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Newsletter

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Agroforestry in Mindanao, the Philippines.
(Photo by Y. Matsumoto, TARC)

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FOR INTERNATIONAL COLLABORATION

TARC
TROPICAL AGRICULTURE RESEARCH CENTER

New TARC Visiting Research Fellowship Program

Toshio Kobayashi

Unlike most of the other international collaboration programs funded by the government of Japan which are implemented under government-to-government agreements, TARC's programs have been formulated under direct agreements between the Center and individual overseas institutions to promote the development of technology pertaining to agriculture, forestry and animal husbandry in the host countries. Under the institution-to-institution memorandum of understanding TARC dispatches researchers to the respective countries to undertake specific projects in collaboration with their counterparts. It is also stipulated that TARC should provide the former counterparts with the opportunity to spend a certain period of time in Japan to become acquainted with specific methods required to further promote and improve the collaboration.

Under the existing scheme, in the fiscal year 1990, a total of 143 TARC researchers were sent to Asian countries mainly and a small number to Latin American and African countries. The researchers on long term assignments normally stay abroad for a minimum of two years to complete their projects. Other researchers go overseas on a short term basis (one to three months) to carry out studies on a small scale or to assist the researchers staying overseas for a long period of time. In 1990, 40 researchers were sent on a long term basis and 104 went overseas for short assignments. About ten counterpart researchers from various countries as well as research administrators were invited to participate in the programs sponsored by TARC, including study tours for administration staff, special studies, international seminars and symposia for scientific purposes. Recent trends in research on agriculture and forestry call for the shift to more basic areas to assimilate findings and technologies developed in advanced scientific research communities. In addition to the traditional areas of agronomy and forestry sciences, applications of basic research on molecular genetics, as well as biochemical, physiological, and even physical processes pertaining to biological fields have become essential for addressing more complex problems confronting the present-day demands for agriculture and forestry development and environmental conservation on a global scale.

New approaches and methodologies require a higher level of concentration of scientific expertise and material resources, which can not always be attained within existing institutional structure and manpower allocation.

Against this background, TARC decided to implement a new Visiting Research Fellowship Program for the fiscal year 1991. The foreign researchers are scheduled to initiate the studies in October 1992. TARC plans to invite suitably qualified researchers from abroad with a comparatively high level of expertise to participate in the projects which will be carried out at the Okinawa Branch of the Center on Ishigaki Island.

The site was selected due to the prevailing subtropical climate which is deemed suitable for conducting scientific research on subjects relevant to tropical and subtropical themes. Another advantage of the Branch is the presence of an infrastructure for basic research built up for many years since its establishment, which will be further upgraded with the new funds allocated for the Fellowship Program.

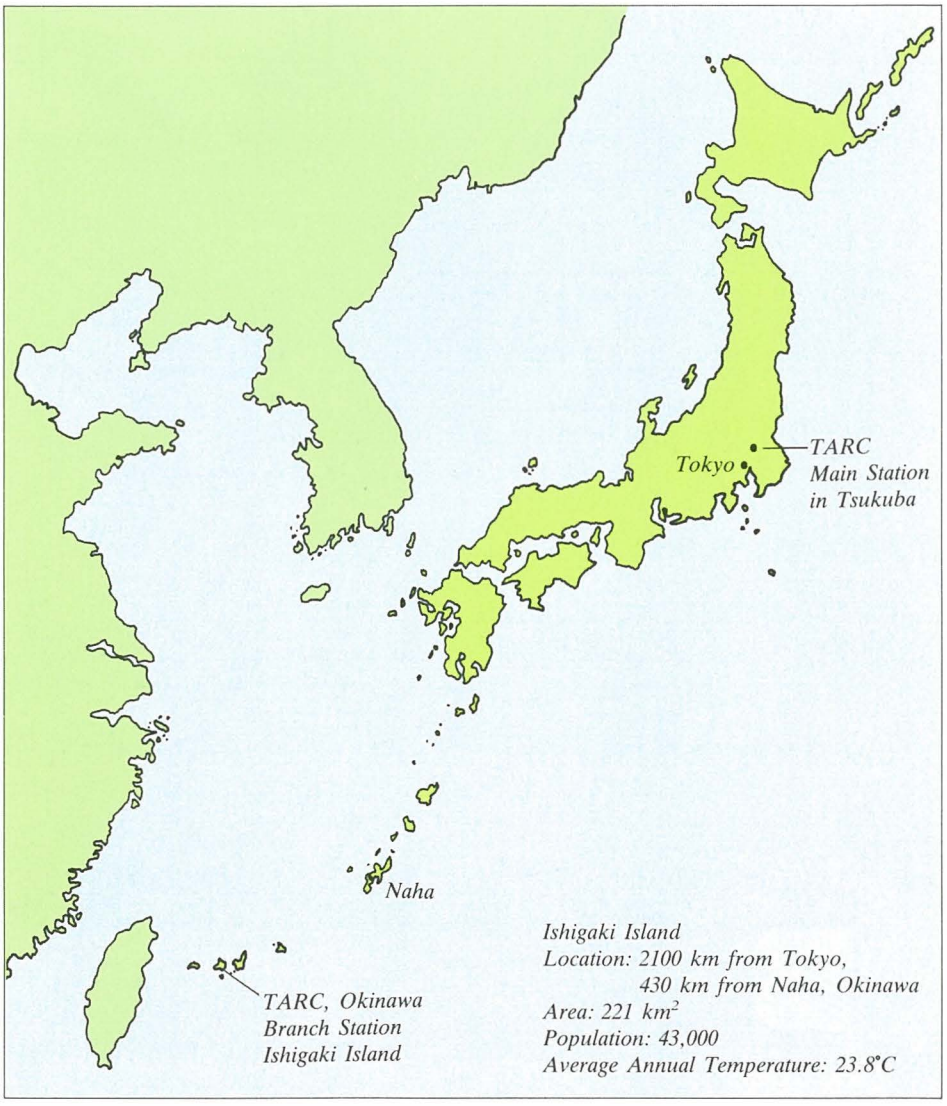
The successful applicants will undertake research in one of the four themes listed as follows:

(1) Development of techniques for environmental control by using plants and microorganisms specific to the tropics and subtropics.
(2) Studies on the mechanism of heat-tolerance of tropical and subtropical crops.
(3) Identification and evaluation of salt-tolerant crops.

Director. Research Planning and Coordination Division

(4) Evaluation and development of long-term conservation techniques of genetic resources of vegetatively propagated crops in the tropics and subtropics.

Details about the conditions of application will be announced soon after the preliminary budgetary appropriation for the 1992 fiscal year will be authorized, around January 1992.



Reassessing TARC's Overseas Collaboration in the 1990s

Yoshikazu Ohno

Since its establishment 20 years ago as a research center dealing with problems associated with all aspects of agriculture and forestry in the tropics and subtropics, TARC has devoted its efforts to contribute to the development of new scientific knowledge for technological advancement. Taking into account the vast areas of its past engagements and achievements, and also contemplating new avenues compatible with the changing global research needs, TARC management has set in motion the process of re-evaluating its priorities for worldwide activities in the coming decade. A series of discussions was started among 6 Research Coordinators with regional assignments and 7 Directors of Divisions under the leadership of Dr. S. Tsuru, Director General and Dr. Y. Ohno, Director of Research Information Division. Debates were focused on identifying the relevance of specific proposals put forward for consideration in the formulation of new action plans. Summary of the outcome of the discussions follows:

In many developing countries, where agricultural development is a prerequisite, TARC's activities should be expanded.

1. The objectives of TARC have been defined as follows: (1) To implement research programs for the promotion of agriculture and forestry in the developing countries of the tropics and subtropics. (2) To improve the research infrastructure of the cooperating research institutions as counterparts. (3) To contribute to the fostering of human resources for tropical agriculture research in developing countries. Therefore, TARC continues to plan to collaborate with the national research system of the developing countries as well as with international research organizations (IARCs).

2. It is deemed desirable to implement research programs in close cooperation with IARCs under the CGIAR system for problems beyond the scope of bilateral projects as well as for basic research subjects,

3. The main research subjects taken up in the respective developing regions of the world have been reassessed for the projects underway in 1990, and it was decided that TARC will continue to focus its activities on Asia, and pursue the activities in other regions including Africa, Latin America and the Pacific at the present level of commitment. To Africa, where the dispatch of TARC staff is still difficult, the collaboration with IARCs in Africa will be considered for research problems of mutual interest depending on the requirements.

4. TARC presently dispatches half of overseas research staff to Thailand and Malaysia. This situation is due to historical aspects of collaboration, infrastructure, living conditions and TARC's accumulated research achievements in the two countries. However, in future emphasis will be placed on the initiation of TARC's activities in other countries. Further studies are to be performed on such possibilities.

5. TARC assigns *de facto* representatives in Thailand and Malaysia to coordinate activities there. To facilitate their role, their status and suitable accommodation with the host countries need to be negotiated. Presently, national centers cannot operate readily as regional centers. It is, however, desirable that the representatives promote coordination to carry out such programs to benefit the host country as well as her neighbors.

6. The new Visiting Research Fellowship Program, which will be initiated aiming at frontier research at the Okinawa Branch of TARC from 1991 and in which researchers will be invited actually from 1992, is expected to play a complementary role in TARC's research collaboration overseas. Intensive planning is required for the implementation of this new program.

7. In the official formulation of TARC's research projects, the results of the present studies carried out at the regional and national level worldwide and on important subject areas have to be carefully taken into account. Multidisciplinary approaches should be encouraged for improved efficiency and enhancement of scientific standards of research. This possibility will have to be further explored. (Director, Research Information Division)

Director General of Thailand DOA, Visited TARC

Dr. Tanongchit Wongsiri, the Director General of the Department of Agriculture (DOA), Ministry of Agriculture and Cooperatives, Thailand, was officially invited to visit TARC during the week of June 16-23, 1991. The invitation aimed at holding discussions for further promoting the research collaboration between the DOA and TARC which has yielded major achievements covering a wide scope of agricultural fields for the past 23 years.

Dr. Tanongchit and Dr. S. Tsuru (the Director General of TARC) discussed a broad range of subjects including: 1) Participation of Thai visiting scientists in the newly established Visiting Research Fellowship Program at TARC Okinawa Branch, and 2) Future plans for TARC-DOA collaborative research programs, with emphasis placed on crop production and protection.

Dr. Tsuru appreciated the DOA's continuous support extended to TARC's Bangkok Office (Dr. Yoshimi Ueno, Representative), which was opened in 1989 to promote efficient coordination and liaison with the DOA and other agricultural research institutions of Thailand.

Dr. Tanongchit (right) and Dr. Hidaka (left) at an experimental field in Tsukuba.

≪Insect Pest≫

Natural enemies suppress planthopper population in the paddy fields of the Muda area, West Malaysia

*T. Wada, T. Watanabe, K. Tanaka and M. N. Nik**

The Muda irrigation scheme is the largest rice bowl area of Malaysia. It comprises 96,000 hectares of paddy fields and accounts for about 50% of the national rice production. After the construction of the irrigation system, double cropping of rice was first implemented in 1970 and since 1974 over 90% of the fields could be double-cropped. The increase of the cropping intensity together with the promotion of fertilization and the introduction of high-yielding varieties resulted in the modification of the field environment and an increase in the severity of the rice pest situation. The collaborative research project between TARC and Malaysian Agricultural Research and Development Institute (MARDI) entitled "Studies on the Incidence and Ecology of Major Insect Pests in Relation to the Implementation of Rice Double-cropping in Malaysia" was conducted from 1985-1990. Analysis of the population growth mechanism of the planthoppers, the brown planthopper *Nilaparvata lugens* and the white-backed planthopper *Sogatella furcifera* was one of the main objectives in this project.

Although the planthoppers were a potential serious threat to rice production in Muda, population levels of the planthopper were usually low. It seemed that various natural enemies successfully suppressed the planthopper population there. Serious outbreaks of planthoppers often occurred in the fields where the field environment had been considerably disturbed. A good example of such fields was the paddies where farmers had unnecessarily applied insecticides. A higher hopperburn occurrence was also recorded in the fields which were seeded just after the crop-free fallow period before the 1st crop every year. In such fields the densities of the natural enemies were often extremely low as compared with ordinary fields at the same rice stages. Imbalance of densities between the planthoppers and their natural enemies seemed to promote the rapid increase of planthopper population and finally hopperburn.

Egg parasitoidds seemed to be the most important natural enemies among parasitoids and parasites of the planthoppers. The predominant egg parasitoids included two genera of tiny wasps, *Anagrus* and *Oligosita*. *A. optabilis*, *O. naisa* and *O. aesopi* parasitized the eggs of the brown planthopper. *A. flaveolus*, *A. perforator* and *O. aesopi* attacked the eggs of the white-backed planthopper. Percentages of planthopper eggs parasitized by either genera ranged from 10-80% depending on the fields and periods. In general parasitism by these wasps increased with the progression of rice growth, and reached usually a value of more than 50% in the later stages. Parasitism by drinid wasps and twisted-winged parasitoids, elenchids which attack nymphs and adults of the planthoppers was also common in Muda. The proportion of planthoppers parasitized by these nymphal parasitoids, however, was usually less than 20%. These nymphal parasitoids were less effective on the planthopper population.

Spiders and the small water bug, *Microvelia* were the predominant polyphagous predators in the paddies. Most spiders belonged to the four families, Lycosidae, Linyphiidae, Tetragnathidae and Araneidae. Spiders and *Microvelia* were observed even immediately after rice seedling growth at the density of a few to several individuals/m^2. The densities of these predators increased with the progression of the rice stages and reached a maximum after the flowering of rice (usually a few or sometimes several hundred/m^2, respectively). Other common polyphagous predators in the paddies were mirid bugs, Coccinelids, Carabids, damselflies, etc., but their densities were much lower than the planthopper density except for the mirid bugs which sometimes increased markedly in number, especially at the time of planthopper outbreaks.

It is difficult to evaluate the role of polyphagous predators as natural enemies of the planthoppers because we do not know how many planthoppers were killed by the target predators. We analyzed the survivorship of small nymphs of planthoppers, using age-specific planthopper population data obtained periodically in various fields. The results showed a clear relationship in that the survivorship of small planthoppers decreased when the density of spiders or *Microvelia* increased. These results suggest that spiders and *Microvelia* contributed significantly to the suppression of the planthopper population.

* Malaysian Agricultural Research and Development Institute (MARDI), Alor Seter, Malaysia

Egg parasitoid, Anagrus adult wasp

Normal eggs of white-backed planthopper (top) and parasitized eggs (middle and bottom) (Phot by T. Wada)

≪Crop Production≫

Development of a sexually reproducing tetraploid line for breeding apomictic guineagrass

H. Nakagawa, N. Shimizu*, H. Sato*, T. Momonoki* and H. Nakano**

Apomixis, an asexual method of reproduction, provides a method for cloning plants through seed. One of the main advantages of apomixis is that it enables the development of hybrids or genotypes that breed true regardless of heterozygosity, which simplifies commercial seed production.

Guineagrass (*Panicum maximum* Jacq.) is an apomictic grass native to tropical Africa. Breeding of guineagrass is difficult unless plants with sexual reproduction (hereafter referred to as sexual are) available for hybridization. Such plants both at the diploid level (2n=16) and at the tetraploid leve (2n=32) have been reported. However, most guineagrasses are tetraploid and apomictic.

In Japan, about 140 accessions of guineagrass were collected in East Africa by S. Hojito and T. Horibata under the project sponsored by the Tropical Agriculture Research Center during 1971-1973. Among them, one diploid obligate sexual strain,

73-1126 (GR 297), was identified and this accession was early-flowering and grew rapidly.

The most efffective way to use the tetraploid apomictic germplasm is to cross it with sexual tetraploids. Therefore, the major objective of the study was to double the chromosome number of sexual diploid GR 297 by colchicine treatment and develop tetraploid sexual lines so that a guineagrass breeding program could be established.

In 1986, germinating seeds of GR 297 were treated with 0.1% colchicine for 4 hours. Seedlings from 88% of the 660 seeds treated died, while 3 tetraploids were obtained. The induced tetraploid sexual plants were placed in a separate greenhouse and were open-pollinated. In 1987, all the 26 progenies obtained were found to be tetraploid and sexual. Eight selected plants of this type were open-pollinated in a separate greenhouse and eight maternal lines were developed by collecting seeds from each plant. In 1988, three lines were selected and designated as Col 1-1, Col 1-2, and Col 1-3. In 1990, a promising line, Col 1-3, was renamed "Noh PL 1" guineagrass after the evaluation of the lines and progenies from hybridization between sexual lines and apomictic germplasm. The "Noh PL 1" guineagrass is tetraploid (2n=32) and can reproduce sexually by cross-pollination. It is annual and grows rapidly though most of the guineagrasses are perennial and grow slowly. This line crossed with apomictic tetraploids should produce vigorous apomictic hybrids which are true breeding and could rapidly be incorporated into a testing program for desirable characteristics. The sexual X apomictic crosses should also produce sexual progeny with a modified genotype. The new sexual plants will be extremely useful for broadening the genetic base of sexual female parents. Preliminary data indicate that the hybrids between "Noh PL 1" guineagrass and apomictic males grew fast and the productivity in the first growing season was high though the productivity of the line itself is not very high. The hybrids between annual and perennial are perennial and some show hybrid vigor.

This true-breeding induced tetraploid sexual line propagated by seed should enable the development of an effective breeding program in *Panicum maximum*.

* TARC Okinawa Branch Station

"Noh PL 1" guineagrass at the flowering stage. (Photo by H. Nakagawa)

≪Forestry≫

Growth of trees planted in degraded forest land

*S. Sakurai and L. U. De la Cruz**

Forest land is important for local people as farming site. However, since the land is usually inclined, farming activities in such an area are apt to cause land degradation. Degradation of vast forest lands in tropical regions exerts an adverse effect on the global environment. To recover the land productivity in such degraded areas, re/afforestation is the most reliable method. Tree growth is one of the important indices of land productivity.

Grazing of cattle in burnt Acacia plantation

Therefore, we attempted to analyse the effect of tree growth reflecting the improvement of the productivity by planting fast-growing tree species in a markedly degraded area, in Carranglan, central Luzon island, the Philippines.

In Carranglan, the annual average temperature is 26.8°C and annual fluctuations of the monthly average temperature are about 4.1°C. The rainfall pattern is characterized by heavy rain during the rainy season, with 89% of the total rainfall occurring from May to November, while there is almost no rain during the dry season, from December to April.

Grasses wither in the dry season, but burning results in a flush of new leaves even in the dry season which are palatable fodder for grazing cattle. Farmers around the surveyed area often burn the vegetation for cattle grazing. Such pressures on the land lead to a rapid decrease of the productivity. In addition, heavy and strong rain washes away the field surface while repeated burning prevents the growth of woody vegetation. Finally, the land becomes bare, being exacerbated by the long dry season.

Afforestation attempts in Carranglan were initiated in 1977 under a project between Japan and the Philippines sponsored by the Japan International Cooperation Agency (JICA). More than 24 tree species were planted in order to identify species suitable for such a degraded land. Many seedlings died due to drought and soil compaction. Since 1981, a site has been prepared by using a bulldozer with a three-blade-ripper and mechanized backhoe in gentle slopes, to dig up large holes, 30cm x 30cm x 30cm. These efforts improved the physical soil properties, resulting in good adaptation of *Acacia auriculiformis* and *Gmelina arborea* (yamane) to the environment.

Growth of *Acacia* trees in the stand established in 1981 was satisfactory and the canopy has already closed. The average annual increment of volume is about $10m^3$ which is by no means inferior to values recorded in forests in Japan. The growth of young *Acacia* trees in the stand established in 1984, on the other hand, was not satisfactory. Since the site conditions of both stands were very similar, it is suggested that the productivity in the former *Acacia* stand may have been improved by the growth of the legume tree species.

Also, it is generally considered that once a tropical forest is destroyed, regeneration of the same kind of forest is very difficult. Since the rehabilitation of indigenous vegetation is impor-

(Continued on Page 6)

The Organization of Tropical Agriculture Research Center *143 staff (104 scientists) 1 Oct. 1991*

Director General *Dr. S. Tsuru*

- Planning and Coordination Division *Dr. T. Kobayashi, Director* (7)
  Planning of the research projects, overseas research implementation, liaison and coordination of cooperating institutions both in Japan and overseas, organization of international symposia, invitation of counterpart researchers and senior research administrators from overseas.
- Research Information Division (since 1985) *Dr. Y. Ohno, Director* (14)
  Management of information on tropical agriculture. Information retrieval through survey missions and document analyses to file databases necessary for project organization and evaluation, coordinated by Senior Research Coordinators. Publication, documentation, library and audio-visual services.
- Research Division I (since 1970) *Dr. T. Hidaka, Director* (30)
  Implementation of overseas research projects under agreements with counterpart institutions and IARCs, covering a wide range of disciplines including agronomy, crop breeding, physiology, ecology, plant protection, soil science, water management animal health and production, forestry/agro-forestry, food technology and others.
- Research Division II (since 1975) *Dr. T. Yamaguchi, Director* (10)
  Large scale programs for the promotion of farm production systems in tropical countries integrating a wide range of techniques developed under joint research with counterparts. Comprehensive studies aiming at integrated development of agriculture, animal husbandry and forestry.
- Eco-Physiology Research Division (since 1987) *Dr. N. Murata, Director* (16)
  Basic studies on physiology and genetics underlying agricultural productivity in the tropics. Studies on the functions of crop plants, livestock and their microbial symbionts adapted to tropical/subtropical climate.
- Marginal Land Research Division (since 1988) *Dr. M Araragi, Director* (11)
  Studies on the structure and functions of agro-environmental resources, land and water in the marginal areas of the tropics/subtropics in particular, aiming to promote the utilization of such resources and areas under constraints for agriculture, animal husbandry and forestry.
- Okinawa Branch (since 1970) *Dr. M. Nara, Director* (34)
  Experimental research to solve problems relating to agriculture in the tropical zone, including crop improvement and protection, agronomy, soil management and tropical fruits production, under the subtropical climate of the Ryukyu Islands, and to link such research results to the research pursued overseas.
  Visiting research fellowship program starts.
- General Affairs Division *Mr. M. Shimizu, Chief* (20)

Young palosapis in Acacia plantation

(Continued from Page 5)

tant we analysed the growth of two dipterocarp species, *Anisoptera thurifera* (palosapis) and *Shorea guiso* (guijo), planted under *Acacia* trees in 1984.

The average annual increment of height of these dipterocarps ranged from 30cm to 40cm. Although they were planted in the shade and in a markedly degraded site, growth steadily improved year by year and the height of some trees exceeded 4m. If such a growth can be maintained, it is anticipated that an artificially regenerated dipterocarp forest could be established in Carranglan. To achieve this objective, it is essential to obtain more information on silvicultural techniques such as thinning level for light control, timing of removal of nurse trees, methods for the enrichment of species diversity, density control, etc.

* College of Forestry, University of the Philippines, Los Banos, The Philippines

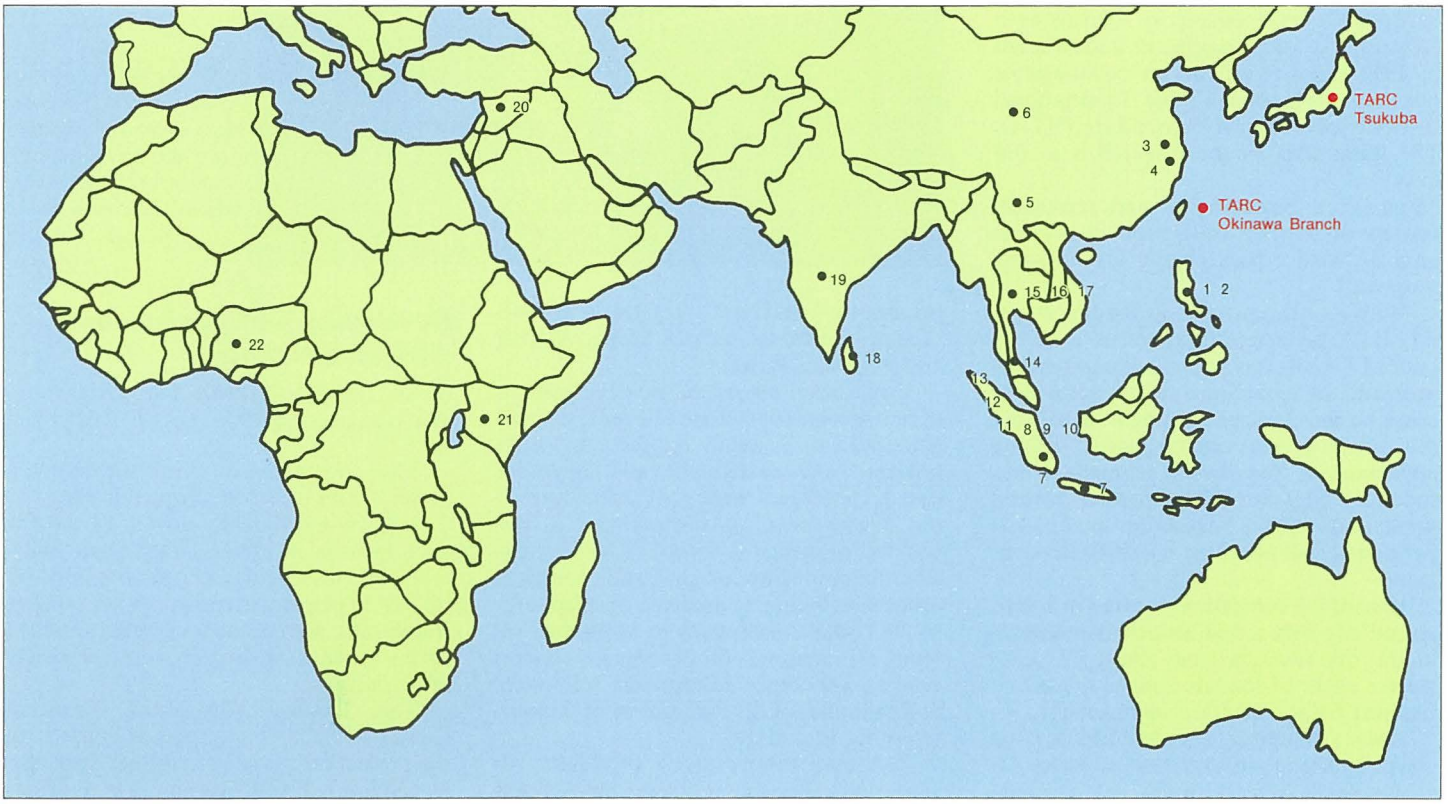
TARC New Research Projects Overseas

Seven overseas research projects newly set up by TARC are in progress for the further development of tropical agriculture and forestry research. Several projects listed below are expected to start within the year 1991.

1. *Ecological studies on long-distance migratory insect pests of rice in the monsoon area of East Asia (China)*
2. *Dynamic behavior of soil erosion degradation and development of techniques for prevention of erosion in tropical land uses (Pakistan)*
3. *Ecological studies on Palawija crops in relation to farming systems (Indonesia)*
4. *Pedological characterization of lowland areas in the Philippines (the Philippines)*
5. *Ecophysiological research on adaptation of tropical tree species to environmental stresses with emphasis on water relations of dipterocarps (Malaysia)*
6. *Studies on the ecological characteristics and methods of control of insect pests of trees in reforested areas in Indonesia (Indonesia)*

TARC research staff on long-term assignments in the research institutions overseas

(34 research staff, 20 August 1991)



1. College of Agriculture and of Forestry. University of the Philippines, Los Banos, The Philippines
2. International Rice Research Institute (IRRI), Los Banos, The Philippines
3. Horticulture Research Institute. Shanghai Academy of Agricultural Sciences, Shanghai, P. R. China
4. National Rice Research Institute, China Academy of Agriculture Sciences Hangzhou, P. R. China
5. Yunnan Academy of Agricultural Sciences, Kunming, Yunnan, P. R. China
6. Xinjiang Institute of Biology, Pedology and Desert Research, Chinese Academy of Sciences, Urumqi, Xinjiang, P. R. China
7. Forest Research and Development Center, Reforestation Technology Center, Benakat, Bogor, Indonesia
8. Malaysian Agricultural Research and Development Institute (MARDI), Serdang, Malaysia
9. Agricultural University of Malaysia (UPM), Serdang, Malaysia
10. Forestry Research Institute Malaysia (FRIM), Kuala Lumpur, Malaysia
11. MARDI Jalan Kebun Station, Kelang, Selangor, Malaysia
12. Rice Research Center, Seberang Perai, Malaysia
13. Muda Agricultural Development Authority (MADA), Alor Setar, Malaysia
14. Narathiwat Animal Nutrition Research Center, Narathiwat, Thailand
15. Department of Agriculture, Bangkok, Thailand
16. Department of Agriculture, Kasetsart University, Bangkok, Thailand
17. Department of Forestry, Kasetsart University, Bangkok, Thailand
18. International Irrigation Management Institute (IIMI), Colombo, Sri Lanka
19. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad, India
20. International Center for Agricultural Research in the Dry Areas (ICARDA), Aleppo, Syria
21. International Laboratory for Research on Animal Diseases (ILRAD), Nairobi, Kenya
22. International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria

23. Centro Internacional de Agricultura Tropical (CIAT), Cali, Colombia
24. Centro Internacional de Papa (CIP), Lima, Peru
25. Universidade Estadual Paulista, Botucatu, Brazil

Collaborative Research Program of TARC with IITA

I. Watanabe

TARC's involvement in African agriculture on a long assignment basis started in 1990 when it initiated a collaborative research program with the International Institute of Tropical Agriculture,(IITA). The framework of the research is as follows:

"Studies on physiological and ecological aspects of cowpea cultivation in savanna area of West Africa chiefly for breeding purpose."

With its headquarters in Ibadan, Nigeria, IITA an agricultural research center under CGIAR, has actively worked on the problems of agriculture in the areas centered on the African Continent, especially the western and central parts. Taking advantage of the diverse climatic zones found in Nigeria, IITA operates several substations within Nigeria as sites of experiments adapted to specific environments.

One of the substations located in Kano, an old city with a few historic monuments in the dry savanna zone about 900 kilometers north of Ibadan, started the activities just before TARC's involvement.

Kano substation is expected to develop cowpea varieties and agricultural technology for small holders in the dry savanna, covering central and West African countries. The main objectives are 1) breeding of cowpea varieties adapted to intercropping based on millet, sorghum or maize, 2) physiological studies on drought, water-management and heat tolerance, 3) control of special diseases such as Striga, Alectra and bacterial blights.

Emphasis is placed on the development of technologies which are relevant, sustainable and can be easily adopted by smallholders. Such sustainable and minimum cost technologies may also contribute to the development of technologies in developed countries in future. TARC scientists will cover physiological and ecological aspects including 1) analyses of adaptability of cowpea genotypes to cropping systems, 2) analyses of differences among cowpea genotypes in drought tolerance, and 3) studies of the mechanism of drought tolerance of cowpea.

The opportunity given to TARC to work on challenging problems through the collaboration with IITA should contribute to the improvement of cowpea and its cultivation for further application to the conditions prevailing in the Sahel, a wide dry zone crossing the African Continent.

New facility for cowpea research by IITA at the Kano campus of Nigeria's Institute for Agricultural Research (foreground), which has its main station in Samaru, Northern Nigeria.

Cowpea at the Kano campus, Northern Nigeria.

Developing Cowpea for the African Savanna

S. R. Singh (Grain Legume Improvement Program, IITA)

The drier areas of West Africa are a major center of world cowpea production. Cowpea is traditionally grown by subsistence farmers in mixed cropping or intercropped with cereals, such as sorghum and millet. Management practices are mainly traditional, with no or low modern inputs, access to which is severely constrained for most farmers.

The Tropical Agriculture Research Center (TARC) has provided support to the project on cowpea physiology research, by sending a TARC scientist, Dr. I. Watanabe, to Kano since January, 1990. The project will establish facilities for studies on cowpea's adaptability in mixed farming, and its microbiology and nutrition, to better understand limitations to increased productivity in traditional and improved cereal/cowpea systems.

More specifically, Dr. Watanabe will study:

- relationships between carbon isotope discrimination, assimilation and transport and the potential use of carbon isotope discrimination in breeding for improved water-use efficiency;
- phosphorus and nitrogen nutrition of cowpea and associated cereals in traditional and improved system; and
- adaptability of growth habit in cowpea to mixed cropping.

IITA is pleased with its collaboration with TARC and hopes that the Center will devote more years of productive scientific endeavors.

LETTER TO THE EDITOR

Dr. George Kuo (AVRDC) asks TARC to inform that it plans to organize an international symposium as follows;

August 13-18, 1992, Taipei & Tainan (Taiwan)

Symposium on the Adaptation of Vegetables and Other Food Crops to Temperature and Water Stress.

Tentative Topics for the Symposium: 1. Problems of Stress, 2. Response of Higher Plants to Stress, 3. Mechanisms of Tolerance to Stress, 4. Approaches of Crop Improvement for Stress-Prone Areas, 5. Approaches of Crop and Resource Management for Stress-Prone Areas, 6. Future Research Needs and Priorities.

Information: George Kuo, Asian Vegetable Research and Development Center, P0 Box 42, Shanhua, Tainan 74199, Taiwan (Phone 886-6-583-7801; Fax 886-6-583-0009)

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