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Children carry grass fodder to feed animals kept at a homestead in Ethiopia. (Photo by Miyuki Iiyama)

In This Issue

JIRCAS
JAPAN INTERNATIONAL RESEARCH CENTER FOR AGRICULTURAL SCIENCES

Achieving Food Security for Japan and the World: Taking on the Challenges under JIRCAS's Fourth Medium to Long-Term Plan

Japan's food self-sufficiency ratio on a calorie basis is only 39%, which means that 61% of its food supply come from imported products. This makes Japan one of the largest importers of food; hence, it must consider not only its own food security but also global food supply and demand problems, which may develop into something more serious because of various instability factors.

The world population is estimated at 7.3 billion and will reach around 9.5 billion by 2050. Because of the projected economic and income growth in emerging countries, there are concerns that global strains on food supply and demand could occur in the medium to long-term. This means that food production will have to increase by more than 60% by 2050. Developing regions where agricultural production has not been exploited to its full potential are being targeted for this purpose, and sustainable agricultural production activities must be promoted to increase global food production without compromising the local natural environment.

International market prices of major cereals have been unstable because of erratic weather conditions during the growing seasons and due to supply and demand trends. Likewise, world food production has fluctuated owing to large-scale national disasters and abnormal weather. It has been predicted that global agricultural conditions will be disrupted in the future due to the increasing frequency of abnormal weather events, the spread of emerging/re-emerging livestock diseases and pests, and water resource shortages associated with global warming. Under such circumstances, we are expected to promote research activities and contribute actively in international collaborative efforts to address global issues such as climate change mitigation and adaptation.

Important research policy and targets for the next 10 years were set in March 2015 by the Ministry of Agriculture, Forestry and Fisheries of Japan. The international agricultural research activities being carried out by JIRCAS is part of its contribution to the international society in response to global food and environmental challenges such as climate change mitigation and stable food production in developing countries.

The "2030 Agenda for Sustainable Development" was adopted in September 2015 at the United Nations Summit, thereby establishing the 17 Sustainable Development Goals (SDGs) including one aimed to "end hunger, achieve food security and improved nutrition and promote sustainable agriculture." Moreover, the G7 leaders, through the Ise-Shima Leader's Declaration adopted in May this year, committed to "engage collectively in concrete actions in collaboration with relevant partners and stakeholders towards the achievement of our aim to lift 500 million people in developing countries out of hunger and malnutrition by 2030."

In order to implement these commitments, we must work together toward a new global partnership where all stakeholders, including all countries, join forces and play their respective roles. JIRCAS, as Japan's sole national institute responsible for undertaking comprehensive research on agriculture, forestry and fisheries technology in developing areas, fulfills its role as the focal point of Japanese agriculture research for international collaboration.

At the JIRCAS International Symposium 2015 titled *"Why 'Quality' Matters in International Agriculture Research?"* held last October, emphasis was placed on the importance of diversified thinking and the necessity of hearing different viewpoints, from consumers and communities as well as farmers. It also concluded that research outputs should always lead to practical impacts to our individual societies in order to realize 'quality' research.

In this light, I wish to declare that JIRCAS shall apply the core value, *"Japan is an active member of the united world,"* in the center of its programs as it continues to grow and evolve into an active and effective organization working towards the fulfillment of its mandated mission.

Masa Iwanaga
President

Our Goal under the Fourth Medium to Long-Term Plan

On March 2, 2016, the Ministry of Agriculture, Forestry and Fisheries (MAFF) established JIRCAS's goal under its Fourth Medium to Long-Term Plan (hereinafter referred to as "the plan"), which commenced on April 1, 2016 and will run through March 31, 2021. MAFF had also officially directed JIRCAS to formulate an action plan to achieve its targets (hereinafter referred to as "the target") during this 5-year period. Described below is "the plan," which had been drawn up based on "the target" and with the approval of MAFF.

The target

JIRCAS is expected to continue playing its critical role as a research and development center by promoting highly sustainable agriculture, forestry and fisheries, and ensuring world food security while preserving the regional environment in developing areas that have not been able to fulfill their potential. In addition, JIRCAS is expected to take important roles in enhancing diplomatic relationships through academic activities based on longstanding trust and friendship with these countries. Regarding research management, JIRCAS should not only pay attention to trends and developments at the region of interest but also provide useful knowledge and technology seeds to meet the needs of the domestic private sector and farmers. Additionally, JIRCAS will coordinate and support major governmental policies such as those aimed toward African development and global food value chain expansion.

Furthermore, JIRCAS will introduce the segment management system (which is an aggregation of projects and affairs) during "the plan" period and make steady progress toward maximizing the research outcomes and improving the quality of services. JIRCAS had already revised its management system during the 3rd medium-term plan period, i.e., from a "research project based" to a "program-project based" approach (note: a program is an aggregate of research projects), in which budget management, staffing, and performance evaluation are carried out in an integrated manner. With the introduction of the segment management system, we expect to become more effective and efficient in managing not only our research programs but also our planning & partnership affairs and information analysis activities.

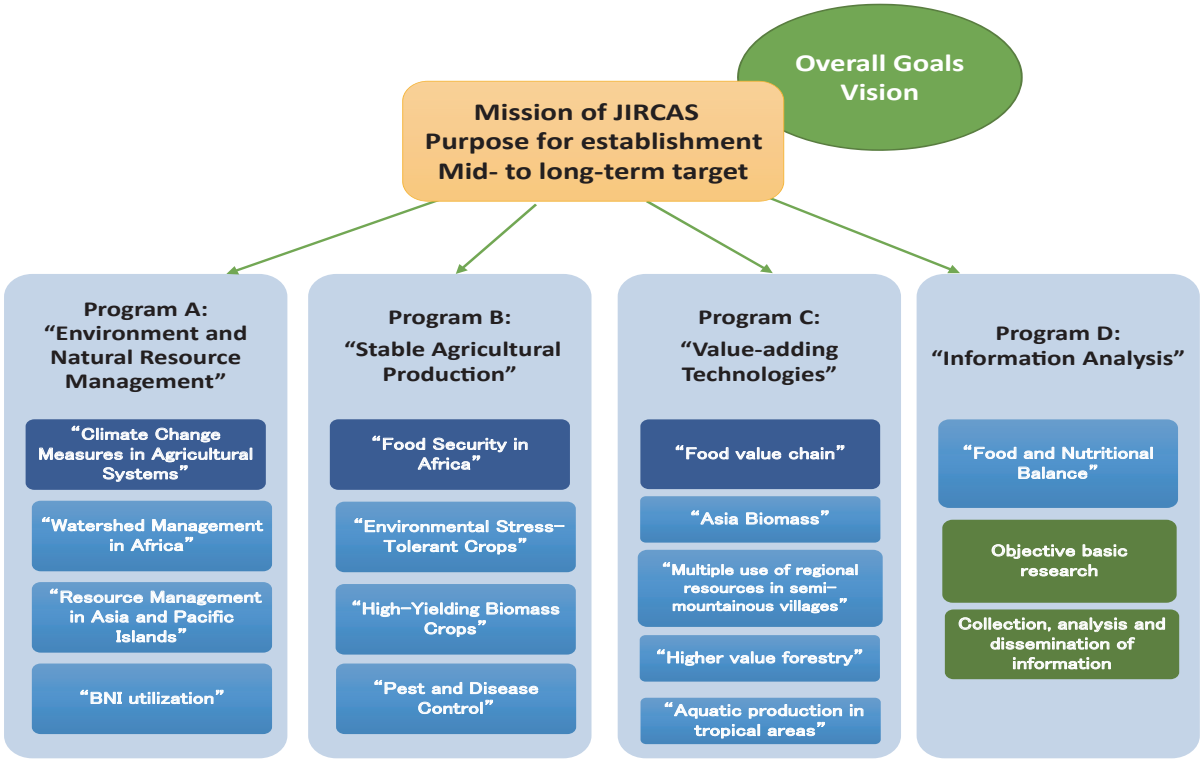


Fig. 1. An association chart showing JIRCAS's programs and projects

The plan

JIRCAS's research issues were indicated in the Basic Plan for Agriculture, Forestry and Fisheries Research (hereinafter referred to as "basic plan") that was established by the Agriculture, Forestry and Fisheries Research Council on March 31, 2015 on the basis of international agreements, research trends, and external & internal issues. It also recognized the importance of research activities related to resolving climate change and food security matters in developing regions.

In fiscal year 2014, JIRCAS set up a medium-term research strategy working group (WG), which evaluated the research outcomes and studied issues and areas that should be tackled in "the plan." In fiscal year 2015, WG was reorganized into the Medium to Long-Term Research Program Planning Committee (hereinafter referred to as "the committee") to oversee the smooth and successful formulation of plans. "The committee" had been studying the new research issues in accordance with "the basic plan" as well as major international agreements (such as the 2030 Agenda for Sustainable Development and the 21st Conference of the Parties [COP21]), collecting information & trends and analyzing the results, with the participation of all JIRCAS researchers based on proposals made in light of needs in the field.

Based on the results of the committee's discussion, JIRCAS has decided to implement four new research programs under "the plan" as follows:

- Program A: "Environment and Natural Resource Management"

Development of agricultural technologies for sustainable management of the environment and natural resources in developing regions

- Program B: "Stable Agricultural Production"

Technology development for stable production of agricultural products in the tropics and other adverse environments

- Program C: "Value-adding Technologies"

Development of high value-adding technologies and utilization of local resources in developing regions

- Program D: "Information Analysis"

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

Additionally, JIRCAS has formulated its five-year work plan, which incorporates an annual target for each of the projects, to finally enable social implementation of the research outcomes.

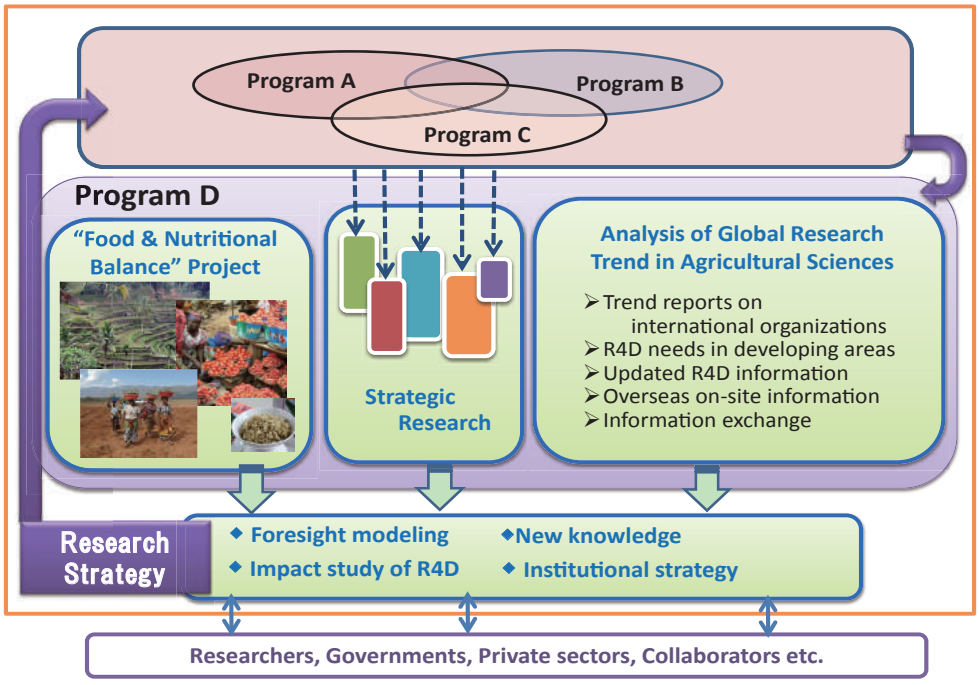


Fig. 2. A diagram showing the relationship between Program D's main components and programs

Program D: Information Analysis

The global situation and problems surrounding agricultural production and the food market as well as food and nutrient supply are widely diverse, and they are constantly affected and changing along with global phenomena such as climate change, deteriorating natural environments, and international socio-economic trends. To address the stable and sustainable development concerns of agriculture, forestry and fisheries, it is essential to do the following: carry out analyses on the current status, identify the problems, assess the impact of past development efforts, and integrate foresight studies. We also recognize that recurrent feedback and the results of analyses into institutional strategies would make our research for development (R4D) activities more adequately focused, efficient, and cost-effective.

Program D, in coordination with JIRCAS's other three programs, plays a role in analyzing global research trends and needs in agricultural sciences through the following activities:

- "Food and Nutritional Balance Project" to evaluate current status and to develop a foresight model of global supply-demand and nutritional balance,
- "Strategic research" and "Impact study" to develop creative ideas, new knowledge, and innovative technology for revitalizing R4D in agriculture, forestry, and fisheries, and
- "Analysis of global research trend in agricultural sciences" to update, analyze, and exchange R4D information.

Evaluation of global food supply-demand and nutritional balance (Food and Nutritional Balance)

In this project, we will examine the current situation of agricultural production, food consumption, and nutrient supply. We will construct a foresight model of global supply-demand that will take into consideration any uncertain factors, such as the effects of climate change, change in crop acreage, technological innovation, and socioeconomic characteristics, in order to predict future global food supply-demand. We will also analyze the nutritional balance both globally and regionally. Furthermore, we will measure and evaluate the impacts of past agricultural research and development projects from medium to long-term perspectives. Through analyses and evaluation, we will aim to contribute to the development of an effective strategy in agricultural research and technological innovation for global food security and nutritional improvement.

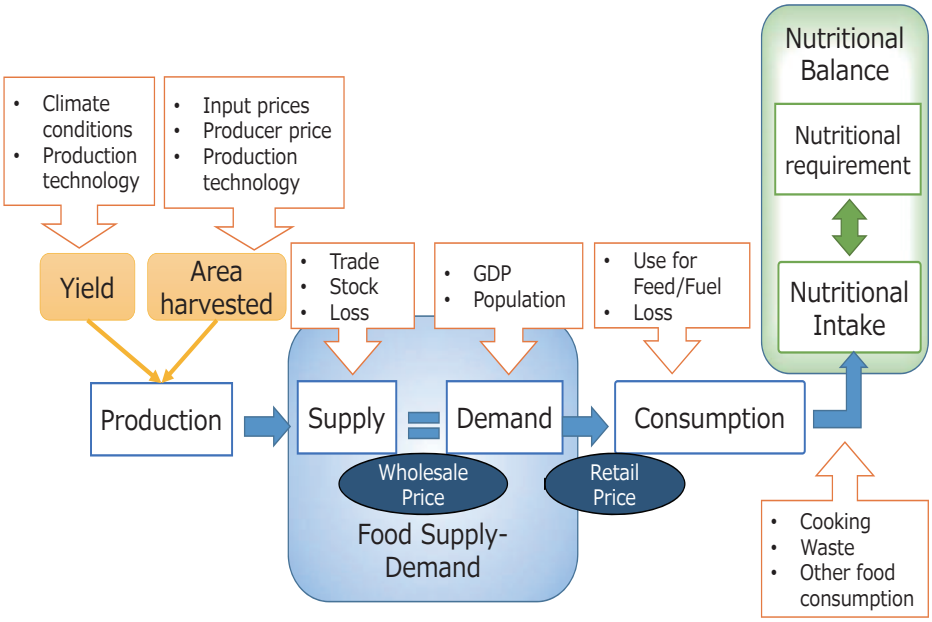


Fig. 3. Analysis flow diagram for Food and Nutritional Balance Project

Kunihiro Doi
Director
Research Strategy Office

Environment and Natural Resource Management

The Environment and Natural Resource Management Program (full title: "Development of agricultural technologies for sustainable management of the environment and natural resources in developing regions") has been established by JIRCAS and clearly defined as one of its missions under its new five-year plan (from FY 2016). Global environmental problems like climate change, desertification, and soil degradation are getting more serious, and this will be addressed by the program, whose responsibility is to develop agricultural technologies in collaboration with research institutions and disseminate them in coordination with extension agencies in developing regions.

Sustainable management of natural resources, e.g., water, soil, vegetation, fertilizers, etc., is necessary for any agricultural system in the world to succeed. However, various global-level problems, such as unmitigated greenhouse gas (GHG) emissions, excess application of fertilizers, unbalanced nutrient cycle, salt accumulation in soils by rising groundwater, deforestation, and soil erosion, are happening and would require global solutions. In Fig. 1, problems are shown in the inner circle around the Earth, whereas the corresponding scope of research and the development of strategies to solve these problems are depicted in the outer circle. Four projects, described in the following sections, will be implemented under Program A.

1. Climate Change Measures Project

This flagship project of JIRCAS's Environment and Natural Resource Management Program is officially titled "Development of agricultural technologies for reducing greenhouse gas (GHG) emissions and climate-related risks in developing countries."

Various international actions have already been taken to intensively cope with climate change, starting with the first global initiative almost 25 years ago at the Rio Summit in 1992. The latest event in December 2015 saw the adoption of the Paris Agreement by the Conference of the Parties (COP21) at the UN Climate Change Conference. The agreement, which is being recognized as the new framework for global warming measures after the expiration of the Kyoto Protocol, calls all nations and stakeholders to "hold the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels." The IPCC had already been requested to submit a Special Report detailing the GHG-reducing actions of the member states to realize the above formidable goals.

GHG emissions caused by agricultural activities account for about 14% of all GHGs from human activities, with methane (CH_4) and nitrous oxide (N_2O), both strong GHGs, comprising half of human-related emissions from the agricultural sector. Therefore, the development of

Fig. 1. Global problems (in inner circle around the earth) and the scope of our research (outer circle) encompassing four projects to cope with these problems

agricultural technologies that reduce GHG emissions while avoiding negative economic impacts to farmers is of critical importance.

During JIRCAS's previous medium-term plan period (FY 2011-2015), the project was able to reduce methane emissions from paddy fields through a novel irrigation scheme and from animal husbandry through better feed management. Assistance was also extended toward the development of a CDM-based, low-carbon society for mitigation of climate change. For adaptation, a decision support tool was created to give the best sowing dates for rice based on seasonal climate forecasts, and a long-term prediction model of rice supply/demand under possible climate change scenarios was formulated.

In the current medium to long-term, the project will be aimed at maximizing achievement of the above-mentioned goals. As for mitigation methodologies, we will improve both the alternate wetting and drying (AWD) technique and the biogas digester (BD) system in view of the increased number of farmer-practitioners in the Mekong Delta area in Vietnam. AWD enables farmers to save irrigation water for paddy fields and reduce methane emission at the same time. More notably, we will integrate various technologies, for example, by making better use of underutilized local wastes from cattle raising and in BDs and incorporating them into the AWD technique for more efficient resource use and less environmental load (Fig. 2).

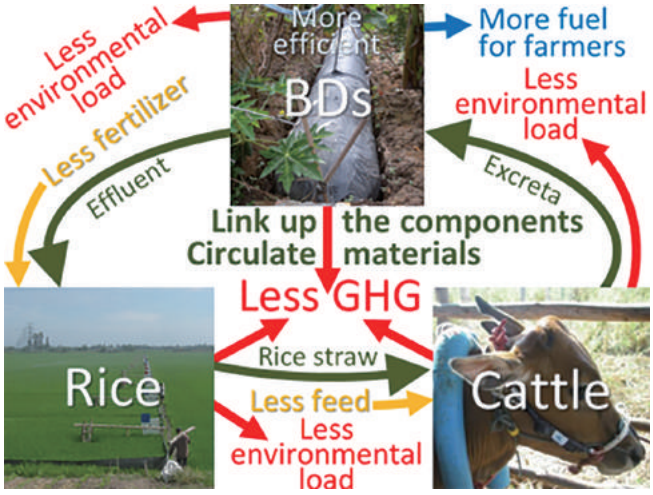


Fig. 2. Linkage of GHG-reducing technologies for efficient resource use and less environmental load

As for agriculture risk management for climate change adaptation (Fig. 3), we will try three techniques. First is the development and economic evaluation of adaptation measures to extreme weather events in the Bay of Bengal Region. To build high and long embankments for food prevention is not feasible in developing countries; therefore, the adoption of a weather index insurance scheme for agricultural products is being considered as a promising and practical measure to protect farmers in disaster-prone areas. Second is the improvement of the Weather-Rice-Nutrient Integrated Decision Support System (WeRise), which

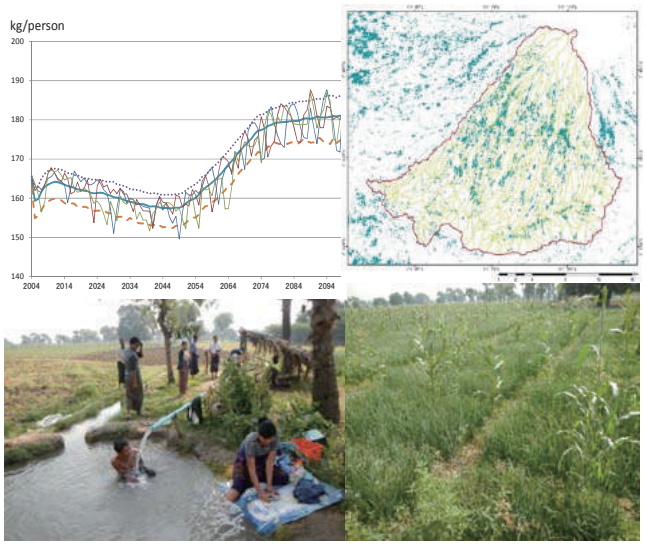


Fig. 3. *Clockwise from top left:* Sample output of the rice consumption model, suitability map of rainfed rice in Indonesia, drought-tolerant farming in Myanmar, and multiple use of irrigation water in Myanmar

supports rainfed farmers in stabilizing paddy yield. Third is the improvement of irrigation methodology in the Central Dry Zone of Myanmar. JIRCAS will develop methodologies to improve irrigation efficiency in irrigation projects and promote adaptive farming practices to reduce drought risk.

2. Watershed Management in Africa Project

Land degradation such as soil erosion has been continuing in many regions of Sub-Saharan Africa (SSA) due to ongoing deforestation activities to expand farmland and obtain firewood. This project will aim at developing technologies to effectively conserve, manage, and utilize natural resources such as soil, water, and vegetation at a watershed level in the Central Plateau of Burkina Faso and the Ethiopian Highlands, both of which are at high/very high risk of land degradation in SSA (Fig. 4). In Burkina Faso, primary technologies will be proposed towards an intensive land use system that integrates crop, livestock, and

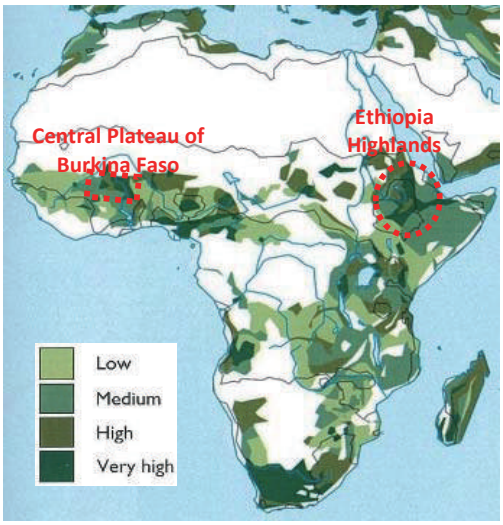


Fig. 4. Water erosion risk map in Africa

forestry. The technologies will be evaluated for resource use efficiency as well as for boosting farmers' income and local economy. In Ethiopia, a sustainable and holistic forest management system will be made while considering a better land use scheme at the project site (Fig. 5).

Fig. 5. Forest and croplands jointly conserved in the Ethiopian Highlands

3. Resource Management in Asia and Pacific Islands Project

The dry areas of Central and South Asia and the humid areas of the Pacific Islands are both vulnerable to risks related to increased agricultural water use. This project will develop technologies for effective and sustainable management of natural resources and for coping with problems in each area. In the Asian dry areas (Uzbekistan, northern central India, and Bangladesh), increasing soil salinization is a serious problem (Fig. 6). This will be mitigated by an adequate soil/water management method through introduction of an improved low-cost drainage system, and by adapting to the salinized condition through adjustment of cropping systems, and breeding salt-tolerant crop varieties. For humid areas in the Pacific such as in Palau and the Philippines, the ecological functions of watersheds, from forest to coast, shall be recognized and conserved. Through elucidation of the dynamics of water, soil, and mineral nutrients, appropriate land use plans and adequate fertilization methods will be proposed.

Fig. 6. Salt-accumulated land in India

4. BNI utilization Project

Nitrification, the process in which a group of soil microbes oxidize ammonia (NH_4–N) to nitrate (NO_3–N), is crucial to the global nitrogen cycle and to crop production. Modern agriculture systems depend heavily on fertilizer-nitrogen inputs, resulting in very high nitrification rates. This increases the amount of unused nitrogen in the soil, which is then leached out to pollute the aquatic environment, with some released into the atmosphere as nitrous oxide (N_2O), a very powerful GHG. Biological Nitrification Inhibition (BNI) is a function of nitrification inhibitors released from plant roots. Based on achievements in the previous phase (3rd medium-term plan period), the Project will develop breeding materials for enhanced BNI ability in wheat and sorghum, and will propose technologies applicable to farmers' fields with effective use of BNI ability (*Brachiaria* grass).

These will be accomplished by the research consortium organized by JIRCAS, Consultative Group (CG) centers, and advanced research institutions, through which low-nitrifying and environmentally-friendly systems can be established as long-term goals for agricultural sustainability (Fig. 7).

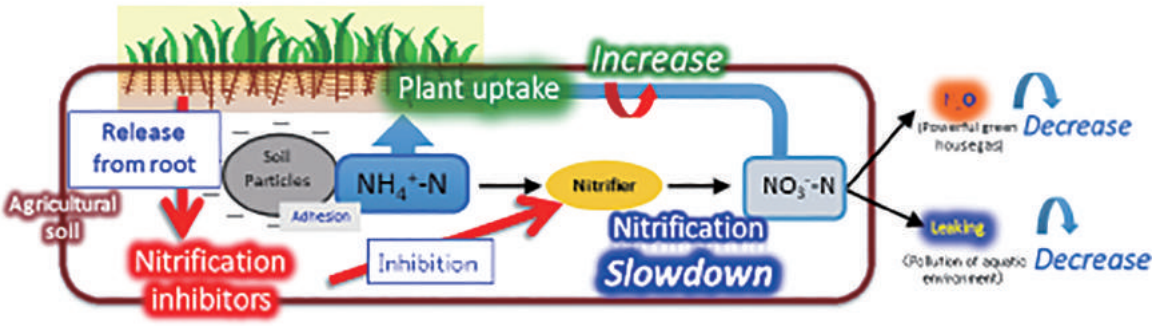


Fig. 7. BNI utilization to increase nitrogen uptake by plants and to reduce environmental risks

Satoshi Tobita
Program Director
Environment and Natural Resource Management Program

Stable Agricultural Production

The Stable Agricultural Production Program corresponds to "Technology development for stable production of agricultural products in the tropics and other adverse environments" as identified in JIRCAS's Fourth Medium to Long-Term Plan.

Agricultural potential in developing regions, including Africa, has not been fully realized because of adverse conditions such as low fertility and droughts; therefore, ensuring food and nutrition security is a challenge. This program aims to enhance agricultural productivity and improve nutrition in developing countries through development of technologies for stable production of agricultural products in the tropics and other adverse environments. In other words, we will develop breeding materials with high productivity and agricultural technologies for adverse environments, conduct verification trials, and make manuals and commentary articles. This will be carried out through joint research with national and international agencies based on the research results of the Stable Food Production Program under JIRCAS's Third Medium-Term Plan. Accordingly, we will provide rapid dissemination of these developed technologies to breeders, government officials, and farmers. By promoting the research and dissemination of the developed technologies to maximize the research results, we hope to contribute to enhancing agricultural productivity, improving the nutrition situation in developing regions, eradicating poverty, and building more peaceful societies across the world. At the same time, we also contribute to food security in Japan through our efforts to stabilize global agricultural production.

The Stable Agricultural Production Program will strive to achieve its goal by carrying out four projects, as shown in Fig. 1. The following sections summarize the program's flagship initiative and other projects.

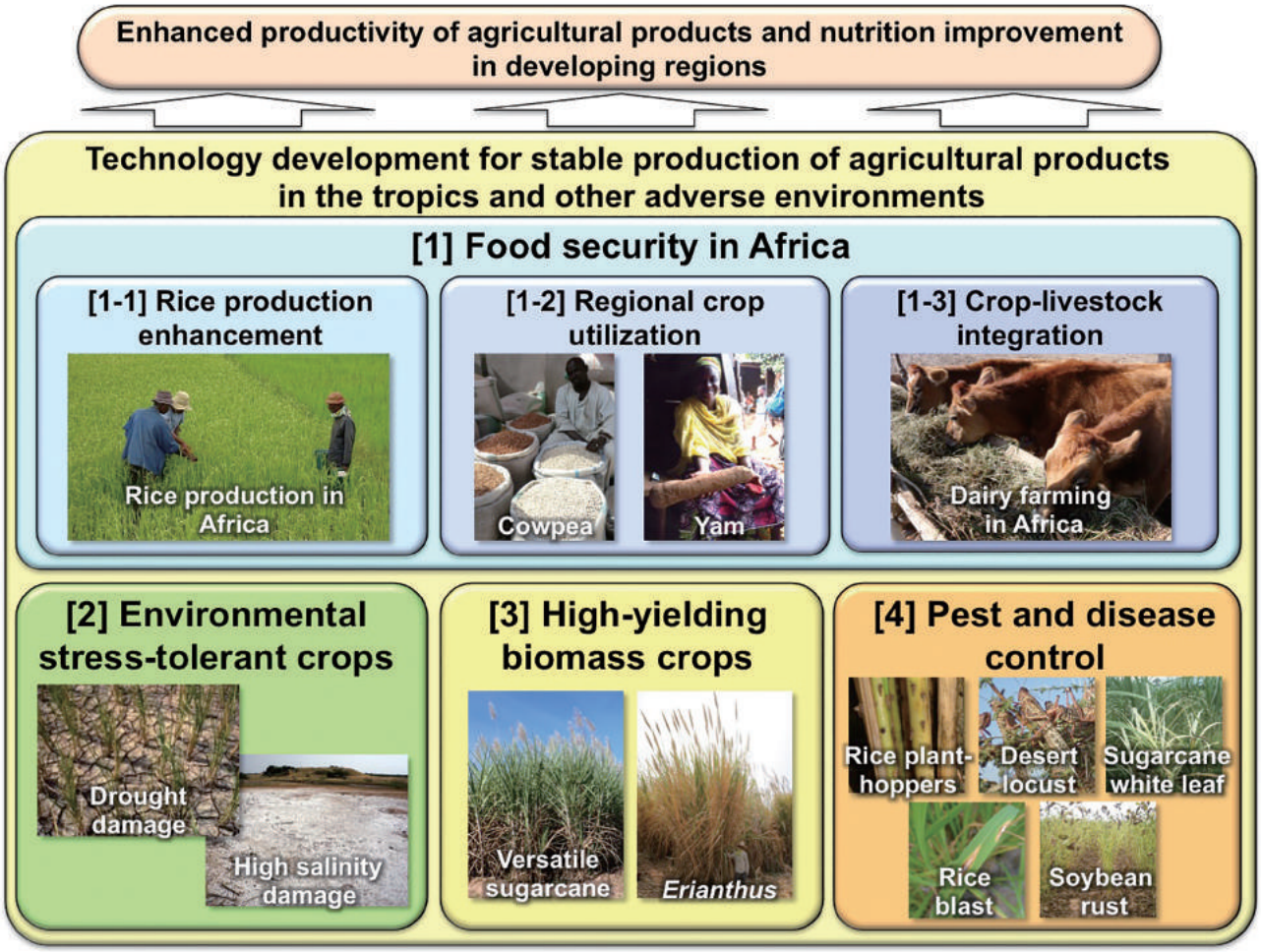


Fig. 1. Outline of the Stable Agricultural Production Program

1. Food Security in Africa Project

JIRCAS's new flagship initiative, titled "Development of sustainable technologies to increase agricultural productivity and improve food security in Africa," is its contribution to the United Nation's 17 Sustainable Development Goals (SDGs) particularly the second goal, "End hunger, achieve food security and improved nutrition and promote sustainable agriculture." It is well recognized that alleviating food shortage in Sub-Saharan Africa (SSA), where 215 million people are currently undernourished, is the key to achieving this goal. To meet this challenge, the following research subjects, namely 1) Rice production enhancement, 2) Regional crop utilization and 3) Crop-livestock integration, were selected to improve food production and nutritional supply in SSA.

1-1. "Rice production enhancement" aims to provide materials and key technologies to enhance the productivity of rice in Africa via development of improved breeding materials with required abilities, such as better uptake of nitrogen and phosphorous, simple diagnostic tools to evaluate soil fertility for better soil fertility management corresponding to various soil conditions, and improved water management technologies to channel excess water to irrigate rice fields. Impact assessment and factor analysis of farmers' acceptance will also be conducted before introducing these new technologies to local areas (Fig. 2).

1-2. "Regional crop utilization" puts focus on two important regional crops in SSA, cowpea and yam, which play important roles as food and cash crops. Fundamental information about their genetic resources and rich genetic diversity will be generated to explore useful parental materials for breeding, and tools will be developed to enable cowpea and yam breeders who are implementing international and national breeding programs to select/evaluate their materials effectively (Fig. 3).

1-3. "Crop-livestock integration" tackles the challenge of increasing dairy production in the tropical savanna throughout the year across distinct rainy and dry seasons. It aims to develop technologies associated with an effective and efficient crop-livestock integration model to make animal feeds using crop production and food processing byproducts. Wastes from livestock farming will be utilized to maintain soil fertility for a sustainable crop and forage production by farmers (Fig. 4).

Based on the foregoing, we hope that this flagship project can contribute to laying the foundation for food sovereignty through stable agricultural production, thereby promoting dietary diversification and improving the quality of life of farmers and consumers in SSA. Through collaboration with international and national institutions in SSA and by making use of the advanced research capacity in Japan, we can generate scientific outputs and solutions that would allow the effective development of new varieties and accelerate the efficient use of land and natural resources.

Fig. 2. More rice is required (Ghana)

Fig. 3. Left: Cowpea being weighed and sold at the market (Nigeria); Right: Piles of yam awaiting long distance transportation (Ghana)

Fig. 4. Dairy farming can make a contribution to peoples' nutrition (Mozambique)

2. Environmental Stress-Tolerant Crops Project

In order to establish stable and sustainable production of agricultural crops in developing countries that are vulnerable to climate change impacts such as droughts, high salinity, and poor soil, we will work on developing breeding materials and basic breeding technologies to produce crops that are highly productive yet adaptable to such adverse environments. For rice, breeding materials that have high

temperature resistance, drought tolerance, phosphate deficiency resistance, and high nitrogen use efficiency will be developed (Fig. 5). For soybean, development of breeding materials that are tolerant to drought and high salinity will be undertaken. In addition, we will develop a double haploid breeding technology, a non-GM crop production technology, and a growth evaluation method in a greenhouse that mimics the stress conditions of farm fields.

Fig. 5. Rice near-isogenic line with early-morning flowering trait for avoiding high temperature-induced sterility

3. High-Yielding Biomass Crops Project

The objective of this project is to develop a method to increase both food and energy using high-yielding biomass crops in unstable environments. We will develop sustainable cultivation methods and utilization technologies for high-yielding biomass crops such as multi-purpose sugarcane and *Erianthus*, which is a wild relative of sugarcane and tolerant to unstable environmental conditions (Fig. 6). We will also develop new breeding materials that produce high biomass yield in several unstable environments through intergeneric hybridization between sugarcane and *Erianthus*. For this purpose, we will establish techniques for evaluating important characteristics related to biomass production and for selecting intergeneric hybrids using DNA markers.

Fig. 6. *Erianthus* showing vigorous growth in Northeast Thailand

4. Pest and Disease Control Project

In this project, we will focus our research on migratory rice planthoppers (Fig. 7), which are abundant in Southeast Asia and Japan; desert locusts, which form large swarms; and leafhoppers, which transmit sugarcane white leaf disease, the most important disease affecting sugarcane production in Southeast Asia. Against rice planthoppers, we will obtain information about their occurrence, insecticide resistance and natural enemies as well as the mechanism of rice resistance to planthoppers in order to develop control techniques. Against desert locusts, we will elucidate the environmental factors that provoke phase polyphenism (from solitary to gregarious form) by conducting field observations. Against leafhoppers and sugarcane white leaf disease, we will develop an integrated pest management method for healthy seed cane production based on the ecology of the vectors.

Fig. 7. Brown planthoppers infesting rice

Fungicide application has been found effective in controlling the wide dissemination of air-borne diseases such as rice blast or soybean rust. However, fungicides need to be applied regularly, which in turn increase application costs and the risk of developing fungicide-resistant strains. Through international research networks that we have constructed, we will develop rice breeding lines resistant to blast (by incorporating field resistance genes) and soybean cultivars resistant to rust (by pyramiding resistant genes).

Kazuo Nakashima
Program Director
Stable Agricultural Production Program

Value-adding Technologies

We launched this new Value-adding Technologies Program (full title: "Development of high value-adding technologies and utilization of local resources in developing regions") as a policy-oriented development research to address one of the high priority items on JIRCAS's agenda under its Fourth Medium to Long-Term Plan.

In Asia, consumers' needs for food and agricultural products have become diversified as economies have grown. This program aims to develop value-adding technologies for indigenous regional resources and establish regional and global value chains that provide benefits to farmers, processors, distributors, and consumers, through implementation of environment-friendly and sustainable agriculture, forestry, and fisheries systems. To achieve our goals, we will conduct five projects, with due consideration for social implementation by dissemination, practical application, and industrialization. In each project, we will clarify the potential of targeted regional resources and food resources, determine technical solutions for value-addition, and predict future outcomes (Fig. 1).

1. Food Value Chain Project

The food products we consume on a daily basis originate from areas all over the world. Even in developing regions, a considerable variety of food products are more or less transported from other areas. A number of people are engaged in food product flow, i.e., from food production to consumption, thus there should be coordination between different sectors in order to optimize the benefits for all concerned. JIRCAS has been implementing international collaborative researches in the field of food sciences with institutes in a number of developing countries and also in the field of crop production and agro-economy, particularly in studies concerning the distribution of major crops, among others. From this background, we initiated a new project, entitled "Formation of food value chain through value addition of food resources to support sustainable rural development," by integrating themes under the research fields mentioned earlier. This research project aims to support the enhancement of the rural people's economic condition as well as the movement of food products/supplies to consumers in urban areas according to their needs and preferences.

Thailand, Laos, and China were selected as major study sites of the project. These countries have a variety of food resources and food processing technologies that offer great potential for high quality and high functionality food products to be produced locally. In many cases, these products are processed and distributed only within spatially small or small scale markets (Fig. 2, Fig. 3); as a consequence, their potential value remain under-recognized as they do not have global reach. Furthermore, these countries do not have an established product distribution system that properly matches consumers' demand.

The project activity consists of the following four major subjects: The first is to develop a method to evaluate food quality through scientific analysis of materials in local food resources (such as underutilized food components, cereal, and fermented foods) whose quality and functionality have not yet been identified. The second is to develop a technology to

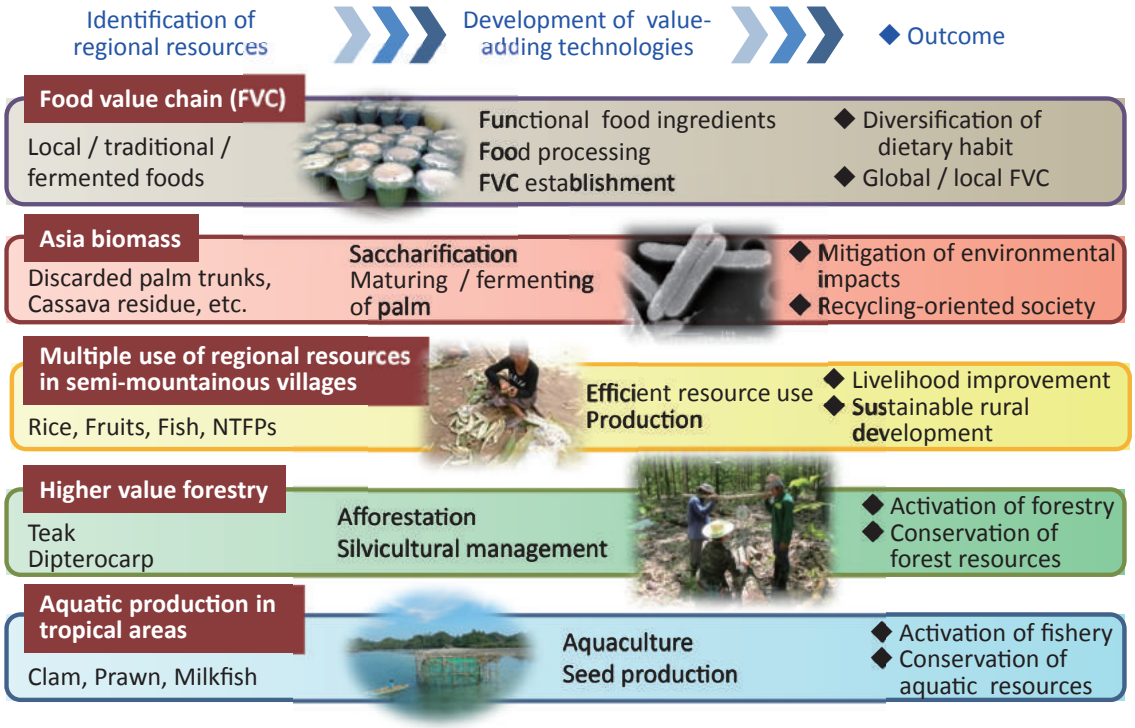


Fig. 1. Structure of the Value-adding Technologies Program

Fig. 2. A traditional rice noodle, *khanom chin*, sold at a market in Thailand

Fig. 3. Salty-fermented freshwater fish paste, *pa-daek*, sold alongside vegetables at a market in Lao PDR

produce food that is high quality and has high functionality based on tacit knowledge of traditional cereal or fermented food processing technologies. The third is to develop effective strategies to formulate a food value chain through analysis of distribution and consumption characteristics, focusing on rice and fermented foods and applicable to areas under various economic levels. The fourth is to develop methods to evaluate the effectivity of a food value chain formed for a specific food product and also to examine the applicability of ICT (Information and Communication Technology) to enhance the added value of the products.

2. Asia Biomass Project

Southeast Asian countries are expected to experience sustained economic growth which, due to their large population, will have a great impact on the world's energy situation and the environment. On the other hand, most of them possess abundant renewable biomass resources. Japan has been accumulating many technologies in this field and therefore can contribute to the development of sustainable biomass utilization in Southeast Asian countries through collaborative research.

The Asia Biomass project deals with the following two primary themes: the development of an efficient and cost-effective saccharification technology for tropical crop residues such as oil palm, cassava, or sugarcane residues (Fig. 4), and the development of a conversion technology to transform renewable

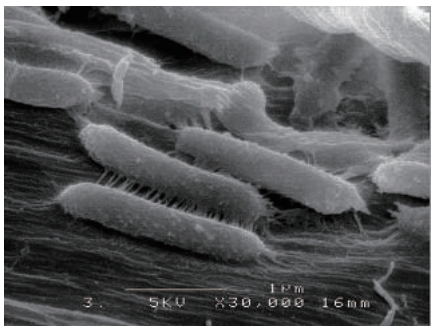


Fig. 4. Direct saccharification technology for lignocellulosic biomass conversion using anaerobic thermophilic bacteria

energy and materials. The achievements will contribute to identifying the socio-economic effects of increased biomass use in Southeast Asia on agriculture and industries. The outcomes of the project will also provide inputs for the construction of sustainable social systems in Southeast Asia, encourage cascade utilization of biomass, and help address global environmental issues.

3. Multiple Use of Regional Resources in Semi-mountainous Villages Project

Small-scale agriculture is the principal industry in most of the inland parts of the Indochinese Peninsula, with semi-mountainous areas being the main farming fields. However, the livelihoods of farmers in these areas are being threatened because of decreased agricultural productivity due to recent population growth, insufficient water supply, and soil fertility deterioration caused by inappropriate land use. This is widespread particularly in Laos, where high poverty rates and insufficient nutrient supply in semi-mountainous rural areas are considered national problems. Therefore, improving the conditions for securing stable food production and supply by sustainable agriculture in such areas is an important political agenda. However, agricultural systems in semi-mountainous areas are composed of complex components, and due consideration must be given to farmers' preferences and product marketability, as well as water and soil management methods, to improve productivity, promote product diversification strategies, and introduce value-added products.

To tackle the above issues, this project will be undertaken in the semi-mountainous areas of Laos with a focus on productivity improvements for major crops (mainly paddy and upland rice) as well as on conservation and sustainable use of forest areas, product diversification (by introducing fruit cultivation and fish culture techniques to create value-added products) and the development of food processing technologies to produce nutritionally enhanced value-added products. The results of these research activities are expected to contribute toward improving the livelihoods of farmers in the areas (Fig. 5).

4. Higher Value Forestry Project

Tropical forests supply varied products (such as timber,

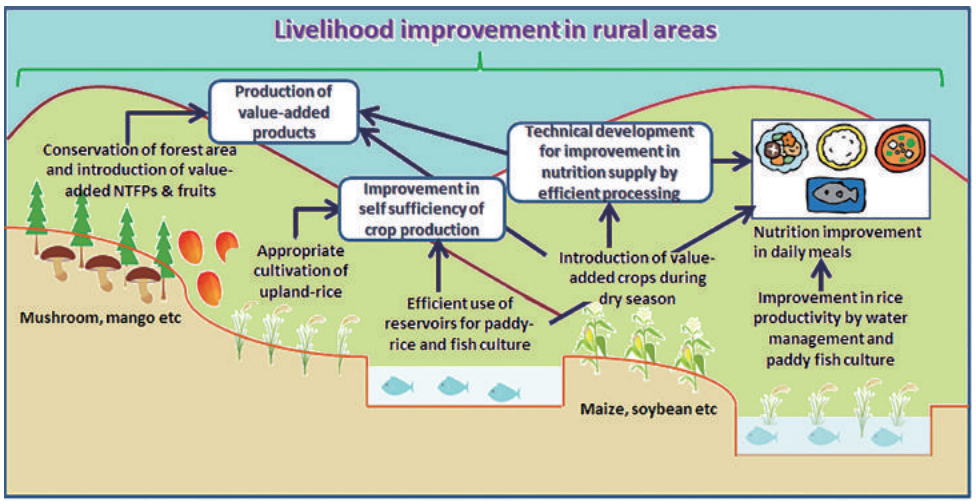


Fig. 5. Improvement of farmers' livelihoods through value-adding approaches

fuel, food, and medicine), thus supporting local livelihoods and benefiting the lives of those outside the forest. However, deforestation and degradation of tropical forests have been advancing rapidly and valuable tree species have been depleted from forests in many tropical countries. The demand for these depleted tree species/resources is being supplemented by products harvested from tree plantations (Fig. 6), which contribute to restoring forest cover, mitigating the logging pressure to the remaining natural forests and improving the livelihoods of farmers.

To attract more local people to plant trees, it is necessary to demonstrate the competitiveness of tree plantations. This project, therefore, intends to develop and disseminate techniques and knowledge to grow higher-value plantation products in a more efficient and stable manner. To achieve its goals, a suite of techniques, such as adding value to the standing trees, improving the soil, monitoring the plantations efficiently, and breeding trees of higher-value traits, will be developed for indigenous tree species in Southeast Asia.

Fig. 6. A 15-year-old teak (*Tectona grandis*) plantation in Thailand

5. Aquatic Production in Tropical Areas Project

Southeast Asian countries have achieved rapid economic development in recent years. Fisheries, especially aquaculture, have also developed markedly in these countries, accounting for 40 to 50% of the world's cultured shrimp production. On the other hand, the construction of aquaculture farms has caused environmental destruction, made worse by diseases often spreading to many other shrimp farms. Around urbanized areas, industrial and domestic wastewater flows into the sea, polluting the coastal waters.

To solve these problems, fisheries resource utilization systems using natural circulation function, environment-friendly non-feeding aquaculture methods, and efficient aquaculture feeding techniques achieved by combining multiple organisms are being developed (Fig. 7). Low fishmeal feed using alternative resources is also being developed to reduce aquaculture feed costs. The results of these research activities will make aquaculture technologies more sustainable and improve the livelihood of fishermen in developing regions. Furthermore, this will help Japan ensure a stable source of high-quality aquaculture products.

Fig. 7. A combined aquaculture demonstration facility in the Philippines

Yukiyo Yamamoto
Program Director
Value-adding Technologies Program

JIRCAS TODAY

○JIRCAS participates at the 5th Meeting of G20 Agricultural Chief Scientists (G20 MACS)

The 5th Meeting of the G20 Agricultural Chief Scientists (G20 MACS) took place in Xi'an, China on May 30-31, with chief agricultural researchers of G20 countries and international research institutes gathering for the purpose of strengthening cooperation among members and identifying priorities. JIRCAS has attended all meetings starting from the first one in Mexico in 2012.

At the meeting, JIRCAS President Masa Iwanaga explained JIRCAS's role in relation to the Global Rice Science Partnership (GRiSP), the research program on rice by the Consultative Group on International Agricultural Research (CGIAR). He cited the program as a success story of domestic research forces working within the framework of international cooperation.

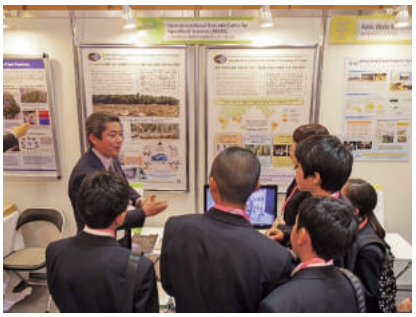
In addition to the chief agricultural researchers of the G20 countries, 96 others from international research institutions attended the meeting. There were six participants from Japan including Ms. Ryuko Inoue, research councillor of the Agriculture, Forestry and Fisheries Research Council Secretariat. The participating members and attendees engaged in a wide-ranging exchange of views, with the outcome document or "agricultural research meeting communique" outlined and compiled based on a broad consensus.

JIRCAS President Masa Iwanaga at the G20 MACS

○ JIRCAS sets up booth at the Special Exhibition during the G7 Science and Technology Ministers' Meeting

In conjunction with the G7 Science and Technology Ministers' Meeting in Tsukuba City, Ibaraki Prefecture, a "Special Exhibition" was held in Tsukuba International Congress Center on May 15-17, with officials from G7 nations and assembly participants in attendance. JIRCAS participated by setting up a booth with poster panels highlighting its research outputs and a video loop introducing the organization and its research activities. The exhibit was opened to the public on May 18-21 and a symposium was also held to commemorate the event.


Attendees to the G7 S&T Ministers' Meeting visited JIRCAS's exhibit, which included poster panels and an introduction video of the research center and its activities.


JIRCAS's research activities were introduced and explained to students.

○JIRCAS places 6th among Japanese institutes for most number of journal citations in the field of "plant and animal science"

For the second straight year, JIRCAS placed sixth among Japanese institutes in terms of most number of journal citations in the field of plant and animal science. This was announced by Thomson Reuters, a US-based global information services company (Headquarters: New York, USA, Japan Office: Minato-ku, Tokyo), which based the ranking on institutes that have produced the highest number of highly cited papers or journal articles.

Thomson Reuters produced its list by analyzing statistics and trends from the Essential Science Indicators (ESI) database across 22 research fields in science. This achievement sustains JIRCAS's status as a high performing, world-class organization in the field of plant and animal science, and is an indication that its research outputs in this field have significant impact on subsequent studies.

○Two JIRCAS researchers among Thomson Reuters' 2015 Highly Cited Researchers

On January 14, 2016, Thomson Reuters Corporation, a major multinational mass media and information firm, announced the 2015 Highly Cited Researchers list, which identifies contemporary scientists whose work has significantly influenced others in their


Senior Researchers Kyonoshin Maruyama (left) and Yasunari Fujita (right), together with President Masa Iwanaga.

JIRCAS TODAY

field. The list in the category of Plant & Animal Science included two JIRCAS researchers, Drs. Yasunari Fujita and Kyonoshin Maruyama, senior researchers of Biological Resources and Post-harvest Division. The list named over 3,000 scientists from around the world, of which about 80 belong to research institutes in Japan. The selections are based on the number of Highly Cited Papers, defined as those that rank in the top 1% by citations for field and publication year in the Web of Science database, published from 2003 to 2013 across 21 subject categories. - See more at: http://highlycited.com/

○JIRCAS receives letter of appreciation from Forest Research Institute Malaysia

The JIRCAS project titled "Development of forest management techniques through sustainable use in Southeast Asia" is currently implemented through a collaborative agreement with the Forest Research Institute Malaysia (FRIM). As part of the project's outreach activities, JIRCAS and FRIM co-organized a seminar, titled "Ecology & Genetics of Dipterocarp Forests: Its Role in Sustainable Forest Management," in late January 2016. For co-organizing the seminar, President Masa Iwanaga, on behalf of JIRCAS, was awarded a certificate of appreciation by FRIM Director General Dato' Dr. Abd. Latif bin Mohmod.


Certificate of Appreciation

This certificate is awarded to

Dr. Masaru Iwanaga, President
Japan International Research Centre for Agricultural Sciences (JIRCAS)

With Deep Appreciation For Your Co-organizing FRIM/JIRCAS Seminar on 'Ecology And Genetics Of Dipterocarp Forests' (2016)

(DATO' DR. ABD. LATIF BIN MOHMOD)
DIRECTOR GENERAL
FRIM

1 FEBRUARY 2016

Letter of appreciation signed by the director general of Forest Research Institute Malaysia

FRIM has been a frequent collaborator of JIRCAS over the years since the establishment of its precursor, the Tropical Agriculture Research Center (TARC, from 1971-1980) and upon its reorganization as JIRCAS (starting 1991). Apparently, FRIM and JIRCAS share a common goal of achieving sustainable use of the rainforest through research and development activities.

Malaysia, due to its forests, is a major producer and exporter of timber products to Japan. Tropical rainforests are very important terrestrial ecosystems because it stores carbon; however, the depletion of forested areas has become a significant contributing factor to global climate change. For this reason, JIRCAS and FRIM have been conducting research for the effective and sustainable use of wood resources from tropical rainforests.

○Madagascar Minister of Agriculture and Embassy Chargé d'Affaires visit JIRCAS

On March 9, 2016, Madagascar Minister of Agriculture Roland Ravatomanga, together with Madagascar Embassy Chargé d'Affaires Rosette Lalatiana Rasoamanarivo and two other officials, visited JIRCAS. JIRCAS officials presented an overview of the research center and introduced its research studies in Madagascar. This was followed by an exchange of views on joint agricultural research between the two countries. JIRCAS has new research activities for implementation in Madagascar, thus the meeting was a good opportunity for JIRCAS to hold a discussion with Madagascar officials.


Senior officials and researchers of JIRCAS pose for a group photo with visitors from Madagascar. (JIRCAS President Masa Iwanaga and Madagascar Minister of Agriculture Roland Ravatomanga are 2nd and 3rd from left, front row.)

○Israeli Ambassador to Japan visits JIRCAS

On February 16, 2016, H. E. Ambassador Ruth Kahanoff together with two others visited JIRCAS and exchanged views on agricultural research activities being conducted by JIRCAS and by her country.

Before the discussion, the visitors were shown the JIRCAS introduction video and were given an overview of the research studies on biomass and shrimp aquaculture. The visit was a good opportunity for JIRCAS to highlight its research outputs and for the ambassador to understand JIRCAS's mission.


Exchange of views on the research activities

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