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Newsletter

FOR INTERNATIONAL COLLABORATION

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On the road to Samarkand
(Photo by M. Oka)

CONTENTS

JIRCAS
JAPAN INTERNATIONAL RESEARCH CENTER FOR AGRICULTURAL SCIENCES

JIRCAS, THE SECOND YEAR

Dr. Keiji Kainuma
Director General of JIRCAS

One year has already passed since Japan International Research Center for Agricultural Sciences (JIRCAS) was established in October 1993 to conduct collaborative research to promote the development of sustainable agriculture, forestry and fisheries production in order to meet the demand for food of a rapidly increasing population, in particular in the developing countries while recognizing the importance of preserving the natural environment.

Reflecting on this year's experience, it appears that JIRCAS's role and activities which are considered to be significant in the international community have been mainly centered on the three following aspects.

Consolidation of research structure in Tsukuba and Okinawa

One of the activities of JIRCAS is to dispatch Japanese researchers overseas in order to carry out collaborative research projects. In addition, it is important to consolidate the research structure in Tsukuba and Okinawa Subtropical Station for supporting these overseas activities. At present, the International Collaboration Section in Okinawa Station is actively engaged in the Visiting Research Fellowship Program established in 1992 where ten scientists from various countries have been invited each year to carry out research mainly centered on biotechnology.

At the Tsukuba Campus, an aquaculture research laboratory, plant biotechnology laboratory as well as facilities for the simulation of various environmental processes, such as the process of desertification, rock weathering, etc. have been constructed in 1994. Also, we will improve the other facilities available at the Campus to initiate a visiting scientist program in Tsukuba in the near future.

Cooperation with other organizations

In order to implement efficiently the research projects, JIRCAS is promoting close relations with the MAFF administration authorities and related research institutes. JIRCAS will further enhance the collaboration with the international institutes affiliated to the CGIAR and national research stations of various countries.

Particularly, we are considering that the promotion of a close cooperation between JIRCAS and JICA (Japan International Cooperation Agency), which are the key organizations in Japan for the transfer of technology and research collaboration in agriculture, forestry and fisheries fields in developing countries, will increasingly be requested in the future to enhance Japan's contribution to the international community by solving the agricultural and environmental problems at the national and global level.

Importance of continuity in research collaboration

This year, I had the opportunity of visiting our counterpart research institutes in several countries to exchange views about the past, present and future research collaboration and appreciated the importance of continuity in the collaboration for agriculture, forestry and fisheries research which requires a relatively long period of time.

In some countries such as Malaysia, Thailand, China, etc. with which JIRCAS and his predecessor TARC have had a long history of research collaboration for more than twenty years, we realized that the outcome of the research collaboration has brought about changes in the agricultural systems of regions and even countries by the introduction of improved crop cultivars, implementation of disease control and adoption of direct seeding culture of rice, etc.

It will be necessary for JIRCAS to continue this policy in future by frequently reviewing the progress made.

In this regard, last September, the Department of Agriculture, Department of Livestock Development and Kasetsart University of Thailand and JIRCAS celebrated the 25th anniversary of research collaboration. During the ceremony, many research highlights stemming from the collaboration were presented and reviewed. JIRCAS is now planning to initiate research programs in the new areas targetted for collaboration including the temperate and cold zones.

Figure 1. Forty scientists are engaged in collaborative research in 16 countries in Asia, South America and Africa.

JIRCAS Research Objectives and Strategy

Dr. Nobuyoshi Maeno
Director, Research Planning and Coordination Division

Along with the reorganization of the Tropical Agriculture Research Center (TARC) to the Japan International Research Center for Agricultural Sciences (JIRCAS) since October 1, 1993, the research fields and geographic areas which the new Center will have to cover have markedly expanded.

Therefore, an official document entitled: "New Research Objectives and Strategy" is being prepared to promote effectively collaboration with other national and international organizations in the next decade (1995-2005).

In Chapters 1 and 2 of the document, the background for research promotion and the research problems to be addressed as well as the orientation of research are outlined.

In Chapter 3, the research subjects selected to achieve these objectives are described as follows:

I. (1) Identification of socioeconomic characteristics of agriculture, forestry and fisheries, and the technologies which should be adopted in the developing countries, and (2) Development of efficient network systems for exchange of information.

II. Development and improvement of technologies for promotion of sustainable agriculture, forestry and fisheries activities in the developing countries.

III. Development and improvement of postharvest technologies for better utilization of agriculture, forestry and fisheries products.

IV. Conservation of biological resources and development of technologies for the enhancement of their functions in the developing countries.

V. Development and improvement of technologies for the utilization and preservation of environmental resources, in relation to the effect on the global environment.

VI. Analysis of the trends of development in agriculture, forestry and fisheries in the developing countries, and integrated strategy for enhancing production and marketing systems.

In Chapter 4, an agenda of research subjects to be taken up in the next decade and development of a collaboration system to achieve these objectives is presented.

Pasture Agronomist. Born in Fukuoka in 1940. Graduated from Kyushu University in 1964. After finishing Ph. D. Course in Kyushu University in 1969, he has been working at Kyushu University, Shikoku Agricultural Experiment Station, National Grassland Research Institute, TARC, Fukuoka Agricultural Research Center and Agriculture, Forestry and Fisheries Research Council. During his stay in TARC, he was sent to CIAT for carrying out collaborative research on tropical pastures. He was appointed Director of Ecology Department in 1991, and then in 1992 Director of Grassland Planning Division at the National Grassland Research Institute. He joined JIRCAS in August 1994.

New Role of International Research Coordinators

The role of the Research Information Division and international research coordinators changed after the reorganization of the Tropical Agriculture Research Center (TARC) into JIRCAS. International research coordinators at present conduct overseas surveys and collect information, then develop a strategy for research programs and formulate new research projects. They are responsible for coordinating and implementing integrated research projects.

There are 8 international research coordinators in charge of different regions of the world, research fields and specific problems.

Intl. Research Coordinators	Areas, Research Fields and "Integrated Research Projects"
Mr. Akira Kobayashi	**Asia I***, Plant breeding, "Development of agriculture in Mekong Delta (1994-1998)"
Dr. Mitsunori Oka	**Asia II****, Cropping systems, "Development of agriculture in Northeast Thailand (1995-2001)"
Dr. Kozo Fujisaki	**Central and South America**, Animal production and health
To be designated	**Africa**
Dr. Masaaki Suzuki	**Conservation of global environmental resources**, Soil science and plant nutrition, "Brackish water mangrove ecosystems (1995-1999)"
Dr. Takasuke Ishitani	**Advanced countries, International agricultural research organizations**, Postharvest technology
Dr. Yoshinobu Kitamura	**Rural planning and development**, Agricultural engineering
Dr. Mitsuhiro Nakagawa	**Food supply and demand**, Agricultural economics

*: East & Southeast Asia
**: West & South Asia

(Takasuke Ishitani)

JIRCAS RESEARCH HIGHLIGHTS

Three New Cucumber Varieties of High Quality with Heat Tolerance and Disease Resistance for the Subtropical Zone of China

Masami Morishita[1], Masatake Fujino[2], Kenichi Hida[3], Takehiko Nakashima[4], Shaobo Luo, Weibo Zhou, Zhijun Li and Zhanyoung Luo[5]

There is a shortage of vegetables in summer in the subtropical zone of China. Therefore TARC and the Guangdong Academy of Agricultural Sciences of China were engaged in collaborative research during the period 1986 to 1991 in order to solve the shortage of summer vegetables. In the Guangdong region, cucumber is one of the important vegetables in summer. Since the current leading F1 hybrid variety 'Xiaqing 2' shows a low productivity and a bitter taste, we attempted to develop new varieties characterized by a high productivity and good quality with heat tolerance and disease resistance that are adapted to the subtropical zone of China. Germplasm accessions of cucumber from Japan, Taiwan and China were screened for heat tolerance, disease resistance, quality and yield under field conditions. The Japanese varieties had a good quality, but exhibited a low heat tolerance and disease resistance. The Taiwanese varieties were heat-tolerant, disease-resistant and showed a comparatively good quality. The South Chinese varieties were vigorous, heat-tolerant, disease-resistant, but showed a low productivity and quality. Twenty accessions were selected as breeding materials and thirty cross combinations were made among these superior materials.

Combining ability tests carried out for several years showed that the following three combinations, GE × Fenyan (Zajiao 1), GE × Lubao (Zajiao 2) and GE × Koufu 3 F 6 (Zajiao 3), showed superior characteristics for heat tolerance, yield and quality, compared with the check variety, Xiaqing 2. The GE of the seed parent, which is a gynoecious strain with heat tolerance, is an inbred line derived from Xiaqing 2. The three F1s bore a larger number of fruits per plant, slightly longer fruits that were less bitter than those of Xiaqing 2, and showed a similar disease tolerance. Zajiao 1 and Zajiao 2 were earlier than Xiaqing 2. The average yield of the three F1s was thirty to forty percent higher than that of Xiaqing 2 in Guangdong provincial regional trials.

These F1s could become promising new summer cucumber varieties in the Guangdong region.

1) Kurume Branch of National Research Institute of Vegetables, Ornamental Plants and Tea, Kurume, Fukuoka, Japan.

Photo 1: New F_1 hybrid of cucumber, Zajiao 1 (GE × Fenyan) (Photo by Shaobo Luo)

Photo 2: New F_1 hybrid of cucumber, Zajiao 2 (GE × Lubao) (Photo by Shaobo Luo)

New Buildings and Facilities for JIRCAS

Three buildings are currently under construction for JIRCAS at a cost of about 35 million US dollars: one for the headquarters and the other two for housing research facilities.

One of them, which has been completed recently, is a multipurpose building for experiments to be carried out in collaboration with overseas scientists.

In this building, there are laboratories with the most advanced equipment. For example:

1) **Aquatron** consisting of rearing tanks with a circulatory system, water temperature control, and possibility to create brackish water conditions to analyse the biological characteristics of marine, brackish, and freshwater fishes for aquaculture (see photo P. 11).

2) **Electron Spectroscopy for Chemical Analysis (ESCA 300)** to study the weathering mechanism of rocks in relation to the desertification process in dry areas (Photo 3).

3) **Wind tunnel** to study the mechanical and physiological effects of wind on crops and agricultural facilities in order to develop methods of control (Photo 4).

Two new buildings will be completed by April '95.

(Naomichi Shindo)

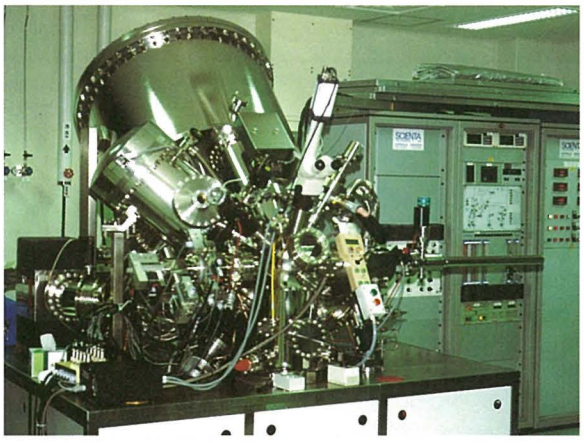


Photo 3: ESCA 300 apparatus

Photo 4: Wind tunnel

2) Morioka Branch of National Research Institute of Vegetables, Ornamental Plants and Tea, Morioka, Iwate, Japan.
3) National Research Institute of Vegetables, Ornamental Plants and Tea, Ano, Mie, Japan.
4) National Research Institute of Vegetables, Ornamental Plants and Tea, Chita, Aichi, Japan.
5) Guangdong Academy of Agricultural Sciences, Guangzhou, Guangdong, China.

Genetic Diversity of *Bradyrhizobium* Strains Isolated from Nodules of Mungbean in Thailand

Shotaro Ando, Norihiko Tomooka[1)] Toshifumi Murakami and Tadasi Yokoyama[1)]

Mungbean is an important grain legume cultivated traditionally throughout Asia, and grown under various cropping systems because it has a very short maturity span. It is a rich source of protein and it contributes to the improvement of soil fertility in these regions. However, the productivity of mungbean is still low in Thailand. The average yield is about 600 kg per ha in farmers' fields. It is thus necessary to improve the biological nitrogen fixation of the legume rhizobial symbiosis.

Bradyrhizobium strains nodulate many tropical legumes, for example, soybean, pigeonpea, groundnut, cowpea, mungbean and black gram. *Bradyrhizobium* strains isolated from soybean are classified into two species, *B. japonicum* and *B. elkanii*. *Bradyrhizobium* strains that nodulate other tropical grain legumes have remained poorly characterized genetically and are still unclassified. In order to classify and to analyse the genetic diversity of *Bradyrhizobium* strains isolated from nodules of mungbean in Thailand, we performed restriction fragment length polymorphism (RFLP) analysis, and compared these mungbean bradyrhizobia with the isolates of soybean in the United States, Japan and Thailand.

We collected 43 indigenous *Bradyrhizobium* strains from the nodules of mungbean plants growing in Thailand. Genomic DNAs were isolated and completely digested with different restriction enzymes. The southern blots were hybridized with the common nodulation genes (nodDYABC) of *B. japonicum* USDA110. Thirteen RFLP patterns were generated from 43 strains. The expected proportion of nucleotide substitution in and around the nodDYABC genes was estimated from the restriction site variation of 13 RFLP patterns. Forty three strains were classified into three major clusters by cluster analysis. The strains that belonged to cluster 1 were isolated from many collection sites in Thailand. Four recommended inoculants for mungbean in Thailand belonged to cluster 2. More than half of the soybean bradyrhizobia in Thailand also belonged to clusters 1 and 2. These two clusters are predominant in Thailand.

Soybean bradyrhizobia originating from soils in the United States and Japan are classified into *B. japonicum* and *B. elkanii*. On the other hand, all the strains belonging to these two clusters were neither *B. japonicum* nor *B. elkanii* and they harboured different nodDYABC genes from *B. japonicum* and *B. elkanii*.

From the above results, it is suggested that the two clusters containing the isolates of Thailand are a new phylogenetic group.

1) National Institute of Agrobiological Resources

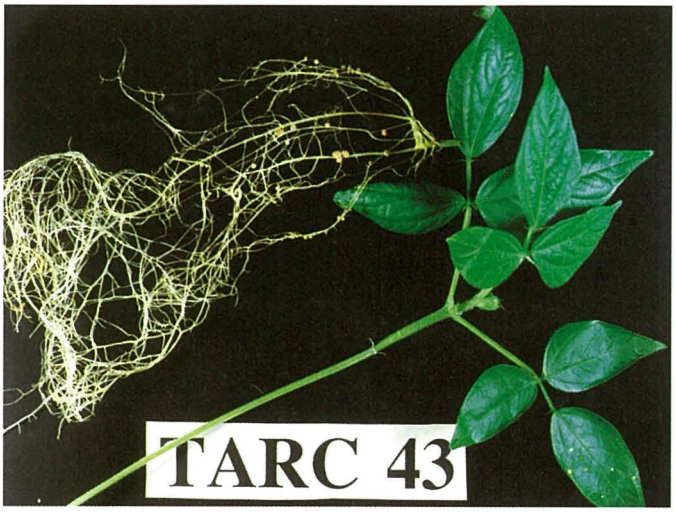


Photo 5: Bradyrhizobium TARC43 isolated from the nodules of soybean in Thailand belongs to cluster 2. It nodulates mungbean and fixes nitrogen well

Detection of Mycoplasma-like Organisms in Southeast Asia Using DNA Probes

K. Nakashima, T. Hayashi, W. Chaleeprom[1)] P. Wongkaew[1)] and P. Sirithorn

Sugarcane white leaf disease (SCWL) widely occurs in major cane-growing areas and is one of the most destructive sugarcane diseases in Thailand. Rice Yellow Dwarf disease (RYD) has been reported in most of the rice-growing countries in Asia including the Southeast Asian countries and Japan. The typical symptoms of these diseases consist of chlorosis, stunting, and profuse tillering. These diseases are caused by mycoplasma-like organisms (MLOs ; Phytoplasma). MLOs consisting of prokaryotes devoid of a cell wall and showing similarities to the mycoplasmas (mollicutes) infect animals and humans. The MLO cells were observed in sieve elements from the ultra-thin sections of the diseased plants by electron microscopy mainly. The approximate size was 0.1-1.0 μm. The MLOs are transmitted by

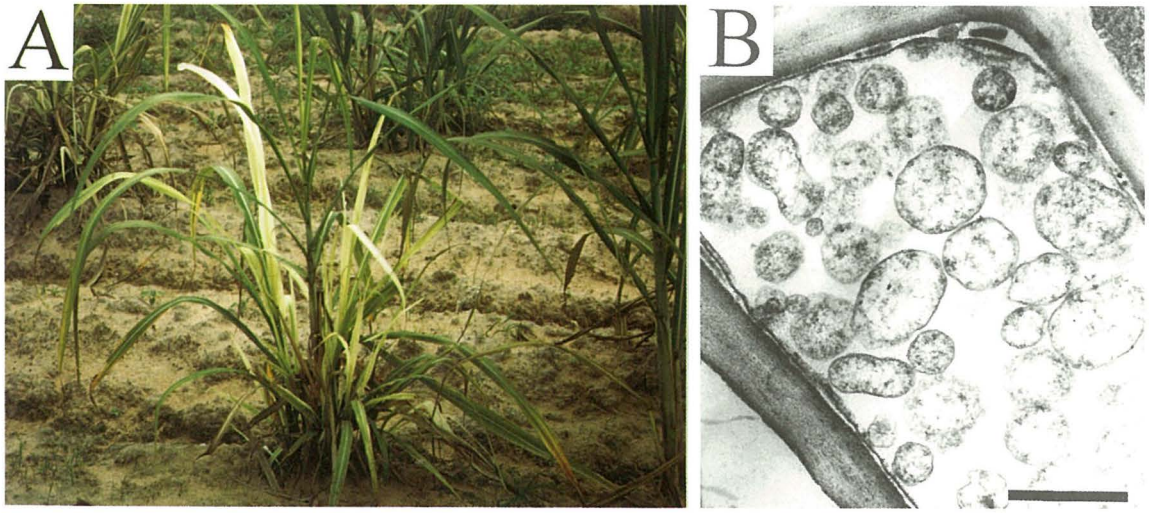


Photo 7: (A) Symptoms of sugarcane white leaf disease (SCWL), (B) Causal agent, mycoplasma-like organism, of SCWL Bar represents 0.5 μm.

leafhoppers. Because so far it has not been possible to culture MLOs in vitro, there is a lack of information about the MLOs including microbiological and genetic characteristics. Detection of the MLOs has been based on the electron-microscopic examination of ultra-thin sections and transmission by insect vectors. However, such a method is not practical. Transmission tests are of limited value due to the latency and the long incubation period in insects and plants (more than one month each). Ultra-thin sectioning is a tedious procedure that requires expensive equipment. Polyclonal antisera have been produced with partially purified MLO antigens from infected plants. However, the antisera showed substantial cross-reactions with antigens from healthy plants. Therefore, efficient and reliable methods of detecting the pathogens are urgently needed for the selection of healthy shoots, disease forecasting, quarantine procedures, development of methods of control of the disease, screening of resistant cultivars and basic studies on the behavior of the pathogens. The major purpose of our study is to develop methods of detection of the MLOs and eventually to develop methods of control of the diseases.

We isolated the DNA of the causal agent, cloned random DNA fragments, and used them as DNA probes to detect the pathogen rapidly and easily. As the contents of guanine plus cytosine of DNA from mollicutes are known to be lower than those from the other organisms, we successfully separated the DNA of the MLOs from the DNA of host plants by repeated bis-benzimide-CsCl equilibrium density gradient centrifugation. The DNA fragments cut by restriction enzymes were cloned in a plasmid – *Escherichia coli* system. Southern hybridization analysis revealed that the inserts of some recombinant plasmids consisted of fragments of chromosomal DNA of the MLOs, whereas the inserts of the other recombinant plasmids consisted of fragments of extrachromosomal DNA of the MLOs. The major extrachromosomal DNA of RYD MLO was circular with a size of ca. 4 kb and that of SCWL MLO was also circular with a size of ca. 2.5 kb. By using non-radioactive peroxidase-labeled DNA fragments as DNA probes and an enhanced chemoluminescent system for the detection, we were able to detect MLOs from less than 1 mg of tissue and an insect vector within two days. These probes hybridized with the DNA from the leaves, stems and roots of all the plants and insects affected with the MLO diseases, but not with those of healthy plants and insects. Extrachromosomal DNA probes gave much stronger signals than chromosomal probes. These results indicated that the copy number of the extrachromosomal DNA of RYD and

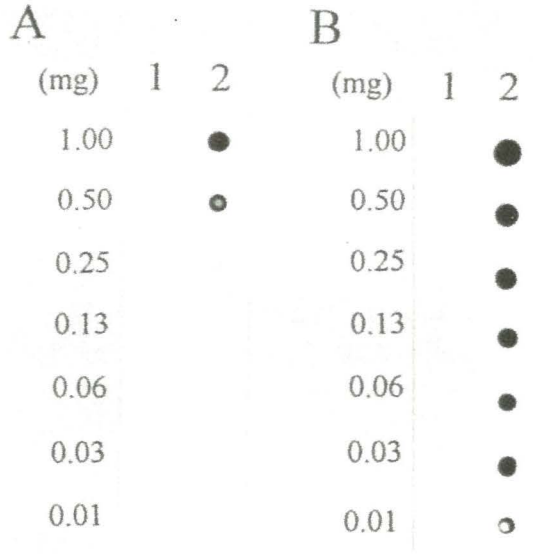


Photo 6: The DNA probes of SCWL MLO hybridized with the DNA extracted from sugarcane plants with white leaf disease (column 2), but not with healthy sugarcane plants (column 1). Twofold serial dilutions of the extracted DNA samples were blotted (top to bottom) onto membranes. The membranes were hybridized with the chromosomal probe S28 (A) and the extrachromosomal probe S1 (B). Numerals indicate weight of fresh leaves per dot.

SCWL MLOs was considerably larger than that of the chromosomal DNA of the MLOs within a cell of the MLOs. As the extrachromosomal DNA was detected from all the specimens used in the experiment, it is considered that the extrachromosomal DNA probes may be a useful tool to detect these MLOs. Hybridizations using the DNA probes indicated that SCWL MLO and MLOs of gramineous plants including RYD MLO and MLOs occurring in weeds in Thailand share a greater nucleotide sequence homology with one another than with other MLOs. The detection methods of these MLOs developed in Japan were found to be useful to detect the pathogens infecting plants in small samples in Khon Kaen, Thailand. The methods may give us a clearer picture of the incidence of the MLOs and eventually allow us to control the RYD and SCWL diseases.

1) Khon Kaen University, Thailand

The 2nd JIRCAS International Symposium (1995)
"Innovative Weed Management Strategy for Sustainable Agriculture"
Tsukuba, Japan, July 24-28

Session 1. Weed problems for sustainable agriculture

1. Noxious weeds in Asian tropics and their control *Umporn Suwannamek (Thailand)*
2. The succession of noxious weeds in tropical rice field ecosystems *Azmi Man (Malaysia)*
3. Implementation of integrated weed management for sustainable rice production *Prasan Vongsary (Thailand)*
4. Weedy rice problem in South-East Asia and control strategy *H. Watanabe (Japan)*
5. Weed management in rice-based cropping systems *K. Moody (IRRI)*
6. The contribution of no-tillage crop production in upland fields to sustainable agriculture *A. D. Worsham (USA)*
7. Minimum tillage cultivation in plantations in Indonesia with reference to weed management *Soekisman Tytrosemito (Indonesia)*

Session 2. Innovative trends of herbicide use for sustainable agriculture

1. Current status of herbicide use in the tropics *Ho Nai Kin (Malaysia)*
2. Economical use of herbicides in paddy fields *J. O. Guh (Korea)*
3. Technical innovation in herbicide use *K. Noritake (Japan)*
4. Effectiveness and behavior of soil-applied herbicides *Y. W. Kwon (Korea)*
5. Concept and biorational approaches to designing of safeners *(CIBA-GEIGY)*
6. Current status of herbicide-resistant weeds and management strategy *(DUPONT)*
7. Environmental impact of herbicide use and management *(DowElanco)*

Sessions related to the symposium

1. Noxious weeds and their control in Brazil *Edivaldo Domingues Velini (Brazil)*
2. Possible utilization of plants and allelochemicals for weed control *K. U. Kim (Korea)*
3. Current status of herbicide use in North-East China *Su Shao Quan (China)*
4. Weeds in deep water and paddy fields in Myanmar *Saw Ler Wah (Myanmar)*
5. Noxious weeds and their control in laos *Soukavong (Laos)*
6. Several factors of herbicide disappearance in paddy water *Hassan Said (Malaysia)*
7. New approaches for weed control in Yunnan Province of China *Sun Xizhi (China)*
8. Noxious weeds and their control in Sri Lanka *W. M. D. Wasala (Sri Lanka)*

THAI-JIRCAS Agricultural Research
— 25 years of Cooperation —

From 6th to 8th September, 1994, a ceremony marking the 25th anniversary of the research collaboration between the agricultural research organizations of Thailand and the research institutes affiliated to the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan was held at the Central Plaza Hotel, in Bangkok.

As distinguished guests, Mr. Boonchu Rojanasathien, Deputy Prime Minister of Thailand and Mr. T. Yoshida, Parliamentary Vice-Minister of MAFF, Mr. Seiichirou Otsuka, Chargé d'Affaires a.i., Embassy of Japan, gave addresses. There were approximately two hundred Thai and 54 Japanese participants.

Since JIRCAS (TARC) was established in 1970, Thailand has been the major counterpart country. Now besides DOA (Department of Agriculture), JIRCAS has signed a MOU (Memorandum of Understanding) with the DLD (Department of Livestock Development), KU (Kasetsart University) and KKU (Khon Kaen University).

During the ceremony, lectures on the following 12 topics were delivered and old slides which were recorded during the past 25 years were also projected, as follows: 1) Forage Crops Development (DLD) 2) Development of Technology for Pasture Management in Thailand (DLD) 3) Technical Cooperation on Foot and Mouth Disease (DLD) 4) Highland Agroforestry (KU) 5) Identification and Utilization of Useful Microorganisms for the Improvement of Tua Nao or Thai Natto (KU) 6) Joint Research Projects between JIRCAS and Entomology and Zoology Division, Past-Present (DOA) 7) Research Highlights on Plant Pathology and Thailand-JIRCAS Project (DOA) 8) How to Utilize the Sericulture Research Project from JIRCAS and DOA Cooperation (DOA) 9) Cooperative Research on Rice (DOA) 10) Quality Evaluation and Utilization of Rice in Japan (Special lecture by Dr. Ohtsubo (NFRI) 11) Highlights on Research Cooperation in Field Crops (DOA) 12) Review of Research Activities on Soil Science (DOA).

Photo 1: Signature of MOU between DOA and JIRCAS by (left) Dr. Montri Rumakom and Dr. Keiji Kainuma

(Koji Kawashima)

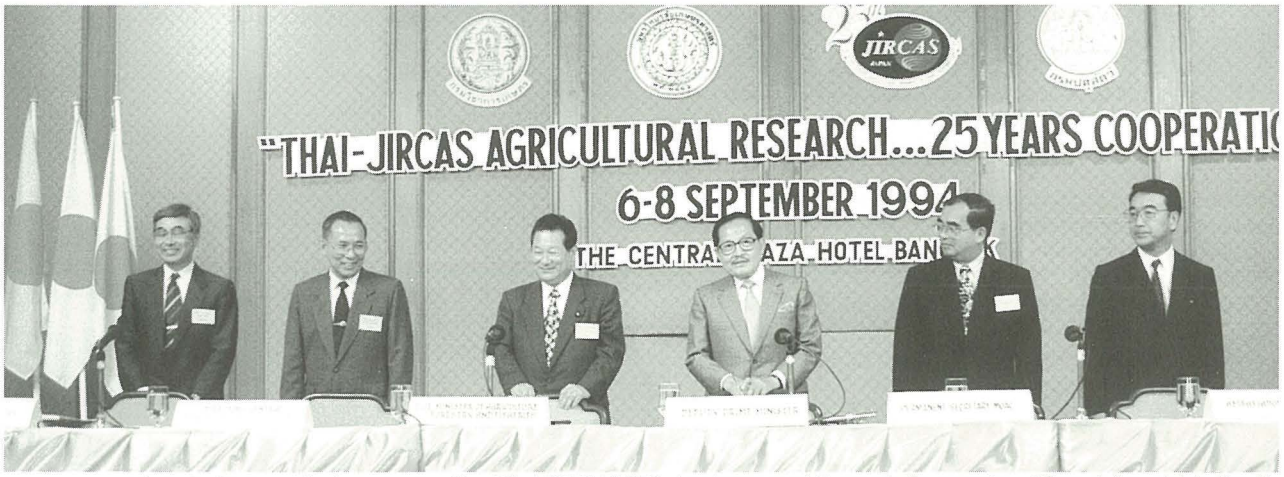


Photo 2: Distinguished guests attending Thai-JIRCAS 25th Anniversary of Research Cooperation. (From left to right): Dr. K. Kainuma, Dr. M. Rumakom, DG of Dept. of Agriculture; His Excellency T. Yoshida, Parliamentary Vice-Minister of MAFF, Japan; His Excellency Boonchu Rojanasathien, Deputy Prime Minister, Thailand; Mr. Sommai Surakul, Permanent Secretary, Ministry of Agric. and Cooperatives, Thailand; Mr. S. Otsuka, Chargé d'Affaires a.i., Embassy of Japan

The 1st JIRCAS International Symposium
XXIVth International Horticultural Congress

Fruit Production in the Tropics and Subtropics

The 1st JIRCAS International Symposium on "Fruit Production in the Tropics and Subtropics", sponsored by Japan International Research Center for Agricultural Sciences (JIRCAS) in cooperation with the Fruit Tree Research Station (FTRS) and in conjunction with the XXIVth International Horticultural Congress (IHC) was held in Kyoto on August 22 and 23, 1994. The subject of the symposium covered the current situation and future prospects of fruit production in the tropics and subtropics. It aroused much interest on the part of both the Japanese and foreign researchers, resulting in a large number of participants (more than 500), including many foreign researchers attending the IHC.

The objective of the symposium was to discuss various aspects relating to the management of fruit production, with emphasis placed on technical advances and international cooperation. The symposium consisted of a keynote address and four technical sessions as follows: 1) Collection and utilization of tropical and subtropical fruit tree genetic resources 2) Cultivation of temperate zone fruits in the tropics and subtropics 3) Pest control of tropical and subtropical fruits and 4) Storage and postharvest physiology of tropical fruits.

During the opening session, Dr. K. Kainuma, Director General of JIRCAS, gave the inaugural address, followed by the welcome addresses by Dr. E. Miwa, Deputy Director General of the Secretariat of the Agriculture, Forestry and Fisheries Research Council (SAFFRC), and Dr. I. Ueno, Director General of FTRS. The symposium started with a keynote address on the role of fruit production in the tropics and subtropics, delivered by Dr. H. Kitagawa, Kagawa University.

At the end of the symposium, general conclusions were delivered by the chairpersons, which can be summarized as follows; The selection of the symposium theme was particularly timely and it was indicated that international cooperation was very important for research relating to various aspects of fruit production to promote the development of the fruit industry in the tropics and subtropics.

The proceedings of the symposium will be published as International Agricultural Research Series (IARS) in the near future by JIRCAS. (Keiichi Tanaka)

≪Research Focus≫

Japan-China Collaborative Research Project for Rice Breeding Using Unexploited Genetic Resources in Yunnan Province, China

Yoshihiro Sunohara [1], Kazuo Ise, Hisashi Tanno [2], Jiang Zhinong [3], Fang Yongyan [3] and Shoji Miyazaki

In May 1993, the provincial government of Yunnan officially approved the registration of four new japonica varieties developed through the Japan-China collaborative rice breeding project, which the Tropical Agriculture Research Center of Japan (the predecessor of the Japan International Research Center for Agricultural Sciences) and the Yunnan Academy of Agricultural Sciences, Peoples' Republic of China, have been implementing since 1982. So far, a total of nine varieties developed through the project have been registered by the provincial government. These varieties were grown over almost 100,000 ha in and around the province in 1994.

Main characteristics of the four new varieties

1) Hexi 15 (Dianjing 34) is an early maturing variety with cold tolerance and high yielding ability, which is adapted to paddy fields located at a high elevation between 1900-2100m above sea level in the province.

2) Hexi 24 (Dianjing 35) is a variety with intermediate maturity characterized by lodging resistance and blast resistance. This variety is recommended for paddy fields located at an elevation between 1500-1800m above sea level in the province, where the high yielding ability of the variety can be well demonstrated.

3) Hexi 25 (Dianjing 36) is a variety with intermediate maturity as well as with lodging and blast resistance controlled by gene(s) which have not yet been identified. Since this variety displays cold tolerance to some extent, it is recommended for paddy fields at a relatively high elevation between 1800-2000m above sea level in the province.

4) Hexi 30 (Dianjing 37) is a variety with intermediate maturity characterized by blast resistance, high yielding ability along with good quality and taste. This variety is recommended for paddy fields at an elevation between 1500-1800m above sea level in the province.

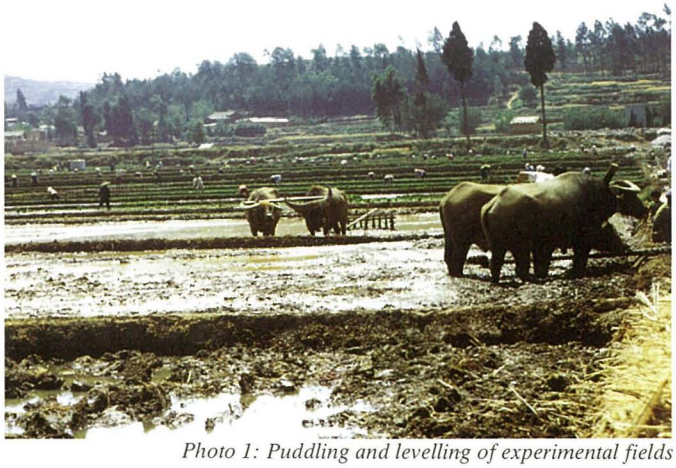


Photo 1: Puddling and levelling of experimental fields

Rice breeding for cold tolerance and blast resistance

Rice-growing area in Yunnan province covered approximately one million ha in 1994, with indica paddy rice accounting for 40% of the total rice-growing area, japonica paddy rice for 50% and japonica upland rice for 10%. Rice is distributed widely, from 76m above sea level at Hekou to 2670m at Yongning. Since the climate and varieties vary considerably with the altitude in the province, the Japan-China collaborative rice breeding project is currently concentrating its activities on the zone for

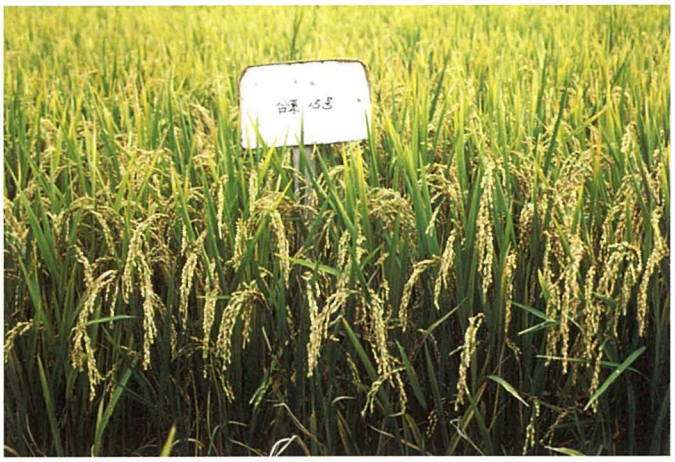


Photo 2: Hexi 15 – a new rice variety with cold resistance

Photo 3: Hexi 24 – a new high-yielding rice variety

japonica rice cultivation located between 1500-2100m above sea level.

The main constraints on the achievement of stable and high yield in these areas are the low temperature and blast disease.

At the beginning of the project, numerous germplasm accessions of Yunnan and Japan were evaluated for cold tolerance, blast resistance and other agronomic characters. A large number of varieties with high cold tolerance were identified in the breeding materials of Yunnan germplasm. However, most of them showed unfavorable characteristics in terms of plant type and grain quality. Numerous crosses, therefore, have been performed between the Yunnan varieties and Japanese ones and then promising lines with a good plant type as well as with cold tolerance and blast resistance have been selected. Since the screening methods for cold tolerance and blast resistance were adequately developed in the project, promising lines have been effectively selected.

Rice breeding for high grain quality

Recently, the living standard in urban areas of China has been rapidly rising, resulting in a remarkable increase in the demand for rice with good quality and taste.

Recent surveys carried out in Yunnan province by one of the authors have clearly shown that city people in Yunnan province prefer soft and sticky rice to hard and dry one as Japanese people

do. Since soft and sticky rice can be obtained by lowering the amylose content and nitrogen content of rice grain, almost the same methods as those developed by rice breeders in Japan to improve the grain quality and taste, especially in Hokkaido, could be applied in the project.

Prospects

Recent studies carried out by economists of the Yunnan Academy of Agricultural Sciences have revealed that since the yield of the varieties developed through the project was 15% higher than that of local cultivars on the average in farmers' fields in 1993, total yield increase due to these varieties in the province is estimated to be approximately 100,000 tons.

Although the project is very successful, as mentioned above, the abundant genetic resources of Yunnan province have not yet been sufficiently evaluated and utilized. In order to utilize the resources more effectively and to contribute to the development of rice cultivation not only in Yunnan province but also in the world, genetic studies on cold tolerance and blast resistance of the Yunnan varieties are now being undertaken intensively.

Finally, in addition to the effective utilization of rice genetic resources in Yunnan province, research activities on the conservation of rice genetic diversity including *in-situ* conservation of wild rice populations in the province should be promoted in the future.

Photo 4: Pedigree selection carried out by rice breeders

1) Aomori Agricultural Experiment Station
2) Hokkaido Kamikawa Agricultural Experiment Station
3) Yunnan Academy of Agricultural Sciences

Mr. Matsumoto, Chairman of AFFRC, visited China

Mr. S. Matsumoto, Chairman of the Agriculture, Forestry and Fisheries Research Council of MAFF and Dr. K. Kainuma, DG of JIRCAS visited Yunnan province of China in September 1994. They held consultations with the Director of the Yunnan Academy of Agricultural Sciences and the Vice-President of Yunnan Government about collaborative research works and cooperation in the future.

The results of the 12-year research collaboration on rice breeding and cultivation between MAFF and Yunnan Province have been highly evaluated.

They also visited rice fields and farmers' houses near Kunming city, the capital of Yunnan province, and talked with farmers about their daily life.

(Takasuke Ishitani)

Photo 5: Visit of experimental plot for rice breeding at Yunnan Academy of Agricultural Sciences
(From left to right): Mr. Xiong Jianhua, Mr. Li Jiarui, Mr. K. Ise, Mr. S. Matsumoto, Mr. H. Tanno, Dr. K. Kainuma, Mr. K. Kadowaki

Photo 6: Rice-growing area near Kunming city, Yunnan, China
(Photo by T. Ishitani)

Profile of JIRCAS Divisions (2)

Animal Production and Grassland Division

Dr. Hirofumi Hayakawa

Director, Animal Production and Grassland Division. Veterinary Entomologist. Born in Fukushima in 1937. Graduated from Tokyo University of Agriculture and Technology in 1961. Started his career as researcher on cattle grazing in MAFF, Tohoku Natl. Agric. Expt. Stn. (1961-84), carried out research on insect pests of upland crops in Hokkaido Natl. Agric. Expt. Stn. (1984-88) and on livestock pests in Tohoku Natl. Agric. Expt. Stn. (1988-93). Visiting scientist at Lincoln College in New Zealand and at CSIRO in Australia (1972-73), and at Veterinary Toxicology and Entomology Lab., USDA in 1983. Participated in a JICA project for the control of Human Onchocerciasis at Jos University in Nigeria (1986-87). In April 1993 he joined TARC as Director of Research Division II.

Animal Production and Grassland Division started its research activities with ten staff members.

The Division focuses on the sustainable increase of animal production in harmony with natural resources and the environment by enhancing the animal capacity for production, securing feed resources either by improvement of grasslands or a better utilization of agro-industrial by-products, control of animal diseases, improvement of management practices,etc.

Currently, seven projects are being carried out abroad by researchers on long term assignments (2-5 years). The themes and the collaborative research organizations are as follows: 1) Ecophysiological studies on the persistency of tropical pastures in the Latin American Savanna: The Centro Internacional de Agricultura Tropical (CIAT) 2) Geographical information systems for characterization and analysis of rangelands in West Asia and North Africa: The International Center for Agricultural Research in Dry Areas (ICARDA) 3) Development of genetic evaluation for Trypano-tolerance and meat and milk production in African cattle: The International Livestock Center for Africa (ILCA) 4) Immunohistological studies for the development of a vaccine against East Coast Fever: The International Laboratory for Research on Animal Diseases (ILRAD) 5) Development of technology for forage crop management in Northeast Thailand: The Department of Livestock Development, Thailand (DLD) 6) Improvement of cattle production with locally available feed resources in Northeast Thailand: DLD 7) Mineral nutrition research in tropical ruminants: The Malaysian Agricultural Research and Development Institute, Malaysia (MARDI).

The following studies are being carried out presently by researchers on short term assignments (1-3 months): 1) Identification of endophytic fungi in pasture plants of South America: CIAT 2) Silage fermentation under tropical conditions: DLD 3) Gas metabolism in tropical cattle: DLD 4) Mineral metabolism in cattle fed with oil palm feedstuffs: MARDI 5) Special characteristics of flora and fauna in the rumen of lesser mouse deer: University Pertanian Malaysia (UPM).

A new collaborative research project on integrated farming systems combining agriculture, livestock and fisheries in the Mekong Delta will be initiated this year.

Forestry Division

Dr. Yasuo Osumi

Director, Forestry Division. Soil Scientist: Born in a small town near Nagoya in 1940. Graduated from Nagoya University in 1964. Completed graduate course of the University in 1969. Since then, he has been engaged in studies on forest soil science mainly at the Forestry and Forest Products Research Institute (FFPRI).He joined TARC and was dispatched to Malaysia from 1975 to 1978 where he carried out studies on "Site Classification for Useful Tree Species". He returned to FFPRI where he worked as Chief of Soil Laboratory and Director of Overseas Forestry Research Information Section. He joined TARC again as Research Coordinator at the Research Information Division from 1989 to 1991. He returned to FFPRI where he held the position of Director of Forestry Division, Tohoku Research Center and Research Coordinator. When JIRCAS was established in October, 1993, he became Director of the Forestry Division.

Forest degradation and destruction are advancing rapidly, in particular in the developing regions. Although forestry studies had already been carried out by TARC, after the reorganization into JIRCAS, research became systematized and a new Division was eventually established to address more effectively the problems associated with deforestation.

The Forestry Division focuses on forest rehabilitation and enrichment, along with the exploitation of forest products for regional use. The two major research thrusts are as follows: 1) Development and improvement of silvicultural and forest management technology in developing countries and 2) Evaluation of underutilized forest products and improvement of processing technology of forest products for regional use. The Division started with six staff members, including a tree physiologist, an ecologist, two silviculturists, a mycologist and an entomologist. A soil scientist and a wood technologist will join the Division in the near future.

Currently, six projects are being implemented as follows: 1) Identification and characterization of mycorrhizal fungi related to survival and growth of Dipterocarps 2) Eco-physiological characteristics of useful tree species under tropical rainforest conditions 3) Control of insect pests attacking fast-growing tropical legume trees 4) Improvement of silvicultural methods in logged-over tropical hill forest 5) Monitoring of recovery of tropical rain forest after degradation and 6) Natural regeneration status of tropical montane forest.

In addition, two projects are currently being planned; 1) Development of methods for integrated control of the insect pest, *Hypsipyla* spp., occurring on Meliaceae trees and 2) Evaluation of biomass production of mangrove forests for sustainable use of brackish water areas. The division also plans to initiate research on forest products.

These studies are integrated through collaboration with other research organizations engaged in similar or different research fields in Japan and overseas on a long term or short term basis.

Fisheries Division

Dr. Kunihiko Fukusho

The Fisheries Division is in charge of research on marine and freshwater fisheries resource management, aquaculture, fisheries product processing, which are major themes for international collaboration. All the researchers who have joined the Fisheries Division since October 1, 1994 pursue research in the following fields.

Dr. Shigeo Hayase (squid ecology), Dr. Koji Nakamura (marine biochemistry), Dr. Motoyuki Hara (fish genetics), Dr. Katsuisa Tanaka (marine chemistry), Dr. Marcy Nicole Wilder (crustacean endocrinology), Mr. Satoshi Suyama (marine fish ecology), and Mr. Masashi Sekino (freshwater fish culture).

Although the Division has a small number of researchers, it is being supported by nearly 430 scientists affiliated to the nine fisheries institutes of the Fisheries Agency.

Director, Fisheries Division. Aquaculture Biologist for Marine Finfish. Born in Pusan, Korea in 1942. Graduated from Tokyo University of Fisheries (TUF) in 1965. Completed master course of the TUF in 1967. Visiting researcher at Department of Fisheries, Kyoto University (1967-1969). Since then, he has been engaged in studies on fry production of marine finfish at Nagasaki Prefectural Institute of Fisheries (1969-1979). Ph. D., Kyoto University, 1979. He moved to the National Research Institute of Aquaculture (NRIA) as Chief of the Genetic Breeding Section (1979-1989). During this period, he was dispatched as short-term expert to Indonesia, Singapore, Thailand and China sponsored by JICA, FAO, and IDRC. He was appointed Chief of the Research Planning Section of the NRIA (1989-1990). Thereafter, he was appointed Director of the Nikko Laboratory, NRIA. He joined JIRCAS in October, 1993.

Okinawa Subtropical Station

Dr. Tadaaki Yamashita

Ishigaki city where the Okinawa Subtropical Station is located is the southernmost city in Japan, 2100 km apart from Tokyo. The Station is the only national research organization which carries out agricultural research under subtropical conditions.

Research at the Station includes: 1) Introduction, acclimatization and cultivation of tropical vegetables 2) Production of breeding materials for tropical crops and development of breeding methods 3) Introduction and cultivation of new cultivars of tropical fruits 4) Improvement of methods for rapid generation advance for hybrid populations of rice and wheat 5) Tropical insect and plant virus diseases 6) Utilization of soil microorganisms and genetic regulation of nutrition in tropical crops 7) International collaboration for improvement of technology in the tropics.

Under the JIRCAS Visiting Research Fellowship Program, researchers from developing countries are invited to undertake advanced studies at the International Collaboration Section of the Station. They stay in Ishigaki for at least one year for their work. Ten researchers from 9 countries participated in the program in 1993. In this program emphasis is placed on studies for optimum utilization of bioresources for conservation of the environment and sustainable agricultural production mainly in the tropics.

Director, Okinawa Subtropical Station. Born in Osaka in 1937. Research Field: Plant Nutrition. Graduated From Faculty of Agriculture, Tohoku University (BS. 1961, MS. 1963, Ph.D. 1968). Graduate study at Department of Biochemistry, University of California, Riverside (1963-1964). Started his career at MAFF as Researcher, Department of Chemistry, Sericultural Experiment Station (1968). Head of By-product Lab. (1975). Head of Radio Isotope Lab. (1980), Head of Mulberry Nutrition Lab.(1983) and Head of Mulberry Physiology Lab. (1988). He joined TARC as Chief of the International Relation Section in April, 1990. Director of Okinawa Subtropical Station since April, 1993.

A New Approach to Studies on Brackish Water Mangrove Ecosystems

Masaaki Suzuki
International Research Coordinator

Brackish water areas and mangroves

The term brackish water refers to the mixture of fresh water and sea water in lagoons and river estuaries. Large brackish water areas will be formed if the topography near the sea is flat, because high tide flows upstream deep into the land.

Mangrove forests develop in lagoons and river estuaries of tropical and subtropical regions such as Southeast Asia, Oceania, Africa and Central and South America. Mangrove forests in Japan can be seen in Kyushu, Okinawa and Ogasawara. Mangrove forests cover 14.19 million hectares worldwide, with Southeast Asia accounting for 50 % of the total area. Among the Asian countries, Indonesia has the largest acreage of mangrove forests, totaling 4.25 million hectares.

Utilization and role of mangrove forests

Mangrove trees are utilized for fuel, and are an important source of chips, timber, medicinal products, etc. They protect the coast from erosion and the threat of hurricanes and cyclones. Mangrove forests are known to act as a nursery for fishes. Mangrove forests also protect coral reefs which are important as a nursery for fishes. For this reason, these forests on the sea coast are valuable for fish production.

New project on "Productivity and Sustainable Utilization of Brackish Water Mangrove Ecosystems"

The majority of the population in the world lives along the sea coast. The population density is especially high in Southeast Asia and is expected to further increase. The increase in population and growth of the economy in developing countries accelerate the development of coastal areas, particularly mangrove forests along the sea coast.

Recently, many countries in the tropics have begun to realize the importance of the mangrove ecosystems. The development of brackish water areas, therefore, should proceed very carefully.

Our knowledge is still very limited as to what effect on the environmental capacity of the coast would be brought about by the development of the brackish water areas. A larger amount of quantitative information should be accumulated to evaluate the potential of brackish water areas for biomass production and to promote a sustainable utilization of mangrove ecosystems in brackish water areas. We plan to implement a new project related to brackish water areas entitled "Productivity and Sustainable Utilization of Tropical and Subtropical Brackish Water Mangrove Ecosystems". In this project, we intend to clarify the food chain and to calculate the energy balance in the brackish water areas and also clarify the effect of the development of brackish water areas on the environmental capacity especially in relation to fish ecology.

Tripartite project

This will be a tripartite project involving the participation of three countries, namely Japan, Australia and Malaysia. Australia has large mangrove forests and has accumulated a great deal of information on mangrove ecosystems. Malaysia also has a large area of mangrove forests, especially in Matang (Perak State) which are very well managed. This project will be initiated in Malaysia during the 1995 fiscal year.

Photo 1: "Silvo-fisheries": Development of mangrove forests for fishponds (Chikiong, West Java)

Photo 2: Mangrove timber resources in Matang are utilized for charcoal manufacture industry (Matang, Malaysia) (Photos by T. Ishitani)

Agricultural Constraints in Central Asia — Visit of Kazakhstan and Uzbekistan —

Mitsunori Oka
International Research Coordinator

Central Asia is one of the major areas on the Silk Road which contributed to the introduction of western civilization to Japan. Therefore for many Japanese, a visit to this region is like a distant dream. Our visit to Central Asia was planned after the reorganization of TARC into JIRCAS to expand the areas targetted for research collaboration which hitherto had been limited to the tropics and subtropics. When we reached Almaty from Moscow in late spring, the apple trees were in full bloom. We were met at the airport by Dr. Iskakov, a young scientist in charge of international research collaboration at the Kazakh Academy of Agricultural Sciences.

Central Asia and agriculture

Central Asia stretches over four million km^2 on a vast steppe and desert with a wide range of temperatures, from the Tianshan and Pamir mountains to the east to the lower reaches of the Volga river and the Caspian Sea to the west. The area consists of five new independent republics, Kazakhstan, Uzbekistan, Kirghizstan, Tajikistan and Turkmenistan formed immediately after the division of the Soviet Union in 1991.

Traditional agriculture consisted originally of pastoralism in the steppe and oasis agriculture in the piedmont and desert areas. At present, agricultural activities are characterized by 1) settled cattle raising on grasslands, 2) rainfed upland crop production in the steppe of northern Kazakhstan, 3)agriculture based on large scale irrigation as well as oasis agriculture and 4) fisheries in river and lake basins.

Kazakhstan: "Pasture Country"

In Almaty we visited various agriculture institutes under the Academy and agricultural areas around the city with a beautiful interpreter (Mrs. Elmira). The vast expanses of grasslands with grazing sheep emphasize the pastoral characteristics of Kazakhstan. In Kazakhstan, rainfed agriculture predominates in contrast to irrigated agriculture in the other republics.

The steppe which plays an important role in wheat and meat production is currently undergoing considerable degradation. Continuous cultivation of wheat in the grasslands covered with Chernozem soils has resulted in soil erosion due to wind. Desertification has made rapid progress due to the decrease of the cover formed by plant canopies and useful grass species all over the steppe.

Uzbekistan: "Cotton Country"

After leaving Almaty Airport in the evening, we reached Tashkent, the capital of Uzbekistan. We drove to Samarkand by car after visiting the Uzbek Academy of Agricultural Sciences. We enjoyed our trip with young Mr.Sarvam, for whom it was the first opportunity of meeting foreigners. We crossed the River Syr-Dar'ya after about one hour's drive and we observed the vast area of cotton fields along the road to Samarkand.

The gradual disappearance of the Aral Sea and soil salinization due to cotton cultivation with large scale irrigation are the most serious problems for agriculture in Central Asia. In the Aral Sea the coast line has receded over a distance of 80-100 km for the last four decades and the area has decreased to one-third of the original value. As a result, social and environmental problems, including the collapse of the fishing industry, the widespread accumulation of salt on the sea bottom, pollution of water by fertilizers and agricultural chemicals in the Aral basin, far outweigh the problems confronting agriculture.

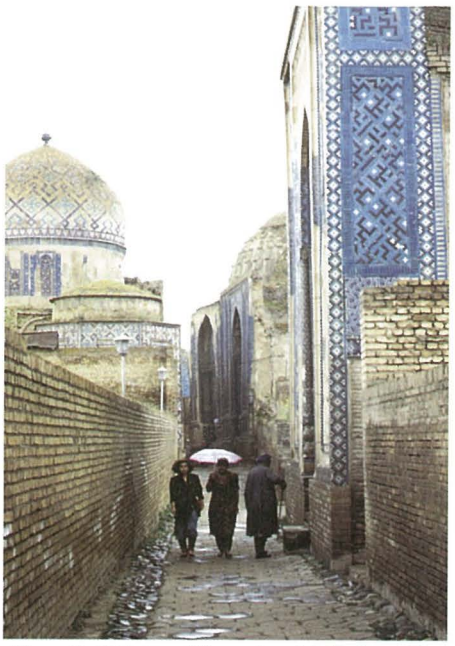


Photo 2: Old city of Samarkand full of mosques and domes

The last city we visited, Samarkand is an ancient city located along the middle reaches of the Zerav'shan River. We visited one institute for fruit tree cultivation under irrigation and another dealing with the processing of hides of Astrakhan lambs in the old city full of people with various faces, huge mosques and blue domes.

Promotion of cooperation in the field of agriculture

Agricultural activities as well as the life style of the people in Central Asia are markedly diversified. It is essential to address the agricultural and environmental problems described above, by further promoting research to improve the production of abundant agricultural resources, including fruits and vegetables, cereals, forage crops and mulberry plants, as well as of animals (sheep, cattle, horse, goat, camel, yak) and fishes in the river and lake basins.

To enable the Central Asian countries to overcome the current economic depression after the independence, international research collaboration is essential to enhance agricultural production. We plan to initiate research collaboration in the field of agriculture to revive the cultural exchanges with the partners of the Silk Road in the past.

Photo 1: Sheep grazing in the vast steppe of Kazakhstan

The Rural Development Programme of OECD

Junko Goto
Research Information Division

The Organization for Economic Cooperation and Development (OECD) is usually regarded as "salon of developed countries".

Until Mexico became the 25th member in 1994, the membership had been very stable, and Japan, which joined in 1964, has been and is still the only member country of OECD in Asia.

Among the general activities sponsored by this international organization, there is a programme implemented on a small scale that non-member countries, mostly in the developing region, can highly appreciate.

OECD drafted the Rural Development Programme in 1991. Its first substantial publication entitled "What Future for Our Countryside? A Rural Development Policy" introduced the following political context: "The rural world – one third of the population and nine tenths of the territory of OECD member countries – is going through a period of profound change. Some areas are developing rapidly while others are faced with constant decreases in population. Agricultural policy concerns only a small, shrinking proportion of rural dwellers and economies. Recognition that the rural world plays an important role in the vital societal balance between town and country is growing." (from the back cover). Agriculture alone cannot solve the economic and social problems of rural areas. A horizontal as well as vertical cooperation is necessary for tackling rural problems. The policy review continues: "The central challenge for rural development is to foster an improved national balance of economic opportunities and social conditions, utilizing an appropriate mix of market and nonmarket mechanisms to improve national economic performance, while safeguarding and developing important aspects of the rural heritage." (p.15).

OECD's Rural Development Programme is sponsored by the Group of the Council on Rural Development, established in July 1990, which comprises representatives of all Member countries, civil servants in various ministries and offices concerned with rural development matters. The Programme has been supported by a small secretariat newly created independently of existing directorates and programmes, and, since January 1, 1994, has been part of the new Territorial Development Service of the OECD.

The activities of the Rural Development Programme will be of a greater value to non-OECD countries as well, since developing countries are also faced with dilemmas and challenges of rural development. During its second mandate (1993-1995), the Programme continues policy reviews and studies on the following subjects: 1) Geographic variations among rural areas and the establishment of internationally comparable rural indicators. 2) Rural employment and unemployment with a view to working out a plan for job creation in rural areas 3) Producing niche goods and services as a rural development strategy 4) Rural amenities, the growing demand and its contribution to rural development.

The Sixth Session of the Group of the Council on Rural Development was held in Helsinki, Finland in mid-June 1994 with a delegate from Mexico attending for the first time. Finland was the very first country to accept the Programme's comprehensive country review of rural policy. During the meeting, there was a heated discussion on the analysis and implication of the employment study, because many member countries were and are still confronted with a high rate of unemployment.

The Seventh Session will take place in December 1994 together with the Workshop on "Producing Goods and Services for Niche Markets as a Rural Development Strategy." The results of the first phase of the study on niche goods and services will be published by the end of 1994. This coming Workshop is expected to give an opportunity to member countries to exchange experiences and ideas on the roles of niche market activities and to discuss various policies to promote them.

Photo 1: The market square of Helsinki is full of sun-loving people in summer

Photo 2: Wooden handicrafts are the most genuine Finnish products

Profile of new director

Dr. Katsuyuki Minami

Director of Environmental Resources Division. Born in Hagi city in 1943. Received Doctorate Degree in Soil Science from Tohoku University in 1971. Since then he has worked at Tokai-Kinki National Agricultural Experiment Station (1971-72), National Institute of Agricultural Sciences (1973-1983), Iowa State University as a visiting professor (1977-1978), Agriculture, Forestry and Fisheries Research Council (1984-1986) and National Institute of Agro-Environmental Sciences (1986-1994). He joined JIRCAS in August 1994. He received the Japanese Society of Soil Science and Plant Nutrition Award in 1990, and Ministry of Environmental Agency, Ministry Award in 1991.

≪Research Collaboration≫

Collaborative Research Work to Improve Cowpea Production at IITA, Kano Station, Nigeria

Tomio Terao
Biological Resources Division

International Institute of Tropical Agriculture (IITA) was established in 1967 in the Federal Republic of Nigeria to increase the productivity of cowpea, maize, rice, soybean, banana and plantain, and root crops, and to develop sustainable agricultural systems in the tropics, particularly in Sub-Saharan Africa. IITA has a global mandate for cowpea improvement.

Cowpea (*Vigna unguiculata* (L.) Walp) is an important leguminous crop widely grown in the semi-arid regions of Africa because of its tolerance to drought and superior source of protein. It is primarily grown for human food but its haulms are also an important feed for livestock. IITA established a station in 1989 at Kano which is in the center of the cowpea-growing region. The major objective of the station is to develop improved cowpea varieties and production systems.

Presently, there are 4 scientists including a breeder, an agronomist, an entomologist and myself, and about 40 national staff members.

The major constraints on cowpea cultivation include insect pests, diseases, parasitic weeds such as *Striga* and *Alectra* which become attached to cowpea roots and absorb nutrients to make cowpea unproductive, and low soil fertility and drought. Traditionally, farmers do not use chemicals and fertilizers and practice intercropping systems although yields of grain and fodder are very low. Therefore the scientists based at IITA Kano station are making concerted efforts to improve the productivity of cowpea in traditional cropping systems and develop technologies which are transferable to farmers. According to this strategy, IITA scientists work as a team to improve relevant cropping systems and varieties.

The first priority is to breed cowpea cultivars resistant to diseases, insect pests and parasitic weeds. Some improved traditional types of cultivars combining these traits are already being tested in farmers' fields. However, no good sources of resistance have yet been identified for two major insect pests: Maruca pod borer and pod bugs. Efforts are underway to screen a large number of germplasm lines and wild species to identify sources of resistance to these insects. Also much work on biotechnology and wide crosses has been initiated to introduce resistance genes from other species such as *Vigna vexillata* which is highly resistant to these insects.

Second objective is to make the traditional cropping systems more productive and efficient. An agronomist and two volunteers from the Volunteer Service Overseas (VSO) of UK are currently surveying and analyzing farmers' traditional cropping systems to identify important constraints. JIRCAS scientists are studying basic physiological constraints such as light utilization by leaves and water and soil fertility competition in roots in these systems.

The third objective is to increase the drought tolerance. In the dry savanna area, low and erratic rainfall often causes severe reduction in grain and fodder yields. Two strategies are available to eliminate these yield reductions; one is to develop early maturing cowpea cultivars which will escape drought, and the other is to improve the drought tolerance itself. Several early maturing varieties have been developed which yield well if there is no drought during the growing period. However, they experience injury in the case of intermittent drought. Therefore, the major focus of the collaborative work with JIRCAS is to combine early and medium maturity with drought tolerance. Since 1990, more than 900 accessions of cowpea germplasm have been screened to identify drought-tolerant lines (I. Watanabe). Screening methods have been developed and several promising lines were selected.

Recent field experiment in the dry season showed that the most drought-tolerant strain TVU-11979 planted just after the last rain grew vigorously and produced an adequate amount of seeds without any precipitation and irrigation, while other strains died or their growth was very much inhibited. This strain appears to be drought-tolerant and it is being used for genetic studies and breeding programs. Studies have also been initiated to ascertain the physiological basis of drought tolerance in this line. We anticipate that improved cultivars of traditional type with combined resistance to many diseases, parasitic weeds, insects as well as with drought tolerance will soon be developed through the collaborative research between IITA and JIRCAS.

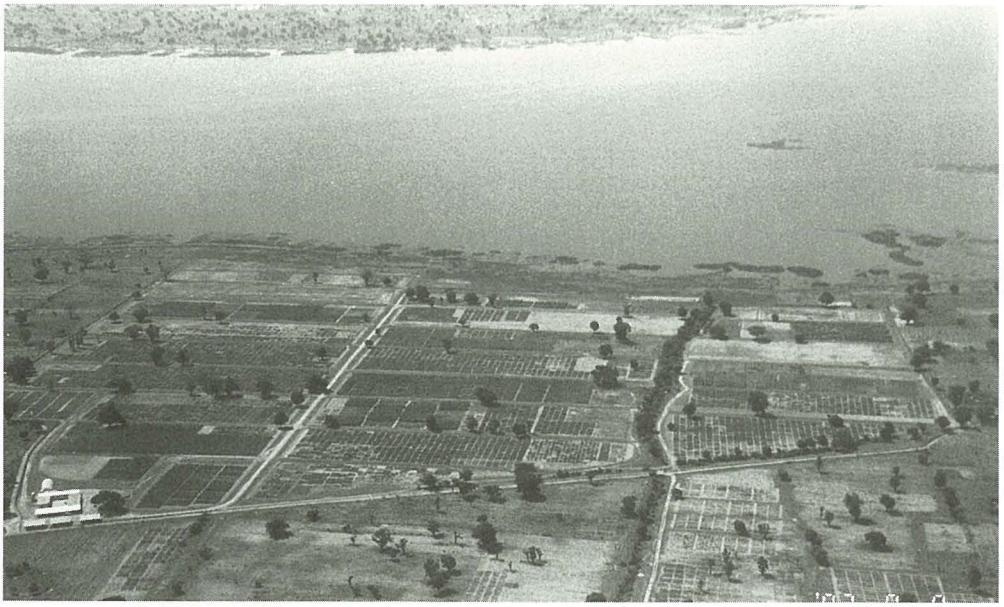


Photo 1: An overview of the experimental farm of Kano Station at Minjbir, Nigeria

Photos 2, 3: Drough-tolerant (left) and susceptible (right) cowpea cultivars grown in Kano during the dry season. Leaves from susceptible cultivars experienced drought injury unlike those from drought-tolerant cultivars. Tubes installed between rows are access tubes for neutron probe to monitor soil moisture content

Collaborative Research with ILRAD on Bovine Theileriosis

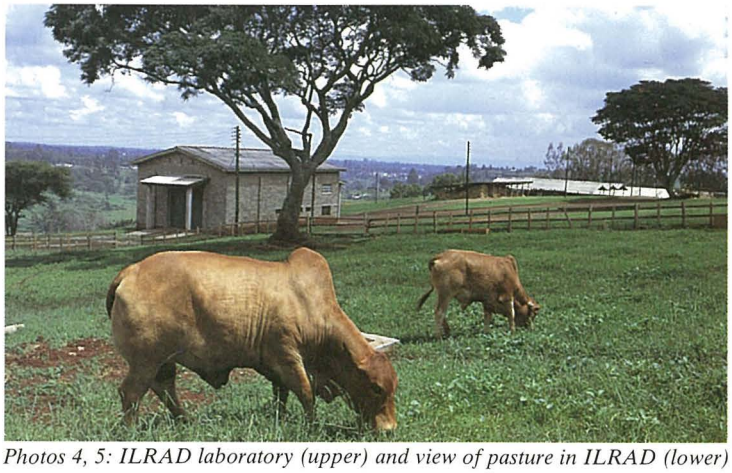
Yukio Yagi[1)]

The International Laboratory for Research on Animal Diseases (ILRAD) is one of the research institutes with which JIRCAS is promoting collaborative research programs in the tropical and subtropical regions. ILRAD which was founded by the CGIAR in 1973 is located in Nairobi, Kenya, with a mandate to conduct research for the control of livestock diseases, especially in Africa and in other developing countries. The primary objective of the Laboratory is to develop safe, effective and economical methods of control of the most important parasitic diseases that limit animal production in the tropics and subtropics: trypanosomiasis, a disease transmitted to animals by the tsetse and other biting flies, and tick-borne diseases, particularly a virulent form of theileriosis called East Coast Fever (ECF).

Collaborative research between ILRAD and TARC/JIRCAS has been carried out since 1980 and has focused on strain characterization within the framework of the Epidemiology and Experimental ECF Control Project for the development of *in vitro* methods of classification of *Theileria* strains into antigenic groups and the analysis of their cross-protective potential *in vitro* in order to develop an effective ECF vaccine.

Current cooperative studies have been centered on the analysis of parasite proteins at the molecular biology level. P67 which is a dominant surface protein of *Theileria parva* sporozoites has been identified as an important vaccine candidate antigen against ECF. JIRCAS researchers demonstrated that P67 and its recombinants were both glycosilated but that their carbohydrate side-chains were different from each other. This difference was considered to be due to translational modifications by host cells. These results should contribute to basic knowledge for vaccine development in this disease.

1) National Institute of Animal Health



Photos 4, 5: ILRAD laboratory (upper) and view of pasture in ILRAD (lower)

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