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Sowing pigeon pea in an alfisol field at ICRISAT
(Photo by O. Ito)

CONTENTS

JIRCAS

JAPAN INTERNATIONAL RESEARCH CENTER FOR AGRICULTURAL SCIENCES

Feature Article

Future Orientation of International Collaborative Research on Postharvest Technology for Developing Countries

Akinori Noguchi
Director, Crop Production and Postharvest Technology Division, JIRCAS

The Crop Production and Postharvest Technology Division implements research projects on topics ranging from production and storage to the processing and marketing of agricultural products. Our research activities encompass a variety of disciplines including agronomy, plant protection (pest, disease, and weed control), agricultural mechanization, irrigation, drainage, cropping systems, food storage, postharvest technology, farm management and agricultural economics.

Far too often the problem of feeding the world's hungry is conceived in terms of producing a sufficient amount of food. Equally pressing problems related to preservation and distribution issues that affect food products between harvest and consumption are frequently neglected. Postproduction operations in agriculture and horticulture include a wide range of functions necessary for supplying good quality food, reducing transaction costs, and raising domestic welfare. It is necessary to place emphasis on postharvest studies of agricultural products, such as quality improvement, safety, extension of shelf life, and control of insects and microorganisms in foodstuffs. These constitute important objectives of this Division.

Finally, sustainable production of agricultural commodities can only be supported by the development of sustainable markets. Technology for enhancing the value of agricultural products is being developed with a view to increasing incentives for farmers to promote sustainable production. Economic studies are essential for furthering the development of target countries.

It is only natural that food production covers wide fields as a chain from the cultivation to the final food market. Postharvest technology including selection, preservation, packaging and processing has contributed to the promotion of agricultural production through the improvement of farmer's income by raising the value of agricultural produce. Agriculture is very sensitive to the natural environment and there are many constraints on the rapid increase of production. Therefore, it is very important to develop techniques to reduce postharvest losses as well as to preserve or improve the quality, freshness and nutritional value of agricultural produce until the products reach the consumers.

The Division will concentrate its research activities on the prevention of postharvest losses, with emphasis placed on the improvement of methods of drying, transportation and storage of the products, quality preservation and evaluation and food processing. The constraints on the infrastructure and relevant technologies in developing regions, result in quality deterioration of agricultural produce and in compelling the farmers to sell their products at a low price in the market. Low-input preservation technology will be developed by identifying the factors controlling quality deterioration during collection, storage and distribution. On the other hand, since the price of agricultural products is determined based on their quality such as freshness, shape, size, color, flavor, texture, components, nutritional value, safety, damage caused by pests and functional properties for processing, technology for quality preservation and evaluation will play a very important role in the pricing of agricultural products. However, since most of these technologies have been designed in developed countries, they must be adapted to the needs of developing regions and more simple and low-cost technology for quality preservation and evaluation should be developed. As for processing, in general, traditional methods of food processing aim at meeting the requirements of the domestic market sometimes under unpredictable supply of raw materials and limited level of technology. The Division will attempt to analyze and improve the various steps involved in the traditional methods of food processing to meet the increasing demand of consumers for diversified foods, along with developing new technologies for food processing through technology transfer.

This approach was also emphasized during the 19th ASEAN and 1st APEC Seminar on Postharvest Technology (Ho Chi Minh City, Vietnam, 9-12 November 1999). This seminar covered a wide range of durable and perishable agricultural commodities and focused on issues relating to quality assurance, evaluation of quality, quality maintenance and contaminant reduction, cost efficiencies and systems approaches to postharvest research and development.

Sun-drying of paddy rice on the road (Cantho, Vietnam)

Cabbage damaged during transportation is unloaded from a truck (Beijing, China)

Natural Food Chain in Aquaculture

Masachika Maeda
Director, Fisheries Division, JIRCAS

For years the food chain in seawater has been misunderstood, and consequently aquaculturists have often followed the wrong direction. Until recently, scientists had considered that the food chain's primary producers (microalgae, which fix light energy and yield organic materials), were consumed by the zooplankton as soon as they were produced. However, recent studies have shown that several other food transfer pathways exist as well. For example, it was reported that the dominant species in zooplankton communities, which have been considered to be typical herbivores, feed on detritus and bacteria. Maeda (1999) also outlined the significant role of bacterial aggregates as food for the zooplankton.

In terrestrial ecosystems, few of the primary producers are directly utilized by predators as food. In the forest ecosystem, for example, only a small proportion of the leaves is eaten by animals, whereas a major proportion of the nutrients from fallen leaves is transferred through bacteria, fungi and protozoa, as well as through small plants and small to middle-sized animals.

Although this energy transfer is considered to represent the detritus food chain, a large number of microorganisms attached to the detritus are in fact the main nutrient source for the predators (Fig.1). This food pathway could thus be designated as microbial food chain instead of detritus food chain (Maeda 1999). It is therefore more appropriate to define primary producers as builders of a dissolved organic matter (DOM) pool. Based on this DOM pool, which originates from exudates of microalgae, etc., "microbial food assemblages" are formed. These assemblages are the starting point of the energy flow in the lower trophic levels of the food chain in the aquatic environment as shown in Fig. 2, although the effect of viruses on these microorganisms has not been considered.

Since many protozoa feed on bacteria, the bacteria contribute to higher trophic levels. In fact, protozoa are considered to be a significant food source for fish and zooplankton. Furthermore, Robertson (1983) increased the feeding rate of *Acartia* by using tintinnids as food at a concentration of 10^3cells/L. It is interesting to note that the copepod *Scottolana canadensis* was capable of producing eggs more frequently when ciliated protozoa were given as food than when only microalgae were available. Gall *et al.* (1997) also reported the significant role of protozoa as live feeds to oyster, *Crassostrea gigas*.

In aquaculture, the concept of the microbial food chain can be adopted. In fact, the addition of low concentrations of organic matter promotes the growth of fish. For example, in cases where the phytoplankton is used as the main live food, certain species of bacteria may be added with the algae. Under such treatment, survival rates of fish increase significantly. It is therefore considered preferable to feed microbes to fish along with algae. In conclusion, microbial food assemblages formed by the addition of microalgae and organic matter play a significant role as live food in aquaculture waters.

Note: Detailed information and references are available in the book of Maeda (1999). The scientists who would like to read this book can obtain it by writing to JIRCAS.

References

Gall, S. L., Hassen, M. B. and Gall, P. L. (1997): Mar. Ecol. Prog. Ser., 152, 301-306.
Maeda, M. (1999): Microbial Processes in Aquaculture. Biocreate Press, London, 102 pp.
Robertson, J. R. (1983): Estuar. Coast. Shelf Sci., 16, 27-36.

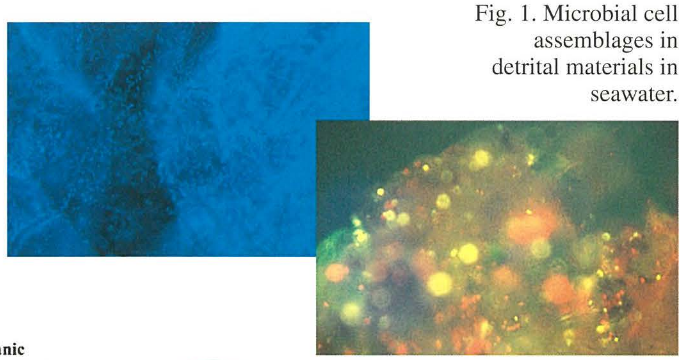

Fig. 1. Microbial cell assemblages in detrital materials in seawater.

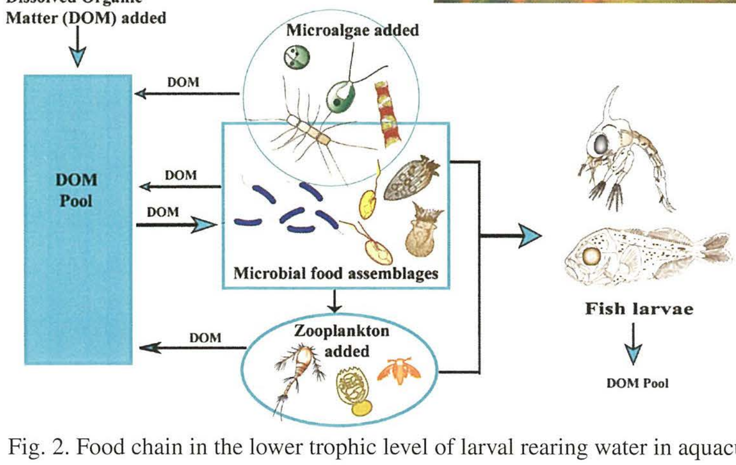

Fig. 2. Food chain in the lower trophic level of larval rearing water in aquaculture.

JIRCAS International Workshop

JIRCAS plans to organize the International Workshop on "Brackish Water Mangrove Ecosystems –Productivity and Sustainable Utilization –" to be held in Tsukuba, Japan during the period February 29–March 1, 2000. Four themes will be covered in four sessions as follows:

1) **Production and decomposition process in mangrove areas**
2) **Nutrient flux from rivers to coastal areas**
3) **Energy flow in brackish water of mangrove areas**
4) **Socio-economic evaluation of mangrove coastal areas.**

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JIRCAS Research Highlight

A Fungus (*Ephelis* sp.) of Grasses on Ishigaki Island and Its Effect on the Feeding of Two Insect Pests

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Photo 1: Inflorescence of *Digitaria decumbens* covered with stroma of the *Ephelis* fungus

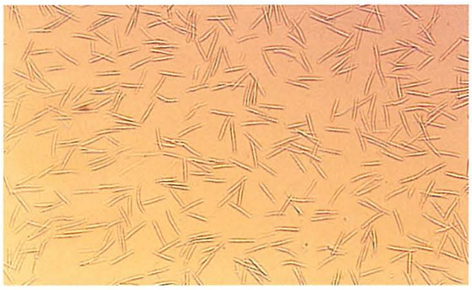

Photo 2: Elongated conidia of *Ephelis* on stroma in *Brachiaria mutica*

A number of alkaloids with insect deterrence or toxicity are present in grasses infected with fungi belonging to the tribe Balansiae, especially *Neotyphodium* species. However, no information is available for *Ephelis* species. We, therefore, studied *Ephelis*-infected grasses and their effect on the feeding of insect pests in Okinawa.

Ephelis sp., a fungus belonging to the family Clavicipitaceae (tribe Balansiae), was detected in fifteen species of grasses on Ishigaki island, Okinawa; *Brachiaria mutica* (Forsk.) Stapf, *Chloris barbata* Swarzt, *C. divaricata* R. Br., *Chrysopogon aciculatus* (Retz.) Trin., *Cynodon dactylon* (L.) Pres., *C. pletostachyrus* (K. Schem.) Pilger, *Digitaria decumbens* Stent., *D. violascens* Link, *Imperata cylindrica* (L.) Beauv. var. *koenigii* (Retz.) Durand et Schinz, *Leptochloa panicea* (Retz.) Ohwi, *Panicum crus-galli* Beauv. var. *praticola* Ohwi, *P. repens* L., *Paspalum scrobiculatum* L., *P. urvillei* Steud. and *Eriochloa procera* C. H. Hubb.

Sites with *Ephelis* infection were most commonly wet areas that had remained undisturbed for many years. The frequency of infection varied widely between grass species. In three of the fifteen grasses, *C. aciculatus, D. violascens* and *P. scrobiculatum*, infected plants were observed at many sites, while in other species, infected plants were present at only one or two sites. *Ephelis* infection of *C. dactylon, E. procera* and *P. urvillei* was found only in a single plant. The number of infected tillers at each site was typically low, and apparently showed a random distribution, with no evidence of spread from sites of infection. Infected plants were characterized by stromata that covered the inflorescence with dense mycelial growth (Photo 1). Numerous narrow, elongated conidia were present on the stromata (Photo 2). In most grasses, hyphae were observed on the surface of the leaf blades. Infected plants of 10 species revealed that the *Ephelis* fungus was essentially an epiphyte, with hyphae in vegetative tillers being located on the surface of the stem apex, including primordial leaves. Hyphae on leaf blades were also apparently confined to epiphytic growth.

Insect feeding deterrence associated with the presence of the *Ephelis* sp. was detected in choice tests involving infected and uninfected leaves. Larvae of the armyworm, *Mythimna (Pseudaletia) separata*, preferred *Ephelis*-free grass to *Ephelis*-infected leaves of *D. decumbens* (Fig. 1), but feed-

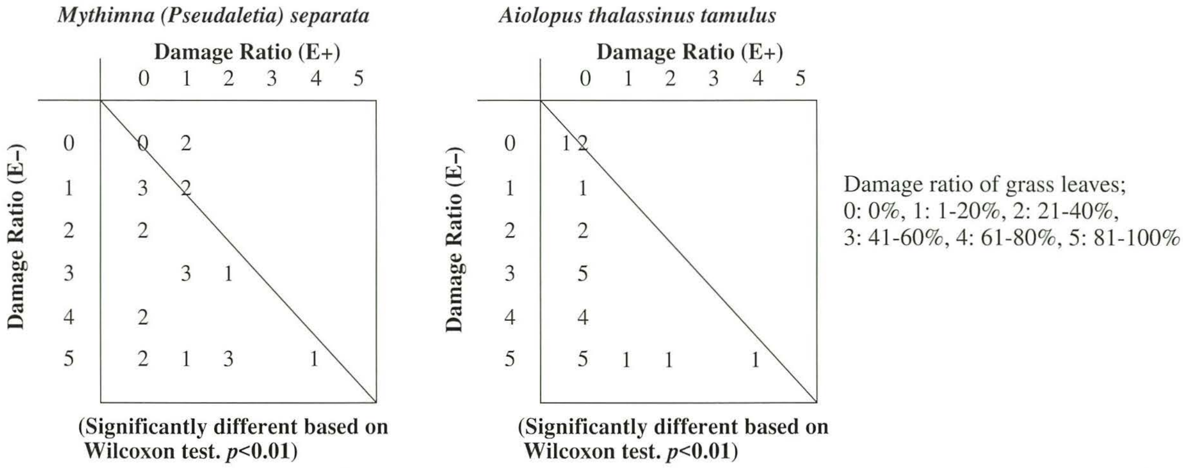

Fig. 1. Comparison between *Ephelis*-infected (E+) and *Ephelis*-free (E−) *Digitaria decumbens* leaves in relation to eating preference of the 6th instar larvae of *Mythimna (Pseudaletia) separata* and the adults of *Aiolopus thalassinus tamulus*. The numbers indicate the number of individuals.

ing was unaffected on *Ephelis*-infected leaves of *C. pletostachyrus*. Adults of the grasshopper, *Aiolopus thalassinus tamulus*, preferred *Ephelis*-free to *Ephelis*-infected leaves of *D. decumbens* and *C. pletostachyrus* (Fig. 1). Adults of *A. thalassinus tamulus* fed on *Ephelis*-free *D. decumbens* leaves survived over a significantly longer period than those fed on *Ephelis*-infected leaves (Table 1). These studies indicate that the *Ephelis* fungus occurring on Ishigaki island produces at least one feeding deterrent in the host grasses examined.

A number of alkaloids with insect deterrence or toxicity are present in grasses infected with fungi belonging to the tribe Balansiae. These have been extensively studied in grasses infected with *Neotyphodium* species, in particular those which form seed-borne endophytic associations with perennial ryegrass, *Lolium perenne* L. and tall fescue, *Festuca arundinacea* Screb. The main alkaloids known to confer resistance are peramine, lolines and ergovaline. Peramine is a feeding deterrent that affects oviposition. Lolines are toxins that occur at high concentrations, up to 10,000 ppm. Ergovaline, found throughout the Balansiae, is mainly considered to be a mammalian toxin but is known to enhance protection against insect pests. The presence of ergovaline and other alkaloids in *Ephelis*-infected grasses in Japan, and the spectrum of alkaloids in different host species, remain to be determined.

Table 1. Comparison between *Ephelis*-infected (E+) and *Ephelis*-free (E−) *Digitaria decumbens* leaves in relation to survival (days) of the adults of *Aiolopus thalassinus tamulus*

	(Date of start)	1st trial Sep. 10	2nd trial Oct. 6	3rd trial Nov. 30
Survival	E+	13.0±4.0**	7.5±3.5**	8.5±2.8*
(days)	E−	21.0±7.0**	15.8±8.1**	12.7±5.0*

** : Significantly different based on Mann-Whitney test. $p<0.01$
* : Significantly different based on Mann-Whitney test. $p<0.05$

Ascaris suum Infection in the Mekong Delta, Vietnam and Application of Anthelminthics

Shinobu Yoshihara
National Institute of Animal Health

It is well known that helminthic diseases are associated with the low productivity of pigs and cause economic losses in small-scale farms in the Mekong Delta. Therefore, an attempt was made to estimate the economic losses due to *A. suum* infection.

Six littermate pigs weighing approximately 40 kg from the Experimental Animal Farm of Can Tho University were used. *A. suum* eggs were detected. Group 1 consisted of 3 pigs treated with 1 mL per 15 kg of polystrongyle (injectable form of tetramizole hydrochloride, France). Group 2 consisted of 3 untreated control pigs. Their body weight was checked biweekly for 12 weeks. In 3 pigs of the treated group, adults of *A. suum* were eliminated within a few days after treatment. However, since *A. suum* eggs were found again 6 weeks later, the treatment was resumed. The growth period of the treated pigs which reached a weight of 80 kg was shortened at least by 2 weeks compared with the untreated pigs (Table 1). Fig. 1 shows an emaciated pig in the untreated group. Based on data collected in Vietnam, it was estimated that the economic loss due to the infection amounted to about 25,000 Don Vietnam (about US$ 2.0) per head in an experimental farm. Low nutrition level including deficiency in protein and vitamin A may exert more deleterious effects on the growth of infected pigs. Therefore, it is considered that the growth rate of untreated pigs in small-scale farms may be even lower.

As a result, it may be necessary that the farmers use anthelminthics to increase productivity.

Table 1. Body weight of treated and untreated pigs

(Unit: kg)

Group	Pig No.	Weeks after treatment 0	2	4	6	8	10	12
Treatment	1	37	44	51	60	79	81	89
	2	40	45	52	60	70	82	89
	3	39	44	51	58	68	80	90
Control	4	41	46	52	59	66	74	82
No treatment	5	39	44	50	57	64	72	81
	6	42	46	51	58	66	69	72

Fig. 1. Treated (back) and untreated (front) pigs in experimental farm. Untreated pig was emaciated.

Remarkable Antimutagenic Effect of a Thai Ginger, Fingerroot

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It has been suggested that antimutagenic phytochemicals, such as polyphenols, in some fruits or vegetables may play a role in the prevention of cancer based on epidemiological investigations as well as animal model experiments. Several edible plants, such as common ginger (*Zingiber officinale*) and turmeric (*Curcuma longa*), in the family of Zingiberaceae are reported to contain some phenolic compounds that exhibit strong antimutagenic effects. In Thailand, several members of the Zingiberaceae family besides common ginger and turmeric are available in food markets. One of them, fingerroot (*Boesenbergia pandrata* Schl. syn. *Kaempferia pandurata* Roxb.), known as "krachaai" in Thailand, has a characteristic appearance with several slender, long tubers sprouting in the same direction from the central part of the rhizome (Fig. 1). Fingerroot is generally utilized as a folk medicine in Southeast Asia. Interestingly, fingerroot is used as an ingredient in some dishes in Thailand. Since it had been already reported that fingerroot contains a large amount of some polyphenols as major constituents, it was expected that the plant would display an antimutagenic effect. In the current studies, we examined the antimutagenic properties of fingerroot and determined the chemical structure of active constituents under the JIRCAS Visiting Research Fellowship Program at Tsukuba.

One kilogram of fresh fingerroot rhizomes, purchased in a local market in Bangkok, were homogenized and extracted in 80% methanol. Then, the filtrate was collected, concentrated under reduced pressure and used for an antimutagenic assay (Ames Test). In this study, the antimutagenic effect was manifested by the suppressive activity of the extract toward the mutagenicity of 3-amino-1,4-dimethyl-5H-pyrido[4,3-*b*]indole (Trp-P-1) with *Salmonella typhimurium* TA98 in the presence of S-9 enzyme, that activates Trp-P-1, prepared from rat liver. The fingerroot extract showed a highly potent antimutagenic activity (Fig. 2). Only 0.15 mg of the fingerroot extract almost completely suppressed the mutagenesis, while a Thai spice galanga (*Languas galanga* syn. *Alpinia galanga*) showed about 80% of suppression at the same dose. The antimutagenic effect of both fingerroot and galanga was much more pronounced than that of lemon grass, another common spice in Thailand. It was reported that 10 mg of lemon grass extract suppressed 84% of mutagenesis.

Subsequently, active compounds in the extract were isolated to analyze the antimutagenic properties and chemical structure. Six antimutagenic compounds FR1, FR2, FR3, FR4, FR5 and FR6 were obtained. And, all six isolated compounds exhibited a potent antimutagenic activity in a suppressive range of 90% to 95% at a concentration of 25 µg/plate. Effective dose of these compounds that can suppress 50% of mutation (ED_{50}) was estimated at 1.1, 0.9, 0.5, 1.0 µg, for FR1, FR2, FR3 and FR4, respectively. Preparations of FR5 and FR6 could not be used for the experiments and structural determination due to the very small amount obtained. The chemical structure of FR1, FR2, FR3 and FR4 was determined by liquid chromatography mass spectrometry, UV-absorption spectrometry and nuclear magnetic resonance spectrometry. FR1 and FR3 were identified as two chalcone derivatives, 2', 4', 6'-trihydroxy chalcone and cardamonin. FR2 and FR4 were identified as two flavanone derivatives, pinocembrin and pinostrobin, respectively. All of these four identified compounds are not new ones. However, the antimutagenic activity of these compounds had not been reported except for pinocembrin. Edenharder reported that pinocembrin acted as an effective antimutagen against another mutagen, 2-amino-3-methylimidazo[4,5-*f*]-quinoline (IQ). This was not surprising because Trp-P-1 and IQ are metabolized by almost the same molecular species of cytochrome P450 in S-9.

When rhizomes of fingerroot are utilized as ingredient in Thai dishes, heating is involved in the preparation process. It was reported that antimutagens found in vegetables could be either heat-stable or heat-sensitive. Therefore, heat stability of antimutagens (FR1, FR2, FR3 and FR4) in fingerroot was determined by heating at 105°C for 15 min. No deterioration of the antimutagenic activity of any of the compounds was observed, which is an important information for food ingredients. The results suggested that fingerroot may play an important role in cancer chemoprevention, and, may have a potential as an effective functional food.

Fig. 1. Fingerroot (Chinese key).

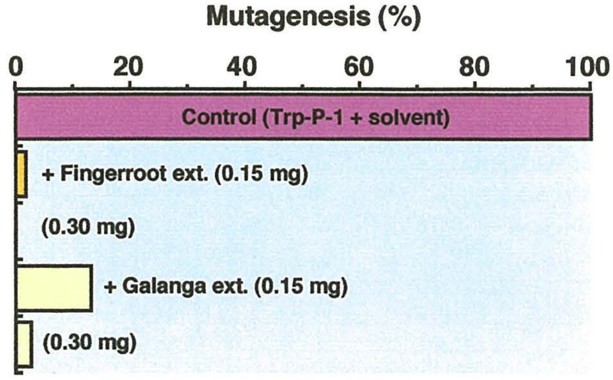

Fig. 2. The antimutagenic effect of fingerroot and galanga.

Symposium

The 6th JIRCAS International Symposium: "GIS Applications for Agro-Environmental Issues in Developing Regions" Was Held in Tsukuba

The 6th JIRCAS International Symposium on "GIS Applications for Agro-Environmental Issues in Developing Regions" organized by Japan International Research Center for Agricultural Sciences (JIRCAS) in cooperation with International Center for Tropical Agriculture (CIAT), National Institute of Agro-Environmental Sciences (NIAES), Forestry and Forest Products Research Institute (FFPRI) and National Research Institute of Fisheries Science (NRIFS) ,was held in Tsukuba, Japan during the period of September 7 – 9, 1999.

GIS technology which involves complex computer-based processing of georeferenced and attribute data obtained from various sources, including remote sensing, provides integrated and updated spatial and temporal information for the inventory and monitoring of environmental resources which are closely related to agriculture, forestry and fisheries activities. JIRCAS is actively implementing GIS-related research in collaboration with various countries in different geographic environments. This symposium offered a unique opportunity to review the studies carried out in this field by JIRCAS and other institutes, evaluate the current status of research and plan for the future.

A total of 155 scientists and administrators including 26 participants from abroad representing 13 countries gathered and exchanged views on the main issues, major constraints of GIS applications in developing regions, as well as the future orientation of the GIS applications in the regions. At the beginning of the symposium, Mr. Sakue Matsumoto, Chairman, Agriculture, Forestry and Fisheries Research Council, Ministry of Agriculture, Forestry and Fisheries gave the welcome address, following the opening address delivered by Dr. Nobuyoshi Maeno, Director General of JIRCAS.

The symposium consisted of two keynote speeches and three sessions as follows. As keynote speakers, Andrew K. Skidmore, ITC, Netherlands and Tsuyoshi Akiyama, Gifu University, Japan, gave lectures on the application of GIS and remote sensing technology for agro-environmental issues in developing regions.

Participants in the symposium

Session 1 reviewed the current status of the development of global data sets and models for agro-environmental sciences. Session 2 dealt with the applications of GIS for agro-environmental issues in various developing regions. During the session, eight presentations covering different geographic environments (Nepal, Indonesia, P. R. China, Mongolia, Colombia, Thailand and Japan) were given. In Session 3, the current status of education and training in the field of GIS was considered. Following the general discussion, Dr. Grant Scobie, Director General of CIAT, delivered the closing address.

The proceedings of the symposium will be published by JIRCAS in early 2000.

(Makie Kokubun)

Workshop

The ICRISAT/JIRCAS International Workshop on "Food Security in Nutrient-Stressed Environments: Exploiting Plant Genetic Capabilities"

The ICRISAT/JIRCAS international workshop on "Food Security in Nutrient-Stressed Environments: Exploiting Plant Genetic Capabilities" organized by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and Japan International Research Center for Agricultural Sciences (JIRCAS), was held at ICRISAT-Patancheru, India during the period of September 27-30, 1999.

This workshop marked the culmination of the activities of the Government of Japan Special Project Phase III (1994-1999) on "Sustainable Cultivation of Upland Crops in the Semi-Arid Tropics." The Project funded by the Economic Affairs Bureau, Ministry of Agriculture, Forestry and Fisheries of Japan had been implemented for 15 years since its initiation in 1984 at ICRISAT. During the 15-year period, scientists conducted research aimed at improving crop nutrient and water uptake and utilization efficiency through field management practices and/or by exploiting morphological, physiological and genetic systems to improve the adaptation of ICRISAT mandate crops to the low-nutrient and low-moisture environments of the semi-arid tropics. During the Project, research fellows, visiting scientists and scholars were trained and the technical skill of the supporting staff was eventually upgraded. In conclusion, the Project helped to increase the

Participants in the workshop and the Project staff at ICRISAT productivity of upland crops in the semi-arid tropics through research, and enhanced the knowledge base of the mechanisms of phosphorus and nitrogen acquisition by crops. The Project also helped to strengthen interdisciplinary efforts among scientists from Japan and their counterparts at ICRISAT.

From 23 international and national institutes, and universities of 16 countries, more than 50 scientists including 10 scientists from Japan participated in the workshop. Dr. L. D. Swindale, Interim Director General of ICRISAT, who helped initiate the Project in 1984, delivered the welcome address and Dr. T. Hamazaki gave closing remarks. After the Government of Japan Special Project activities were reviewed by the Project leader Dr. J. J. Adu-Gyamfi *et al.*, 31 papers were presented during 4 sessions. Session 1 dealt with the theme "Breeding for low-nutrient environments: is it sustainable?" covering crop physiology, breeding and socio-economic aspects. During Session 2, genotypic variability and mechanisms of nutrient uptake and use efficiency of crop plants in low-nutrient environments were outlined. The research achievements of the Project were presented in this session. During Session 3, the methodology for genetic manipulation of nutrient availability in low-nutrient environments was reviewed while the theme "Combining genetic improvement with natural resources management in low-nutrient environments" was considered during Session 4.

The workshop was successful due to the effort of the organizing committee of ICRISAT to ensure a high standard of paper presentation and discussions. I would like to thank the ICRISAT staff and all the participants in the workshop for their contributions.

The proceedings of the workshop will be published by ICRISAT/JIRCAS within this fiscal year.

(Tadao Hamazaki)

Workshop and Mid-Term Evaluation Meeting on Northeast Thailand Project

The Workshop and Mid-Term Evaluation Meeting on the Northeast Thailand Project titled: "Comprehensive Studies on Sustainable Agricultural Systems in Northeast Thailand" were held at the International Training Center for Agricultural Development (ITCAD), Department of Agriculture (DOA) in Khon Kaen on September 23 and 24, 1999.

This collaborative project is focused on the area of rainfed paddy fields in Northeast Thailand and aims at the development of technology for the promotion of sustainable agricultural systems that combine farming with animal husbandry. The project was launched in April 1995 and it will last until the end of March 2002.

The workshop was held on the first day. There were 67 participants including 13 persons from Japan. Thai participants were mainly from Bangkok and from Khon Kaen Province. There were 9 research organizations from Thailand and 5 from Japan. The researchers who had been engaged in the project described the research activities and research highlights. Major topics were as follows: 1. Evaluation and effective utilization of environmental and biological resources in the region. 2. Development of sustainable crop production systems. 3. Improvement of livestock feeding management with locally available feed resources. 4. Development of postharvest technologies for local agricultural products. 5. Economic evaluation of multiple cropping and livestock farming.

On the second day, a field trip and the mid-term evaluation meeting took place at the Khao Suan Kwang Demonstration Farm in the morning and at ITCAD in the afternoon, respectively. About 30 participants joined the morning session in the field and they listened to the outline of the field trials conducted by the researchers. Participants showed a keen interest in the field trials and also in the small-sized agricultural machines and attachments such as soil manipulator, binder, drill seeder and subsoiler, etc. which were displayed at the farm.

The mid-term evaluation meeting was held after the field visit with committee members engaged in various research fields. The outline of the overall project and five research themes was given by concerned scientists prior to the discussion. It was generally agreed by the committee members that satisfactory progress had been made so far, and that for further development of the project, much closer linkage among the project scientists and more active input from socio-economic aspects would be required.

(Masaaki Suzuki)

☆☆JIRCAS News☆☆ Dr. Noguchi Received the 1999 Friendship Award of P. R. China

Dr. A. Noguchi, Director of Crop Production and Postharvest Technology Division, received the 1999 Friendship Award from the State Administration of Foreign Experts Affairs, P. R. China, on account of his major contribution to the implementation of the JIRCAS-China Project titled: "Development of Sustainable Production and Utilization of Major Food Resources in China."

PEOPLE

Dr. Terunobu SUZUKI, a forestry scientist, became Director of JIRCAS's Forestry Division on October 1, succeeding Dr. Kiyoshi Tanaka who was appointed Director of the Research Coordination Division, Forestry and Forest Products Research Institute. Dr. Suzuki worked as a Senior Research Scientist in the Research Coordination Division, Forestry and Forest Products Research Institute (1997 - 1999) after carrying out studies at the National Amazon Research Institute in Brazil as a team-leader of the Brazilian Amazon Forest Research Project of JICA.

Dr. Osamu ITO who spent three years at the International Rice Research Institute as Director of the Agronomy, Plant Physiology and Agroecology Division returned to JIRCAS on October 1, 1999. He joined the Research Information Division and will be mainly in charge of coordinating the research collaboration between JIRCAS and several research organizations in Thailand, which has been actively promoted for many years.

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