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Newsletter

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Marginal grazing land near Aleppo, Syria
(Photo by M. Araragi)

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TARC
TROPICAL AGRICULTURE RESEARCH CENTER

Global Environmental Issues and Tropical Agriculture Research

Michio Araragi

Director, Marginal Land Research Division TARC (since 1988)

Soil and environmental microbiologist. Born in Saga in 1936. Graduated from Kyushu University and Research Officer in Nat'l Inst. of Agr. Sciences, TARC and Kyushu Nat'l Agr. Exp. Station. Between 1971-74, as TARC staff, carried out research on Microflora of Tropical Paddy and Upland Farm Soils in Thailand.

The world population which now stands at 5 billion is growing rapidly and projections point to a figure of 6 billion people in the year 2000.

The increase of the population is particularly evident in the tropics and subtropics and since 70% of the world population lives in these regions, it is anticipated that many people will be confronted with problems associated with the deterioration of the environment, including food shortage, disappearance of tropical forests and desertification.

On the other hand the media, that is the press and television remind us continuously of the urgency of the problems related to the environment worldwide, for example:
(1) The greenhouse effect caused by the increase of the concentration of carbon dioxide linked with the consumption of energy, such as petroleum, etc.
(2) The progression of desertification associated with population increase, overlogging operations in the tropical forests, inappropriate methods of cultivation and overgrazing.
(3) The increase of the amount of ultraviolet rays due to the depletion of the ozone layer associated with the discharge of chlorofluorocarbon gas.
(4) The occurrence of acid rain and destruction of the vegetation due to the release of acid compounds of sulfur and nitrogen.

Since in the tropics which are endowed with rich natural resources, agriculture, forestry and animal husbandry are closely related to the natural ecosystems, the impact of deforestation, desertification and acid rain is considerable and endangers sustained production in the field of agriculture and forestry. Mankind has so far been able to overcome obstacles in making the best use of its knowledge and wisdom. Since human beings cannot remain indifferent to the predicted changes of the global environment, they must devise a strategy to solve the problems through the exercise of restraint or the promotion of science and development of technology.

Since the depletion of tropical forests tends to be linked to the high value of timber, it is not only important to preserve these resources but also to maximize the use of areas with a high potential for biomass production or devise a new technology for sustained production through the development of methods for the utilization of forest trees characterized by profuse growth and consolidation of the eroded topsoil.

In addition, in the arid areas, emphasis must be placed on the preservation of water resources. To achieve this objective the planting of forest trees should be promoted as it further enhances the function of water preservation which will enable the development of agriculture in these areas. Since it is estimated that arid lands account for one-third of the surface of the continents, it may indeed not be possible to secure food resources unless the progression of desertification is checked. Should arid lands expand over the earth, it is obvious that agriculture and animal husbandry activities would be curtailed.

Moreover, it is hoped that problems associated with land deterioration such as salt deposition and soil erosion will be solved by adopting a double strategy, namely by preserving the environmental resources and breeding plants that are highly resistant to such adverse conditions through the use of biotechnological procedures.

Against this background, the Marginal Land Research Division is currently carrying out projects relating to various global environmental issues as follows:
(1) Analysis of water movement and soil characteristics of arid lands, including: large scale and yearly variations of the amount of water resources, mechanism of accumulation of salts, prevention of wind erosion.
(2) Analysis of variation in grassland resources, and development of techniques for their preservation in the arid and semi-arid zones of Africa, including: changes in the amount of grassland resources, introduction of pasture crop seeds, determination of optimum carrying capacity of pastures.
(3) Analysis of soil erosion and deterioration in tropical cultivated land, including: dynamic behavior of soil erosion and deterioration, factors causing soil erosion and deterioration, prevention of soil erosion and deterioration.
(4) Analysis of ecological function of tropical forests in relation to global environmental changes, including: evaluation of carbon dioxide fixation by major tree species and biomass production in degraded forest land, techniques to improve degraded forest land.

The 20th Anniversary of TARC, 11 June 1990

The Tropical Agriculture Research Center, Ministry of Agriculture, Forestry and Fisheries was established on 10 June 1970. TARC will observe its 20th Anniversary on 11 June 1990, under the presence of distinguished guests and friends, at its home station in Tsukuba, Japan. The Anniversary events will be marked by an Anniversary Ceremony and Memorial Lectures by three prominent speakers. The Program of the 20th Anniversary will be as follows:

1. Anniversary Ceremony 10:00-11:00
   Speeches by Dr. Tsuru, Director General, Dr. Nishio, Director General, Agriculture, Forestry and Fisheries Research Council Secretariat, MAFF.
2. Memorial Lectures 11:00-15:00
   Dr. Takekazu Ogura, Advisor to TARC and former Vice Minister of MAFF, "Unreasonable Terms"
   Prof. T. Watabe, Kyoto University "Tropical Agricultural Research in Universities"
   Dr. Shiro Okabe, Advisor to TARC and former Director-General "Internationalization: Three Dimensions"
3. TARC Research Highlights by TARC Research Staff 15:15-16:30
4. Anniversary Party 17:30-19:30
   with invited guests, friends, TARC staff and family members.

CG DAY in EXPO 1990 Osaka and Visit of CG Delegates to TARC

In conjunction with International Garden and Greenery Exposition (EXPO 1990) in Osaka, Japan (from 1 April-30 September 1990), the Consultative Group on International Agricultural Research (CGIAR) will hold a CG DAY in EXPO Compound in Osaka, on 28 May 1990. A distinguished delegation from CG Headquarters and associated International Centers (IARCs) will be visiting Osaka, Tokyo and Tsukuba for a week.

The delegation will also give a lecture meeting in Tokyo and will officially visit the Tsukuba Agricultural Research Complex and TARC on 31 May.

TARC's Collaborative Research: A Time of New Challenges

Advisor to TARC, Shiro Okabe

The present article outlines the operational mandate of the Tropical Agriculture Research Center (TARC) with a view to promoting effective collaboration for agricultural research development in the third world. Taking into account the established mandate, it briefly reviews the last twenty-year activities of the Center to learn lessons and identify problems for the improved next steps to be followed by the TARC itself as well as by its collaborating overseas institutions. It also proposes, for consideration of the concerned parties, a mid-term strategy to promote productive collaboration and alleviate some difficulties experienced in the past.

What is the mandate of TARC?
– In connection with the role of JICA –

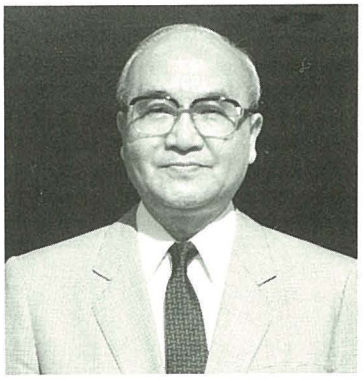
The long-term objective of the TARC is to contribute to agricultural development in the tropics and subtropics, specifically through the undertaking of research programs. Toward this end, the Center is engaged in agricultural research, covering a wide range of disciplines and sectors with the exception of fisheries, in these regions. The major programs of the Center consist of conducting research, in Japan and overseas, pertaining to tropical and subtropical agriculture, and collecting, exchanging and disseminating information on the subjects relevant to the Center's mandate.

Prior to reviewing the activities of the Center, it may be useful to outline the operational mandate of the Center, emphasizing the specific role played by the Center and distinguishing its task from the role of the Japan International Cooperation Agency (JICA) and stressing the importance of complementary functions of these two bodies in the field of agricultural research cooperation with developing countries.

The TARC, established in 1970, is one of the 29 research institutions affiliated with the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan. The Center's overseas programs are implemented in close collaboration with institutions under national agricultural research systems (NARSs) of developing countries as well as with international agricultural research centers (IARCs) and other organizations. The collaborative programs of the Center with overseas institutions are formulated on an institution-institution agreement basis to pursue common objectives.

In initiating the Center's activities at the onset, it was strongly felt that in view of the limited applicability of the existing information and skills to the complex environment, including biological, socio-economic and political conditions in developing countries, there was a great deal of potential need for the accumulation of new knowledge and technology relating to the development of tropical agriculture. It was therefore envisioned that the Center would concentrate its major efforts to research and related activities on tropical agriculture. This implies that technical assistance, such as technology transfer and provision of equipment and other materials, is not included in the primary assignment of the TARC. In fact, the Center has great limitations in its capacity in meeting the requirements from the developing countries in this respect.

The technical assistance of Japan for the developing countries, including the agricultural sector, was initiated in 1954, well in advance to the establishment of the TARC. The executing agency was the Overseas Technical Cooperation Agency (OTCA) for some time, and later on the Japan International Cooperation Agency (JICA) as the successor of the OTCA, both of which are affiliated with the Ministry of Foreign Affairs. The major functions of the JICA are to provide the developing countries with technical assistance in various sectors, especially in the form of: (a) transfer of the existing knowledge and technology; (b) supply of facilities, equipment, machinery and other requirements; and (c) provision of training opportunities in Japan. In the agricultural research field, the JICA is expected to contribute to the strengthening of the research capabilities in particular of the NARSs of the developing countries. However, the JICA is not prepared to be engaged in the implementation of agricultural research programs by itself.



As seen above, there is a distinctive difference between the TARC and the JICA regarding the respective mandate and related strategy. However, their long-term objectives in agriculture are both oriented toward the contribution to the agricultural development in the developing countries, and their assignments are complementary to each other. Therefore, it would be highly beneficial for these two organizations to collaborate closely in pursuing their common objectives. The developing countries would also greatly benefit from this collaboration.

In brief, the operational mandate of the TARC is primarily oriented toward implementing agricultural research in the tropics and subtropics, whereas that of the JICA, as far as agricultural research is concerned, is primarily related to technical assistance by the Japanese experts to strengthen the research capabilities of developing countries. Therefore, the status of the concerned institutions in the developing countries in these two associations is different: in the former case, the "counterpart" of the TARC implements a joint research program; while in the latter case, the JICA "recipient" benefits from the technical assistance provided by the Government of Japan.

What has been done and what should be done?
– Retrospect of the TARC's twenty-year activities –

In reviewing the TARC's programs in the field of agricultural research in the third world during the past two decades, it might be useful for future reference to classify those overseas activities into two stages and outline the nature of the achievements attained as well as the difficulties confronted in each stage.

First decade:

When the TARC initiated its programs in India, Indonesia and Thailand in the early 1970's, it was the first challenge for the MAFF to expand its overseas research programs, specifically in the tropics and subtropics, under its own jurisdiction. Prior to that initiation, some overseas experience in research fields had been gained in the course of the implementation of the development assistance programs that were organized by the OTCA/JICA. During this stage, the association of the MAFF with that agency had been limited in terms of the disciplines covered and the continuity in research programs. In addition, the accumulation of information and experience had been only developed on an individual basis by researchers without any well-defined framework and systematic integration.

Due to the limitation of experience and available information, in the first stage of its overseas activities, the TARC carried out its projects inevitably with "trials and errors": a number of problems facing the Center, its management and research staff were solved in an *ad hoc* manner. This situation lasted for approximately ten years since the establishment of the Center.

Even under such circumstances, however, during the first ten-year period, the Center contributed within its capacity to the development of agricultural technology and the accumulation of relevant scientific information in the selected developing countries in various fields.

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Development of Near-isogenic Lines as International Differentials for Testing the Resistance to Bacterial Leaf Blight of Rice

T. Ogawa, T. Yamamoto, G.S. Khush, T.W. Mew, R. Ikeda and H. Kaku

Bacterial leaf blight of rice (BLB) is one of the most serious diseases occurring both in tropical and temperate rice growing countries. The use of varietal resistance is main control measure as there is no other countermeasure which would be economically effective against the disease under the tropical conditions. Many studies on genetic analysis of resistance genes and variations in pathogenicity of causal bacteria in relation to resistance of rice varieties have been carried out in Japan as well as at the International Rice Research Institute (IRRI) and in other Asian countries. However, since only local materials were used, it remained impossible to compare the results obtained in order to derive a strategy for the control of the disease.

To alleviate this shortcoming, collaborative studies on BLB between the Ministry of Agriculture, Forestry and Fisheries of Japan, through the Tropical Agriculture Research Center (TARC), and IRRI were initiated in 1982. One of the main subjects involved the development of near-isogenic lines as international differentials for testing the resistance to BLB.

To develop the near-isogenic lines, all the donors with known genes for resistance to BLB (Ogawa 1987) were crossed with IR24, Milyang23 and Toyonishiki. The respective hybrids were backcrossed at least 4 times using IR24, Milyang23 and Toyonishiki as recurrent parents, which had been selected on the basis of their susceptibility to all the known races of BLB in Japan and the Philippines (Ogawa and Yamamoto, 1987). During the backcrossing process, progenies were tested for resistance using Philippine races at IRRI and Japanese races at TARC. The near-isogenic line developed so far are listed in Table 1. It is considered that the use of the lines in studies on BLB carried out in various countries may provide a common base to compare the results and develop method of control. The lines can be used for identifying bacterial races as well as for identifying new genes for resistance of rice, and they may be also used as donors for resistance in breeding programs. The lines could also be utilized as materials for studying the mechanisms of resistance. The seeds of these lines are currently being multiplied in the TARC experiment field and will be provided to the researchers in 1990 through the IRRI's network.

Table 1 Near-Isogenic Lines for Testing the Resistance to BLB

R-Gene	Source Variety	Name of the Lines
Xa-1, (Xa-12)	Kogyoku	IR-BB 1, 102, 201
Xa-1, Xa-2	Te-tep	2t, 102t, 202t*
Xa-3	Chugoku 45	3, 103, 203
Xa-3	Java 14	3J, 103J, 203J
Xa-3	Zenith	3Z, 103Z, 203Z
Xa-3	Sateng	3S, 103S, 203S
Xa-4	IR 20	4, 104, 204
Xa-5	IR 1545-339	5, 105, 205
Xa-7	DV 85	7, 107, 207
Xa-8	PI 231129	8, 108, 208
Xa-10	Cas 209	10, 110, 210
Xa-11	IR 8	11, 111, 211

* tentative line

Recurrent Parents are: IR 245 for IR-BB 1-11, Toyonishiki for IR-BB 101-111 and Milyang 23 for IR-BB 201-211

Low-input Pasture Improvement by Using the Paper Bag Planting Method in the Eastern Plain of Colombia

Yasuo Ogawa, Tsuyoshi Mitamura and Yoichi Nada

The Eastern Plain of Colombia, Llanos Orientales, is mostly covered by native grasses, and is used for extensive grazing of beef cattle. However animal production is very low in the pastures due to the low protein content of the native grasses. To improve the conditions of animal nutrition the introduction of legumes into the pastures is the most important measure for increasing animal production.

Some cultivars of legumes adapted to the acid soils with low fertility of the Llanos Orientales have been recently released by CIAT (Centro Internacional de Agricultura Tropical). However, since even these legumes require a considerable amount of nutrients at the phase of establishment the main constraint on their introduction is the high cost associated with the high application rate of chemical fertilizer. To alleviate this shortcoming we developed the paper bag planting method in collaboration with the CIAT researchers.

The paper bag planting method is a simple procedure combining spot sowing of legume seeds and localized fertilizer placement. A small paper bag (5 cm x 10 cm) containing the seeds and a fertilizer chunk (About 10 g per each) is directly applied in the pasture, at a density of 3 m x 3 m grid of pasture, equivalent to 1110 bags/ha. After the application, the paper bag decomposes into clay. The legume seeds germinate and seedling establishment occurs around the fertilizer chunk (See photograph). The rate of legume establishment in the seed-beds was very high even when tillage was omitted.

The introduction of *Desmodium ovalifolium* by using the paper planting method was examined in the pastures of Llanos Orientales in 1987. The stolons of the legumes expanded vigorously from the fertilizer chunk, and covered more than 40% of the total surface area after 15 months of application. The amount of chemical fertilizer utilized in this experiment was only 5 to 10% of that required in the conventional fertilization method. It is therefore concluded that the paper bag planting method is likely to play a key role in the low-input improvement of the pastures in the infertile acid soils of tropical South America.

Desmodium ovalifolium introduced by paper-bag planting method at CIAT (Photo by Y. Ogawa)

'H HIGHLIGHTS

Utilization of Oil Palm Trunk Constituents as Animal Feed

S. Oshio, D.M. Jaafar and O. Abu Hassan

In Malaysia, oil palm which is cultivated over a surface area of 1,800,000 hectares is the main commodity of the country along with rubber.

The oil palm plantations are regenerated every 25 years and scrapped wood from the felled trees is totally discarded. It is anticipated that the amount of residual dry matter from the trunks of old trees may reach an annual value of 7,000,000 tons in the latter half of the 1990s. Since the wood of the oil palm trunks is not resistant and the moisture content is high, it is not suitable as construction material.

In addition, the potential use of palm materials is limited due to the relatively low content in cellulose. Therefore it is important to develop methods for the effective utilization of these materials for specific purposes. Against this background, the possibility of utilizing oil palm trunk constituents as ruminant feed was considered.

In the first part of the studies, the chemical composition of the trunk and frond of oil palm trees was analysed. The lignin content of the trunk wood was found to be low while the content of soluble sugars was high.

In vitro digestibility tests of samples from both the trunk and frond subjected to steam and alkali treatments revealed that since the trunk constituents exhibited a high rate of digestibility, they could be utilized as ruminant feed.

Subsequently *in vivo* tests were carried out to determine which treatment would be most effective for improving the rate of digestibility of the trunk constituents.

The results showed that the highest rate of digestibility was achieved by steam treatment followed by alkali treatment, ensilage and absence of treatment.

Optimum conditions for the steam treatment were 30% moisture content, pressure of 12.5 kg/cm^2 for a period of 7 minutes and for the alkali treatment 7% of NaOH content (dry matter basis).

Cows fed on processed palm trunk materials at MARDI (Photo by S. Oshio)

In addition, comparative studies were carried out on the digestibility rate of the vascular bundles and parenchyma tissues of the trunk. The results showed that even when the parenchyma tissues were not subjected to any treatment, they could be utilized as an adequate feed and source of energy.

In the last series of studies, experiments were performed to analyse the effect of long-term administration of oil palm trunk (OPT) constituents as ruminant feed. Comparative studies were carried out to determine the body weight gain and voluntary intake in steers fed *ad libitum* 30% (dry matter basis) of ensiled OPT, NaOH-treated OPT and rice straw for a period of 8 months.

Analysis of viscera and carcass composition in slaughtered animals showed that OPT constituents as a source of energy were comparable to rice straw and that prolonged intake did not exert any adverse effect on the organs of the animals.

On the basis of the results obtained it was eventually concluded that: 1) Even in the absence of treatment, the nutritive value of the OPT constituents was similar to that of rice straw, 2) When the OPT constituents were subjected to appropriate physical and chemical treatments they could be effectively utilized as a source of roughage for ruminants since their digestibility rate was superior to that of conventional tropical forage crops.

Three High-yielding New Varieties Released from Joint China-Japan Project in Yunnan Province

The Tropical Agriculture Research Center has been cooperating with the Yunnan Academy of Agricultural Sciences by undertaking collaborative studies on the utilization of unexploited genetic resources since 1982. This collaborative research mainly aims at improving the technology for breeding of high-yielding rice varieties resistant to cold weather and diseases.

Recently, the government of Yunnan province has registered three new rice varieties developed by cross-hybridization of the Yunnan and Japanese breeding materials under this cooperative effort, as those varieties are considered to be superior varieties in the Yunnan province. The characteristics of the three varieties are as follows:

1. DIEN JING No. 18 = HEJIAO (HEXI) No. 4: This progeny from the cross TODOROKI-WASE x YUNGENG No. 135, is characterized by a high-yield, early maturity, intermediate plant type, cold resistance and blast resistance.

2. DIEN JING No. 19 = HEJIAO (HEXI) No. 5: This progeny from the cross TODOROKI-WASE x YUNGENG No. 135, is characterized by an intermediate plant type, high-quality of hulled rice, blast resistance and intermediate maturity.

3. DIEN JING No. 20 = HEJIAO (HEXI) No. 10: This progeny from the cross TODOROKI-WASE and YUNGENG No. 9, is characterized by an intermediate plant type, blast resistance, high-yield and intermediate maturity.

(continued from p. 3)

Administratively speaking, all these research projects were supervised and logistically supported by the TARC management in collaboration, on the spot, with the counterpart institutions of the respective developing countries or the IARCs such as IRRI, ICRISAT and CIAT. As far as the scientific information needed for research was concerned, however, a majority of substantial matters was prepared and designed for use by the TARC's research staff themselves with limited guidance. In maintaining the consistency of the program implementation in the counterpart institutions, appropriate ways and means for promoting collaborative activities were also worked out by them. The major credits in research activities at that stage may therefore be attributed to the research staff for their pioneering attitude as well as for their intellectual pursuit which involved strenuous efforts. The counterpart staff of the collaborating institutions supported those efforts in consultation with their research administrators.

In the first ten-year period, the TARC management was, in addition to the logistic support extended to the Center's staff overseas, devoted to, or even badly exhausted by, two endeavors. One was to explore new contacts with a greater number of countries for collaboration, and also to establish formal relationships with the collaborating institutions overseas. The other concern was to hold difficult consultations at the domestic level with the research administrators and the government authorities who were responsible for staffing matters in the national research programs. During this stage, information about TARC and its mandate had not been well disseminated outside the country or even in Japan. In order to mobilize research manpower for international assignments, the Center's management had to spend considerable time and energy for the negotiations with those administrators.

This short retrospect of the Center's activities in the first decade (up to 1980) underlines the challenging efforts made by the first generation in opening new avenues for research activities in the international sphere. The first decade ended with a milestone, on which some successes accompanied by failures were carved as references for the second and following decades.

Second decade:

During the next decade 1980 to 1990, considerable progress was achieved by the Center in strengthening, and further expanding, its program activities mainly through the efforts oriented toward the following two directions: (1) institutionalization of the Center's relationships with the overseas research organizations as well as with supporting institutions within Japan; and (2) continued endeavors of the Center's staff in research collaboration with the NARSs of developing countries and the IARCs as well.

In order to institutionalize the collaborative activities, a memorandum of understanding (MOU) has been exchanged between the TARC and each of the associated institutions abroad. As of March 1990, out of the 23 collaborating institutions, nineteen MOUs were effective and additional four MOUs were being worked out with the remaining institutions.

Regarding the support within Japan, the MAFF formally assigned the TARC as an apex for coordinating national research programs for collaboration in the tropics and subtropics. Under this system, the research institutions affiliated with the MAFF are officially requested to support the TARC by mobilizing their researchers for the Center's programs. This arrangement has provided a sound basis for the Center to formulate and conduct its programs in an integrated manner with the whole national research system of the MAFF. In fact, in the second decade, the serious difficulties experienced earlier in mobilizing human resources for the Center's overseas tasks have been greatly alleviated by that integrated system.

It may be important to refer to an additional advantage which has been brought about by the above-noted integration: that is a potential route for the Center's overseas staff to receive officially a support in substantial matters from the scientific groups of the national institutions in Japan. Under this system, it would not be very difficult for them to obtain needed information, technical guidance and assistance services of short-term experts on specific subjects, as and where necessary. Furthermore, those staff would enjoy the backstopping not only in scientific matters but also in psychological aspects: they are released from the feeling of being isolated from the scientific groups with which they are closely associated, even though they are dispatched under long-term assignments overseas.

The Center strengthened its capabilities in the institutional aspects, including *inter alia* the establishment of three new divisions and increased research manpower, as follows:

- Eco-physiology Research Division for the assignment of research on eco-physiological mechanisms of plants in the tropics and subtropics, with emphasis placed on adverse environments and nutrition mechanisms;
- Marginal Land Research Division for the assignment of research on characteristics and functions of environmental resources in the marginal areas;
- Research Information Division for the assignment of collecting, analysing and disseminating information on the subjects relating to the Center's mandate;
- Total staff members: 141, of which 103 members are researchers (as of December 1989).

During the period 1980 to 1990, the Center considerably expanded its collaboration and program activities. Twenty-three research institutions, comprising 17 NARSs and 6 IARCs, in 13 developing countries are currently collaborating with TARC. Several research projects initiated during the earlier stage were completed during this period.

The types of research of the Center are divided into two groups: (1) studies aiming at the improvement of agricultural technologies relating to specified subject matters; and (2) studies on comprehensive themes which cannot be dealt with easily as the above and usually require an interdisciplinary approach. In the second stage, the latter type of research projects has been greatly expanded.

In brief, the Center's activities during the second ten-year period may be characterized by the following distinctive features: (a) major expansion of the program activities; (b) institutionalization of the Center's collaboration with the associated institutions overseas; and (c) formulation of an official mechanism for integrating the Center's activities with the whole national research system of the MAFF.

Toward collaborative research development for the mid-term future

In planning and directing TARC's operations, the current changes of the global food situation as well as the recent advances in agricultural technologies attained in some research fields in developing countries will have to be taken into consideration. Considering the need for the development of sustainable agriculture in the tropics and subtropics, special attention will also have to be paid to agriculture and forestry from the viewpoint of the protection of the environment. Against this background, the research needs in the third world agriculture are now increasingly related to more complicated and difficult matters to deal with. These are the very issues in which the TARC is requested to be involved in collaboration with research institutions in developing countries. Some examples of those subjects are as follows:

- Methods for reliable and economically viable plant protection to control diseases and insect pests with emphasis on biological control;
- Appropriate technology to significantly increase crop yields with low-level application of chemical inputs;
- Wider utilization of agricultural products;
- Exploitation of new genetic resources and identification of their usefulness;
- Preservation of eco-systems and environment in agriculture and forestry;
- Analyses of comparative advantages of production of a given agricultural commodity and research implications;
- Commercialization of agricultural products vs. subsistence agriculture;

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RESEARCH DIVISION I

Dr. Terunobu Hidaka, Director

Profile of TARC Divisions

RESEARCH DIVISION II

Dr. Takeo Yamaguchi, Director

The Research Division I, which was established in 1970 at the same time as TARC, was the only Division entrusted with research at the Center. Even earlier in 1966 and 1967, overseas researchers had already been dispatched to Thailand and Sri Lanka as a starting point of the activities of the Division, when the Center operated as a unit or an office for research on tropical agriculture, respectively.

Presently, the Division consists of 34 staff members, out of which 17 are sent on a long-term basis to carry out collaborative research in institutions located in 8 countries in tropical Asia, Africa and Latin America. The research subjects carried out by this Division encompass a broad spectrum of disciplines, including crop breeding, cultivation, physiology, ecology, plant protection, soil conservation, post-harvest technology, etc. The target crops include rice, maize, sorghum and legumes.

Research pertaining to animal husbandry covers grasslands, animal production and animal health. The research projects in which significant contributions have been made include the control of pests and diseases affecting lowland rice, prevention of mycotoxins contaminative in maize, grasslands and animal production systems, rainfed agriculture in the semi-arid and arid areas, improvement of stress resistance of vegetables, and utilization of genetic resources of wild species.

Research collaboration with the international agricultural research organizations, i.e. IRRI, ICRISAT, ILRAD and CIAT, which is currently underway will be further promoted.

The purpose of Research Division I is to carry out original studies relevant to the development of appropriate technology to achieve sustainable production of agriculture in the tropics and subtropics.

Born in Miyazaki in 1931. Graduated from Entomology Dept., Kyushu University. After research work in national agriculture research stations, he joined TARC as a founding staff and was dispatched to Thailand for duties between 1968-79. His main contributions include the ecology and control of a major rice pest in the tropics, the rice gall midge. Between 1980-83, he was appointed as JICA Expert of Plant Protection Project, Dept. of Agriculture, Indonesia to undertake rice pests control programs. He has been a recipient of Awards from Tropical Agriculture Society (1973), Japan Applied Entomology and Zoology Society (1984) and Minister of Agriculture (1990).

The Research Division II, which consists of 10 staff members, was established in July 1975 with the following mandate: "To carry out experimental research for the development of systematized technology required for the development of agriculture, forestry and animal husbandry in the tropics and subtropics".

Presently, two joint projects are being implemented:

1) "Systematization of production technology for rice double cropping in the Muda irrigation area in Malaysia", involving a variety of fields such as rice breeding and cultivation, weed control, plant protection, agricultural engineering, farm mechanization, farm management, etc.

2) "Utilization of unexploited genetic resources in Yunnan Province, People's Republic of China, including breeding of high-yielding rice varieties resistant to cold weather and diseases". This project is implemented with close collaboration with plant breeders and experts in plant protection.

In future, research objectives of this Division will be expanded to include the systematization of production technology for upland crops to promote the intensive utilization of upland and paddy fields.

For the systematization of technology, the integration of systematized individual techniques is a prerequisite. Moreover, it is essential that such a systematization become firmly rooted in a given area.

Plant Pathologist. Born in Nagasaki in 1933. Graduated from Kyushu University. His research career was with Sugar Beet Research Institute, Kumamoto and Sapporo (1961-73), Hokkaido Nat'l Agr. Exp. Station (1973-81), TARC (1981-86) and Chugoku Nat'l Agr. Exp. Station (1986-88). During the above period, he was appointed as JICA Expert for Agricultural Research Cooperation Project at the Central Research Institute for Food Crops, Bogor, Indonesia (1979-81), and guided Indonesian research in the area of soybean diseases. He joined TARC in 1981, was Head of Research Planning (1983-86) and assumed the present position in 1988. His major research subjects are: Ecology of soil-borne fungal pathogens, i.e. Pythium, Corticium and Rhizoctonia solani, on sugar beets, soybean and vegetables.

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- Village structure and its implications for agricultural development in developing countries.

All these matters require basic data and information which can be accumulated only through research activities with a long-term perspective.

In view of the Center's mandate as stated earlier, it should be a basic approach for the TARC and its collaborating institutions to formulate and conduct a "joint" project. In so doing, special efforts will have to be made by the TARC, the collaborating institutions and the concerned parties in the following matters:

(a) Setting up research priorities to maximize the efforts under limited resources available;

(b) Establishing a written contract or a similar document between the TARC and the collaborating institutions for the implementation of each joint program/project;

(c) Defining a framework, designing a work plan and establishing strategies for the implementation of each program/project in greater details; and

(d) Allocating far more resources and time in preparing and formulating joint projects, prior to the implementation, as well as in jointly monitoring the progress made.

In the course of these steps, the institutionalized relationships of the Center with its collaborating institutions as well as the integrated system with the MAFF-affiliated research institutes could be well functional in practice.

In conclusion, the TARC is expected to be engaged in challenging tasks with a long-term perspective for the agricultural development of the third world. Toward this end the Center requires a further strengthened basis for close collaboration with the associated research institutions in pursuing its objective. In order to ensure continuity and lasting consistency of the collaboration, special arrangements will have to be made by all the parties concerned, including the TARC and the collaborating organizations as well.

Collaborative Research Programs of TARC in Malaysia. Part 1

Takeo Yamaguchi

In 1967, prior to the establishment of the Tropical Agriculture Research Center, the unit for research on tropical agriculture had already sent researchers from Japan to Malaysian research institutions. These activities were taken over by the Center in 1970.

The collaborative research programs of the Tropical Agriculture Research Center (TARC) in Malaysia were roughly divided into two categories such as "Rice research program" and "Other research fields such as animal husbandry, forestry and vegetable crop research programs". Part 1 deals only with the rice research program in Malaysia, and other research programs will be described in the next issue as Part 2.

The rice research program of TARC in Malaysia mainly aims at improving the technology for the implementation of double cropping schemes and to remove some of the constraints which offset the benefits derived from this practice.

The Muda irrigation scheme which is Malaysia's largest rice double cropping project covers a flat, coastal, alluvial plain of 100,000 ha in surface area straddling the States of Kedah and Perlis in the northwestern part of Peninsular Malaysia.

To promote the development of the Muda irrigation scheme by alleviating various constraints, TARC has been cooperating with Muda Agricultural Development Authority (MADA) by undertaking joint surveys and studies and by providing a number of research scientists specialized in rice agronomy, agricultural engineering, farm mechanization and farm management and agricultural economics. On the other hand, TARC has also cooperated with the Malaysian Agricultural Research and Development Institute (MARDI) by undertaking joint studies on rice breeding of resistant varieties for tungro virus disease and control of pest and diseases associated with the promotion of rice double cropping and by providing a number of research scientists such as rice breeders, entomologists, plant pathologists and weed scientists.

These joint surveys and studies have involved a multidisciplinary approach for the establishment of an elaborate infrastructure, the adoption of complex agronomic practices to use as efficiently as possible the inputs available as well as concerted efforts to foster the understanding and cooperation of the rural communities.

On the other hand, TARC has undertaken some specific research projects relating to rice double cropping in Malaysia as follows:

1. Mechanization of rice cultivation in the tropics. (1973-1977)
2. Mechanization of farm operations in the paddy growing areas of the tropics. (1978-1982)
3. Promotion of rice double cropping through rationalization of system water management and farming systems in the lowland tropics. (1983-1987)
4. Methods of control of diseases and pests associated with the promotion of rice double cropping in the tropics. (1985-1989)
5. Promotion of rice double cropping through direct seeding culture in the tropics. (1988-1992)

Highlights of the collaborative research relating to the rice research programs in Malaysia during the period from 1967 to 1989 are as follows:

1. Farm mechanization: Trials on the development of rice transplanters and harvesters adaptable to the Muda area were carried out initially by the farm mechanization team. In the transplanting operation, the four-row walking type transplanter was found to display a high performance. The final model of the head-feeding combine harvester with combined use of a shallow tilling drive harrow is suitable for the operation, as it is associated with minimal grain loss under the soft ground conditions of the Muda area. However, compared with the large combine harvester, the efficiency, economy and durability are inferior. The farm mechanization team carried out trials for the development of a series of attachments for tractors, including several types of cage wheels, float-strakes and both chopping and rotary types of drive harrows. These instruments were highly effective for land preparation in the Muda area.

Throughout the studies on farm mechanization, the results obtained suggested that the introduction or simple modification of the technology adopted in temperate countries was not compatible with the conditions prevailing in the Muda area. It was also deemed important to combine harmoniously "software" fields such as plant breeding, methods of cultivation and fertilization, control of pests and diseases, farm mechanization and management with "hardware" components such as construction of irrigation and drainage facilities and farm roads as well as field consolidation.

2. System water management and farming systems: In the Muda irrigation area, a yield increase per unit area of about 24% was achieved during the 14 years period since the beginning of the double cropping practice through the introduction of higher-yielding varieties and the application of large amounts of fertilizer. However, after the double cropping practice spread to the whole area, the yield became extremely unstable mainly due to the insufficient supply of irrigation water and severe occurrence of rice tungro disease associated with year-round cultivation with erratic schedules caused by the low canal density, the labor shortage and the farmers' attitude to scheduled cropping, as well as heavy application of fertilizer.

To overcome the yield instability a new double cropping system based on transplanting cultivation involving a complete fallow period to be implemented over the whole Muda area during the dry season was proposed. It was eventually recognized that for the implementation of this double cropping system, water management in an irrigation system with reservoir should function effectively from the water source to the terminal lots.

3. Rice double cropping through direct seeding culture: Recently, direct seeding culture has been disseminated to more than 60% of the rice-producing area of the Muda area. Since 1988, TARC and MADA have been carrying out studies on the promotion of rice double cropping through direct seeding culture.

Overview of vast paddy, Muda irrigation area, State of Perlis (Photo by the courtesy of MADA)

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