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A beautiful rainbow appears over the paddy fields in Laos (Photo by K. Kimura)

In This Issue

JIRCAS
JAPAN INTERNATIONAL RESEARCH CENTER FOR AGRICULTURAL SCIENCES

Technology Development for Rural Livelihood Improvement in Developing Regions

Many of the poor in developing regions make their living from agriculture, forestry and fisheries. Therefore, access to modern agricultural technologies is crucial in improving the income-earning capacities and livelihoods of rural populations as well as in making contributions toward regional development.

The current situation raises the following questions: What kind of technology improvement or development is needed; and how should we practice these technologies in the regions?

In response, the Japan International Research Center for Agricultural Sciences (JIRCAS) conceptualized "The Rural Livelihood Improvement" program to (a) promote appropriate development in line with the respective natural conditions and cultural background, and (b) evaluate the multilateral values of various agricultural, forestry and fishery products to improve incomes in rural areas. To achieve these objectives, we will develop key production technologies for sustainable agriculture, forestry, fisheries, and rural development. We will also develop novel processing, distribution, and storage technologies for effective utilization of the products.

To further develop these technologies, we will conduct and promote collaborative research, mainly with institutes and research centers in Southeast Asian countries.

In the field of food resource utilization, we will investigate the processing of various traditional foods in local areas and aim toward stabilizing and improving food quality. For example, improvement of uniquely processed foods such as fermented soybean in China and utilization of food components in fermented fish in Southeast Asia for hypertension prevention, are in progress.

In the field of biomass utilization, we will aim to produce energy from agricultural wastes in Southeast Asia. We are currently developing industrial scale technologies to produce ethanol from cassava pulp or old oil palm trunks.

As part of our efforts toward sustainable agriculture, recycling-based agricultural production technologies are being developed in an intensive cereal farming area and in a farming and livestock-raising region in China. For sustainable development of the forestry, use of forest resources is being carried out taking advantage of forest multi-functionality. As for fisheries, we are developing sustainable aquaculture technologies with less environmental burden through multi-trophic aquaculture.

We present the initial results of our joint research in this issue of the newsletter, featuring the establishment of a sustainable and independent farm household economy in the rural areas of Indochina. The main target region of this project is Lao PDR, which is one of the least developed countries according to the UN. We conducted our research at a common site in Laos called the "research village." We coordinated and cooperated with local research institutes, government and farmers in developing and demonstrating these new technologies.

It will be our pleasure if these articles help you better understand our research activities for rural development.

Masayoshi Saito
Program Director
Rural Livelihood Improvement Program

Establishment of a Sustainable and Independent Farm Household Economy in the Rural Areas of Indo-China

1. Objective and Rationale

A research project, titled "Establishment of a Sustainable and Independent Farm Household Economy in the Rural Areas of Indo-China," was started in April 2011. This is an integrated and demonstrative research focusing on Lao PDR (as well as Myanmar and Cambodia). Laos hopes to graduate from its least developed country (LDC) status by 2020 through implementation of the "National Growth and Poverty Eradication Strategy." JIRCAS, through this project, aims to contribute toward achieving this national endeavor by developing agricultural technologies.

The objective of this project is to establish sustainable, stable, and independent farming strategies based on appropriate land use systems in order to improve self-sufficiency, boost commercial production, and expand rural farmers' livelihood opportunities. Although Lao PDR's economy has improved in recent years, there remains a regional disparity in income between farmers in lowland areas (along the Mekong River) and those at the mountainous and hilly areas (in the northern districts and near its border with Vietnam), as shown in **Figure 1**. This disparity is closely related to ethnicity and farming systems. In concrete terms, the minority ethnic groups, such as the Hmong and the Khmu who are engaged in shifting cultivation in the uplands, are relatively poorer than the Lao (Loum) people, who produce rice in lowland paddies.

The Lao government has been implementing the "Land Allocation Program" since the 1990s to encourage the Hmong and the Khmu to move down the mountains by offering them agricultural plots in the lowlands. However, the transition has not been easy because migration means that the people will have to change not only their domiciles, but also their farming methods and way of life.

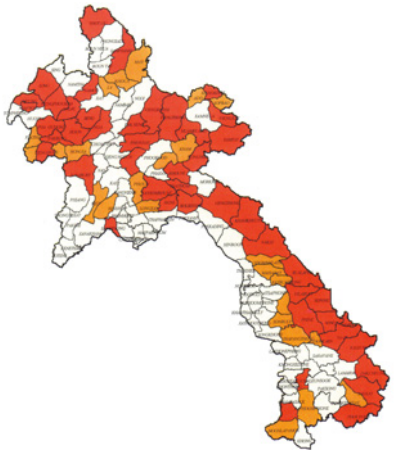


Fig. 1. Poverty distribution map of Laos
(source: *The Geography of Poverty and Inequality in the Lao PDR, IFPRI, 2008.*)

A common research village has been designated northwest of Vientiane Province where researchers may gather, formulate, and propose new farming systems that can improve rural livelihoods and promote domiciliation. The researchers hope that the proposal finds practical application, and that it benefits local farmers as well as those from other mountainous villages confronting the same problems.

The characteristics of agriculture production and the dynamics of rural society in the common research village are briefly explained below.

2. The Research Village

The research village is a three and a half hour drive northwest from Vientiane, the capital and largest city of Laos. Agricultural production is mainly for self-sufficiency, i.e., by traditional rice paddy cultivation in lowlands and by shifting cultivation for growing upland rice. The village was originally established by the ethnic Lao in 1920, but migrant population (the Khmu) from Luang Prabang surged after 2000, eventually surpassing the village's Lao population. The rapid increase in population has greatly impacted the distribution of cultivable agricultural lands, which are the economic basis of family life. This is noteworthy because arable lands, especially paddies, are limited in mountainous regions. According to **Table 1** and **Figure 2**, the later the households moved into the village, the lesser amounts of farmland that were allocated and also the more upland (or less lowland/paddy) in terms of proportion and location. Households without paddy lands to cultivate comprise 56% of the village total. Considering that rice yield per hectare is 3-4 tons in paddies against only 2 tons in uplands, half of the village population (which rely only on upland rice) would likely experience rice shortage and thus, would not be able to attain self-sufficiency. Accordingly, the main targets

or beneficiaries of this agricultural technology development project will be these particular households who lack enough cultivable lands for subsistence farming.

Table 1. Average farm sizes by immigration year

	Before 1996	1996~ 2000	2001~ 2005	After 2005
Number of households	32	23	22	47
Average farm size	2.3 ha	2.0 ha	1.7 ha	1.5 ha

Data source: Farm households survey. JIRCAS, Sept. 2011.

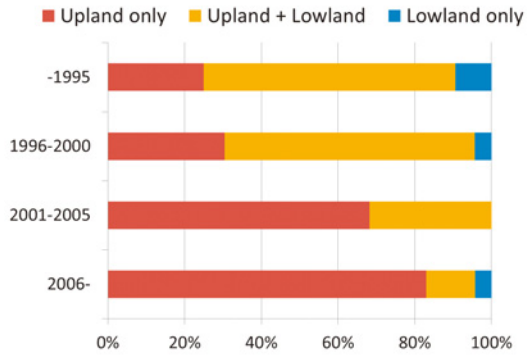


Fig. 2. Composition of land category by immigration year)

3. Key Issues and Research Subjects

Strategies for agricultural development in Lao PDR will focus on food production for self-sufficiency as well as commodity production for cash income. However, as free trade with ASEAN countries becomes inevitable in the near future, traditional agriculture systems will be pressed to advance toward commercial production. The agricultural sector must be prepared if and when the time comes. It would be very risky for farmers to depend mostly on commodity production unless there is full governmental or cooperative support. Fluctuation in market prices of agricultural products could adversely affect farmers' incomes and seriously damage farm household economies. Therefore, it is essential to first establish self-sufficient production at the household level, and subsequently, promote commodity production based on self-sufficiency. This project, which is composed of four research subjects (Table 2), is being implemented based on this idea.

Masuo Ando
Director
Social Sciences Division

Table 2. List of research subjects

Establishment of a Sustainable and Independent Farm Household Economy in the Rural Areas of Indo-China
I Improvement of Stability and Sustainability for Self-Sufficient Production in Lao PDR
1) Establishment of small scale irrigation systems for stabilization of rice production
2) Development of low-input and sustainable cultivation technologies for lowland rice production
3) Establishment of low-input aquaculture and sustainable small scale fisheries systems in artificial water masses
4) Clarification of forest product use for livelihood and development of measures to manage forest through sustainable use
II Promotion of Stable Commercial Production in Lao PDR
1) Development of dry season cropping technology for year-round utilization of lowlands
2) Utilization of local organic resources for sustainable upland crop production
3) Development of feed resources and forage crops for the domestic livestock in Indo-china
4) Development of sustainable fruit production technology in Indo-China
5) Establishment of sustainable use and production system of high-value aquatic animals
III Socio-Economic Conditions for the Stability and Independence of Farm Household Economy in Lao PDR
IV Assessment of Biodiversity and Its Conservation in Lao PDR

Establishment of Small-Scale Irrigation Systems for Stabilization of Rice Production

Rice production in Laos has been increasing year by year and rice self-sufficiency has also been improving. However, there are regional and local differences in terms of productivity. In this study, improvement of rice productivity in low-productive fields is addressed through effective use of water resources, where building a "small-scale irrigation system" means not only installing irrigation facilities such as reservoirs and canals but also formulating a framework for effective water use.

1. Field survey on rice planting and water use

In order to improve lowland rice productivity in spotted low-productive fields, factors affecting paddy rice cultivation such as location, water use, planting situation and so on, have to be understood. An interview survey on lowland rice planting in 2010 and 2011 was conducted followed by a field survey on lowland rice production in 2012. The surveys were implemented at the project site in N.Village, Vientiane Province where lowland rice planting is carried out once a year during rainy season.

Annual precipitation at the project site is more than 2000mm. Survey results showed that rainfall amounts were much higher than normal towards the end of rainy season in 2010 and at the beginning of rainy season in 2011. Also, there was less precipitation in 2012 compared to usual.

There was a three-month difference in transplanting times between early-planted and delayed fields in 2010 and 2011. Transplanting activities were carried out intensively from early July. In late-planted paddy fields, the delay was attributed to water shortage due to less rainfall at the beginning of rainy season in 2010. Water is crucial in completing routine field tasks such as making nurseries, plowing, paddling and transplanting. Labor shortage was another reason for the delay. From interview surveys, it was inferred that labor competition occurred in the village.

Water use and yield surveys were carried out in 2012 to understand the relationship between rice yield and water resource availability and usage, timing and situation of farming activities, and location of fields. Results revealed that the times of farming activities and yield vary for each rice field. It is expected that the interrelationship among field locations, water resources conditions, and rice yields will be clarified through detailed analysis.

In addition to the above surveys, it was observed that proper collection and organization of meteorological records, water discharge data, and water level marks in reservoirs are necessary in developing appropriate and efficient irrigation systems.

2. Evaluating the best times for transplanting to increase rice yield

Even within the same village, the large difference (more than two months) in transplanting times can affect rice yield. Hence, determining the best times for transplanting is important in order to secure and allocate water resources at the target time and maximize rice yield. Rice planting experiments were done at different transplanting times to compare yields. Six rice varieties (four local varieties collected in N.Village plus two improved varieties) were transplanted to experimental fields from the beginning of July. It was spaced at two-week intervals over a six-week period (four different times). Before harvesting, variations in plant heights and panicle sizes were confirmed between early-planted and delayed plots. It is expected that the factors affecting variations in rice yield, in particular the ideal transplanting time for each variety, will be verified.

Photo 1. Transplanting in N.Village

Photo 2. Experimental plots showing transplanted rice spaced at two-week intervals

Hiroshi Ikeura
Rural Development Division

Improvement of Rice-based Cropping Systems in the Mountainous Areas of Lao PDR

Intensive agriculture is partly practiced in the plains of the Mekong Corridor, where rice farmers employ chemical fertilizers, improved cultivars, and machineries. In contrast, traditional or "low input and low return" agriculture characterize rice production in mountainous valleys of Lao PDR, including N.Village.

Rice yield in N.Village is not necessarily low; however, improvement of yield per unit area as well as field utilization after rainy season rice cropping is required. This will ensure self-sufficiency in rice and increase household incomes in anticipation of the annual decrease in average holding area per household due to the influx of migrants or families branching out.

For this reason, we are trying to develop new cultivation techniques to improve rice yield under low-input conditions. First is by priming treatment of seedlings (done through application of small amounts of phosphate in the nursery) and second, by double cropping with water spinach (*Ipomea aquatica*).

So far, we have obtained results showing that priming treatment increases rice grain yield by increasing the number of productive tillers, regardless of inhibitive effects on seedling growth in the nursery and on the development of rice plant in the field. Meanwhile, it has been reported that compared to continuously cropped rice, yields are higher when rice is rotated annually with water spinach, a popular vegetable that can grow under submerged conditions. However, the effect of water spinach on succeeding rice yield (under the condition that water spinach biomass is not retained) was unclear, and its effects were similar to having green manure applied to the field instead of crop rotation.

We investigated whether water scarcity during dry season (between Nov-Apr) was the primary constraint to crop production after rainy season. We found that water supply is not necessarily critical in N.Village as it is situated on a recharge zone surrounded by forests and ponds. We also studied the death of maize plants in the target village but we determined that soil acidity, not water shortage, was the cause.

Soil analysis indicated that half of the examined paddy fields have acidity below pH 5.0 (Fig.1) and that exchangeable cations such as Ca, Mg and K were extremely low. This suggests that the soil may have been acidified by leaching of soil minerals which was made soluble by abundant rainfall (annual average >2400mm).

The soil's relatively high acidity tends to overcome the neutralizing effect of limestone which makes up the hills and ridges surrounding the target area (Photo 1). The growth of upland crops have been adversely affected by aluminum toxicity and deficiency in plant nutrient, making soil amendment necessary to allow cultivation. In pot experiments using farmers' field soil, crop responses to soil amendments varied greatly. In addition, the influence of soil acidity on rice tend to be underestimated because of increasing soil pH under reducing conditions or low calcium requirement in rice. Low soil pH delivered excess Mn or Fe, and calcium application seemed to affect the response of rice to chemical fertilizers. Therefore, it is necessary to clarify the soil amendment suited for rice-based cropping systems in lowlands and conversely, it is necessary to adapt crops or cultivation practices according to amended soil under actual farmers' field conditions.

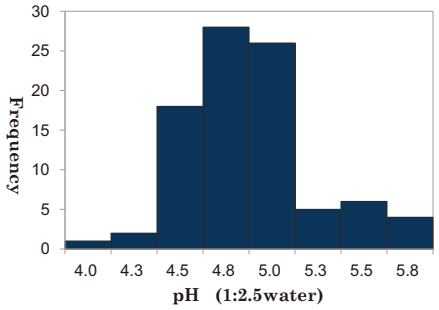


Fig.1. Frequency distribution of soil pH in the paddy fields of N.Village

Photo 1. Paddy fields of N.Village surrounded by limestone hills and ridges

Kazuyuki Matsuo
Crop, Livestock and Environment Division

Low-Input Aquaculture and Small-Scale Fisheries System in Rural Areas

Background and current situation

The Mekong River basin, which hosts over 1200 indigenous fish species, is particularly rich in fishery resources. These fish resources are eaten in fresh, dried, and fermented forms. In Laos, fish consumption is currently estimated at over 10 kg per year per capita. Demand for fish has been rapidly increasing in recent years corresponding to the increase in national population (around 2.7% per year). This situation has led authorities to promote fish culture and to increase aquacultural production by introducing exotic fishes such as Nile tilapia and African catfish in peripheral areas. However, settlement and expansion of these exotic fishes in the wild has raised concerns regarding possible negative impacts (e.g., species invasion) to indigenous biodiversity in the region. Moreover, aquacultural activities and production in remote rural areas are still limited due to lack of technical extension services, unlike in urban areas. Besides aquaculture, traditional fishing activities in such areas are also limited due to small fishing grounds (i.e., rivers and lakes), exposing the resources at risk to exploitation and overfishing. With this as background, low-input aquaculture trials and fisheries biology investigations are being conducted in small remote villages with the hope of finding applicable and sustainable technologies for future stock management.

Research components and progress

1) Low-input aquaculture— Researchers are currently conducting aquaculture experiments using omnivorous fish species (cyprinid and osphronemid) in order to reduce the need for fish feed, which occupy a major portion of aquacultural expenses (Fig.1). Rice paddy fish (using cyprinid) are left to feed on natural sources (e.g., aquatic insects and plants) supplemented by artifical diets.

Fig. 1. Rice paddy fish culture (left) and cage culture (center); a cyprinid used for rice paddy fish culture (*Barbonymus gonionotus,* upper right) and an osphronemid used for cage culture (*Osphronemus exodon,* lower right). Scale bars: 5 cm.

2) Fisheries biology for natural fish resources— At present, investigations are focused on growth and reproductive biology of the small cyprinid *Rasbora rubrodorsalis*. This species, as well as another small cyprinid, *Esomus metallicus* (which sympatrically inhabits with *R. rubrodorsalis*), is abundant in agricultural waters (e.g., canals and reservoirs). It is also one of the main fishery products for domestic consumption because it is easy to catch. A survey conducted over the past year revealed that *R. rubrodorsalis* has a short lifespan (maximum age around 120 days) and that the females reach maturity at age 70-80 days and standard length of 20-25 mm (Fig. 2). These characteristics, particularly short lifespan and early maturation, suggest that should there be a stock decline caused by overfishing once, it can be recovered quickly by implementing simple fishing regulations, for instance, short-term fishing prohibition and/or designation of restricted/no fishing areas. Apart from subsistence fishing (of small fishes), small-scale commercial fishing (of large fishes) also take place in the area, with the snakehead *Channa striata* and catfish *Hemibagrus filamentus* being the main targets. These two species are more expensive than the small cyprinids. They are also at higher risk of stock decline by overfishing because they are carnivorous and population sizes are relatively smaller. Plans as future research activites are underway to investigate the fisheries biology of carnivorous and commercially-important fishes, including the snakehead and the catfish, for stock management .

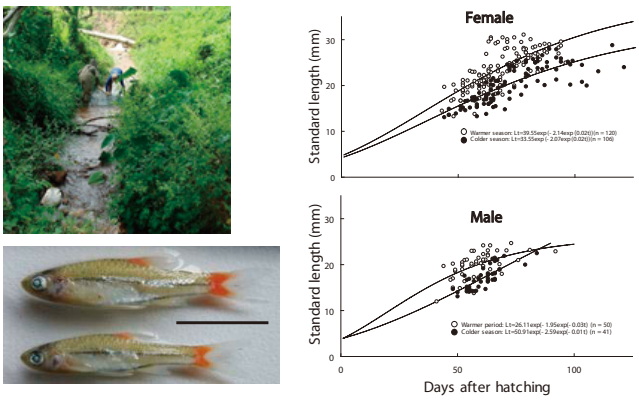


Fig. 2. Collecting fish samples from a stream (upper left); Adults of a small-sized cyprinid *Rasbora rubrodorsalis* (lower left; scale bar: 10 mm); Growth curves of *R. rubrodorsalis* by season/sex (Gompertz Growth Curves; right).

Shinsuke Morioka
Fisheries Division

Actual Forest Use and Development of Sustainable Forest Management Strategy in Lao PDR

People's lives in rural areas of Lao PDR are deeply connected with the forests, which provide the people practically everything that is essential for living, particularly wood products and non-timber forest products (NTFPs).

Local culture has been shaped by the communities' long association with NTFPs, whose abundance is likewise limited only by the abundance of forests. Rice, their staple food, is cultivated by clearing forests into farmlands through slash-and-burn agriculture (Fig. 1). Other food products such as bamboo shoots, mushrooms and wild vegetables (Fig. 2), as well as traditional herbal medicines, are readily obtained from nearby forests. They also earn income by making roofs and bags from bamboos.

Fig. 1. Swidden cultivation (Slash-and-burn agriculture) and fallow forest

Fig. 2. Various NTFPs (e.g., rattan and various bamboo shoots) for sale at the local practices

However, rural people's lifestyles and dependence on NTFPs have resulted to drastic reduction in forest areas, from 70% in the 1940s to about 40% at present, due mainly to illegal logging and slash and burn practices.

JIRCAS, through this project, aims to develop a sustainable forest management system so that the remaining forests can provide stable supply of NTFPs and guarantee a good quality of life for the people who rely on forest products to live. This study applies a two-step approach to attain its objective:

Step 1: Clarify the relationship between people and forests

A data survey was conducted among 140 households in a village. NTFP data were collected, categorized, and recorded throughout 2007 and 2011. The NTFP sources and frequently-visited sites were geolocated using global positioning system (GPS) devices.

Step 2: Develop a sustainable forest management system

The growth of NTFPs is greatly influenced by the environment inside the forest. JIRCAS researchers are going to identify environmental factors such as water and light, and develop management methods to maintain the environment in which NTFPs can be sustainably obtained.

As for fallow forests, i.e., thickets extending over the land after slash-and-burn farming, it was determined that they are not often utilized for NTFPs. Therefore, researchers are going to develop methods to make effective use of unused fallow forests.

Survey results showed that all households currently gather more than 140 kinds of NTFPs from nearby forests. It also revealed that the collection points for the most often used NTFPs, i.e., bamboo shoots and mushrooms, had been extended farther during the past five years (Fig. 3). These results imply that the availability of NTFPs in forests close to the village cannot be sustained at current NTFP harvest rates, hence the need to urgently develop sustainable forest management techniques.

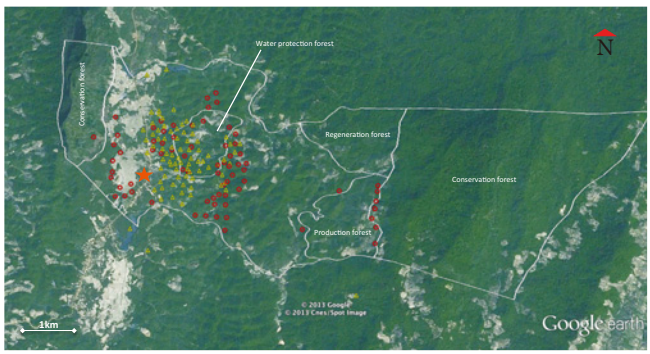


Fig. 3. Outward migration of collection points for main NTFPs within a 5-year period
Collection Points : △ 2007 ; ○ 2011 Center of Village: ★

Kenichiro Kimura
Rural Development Division

Development of Sustainable Commercial Production Systems

Selling agricultural products such as livestock and food crops (e.g., grains, soybean and fruits) to the market provides income for farmers and helps improve farm management. However, new knowledge and modern techniques need to be acquired to ensure long-term profitability and sustainability. This project aims to address this matter through development of technologies that will boost commercial production and increase farmers' incomes, consequently producing independent and stable farm household economies. The developed technologies will be used as a farm diversification tool compatible with existing land uses.

Lowland paddy fields in Laos retain some water in the soil even during dry season (November to April); hence, production of cash crops such as maize and soybean might be applicable. Surveys were carried out to determine the amount or percentage of paddy soil water, how much was available to crops, and how much was drawn from beginning to end of the dry season. Field trials were also conducted in paddies containing cash crops but the soil was found to be highly acidic, killing the seedlings. Therefore, the development of a low-input technology to ameliorate existing soil conditions is needed.

Upland field areas for cash crops such as maize and cassava have been expanding in Laos (Photo 1). However, they are being cultivated mostly without fertilizer application, raising concerns about reduced soil fertility. Rice, the main staple food and crop, is being cultivated in the mountains because of limited paddy fields in the area. Hence, the development of technologies for cash crop cultivation will be based on rotation with upland rice as well as improved soil fertility, which will be achieved by using local organic resources such as crop residues (including rice straw) and animal excreta.

Livestock production in Laos can be classified as mostly low input or traditional (Photo 2). Cattle graze freely at the mountains during rainy season and on paddy fields during dry season while pigs and poultry get natural feed or leftovers/ food scraps from family tables. In contrast, commercial livestock production requires the establishment of a livestock farming system that could fatten animals effectively and efficiently. In particular, feed supply is important, and production of high quality forage adaptable to Laotian environment is essential when undertaking intensive cattle production. This will be evaluated in terms of carrying capacity, i.e., how many cattle can be raised within 1 ha of forage. Furthermore, the establishment of an integrated crop-livestock system will be implemented, wherein increased livestock production provides animal excreta as input to paddy and upland fields to help improve soil fertility. This system will consequently increase agricultural production in the area.

Fruit production for the domestic market is limited; most fruits found in local markets are imported from neighboring countries such as Thailand. Lao growers have expressed interest in learning better techniques so they can send their fruit to the markets. In this regard, they can apply pruning – a technique which involves selective removal of plant parts – to keep tree heights low and to simplify fruit harvesting and orchard maintenance. Additionally, they can try flowering control – a technique for extending harvest periods – to produce out-of-season fruits which can then be sold at higher prices. Further studies will be conducted to develop these technologies (pruning and flowering control) in order to increase farmers' incomes.

Photo 1. Expansion of maize fields in mountainous areas

Photo 2. Cattle graze in the mountains during rainy season

Naruo Matsumoto
Crop, Livestock and Environment Division

JIRCAS TODAY

○ Global Festa Japan 2012

JIRCAS, the sole national institute to undertake comprehensive research on agriculture, forestry, and fisheries in developing regions participated during the Global Festa Japan 2012 event held in Hibiya Park on October 6-7 (Sat-Sun). Research results were summarized on poster panels and explained to visitors. In addition, publications such as handbooks and newsletters were distributed and a video loop (Introduction to JIRCAS) was played to increase public awareness of the center's activities.

This year's theme was "Think Global, Think Green." Held annually to commemorate the Japanese government's designation of Oct 6th as "International Cooperation Day," the two-day event attracted an estimated 100,000 people.

JIRCAS display booth

Researchers interacting with visitors

○ Science Information Corner at the Tsukuba Expo Center

Tsukuba Expo Center featured JIRCAS at its Science Information Corner from September 8 (Sat) to December 16 (Sun). The Science Information Corner provided a venue for JIRCAS to publicize its research activities through panel displays and exhibits as well as brochures and pamphlets.

Scale models of the ethanol production system showing details of the solid mixture separator and the sap extractor were the main exhibits from September to October. Posters explaining ethanol production from oil palm trunk waste materials were also installed (Fig. 1).

From October to December, posters on resource management of the orange-spotted grouper (*Epinephelus coioides*) and fluvial shrimp (*Macrobrachium yui*) were displayed. A giant river prawn (*Macrobrachium rosenbergii*) contained in a temperature-controlled aquarium proved popular, especially among school boys (Fig. 2).

Fig. 1. Display from September to October

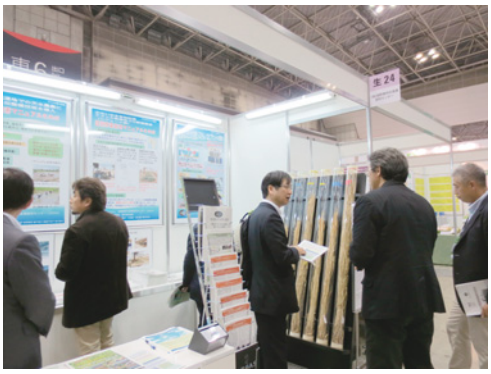
Fig. 2. Display from October to December

○ Agribusiness Creation Fair 2012

The Agribusiness Creation Fair 2012 was held from November 14-16 (Wed-Fri) at the Tokyo Big Sight

Exhibition Hall in Ariake, Koto Ward in Tokyo. Sponsored by the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan, the three-day fair brought together a total of 189 exhibitors including research institutes and private companies. It showcased the latest research results and technology trends in agriculture, forestry and fisheries as well as the food industry. Research results with practical application and high potential for commercialization were highlighted during the event.

The development of a technology for systematized production of shrimp (vannamei) was publicized. This technology is expected to find practical application domestically and internationally. Another featured exhibit was a CDM project aimed at improving the environmental and living conditions in low-income areas in Vietnam. JIRCAS researchers and engineers discussed the project activities through presentations, scale models, posters, brochures and other materials in order to attract private/corporate sponsors to support future expansion and realization of CDM projects.



Scenes at the JIRCAS exhibit booth

Scenes at the JIRCAS exhibit booth

JIRCAS also introduced two guidebooks -- "Manual for growth promotion of dry season vegetables utilizing limited water resources" and "Manual for improving rice production in Africa" -- which were intended mainly for use in lowland paddy fields and inland areas of West Africa. Samples of New Rice for Africa (NERICA) varieties, which were developed to improve rice yield in Africa, were displayed.

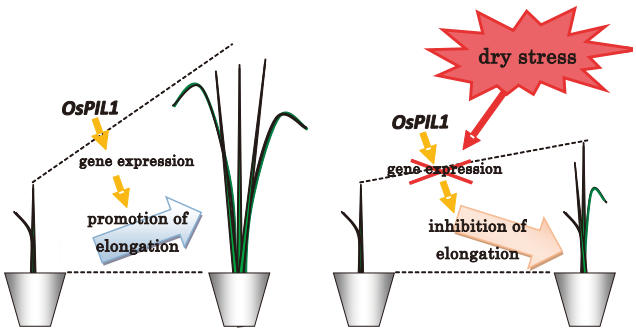
○ Research Results (Press release)

Researchers have elucidated the mechanism by which rice growth is inhibited under dry stress conditions

JIRCAS, in collaboration with the University of Tokyo, RIKEN, and the National Institute of Advanced Industrial Science and Technology (AIST), have elucidated the molecular mechanism by which dry stress conditions such as drought inhibit rice plant growth.

Plant growth under dry stress conditions is inhibited resulting to low or reduced yields. In particular, the expression of *OsPIL1* gene, which regulates internodal length in rice, is inhibited under drought conditions resulting in reduced plant height. Overexpression of *OsPIL1* in rice promotes growth; therefore, this gene is deemed important in promoting plant growth under dry stress conditions.

*This study was published online on September 10, 2012 in the *Proceedings of the National Academy of Sciences*.



Mechanism by which rice growth is inhibited under dry stress condition. In the absence of dry stress, *OsPIL1* expression is enhanced, promoting internode elongation in rice (left). On the other hand, *OsPIL1* expression is inhibited under drought conditions, reducing plant growth (right).

Agricultural and rural landscape in Laos. The fields are three hours away from the farmers' village.

A girl and a buffalo take a break in the paddy fields of Laos.

A family threshing rice by hand. The grains are packed into 30-kg sacks and carried back to the village.

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