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JIRCAS Newsletter

for INTERNATIONAL COLLABORATION

Felled old oil palm trunks at a plantation in Redang Panjang, Perak, Malasia (Photo by A. Kosugi)

In This Issue

JIRCAS
JAPAN INTERNATIONAL RESEARCH CENTER FOR AGRICULTURAL SCIENCES

JIRCAS Research Style

We have been recently requested to produce not only “outputs” but also “outcomes” in our researches. For example, the development of a new variety or a piece of machinery is only considered as an output. This output can only be transformed into an outcome for the first time when the farmers can actually increase their farm income by introducing this output. The researchers, off course, are exerting efforts to produce outcomes as well as outputs in their individual researches. However, it is not actually easy to do as expected. This dilemma gives us a good chance to reconsider the intricate linkaging between our research and society.

Research outputs, if separated from the social needs, can never contribute to the development of society. It is only the outputs derived in response to social needs that can be defined as outcomes. But, it is both difficult and troublesome to grasp the actual social needs. They vary with their sources, such as where, when and whose needs they are and also the stance of the researchers concerned. In addition, we are handicapped in collecting information especially in developing countries where statistics and reports are not always available and sometimes incorrect. Therefore, it would be very difficult to grasp the social needs efficiently and correctly under these adverse conditions in developing countries.

In terms of collecting information, we must not forget the information obtained through direct conversation or discussion with farmers, extension workers, government officers and researchers. This can be said of the kind of raw information which tells us what is actually happening every moment, while the statistics and reports published by government or research institutes are the so-called fixed information which the persons concerned had already processed from their own viewpoint. Collecting raw information through conversation and discussion is, needless to say, somehow dependent on language abilities. But, may I dare to emphasize that high language fluency doesn’t always translate into the same level of high ability in collecting raw information. According to my personal experiences, we cannot obtain other people’s real intentions and feelings without mutual trust, and sometimes we can only obtain these through a slight change in the locals’ usual behavior. This is dependent on the establishment of a close relationship with the people in the research sites. The intimate relationships can be established only through the accumulation of interactions in everyday life, which is not always dependent on language ability. The raw and real information are useful for us in order to be

able to grasp the social needs precisely and effectively, and help us to select research subjects suitably and in timely fashion. In addition, such fixed information, such as statistics and reports, can be useful and practical only when they are supplemented by the raw information obtained above.

Nowadays in Japan, more domestic research institutes as well as universities have aggressively started various kinds of overseas researches. So, JIRCAS no longer have the sole monopoly for overseas researches anymore. In this current situation, I would like to ask myself, “What kind of research style should JIRCAS undertake?” or “What is the kind of unique research which JIRCAS is exceptionally capable of performing?”

I think that the researches currently undertaken abroad through long term assignments and the human and organizational network established through this type of researches are one of the most important and strategic components. It is because this social network, kind of a so-called intangible and historical resource, is a system for collecting raw information which JIRCAS itself has established already for so many years. Therefore, by utilizing this network which should be constantly reviewed and reinforced from the viewpoint of its effectiveness, we should be able to grasp the social needs precisely and effectively. And then, we will be able to produce not only outputs but also outcomes which will have beneficial impacts on agriculture in developing countries.

Masuo Ando
Director, Development Research Division, JIRCAS

Development of Utilization Technology for Sustainable Biomass Resources in Southeast Asia –Ethanol and Lactic Acid Production from Oil Palm Trunk–

Felling of old oil palms

Palm oil produced from oil palm is utilized for edible products, such as margarine, instant noodles and oil for deep-fried dishes and it is also used in great quantities for industrial uses, such as soap and cosmetics. Palm oil is one of the typical agricultural products of Southeast Asia where approximately 43,000,000 ton/year are produced in the world. Two nations, Malaysia and Indonesia, produce 50% each of about 90% of total oil production.

Oil palm plantations have begun since the early 20th century. In order that the oil palm trees grown for palm oil production can maintain their productivity, recultivation is needed at intervals of 25 years. In Malaysia, since full-scale plantations established in 1980 are being recultivated at about 40,000 ha per year, 30 million of palm trees have been felled down. It is expected, as a result of expansion in old plantation areas in the near future, that no less than about 200,000-250,000 ha of recultivation will be required every year. During felling, a chemical is injected into the trunk of the oil palm targeted as the object of felling so it will wither, or after felling, oil palm trunks are just neglected or incinerated. This neglect of felled palm trunks and incineration means of disposal could lead to serious environmental destruction, so the effective use of a felled palm trunk that does not hang a negative impact on the environment is called for.

Global warming issue and utilization of biomass resources

Petroleum alternative energy sources, such as ethanol for fuel and manufacturing techniques for bioplastic materials, such as lactic acid, are actively developed because of the mitigation policy on preventing the drain of natural petroleum resources and the global warming issue in recent years. Especially on ethanol as a biofuel, a great deal of attention has been drawn to it as an alternative fuel to gasoline, which is an automobile fuel and the demand is very large. However, ethanol for fuel is manufactured from farm products, such as cornstarch and sugarcane juice, and it is expected that with the increase in demand for farm products accompanying future increases in population, etc., this may cause competition between edible production and energy uses. Therefore, although it has been desired to develop a conversion technology for ethanol as biofuel etc., from the unused portions, i.e., the agricultural production wastes of agricultural products, technical development is still at the stage where it has reached some unresolved extreme difficulties.

Ethanol and lactic acid production from oil palm trunk

JIRCAS advances the development of sustainable biomass utilization in Southeast Asia which possesses abundant renewable biomass resources. In this project, we are conducting collaborative research with the Forestry and Forest Products Research Institute (FFPRI), Forest Research Institute Malaysia (FRIM) and University Science Malaysia (USM) that encourages the development of utilization technologies for the old oil palm trunks without additional environmental loads. In our attempt to further develop the method, we found that the felled oil palm trunks contain large quantity of sap, and abundant quantity of fermentable sugars, such as glucose, etc. exist in the sap. Based on these findings, we demonstrated a method on how to ferment the sap to produce ethanol and lactic acid using industrial alcohol yeast and lactic acid bacteria, respectively. In addition, we also found that the concentration of fermentable sugars drastically increased during the storage period as the fruits became mellower. Thus, the old oil palm trunks that previously posed a problem which leads to serious environmental damage have been discovered to possess a huge potential to become sustainable, useful biomass resources rivaling sugarcane. Anyway, JIRCAS has already filed patents covering these knowledge and technologies. And, we expect that our research activities will further contribute towards resolving our serious energy problems and global environmental issues.

Akihiko Kosugi
Post-harvest Science and Technology Division, JIRCAS

Old oil palms are felled by a power shovel for site recultivation.

Fermentation test using the sap from an oil palm trunk

An *Arabidopsis* Histidine Kinase AHK1 Functions as an Osmosensor and its Overexpression Improves Plant Drought-Stress Tolerance

Plants are constantly exposed to environmental stresses that frequently impose constraints on their growth and productivity. Plant cells have developed elaborate and sensitive protection systems which enable them to rapidly signal, respond and properly adapt to various stresses, including drought and high salinity. Phosphorylation, which is catalyzed by protein kinases, is a key mechanism for intracellular signal transduction in both eukaryotic and prokaryotic cells.

In yeast, a histidine kinase SLN1 functions as an osmosensor that can sense and transduce a signal of external osmolarity to downstream targets. *Arabidopsis* contains eleven receptor histidine kinases and among them, *AHK1*, *AHK2* and *AHK3* were shown to be stress inducible, suggesting their roles in the regulation of plant response to abiotic stress. Overexpression of an *Arabidopsis* histidine kinase *AHK1* in yeast *sln1* deletion mutant enable the yeast mutant to grow normally under high salinity conditions, suggesting that the histidine kinase AHK1 can function as an osmosensor. Then, we introduced the AHK2 and AHK3 cDNAs into the *sln1* mutant and found that these 2 kinases can also complement the SLN1 function, suggesting the functional importance of these histidine kinases for the efficient sensing of environmental signals.

To understand the *in planta* role of the stress-responsive histidine kinases in osmotic stress, we used both gain-of-function and loss-of-function genetic approaches. Multiple mutants of *ahk1*, *ahk2* and *ahk3* were constructed to elucidate the function of these kinases in plant growth and development. Phenotypic analyses for *ahk1* knockdown mutants suggested that these mutants are not affected in growth or morphology under normal conditions. However, under drought stress condition, fewer *ahk1* plants survived than WT (wild-type control) plants, indicating a clear drought sensitivity for the *ahk1* mutant. Moreover, the *ahk1* mutant was more sensitive to high-salinity stress than WT. Then, we compared the level of drought and salt stress tolerance of the *ahk2* and *ahk3* mutants, as well as the *ahk2 ahk3* double mutant to WT plants. Different from the *ahk1* mutant, the results showed a strong drought and salinity tolerance for both *ahk2* and *ahk3* mutants. The *ahk2 ahk3* double mutant was even more tolerant to drought and salt stresses than the respective single ones, suggesting a combinatory function of AHK2 and AHK3 in osmotic stress signaling (Fig.1).

We performed microarray analyses to understand the diversity of these histidine kinases. Under normal conditions, many stress-responsive genes, including genes for stress-related transcription factors (TFs) *ANAC055* and *ATMYC2*, were upregulated in the *ahk2 ahk3* double mutant. Importantly, overexpression of these TF genes significantly improves drought stress tolerance in *Arabidopsis* plants. These data indicate that AHK2 and AHK3 function as negative regulators in stress signaling. In contrast, many stress-responsive genes, including AREB1, DREB2 and ANAC TFs, were downregulated in the *ahk1* mutant under dehydration stress, which indicates that AHK1 functions as a positive regulator in stress signaling. Therefore, we generated *Arabidopsis* transgenic plants, in which *AHK1* was over-expressed by using its own promoter. We obtained two stable lines showing higher dehydration-induced *AHK1* transcript. Under normal conditions, these transgenic plants (Fig.2) displayed similar morphological phenotypes regarding the size of rosette leaves and inflorescences. The drought tolerance of the transgenic plants was increased as compared with that of the control plants. These data suggest that the *AHK1* gene can be used to develop crops that are tolerant to drought stress.

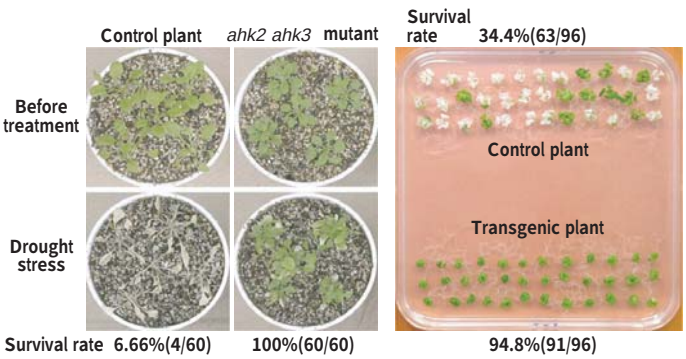


Fig.1
Drought stress tolerance (left) and salt stress tolerance (right) of *ahk2 ahk3* double mutant.
Arabidopsis plants lacking *AHK2* and *AHK3* showed improved tolerance to drought and high salinity, but exhibited growth retardation on the other hand.

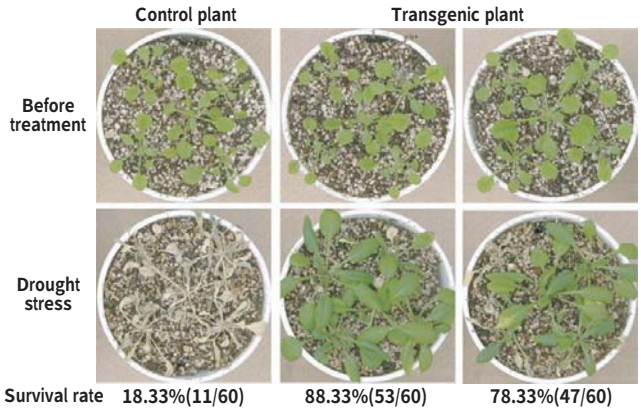


Fig.2
Drought stress tolerance of transgenic *Arabidopsis* over-expressing *AHK1*.
Transgenic *Arabidopsis* grew as well as the control plants under normal conditions, and on the other hand, showed improved tolerance to drought stress.

Kyonoshin Maruyama, Lam-Son Phan Tran and Kazuko Yamaguchi-Shinozaki
Biological Resources Division, JIRCAS

APAARI General Assembly Meeting

The 10th APAARI (Asia-Pacific Association of Agricultural Research Institutions) General Assembly Meeting (GAM) was held on the 20th of October, 2008 at Tsukuba International Congress Center, Tsukuba City, Japan. APAARI was established in 1990 as an association of agricultural research institutions in the Asia-Pacific region. At present, 20 national research, educational and administrative institutions, including JIRCAS, have joined APAARI as NARS Members and in addition, 25 international and regional institutions have also joined as Associate Members. APAARI facilitates information exchange regarding research activities for poverty reduction, productivity increase and others. On biotechnologies and Information and Communication Management (ICM), in particular, it provides regular recommendations, and has organized a consortium and an expert group.

JIRCAS has always actively participated in APAARI, having once officiated as its Chairman for example. Last year at the Executive Committee Meeting in India, it offered to host the annual GAM in Japan, since Japan as a member had not yet hosted any major meetings of APAARI before. More than 40 representatives gathered during this year's GAM. In the meeting, the activities in 2007-2008 were reviewed and budget and work plans for 2009-2010 were approved. In addition, some proposals for constitutional amendments were determined and the formation of the Excutive Committee for the next term was held.

Apart from the regular agenda, the meeting discussed the direction of the management reform within the CGIAR (Consultative Group on International Agricultural Research) and on the strengthening of cooperation with other regional fora belonging to GFAR (Global Forum on Agricultural Research), etc. The next GAM is planned to be held in Korea in 2010.

(Reference: APAARI homepage/www.apaari.org)

Participants of APAARI-GAM 2008

Osamu Koyama
Research Strategy Office, JIRCAS

The APAARI-JIRCAS International Symposium

On October 21-22, 2008, in the Tsukuba International Congress Center (EPOCHAL-TICC) in Tsukuba City, Japan, 160 participants from 31 countries joined the "Symposium on Global Climate Change: Imperatives for Agricultural Research in the Asia Pacific," which was jointly sponsored and organized by the Asia-Pacific Association of Agricultural Research Institutions (APAARI) and the Japan International Research Center for Agricultural Sciences (JIRCAS). Other co-sponsoring international organizations were the Global Forum on Agricultural Research (GFAR), the International Maize and Wheat Improvement Center (CIMMYT), the International Center for Agricultural Research in Dry Areas (ICARDA), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the World Vegetable Center (AVRDC), under the auspices and support of domestic organizations such as the Agriculture, Forestry and Fisheries Council Secretariat, Ministry of Agriculture, Forestry and Fisheries (MAFF), the National Agriculture and Food Research Organization (NARO), the National Institute for Agro-Environmental Sciences (NIAES), the Forestry and Forest Products Research Institute (FFPRI) and the Japan Forum on International Agricultural Research for Sustainable Development (J-FARD).

After the Introduction and Welcome Remarks rendered by the APAARI Chairman, Dr. Raghunath Ghodake and the JIRCAS President, Dr. Kenji Iiyama, the Intergovernmental Panel on Climate Change (IPCC) Working Group II Co-Chair, Martin Parry, Professor of the Imperial College London, presented the Keynote Lecture on "The Implications of Climate Change for Agriculture: Globally and in the Asia-Pacific Region." Afterwards, three lead papers were presented by Takeshi Horie, President of the National Agriculture and Food Research Organization (NARO, Japan) on "Adaptation Opportunities to Global Climate Change in Agriculture in Asia-Pacific," by Professor Rattan Lal of Ohio University, U.S.A. on "Mitigation Potential and Opportunities in Asia-Pacific" and Professor Tim Wheeler of UK's Reading University on "Tools and Techniques for Adaptation and Mitigation."

In succession, Technical Session I introduced Research Strategies at the National Level: Selected Asia-Pacific Country Reports, while Technical Session II focused on Research Strategies at the International Level. During the Panel Discussion and the Plenary Session, there were vigorous exchanges of opinions and the following mutual agreements were reached in the so-called "Tsukuba Declaration on Adapting Agriculture to Climate Change," which will be presented to all concerned stakeholders and related organizations :

- In the Asia-Pacific region, agriculture plays a critical role; therefore, the adverse effects of climate change on the efforts to reduce poverty and other developmental targets are of a major concern.
- Water is the main limiting factor of food production in this region and enhancing its efficient use and maintenance is important.

- Among efforts to reduce poverty among the poor populations which are the most vulnerable to the effects of climate change, increase in local food production is the best solution, as well as continuous support for technological development towards the improvement of crop productivity and technological dissemination.
- The development of new genotypes of crops with tolerance to various stresses is important and all research institutions bear an important duty towards this endeavor.
- A reliable and timely early-warning system is useful for discovering potential hazardous areas and climatic risks. Advanced Research Institutions such as JIRCAS, etc. are expected to take on the leadership role in disseminating information with regards to climate change.
- The introduction of a weather/crop/livestock insurance system, etc. is effective towards mitigating the climatic risks faced by farmers from the frequent occurrence of floods and droughts.
- The governments in the region should strengthen mutual cooperation through the establishment of a common regional fund for improving climatic services and risk management programs, etc. for the effective enforcement of suitable adaptation and mitigation strategies towards climate change. Training and capacity-building programs for young professionals are also important.
- Carbon sequestration in the soils is possible through several approaches which are useful to improve food security. It is necessary to urge the introduction of economic incentives and rewards to small farmers for the adoption of new sustainable agricultural management techniques.
- In order to cope with the many aspects of climate change, regional cooperation is indispensable, hence APAARI which is responsible for stimulating regional collaboration for agricultural research with other international agricultural research centers and national research institutions, should continue its important role in facilitating such collaboration to ensure future sustainability in the region.

The APAARI-JIRCAS International Symposium participants

Osamu Koyama
Research Strategy Office, JIRCAS

The Japan International Award for Young Agricultural Researchers

On November 11, 2008, the Commendation Ceremony of the Japan Award for Young Agricultural Researchers (sponsored by the Agriculture, Forestry and Fisheries Research Council) was held at the U Thant International Conference Hall in the United Nations University in Tokyo. In this Awarding Ceremony, which is being held for the second time this year, the Chairman of the Agriculture, Forestry and Fisheries Research Council extends his commendation to young foreign researchers who have distinguished themselves by achieving excellent performances in research and development in agriculture, forestry, fisheries and other related industries for developing countries. The winners and their achievements are as follows:

Xiaoyuan Yan (Institute of Soil Science, Chinese Academy of Sciences)
Developing greenhouse gases emission inventories for croplands and evaluating their environmental impacts

Maryam Ambundo Imbumi (Kenya Resource Centre for Indigenous Knowledge-KENRIK)
Promotion and research of African leafy vegetables for improved nutrition, health and incomes

Thuy Thi Thu Nguyen (Network of Aquaculture Centres in Asia Pacific-NACA)
Application of molecular genetics in aquaculture and fisheries management

Tamao Hatta
Public Relations Section, JIRCAS

The awardees and all concerned parties

Lecture by the awardee

The Enhanced "Research Strategy Office"

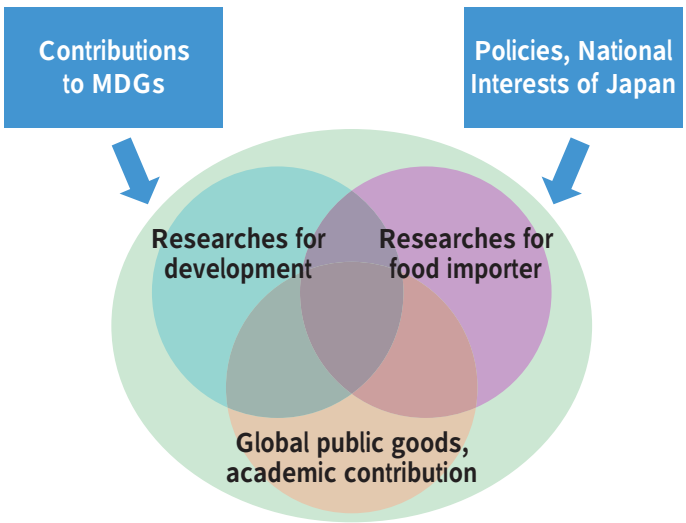
JIRCAS established the Research Strategy Office (RSO) which reports directly to the President and Vice President, at the same time when the Second Medium Term Plan (MTP) started in April, 2006. It is responsible for the effective collection and analyses of information on world agriculture, the current research situation, related policies etc., for formulating JIRCAS research strategies which are used for priority setting of research projects. In April 2007, four adjunct staff members from the Research Planning and Coordination Division were assigned to the former single-staff office. It carried out the planning of the APAARI-JIRCAS International Symposium and a strategic study on the key technologies for African agricultural development, etc. Since the start of FY 2008, in the middle of the current MTP period, the office has started off with a new team in order to be ready for the mid-year review of the research projects as well as for the preparatory tasks for the next MTP, having been assigned an additional full-time researcher and two part-time staff members (including an exchange staff from JICA (Japan International Cooperation Agency)).

In May, 2008, it was in-charge of holding a Round Table Meeting for Agricultural Research for African Development, and participated in the Coalition for African Rice Development (CARD) which was inaugurated on the occasion of TICAD IV (The Fourth Tokyo International Conference on African Development). Likewise, it was involved in a series of follow-up meetings, such as the Japan-Africa Science and Technology Ministerial Meeting and the First CARD General Meeting. This year, strategic approaches to agricultural research for development and the climate changes drew extensive attention at the Food and Agriculture Organization (FAO) Food Summit in June and the G8 Hokkaido Toyako Summit in July. Following these directions, the RSO played a key role in organizing a Symposium on Global Climate Change together with APAARI (Asia-Pacific Association of Agricultural Research Institutions) and many other international organizations. The APAARI General Assembly Meeting was also held at the same time (Please see another article on this).

In 2008, the RSO collected and analyzed research information on areas such as the prevention of desertification, supply and demand of agricultural products in China and the dissemination of Conservation Agriculture practices in Africa by participating in various international meetings. The situation surrounding international agricultural researches varies rapidly, as seen in the severe fluctuation of food prices last year, the change in funding allotment to development projects, organizational reform in the Consultative Group on International Agricultural Research (CGIAR) and food consumption changes in the newly developing countries. It is essential for JIRCAS as a leading institution in Japan to react in a timely fashion to the abovementioned situational changes and to provide appropriate information on the changes.

Anyway, the enhanced RSO will start the revision of the paper, "Strategy for International Collaborative Researches on Agriculture, Forestry and Fisheries --JIRCAS' Role--" aiming at concluding it by the end of Fiscal Year 2009. The revision will reflect the results of preceding discussions in "International Research Strategies" published by the Ministry of Agriculture, Forestry and Fisheries in May 2008 and "Toward the Reinforcement of Science and Technology Diplomacy" published by the Council for Science and Technology Policy of the Cabinet Office in May, 2008, as well as the requests and needs from counterpart institutes of JIRCAS in developing regions.

Osamu Koyama
Research Strategy Office, JIRCAS



A Vision for International Collaborative Research

JIRCAS Exhibit in the "Global Festa Japan 2008"

The Global Festa event is held annually as a venue wherein organizations executing international cooperation programs can introduce their overseas activities to the general public in Hibiya Park and usually falls on a weekend which is usually nearest to the commemoration of the International Cooperation Day on October 6. Last year, it was held on October 4 to 5, 2008.

JIRCAS exhibited alongside other international organizations, such as the Consultative Group on International Agricultural Research (CGIAR), World Bank (WB), etc. Inside the JIRCAS booth, we displayed some panels which described JIRCAS and its recent researches, distributed printed materials such as brochures, newsletters and showed the JIRCAS Introduction DVD to the visitors. A survey through a questionnaire to gather opinion from the public was carried out, accompanied by a quiz, to measure the visitors' understanding of JIRCAS activities. We handed out some small tokens to the visitors who cooperated graciously by answering the questionnaire and quiz.

With the cooperation of good weather and the added interest in the unusual souvenirs, we were able to attract about 1,000 visitors during the festival. Many visitors answered the quiz about JIRCAS and NERICA, and some visitors posed various questions about these. We hope that this activity was able to provide a good opportunity which allowed many people to learn more about JIRCAS and its agricultural research and other related activities.

Many visitors checked out the JIRCAS booth during the Global Festa 2008 exhibit.

Shinji Hirouchi
Public Relations Section, JIRCAS

JIRCAS Visiting Research Fellowship Program 2008 at Tsukuba, Okinawa and Overseas Project Sites

JIRCAS has been implementing the "Visiting Research Fellowship Program" since 1992, under which promising researchers from developing countries are invited to conduct collaborative research with JIRCAS to address various problems confronting developing regions, which include the critical situation of food production and related environmental and economic issues. This program also aims to upgrade the performance ability of the invited researchers through collaborative research which would enable them to respond to their countries' development needs. Under the 2008 Fellowship Program, a total of 16 researchers have been invited; eleven of them presently carrying out research at the JIRCAS main premises in Tsukuba, two at the Tropical Agriculture Research Front (TARF) in Okinawa, two in Thailand and one in Niger, where they are performing collaborative research with the JIRCAS researchers who have been dispatched to each of these research sites.

Kazunobu Toriyama
International Relations Section, JIRCAS

JIRCAS Visiting Research Fellows (Tsukuba)			
No.	Name	Nationality	Division Name
1	Tuyen Duc Do	Vietnam	Biological Resources
2	Widodo	Indonesia	Crop Production and Environment
3	Tory Chhun	Cambodia	Biological Resources
4	Santoso	Indonesia	Biological Resources
5	Noelle Giacomini Lemos Torres	Brazil	Biological Resources
6	Rattiya Waeonukul	Thailand	Post-Harvest Science and Technology
7	Patthra Pason	Thailand	Post-Harvest Science and Technology
8	Do Thi Thu Huong	Vietnam	Post-Harvest Science and Technology
9	Zhigao Zhou	P.R. China	Crop Production and Environment
10	Adel Mohamed Ghoneim	Egypt	Crop Production and Environment
11	Thi Tar Oo	Myanmar	Crop Production and Environment
JIRCAS Visiting Research Fellows (Okinawa)			
12	Farid Abdel Aziz El-Sayed Hellal	Egypt	Island Environment Management Group
13	Imelida Campion Genson	Philippines	Island Environment Management Group
JIRCAS Visiting Research Fellows (Project Site)			
14	Saowalak On-Ming	Thailand	Kasetsart University
15	Saidou Addam Kiari	Niger	ICRISAT Sahelian Center
16	Natthamon Tangjitwattanachai	Thailand	Department of Livestock Development

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