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Newsletter

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Cultivation of potatoes in Andean Mountains (4000 m) of Peru. (Photo by K. Ishiki, TARC)

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TARC

TROPICAL AGRICULTURE RESEARCH CENTER

Insect Pest Management and Tropical Agriculture Research

Terunobu Hidaka

Director, Research Division I, TARC (since 1989).

Born in Miyazaki in 1981. Graduated from and Research Associate in 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).

Insect Pest Management for food crops has long been implemented in the tropics in collaboration with the International and National Agriculture Research Institutes to develop technologies for controlling insect populations at a level below the economic injury level (EIL) and minimizing insecticide application to avoid insect resurgence and resistance to insecticides as seen in the brown planthopper, rice stem borers, and the diamond back moth, etc. Although utilization of resistant varieties has been extensively and strongly recommended, biotype problems have also arisen as the resistance of the varieties was broken by the insect pests. Natural enemies involving parasitoids, predators and pathogens have been recognized to be effective to suppress pest populations under some conditions. However, their effectiveness is strongly affected by insecticide application and cultivation of food crops. Although the conservation of natural enemies attacking insect pests is certainly important, technologies for conservation have not been established yet under field conditions.

As a matter of fact, although the term "IPM" is a clear concept for managing insect pests, the complete eradication of insect pests under field conditions has not been achieved, in spite of the adoption of advanced technologies for control in the case of pests. The insect pests existed long before man on the earth, and they were able to survive due to their high functional adaptation to environmental stresses. The specific functions of insect pests should be clarified and could be utilized for control measures.

In the Insect Pest Management program, efforts for suppressing insect pests have involved forecasting including monitoring for early detection of pest occurrence, cultural practices, biological control, utilization of resistant varieties, insecticide control, physical and mechanical control, genetic control, and communication disruption using sex pheromones, etc.

The effectiveness of Insect Pest Management in suppressing insect populations is limited by the following factors: fluctuation of population density of pests, erratic weather conditions, unreliable forecasting of insect occurrence, and insufficient information on interaction mechanisms among insects inhabiting crop fields. Therefore, insect management has been implemented for major insect pests. This method resulted in creating other problems as minor insects became major pests.

Now, in the attempt to develop new technologies for control, various approaches can be considered. At first, studies on insect behavior should provide useful information on the inhibitory and stimulating factors that affect behavior. For example, in the migratory insect pests i.e. the desert locust and the oriental migratory locust, the gregarious form shows significantly longer flight hours than the locust in the solitary form. Both forms are morphologically different in their body colour and size, and feeding behavior is more active in the gregarious than in the solitary.

If key factors regulating the flight behavior of the locusts could be analysed with emphasis placed on the substances controlling the flight, this information could be applied not only to the control of locusts but also to that of other insects. Research on the physiological factors regulating insect behavior is essential for the development of new control measures.

Recently research programs relating to insect and plant communication, bioactive substances, antifeedants, biological clock, diel response, growth inhibitors, oviposition and hatching substances and sign stimulus have been implemented with the purpose of utilizing the highly developed functions of insects. Substances produced by the insects could be used for the control of pests.

In the Tropical Agriculture Research Center (TARC), studies on the ecology and control of insect pests of food crops have been carried out in cooperation with national institutes in the tropics. The insect pests examined were as follows, rice brown and white backed planthoppers, rice green leafhopper, rice gall midge, corn borer, rice stem borer and stored product insect pests. At present, at the Alor Setar Station of Malaysian Agricultural Research and Development Institute (MARDI), studies on the relationship between insect pests of rice and natural enemies involving the feeding behavior are being carried out in direct-sowing fields in the rice double cropping areas of the MUDA district. It is interesting to note that large swarms of black rice bug migrate only in the full moon nights. Subsequently, ethological studies on the relation to the flight behavior were conducted. At the Department of Agriculture, Thailand, the hormonal control of the inhibition of pupation caused by crowding larvae of *Tribolium freemani* Hinton is currently investigated using several types of anti-juvenile hormone agents. A plant, iris, was found to inhibit the growth of the stored pests.

A specific project on tropical agriculture entitled: "Investigations on the actual conditions of migratory insect pests of rice in the monsoon areas of East Asia" will be implemented during the period 1990 to 1994 in collaboration with tropical Asian countries. At the Laboratory of Biology, TARC, an entomologist is attempting to analyse the sources of immigrant insects to Japan using the mitochondrial DNA method. At the Laboratory of Plant Protection, the Okinawa Branch, TARC, the feeding and transfer behaviors from wild host plants to cultivated plants are studied in a coreid bug, *Leptoglossus australis*, a major pest of vegetables. The physiological factors that induce these behaviors will be analysed.

The struggle between insect pests and human beings will undoubtedly continue so far as food crops are cultivated. Will there be a possible communication between insects and us in future?

TARC International Symposium 1991 in Tsukuba on Ruminant Feed Resources and Nutrition in the Tropics

TARC has announced that TARC International Symposium 1991 will be convened in Tsukuba Science City of Japan, during 24-26 September 1991, under the title of "Utilization of Feed Resources in relation to Nutrition and Physiology of Ruminants in the Tropics". The Symposium is now being planned to cover the subjects of 1) Country Reports and Organization Strategies, 2) Analysis and Evaluation of Feedstuffs, 3) Utilization of Fibrous Feed Resources, 4) Digestion and Metabolism of Ruminants and 5) Nutrient Requirements and Management in Hot Environment.
Country Reports are being invited from China, India, Thailand, Malaysia, Indonesia and Brazil, and strategic papers will be contributed on behalf of RAPA/FAO, IDRC of Canada, ILCA and TARC.

Forestry-Agroforestry Development in CGIAR System

TAC Member, CGIAR, Mitsuma Matsui

CGIAR-affiliated international agricultural research centers have been working on agricultural commodities except for two centers dealing with social and political issues. Commodity centers have successfully developed high-yielding and pest-resistant varieties, especially for rice and wheat which led to the *green revolution* in the developing countries.

Though these studies are still important, the increase of the world population contrasting with the limit in the land area available for cultivation is another challenge for the centers.

TAC has discussed the possibility of expanding the CGIAR activities and priorities for existing and new areas of research for several years.

At the TAC meeting in March 1990, TAC was presented with the recommendations of a number of subject matter panels; banana and plantain, livestock diseases in sub-Saharan Africa, fisheries/aquaculture, natural resource management, forestry, crop protection and interfaces with national research programs.

CGIAR meeting in Washington D.C. in November 1990 decided to establish an agroforestry/forestry research center as well as other centers and introduce new research fields after discussions based on TAC recommendations. TAC recommended also to restructure the system based on a background analysis of international agricultural research. It was suggested that the emphasis on "increasing sustainable food production" should be shifted to the promotion of "food self-reliance" in the developing regions of the world. Food self-reliance was defined as the capacity of a nation to provide a sufficient stable food supply to all of its inhabitants either from domestic production or from the production of exportable goods to enable commercial imports to cover the domestic deficit.

This concept is related to the emphasis on an ecoregional approach in parallel with the world commodity approach. Land use system is largely influenced by regional ecological conditions whose characteristics and relations to crop yield have been clarified recently.

Agroforestry/forestry issues stem from the urgent need to investigate significant research problems relating to natural resource management for sustained food production and for the long-term maintenance of the land best suited to tropical and sub-tropical forests. CGIAR wished to include research on the optimal management of tropical and sub-tropical forest lands with particular emphasis on the interaction of agriculture and forestry, and the use of forest resources as an important contribution to the rural economies, energy needs, and the wealth of partner nations. TAC held an exhaustive series of consultations with agencies, other groups and individuals, and recommended an integrated agroforestry/forestry approach and a decentralized program under which some 70% of the resources would be allocated to regional and national research in agroforestry/forestry and 30% to centralized activities.

This integrated approach is derived from the concept of the importance of trees in land use, namely forestry and agroforestry should be treated as a continuum. Decentralization recognizes the importance of an ecoregional approach and the need for strengthening the national research institutes.

1) The scope and focus of the program for the new agroforestry/forestry research center, 2) institutional design, 3) location, staffing and budget, and 4) sharing of responsibilities with ICRAF are being considered by a designated working group and a conclusive proposal is to be discussed at the next CGIAR meeting in May 1991.

On this occasion, I would like to express my opinion on the new entity.

The major problem of world forestry presently is "Deforestation" which causes environmental degradation as well as degradation of soils upon which agriculture relies.

Production of timber is an important foreign exchange earning activity in developing countries. As tropical forests are composed of a large variety of tree species, only trees of marketable species and size are selectively felled, and the harvested volume is usually 30 to 60 cubic meters per ha. The remaining trees are left until smaller valuable trees grow up to the marketable size. Though this kind of exploitation of forests is not associated with deforestation, the re-growth of valuable trees is usally hindered by the presence of fastgrowing species of low marketable value and vines whose growth is stimulated by the opening of closed forest conditions. Thus exploited natural forests tend to become degraded and are the target of expansion of land for other purpose through newly opened forest roads.

To promote sustainable timber producion, it is important to develop a regeneration system of natural tropical forests and secure a source of income for the people without deforestation. Research on natural regeneration should be actively pursued in the new center.

Forests, as is well known, play an important role in the accumulation of nutrients, and organic materials in soil. This function must be well utilized to control soil degradation of farm lands. Agroforestry has been studied recently and found to be one of the most promising farming systems in the developing world. Agroforestry is a very difficult research field because it requires a close cooperation among agronomists, foresters, sociologists and economists. Thus a multidisciplinary research system should be adopted in the new center. The need for selecting multi-purpose tree species best suited to the different ecological regions has been discussed at TAC. Multi-purpose trees are tree species which fix nitrogen, can be used as a source of animal feed, fuel for cooking, composting materials, etc. Trees in farming areas may act as a wind break and erosion control barrier and improve crop yield.

Basic studies on rational land use are also important. Examples of poverty and deforestation induced by misuse of land can be seen everywhere. The characteristics and formation processes of forest soils must be studied and soils that are easily degraded should be kept under forests, while only productive soils should be exploited for farming.

Finally, since TARC was able to develop as a multidisciplinary research institute during its 20 years' history, it may become a suitable counterpart for the new agroforestry/forestry center.

Forest soil scientist. Born in Tokyo in 1920. Graduated (B.S. 1944, M.S. 1946) and received Doctorate Degree in Forestry (1974) from Forestry Dept., University of Tokyo. Engaged in forest soil surveys as senior research staff in National Forestry and Forest Products Research Institute, MAFF (FFPRI) from 1944 until 1974, and assumed Director, Research Coordination Division (1974-78) and Director General (1978-80), FFPRI. Member of Japan Science Council (1981-85), Scientific Advisor to Japan Forest Technical Association (JAFTA) (since 1980) and Vice President, The Japan Forestry Association (since 1989). Appointed as Member representing forestry sector in Technical Advisory Committee (TAC), CGIAR in 1990.

≪Plant Protection≫

A Method of Differentiating Blast Races of the *Japonica* Rice in Yunnan Province, China

Masataka Iwano, Jalui Lee, Ping Kong and Chengyun Lee

Blast disease caused by *Pyricularia oryzae* Cav. is most destructive in the rice-growing areas in Yunnan Province, China (Photo). The Use of resistant varieties is the most effective and economical method to protect rice plants from the disease. The mechanism of blast resistance is divided into two categories, i.e., "true resistance" and "field resistance". The true resistance which is characterized by the specificity to each race of the blast fungus is occasionally called vertical resistance, while the field resistance which is nonspecific, is called horizontal resistance.

Since breakdowns of highly resistant varieties dependent on true resistance genes took place frequently in several countries including China, breeding programs in these were aimed at developing a high level of field resistance rather than true resistance.

In order to develop an effective breeding program for durable resistance to blast disease, it is important to look in more detail into the pathogenic specialization of the blast fungus. The current studies were conducted to develop a set of differentials using *japonica* varieties in Yunnan Province.

Classification of Japonica rice varieties based on reaction patterns to blast fungus isolates

Two hundred twenty-six rice varieties bred at twelve agricultural science institutes in Yunnan Province, twenty-nine varieties from Japan with already known genotypes for true resistance and nine Japanese differential varieties were tested in the experiments. The varieties were inoculated with six isolates collected in Yunnan Province and classified into varietal groups on the basis of their specific reaction patterns.

Two hundred twenty-six japonica rice varieties in Yunnan Province were divided into seven groups, I to VII. Varieties of Groups I, IV and II, III were further divided into three and two subgroups, respectively.

Group I-1 corresponds to the shin 2 type in terms of the reaction pattern to blast races and each variety of Groups I-2 and I-3 may carry resistance gene(s) not yet identified. Group II-1 corresponds to the Aichiasahi type and the varieties in this group carry the gene *Pi-a*. Group III-1 correspondes to the Ishikarishiroke type or Shinsetsu type and the varieties in this group carry the gene *Pi-a* or *Pi-a* and *Pi-i*. Group IV-1 corresponds to the Kanto 51 type or To-to type, and this group may include varieties of the following three different genotypes, i.e., *Pi-k*, *Pi-a Pi-k* and *Pi-i Pi-k*. Group V-1 also corresponds to the Kanto 51 or To-to type, and this group may include varieties with the following different genotypes, i.e., *Pi-k*^{m}, *Pi-a Pi-k*^{m} and *Pi-1 Pi-k*^{m}. Group VI-1 corresponds to the Yashiromochi type and the varieties in this group carry the gene *Pi-ta*.

Twenty-eight varieties of the Group VII were found to be resistant to all the isolates inoculated. To classify them further into subgroups, the varieties of Group VII were inoculated with eight isolates which were virulent to the varieties carrying at least one of the following genes, i.e., *Pi-z*, *Pi-ta*^{2}, *Pi-z*^{t} and *Pi-b*. Varieties of Group VII were divided into four subgroups. Group VII-1 and VII-2 may carry the gene *Pi-b*, *Pi-b* and another gene or genes, respectively. Varieties of Group VII-3 may carry the gene *Pi-z*^{t}.

Rice blast occurrence. The variety in Field B Shows a high level of resistance while the variety in Field A is severely damaged. (Photo by M. Iwano)

Maize grown with (A) and without (B) plant residue mulch. (Photo by T. Inoue, NARC)

Selection of differential varieties

Several varieties in which many susceptible-type lesions were observed or which displayed a high resistance were selected from the Groups I-1, II-1, III-1, IV-1, V-1, VI-1 VII-1, VII-3 and VII-4, respectively. These varieties were inoculated with 86 isolates collected in Yunnan Province, and a total of nine varieties which may carry different resistance genes and showed a stable reaction to the isolates were selected as the differential varieties from each group. As no suitable variety carried *Pi-k*^{m}, the Japanese differential variety Tsuyuake was adopred as representative of Group V-1.

Nomenclature of the races

Gilmour's (octal) notation according to Yamada *et al*. proposal was adopted for differentiating the races. First, 9 differential varieties were arranged in the order listed in Table 3, and a code number was given to each variety. The number of each race is obtained by the additon of all the numbers coded. For example, the race virulent to Lijiang-xintuanheigu, Yunjin 20, 04-2685 and Hexi 16 is represented as 1+2+40+200=243. Y means Yunnan Province.

This method for differentiating races should contribute significantly to the improvement of the breeding programs of resistant varieties to blast disease in Yunnan province.

'H HIGHLIGHTS

Soil

Soil Improvement in Corn Cropping by Long-Term Application of Organic Matter in Ultisols of Thailand

T.Inoue, W. Cholitkul, S. Phetchawee, P, Morekul, P. Virakornphanich, P. Chogpradintnant, D. Chueysa, N. Hansakdi, T. Na Nagara, O. Suriyapan, P. Chairoj, W. Masangsan, N. Nakaya, Y. Ueno, Y. Uehara, M. Watamabe, P. Piyapongse, K. Billamas, T. Piyasirananda, T. Kubota and T. Igarashi

For sustainable upland crop production in the sub-humid tropics, where there are distinct wet and dry seasons with annual rainfall ranging from 1,100 to 1,500 mm, the soil should be well managed in terms of soil nutrients, organic matter conservation and soil erosion control. Recent continuous mono-culture such as corn, sugarcane and cassava cultivation in Thailand, does not always satisfy these conditions, hence the deterioration of upland soil productivity.

TARC has carried out a research project on the effective use of organic matter for increasing soil productivity since 1976, in collaboration work with Department of Agriculture, Thailand. The studies were mainly focused on effect of long-term application of organic matter, either through plant residue mulch or compost incorporation, on the yield of corn and on the short-term and long-term changes in the soil properties that may limit yield.

Two long-term experiments on the effects of plant residue mulch and organic matter incorporation on the growth of corn and soil ferility were carried out in Ultisols (a Reddish Brown Lateritic Soil) of Central Thailand, starting from 1976 and 1981, respectively.

Plant residue mulch (5 t/ha/year) combined with fertilizer application was remarkably effective in maintaining a higi-yield of corn throughout the expermental period. Without mulch application, the corn yield fluctuated to a great extent and decreased markedly in drought years even under chemical fertilizer application. The effect on the growth and yield was mainly ascribed to the maintenance of a suitable amount of soil moisture and the behavior of soil nitrogen.

The effect of compost application (20 t/ha/year) on the yield was negligible in the first eight years. However, thereafter, gradually the yield increased compared with that in the absence of compost application. Organic carbon and total nitrogen contents in the soil increased. The amount of soil biomass nitrogen and the content of available nitrogen (mineralizable nitrogen and inorganic nitrogen) increased with the decrease in the rate of organic matter application. Soil bulk density, water permeability, plasticity, soil hardness, aggregate formation were improved by long-term incorporation of organic matter to the soil.

Though many technical problems remain to be solved before the technology can be transferred, proper soil management consisting of the application of either plant residue mulch or compost may provide some economic answers to sustainable upland crop production under rain-fed condition in Thailand.

Breeding

Long Term Preservation of Pineapple Clones by Application of *in vitro* Culture

A. Sugimoto, I. Yamaguchi, M. Matsuoka, H. Nakagawa, S. Kato and H. Nakano

As genetic erosion of tropical crops has recently become a serious problem, the deveolopment of techniques for the preservation and propagation of such genetic resources is highly important.

A technique for long term preservation of pineapple clones was improved at TARC Okinawa Branch.

For the improvement of the efficiency of long term *in vitro* preservation, the following conditions must be fulfilled.

1. Explants must be sterilized, but a high capability of leaf development must be maintained
2. Growth of plants after leaf development must be repressed, but a high capability of growth must be maintained
3. Mutations should not be induced in any materials

To meet these conditions, we attempted to improve meristem culture as folows;

1. Axillary buds were collected from young crowns
2. They were sterilized by washing for 5 seconds with 70% ethanol and 5 minute incubation in 2% chlorine antiformine
3. The sterilized buds were placed on MS hormone-free media containing 1.5% sucrose and 1% agar in test tubes or small flasks (some buds were cultured in MS liquid media with 3% sucrose)
4. They were kept at 26°C or 32°C for leaf development
5. After leaf development, the cultures were kept at 16°C or 20°C for preservation without any subculture

At the beginning of this study, a few clones of a commercial cultivar were kept over four years in 50 ml flasks without subculture. However, with the improvement of the meristem culture technique, some clones of various varieties including a wild species were developed and were kept at lower temperatures for long term preservation. (Table 1, Fig. 1)

Thus, the application of this improved technique enabled to preserve pineapple clones for several years *in vitro*. This technique can also be used for the preservation of other genetic resources of vegetatively propagated crops in the tropics.

Pineapple clones growing in test tubes (Photo by A. Sugimoto)

Table 1. Growth of axillary buds of pineapple on MS media (temperature 26°C)

medium	Y. Mauritius			A. ananasoides			Hawaii			A. blanco		
	R.C	R.D	N.D	R.C	R.D	N.D	R.C	R.D	N.D	R.C	R.D	N.D
1	3/6	3/3	6.7	3/7	0/4		2/6	2/4	3.0	3/9	4/6	1.8
2	3/8	5/5	4.8	2/6	2/4	4.0	2/6	2/4	4.0	1/7	3/0	1.3
3	2/4	2/2	10.5	0/3	2/3	4.5	2/7	4/5	4.7	1/5	3/4	4.7

R.C: ratio of contaminated buds (number of contaminated buds/number of buds used)
R.D: ratio of developed buds per uncontaminated buds (number of developed buds/number of uncontaminated buds)
N.D: number of developed leaves per bud
media 1: MS hormone-free media containing 3% sucrose and 1% agar
2: MS hormone-free media containing 1.5% glucose and 1% agar
3: MS liquid media without hormone containing 3, 5 or 7% sucrose

TARC in South America

Collaborative Research of TARC in Brazil since 1972

Research collaboration between Brazilian agricultural institutes and TARC started in 1972. N. Miyazaki as the first TARC researcher studied the physiological characteristics of legumes in Brazil at the Instituto Agronomico do Campinas (IAC) for a year. T. Hino studied the phytopathological characteristics of Cercosporae in Brazil at Escola Superior Agricultura "Luiz de Queiroz" (ESALQ), Universidade de Sao Paulo, Piracicaba during the period 1974 to 1976 and at the same university K. Nakazono studied the ecology and control of Nematoda infesting upland crops from 1977 to 1979.

Another collaborative research project between Instituto Agronomico do Parana (IAPAR), which was newly established at that time in Londrina, Parana, and TARC began in 1975. Y. Ohno as the first TARC researcher there was engaged in studies on physiological factors limiting the growth and yield of upland rice during the period 1975 to 1980. A. Sugimoto studied the ecology and control of pyralid moths in the tropics from 1979 to 1984. Y. Ohshima was engaged in studies on the classification and identification of Nematoda in Brazil from 1981 to 1984 which were continued by A. Goto up to 1986.

Collaborative research activities between TARC and Faculdade de Ciências Agronômicas, Universidade Estadual Paulista (Agronomic Sciences Faculty, São Paulo State University; FCA, UNESP) were initiated in 1982. UNESP is composed of fourteen campuses with twenty-five faculties and institutes located in São Paulo State. The collaborative research activities have been continuing at the Department of Agronomy and Soil Science of FCA, UNESP.

The major collaborative studies include:

1. Studies on the Properties and Management of the Main Soils in Central-South Region of Brazil

Physical and chemical soil properties of the representative profiles in São Paulo State and its surroundings were investigated. In this region, the distribution of the soils was related to the parent material and the type of erosion surface, and the soils were distributed in geometric catena orders. These soils were classified into three main groups according to the parent material.

The most general soil-forming process was found to be "Laterization" or "Latosol-forming process". Under the high humidity and temperature conditions, the following processes were considered; 1) strong leaching of bases, 2) partial leaching of silicic acid, 3) complete decomposition of the primary silicate minerals with the exception of quartz and 4) strong acidity and strongly developed very fine granular structure.

Changes and dynamic aspects of the soil physical and chemical properties under mechanized farming were investigated. The soil fertility differed according to the kind and process of accumulation of the parent material, and the degree of leaching and weathering.

2. Effects of No- and Conventional-Tillage Systems on Growth, Yield and Yield Components of Wheat and Soybean Cultivated in Rotation.

The effects of conventional and no-tilage practices on the growth and yield components of wheat and soybean, and the changes in the physical and chemical properties of the two types of soils were investigated. Crop growth was influenced by the tillage method through the changes in the physico-chemical properties of soil. The difference in the mode of nutrient accumulation and physical properties of the soil profile affected the development of the rooting pattern of crops.

In the no-tillage plots, accumulation of organic matter and nutrient elements in superficial layers was observed. The values of soil hardness and bulk density in superficial layers were slightly higher in the no-tillage plot. Amounts of organic and mineralized nitrogen in the first layer were larger in the no-tillage plot and tended to increase with cultivation. Accumulation of nitrogen in the ammonium form tended to increase with the depth of the layers and increase of the number of croppings. The transformation of inorganic nitrogen proceeded actively in the superficial layers of the no-tillage plot. *(A. Fujimoto)*

Cooperative Research on Tropical Pastures at CIAT in Progress

CIAT, an international research organization siuated in Colombia, has its mandade on research on beans, rice, cassava and tropical pastures.

TARC's collaborative research with CIAT started in 1975 with the breeding of cassava, particularly for disease-resistant cultivars. Y. Irikura and Y. Umemura, two Japanese experts on tubers and roots sent from TARC were at work in CIAT between 1975 and 1979.

Since 1977, TARC has sent five researchers in succession to participate in the tropical pasture program. They are Drs. Maeno, Hayashi, Mitamura, Ogawa and Nada.

The tropical pasture program places emphasis on the collection of germplasm and its utilization for adaptation to poor soils with low pH, low nutrient and high aluminium contents in South America. To test these improved accessions, networks have been set up in Brazil (adaptation to Cerrados), Peru (adaptation to humid tropical conditions) and Costa Rica (soils of Central America). Studies on methods of pasture establishment, grazing, pathological and entomological studies have also been promoted.

Since 1990, a new network has been set up in Africa and Asia to utilize CIAT's pasture germplasm. Introduction of new technology such as biotechnology will enable to improve the germplasm.

A Japanese researcher from TARC first evaluated the use of selected grasses and legumes to supplement the native grasslands of the tropical American savannas. The following TARC researcher analyzed dynamics of grassland vegetation with and without fire practices.

The use of macro-pellets for the introduction of legumes into the savanna which was initiated in 1984 is still being pursued. The use of macro-pellets aims at sowing seed and fertilizer in the same spot in order to decrease markedly the amount of seed and fertilizer applied. A method for direct sowing of legumes with pellets into burnt savanna was successfully developed.

since 1990, a Japanese researcher has been sent to CIAT to promote pasture establishment in the Llanos. Recommendations for legume oversowing for low-input improvement of savanna are as follows : For poor sandy soils, pellet sowing of *Stylosanthes guianensis* or *Desmodium ovalifolium* into burnt savanna can be performed while, for fertile soils, broadcasting of seeds of *S. guianensis, D. ovalifolium, S. capitata* or *C. acutifolium* into burnt savanna is effective.

(Yoichi Nada)

Erosion observed in upland rice field of Parana State, Brazil (Photo by Y. Ohno, TARC)

Research Planning and Coordination Division

Dr. Tosio Kobayashi, Director

Profile of TARC Divisions

Marginal Land Research Division

Dr. Michio Araragi, Director

The division is in charge of the general management or reseach promotion in TARC, namely, the arrangements for research, planning of projects, general liaison coordination as well as organization of meetings. Seven research staff and normally five assistants have been working for the division. They assist the Director Genral and Directors of Reserch Divisions. Most of their work is focused on the relationships between TARC and organizations in Japan, such as MAFF (Ministry of Agriculture, Forestry and Fisheries) Research Council Secretariat, and other research institutes as well as research collaboration with various organizations in foreign countries including IARCs.

The Division consists of the following three Section.

Research Planning Section: Dr. E. Imaizumi and Mr. A. Sugimoto are in charge of the research projects planning and of budget allocation. They are also taking care of the annual research promotion meetings and multilateral arrangements related to the promotion of research activities.

Coordination section: Mr. A. Muroga and Mr. S. Kawasugi are mainly in charge of the liaison and coordination of activities with the organizations concerned in Japan and overseas, including the procedures for the dispatching of researchers to foreign research sites. They also look after Japanese trainees sent to TARC.

International Relation Section: Dr. T. Yamashita and Mr. M. Inagaki are responsible for the organization of liaison activities, such as general arrangements for inviting administrators and counterpart researchers to Japan, receiving visitors from overseas and Japan to TARC and organizing the annual "TARC international Symposium".

The role of the Division which, as mentioned above, acts as the core for the planning, liaison and coordination of the activities of TARC both in Japan and overseas is becoming more important year after year along with the remarkable increase of the budget allocated to the Center and the larger number of researchers.

This policy reflects the firm commitment of TARC to further promoting international cooperation in the field of agricultural and forest research with the developing countries in the tropics and subtropics by increasing the number of collaborative projects and improving their quality to meet the needs of these countries.

Research Chemical Engineer. Born in Tokyo in 1937. Graduated from Dept. of Agricultural Chemistry (B. Agr.) and Dept. of Chemical Engineering (M. Eng. and D. Eng.) of University of Tokyo. Research Associate in Dept. of Chem. Eng., Univ. of Tokyo (1965-73). Post-Doctoral Fellow, Univ. of Pennsylvania for enzyme kinetics studies with Prof. B. Chance (1967-69). Joined National Food Research Institute (NFRI) of the MAFF as Chief, Food Engineering Laboratory (1973-83), Fellow of Alexander von Humbold Foundation at Federal Institute of Nutrition in Karlsruhe, FRG for research on ice formation in food engineering processes (1974-75) and also conducted research on antarctic krill aboard a research vessel of Krill Project, National Fisheries Agency in the antarctic ocean in 1975/76. Appointed as Research Counsellor, Agriculture, Forestry and Fisheries Research Council Secretariat in 1985 to formulate and coordinate national agricultural research programmes. Director, Research Planning and Coordination Div., NFRI (1987-89) and joined TARC to assume the present position in 1989.

The Marginal Land Research Division was established in 1988 to analyze the characteristics and functions of environmental resources such as land, water, etc. in the marginal areas of the tropics and subtropics to promote and improve the utilization of these areas for agriculture, forestry and animal husbandry. Currently, four major projects are being carried out.

1) Analysis of water movement and soil characteristics of arid lands. In collaboration with the Xinjiang Institute of Biology, Pedology and Desert Research, Chinese Academy of Sciences, we started this project focusing on the following subjects. (1) Studies on soil classification and properties in dry lands. (2) Studies on climate characteristics and water distribution in dry lands and develoment of measures to prevent wind erosion. (3) Cartographic assessment of agroenviromental resources, in which the dynamic changes of vegetation in dry lands are analyzed by remote sensing technology.

2) Analysis of variation of grassland resources, and development of techniques for their preservation in the arid and semi-arid zones of Africa:From February 1900, we started this project in collaboration with the International Center for Agriculture Research in Dry Areas (ICARDA). Analysis of the vegetational condition is essential for sustainable management of rangelands covering large areas. The TARC researcher who was dispached to ICARDA has undertaken the identification of vegetation types using remote sensing techniques, analysis of the dynamics of plant communities in terms of topographical and environmental conditions and grazing intensity.

3) Analysis of the vegetation and soil characteristics of lowland tropical swamps: Research collaboration with the Jalan Kebun MARDI station involves "Studies on biochemical characteristics of tropical peat soil" which include the following subdivisions a) Decomposition kinetics of peat soil b) Characteristics of peat soil d) Microbial characteristics of peat soil. We plan to contribute a paper to the International Symposium on Tropical Peat which will be held in Sarawak, Malaysia in May 1991,

4) Rehabilitation of degraded tropical land and development of agroforestry systems: We are carrying out this project in collaboration with the researchers of the College of Forestry, University of the Philippines, at Los Banos (UPLB) and the Faculty of Forestry, Kasetsart University, Thailand. One of the research results was introduced in the Newsletter (No. 4).

Starting this year, the Division will be involved in the implementation of integrated national research programmes on global environment issues, which will include a project "Methane formation mechanism and control measuress in farmlands of humid tropics". The studies will cover: 1) Microbiology of CH_4 (methane) formation and decomposition and 2) Control measures of CH_4 (methane) evolution.

Soil and environmental microbiologist. Born in Saga in 1936. Graduated from Kyushu University. After research work at the National Institute of Agricultural Sciences (1960-1971), he joined TARC in 1971 and moved to Kyushu National Agricultural Experiment Station (1980-1986) as Head of Laboratory. He worked as the Counsellor for Research and development, Agriculture, Forestry and Fisheries Research Council Secretariat (1986-1988) and he joined TARC again as Director of Research Division II (1988) and thereafter assumed the present position in 1988. During the above period, he was granted the Award from the Japanese Society of Soil Science and Plant Nutrition for "Comparative Studies of Microflora between Tropical and Temperate Soils-Especially on Actinomycete Flora" (1981).

TARC-CIP Collaborative Project Focusses on Sweet Potato Virus

Peru is frequently associated with the Inca Empire and the Andes Mountains, the home of the potato. This is one of the reasons why the International Potato Center (CIP) is located in Peru. It is also probably the reason why most of my friends in Japan ask me "You stay at high altitudes in Peru, don't you". Surprisingly, CIP headquarters are located at Lima which is in the coastal desert, facing the Pacific Ocean. Peru is a very interesting country with a range of climatic conditions: desert, valleys, mountains, plateaus, and jungle, which facilitate the production of many different kinds of crops, vegetables and fruits, many of them unknown in Japan. CIP has experimental stations in each of these geographical areas, representing the different climatic conditions of the world. The variability of climatic conditions within one country facilitates the rapid and inexpensive evaluation of new technologies under field conditions. I think this is another reason why CIP is in Peru.

CIP was founded in 1971 by Dr. Richard Sawyer, the present Director General. He signed an agreement with the Peruvian Government and North Carolina State University to create an international tuber and root crop center. In 1972, CIP became a CGIAR system member. After 15 years of having potato as its only mandate crop, CIP entered sweet potato research in 1985. In cooperation with GTZ and IBPGR, other Andean root and tuber crops, such as "Olluco", "Mashua", "Oca", etc., are included in its research activities. At present, about 80 scientists from different countries, including Japan, are engaged in research at CIP. Nearly half work in Lima the rest at eight regional stations distributed worldwide.

TARC-CIP collaborative project, initiated in September 1989, focuses on virus diseases of root crops, particularly sweet potato. Sweet potato is the fifth most important crop worldwide and virus diseases of sweet potato limit production quite severely.

The region between Mexico and Peru is considered to be the center of origin of this valuable crop. TARC believes that there is great genetic diversity in this zone and that here we have a good chance of finding many new cultivated and wild sweet potato varieties with genetic resistance to viruses and other biotic and abiotic constraints that could help improve sweet potato through breeding or genetic engineering.

Virus diseases of sweet potato reduce yields. The damage is more serious when the plant is infected with more than one virus. Unfortunately, the viruses infecting sweet potatoes have not been well characterized and, in many cases, we still do not know the causal agent. Dr. Murata, TARC, quoted Sunwu in Newsletter No. 4, "knowing your enemy and knowing yourself you will never fail in hundreds wars....". In this case, we have to know the enemies of sweet potato well to control them. At present, we are trying to characterize sweet potato viruses that have never been reported. Unfortunately, it is not an easy task because viruses do not multiply well in this host plant and it seems that some substances present in sweet potatoes prevent easy isolation and purification of virus particles. These difficulties may be the reason why virus diseases of sweet potato have been so neglected. Once we are able to purify virus particles, we can easily apply serological methods and molecular biological techniques for their detection and further studies. We should then be able to transfer the results to solve problems of sweet potatoes in other countries. To achieve this goal CIP's resources and systems can be utilized through technical and financial commitment from Japan. These are the advantages of our bilateral collaborative work. With these, we believe that we will contribute to the rapid progress with the sweet potato.

Due to quarantine regulations virus diseases are barriers to easy international transport of sweet potato. Since CIP is the only international center that works with sweet potato, it is responsible for distributing sweet potato genetic materials to the entire world. CIP cannot distribute these materials unless it develops reliable systems for the detection of pathogens, including viruses. This work is urgently needed. *(Masaaki Nakano, CIP)*

Wild species of sweet potato grown for virus studies in CIP. (Photo by K. Ishiki, TARC)

Congratulating CIP's 20th Anniversary TARC pledges further collaboration

Toshihiro Kajiwara

Potato and sweet potato, both of Andean origin, attract global attention due to their growing economic imporatnce in the third world. In the course of two decades of research with its headquarter in Peru on these global mandate crops (sweet potato more recently), CIP has formulated a rather unique structure among other IARCs under the CGIAR system. Research activities are "de-centralized" relying upon the Region Offices posted in the target areas distributed all around the world. Among the eight Regions designated, three cover Asia and the Pacific region: VI for South Asia with the office in India, VII for South East Asia with offices in the Philippines, Indonesia and Thailand and VIII for China. Due to the geographical and cultural affinities of the countries in the region, strengthened communications with Japanese institutions including TARC are expected to foster mutual benefit.

Among the diversified activities centered on the two mandate crops, management of genetic resources occupies a very important position. Currently CIP enjoys the services of Dr. Kazuo Watanabe a cytogeneticist in the Genetic Resources Department. In his Department biotechnological methods are being applied to rationalize the genetic resource management and to utilize the resources as breeding materials for varietal improvement. Studies on plant viruses, being carried out by Mr. M. Nakano (TARC), also contribute to the management of germplasm of these vegetatively propagated crop plants. Information and skills accumulating in Japan in the biotechnological approach to the genetics of sweet potato and potato will enhance future co-operation in research in this area. (CIP Board Member from Japan.)

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