co-cultured seaweed and snails on the growth of giant tiger prawns were studied in the laboratory. In the Philippines, culture methods of sea cucumber, the key species for an integrated multi-trophic aquaculture (IMTA), were examined in the laboratory and on the field under milkfish net cages. In Malaysia, the spatial distribution and abundance of blood cockle larvae were investigated and compared with its mature cockles in Selangor to clarify the reproduction-recruitment relationship.

TOPIC 1

Influence analysis of climatic and input factors on maize yield in Hebei Province

When China became a net maize-importing country in 2010, full attention was given to the possibility of further increasing domestic supply capability. As the expansion of arable land nears its limit, further increase in supply can only be achieved by increasing maize yield. However, increasing maize yields is very difficult due to the deterioration of production environment caused by excessive use of chemical fertilizer, climate change, and shortage of farm labors. As Hebei Province is among the three biggest maize-producing provinces and the fact that maize supply depends mainly on its yield, clarifying the main factors that influence yield is important for predicting maize supply trends. Further, this study may also lead to risk analysis and policy making for stable production. Farmer household survey data of nine counties in Hebei Province were used in the study, taking into account the various regional differences, in order to achieve higher accuracy.

We built several analytical models, including the ordinary least squares (OLS) regression, the maximum likelihood (ML), and the residual maximum likelihood (REML) multilevel models, to analyze the impact of input and climatic factors on maize yield using survey data collected between 2003 to 2010 from 4152 farmer households. Based on the results of panel analysis, the ML model was selected for its good modeling capacity. The model was used to estimate the elasticity and the contribution

Table 1. The elasticity coefficients of impact factors on maize yield

Variables	Elasticity	STD	
Input factor	0.176	0.016	***
Fixed assets	0.014	-0.004	***
Pesticide	-0.003	-0.007	
Fertilizer	0.030	-0.010	***
Seed	0.076	-0.009	***
Labor	0.021	-0.009	**
Irrigation	0.033	-0.003	***
Machine operation	0.003	-0.007	
Climatic factor			
June temp.	-0.157	(-0.129)	**
July temp.	-0.782	-0.273	
August temp.	-0.082	-0.296	***
September temp.	-1.139	-0.297	***
Jun. to Sep. accumulated temp.	-2.159	-0.323	***
June ppt.	-0.147	-0.014	***
July ppt.	0.057	-0.013	***
August ppt.	0.065	-0.014	
September ppt.	0.045	-0.011	***
Jun. to Sep. precititation	0.019	-0.025	***

Note : ***, ** and * denote statistical significance at the 1%, 5% and 10% levels.

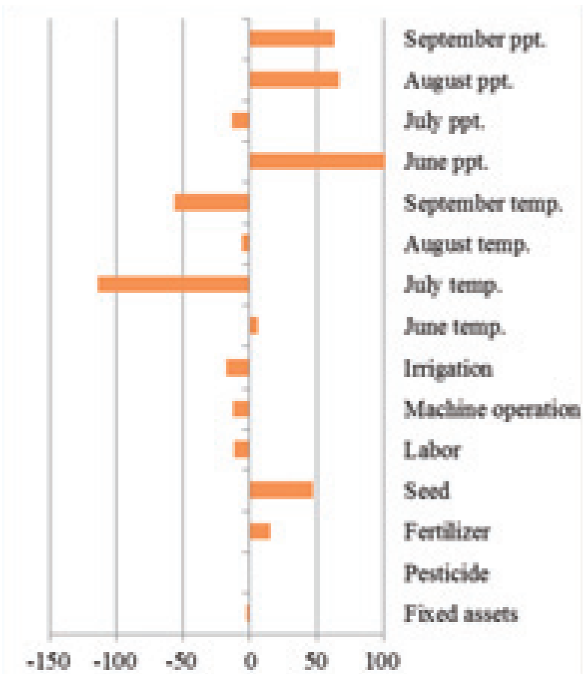


Figure 1. Contribution ratios of input factors on maize yield increase
Notes: 1. Ratio in percentage. 2. Average ratio from 2003 to 2010 (simple average)

ratio of input factors (seed, chemical fertilizer, pesticide, fixed asset, labor, machine operation, irrigation) and climatic factors (temperature, precipitation) on maize yield.

The elasticity of inputs affecting maize yield is 0.176. As for the climatic factors (during the growth period from June to September), the elasticity of temperature is -2.159 and the elasticity of precipitation is 0.019. While the influence of precipitation is positive, the influence of temperature is negative and quite big. Specifically, the negative impact on yield due to high temperature in September is significant (Table 1).

Regarding the influence of input factors on maize yield, the positive effect of fixed assets, labor, chemical fertilizer, irrigation, and seed selection has been confirmed. The elasticity of seed selection is 0.076, which is higher than other inputs and reveals the fact that seed selection is important for yield increase (Table 1).

As shown by the contribution ratio of each factor for yield increase during the measurement period, moderate rainfall in June, August, and September, as well as seed selection, produced positive contributions. On the other hand, high temperatures in July and September led to negative contributions. The influence of climatic factors was relatively large.

The analytical method based on panel data analysis should also be applied to similar studies in areas other than Hebei Province. By doing so, it is hoped that the accuracy of supply predictions can be improved. To obtain influence parameters for median and long-term supply predictions, the measurement period should be further increased.

(H. Chien, J. Ma [China Agricultural University], Y. Chen [China Agricultural University], E. Kusano)

TOPIC 2

Cooking method affects antioxidant capacity and total phenolic content in basils

The effects of thermal treatment on the antioxidant properties of fruits and vegetables are important issues in home scale cooking as well as food manufacturing. In Southeast Asia, a variety of locally distinct conventional vegetables, including basil, are produced. Basil, a leafy herb, has recently been attracting research attention because it contains a variety of phenolic compounds which exhibit desirable physiological characteristics believed to provide health benefits. These native vegetables are mainly consumed as an ingredient in cooked dishes though they may also be eaten raw. This study, therefore, examined the changes in antioxidant capacity and total phenolics under five different heat cooking methods. We measured the antioxidant capacity (using the stable free radical diphenylpicrylhydrazyl / DPPH method) and total phenolic content (by Folin-Ciocalteu method) in methanol extracts of four *Ocimum* species commonly consumed in Thailand (Fig. 1) through blanching, boiling, steaming, sautéing, and autoclaving.

The results indicated that among the five cooking methods, sautéing was the best at increasing both antioxidant capacity and total phenolic content in all types of basil. Steaming also saw increases in all types except for sweet basil (Fig. 2).

Among the four species of basil, sautéed hairy basil showed the largest increases in both antioxidant capacity and total phenolic content, at more than double the amount of the untreated sample. On the other hand, both antioxidant capacity and total phenolic content in sweet basil were significantly reduced by cooking methods other than sautéing (Fig. 2). In particular, antioxidant capacity and total phenolic content of vegetables were reduced through blanching as existing components were released from plant tissues into cooking water. Additionally, the types of phenolics in basil extracts did not change greatly during sautéing, but the contents were observed to have increased. This is probably because the phenolics bound to methanol-insoluble materials tend to be isolated by heat cooking.

These results show that antioxidant capacity and total phenolic content in basils are affected by the method of cooking. It is also believed that heat cooking does not intend to promote phenolic contents, but changes it to a state that can be used. Consequently, it is possible to make processed rice that imparts antioxidant properties, for example, by boiling it in liquid in which antioxidants are eluted (JIRCAS Research Highlights, 2010).

(G. Trakoontivakorn [Kasetsart University], P. Tangkanakul [Kasetsart University], K. Nakahara)

Fig. 1. Basils common in Thailand. From left: *O. americanum* (hairy basil), *O.tenuiflorum* (holy basil; syn. *O. sanctum*), *O. basilicum* (sweet basil) and *O. gratissimum* (wild basil)

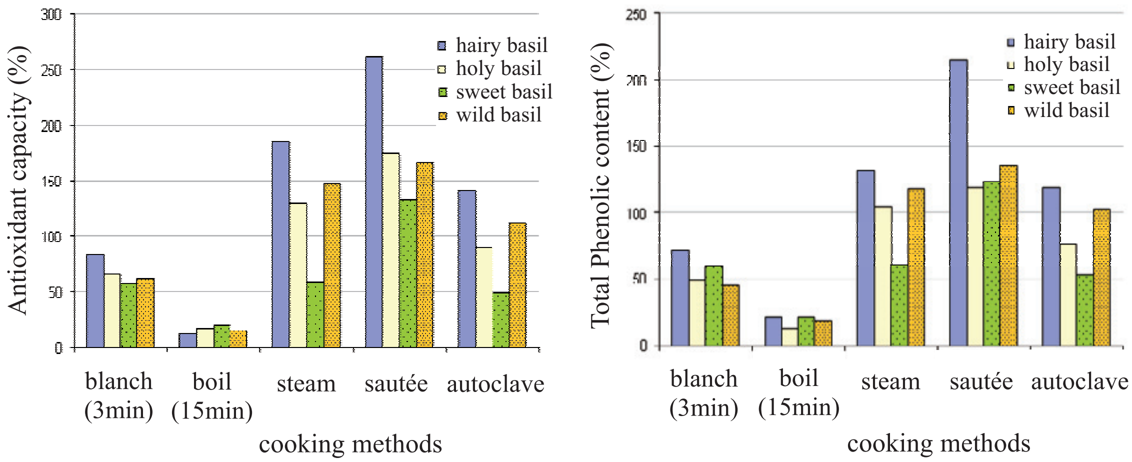


Fig. 2. Antioxidant capacity and total phenolic content remaining in leaves after various cooking methods compared to fresh *Ocimum* herbs
(Data is the average value of the results from multiple experiments; reproducibility has been confirmed.)

Reference: Trakoontivakorn et al. (2012) JARQ 46: 347 - 353

TOPIC 3

Characterization of novel anaerobic alkalithermophilic, cellulolytic-xylanolytic bacteria

Lignocellulosic plant biomass is difficult to hydrolyze because cellulose has a tightly packed crystalline structure and is surrounded by a lignin that has covalent associations with hemicellulose. Thus, the rate-limiting step in biomass degradation is the conversion of cellulose and hemicellulose polymers to sugars.

Pretreatment of lignocellulose can be enhanced to enzymatic digestibility. Alkaline pretreatment is one of several chemical pretreatment technologies that have been intensively investigated. It employs various alkaline reagents including sodium hydroxide, calcium hydroxide, potassium hydroxide, aqueous ammonia, ammonia hydroxide, and sodium hydroxide in combination with hydrogen peroxide. Mechanistically, alkali is believed to cleave hydrolysable linkages in lignin and glycosidic bonds of polysaccharides, which causes a reduction in the degree of polymerization and crystallinity, swelling of the fibers, as well as disruption of the lignin structure.

In general, alkaline pretreatment is more effective on hardwood, herbaceous crops, and agricultural residues, which have lower lignin content, than on substrates such as softwood, which contain high amounts of lignin.

The alkaline-treated lignocelluloses must adjust to neutral pH and/or remove completely alkaline reagents because cellulase and hemicellulases in subsequent saccharification process are unable to act under alkaline condition.To develop enzymes which have high degradation ability under alkaline condition, it is necessary to isolate alkalinephilic microorganisms having high cellulolytic ability.

We were able to successfully isolate an anaerobic alkalithermophilic, cellulolytic-xylanolytic bacterium from coconut garden soil in the

Bangkuntien district of Bangkok, Thailand. The bacteria were Gram-stain positive, catalase-negative, endospore-forming, motile and rod-shaped, with a cell size of 0.2-0.3×2.0-3.0 µm. Optimal growth occurred at pH 9.5 and T=55 °C. The bacteria strain fermented various carbohydrates, and the end products from the fermentation of cellobiose were acetate, ethanol, propionate and a small amount of butyrate. Phylogenetic analysis based on 16S rRNA gene sequences revealed that the strain represented a new phyletic sub-lineage within the family Clostridiaceae, with <93.0% 16S rRNA gene sequence similarity to recognized species of this family. On the basis of phenotypic, genotypic and physiological evidence, the strain represents a novel species of a new genus, for which the name *Cellulosibacter alkalithermophilus* is proposed. *C. alkalithermophilus* showed high ability to degrade not only microcrystalline cellulose, but also hemicellulose such as xylan under alkaline condition at pH 9.5, suggesting that the bacteria might possess unique abilities to degrade polysaccharides .

The type strain of the type species has been deposited in the culture collection of Thailand Institute of Scientific and Technological Research as TISTR 1915(T).

(A. Kosugi, A. Watthanalamloet, C. Tachaapaikoon, K. Ratanakhanokchai [King Mongkut's University of Technology Thonburi])

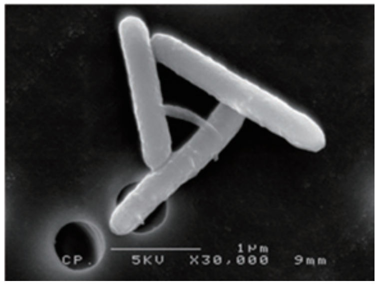


Fig. 1. Scanning Electron Microscope picture of *Cellulosibacter alkalithermophilus*

Table 1. Characteristics of novel bacterial isolate *Cellulosibacter alkalithermophilus*

Properties	*Novel isolated strain Cellulosibacter alkalithermophilus*	*Closest relatives Clostridium thermosuccinogenes DSM 5807*
Cell length (µm)	0.2–0.3×2.0–3.0	0.3–0.4×2.0–4.0
Gram staining	Positive	Positive
Spore forming	Positive	Positive
GC contents (mol%)	30.0	35.9
Optimum growth temperature (ºC)	55	58
Optimum growth pH	9.5	7.0
Cellulose degradation ability	++	-
Xylan degradation ability	++	-

TOPIC 4

Isolation of thermotolerant yeasts for a non-cooling fermentation system in tropical areas

Ambient temperatures in tropical areas are high, therefore ethanol fermenters also show a rise in temperature (up to around 40 ºC) during fermentation. *Saccharomyces cerevisiae*, the typical fermenting yeast, cannot carry out fermentation under high temperatures because it does not have thermotolerance.

We isolated the thermotolerant yeasts, *Kluyveromyces marxianus* (Y2) and *Issatochenkia orientalis* (C19). These yeasts, which have shown greater thermotolerance than *S. cerevisiae*, can produce ethanol under high temperature conditions (more than 40 ºC) and can tolerate the fermentation inhibitors contained in saccharified lignocellulosic biomass. Consequently, ethanol fermentation without cooling can be achieved using these yeasts. It is expected to save energy through reduced cooling costs.

These thermotolerant yeasts can grow at higher temperatures than *S. cerevisiae*. Y2 and C19 strains can grow and ferment at 45 ºC and 42 ºC, respectively (Figs.1A and B). Y2 strain has shown tolerance to furfural, a fural compound, and is relatively insulated from the inhibition by the furfural induced from biomass hydrolysis (Fig. 2A); C19 strain has displayed tolerance to weak acids, hence it is relatively insulated from the inhibition by acetic acid induced from hydrolysis of lignocellulose biomass (Fig. 2B). The kinds of inhibitors to fermentation depend on the type of lignocellulose, therefore, we can select these yeasts as adequate for fermentation in biomass hydrolysis.

In terms of productivity, it can be pointed out that ethanol yield of C19 (73%) is lower than that of Y2 (90%). Additionally, Y2 often produces glycerol as a byproduct when it is incubated under stress conditions.

(Yoshinori Murata, Takamitsu Arai, Akihiko Kosugi, Yutaka Mori)

Reference :

Y. Mori, A. Kosugi, Y. Murata, and T. Arai, Ethanol Production from Sap of Old Oil Palm Trunks Felled for Replanting (2010) Journal of the Japan Institute of Energy 89, 1147-1152.

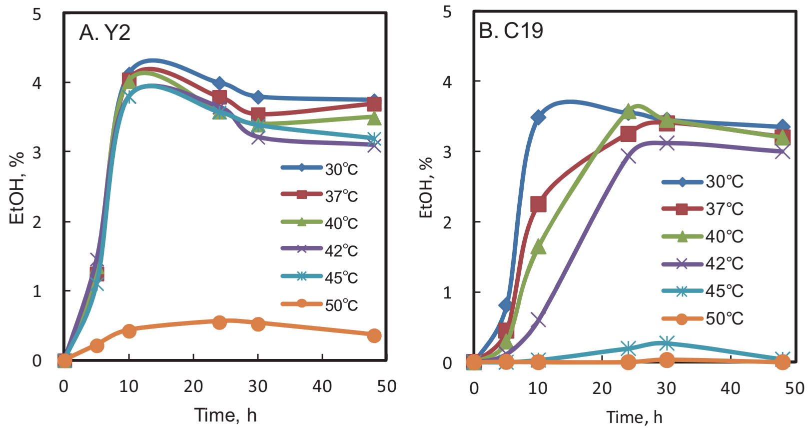


Fig. 1. Ethanol fermentation by thermotolerant yeasts, Y2(A) and C19(B) in 10%YPD（10%glucose, 2% peptone, 1% yeast extract）at different temperature conditions. These yeasts have the thermotolerance to produce ethanol under 42 ºC.

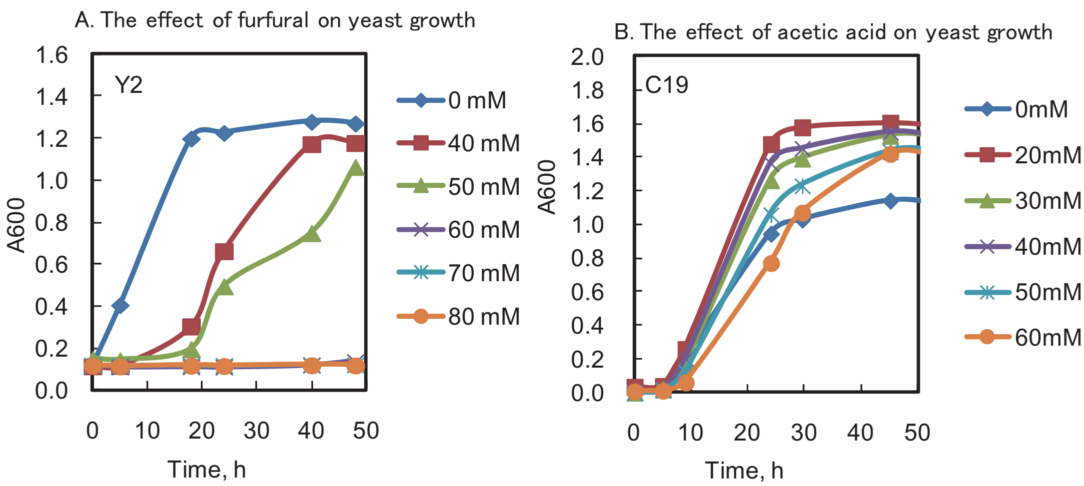


Fig. 2. The influence of inhibitors on yeast growth. (A) Y2 shows tolerance to 40mM furfural at 42 ºC. (B) C19 shows tolerance to 60mM acetic acid at 42 ºC.

TOPIC 5

Non-sterilized bio-plastic production from oil palm sap using halophilic polyhydroxyalkanoate-producing bacteria

We have previously reported that we can produce polyhydroxyalkanoate (PHA), a type of bio-plastics, from oil palm sap (OPS) using PHA-producing bacteria. OPS is a good natural medium. It contains fermentable sugars such as glucose, various amino acids, vitamins, and minerals; however, it is prone to microbial contamination. To prevent microbial contamination, we developed a new PHA fermentation method in which OPS, containing salt (NaCl), is fermented by halophilic PHA-producing bacteria, *Halomonas* sp. SK5.

Studies on the bacterial strain's ability to synthesize PHA were initiated by screening for the most suitable carbon source. Four carbon sources were evaluated, namely, fructose, glucose, sucrose and sodium acetate.

The results showed better growth of the bacterial strain in a medium supplemented with glucose and sucrose. We examined the optimal NaCl concentration in a medium for bacterial growth. Although the growth patterns were almost similar at 5 and 10% (w/v) salinity (Fig. 1), the best cell growth and PHA production were obtained at 10% (w/v) salinity (Table 1). Therefore, we hypothesized that it is possible to avoid microbial contamination by adding a 10% (w/v) saline solution.

We evaluated the potential of OPS in mixtures of artificial salt water and seawater as a growth and production medium. OPS was diluted (1:1) with sterile distilled water or artificial salt water. Results showed that high cell biomass (2.8 ± 0.2) and PHA content (44 ± 6 wt%) were attained (Table 2).

In addition to the utilization of OPS, the potential of natural seawater as growth medium was also evaluated. It showed no microbial contamination even in the case of using sea water. PHA accumulation utilizing mixtures of OPS and seawater showed steady increase, yielding approximately 2.4±0.2 g/L cell biomass and 24±8wt% PHA content at the end of 48h of cultivation (Fig. 2). OPS and seawater as the carbon source and culture medium, respectively, facilitated significant accumulation of PHA. This study showed the potential of OPS and seawater for use in low-cost culture medium to support bacterial cell growth and PHA production.

(*Takamitsu Arai, Akihiko Kosugi, DN Rathi [Universiti Sains Malaysia], K Sudesh [Universiti Sains Malaysia]*)

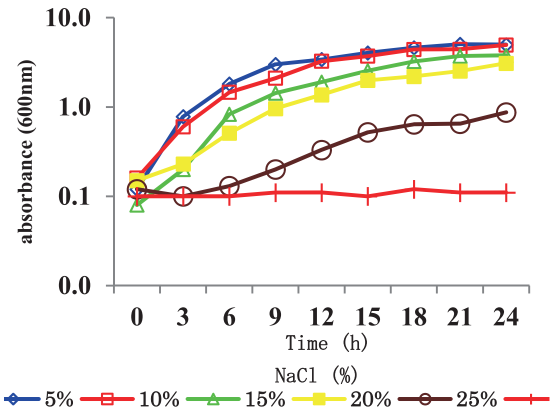


Fig. 1. Growth profile analysis (OD_{600nm}) of *Halomonas* sp. SK5 grown at 30 °C

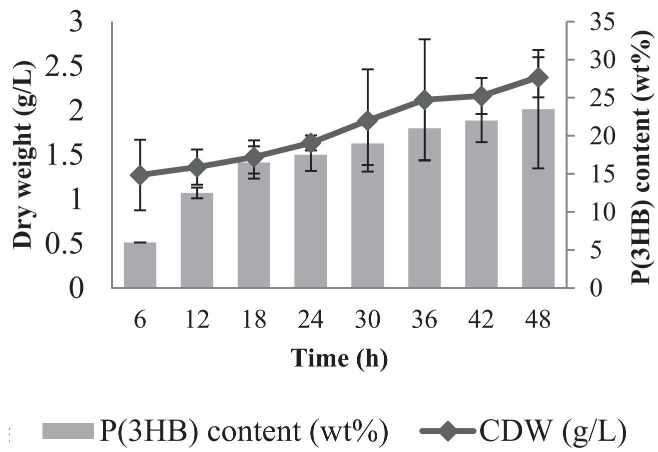


Fig. 2. Time profile analysis of P(3HB) biosynthesis by *Halomonas* sp. SK5 grown in OPS seawater medium at 30 °C and 200 rpm

Table 1. Effects of varying salinity on the cell growth PHA biosynthesis in *Halomonas* sp. SK5

Salinity (w/v %)	Dry weight (g/L)	PHA content (wt%)
5	2.4 ± 0.1	40 ± 4
10	3.5 ± 0.2	41 ± 4
15	3.6 ± 0.2	30 ± 5
20	3.4 ± 0.3	26 ± 4
25	2.6 ± 0.1	15 ± 4

Table 2. Evaluation of the potential of oil palm trunk sap as carbon source as well as sole growth medium in *Halomonas* sp. SK5

	Dry weight (g/L)	PHA content (wt%)
Sap	1.7 ± 0.2	24 ± 4
Sap and salt water	2.8 ± 0.2	44 ± 6

TOPIC 6

Soil suitability map for teak plantation in the Northeast of Thailand

Teak (*Tectona grandis*) is a valuable indigenous tree species in Thailand. Teak wood products are used in making high quality furniture and as building material for houses, etc. It is one of several economic tree species suitable for farm forestry management, and plays a vital role in promoting forest restoration and regional development, thanks to rapid tree growth and high timber prices. Teak has several characteristics, including affinity to specific soil types and conditions, hence future yield depends on site suitability for teak plantation.

Decision support information on determining site suitability is important to teak farmers. There had been no such maps that quantitatively showed soil suitability for teak plantation; thus, not a few farmers came to grief after realizing that they had planted on unsuitable sites.

In general, the northeast region of Thailand is not suitable for teak growing; however, we have observed some promising areas. Thus, we endeavored to produce soil suitability maps for Udon Thani and Nong Bua Lam Phu Provinces in order to promote teak farm forestry for livelihood improvement. Based on field surveys and the soil group map of Thailand created by the Land Development Department, the soil suitability class (SSC) for teak plantation in the two provinces was developed. The SSC was categorized into 5 ranks, ranging from 1 (good) to 5 (poor). Letter suffixes were appended to SSC ranks 2-5 to denote site limitations (i.e., n: nutrition, f: flooding, g: gravel, d: drainage). The areas of slope complex (SC) and water (W) on the soil group map were not classified. The SSC is equivalent to the site quality class shown in 'Yield table for Teak plantation in the Northeast of Thailand' (Fig. 1R). The future yield of a teak forest stand can then be projected by combining data from the soil suitability map and the yield table (Figs. 2 and 3).

Matching accuracy is about 69%; however, actual teak growth might be different from the SSC because of the effects of maintenance (Sukchan and Noda, 2012). The map shows the landmarks (in Thai) and includes photographs of typical soils by SSC to provide guidance to farmers and Royal Forest Department (RFD) extension staffs (Fig. 2). Currently, the soil suitability map covers only Udon Thani and Nong Bua Lam Phu Provinces, but this know-how will be made available so that the map extends to other provinces.

(*I. Noda, T. Vacharangkura, W. Himmapan [Royal Forest Department], S. Sukchan [Land Development Department]*)

References

1*) Noda I., et al. (2012) Soil suitability map for teak plantation in Udon Thani and Nong Bua Lam Phu Provinces. 70pp, RFD-JIRCAS Project. (in Thai)

2) Sukchan S. and Noda I. (2012) Improvement of soil suitability mapping for teak plantations in Northeast Thailand. JIRCAS Working Report 74: 27-32.

3*) Vacharangkura T., et al. (2011) Yield table for Teak plantation in the Northeast of Thailand. 54pp, RFD-JIRCAS Project. (in Thai)

(*) http://forprod.forest.go.th/forprod/ebook/e-book.html

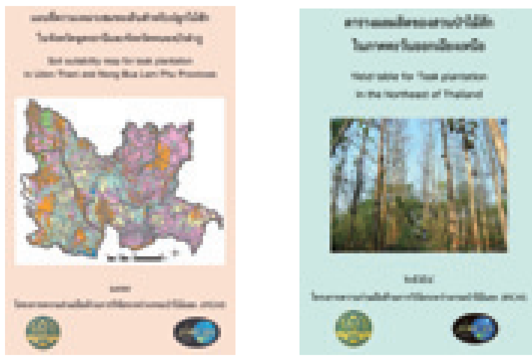


Fig. 1. Left: Soil suitability map for teak plantation in Udon Thani and Nong Bua Lam Phu Provinces (Noda et al., 2012); Right: Yield table for teak plantation in the Northeast of Thailand (Vacharangkura et al., 2011)

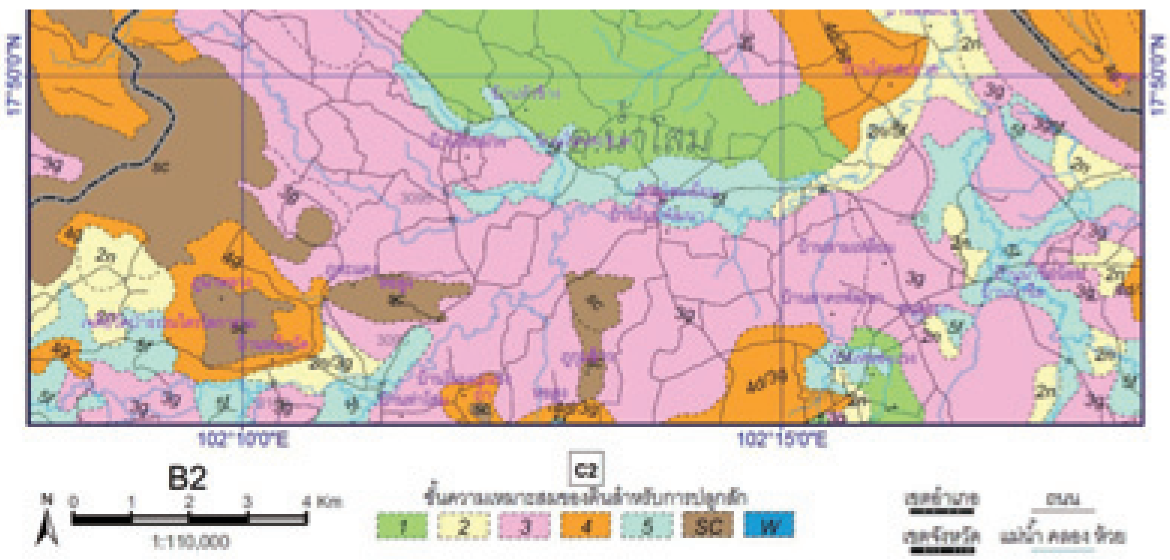


Fig. 2. Soil suitability map (sample page, in Thai). Legend on the map means that SSC 1: green colored area, SSC 2: cream colored area and so on. Also, dashed line: district boundary; dashed-two dotted line: province boundary; solid black line: road; solid blue line: channel or river.

ระยะปลูก 4 ม. X 4 ม. ชั้นคุณภาพพื้นที่ระดับดี (SI = 26)						
อายุ (ปี)	ความสูงไม้เด่น (ม.)	ความสูงเฉลี่ย (ม.)	ความโตเฉลี่ย (ซม.)	พื้นที่หน้าตัด (ม.^{2}/ไร่)	ปริมาตรต่อต้น (ม.^{3}/ต้น)	ปริมาตร (ม.^{3}/ไร่)
...	...	...	...	...	...	...
14	18.7	15.7	59.2	2.035	0.253	17.341
15	19.2	16.2	61.6	2.134	0.279	18.522
16	19.8	16.8	64.0	2.230	0.305	19.698
...	...	...	...	...	...	...

Fig. 3. Yield table (sample page, in Thai). Case scenario: A teak plantation spaced at 4m x 4m, with site index (SI) = 26 and SSC rank = 2. The teak plantation is projected at age 15 to have a dominant tree height of 19.2 m, an average tree height of 16.2 m, an average tree girth of 61.6 cm at breast height, a basal area of 2.134 m2/rai, a stem volume of 0.279 m3/tree and a stand volume of 18.522 m3/rai. (1 rai = 0.16 ha)

TOPIC 7

Genetic diversity of the shrimp, *Macrobrachium yui,* indigenous to Laos

The indigenous shrimp, *Macrobrachium yui*, is utilized as an important living aquatic resource for cash income in northern Laos. Recently, shrimp catch has declined greatly in many fishing sites due to overfishing and deterioration of the river environment. In order to aid recovery of the shrimp stock, we estimated the genetic diversity within a population, the genetic differentiation among populations, and the dynamics of population size in the past using partial mitochondrial DNA control region sequences. In this study, we will suggest measures for shrimp stock recovery suited to each fishing site.

In total, 570 nucleotide sequences were obtained from 355 specimens at seven sampling sites along the Xuang, Ou, Khan, and Houng Rivers of the Mekong River system and the Et River of the Ma River system, in which 58 variable sites were noted and 74 haplotypes were detected (Fig. 1). A minimum-spanning tree (MST) for the shrimp showed two major clades which are linked to each other by 13 base substitutions (Fig. 1). Coefficient of genetic differentiation significantly differed among the five river groups and among localities (Table 1), but not among localities within the same river (Tables 1 and 2), suggesting that the population is structured by the river almost without gene flow. The population at Et River indicated extremely lower genetic and nucleotide diversities than other populations (Fig. 2). Loss of genetic diversity in the Et River population would decrease population growth rate through inbreeding and miniaturization and increase the risk of extinction due to rapid environmental changes. According to the MST (Fig. 1) and mismatch distribution of haplotypes, the Ou (H・K) and Et River (ET) populations have decreased greatly in the past whereas the Khan (XK) and Houng River (NS) populations have remained stable over a long period of time. Only the Et River (ET) population has not reached recovery yet.

Genetic differentiation among *M. yui* populations along the rivers and stock enhancement without regard to genetic diversity could possibly lead to genetic disturbance of local populations. Therefore, we primarily recommend stock management as a concrete measure for recovery of the shrimp stock.

Shrimp migrating into cave streams for reproduction are easily caught by villagers using bamboo traps. Moreover, some shrimp populations have been greatly reduced in the past, implying that *M. yui* is vulnerable to dramatic environmental changes. This suggests the importance of stock management measures such as fishing regulation at the cave stream and habitat conservation.

Stock management of the shrimp should then be carried out at the rivers through the initiative of the villagers with support from the local government. Genetic diversity of shrimp population at the Et River (ET) has been severely reduced; hence, artificial shrimp production under government control may be required as one effective measure for shrimp stock recovery in the future.

(H. Imai [University of Ryukyus], S. Ito, A. KounThongbang, O. Lasasimma [LARReC], P. Soliyamath [Na-Luang Fisheries Station, Luang-Prabang])

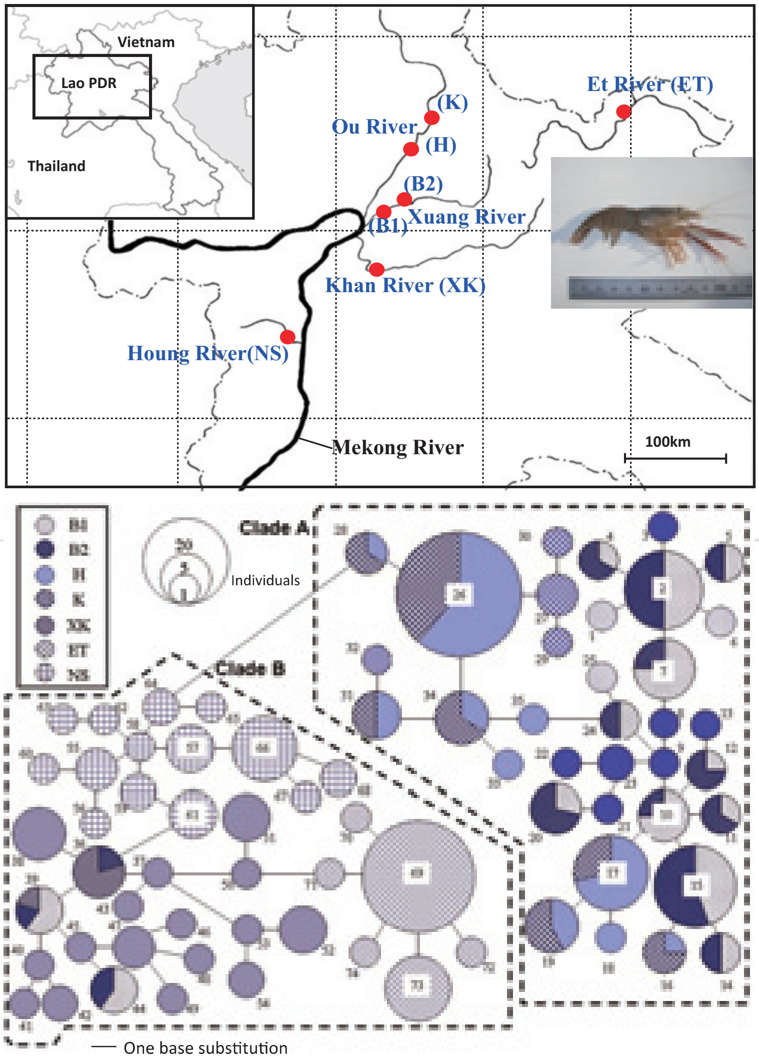


Fig. 1. Sampling sites and minimum spanning tree presenting relationships among 74 haplotypes of the shrimp, *Macrobrachium yui* (Photo inset : the indigenous shrimp, *Macrobrachium yui*) .

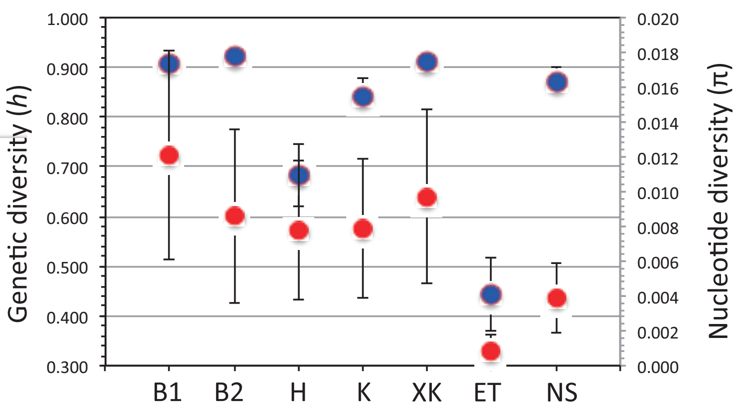


Fig. 2. Genetic diversity (h) (●)and nucleotide diversity (π) (●) at seven localities in five rivers. Error bars show standard deviation.

Table 1. Analysis of molecular variance for pairwise differences (AMOVA) in *Macrobrachium yui*

Comparisions	Percentage of variation	F	P
Among the river groups (F_{CT})	73.34	0.733	<0.01
Among localities within the river group (F_{SC})	0.34	0.013	0.23
Among localities (F_{ST})	26.32	0.737	<0.01

Table 2. Pairwise F_{ST} values (below the diagonal) and pairwise F_{ST} P vales (above the diagonal) for the mitochondrial DNA control region at seven localities of *Macrobrachium yui*

Site	B1	B2	H	K	XK	ET	NS
Xuang R. (B1)	-	0.174	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Xuang R. (B2)	0.011	-	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Ou R. (H)	0.385	0.441	-	0.340	<0.001*	<0.001*	<0.001*
Ou R. (K)	0.423	0.481	0.000	-	<0.001*	<0.001*	<0.001*
Khan R. (XK)	0.669	0.739	0.743	0.741	-	<0.001*	<0.001*
Et R. (ET)	0.820	0.874	0.884	0.883	0.616	-	<0.001*
Houng R. (NS)	0.755	0.816	0.812	0.810	0.544	0.838	-

Bonferroni correction * P<0.001

TOPIC 8

Occurrence of causative dinoflagellates of paralytic shellfish poisoning in Selangor coast, Peninsular Malaysia

The blood cockle, *Anadara granosa* (Fig. 1a), is an important shellfish aquaculture species in Southeast Asia. In Peninsular Malaysia, the center of cockle culture is in Selangor coast, where huge, suitable mud flat habitats are extensive (Fig. 1b). The spats occur in high density throughout the region, for export to neighboring countries as culture seeds as well as for domestic culture.

In recent years, causative dinoflagellates of paralytic shellfish poisoning have been spreading in Southeast Asia, and have become a serious problem to bivalve culture activities. Toxification of bivalves has resulted to big economic losses due to regulations on aquaculture shipping as well as food safety. The main purpose of this study, therefore, is to collect useful knowledge for the future management of cockle fisheries in Selangor coast, by conducting habitat status and distribution surveys for causative dinoflagellates of paralytic shellfish poisoning.

Between January to May 2012, surveys were carried out in wide areas of Selangor coast using plankton nets (mesh size 20μm). Two causative species of paralytic shellfish poisoning, *Gymnodinium catenatum* (Fig. 2a) and *Alexandrium tamiyavanichii* (Figs. 2c, 2d), were detected in the plankton samples. It was evidently clear that the distribution of *G. catenatum* vegetative cells is wide at a 100-km stretch along Selangor coast, from north to south (Fig. 3). The resting cysts, *G. catenatum*, were observed in surface sediment samples (0-2cm) taken by a sediment corer in Selangor coast (Fig. 2b). Sample density was especially high in the northern part, averaging about 0.5 cells/g dried mud (Fig. 4).

Future collaboration with the Malaysian government will focus on the establishment of a monitoring system to detect paralytic shellfish poisoning including the conduct of toxicity analysis in blood cockle. The presence of causative dinoflagellates in the culture grounds will be examined in order to improve food safety of the cultured shells. This monitoring system should enhance stabilization of the cockle culture industry in the region. Local and foreign shipments of the cockle spats, from Selangor coast into other coastal waters, can be a diffusion factor for the resting cysts, and may result to the spread of paralytic shellfish poisoning in Southeast Asia. As part of its future activities toward effective fisheries management, transportation of spats to other culture grounds must take into consideration the diffusion of the resting cysts.

(T. Yurimoto, A. Mohd Nor Azman [FRI Malaysia], Y. Takata [SK-Laboratory], M. Kodama [Univ. of Tokyo], K. Matsuoka [Nagasaki Univ.])

Fig. 1. (a) Blood cockle; (b) A fisherman harvesting cultured cockle

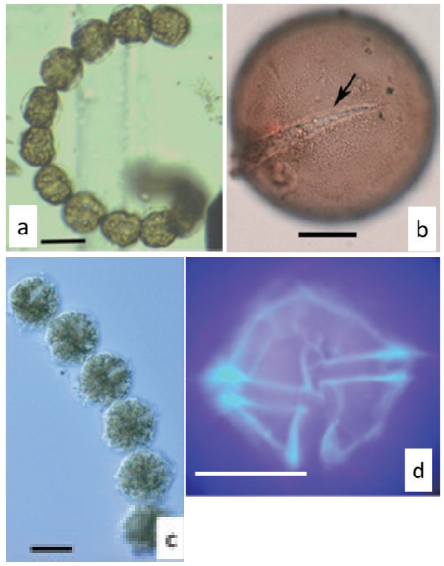


Fig. 2. Vegetative cells of (a) *Gymnodinium catenatum*, (b) the resting cyst and (c) *Alexandrium tamiyavanichii*; (d) fluorescence microscope image of *A. tamiyavanichii* stained with chemical solution. Scale bars correspond to 50 µm (a) and 20 µm (b, c, d)

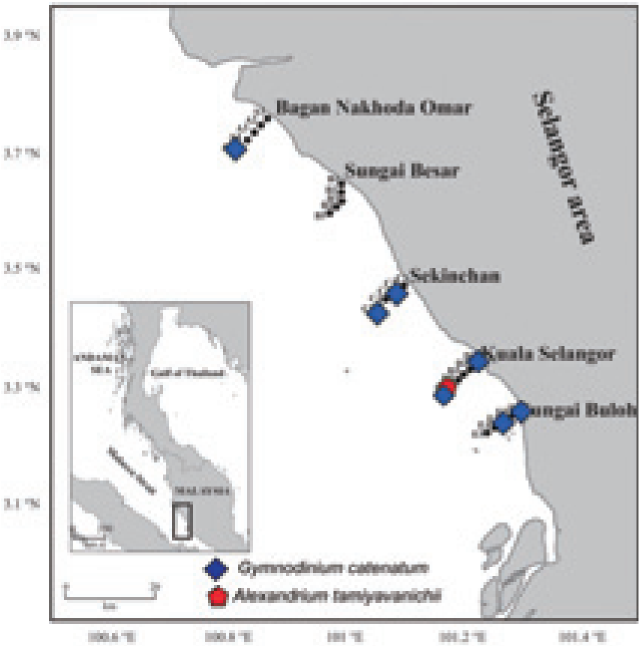


Fig. 3. Occurrence of the vegetative cells, *Gymnodinium catenatum* and *Alexandrium tamiyavanichii,* along Selangor coast

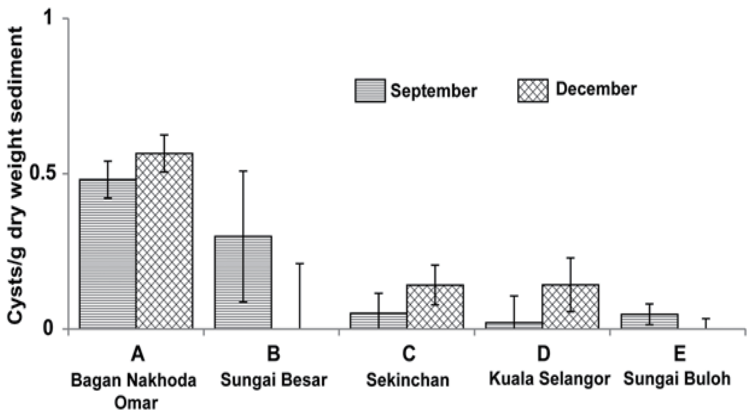


Fig. 4. Comparison of resting cyst (*Gymnodinium catenatum*) cell densities in surface sediments at each site

PROGRAM D
Information Analysis

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 informat ion 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 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 2012 accomplishments showed that Program D performed well in comparison with the original annual implementation plan. Below is a summary of Program D's outputs, among others.

Under Subject A, based on newly-compiled country-based statistical databases, food supply and demand models were developed for Laos and Cambodia and suggested to be used as standard tools for policy analysts in ASEAN countries. Through this activity, collaboration with related institutions such as the ASEAN Food Security Information System and the UN FAO's Regional Office for Asia and the Pacific was strengthened. Continuous efforts were also made to collect information on agricultural market projections. Information on agriculture and water was also collected and cooperation with water-issue organizations, such as the World Water Council, was enhanced. In addition, an analysis of bio-energy production was initiated in collaboration with the International Renewable Energy Agency (IRENA), where a staff member of JIRCAS has been sent on a long-term assignment. JIRCAS also co-organized several symposiums in Japan on this issue.

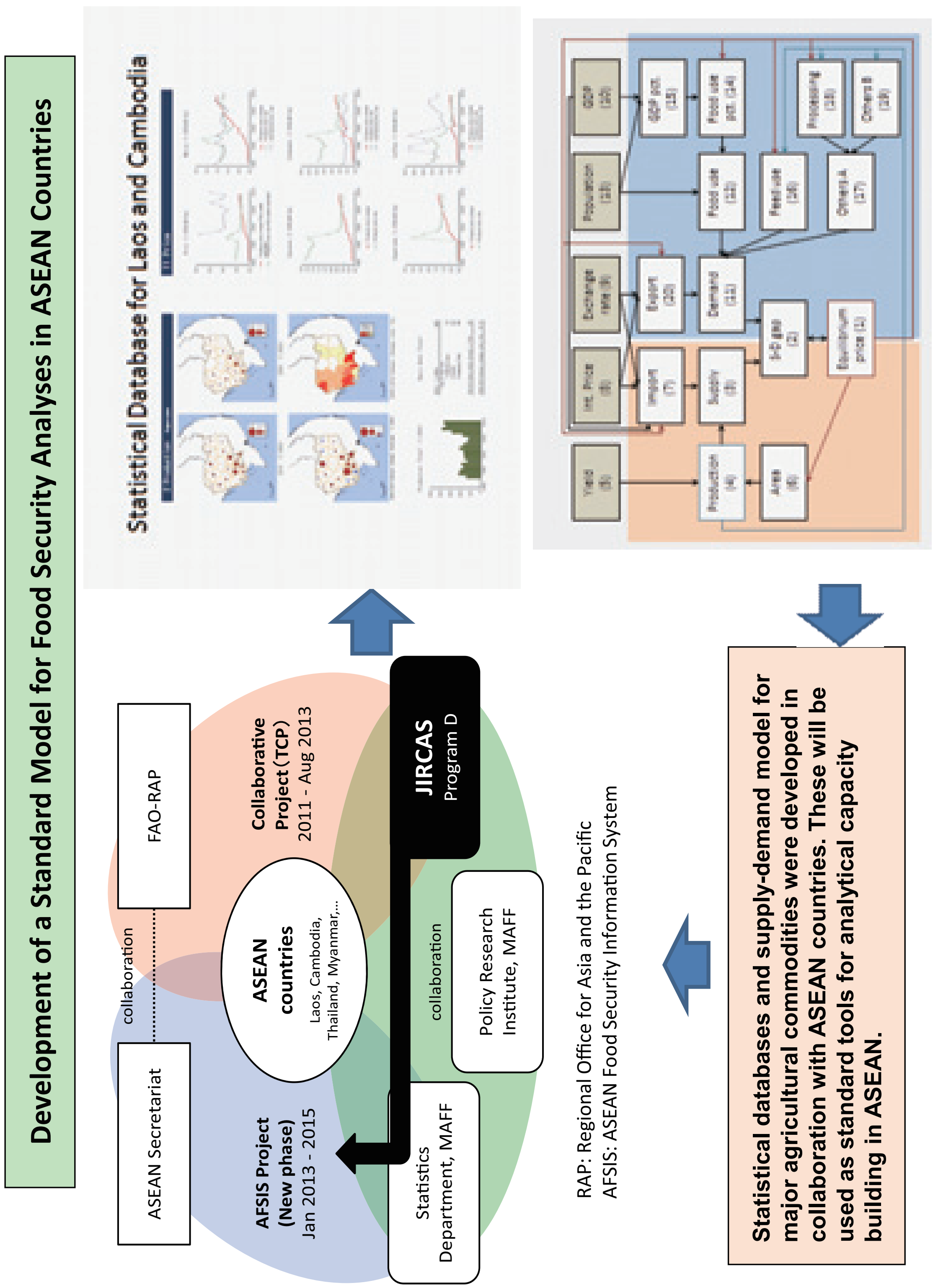
Under Subject B, JIRCAS participated in the 2nd Global Conference on Agricultural Research for Development (GCARD). A staff member of JIRCAS was assigned to the secretariat of the conference, the Global Forum of Agricultural Research (GFAR) Secretariat, for five months. JIRCAS participated or became a member of newly-established G20 related networks for agricultural research, such as the Meeting of Agricultural Chief Scientists (MACS), the Wheat Initiative (WI) and the Tropical Agricultural Platform (TAP), and started research information exchange. 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 2012 to identify potential research subjects in the area of resilient food production systems in developing regions. Besides, 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

Development of a Standard Model for Food Security Analyses in ASEAN Countries

It is essential to make appropriate analyses of the current and future situation of food supply and demand in order to provide research direction and eventually solutions to international food and environmental problems. JIRCAS observes the latest trends in global food markets and food security by conducting joint projects and by participating at relevant international meetings. In order to obtain an accurate and comprehensive picture of Asian food markets, JIRCAS initiated a collaborative project with Laos, Cambodia, and the FAO Regional Office for Asia and Pacific (FAO-RAP) to create a country-based econometric model. After building a statistical database for major food commodities, which includes historical time-series data and charts, detailed structure of the models were designed and determined. In cooperation with the ASEAN Food Security Information System (AFSIS), it was suggested that models will be used as common practical tools for food security analyses in the region as well as for capacity building of the policy makers and statisticians of the member countries. JIRCAS will strive to become a reliable collaborator in this research area for further strengthening of analytical capacities.



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-three individual visits to JIRCAS were made during FY 2012 under the Administrative Invitation Program. Invited administrators and their home institutions are listed below.

Administrative Invitations, FY 2012		
Jirakorn Kosaisawe	Department of Agriculture (DOA), Ministry of Agriculture and Cooperatives (MOAC), Thailand	Aug. 4-7, 2012
Manthana Milne	Department of Agriculture (DOA), Ministry of Agriculture and Cooperatives (MOAC), Thailand	Aug. 4-8, 2012
Praphasri Chongpraditnun	Department of Agriculture (DOA), Ministry of Agriculture and Cooperatives (MOAC), Thailand	Aug. 4-8, 2012
Werapon Ponragdee	Khon Kaen Field Crops Research Center, Department of Agriculture (DOA), Ministry of Agriculture and Cooperatives (MOAC), Thailand	Aug. 4-8, 2012
Sombat Tongtao	Chanthaburi Horticultural Research Center, Department of Agriculture (DOA), Ministry of Agriculture and Cooperatives (MOAC),Thailand	Aug. 4-8, 2012
Jintawee Thaingam	Department of Agriculture (DOA), Ministry of Agriculture and Cooperatives (MOAC), Thailand	Aug. 4-8, 2012
Rosly Bin Hassan	Fisheries Research Institute (FRI), Department of Fisheries Malaysia, Malaysia	Nov. 14-22, 2012
Shenggen Fan	International Food Policy Research Institute (IFPRI), U.S.A.	Nov. 14-29, 2012
Hongwen Li	China Agricultural University (CAU), P.R. China	Nov. 27-Dec. 1, 2012
Yulia Shirokova	Scientific Research Institute of Irrigation and Water Problems, Uzbekistan	Nov. 25-Dec. 5, 2012
Andrew Mude	International Livestock Research Institute (ILRI), Kenya	Nov. 26-Dec. 6, 2012
Mohamed Abdellahi Ebbe	National Centre for Prevention and Control of Desert Locust, Mauritania	Nov. 25-Dec. 6, 2012

Junichi Hanai	JICA Kenya Office, Kenya	Nov. 24-Dec. 3, 2012
Md Syedul Islam	Bangladesh Rice Research Institute (BRRI), Bangladesh	Nov. 25-Dec. 1, 2012
Jiban Krishna Biswas	Bangladesh Rice Research Institute (BRRI), Bangladesh	Nov. 25-Dec. 1, 2012
Md Shahjahan Kabir	Bangladesh Rice Research Institute (BRRI), Bangladesh	Nov. 25-Dec. 1, 2012
Inez Hortense Slamet-Loedin	International Rice Research Institute, Philippines	Dec. 10-13, 2012
Carolina Saint Pierre	Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), Mexico	Dec.10-14, 2012
Arvind Kumar	International Rice Research Institute (IRRI), Philippines	Dec.10-13, 2012
Cecile Grenier	International Center for Tropical Agriculture (CIAT), Colombia	Dec. 9-17, 2012
Manabu Ishitani	International Center for Tropical Agriculture (CIAT), Colombia	Dec.10-14, 2012
Marc Ellis	Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), Mexico	Dec. 8-16, 2012
Nteranya Sanginga	International Institute of Tropical Agriculture (IITA), Nigeria	Feb. 12-20, 2013

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-six researchers were invited under this program during FY 2012. Invited researchers, their affiliated research organizations, and their research activities are summarized below.

Counterpart Researcher Invitations, FY 2012

Terry James Rose	Southern Cross Plant Science Y Block, Southern Cross University, Australia	Enhancing system P utilization efficiency through development of rice germplasm with reduced grain P concentration	May 16-26, 2012 / Jul. 8-12, 2012
Joemel Gentelizo Sumbing	Southeast Asian Fisheries Development Center/Aquaculture Department (SEAFDEC/AQD), Philippines	Mathematical modelling of nutrient flow in polyculture system	Jul. 11-27, 2012
Bounthom Somphanpanya	Horticultural Research Center, Lao PDR	Development of sustainable fruit production technology in Indo-China	Jul. 21-Aug. 3, 2012
Phaythoune Mounsana	Horticultural Research Center, Lao PDR	Development of sustainable fruit production technology in Indo-China	Jul. 21-Aug. 3, 2012
Rattiya Waeonukul	Pilot Plant Development and Training Institute, King Mongkut's University of Technology Thonburi (KMUTT), Thailand	Study of biological saccharification technology using *Clostridium* thermocellum	Nov. 1-March 29, 2012
Romina Mabel Chavez Jara	Centro de Investigación Capitán Miranda, Instituto Paraguayo de Tecnología Agraria (IPTA), Paraguay	Development of soybean varieties resistant against soybean rust in Paraguay	Sept. 8-Nov. 11, 2012
Mohammad Ashik Iqbal Khan	Plant Pathology Division, Bangladesh Rice Research Institute (BRRI), Bangladesh	Development of a differential system for rice blast resistance in Bangladesh	Sept. 24, 2012-Feb. 23, 2013
Theophile Odjo	Faculty of Agricultural Science, University of Abomey-Calavi, Benin	Pathogenicity of blast isolates from West Africa	Sept. 23, 2012-Feb. 22, 2013
Phanchita Nan Vejchasarn	Department of Plant Science, College of Agricultural Sciences, The Pennsylvania State University, USA	Characterization of sorghum and rice root properties in low-P fields	Sept. 2-23, 2012
Patompong Khwan Saengwilai	Department of Plant Science, College of Agricultural Sciences, The Pennsylvania State University, USA	Characterization of sorghum and rice root properties in low-P fields	Sept. 2-23, 2012
Eko Siswanto	Institute of Geospatial Science and Technology, Universiti Teknologi Malaysia (UTM), Malaysia	2012 SPIE Asia-Pacific Remote Sensing Symposium	Oct. 25-Nov. 3, 2012
Someboune Sayavong	Agriculture and Forestry Policy Research Centre (AFPRC), Lao PDR	Socio-economic conditions for the stability and independence of farm household economy in Lao PDR	Oct. 15-26, 2012
Michael Timothy Rose	School of Chemistry, Faculty of Science Monash University, Australia	Rice germplasm for high grain Zn content and tolerance of Zn deficient soils	Sept. 3-9, 2012

Edward Makoto Johns	Department of Plant Science, College of Agricultural Sciences, The Pennsylvania State University, USA	Characterization of sorghum and rice root properties in low-P fields	Sept. 2-23, 2012
Faizul Bin Mohd Kassim	JIRCAS Penang Office, c/o Fisheries Research Institute (FRI), Malaysia	Training on daily ring analysis of fish otolith and planning of benthos sampling for detection of enzyme activity	Nov. 25-Dec. 5, 2012
Waraporn Apiwatanapiwat	Enzyme Technology and Waste Management Research Unit, Kasetsart Agricultural and Agro-Industrial Product Improvement Institute (KAPI), Thailand	Development of yeast that produces bio-ethanol from tropical crop residues	Nov. 26, 2012-Feb. 22, 2013
Woraphun Himmapan	Forestry Research and Development Bureau, Royal Forest Department, Ministry of Natural Resources and Environment,Thailand	Exchange of views on coppicing study and long-term monitoring experiments for tree plantation	Nov. 11-Dec. 2, 2012
Gezahegn Girma Tessema	Clonal Crop Field Bank Management, International Institute of Tropical Agriculture (IITA), Nigeria	SuperSAGE for determination of flowering and sex-related genes in yam	Oct. 31-Dec. 2, 2012
Michael Frei	Institute of Crop Science and Resource Conservation, University of Bonn, Germany	Fine mapping for ozone tolerance	Oct. 25-31, 2012
Nguyen Cong Thuan	College of Environment and Natural Resources, Can Tho University (CTU), Vietnam	Study on nitrogen and carbon supply from a biogas digester for freshwater fish farming	Jan. 5-Feb. 2, 2013
Michael Gomez Selvaraj	International Center for Tropical Agriculture (CIAT), Colombia	Symposium of the MAFF-Funded DREB Project “Development of Abiotic Stress Tolerant Crops by DREB Genes” and the DREB Annual Meeting 2012	Dec. 10-15, 2012
Alexandre Grondin	Crop and Environmental Sciences Division, International Rice Research Institute (IRRI), Philippines	Symposium of the MAFF-Funded DREB Project “Development of Abiotic Stress Tolerant Crops by DREB Genes” and the DREB Annual Meeting 2012	Dec. 10-14, 2012
Amelia Henry	Crop and Environmental Sciences Division, International Rice Research Institute (IRRI), Philippines	Symposium of the MAFF-Funded DREB Project “Development of Abiotic Stress Tolerant Crops by DREB Genes” and the DREB Annual Meeting 2012	Dec. 10-14, 2012
Juliet P. Rillon	Crop Protection Division, Philippine Rice Research Institute (PhilRice), Philippines	Development of a control system for blast disease in the Philippines	Jan. 7-Mar. 30, 2013
Ahmad Dadang	Molecular Biology Division, Indonesian Center for Agricultural Biotechnology and Genetic Resources Research and Development (ICABIOGRD), Indonesia	Development of durable protection system to blast in Indonesia	Jan. 6-Mar. 30, 2013
Asad Jan	Institute of Biotechnology and Genetics Engineering, Khyber Pakhtunkhwa Agricultural University Peshawar, Pakistan	Symposium of the MAFF-Funded DREB Project “Development of Abiotic Stress Tolerant Crops by DREB Genes” and the DREB Annual Meeting 2012	Dec. 10-26, 2012
Aloun Kounthongbang	Living Aquatic Resources Research Center (LARReC), Lao PDR	Development of technique of stock management in the indigenous *Macrobrachium* shrimp	Jan. 8-21, 2013

Furela Tahiru	Soil Science Division, Savannah Agricultural Research Institute (SARI), Ghana	Development of rice production technologies in floodplains of Africa	March 18-28, 2013
Ephraim Sekyi-Annan	Council for Scientific and Industrial Research- Soil Research Institute, Ghana	Development of conservation agriculture-based cropping system and evaluation of its effects on soil conservation and productivity increase	Feb. 22-March 31, 2013
Ousmane Boukar	International Institute of Tropical Agriculture (IITA), Nigeria	Evaluation of cowpea genetic resources for improvement of quality and value addition	Feb. 8-19, 2013
Michael Terence Abberton	Genetic Resources Unit, International Institute of Tropical Agriculture (IITA), Nigeria	Progress and Planning Meeting of EDITS-Yam Project	Feb. 8-17, 2013
Tahirou Abdoulaye	International Institute of Tropical Agriculture (IITA), Nigeria	Analysis of consumption and consumer preferences for cowpea in West Africa	Feb. 8-19, 2013
Haruki Ishikawa	International Institute of Tropical Agriculture (IITA), Nigeria	Appropriate varieties of early maturing cowpea for Burkina Faso (AVEC-BF)	Feb. 7-23, 2013
Antonio Jose Lopez-Montes	Yam Program Unit, International Institute of Tropical Agriculture (IITA), Nigeria	Progress and Planning Meeting of EDITS-Yam Project	Feb. 9-17, 2013
Ranjana Buhattacharjee	International Institute of Tropical Agriculture (IITA), Nigeria	Progress and Planning Meeting of EDITS-Yam Project	Feb. 8-17, 2013
Md. Abdus Salam	Agricultural Economics Division, Bangladesh Rice Research Institute (BRRI), Bangladesh	Impact assessment of climate change on production and market of rice in Bangladesh	Feb. 17-March 9, 2013

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, fifty-one researchers were invited and implemented their programs during FY2012 as listed below.

Project Site Invitations, FY 2012

Oumar Senou	Forestry Resource Division, Sotuba Regional Agronomy Research Center, Institute of Rural Economy (IER), Mali	Forestry Resource Conservation, Niger	Jul. 30-Aug.2, 2012
Adama Coulibaly	Soil, Water and Plant Laboratory, Sotuba Regional Agronomy Research Center, Institute of Rural Economy (IER), Mali	Soil Fertility Improvement, Niger	Jul. 30-Aug.2, 2012
Kalifa Traore	Soil, Water and Plant Laboratory, Sotuba Regional Agronomy Research Center, Institute of Rural Economy (IER), Mali	Soil Conservation, Niger	Jul. 30-Aug.2, 2012
Seydou Sidibé	Animal Nutrition Analysis Laboratory, Sotuba Regional Agronomy Research Center, Institute of Rural Economy (IER), Mali	Soil Fertility Improvement, Niger	Jul. 30-Aug.2, 2012
Oumar Senou	Forestry Resource Division, Sotuba Regional Agronomy Research Center, Institute of Rural Economy (IER), Mali	Forestry Resource Conservation, Niger	Oct. 3-7, 2012
Adama Coulibaly	Soil, Water and Plant Laboratory, Sotuba Regional Agronomy Research Center, Institute of Rural Economy (IER), Mali	Soil Fertility Improvement, Niger	Oct. 3-7, 2012
Kalifa Traore	Soil, Water and Plant Laboratory, Sotuba Regional Agronomy Research Center, Institute of Rural Economy (IER), Mali	Soil Conservation, Niger	Oct 1-4, 2012
Seydou Sidibé	Animal Nutrition Analysis Laboratory, Sotuba Regional Agronomy Research Center, Institute of Rural Economy (IER), Mali	Soil Fertility Improvement, Niger	Oct. 15-18, 2012
Amlius Thalib	Indonesian Research Institute for Animal Production (IRIAP), Indonesia	JIRCAS International Symposium, "Greenhouse Gases and Sustainable Agriculture in Southeast Asia", Vietnam	Nov. 18-21, 2012
Vu Chi Cuong	National Institute of Animal Sciences, Vietnam	JIRCAS International Symposium, "Greenhouse Gases and Sustainable Agriculture in Southeast Asia", Vietnam	Nov. 18-21, 2012
La Van Kinh	Institute of Agricultural Sciences for Southern Vietnam (IAS), Vietnam	JIRCAS International Symposium, "Greenhouse Gases and Sustainable Agriculture in Southeast Asia", Vietnam	Nov. 18-21, 2012
Pham Quang Ha	Institute for Agricultural Environment, Vietnamese Academy of Agricultural Sciences (VAAS), Vietnam	JIRCAS International Symposium, "Greenhouse Gases and Sustainable Agriculture in Southeast Asia", Vietnam	Nov. 18-21, 2012

Kritapon Sommart	Department of Animal Science, Faculty of Agriculture, Khon Kaen University (KKU), Thailand	JIRCAS International Symposium, "Greenhouse Gases and Sustainable Agriculture in Southeast Asia", Vietnam	Nov. 18-22, 2012
Thumrongsakd Phonbumrung	Bureau of Animal Nutrition Development, Department of Livestock Development (DLD), Thailand	JIRCAS International Symposium, "Greenhouse Gases and Sustainable Agriculture in Southeast Asia", Vietnam	Nov. 18-21, 2012
Chitnucha Buddhaboon	Prachin Buri Rice Research Center, Bureau of Rice Research and Development, Rice Department, Thailand	JIRCAS International Symposium, "Greenhouse Gases and Sustainable Agriculture in Southeast Asia", Vietnam	Nov. 18-21, 2012
Md. Ansar Ali	Plant Pathology Division, Bangladesh Rice Research Institute (BRRI), Bangladesh	Temperate Rice Research Consortium (TRRC) Meeting and Annual Meeting of the Project, "Rice innovation for environmentally sustainable production systems", Philippines	Oct. 28 Nov. 1, 2012
Khay Sathya	Cambodian Agricultural Research and Development Institute (CARDI), Cambodia	Temperate Rice Research Consortium (TRRC) Meeting and Annual Meeting of the Project, "Rice innovation for environmentally sustainable production systems", Philippines	Oct. 28-Nov. 1, 2012
Cailin Lei	Institute of Crop Science, Chinese Academy of Agricultural Sciences (CAAS), P.R. China	Temperate Rice Research Consortium (TRRC) Meeting and Annual Meeting of the Project, "Rice innovation for environmentally sustainable production systems", Philippines	Oct. 28-Nov. 1, 2012
Li Chengyun	Yunnan Agricultural University (YAU), P.R. China	Temperate Rice Research Consortium (TRRC) Meeting and Annual Meeting of the Project, "Rice innovation for environmentally sustainable production systems", Philippines	Oct. 28-Nov. 1, 2012
Li Jinbin	Agricultural Environment and Resources Research Institute, Yunnan Academy of Agricultural Sciences (YAAS), P.R. China	Temperate Rice Research Consortium (TRRC) Meeting and Annual Meeting of the Project, "Rice innovation for environmentally sustainable production systems", Philippines	Oct. 28-Nov. 1, 2012
Suwarno	Indonesian Center for Rice Research (ICRR), Indonesia	Temperate Rice Research Consortium (TRRC) Meeting and Annual Meeting of the Project, "Rice innovation for environmentally sustainable production systems", Philippines	Oct. 28-Nov. 1, 2012
Dwinita Utami	Indonesian Center for Agricultural Biotechnology and Genetic Resources Research and Development (ICABIOGRD), Indonesia	Temperate Rice Research Consortium (TRRC) Meeting and Annual Meeting of the Project, "Rice innovation for environmentally sustainable production systems", Philippines	Oct. 28-Nov. 1, 2012
Chanthakhone Boualaphanh	Rice and Cash Crop Research Centre, National Agriculture and Forestry Research Institute (NAFRI), Lao PDR	Temperate Rice Research Consortium (TRRC) Meeting and Annual Meeting of the Project, "Rice innovation for environmentally sustainable production systems", Philippines	Oct. 28-Nov. 1, 2012

Phetmanyseng Xangsayasane	Rice and Cash Crop Research Centre, National Agriculture and Forestry Research Institute (NAFRI), Vientiane, Lao PDR	Temperate Rice Research Consortium (TRRC) Meeting and Annual Meeting of the Project, "Rice innovation for environmentally sustainable production systems", Philippines	Oct. 28-Nov. 1, 2012
Poonsak Mekwatanakan	Ubon Rice Research Center (URRC), Thailand	Temperate Rice Research Consortium (TRRC) Meeting and Annual Meeting of the Project, "Rice innovation for environmentally sustainable production systems", Philippines	Oct. 27-Nov. 1, 2012
Acharaporn Na Lampang Noenplab	Phitsanulok Rice Research Center, Thailand	Temperate Rice Research Consortium (TRRC) Meeting and Annual Meeting of the Project, "Rice innovation for environmentally sustainable production systems", Philippines	Oct. 27-Nov. 1, 2012
Nguyen Thi Lang	Cuu Long Delta Rice Research Institute (CLRRI), Vietnam	Temperate Rice Research Consortium (TRRC) Meeting and Annual Meeting of the Project, "Rice innovation for environmentally sustainable production systems", Philippines	Oct. 28-Nov. 1, 2012
Pham Thi Thu Ha	Cuu Long Delta Rice Research Institute (CLRRI), Vietnam	Temperate Rice Research Consortium (TRRC) Meeting and Annual Meeting of the Project, "Rice innovation for environmentally sustainable production systems", Philippines	Oct. 28-Nov. 1, 2012
Nguyen Thi Minh Nguyet	Molecular Biology Department, Agricultural Genetics Institute (AGI), Vietnam	Temperate Rice Research Consortium (TRRC) Meeting and Annual Meeting of the Project, "Rice innovation for environmentally sustainable production systems", Philippines	Oct. 28-Nov. 1, 2012
Ha Minh Thanh	Department of Plant Pathology, Plant Protection Research Institute, Vietnam Academy of Agricultural Sciences (VAAS), Vietnam	Temperate Rice Research Consortium (TRRC) Meeting and Annual Meeting of the Project, "Rice innovation for environmentally sustainable production systems", Philippines	Oct. 28-Nov. 1, 2012
Hoang Thi Hue	Research Planning and International Cooperation, Plant Resources Center, Vietnam Academy of Agricultural Sciences (VAAS), Vietnam	Temperate Rice Research Consortium (TRRC) Meeting and Annual Meeting of the Project, "Rice innovation for environmentally sustainable production systems", Philippines	Oct. 28-Nov. 1, 2012
Thelma F. Padolina	Plant Breeding and Biotechnology Division, Philippine Rice Research Institute (PhilRice), Philippines	Temperate Rice Research Consortium (TRRC) Meeting and Annual Meeting of the Project, "Rice innovation for environmentally sustainable production systems", Philippines	Oct. 28-Nov. 1, 2012
Loida M. Perez	Genetics Resources Division, Philippine Rice Research Institute (PhilRice), Philippines	Temperate Rice Research Consortium (TRRC) Meeting and Annual Meeting of the Project, "Rice innovation for environmentally sustainable production systems", Philippines	Oct. 28-Nov. 1, 2012

Antonio J. G. Ivancovich	Estación Experimental Agropecuaria Pergamino, Instituto Nacional de Tecnología Agropecuaria (INTA), Argentina	Project Annual Meeting on "Monitoring *Phakopsora pachyrhizi* populations in South America" and "Development of breeding materials by marker-assisted selection", Brazil	Nov. 20-24, 2012
Adrian Dario De Lucia	Estación Experimental Agropecuaria Cerro Azul, Instituto Nacional de Tecnologia Agropecuaria (INTA), Argentina	Project Annual Meeting on "Monitoring *Phakopsora pachyrhizi* populations in South America" and "Development of breeding materials by marker-assisted selection", Brazil	Nov. 20-24, 2012
Monica Isabel Heck	Estación Experimental Agropecuaria-Cerro Azul, Instituto Nacional de Tecnologia Agropecuaria (INTA), Argentina	Project Annual Meeting on "Monitoring *Phakopsora pachyrhizi* populations in South America" and "Development of breeding materials by marker-assisted selection", Brazil	Nov. 20-24, 2012
Alicia Noelia Bogado	Centro de Investigación Capitán Miranda, Instituto Paraguayo de Tecnología Agraria, Ministrio de Agricultura y Ganadería (MAG), Paraguay	Project Annual Meeting on "Monitoring *Phakopsora pachyrhizi* populations in South America" and "Development of breeding materials by marker-assisted selection", Brazil	Nov. 20-24, 2012
Anibal Morel	Centro de Investigación Capitán Miranda, Instituto Paraguayo de Tecnología Agraria, Ministerio de Agricultura y Ganadería (MAG), Paraguay	Project Annual Meeting on "Monitoring *Phakopsora pachyrhizi* populations in South America" and "Development of breeding materials by marker-assisted selection", Brazil	Nov. 20-24, 2012
Miori Uno Shimakawa	Fundacion Nikkei-Cetapar, Paraguay	Project Annual Meeting on "Monitoring *Phakopsora pachyrhizi* populations in South America" and "Development of breeding materials by marker-assisted selection", Brazil	Nov. 21-24, 2012
Christian Espinola	Fundacion Nikkei-Cetapar, Paraguay	Project Annual Meeting on "Monitoring *Phakopsora pachyrhizi* populations in South America" and "Development of breeding materials by marker-assisted selection", Brazil	Nov. 21-24, 2012
Andrew Macdonald	Rothamsted Research, Harpenden, UK	JIRCAS International Workshop "Carbon sequestration in soils through farm land management: The latest world researches and relevancy in Southeast Asia" (Thailand)	Dec. 4-12, 2012
Roland Joseph Buresh	International Rice Research Institute (IRRI), Philippines	JIRCAS International Workshop "Carbon sequestration in soils through farm land management: The latest world researches and relevancy in Southeast Asia", Thailand	Dec. 5-8, 2012
Luu Hong Man	Cuu Long Delta Rice Research Institute (CLRRI), Vietnam	JIRCAS International Workshop "Carbon sequestration in soils through farm land management: The latest world researches and relevancy in Southeast Asia", Thailand	Dec. 5-8, 2012

Nguyen Huu Chiem	Department of Environmental Science, College of Environment and Natural Resources, Can Tho University (CTU), Vietnam	JIRCAS International Workshop "Carbon sequestration in soils through farm land management: The latest world researches and relevancy in Southeast Asia", Thailand	Dec. 5-8, 2012
Suwandi	Indonesian Vegetable Research Insitute (IVEGRI), Indonesia	JIRCAS International Workshop "Carbon sequestration in soils through farm land management: The latest world researches and relevancy in Southeast Asia", Thailand	Dec. 5-8, 2012
Wiwik Hartatik	Indonesian Soil Research Institute (ISRI), Indonesia	JIRCAS International Workshop "Carbon sequestration in soils through farm land management: The latest world researches and relevancy in Southeast Asia", Thailand	Dec. 5-8, 2012
Abdoulaye Hamadoun	Sotuba Regional Agronomy Research Center, Institute of Rural Economy (IER), Mali	General management for the study, Niger	Dec. 10-14, 2012
Adama Coulibaly	Soil, Water and Plant Laboratory, Sotuba Regional Agronomy Research Center, Institute of Rural Economy (IER), Mali	Soil Fertility Improvement, Niger	Dec. 10-14, 2012
Oumar Senou	Forestry Resource Division, Sotuba Regional Agronomy Research Center, Institute of Rural Economy (IER), Mali	Forestry Resource Conservation, Niger	Dec. 10-14, 2012
Kalifa Traore	Soil, Water and Plant Laboratory, Sotuba Regional Agronomi Research Center, Institute of Rural Economy (IER), Mali	Soil Conservation, Niger	Dec. 10-14, 2012
Seydou Sidibé	Animal Nutrition Analysis Laboratory, Sotuba Regional Agronomy Research Center, Institute of Rural Economy (IER), Mali	Soil Fertility Improvement, Niger	Dec. 10-14, 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 researches that address various problems confronting countries in the developing regions. In FY 2006, these fellowship programs were modified and merged into one. In FY 2012, a total of eight researcheres were invited to conduct research at JIRCAS HQ.

JIRCAS Visiting Research Fellowships at Tsukuba
(October 2012 to September 2013)

Tsehaye Habtemichael Tesfamariam	Department of Agronomy, Hamelmalo Agricultural College (HAC), Eritrea	Characterization of sorgoleone release capacity for biological nitrification inhibition (BNI) in sorghum and development of sorgoleone-production evaluation system
Harby Mohamed Sorour Mostafa	Department of Agricultural Engineering, Faculty of Agriculture, Benha University, Egypt	Study on sustainable management-fee collection mechanism for irrigation and drainage facilities in Africa
Md. Motaher Hossain	Department of Plant Pathology, Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Bangladesh	Evaluation of soybean rust resistance in the soybean lines transformed with the disease resistance-related genes
Chen Huatao	Institute of Vegetable Crops, Jiangsu Academy of Agricultural Sciences (JAAS), P.R. China	Identification of environmental stress tolerance genes in soybean and its application in soybean improvement
Amornrat Watthanalamloet	Biochemical Technology, King Mongkut's University of Technology Thoburi (KMUTT) (Bangkuntien), Thailand	Elucidation of efficient saccharification mechanism in highly active cellulosomes
Kunasundari Balakrishnan	School of Biological Sciences, Universiti Sains Malaysia (USM), Malaysia	Development of highly efficient bioplastic production technology using squeezed sap from oil palm trunk
Hatairat Dangjarean	Nanotechnology and Biotechnology Division, Kasetsart Agricultural and Agro-Industrial Product Improvement Institute, Kasetsart University, Thailand	Modification of thermotolerant yeast for acid tolerance
Cheng Leilei	Department of Development Strategy and Policy, Institute of Desertification Studies, Chinese Academy of Forestry, P.R. China	Comparative study on Chinese agriculture focusing on policy and recycling-based agricultural system

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 FY2012, four researchers were invited, one each to Lao PDR, Mongolia, Philippines and Thailand. The fellows and their research subjects are listed below.

For inquiries on the JIRCAS Visiting Research Fellowship Program, please contact the Research Coordination 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 2012 to September 2013)

Zolzaya Sed-Ochir	School of Biological Resources and Management, Mongolian State University of Agriculture (MSUA), Mongolia	Development of a technique for supplemental feeds processing in Mongolia
Bounsong Vongvichith	Living Aquatic Resources Research Center (LARReC), National Agriculture and Forestry Research Institute, Ministry of Agriculture and Forestry, Lao P.D.R.	Diversification of aquacultural species in Laotian indigenous fishes and nutritional examinations for retrenching feed cost
Chonlada Meeanan	Division of Animal Production Technology and Fisheries, Faculty of Agricultural Technology, King Mongkut's Institute of Technology Landkrabang (KMITL), Thailand	Study on survival and substrate preferability of giant tiger prawn under co-culture conditions with seaweeds
Zenith Gaye Almeda Orozco	Southeast Asian Fisheries Development Center/ Aquaculture Department (SEAFDEC/AQD), Philippines"	Tracer study of nutrient cycle in integrated multitrophic aquaculture system in coastal water

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 postdoctoral 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 FY2012 are listed below.

JSPS Postdoctoral Fellowship for Foreign Researchers
(April 2012 to March 2013)

Mary Jeanie Telebanco-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
Babil Pachakkil Kalari Thotathil	None	Molecular and cytological genetic studies on diversity of yam genetic resources	Apr. 2, 2012 - Mar. 31, 2014

Salirian Rachael Claff	None	Zinc uptake of rice as affected by interactions of soil zinc pools and iron oxide root plaques	Oct. 9, 2012 - Oct. 8, 2014

JSPS Invitation Fellowship for Research in Japan (April 2012 to March 2013)

Long-Term			
Ashiq Rabbani Malik	Institute of Agri-Biotechnology and Genetic Resources, National Agricultural Research Center, Pakistan	Functional analysis of genes involved in abiotic stress-responsive gene expression in rice	Jul. 1, 2012 - Apr. 29, 2013
Short-Term			
Wolf Ulrich Blankenhorn	University of Zurich, Switzerland	Clinal variation in body size and associated life history traits in the yellow dung fly	Mar. 17 - Apr. 12, 2013

WORKSHOP

Seminar on CDM-based Rural Development held in Can Tho City, Vietnam

A seminar titled “Development of a Model for Sustainable Rural Communities with Low GHG Emission” was held in Can Tho City, Viet Nam on 28 September 2012. It was the first of two annual meetings planned after a biogas Clean Development Mechanism (CDM) project had been registered with the UNFCCC CDM Executive Board on 15 August 2012. Its purpose was for the stakeholders to discuss the outputs of relevant studies and to plan future CDM project activities.

The CDM project activity, which introduced biogas digesters to 961 low-income farmers, was formulated by JIRCAS and Can Tho University, and is being implemented under the “Development of Agricultural Technologies to Respond to Climate Change” flagship project of JIRCAS.

A total of 71 people, including key farmers, lecturers and researchers of Can Tho University, as well as representatives from the People’s Committee of Can Tho City, three beneficiary districts, relevant villages and wards in Can Tho City, participated in the seminar.

A keynote speech titled “Agricultural & Rural Development through Industrialization” was delivered. It was followed by JIRCAS reporting on the progress of the project and explaining the role of key farmers. Can Tho University researchers, on the other hand, presented the progress in key farmer development and research works related to biogas digesters.

A group discussion coordinated by JIRCAS and Can Tho University was conducted during the second session. The purpose of the group discussion was to evaluate and improve the technologies, including the installation of biogas digesters according to land use by individual households. Various opinions and ideas were exchanged by participants during this session, deepening the knowledge and understanding of key farmers.

Workshop and Seminar on “On-farm mitigation measures against salinization under high groundwater level conditions” in Uzbekistan

Uzbekistan has the largest salinized land area in Central Asia; therefore, practical measures to mitigate salinization at on-farm levels are necessary. JIRCAS, for its part, conducted research activities and elaborated a guideline. This guideline was introduced by JIRCAS as an extension material against salinization during a workshop in Gulistan City, Syrdarya Region on February 28, 2013 and a seminar in Tashkent City, Uzbekistan on March 7, 2013.

There were 90 participants including farmers, laborers and local government technicians during the workshop; they were highly interested in learning the best on-farm measures against salinization. Forty-five (45) participants, mainly from the Ministry of Agriculture and Water Resources of Uzbekistan (MAWR), Farmers’ Council, local implementing agencies, international and local research institutes and Japanese related organizations, attended the seminar; they actively discussed the guideline and other similar projects, and exchanged opinions on necessary support for farmers.

The guideline, in particular the mechanisms of salinization, the necessity of remedial measures and the applicable methods, was intelligibly explained to the farmers. The participants were also cautioned to keep regional differences in mind when applying the measures. Finally, a presentation ceremony was conducted whereby JIRCAS turned the guideline over to MAWR.

A farmer asked a JIRCAS researcher a few questions during the workshop.

The guideline was handed over from JIRCAS to MAWR during the seminar's presentation ceremony.

Participants in the seminar

Seminar on Conservation and Management of Freshwater Lens

JIRCAS held the 4th "Conservation and Management of the Freshwater Lens" seminar in Majuro Atoll in the Republic of the Marshall Islands on October 26, 2012. About 20 persons participated in the seminar, among them officers of the Ministry of Resources and Development and Environmental Protection Authority; a manager of the Integrated Water Resources Management Project; the head of the Freshwater Lens Committee, representing land owners in the project area; representatives of Majuro Water and Sewage Company, Majuro Waste Company, the Japanese Embassy in Marshall Islands, and JICA Marshall branch office; an agricultural extension agent of the College of the Marshall Islands; and a livestock extension agent of Hawaii University. Towards the end of the seminar, the acting secretary of the Ministry of Resources and Development expressed hope that JIRCAS will further research cooperation in the Marshall Islands. "It would be very much appreciated if JIRCAS could kindly continue its research activities and share the information on measures for the conservation and management of the freshwater lens," she said.

International workshop on “Soil carbon sequestration through farm land management”

JIRCAS, together with Thailand’s Department of Agriculture (DOA) and Land Development Department (LDD), co-organized an international workshop titled “Carbon sequestration in soils through farm land management –The latest world researches and relevancy in Southeast Asia–” on 6-7 December 2012 in Bangkok, Thailand. Fifty-five participants, mostly from Thailand, Indonesia and Vietnam, discussed the relevance of carbon sequestration in farmlands of Southeast Asia.

Three keynote speeches were delivered during the workshop: Dr. Yasuhito Shirato of the National Institute for Agro-Environmental Sciences (NIAES), Japan, presented “Simulating changes in soil carbon in Japanese agricultural land by the Rothamsted carbon model”; Dr. Andrew Macdonald of Rothamsted Research, UK, discussed “Soil Carbon Sequestration: Lessons from the Rothamsted Long-term Experiments”; and Dr. Roland Joseph Buresh of IRRI gave “An update on soil carbon sequestration and long-term soil experiments at the International Rice Research Institute (IRRI).”

Three country reports (from Indonesia, Thailand and Vietnam) were presented by national experts involved in implementing long-term soil experiments under the JIRCAS collaborative project, “Development of agricultural technologies in developing countries to respond to climate change.” The general discussion was concluded by acknowledging the importance of long-term soil experiments and the need to share and utilize the experiment outputs as common resources among researchers.

The workshop was held to promote information exchange among researchers in this field and successfully demonstrate the latest achievements in soil carbon sequestration studies and long-term soil experiments.

International Symposiums and Workshops, FY 2012			
1	190th Annual Symposium of Japanese Society for Tropical Agriculture “Possibilities and challenges for extension of rice cultivation area in the lowlands of Africa”	April 1, 2012	Tokyo, Japan
2	2nd Annual review and planning meeting for Climate Change Adaptation in Rainfed Rice Areas (CCARA)	April 19-20, 2012	Vientiane, Lao PDR
3	“Pacific Festa” Side Event of PALM6 (The Sixth Pacific Islands Leaders Meeting)	May 24-27, 2013	Tokyo, Japan
4	Regional Symposium on Promotion of underutilized indigenous food resources for food security and nutrition in Asia and the Pacific	May 31-June 02, 2012	Khon Kaen, Thailand
5	Research seminar on advanced application of local food resources in China 2012	July 17, 2012	Zhengzhou, Henan, China
6	The local briefing for the regulation on the indigenous shrimp (Khung Bo) in Paksen district, Luang Prabang province	July 30, 2012	Luang Prabang in Lao PDR
7	Symposium on International Strategy for Industrialization of Biofuels	September 3-4, 2012	Tokyo, Japan
8	Kick off meeting on the project “Conservation Agriculture Research in West Africa”	September 25-27, 2012	Kumasi, Ghana
9	Workshop on collaborative research activities of JIRCAS in Ghana	September 27, 2012	Accra, Ghana
10	7th Seminar on Rural Development based on Clean Development Mechanism (CDM)	September 28, 2012	Can Tho City, Viet Nam
11	JIRCAS-Africa Rice Meeting in Africa Rice Science Week 2012 and GRiSP-Africa Forum	October 4-5, 2012	Cotonou, Benin
12	Seminar on Conservation and Management of Freshwater Lens	October 26, 2012	Majuro Atoll, Republic of the Marshall Islands
13	Rice Blast Workshop between “Blast Research Network for Stable Rice Production” and Temperate Rice Research Consortium (TRRC) WG2	October 29-31, 2012	Los Banos, The Philippines
14	JIRCAS International Symposium “Greenhouse Gases and Sustainable Agriculture in Southeast Asia”	November 19-20, 2012	Can Tho City, Viet Nam
15	JIRCAS-CTU Climate Change Project Workshop 2012	November 21, 2012	Can Tho City, Viet Nam
16	Annual Meeting of JIRCAS Project Entitled “The Establishment of the Sustainable and Independent Farm Household Economy in the Rural Areas of Indo-China”	November 21-22, 2012	Vientiane in Lao PDR
17	Soybean Rust Project Meeting 2012	November 22-23, 2012	Londrina,Brazil
18	Joint Seminar for the collaborative studies between JIRCAS and BRRI	November 27, 2012	Tsukuba, Japan
19	JIRCAS International Symposium 2012	November 28-29, 2012	Tsukuba, Japan

20	Seminar for Index-Based Livestock Insurance in Northern Kenya	November 30, 2012	Tsukuba, Japan
21	9th Biomass-Asia Workshop	December 3-4, 2012	Tokyo, Japan
22	International Workshop "Carbon Sequestration in soils through farm land management-The latest world researches and relevancy in Southeast Asia-"	December 6-7, 2012	Bangkok, Thailand
23	15th Workshop on Models in relation to Global Warming	December 7, 2012	Tsukuba, Japan
24	"How agriculture, forestry, and fisheries respond to climate change?" Workshop of the MAFF project for climate change	December 10, 2012	Tokyo International Forum, Tokyo
25	3rd 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
26	International Symposium on the Development of Abiotic Stress Tolerant Crops by DREB Genes and the Annual Meeting 2012	December 12-13, 2012	Tsukuba, Japan
27	Final workshop to validate the Guide and Manuals "For Natural Resource Management based on Farmers' Organizations in Niger and Mali	December 13, 2012	Niamey, Niger
28	2013 Seminar for the JIRCAS-Tigray Project "Establishment of sustainable rural society with low GHG emission"	January 11 and January 17, 2013	Mekelle and Addis Ababa, Ethiopia
29	KNUST-JIRCAS Workshop on effective development of paddy field in Ghana~Development of Low Cost Irrigation Facility applicable to Africa (DLCIFA)~	February 4, 2013	Kumasi, Ghana
30	Workshop on Biomass Utilization in Tropical Asia-Summary of the Researches between Forestry division, JIRCAS and School of Industrial Technology, USM	February 4-5, 2013	Penang, Malaysia
31	IITA-Japan Collaboration on Research for Development for Africa: Current Perspective and Beyond	February 14, 2013	Tsukuba, Japan
32	JIRCAS Workshop "On-farm mitigation measures against salinization under high groundwater level conditions"	February 28, 2013	Guliston, Uzbekistan
33	First Seminar of Project JIRCAS-CAAGUAZÚ	March 1, 2013	Coronel Oviedo, Paraguay
34	JIRCAS Seminar "On-farm mitigation measures against salinization under high groundwater level conditions"	March 7, 2013	Tashkent, Uzbekistan
35	The 2nd Steering Committee Meeting of the GrassRISK Project	March 13, 2013	Ulan Bator, Mongolia
36	8th Seminar on Rural Development based on Clean Development Mechanism (CDM) and Key Farmer's Workshop	March 28, 2013	Can Tho City, Viet Nam

APPENDIX

PUBLISHING AT JIRCAS

OFFICIAL JIRCAS PUBLICATIONS

In English

1) JARQ (Japan Agricultural Research Quarterly)

Vol. 46 No. 3, No. 4

Vol. 47 No. 1, No. 2

2) Annual Report 2011

3) JIRCAS Newsletter No.64, No.65, No.66, No.67

4) JIRCAS Working Report Series

- No. 77 Development of Survey Method for Freshwater Lens in Marshall Islands
- No. 78 Development of a Sustainable Agro-Pastoral System in the Dry Areas of Northeast Asia
- No. 79 Greenhouse Gases and Sustainable Animal Agriculture for Developing Countries
- No. 80 Biomass Utilization in Tropical Asia : Past, Present and Future

5) NARO' s new technologies supporting reconstruction – Revitalization of agriculture by post-disaster reconstruction

In Japanese

1) JIRCAS News No.64, No.65, No.66, No.67

RESEARCH STAFF ACTIVITY 2012-2013

Refereed journal articles

Abiko, T., Obara, M., Abe, F., Kawaguchi, K., Oyanagi, A., Yamauchi, T., Nakazono, M. (2012) Screening of candidate genes associated with constitutive aerenchyma formation in adventitious roots of the teosinte *Zea nicaraguensis*. Plant Root DOI : 10.3117/plantroot.6.19.

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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 to 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 anti-desertification 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 multi-functionality. JIRCAS will also develop sustainable aquaculture technologies while preserving habitats through co-culture techniques.

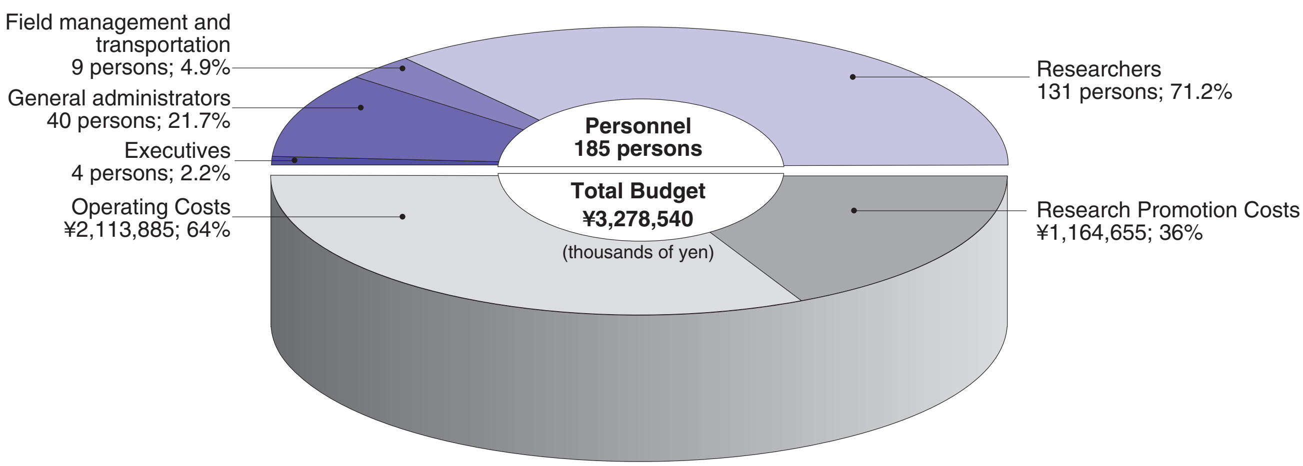
FINANCIAL OVERVIEW

Fiscal Year 2012

	thousands of yen
TOTAL BUDGET	**3,278,540**
OPERATING COSTS	**2,113,885**
Personnel (184)	1,787,323
President (1), Vice-President (1), Executive Advisor & Auditor (2)	
General administrators (40)	
Field management (9)	
Researchers (131)	
* Number of persons shown in ( )	
Administrative Costs	326,562

RESEARCH PROMOTION COSTS	**1,164,655**
Research and development	466,210
Overseas dispatches	192,763
Research exchanges/invitations	11,818
Collection of research information	89,115
International collaborative projects	375,485
Fellowship programs	29,264

Budget FY 2012 (Graph)



MEMBERS OF THE EXTERNAL EVALUATION COMMITTEE

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 2012

President

Masa Iwanaga

Vice-President

Masami Yasunaka

Executive Advisor & Auditor

Hitoshi Nakagawa
Hitoshi Yonekura

Research Strategy Office

Osamu Koyama, Director

Research Coordinator
Shunichi Nakada

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

Research Planning and Coordination Division

Yoshinobu Egawa, Director

Research Planning and Management Office
Hiroshi Komiyama, Head
Research Planning Section
Mie Kasuga, Head
International Relations Section
Koshun Ishiki, Head
Senior Researcher
Kazuo Ise, Rice Breeding

Field Management Section
Takashi Komatsu, Field Operator
Hiroyuki Ishiyama, Field Operator

Research Support Office
Shigeyoshi Sumita, Head
Research Coordination Section
Takahiro Sato, Head
Kazunari Iwafuchi, Assistant Head
Yoshihiko Sumomozawa, Coordination Subsection Head
Katsunori Kanno, 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

Information and Public Relations Office
Masanobu Ohura, Head
Public Relations Section
Yumiko Arai, Head
Technology Promotion Section
Takeshi Matsumoto, Head
Publications and Documentation Section
Minoru Kawaguchi, Head
Hiromi Miura, Network Subsection Head
Akemi Sawata, Managing Subsection Head (Librarian)
Intellectual Property Expert
Akira Hirokawa
Researcher
Yuzo Manpuku, Agricultural Engineering

Administration Division

Hiroshi Nogami, Director

General Affairs Section
Tamotsu Moriiwa, Head
Masao Yoshimura, General Affairs Assistant Head
Keiji Tanaka, Personnel Management Assistant Head
Tadashi Hayakawa, General Affairs Subsection Head
Kazuyo Kadowaki, Welfare Subsection Head
Midori Yamamura, Welfare Subsection Officer
Gaku Takeda, Personnel Subsection 1 Head
Akemi Nomiya, Personnel Subsection 2 Head

Accounting Section
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Kazuo Miyajima, Accounting and Examination Assistant Head
Hiroshi Mizufune, Procurement and Asset Managing Assistant Head
Toshiki Kikuchi, Financial Subsection Head
Junichi Irino, Accounting Subsection Head
Koichi Fuse, Overseas Expenditures Subsection 1 Head
Ryoichi Mise, Overseas Expenditures Subsection 2 Head
Yoshinori Kawasaki, Audit Subsection Head
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

Osamu Inotsuka, Head

Rural Development Planning Division

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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
Yasuyuki Nakanishi, Rural Engineering
Shinji Hirouchi, Agricultural Engineering
Kazuhisa Kouda, Agricultural Engineering
Michio Naruoka, Agricultural Engineering

Tomohiko Taminato, Civil Engineering
Koichi Takenaka, Rural Development Forestry

Taro Izumi, Rural Development
Masakazu Yamada, Rural Development
Mamoru Watanabe, Rural Development
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Keisuke Omori, Soil Salinization in Dryland
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Hiroshi Ikeura, Irrigation
Kenichiro Kimura, Forest Chemistry

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Shutaro Shiraki, Rural Development
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Subproject Leader
Jun Furuya, Agricultural Economics

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Shigeki Yokoyama, Agricultural Economics
Kazuo Nakamoto, Agricultural Economics
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Kazuo Nakashima, Plant Molecular Biology
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Eizo Tatsumi, Food Chemistry
Satoru Nirasawa, Food Functionality
Yasunari Fujita, Plant Molecular Biology
Tadashi Yoshihashi, Food Science
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Naoki Yamanaka, Plant Molecular Genetics

Hajime Akamatsu, Plant Pathology

Kyonoshin Maruyama, Plant Molecular Biology
Takamitsu Arai, Molecular Microbiology
Norihito Kanamori, Plant Molecular Biology
Tsutomu Ishimaru, Plant Breeder

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Mitsuhiro Obara, Plant Physiology and Genetics
Junichiro Marui, Molecular Microbiology

(Kazuko Yamaguchi-Shinozaki, Plant Molecular Biology)

Crop, Livestock and Environment Division

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Seishi Yamasaki, Animal Nutrition

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Naruo Matsumoto, Soil fertility and Nutrient cycling
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Keiichi Hayashi, Soil Management

Senior Researchers
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Satoshi Tobita, Plant Physiology and Nutrition
Cai Yimin, Animal Science
Masato Oda, Crop Management
Guntur V.Subbarao, Crop Physiology and Nutrition
Katsuhisa Shimoda, Grassland Management and Plant Ecology
Matthias Wissuwa, Physiology and Genetics
Takeshi Watanabe, Soil Chemistry
Yoshiko Iizumi, Hydrological Science
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Naoki Tani, Forest Genetics
Daisuke Hoshino, Silviculture
Tomoko Sugimoto, Wood Chemistry
Reiji Yoneda, Silviculture

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Senior Researchers
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Shinsuke Morioka, Fish Biology
Marcy N. Wilder, Crustacean Biochemistry
Satoshi Watanabe, Marine Ecology
Tatsuya Yurimoto, Aquatic Biology
Sayaka Ito, Aquatic Ecology

Researchers
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Isao Tsutsui, Aquaculture

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Subproject Leader
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Hide Omae, Crop Science
Kunimasa Kawabe, Plant Pathology
Shinkichi Gotoh, Soil Science
Shinsuke Yamanaka, Molecular Biology
Takuma Ishizaki, Plant Molecular Biology
Yoshifumi Terajima, Sugarcane Breeding
Youichi Kobori, Entomology

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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 2012

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) 2012 covers the period from April 1, 2012 through March 31, 2013. The Annual Report 2012 summarizes the full extent of JIRCAS activities that occurred during this period. The subsequent Annual Report will detail events and programs from April 1, 2013, through March 31, 2014 (FY 2013).

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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