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Agricultural and fishery production with marketing scenes in Southeast Asia

SPECIAL ISSUE: Southeast Asia

JIRCAS
JAPAN INTERNATIONAL RESEARCH CENTER FOR AGRICULTURAL SCIENCES

New Direction of JIRCAS Activities in Southeast Asia

JIRCAS and Southeast Asia

The forerunner of the Japan International Research Center for Agricultural Sciences (JIRCAS), the Tropical Agricultural Research Center (TARC), had always considered Southeast Asia as a major target region since its establishment in 1970. This was a reflection of the official policy for the Japanese Official Development Aid (ODA) which started in 1954 and had focused on the rebuilding of Asian countries after World War II. Japan already achieved self-sufficiency in staple rice in the late 1960's, and in those days, it was natural for many Japanese experts to lend a helping hand to the rest of the Asian region that was still suffering from lack of food. Through the activities of the ODA programs, they felt that the transfer of established technologies was not enough and that a combination of field survey, research and outreach work based on local conditions was very essential in solving many problems. These considerations had supported the activities of TARC. Almost two decades after its establishment, TARC was reorganized as the Japan International Research Center for Agricultural Sciences (JIRCAS) in 1993 and JIRCAS furthermore still keeps one of its footholds in Southeast Asia.

This fact seems to have made more than a historical impression. In 2003, the Japanese government established its new ODA policy to intensify all efforts to deepen the relationship between Japan and the East Asian region and to narrow the gap between the different countries by considering that the region can furthermore enhance mutually dependent relationships and hasten economic integration. At present, the East Asian region is further strengthening partnerships and integration in more fields other than economics. Beyond the existing regional partnership frameworks such as the ASEAN (Association of Southeast Asian Nations), ASEAN+3 (+Japan, China and South Korea) and APEC (Asia-Pacific Economic Cooperation), the East Asian Summit was started with the objective of promoting the formation of a regional community and enhancing cooperation on development, energy, economic integration and growth, poverty eradication and development gap correction, environmental protection, prevention of infectious diseases and alleviation of disaster-related damages.

Thus, Southeast Asia and Japan have rapidly shifted their relationship from a one-way to reciprocal direction for the last 30 years and have set up a cooperation framework to collaboratively solve emerging issues and challenges. The activities of JIRCAS should be within this context.

Agricultural Development and R&D

Southeast Asia has become the center of global economic growth, and its agricultural sector also exhibits high potentials. In fact, most countries in the region have already attained self-sufficiency in rice, and even some countries have become exporters. Furthermore, crops such as Para rubber, sugarcane, oil palm, cassava, etc. as sources of raw materials, tropical fruits, wood, fishery products, etc. have high export competitiveness as supported by the increasing demands, in response to the rapid Asian economic growth, the emerging middle-income groups, and the rising global demand for various resources and energy supply. Furthermore, there is no doubt that this region is one of the most important biodiversity treasuries on the globe.

At the same time, a considerable number of poor people still remain especially in the rural areas, which has sometimes resulted in social instability. In addition, agricultural land development, urbanization and industrialization have resulted in the degradation of farmlands, forests and other natural resources, abandonment of the same, and the spread of cross-border diseases and pests causing the deterioration of the environment and biological productivity.

In other words, this region has the high potentials for and the high risks linked with development. Therefore, it is a common task for the region to attain sustainable development by minimizing the negative impacts such as poverty and environmental degradation, which are very important issues closely related to the interests of advanced countries including Japan.

The Japanese government often clarifies its position to actively contribute in solving problems common to the region through various means, including R & D. In particular, the 3rd Science and Technology Basic Plan (2006-2010) specified Asia as one of the highest priority regions to strengthen networking and cooperation. Moreover, most economic partnership agreements (EPA), Japanese approaches to free trade agreements (FTA), etc., which were agreed, ratified and are being discussed between countries in the region and Japan, almost always cover cooperation on agriculture and science and technology.

Meeting between the Permanent Secretary of the Thai Ministry of Agriculture and Cooperatives and the President of JIRCAS

Regional meeting of JIRCAS Tropical Livestock Project (Bangkok, Thailand)

New Direction of JIRCAS

JIRCAS has just started its activities under the New Mid-term Plan (2006-2010), which continues to focus on Asia, particularly in Southeast Asia. In fact, more than 20 of the newly started projects place special emphasis on and/or set research sites at Southeast Asia. More emphasis is being placed on multilateral rather than bilateral collaborations in order to focus on common regional issues.

Emerging developing countries such as Cambodia, Myanmar, Laos PDR and Vietnam (CMLV) still have remaining distinct gaps in human resources, research infrastructure, etc. as compared with the other more advanced countries; and it is very difficult for JIRCAS alone to fill them up. JIRCAS is proposing that other advanced countries in the region should jointly work and solve problems through the projects. This is a new challenge to advance south-south cooperation toward the benefit of stakeholders and to improve the philanthropic approach in international cooperation programs. The Japanese ODA has kept the principle of self-reliance development approach by its recipient countries, and TARC and subsequently JIRCAS, have also followed it in principle. We are confident that our approach through collaborative research and coordination of mutual exchanges with Japanese partners has enhanced the capability of solving problems in the region. We would like to keep our partnerships with other advanced countries in the region to support the CMLV cluster countries so that many researchers and experts can share relevant development-related experiences and knowledge built up under similar natural and socio-economic conditions in the region, and thus more synergy can evolve from the many specialized knowledge and experiences of Japanese scientists and experts. Such approach can also provide young scientists and experts with good opportunities to learn and experience the development processes under field conditions.

Fortunately, our approach is shared not only with partners based in the region but also with various development partners working for the region, and we would certainly like to strengthen our partnerships with them.

This issue of the JIRCAS Newsletter invited some of the major JIRCAS partners in the region to frankly express their expectations, requests and other comments toward collaborative research with JIRCAS. JIRCAS has many partners and alumni who have shared so much hard work with JIRCAS in the region and are valuable assets that are irreplaceable. Based on these research objectives and experiences, we would shift our direction to the approaches mentioned above and would like to continuously contribute to the sustainable development of the region.

JIRCAS established its regional office for Southeast Asia in Bangkok in 2004, in cooperation with the Thai Ministry of Agriculture and Cooperatives. The office serves as a base for JIRCAS and its affiliates, and as the hub of the network of research institutions in the region. We warmly welcome all guests and friends who want to share common ideas and are willing to work in collaboration with us.

Satoru Miyata
Representative for Southeast Asia, JIRCAS

The Representative (far left) and staff of the Southeast Asia Office of JIRCAS

JIRCAS Projects with Special Emphasis and Ongoing Implementation in Southeast Asia

Biological Resources

Abiotic stress-tolerant crops (IRRI)
Blast research network for stable rice production (Id, Ph,Vn, IRRI)
Relevant technologies to utilize biomass resources in Southeast Asia (La, Th, CAPSA)
Value-addition to Asian agricultural products (Th, AVRDC)
Breeding materials to diversify sugarcane utilization (Th)
Genetic improvement of vegetable soybean and mungbean for the tropics and subtropics (AVRDC)
Control of reproduction in commercially important shrimp and prawn species (Vn)
Research into suitable stock management in tropical/subtropical areas (My)
Aquaculture technology suited to Southeast Asia (La, Th)

Management and Production

Good Soil Care (GSC) in the tropics (Id, Th, Vn)
Improvement of water utilization and diversification of agricultural production through a participatory approach in rainfed agricultural areas of Indochina (La, Th, CIAT)
Integrated rice cultivation system for reduced water availability (IRRI)
Feeding standard for beef cattle and feedstuff database in Indochina (Kh, La, Th)
Environmental management technology for sustainable crop production in tropical and subtropical islands (Ph)
Nurturing beneficial indigenous tree species and combined management of agriculture and forestry in Northeast Thailand's tropical monsoon regions (Th)
Selective logging techniques for the conservation of biodiversity in the hill dipterocarp forests of Peninsular Malaysia (My)
Low tree height-cultivation and year-round production of tropical fruits in Southeast Asia (Th,Vn)

Global Environmental Change

Water supply fluctuations in Indochina (Kh)
Citrus Greening disease in severely affected areas (Vn)
Biological control of invasive insect pests on coconut trees (Th, Vn)
GIS applications for agricultural land information at local to regional scales (Id)

Development

Technology assessment methods to determine factors that influence technology diffusion in Southeast Asia (Kh, La, IRRI)
Economic integration on agriculture and policy formulation towards alleviation of rural poverty in East Asia (Kh, Id, La, My, Th, Vn)

Note: Kh- Cambodia, Id- Indonesia, La- Laos, My- Malaysia, Ph- Philippines, Th- Thailand, Vn- Vietnam
IRRI- International Rice Research Institute, CIAT-Centro Internacional de Agricultura Tropical, AVRDC- Asian Vegetable Research and Development Center
CAPSA- Centre for Alleviation of Poverty through Secondary Crops' Development in Asia and the Pacific

Roles and Trends of the Department of Agriculture (DOA) - In Relation to JIRCAS

Current Organization

The Department of Agriculture (DOA) was established on October 1, 1972 by the merging of the former DOA and Rice Department. The merging was aimed to facilitate coordination among the various departments and offices and to streamline their functions to enable more efficient implementation of their mandates. Due to re-structuring in 2006, these two departments are now separated again. And it resulted in the reorganization of a new DOA which covers 5 mandates and 23 units for conducting research and development, transferring agricultural technologies, and providing services such as analysis, inspection and advices on soil, water, fertilizers, crops, agricultural input production, product quality for local consumption including export, etc.

Policy on Research and Development

Thailand is one of the leading producers and exporters of agricultural commodities in the world. And in order to remain competitive, DOA needs to be more creative and innovative particularly in the field of research and development, hence spending approximately half of its fiscal budget on research and development in 2006.

DOA has just established its policy on research and development for 2006-2010 which emphasizes production improvement and cost reduction by using new technologies, generating quality produce and processing which are up to international requirements, encouraging farmers to use less chemical fertilizers, and improving the management of natural resources and the environment. The policy consists of four dimensions: production efficiency, food safety, biotechnology and alternative energy sources (biofuel).

At present, DOA runs 94 projects under 30 pilot projects covering 10 issues: economic crops, agricultural engineering, area-based approach, food safety, post-harvest and product processing, plant protection and input products, organic crops as well as energy conversion using crops. Within the next decade, the projects will be conducted under the scope of "sufficiency economy."

International Cooperation

International cooperation in the areas of research and technology transfer is an essential part of the DOA projects. Thailand is gradually shifting its position from a recipient to a development partner in international cooperation. Our partners range from those from more advanced countries (Australia, Germany, Japan, Malaysia, etc.) and international organizations (CGIAR, FAO, ASEAN, etc.) to those from emerging countries, especially neighboring countries (Lao PDR, Cambodia, Vietnam, Indonesia, China, etc.).

JIRCAS is one of the longest-running partners of DOA, and the partnership can be traced back to the late 1960's when research on fertilizers, microorganisms and pests started with the Rice Department of that time. Since then, many research projects have been implemented by the Tropical Agricultural Research Center (TARC), the forerunner of JIRCAS, and in 1989, TARC opened its field office at the Soil Science Building of DOA. It reflected the expansion of DOA-TARC partnership, and the office has significantly contributed towards deepening our collaboration.

In 1994, in conjunction with the reorganization of JIRCAS from TARC, DOA and JIRCAS signed a new Memorandum of Understanding (MOU), under which DOA-JIRCAS projects have shifted from single themes to comprehensive ones, reflecting the situation of the time when the agricultural issues have become more complicated and necessitated more holistic approaches to be significantly effective.

In 2006, DOA and JIRCAS implemented five joint research projects: 1) Technology development to establish Good Soil Care in the tropics, 2) Low-tree height cultivation of tropical fruits in Southeast Asia, 3) Improvement of water use and diversification of agricultural production through a participatory approach in rainfed agricultural areas of Indo-China, 4) Biological control of invasive insect pests on coconut trees, and 5) Development of sugarcane materials by inter-generic hybridization using wild germplasm to diversify sugarcane utilization.

It has been an honor for DOA to host and maintain the long history of friendship with JIRCAS. Moreover, DOA takes great pride that JIRCAS decided to locate its Southeast Asian office in Thailand, in addition to its two field offices around the world. We hope that DOA and JIRCAS will continue to be best partners in research and development and remain as strong instruments for the advancement of the region.

Supranee Impithuksa
Deputy Director General, DOA, Thailand

DOA Building in Chatuchak, Bangkok, Thailand

Meeting between the Director General of DOA and the President of JIRCAS

Collaboration of the Institute of Food Research and Product Development (IFRPD) and JIRCAS

The Institute of Food Research and Product Development (IFRPD) is a research institute of Kasetsart University which undertakes food research and development essential to socio-economic, industrial and agricultural growth, and provides food quality assurance services and support to food industries as well as learning opportunities through various training courses at any level in Thailand.

In 2000, IFRPD and JIRCAS implemented a collaborative research entitled "Development of low-input technology for reducing post-harvest losses of staples in Southeast Asia," in order to develop appropriate and environment-friendly technologies for reducing post-harvest depreciation in the quality of staples. Under this project, various studies have been implemented. In particular, IFRPD has focused on the evaluation of factors affecting changes in the quality of rice during storage and the suitability of retrograded rice for making noodles and rice paper.

Rice has many uses; therefore, the characteristics of quality preferable to each use vary considerably, being related to the consumer's acceptance of each final product. It becomes necessary to maintain quality and/or add value to products in order to make the quality suitable for each product's intended use and meet established requirements. The physico-chemical properties of high-amylose rice change during the first few months of storage particularly after harvesting. Rice viscosity was generally found to decrease with time, but thereafter, those of the paddy and milled rice slightly increased after six months of storage. Results of our studies indicate that both forms of rice can be used for rice noodle manufacturing even when stored up to 12 months.

Value-added products can be manufactured from various kinds of rice such as rough rice, brown rice, milled rice, broken rice, rice germ bran, rice flour, and cooked rice. We evaluated dry-milled flour in preparing sen mee (rice vermicelli) using the same particle size required for well-developed dough. We observed that dry-milled rice flour has the potential as a raw material for the production of rice products such as rice noodles and rice paper with the advantages of minimized waste and a cleaner environment.

Thailand produces a huge amount of waxy rice (rice used for rice flour production) in the north and northeast of Thailand. We investigated the physical properties of 12 waxy varieties from two provinces. And we found that the water solubility index differed among the different varieties in each province and between materials of the same variety from different provinces. Differences were also found in the viscosity values among the varieties within the same province and between the same varieties from different provinces.

We also conducted studies on the properties and function of the water soluble polysaccharide (WSP) on rice pasting behavior, a characteristic used to estimate the physical properties of various cereals or starch-based products. WSP fraction was found to work as a glue to stick swelled up and gelatinized starch granules together in rice. The molecular structures of WSP in Thai and Japanese rice were also found to be similar to amylopectin but characterized by more short-chain branches. We believe that a better understanding of the WSP formation mechanism would help in the manufacturing of rice products.

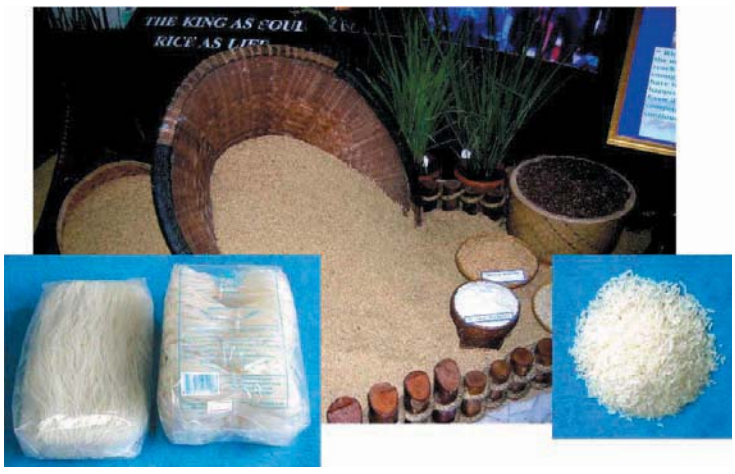
The projects that followed between IFRPD and JIRCAS were on the use of indigenous plants for inhibiting pests in stored rice. The use of botanicals, generally regarded as environment-friendly and safe to use in food, provides alternatives for the protection of rice against insect pests. We studied four rice insects: *Sitophilus oryzae* (rice weevil), *Sitophilus zeamis* (maize weevil), *Tribolium costaneum* (red flour beetle) and *Corcyra cephalonica* (rice moth). *Piper retrofractum* (long pepper: dee plee) was found to be the most effective in inhibiting the growth of all these insects. Other interesting Thai plants evaluated were *Cuscuta* spp. (dodder or sai mai), *Glinus oppositifolius* (khee khuang), *Glochidion perakense* (man poo) and *Garcinia cowa* (cha muang). These plants suppress the emergence of adults from eggs or inhibit the growth and development of rice insect pests.

IFRPD and JIRCAS also implemented projects on the potential of indigenous vegetables to exhibit bioactivities. Almost 900 local vegetables were evaluated for biological functions such as antioxidant activity, antimutagenicity and antiproliferation properties against cancer cells. Information on the biological functions and active compounds of these vegetables may contribute to their increase in production area and volume of sales. Many Thai vegetables such as *Careya sphaerica* (kra don bok), *Glochidion perakense* (man poo) and *Anacardium occidentale* (cashew twigs: yod ma muang himmapan) possess high antioxidant activity and are not influenced by seasonal or geographic factors. In the case of antimutagenicity, the plants found to contain active substances were *Boesenbergia pandurata* (kra chaai), *Micromelum minutum* (mui man), *Oroxylum indicum* (pheka), *Azadirachta indica* (sadao), *Polygonum odoratum* (phak phai) and *Cuscuta chinensis* (sai mai). In addition, follow-up studies were done on the functions relating to anticancer properties like mahanine, an active substance from *Micromelum minutum* (mui man).

The outcomes of research collaboration between JIRCAS and IFRPD are beneficial not only to both parties, but also to other countries such as Laos and Cambodia in Asia, and Ethiopia and Kenya in Africa, toward which we can transfer and apply our technologies, knowledge and experiences for their development.

On behalf of IFRPD, I would like to express my deepest wish to JIRCAS to allow us to work together as a meaningful part of the abovementioned future endeavor.

Warunee Varanyanond
Director, IFRPD, Thailand



Rice and products

Collaborative Research Project on Citrus Greening Management in the Mekong Delta

The Southern Fruit Research Institute (SOFRI) was founded in 1994 and currently employs 130 staff working in eight research (76 researchers) and three management divisions in Tien Giang, and in a sub-station in Ba Ria-Vung Tao Province. Since our institute is located in the southern region of Vietnam, we focus on crops such as citrus, mango, longan, banana, dragon fruits and other tropical fruits in this region. At present, SOFRI has 13 international collaborative research projects with eight countries. It has also become a part of SOFRI's programme of work to transfer the technologies, which are established through domestic and international research projects, to other countries. We have already successfully completed a number of projects; nonetheless, there are still some serious problems which remain to be solved, including the management of citrus greening disease (CG) in the Mekong Delta region.

Three years ago, SOFRI started a collaborative research project with JIRCAS for the management of CG in the Mekong Delta region. This disease is suspected to be caused by the liberibacter species, which is transmitted by a vector insect, the citrus psyllid (*Diaphorina citri*). Hence, a strategy to control this disease will be made possible by studying both the pathogen and vector sides. Thus, the joint project involves four subjects: 1) evaluation of the risk of CG in new citrus orchards, 2) behavioural and ecological traits of the vector, 3) control of the vector and CG pathogen in citrus orchards especially King mandarin, and 4) evaluation of the economic impact of CG on farmers.

CG has severely damaged the citrus cultivars in the Mekong Delta region, and the establishment of control methods for CG has become SOFRI's very important responsibility. More than 90% of the orchards have already been invaded by CG in the Mekong Delta region and more than 60% of citrus trees have been infected with the disease. It was estimated that citrus production would be reduced by more than 50% after the invasion of this disease. Such high infection proportion seems to be primarily attributed to the ability of psyllids to easily invade newly established orchards and proliferate there. In fact, if no control measure for psyllids is undertaken, the proportion of infected trees will reach 20-30% within the first year after planting. Although citrus cultivation is expected to bring higher economic returns than other crops, and many farmers are now interested in citrus cultivation, they are reluctant to expand their citrus cultivation area because of the CG-related problems. Hence, we are urgently required to establish effective control methods.

Our research is still focusing on understanding more the nature of the disease, and no decisive control methods have been established for CG until now. It is widely recognized that the combination of planting disease-free seedlings and subsequent application of systemic insecticides can significantly reduce the occurrence of CG and promise high economic returns even from orchards located in a severely infected area. In the meantime, we still lack enough data to prove the efficacy of this combination. To evaluate the improvement of citriculture by this management method, we have just started experiments on the combination of planting disease-free seedlings and applying systemic insecticide in the province of Vinh Long, southern Vietnam.

We also hope that the damage by CG can be reduced if guava is interplanted with citrus. After the planting of the seedlings of King mandarin, it usually takes 1.5 to 2 years until the first harvest. On the other hand, guava needs only four to six months after planting for the first harvest. Hence, farmers can expect the first fruit yield even in the first half year. Strikingly, it has been reported by farmers that CG apparently occurs much less frequently if guava is interplanted with citrus in their orchards. Our research also showed that citrus orchards intercropped with guava, despite receiving no insecticide at all, have few CG-infected trees in the first year, while the infection proportion in the chemically-controlled orchard was raised to 10-20% within the same time duration.

We are anticipating that our integrated pest management strategy and guava-citrus interplanting study will provide good results such that we can develop suitable models for the management of CG in the Mekong Delta region. We also expect that the government would effectively implement its policy on the strict use of disease-free seedlings only for this will have a significant impact on controlling the CG problem in the region.

Nguyen Minh Chau
Director, SOFRI, Vietnam

SOFRI Headquarters located at Chau Thanh, Tien Giang, Vietnam

SOFRI-JIRCAS IPM experimental field in Vinh Long,Vietnam

National Agriculture and Forestry Research Institute

Lao PDR is one of the least populated Asian countries (23.3 people/km^2). Despite the relatively low population density, the country faces the challenge of raising agricultural productivity to feed the growing population which is projected to double in the next 30 years. Agriculture and forestry provide the socio-economic and cultural base for over 80% of the population and account for more than 50% of the GDP. It has become important for the country to apply and develop new agricultural methods to get the most out of its limited resources.

The National Agriculture and Forestry Research Institute (NAFRI) was established in 1999 by the merging of the existing agriculture, livestock, fisheries and forestry research centers into one institute with the tasks of designing, implementing and coordinating all the agriculture and forestry research in the country. It contributes to the goals of the government (i.e. poverty eradication) by conducting adaptive research to provide technical alternatives and recommendations to support agriculture, the development of forestry and fisheries industries, and strategic formulation of policies and programmes. Currently, 300 staff members are working in three divisions: Administration, Planning, Finance and Cooperation Division (APFCD), Research Management Division (RMD) and Information Management and Strategic Planning Division (IMSPD).

Under the jurisdiction of NAFRI, eight research centers carry out a number of research and related activities around the country: Soil Survey and Land Classification Centre (SSLC), Agriculture Research Centre (ARC), Horticulture Research Centre (HRC), Livestock Research Centre (LRC), Living Aquatic Resources Research Centre (LARReC), Forestry Research Centre (FRC), Coffee Research Centre (CRC) and Northern Agriculture Research Centre (NAFReC).

NAFRI is presently implementing a strategic plan for the period 2005-2010 with a focus on strengthening research and services through improved technologies and practical information on crops, livestock, forestry and aquatic resource production to achieve food security and sustained income for farmers. The key research areas include:

- **Commodity-based research** on prime commodities including rice, maize, cattle, coffee, Mekong fishes, non-timber forest products, multiple-use timber species, and timber species for construction and export
- **Thematic and natural resource management research** on forestry, soil, water, agro-forestry, aquaculture and wetlands, livestock husbandry and production, animal nutrition and health, forest ecology, and community-based forest management
- **Cross-cutting research** on seed multiplication, genetic resource management and agricultural biodiversity, plant protection, post-harvest processing and farming systems
- **Method development** on land-use planning, market analyses and development, agro-ecological analyses and formation of community-based organizations
- **Marketing and socio-economic research** on value chains, agro-enterprise development, livelihood and gender studies, and indigenous knowledge
- **Policy-based research** on the identification and syntheses of information on matters of interest to policy-makers and the provision of information to improve policy implementation
- **Information services and networking** such as library services, data management, geographic information system (GIS), information and communications technology (ICT), packaging and dissemination of research results, and strengthening of coordination between the different actors in the agriculture sector particularly with the National Extension Service.

NAFRI and JIRCAS are currently implementing two projects. First, the project on "Diversification of Farming in Rainfed Lowland Agricultural Area and Sustainable Farming in Mountainous Areas of Laos" aims to evaluate the traditional cropping methods and water-saving mechanisms using a farmer-participatory approach in order to identify suitable technologies for water collection and distribution with appropriate crop selection techniques for increased farm diversification and income. A technology for improved water use and distribution is expected to address the needs of rainfed agriculture in the Indochina peninsula including Laos. The project also has collaboration with Thai institutes on the improvement of water utilization and diversification of agricultural production.

Second, the project on "Development of Sustainable Freshwater Aquaculture Technology Suitable for Southeast Asia" is implemented in collaboration with LARReC. Laotians are highly dependent on fish for their animal protein requirement such that the average fish consumption is estimated annually to be about 12 kg/person. However, fish catch has declined due to overfishing, irrigation, flood control and hydropower development, deforestation and use of pesticides. The potential for developing aquaculture in Lao PDR is promising as people have traditionally practiced fish culture using ponds and rice fields. The project aims to develop aquaculture technologies suitable for the region particularly in areas of hatchery management, pond and cage culture, integrated rice-fish (-prawn) farming and breeding and culture of indigenous fish species. It is expected that the development and dissemination of these technologies will help secure the sources of animal protein and increase farmers' income.

NAFRI's research focuses on "research for development" and ensures that the results can be used by different actors at all levels in the agriculture sector ranging from policy-makers, extension agents to farmers. Another important strategy of the NAFRI is to develop linkages with international research institutes like JIRCAS. This is important because it ensures that NAFRI's research can build upon the experiences and lessons learned from other countries in the region.

Bounthong Bouahom
Director General, NAFRI, Lao PDR

Upland village in Phonxay District, Luang Prabang

Research Collaboration on "Development of Agroforestry Technology for the Rehabilitation of Tropical Forests" in Sabah, Malaysia

The increasing demands for food and wood due to economic growth have exerted so much pressure to increase tree production per unit of 'forest' area. At the same time, forests are expected to meet an expanding array of socio-economic objectives like clean water, recreation sites and biodiversity. Therefore, it becomes necessary to manage forest areas according to the principles of sustainable management. Forest ecosystems must be maintained in a healthy state, and the value of the forests must be sustained for all users.

In 1989, the Sabah State Government started to implement better forest management based on sustainable management concept. The Sabah Forestry Department has strived to ensure that Sabah's forests will remain healthy and that sustainable benefits such as timber and other commercial products, recreational opportunities and wildlife habitats are provided for the state. In forests where destructive harvesting practices or destructive practices of shifting agriculture in the past have resulted in degraded lands, rehabilitation has been carried out to supplement natural regeneration and to regain the protective functions and ecological services of the forests.

The government has recognized the importance and potential of agroforestry, a system of land management that integrates trees with agricultural crops and/or animals so as to obtain higher productivity on a sustained basis than a single crop in the same unit of land, even from marginal areas and under conditions of low levels of technological inputs. In Sabah, woody perennials are deliberately grown on the same piece of land with agricultural crops either in spatial mixture or in temporal sequence. Traditional agroforestry has been practiced since time immemorial and knowledge has been handed down from generation to generation.

Regardless of Sabah's experience in agroforestry practices, farmers are still unsure of the best way to manage their land for maximum utilization and benefits. We are still studying various technical issues relating to agroforestry farming, including the selection of suitable combination of tree species by taking the level of natural soil fertility, type of planting materials, cultivation techniques, land preparation and farm management into consideration, and most remain inconclusive. In addition, more research and development trainings still remain to be carried out and collaborations with other research institutions are needed in order to overcome the problem of shortages of trained and experienced staffs.

Malaysia is one of the several countries with which JIRCAS has been working closely on issues related to deforestation and rehabilitation of degraded areas. In 2001, a collaborative agroforestry research project entitled, "Development of Agroforestry Technology for the Rehabilitation of Tropical Forests," was initiated between JIRCAS and the Sabah State Government through its Forestry Department. The aims of this project were to develop the technological base for growing forests rich in biodiversity, rehabilitate degraded forest areas, produce valuable timbers, maintain environmental functions and promote the forestry projects which lead to optimum land utilization and productivity.

The collaboration has been going on for the past five years and a wide range of studies have been carried out to spur remarkable development in agroforestry in Sabah. An attempt was made to develop a new thinning regime to the existing forest plantation of *Acacia mangium*, a fast growing exotic species. Inside the thinned plantation and secondary forest areas, dipterocarps and other tree species were intercropped with fruit trees and various local medicinal plants. The effect of thinning on light and soil moisture condition was evaluated under this agroforestry system. Growth performance, survival rate and yield of the planted seedlings were monitored to clarify the suitable shading conditions for the establishment of various plant species.

A. mangium has been used extensively for reforestation and currently ranks first as the most widely planted tree species in the state and accounts for 75,120 ha or 70% of all fast growing species planted. This species has the ability to grow on any type of soil and other site conditions together with its 'easy-to-work-on' properties. Results obtained from this project indicate that *A. mangium* tree is superior as a nurse tree compared to other species and a sustainable agroforestry site can be established under this plantation with proper thinning and other site management techniques.

As the project was scheduled to end on March 2007, JIRCAS, in collaboration with the Sabah Forestry Department, organized a workshop on November 28-29, 2006 and will publish the proceedings of the workshop and a technical manual for an agroforestry operation as an output from the collaborative project.

Jupiri Titin
Research Officer, FRC, Sabah, Malaysia

Forest Research Centre of the Forestry Department, Sabah, Malaysia

Project Workshop on Nov. 28-29, 2006

Collaborative Research with JIRCAS for Developing Good Soil Care Technology in Indonesia


R. Suherman

Vegetable production in Indonesia plays many important roles since it provides sources of nutrition, employment and income, raw materials for agro-industry, and foreign currency through commodity export. However, it has been challenged by various problems observed in the production system such as intensive chemical input and monocropping that replaced the traditional multiple cropping, resulting in lower fertilizer efficiency and poor product quality. In order to remove these critical bottlenecks, it is necessary to develop alternative technologies such as low external input and sustainable agriculture (LEISA) and organic farming.

The collaboration between the Indonesian Agency for Agricultural Research and Development (IAARD) and JIRCAS has a long history. During 1996 to 2003, a collaborative research project entitled "Evaluation and improvement of regional farming system in Indonesia" had been implemented. The Indonesian Vegetable Research Institute (IVEGRI) and the Indonesian Soil Research Institute (ISRI) joined the project and conducted various studies to develop technologies which could be used for the improvement of productivity and environmental conservation in vegetable-based farming systems in the highland regions of West Java. After successfully completing the project, a follow-up study was implemented by IVEGRI, ICASEPS (Indonesian Center for Agricultural Social Economics and Policy Studies) and JIRCAS, focusing on a crop rotation system to mitigate the clubroot damage, a serious constraint for farmers in the area.

On April 2006, Indonesia, together with Thailand and Vietnam, was chosen as one of the research sites of the new multilateral project "Technology development to establish Good Soil Care (GSC) in the tropics." The GSC project aims to develop a model to evaluate resource input baseline while monitoring the physical, chemical, and biological properties of the soil in order to illustrate the results of continuous application of organic matters and other soil fertility management practices on agricultural land. ISRI and IVEGRI were the selected partner research institutes in Indonesia for this project. In order to achieve their goals, these institutes formed a multi-disciplinary study team which consists of soil microbiologists, soil chemists and agronomists.

The primary objectives of the study in Indonesia are to examine the effects of non-chemical soil management practices, including 1) organic matter enrichment, 2) green manure/cover crop, and 3) no/minimum tillage, and to clarify the sustainability of soil fertility in the long term basis. The field experiments have been carried out in the experimental fields in IVEGRI, Lembang, West Java.

Our team started the preliminary experiments which include the cultivation of cleaning crops and pot experiments to examine the effects of indigenous ameliorant substances such as rice husk ash, wood ash and charcoal ash. The experiments consist of three treatments: 1) long-term soil fertility experiment, 2) challenge treatment, and 3) organic farming treatment.

We try to understand how various nutrients and crop management practices affect soil fertility in the long term. The treatments were designed by combining these two factors. In addition, the effects of soil fertility, high quality manure, and minimum tillage and cover crops during the dry season will also be studied.

In the challenge treatment, various soil management technologies are examined to clarify the potentials of these "challenging" technologies in improving productivity and farmers' income. Tithonia compost, Multifunction Microflora (a consortium of various plant growth-promoting bacteria), Biophos (phosphate-solubilizing microbial fertilizer) and a few kinds of exotic cover crops will be evaluated in the experiment.

Due to the recent economic development in Indonesia, the demand for organic vegetables continues to increase. Though more farmers are interested in the production of organic products, organic farming technology is still in its development stage. Practical information on the use of organic materials will be provided through the organic treatment.

Indonesia is a country with high potential for agricultural production owing to its abundant natural and human resources. However, poverty is a chronic problem especially in rural areas where many people still rely on agriculture. To realize the pro-poor economic development, the agricultural sector is recognized as an important area of the Indonesian economy. We are confident that the outcome of our new project can contribute to the improvement of soil fertility in vegetable farming systems and to the achievement of sustainable agricultural development in Indonesia.

Rachman Suherman and Nani Sumarni
Director and Senior Researcher, IVEGRI, Indonesia
Rasti Saraswati
Senior Researcher, ISRI, Indonesia


Experimental field in IVEGRI


Indonesian study team working at the JIRCAS laboratory in IVEGRI (Rasti Saraswati, center; Nani Sumarni, far right)

Cambodian Agricultural Research and Development Institute: "Technology for Prosperity"

The Kingdom of Cambodia is an agrarian-based country with the agriculture sector accounting for 31.1 to 45.1 % of its GDP as recorded in the last ten-year statistics (1993-2004). However, the agricultural productivity is still low in terms of both labor (USD 166 per worker) and land (USD 480 per hectare). More than 85% of its 14 million population live in the rural areas.

Currently, rice is the predominant crop across the country with an estimated cultivated area of 2.1 million hectares. Rice and maize account for 91.4% of the total field crops. Only 2.75% is being used for oilseeds followed by 1.4% for vegetables and fruits. Most farmers have less than two hectares of land under rainfed condition; poverty is still widespread and per capita income in rural areas is very low. Economic growth in recent years has taken place at a far faster rate than before, but it has occurred only in the urban areas. As a result, the farming sector accounts for the disproportionately small proportion of the GDP and is considered as the core of the development problem faced by Cambodia.

The Cambodian Agricultural Research and Development Institute (CARDI) was formally established by the Royal Government of Cambodia on August 16, 1999. Since then, CARDI has become the prime national agricultural research institute in the country. It functions to improve the living standards of farmers through agricultural research, training and technology transfer. To achieve such goal, it is responsible for the 1) management and leadership of all research activities to enhance agricultural development, 2) conduct of applied research and technology transfer including agricultural economics, 3) delivery of services to support the implementation and rehabilitation of agricultural development projects, 4) development of human resources in the agricultural field, and 5) cooperation with relevant research institutions both at national and international levels.

Currently, CARDI has six divisions for its Research and Technology Development and a center that continuously work for the achievement of its mission and promote the transfer of technology as "Technology for Prosperity." The objectives of the divisions/center are the following:

- **Plant Breeding Division -** to develop high yielding and premium quality crop varieties through research and utilization of available genetic resources in lowland, irrigated and upland farming systems
- **Plant Protection Division -** to develop technologies and strategies that will assist farmers to increase yield and profit by protecting agricultural crop losses from pests in a safe and sustainable manner
- **Soil and Water Sciences Division -** to develop cost-effective, simple and reliable nutrient management systems to help farmers increase and stabilize crop yields by improving knowledge of soil and water quality
- **Agricultural Engineering Division -** to improve the efficiency, quality and sustainability of crop production in the farming systems by researching, developing and extending appropriate technologies related to tools, equipment and means of production
- **Agronomy and Farming Systems Division -** to improve the living standard of Cambodians, especially farmers in lowlands, irrigated lands and upland farming systems through crop diversification, aquaculture and animal raising
- **Socio-Economics Division -** to improve the household income of the rural poor through research on farm resources, impacts of technologies developed by CARDI, constraints in adoption of new innovations, gender roles in decision-making, and local and international marketing issues in agriculture
- **Training and Information Centre -** to develop knowledge and skills in agricultural R & D through training, information sharing and creating public awareness

CARDI has conducted interdisciplinary thematic and system-based research programs through its three-year rolling plan in order to pursue its ambitious mission and goals, in harmony with the National Research Master Plan (2006-2010), the Agricultural Sector Strategic Development Plan (2006-2010) and the Rectangular Strategy of the Royal Government of Cambodia towards the Millennium Development Goals. Furthermore, CARDI has strong links with regional and international research institutes, including the Australian Centre for International Agricultural Research (ACIAR), International Rice Research Institute (IRRI), National Agriculture and Food Research Organization (NARO), Japan Development Institute (JDI), Centro Internacional de Agricultura Tropical (CIAT), International Network for the Improvement of Banana Plantain (INIBAP), Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), Asian Vegetable Research Development Center (AVRDC), Japan International Research Center for Agricultural Sciences (JIRCAS), etc. CARDI also continues to work in partnership with other research institutes to meet Cambodia's national goals and strategic needs. It strives to establish more partners and adopt a business-like approach and practice that will recoup the costs of its research activities. Therefore, it is anticipated that such principles will ensure the future viability of the organization and enable a continued contribution to the welfare of all Cambodians.

Both CARDI and JIRCAS are committed to strengthen our partnership through our ongoing projects on "Socio-economic analysis on impact of social capital to solve conflicts for water usage groups in different modes of irrigation systems in Cambodia" and "Impact analyses of economic integration on agriculture and policy towards poverty alleviation in rural East Asia" and in the areas of crop production and environment. We also look forward to the opportunity to work with JIRCAS on the improvement of sugarcane and cassava production.

Men Sarom
Director, CARDI, Cambodia

The CARDI Administration Building constructed in 2002

Research Collaboration between JIRCAS and the Bureau of Soils and Water Management (BSWM)


J. Rondal


S. Contreras

The Philippines needs to enhance the productivity of its existing agricultural lands, especially those used for plantation crops, and must develop its marginal and sloping lands for the expansion of agricultural production in order to support its expanding population. For plantation crops like sugar cane, proper water management is the key to increase production. And in marginal and sloping lands, the control of soil erosion and improvement of soil nutrient status are very crucial for increased productivity and enhanced sustainability. It is also important to look at the existing cropping patterns and determine any possible modification and improvement like the use of legumes in areas where only monocropping of corn is practiced.

In terms of research collaboration, the year 2006 is a significant one for the BSWM, the principal government agency responsible for the development of soil and water-based technologies. On September 26, 2006, JIRCAS and the BSWM signed a five-year joint research agreement entitled "Development of Environmental Management Technology for Sustainable Production in Tropical and Subtropical Islands." The principal researchers involved are: Dr. Kiyoshi Ozawa and Dr. Fujio Nagumo for JIRCAS and Engr. Samuel M. Contreras and Dr. Jose D. Rondal for the BSWM.

The research project consists of two components: 1) development of techniques to increase yield with less water use, and 2) development of conservation cropping system. In the first sub-component, the effects of hardpan disruption using a sub-soiler and the application of organic fertilizers on soil-water interactions like infiltration and root penetration, and ultimately on yield, will be evaluated. The use of heavy machineries on plantation crops like sugar cane causes the formation of hard pan, resulting in poor water movement and root penetration. The study will be conducted in Negros Island, a major sugar cane-producing area. A study that will look at the effects of foliar spray and timing of irrigation on some crops will also be undertaken in the BSWM research station.

The second sub-component of the study which is now being conducted in Isabela Province will compare the effects of conservation tillage with the conventional farmers' practices in terms of runoff, soil erosion, soil biodiversity, and corn yield. Isabela is one of the main corn-growing provinces in the country. The crop is grown from the alluvial plains to the foothills. Even in areas where the slope is steep, farmers plow their fields usually in an up and down direction causing heavy runoff and soil loss. Conservation tillage is seen as a possible option for sustainability. The effect of incorporating the cultivation of a legume in the present practice of corn monocropping and the farmers' reactions on the application of the legume-corn cropping pattern with conservation tillage will also be evaluated.

Through the project, we hope to establish appropriate soil and water management technologies for sugar cane farms in the country (i.e. particularly those with problems of plowpan). Water-saving technologies could also be developed by considering the appropriate timing of irrigation application, which could result in higher productivity and more income for farmers. In the case of sloping corn farms, the benefits of conservation tillage and improved cropping pattern could be realized in terms of reduced soil loss, conserved nutrients, enhanced soil biodiversity, and ultimately, increased and sustainable yield and income. BSMW and JIRCAS will continue to strengthen their partnership for the enrichment of knowledge and technology development for the benefit of Filipino farmers.

Jose D. Rondal
Chief, Soil Conservation and Management Division
Samuel M. Contreras
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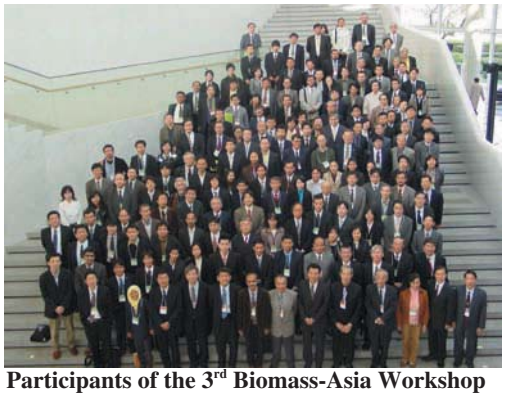
BSWM, Philippines


BSWM Building in Quezon City, Metro Manila, Philippines


Conservation tillage experiment in the Tropical Agriculture Research Front (TARF), Okinawa, Japan

The 3rd Biomass-Asia Workshop



Participants of the 3rd Biomass-Asia Workshop

On November 15-17, 2006, JIRCAS held the 3rd Biomass Asia Workshop at the U Thant International Conference Hall of the United Nations University (UNU), Tokyo, and at the Tsukuba International Congress Center (TICC), Tsukuba City, in cooperation with the Ministry of Education, Culture, Sports, Science and Technology (MEXT), Ministry of Agriculture, Forestry and Fisheries (MAFF), Ministry of Economy, Trade and Industry (METI), and the Biomass-Asia Research Consortium member institutes, such as the National Institute of Advanced Industrial Science and Technology (AIST), National Agriculture and Food Research Organization (NARO), Forestry and Forest Products Research Institute (FFPRI), Central Research Institute of Electric Power Industry (CRIEPI), Research Institute of Innovative Technology for the Earth (RITE), and the University of Tokyo. A total of 450 scientists, administrators and technical experts of both the public and private sectors from 15 countries participated in the symposium and exchanged views and information on the issues addressed by 5 keynote speakers, 12 panelists representing different Asian countries, 15 oral and 31 poster presenters.

The fossil fuel-dependent social system, of mass production, large-scale consumption, and mass disposal, has deepened a variety of serious environmental problems from global warming to the proliferation of waste products and toxic substances. In this context, the value of the effective use of biomass—a renewable, biologically-derived organic resource—is receiving considerable attention. Moreover, though many of the Asian countries are rich in biomass resources due to their climate and other factors, there is profound concern that their future economic and population growth will lead to both increased energy consumption and more greenhouse gas emissions.

Given this situation, as has been pointed out in the "Biomass Nippon (Japan) Strategy," the following tasks have become urgently necessary from both a global and Asian regional perspective:

1. Dissemination and sharing of technological achievements with regard to the effective use of biomass as a part of measures to prevent global warming.
2. Contribution to the creation of sustainable, recycling-oriented societies in Asia through the effective use of wastes and other measures.
3. Fostering of competitive, environmentally friendly industries through the use of biomass for alternative energy generation and for conversion into various products
4. Revitalization of agriculture, forestry, fisheries and the communities engaged in them through effective use of biomass.

In pursuit of these goals and as a concrete step in that direction, JIRCAS and the other collaborating institutions organized the "Biomass-Asia Workshop," bringing together government officials and researchers active in the field of biomass utilization in countries throughout Asia. In the workshop, participants were able to obtain comprehensive information on the kind and amount of biomass resources, utilization technologies, on-going projects, policy and institutions. They were also able to exchange views regarding the direction of biomass research and development. As for the research aspect, it was emphasized that breakthroughs are necessary in some areas, such as sustainable biomass production and utilization of cellulosic materials.

We are facing a wide range of challenges due to the diversified situations in each region of Asia. Each country has different kinds and amounts of biomass. The geographic, economic, cultural, and energy situations vary from country to country and from region to region. Hence, the participants have also come to share their common ideas on the necessity of identifying, developing and adopting relevant technologies, regional systems, laws and institutions.

In the general discussion on "ASEAN Biomass Research and Development Strategy," chaired by Dr. Noguchi of JIRCAS and Dr. Yokoyama of the University of Tokyo, the crucial points that emerged from the previous sessions were reviewed and biomass utilization scenarios for Asia were presented. After some amendments which were based on the discussions among the participants, the scenarios were approved by common assent. In addition, Dr. Matsumura of Hiroshima University reported that a networking system which could be a platform for information exchange was established following the agreements reached at the 1st and 2nd Biomass-Asia Workshop.

Finally, the participants confirmed that partnership is the key towards solving the environmental and energy challenges and agreed to hold the Fourth Biomass Asia Workshop next year to continue the collaborative efforts towards achieving our ultimate goal of "Sustainable development in Asia with less impact on the environment through biomass utilization." This workshop was held as a part of cooperative activities to develop an ASEAN Biomass Research and Development Strategy, a project adopted under the program "Leadership for International Scientific Cooperation," which is supported by the Special Coordinating Funds for Promoting Science and Technology of MEXT.

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