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INTERNATIONAL COLLABORATION

Panoramic view of the Environmental Technology Development Complex (Open Lab)

In This Issue

JIRCAS
JAPAN INTERNATIONAL RESEARCH CENTER FOR AGRICULTURAL SCIENCES

TARF's Contribution to the Development of Overseas and Domestic Agriculture

The Japan International Research Center for the Agricultural Sciences (JIRCAS) has been conducting collaboration projects with national and international agricultural research systems in developing areas of tropical and subtropical regions to provide solutions to international food supply and environmental problems through technology development. Its sole substation, the Tropical Agriculture Research Front (TARF), located at the subtropical Ishigaki Island in Okinawa Prefecture, is well-equipped with scientific instruments and facilities enabling it to carry out fundamental experiments for target areas under similar climate conditions. Consequently, TARF was able to accomplish excellent research outputs particularly on heat and salt tolerances of leguminous crops, efficient management of tropical fruit farms, and integrated pest management of tropical-origin diseases and insects.

TARF has the geographical advantage that allows it to lead specific research on studies aimed at solving common agricultural problems in the Pacific, Caribbean, and Indian islands. The small mountainous islands, characterized by steep slopes and short distances between farms and the seashore, often experience soil erosion and deficiency of water and nutrients. To cope with these problems intensively, TARF opened a research facility in 2003 complete with a meteorological mini-station, artificially sloped fields, and lysimeters to facilitate collaborative research on environmental conservation of agricultural ecosystems. Lysimeter is a measuring device that can measure the amount of actual evapotranspiration released by plants. By recording the amount of precipitation that an area receives and the amount lost through the soil, the amount of water lost to evapotranspiration can be calculated. There are two types: weighing and non-weighing lysimeters. TARF has weighing and non-weighing types outdoors and non-weighing ones in the greenhouse. These are all attached to a sump for capturing drained water and nutrients, and irrigation pipes from the bottom to supply water. TARF's lysimeters are state-of-the-art technology, equipped with rhizotron for observing rooting behavior and the latest sensors and instrumentation for measuring environmental conditions under the ground. With this, JIRCAS researchers and collaborators can collect accurate data on the dynamics of roots, water, and nutrients in the rhizosphere. Accordingly, the first two articles in this issue show research highlights using the equipment.

TARF is also responsible for conserving the genetic resources of tropical and subtropical fruit trees, sugarcane, rice and so on, some of which are very valuable sources because no other place in Japan except TARF is capable of sustaining tropical-origin plants and trees under outdoor conditions. TARF scientists have been leading JIRCAS collaborative projects such as the genetic diversity analyses of African rice, mango, sugarcane, cowpea, and yam; and the identification of valuable agricultural traits. These desired traits, including higher tolerance for drought, insect-pests, and diseases; larger biomass production; and superior food quality, could be used for breeding programs by JIRCAS partners.

Last but not least, TARF has also contributed to the agricultural development of neighboring islands within Japan. TARF researchers developed two papaya varieties (Ishigaki-Sango [*Carica papaya* L.] and Ishigaki-Wanderas [*C. papaya* L.]) and two varieties of leguminous vegetable crops (Naribushi [*Phaseolus vulgaris* L.] and Urizun [*Psophocarpus tetragonolobus* (L.) D.C.]). The vegetable varieties are resistant to high-temperature stresses and can be grown even during the hot summer season when vegetable production in the region is sharply reduced. Thus, it can be said that TARF has been able to contribute to the development of overseas and domestic agriculture, and is looking forward to bigger and better research outputs in the near future.

Ryoichi Matsunaga
Director
TARF, JIRCAS

Measurement of Nitrogen Leaching from Crop Fields Using Lysimeters

Groundwater pollution by nitrogen leaching in the tropical islands

Coral limestone terraces developed in the tropical islands are characterized by karst topography (i.e., plateaus with shallow depressions and subterranean drainage). Due to the permeability of the underlying limestone, the possibility is high that nitrates derived from nitrogen in fertilizers, human waste, and livestock manure can leach underground and threaten water quality. Once the groundwater is polluted, decontamination becomes very difficult. A groundwater survey was done at a village in Negros Island, Philippines to measure nitrate-nitrogen concentrations. The survey showed that the concentration sometimes exceeded the maximum permissible limits of 10ppm for drinking water (Fig. 1). Most local people reside on limestone terrace areas and drink from shallow water wells, hence preventing groundwater pollution is critical. A fundamental study aimed at conserving water quality in the tropical islands was conducted at the Tropical Agriculture Research Front (TARF) using lysimeters to quantify the amount of leached nitrogen. The part of the research using these lysimeters is presented in this article.

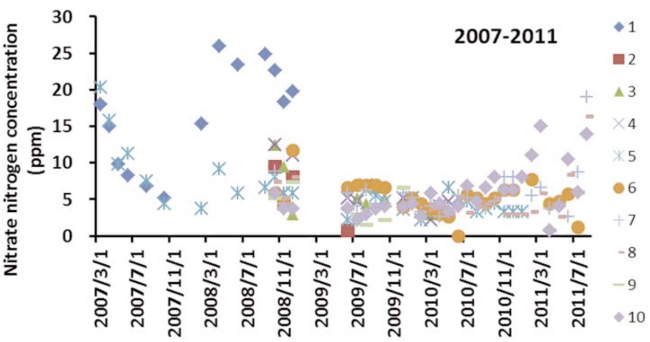

Fig. 1. Nitrate-nitrogen concentrations on sampled water wells at a village in Negros Island, Philippines. Points refer to sampling wells.

What is a lysimeter ?

A lysimeter is an instrument that can simultaneously measure surface (e.g., evapotranspiration) and subsurface processes (e.g., leaching of pollutants). It consists of an experimental soil tank surrounded by concrete. Percolated water is collected at the bottom of the lysimeter, making it suitable for nitrogen leaching studies. Lysimeters were installed inside TARF premises for 46 plots (Fig. 2) comprising 14 field plots (non-weighing, 4m length × 3m width × 2m depth), 4 plots with weighing lysimeters (2m diameter × 1.5m depth), and 28 indoor plots at the greenhouse (non-weighing, 1.55m × 1.25m × 1m).

Fig. 2. Experimental setup
A. Lysimeters and weighing lysimeters in the field (outdoors)
B. Lysimeters in the greenhouse (indoors)

Nitrogen leaching study from sugarcane field

Sugarcane (Ni8) was planted on the field above the lysimeters to evaluate the effects of fertilizer application location on nitrogen leaching. Chemical nitrogen fertilizer was applied at the base and between plants 35 and 153 days after planting. The amount or rate of nitrogen application was 100 kg/ha. Percolated water was taken from the bottom of lysimeters to estimate the amount of leached nitrogen. Results showed that crop nitrogen uptake was low and nitrogen leaching was high for small-sized plants (low leaf area). Also, nitrogen leaching from fertilizer applied at the base of plants was about three times higher than that from fertilizer applied between plants (Fig.3). This indicates that stemflow accelerates nitrogen leaching. Using these findings, we will try to devise methods to reduce nitrogen leaching into the soil and groundwater.

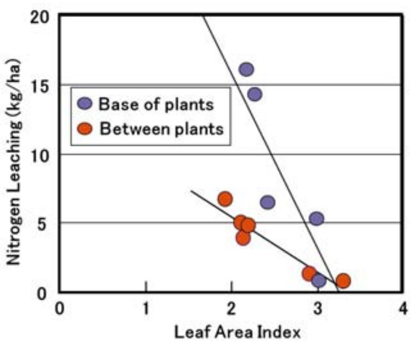

Fig. 3. Relationship between leaf area and nitrogen leaching

Shinkichi Goto
TARF, JIRCAS

A Study on Conservation Agriculture with Artificial Sloping Field

Two out of the total 13 billion hectares of agricultural land in the world are deteriorated due to human activities. The rate of degradation often varies depending on the region. On the other hand, gully formation, wherein soil is eroded by running water, accounts for 46-81% of natural soil erosion processes; loss of topsoil due to aeolian (wind) erosion and geomorphological (terrain) changes account for 17-38%. Therefore, preventing agricultural lands from further degradation by both anthropogenic (human-induced) and natural (rainfall-induced) causes is a critical issue because it affects the production and supply of food crops required by an ever-growing world population.

An artificial sloping field was constructed at a corner lot of the JIRCAS-Tropical Agriculture Research Front compound in Okinawa. The institute's facilities provide optimal field conditions to conduct research and development activities related to soil loss prevention.

The experimental field was comprised of surfaces sloping at 2, 3.5, and 5 degrees (Fig. 1). The length along the slope was 15 m, while its width was 30 m. Each surface was subdivided into 4.2-meter wide plots and utilized for the evaluation of a cover cropping system for conservation agriculture.

During rainfall, some of the rainwater percolated into the lower soil layer while other portions became runoff moving downward across the soil surface. There was a box downslope for each plot, and all the runoff water and soil volume were measured automatically using a turbidimeter and a water-level gauge; and manually using the boxes (Fig. 2).

For manual measurements, the percolated rainfall was partially collected and stored in a receiver buried at a depth of 60 cm. The stored water was analyzed for chemical components after each rainfall. Meanwhile, measurement of soil temperature and soil water content were done automatically by other devices at different soil depths.

Since constructing the sloping field, we have conducted research works and achieved good results, specifically on the cultivation of leguminous cover crops such as mucuna and hairy vetch which helped reduce soil erosion caused by surface runoff. Furthermore, the research also noted its effectivity in water management and weed control studies, among others.

At present, we are launching a new research activity in the sloping field for the development of a cropping system targeting the conservation agriculture zone of the west African savanna. (Fig. 3). At the Guinea and Sudan savanna zones of west Africa, local farmers apply insufficient amounts of chemical fertilizer due to lack of supply and funds to buy chemical fertilizer. Consequently, the farms yield small returns. In such areas, soil degradation caused by surface runoff is actualized and brings further decline to crop productivity. For that reason, we are focusing on "conservation agriculture" to solve such problems. As defined by FAO, conservation agriculture is composed of three basic principles, namely: 1) minimum or partial tillage, 2) mulching with organic materials, and 3) various cropping system (rotation with leguminous crop, intercrop, relayed crop and so on). Therefore, we expect that conservation agriculture, as applied through this research, will contribute to soil conservation by reducing soil erosion caused by surface runoff, thereby improving soil fertility. This should help overcome the problem of soil degradation in west Africa.

Hide Omae
TARF, JIRCAS

Fig. 1. An artificial sloping field constructed at the JIRCAS- Tropical Agriculture Research Front compound in Okinawa
Six plots (15 m in length and 4.2 m in width) at three different slopes (2, 3.5 and 5 degrees) were constructed at the corner of lysimeters. (Photo by Hide Omae)

Fig. 2. Runoff soil in each plot was measured after rainfall.
Volume of runoff soil was less in a cover crop cultivation plot (right) than in a control plot, a natural fallow (left). (Photo by Fujio Nagumo)

Fig. 3. Growth situation of maize after cover crop cultivation
Maize can grow as tall or even taller than the control group. Left half of this photo (control) shows conventional tillage with standard chemical fertilizer application after natural fallow. Right half (cover crop-planted) was cultivated with minimum tillage and applied with chemical fertilizer at half the regular amount. (Photo by Hide Omae)

Evaluation and Utilization of Tropical Fruit Genetic Resources at JIRCAS-TARF

The Tropical Agriculture Research Front (TARF) of the Japan International Research Center for Agricultural Sciences (JIRCAS) is located at the sub-tropical area of Ishigaki Island in Okinawa Prefecture. It performs research activities which promote new techniques and technological advances on agricultural practices affecting tropical and sub-tropical crop production.

Its favorable geographic location and climatic condition allow TARF to be the only national-level agricultural institute in Japan that can conduct on-site studies of tropical fruits. TARF maintains 15 major fruit species (totaling around 300 varieties / 800 accessions) which include useful, modern, and improved varieties as original collections. It has been able to gather from global sources a diverse collection of tropical fruit genetic resources, especially mango and fruits of the genus *Annona* such as cherimoya and atemoya (Fig. 1). Access of these genetic resources is in consonance with the Convention on Biological Diversity (CBD), which established a protocol on matters concerning genetic resources. Under the CBD, the "sovereign rights of states and the authority to determine access over their own genetic resources" must be acknowledged. Tropical fruits are important cash crops in many tropical regions, hence the heightened need to identify genetic resources and protect the commercial varieties. We have been studying genetic diversity of tropical fruits based on agronomic traits and DNA level. Through characterization and evaluation of genetic features in these genetic resources, we have been able to accumulate and provide useful information toward the establishment of an appropriate evaluation and management system of genetic resources in tropical fruit production countries and areas.

At present, we are trying to develop new passionfruit breeding materials (Fig. 2). We aim to produce a variety that has much lower acid content at harvest time. This candidate line will not require post-harvest ripening to reduce acidity; as a result, high fruit quality is expected without fruit skin damage and color change. Preliminary cultivation stability tests under different conditions are being planned. In addition, efficient breeding techniques for artificial crossing of mango cultivars by controlling flowering time are being developed. Beneficial genetic resources from other species will also be utilized for breeding studies.

Apart from doing research and projects using original genetic resources, JIRCAS-TARF also takes part in the national genebank collaborative activity (as the "tropical and sub-tropical crop sub-bank" in Japan) by conserving and maintaining tropical fruit genetic resources (around 40 species / 200 accessions) that belong to the National Institute of Agrobiological Sciences (NIAS) genebank. For more efficient use of tropical fruit genetic resources, further cooperation and collaboration among relevant organizations and institutions are required, both at national and international levels.

Shinsuke Yamanaka
TARF, JIRCAS

Fig. 1. Genetic diversity among mango (top) and genus *Annona* tropical fruit varieties (bottom)

Fig. 2. Passionfruit genetic resources used for developing the new variety.
Left: Yellow line of JIRCAS-TARF genetic resources used as maternal parent
Right: Japanese commercial variety 'Summer Queen' used as paternal parent

JIRCAS-TARF: Bridging Japan and Asia/Africa through Rice Breeding Research

Ishigaki Island, where JIRCAS-TARF exists, is located in a subtropical area of Japan. Thus, unlike the rest of the country, rice can be grown twice a year. JIRCAS-TARF is tackling the challenges of developing both breeding technologies and materials by making the best use of its environmental and geographical advantage. It also offers its facilities for collaborative research with developing countries.

JIRCAS is currently implementing four main programs for research activities under the Third Medium-Term Plan which commenced in April 2011. One of the main programs, "Stable Food Production", involves two rice-related research projects. One is the flagship project, titled "Development of rice production technologies in Africa", whose aim is to minimize yield loss due to stresses such as rice blast, drought, phosphorous deficiency, and so on.

With regard to rice production in Africa, Japan took a lead role by helping establish the Coalition for African Rice Development (CARD), which set a goal of doubling rice production in ten years. It was launched during the Fourth Tokyo International Conference on African Development (TICAD IV) in 2008. JIRCAS's role, therefore, was to develop breeding technologies and materials to be used in Africa through CARD activities. For instance, researchers at JIRCAS-HQ, JIRCAS-TARF, Africa Rice Center (AfricaRice) and the National Agricultural Research Systems (NARS) in Africa are conducting collaborative research for developing new materials with blast resistance, drought tolerance, or phosphorus deficiency tolerance using African rice (*O. glaberrima* Steud.) and descendant varieties. More than 200 accessions of African rice germplasm have been introduced, evaluated, and multiplied at TARF, and these are being examined further for blast resistance or phosphorous deficiency tolerance. TARF is also performing generation advancement of crossed materials.

The other rice-related research project under the "Stable Food Production" program is "Rice innovation for environmentally sustainable production systems", which aims to develop breeding technologies and materials to be used in Asia. One of the challenges in this project is the stabilization of rice production in Asian countries by developing technologies for breeding of blast-resistant varieties and producing materials with iron toxicity tolerance or zinc deficiency tolerance. Another challenge is the development of technology to improve rice varieties through minimum resource input and efficient fertilizer use while maintaining high yield capability and great adaptability in Asian countries. Researchers at JIRCAS-HQ, JIRCAS-TARF, the International Rice Research Institute (IRRI) and NARS in Asian countries are conducting collaborative research on this subject. TARF scientists take part by evaluating rice varieties, establishing a population to analyze useful genes, and accelerating generation advancement of these populations and other breeding materials.

Upland rice fields, paddy fields and greenhouses are currently utilized at TARF to accomplish the aims mentioned above. Sixty-four ares (6,400 m^2) of paddy fields have been allotted for international research programs and generation advancement of materials for the national breeding program. As for the greenhouse facility, the one for generation advancement was renovated and has resumed operation last March. It has a day length control system which enables researchers to multiply seeds of photoperiod-sensitive rice varieties at any given season. In addition, a lighting system was installed to compensate for shorter daylight hours during winter season in Ishigaki so that rice can grow and advance their generation with maximum efficiency.

JIRCAS-TARF will continue to promote international research by serving as bridge between Japanese and foreign researchers through sharing of information on breeding materials and techniques for the improvement of rice production in African and Asian countries.

Seiji Yanagihara
TARF, JIRCAS

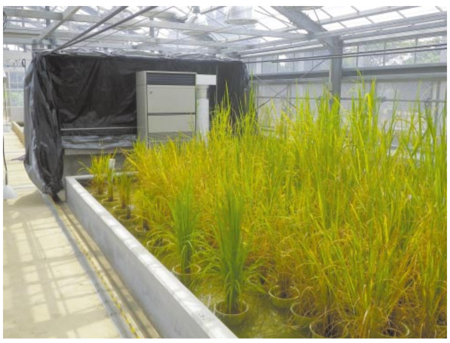

Fig. 1. View of renovated greenhouse. The black drape will cover the tank to shorten day length.

Can Genetic Transformation Technology Enhance Drought Tolerance of Upland NERICA?

Improving rice production has become one of the urgent issues in Africa owing to rising demand caused by population growth as well as uncertainties in future supply. In this context, expectations are high on one particular group of rice variety, called NERICA, for its possible contribution toward increasing rice production in Africa.

NERICA, which stands for New Rice for Africa, is gaining popularity in the continent. It is an interspecific hybrid between *Oryza glaberrima* Steud., which has strong resistance toward various stresses, and *O. sativa* L., which has high yield potential. It was developed by the Africa Rice Center (AfricaRice) with the aim of developing rice possessing the most desirable traits of *O. glaberrima* and *O. sativa*. By 2005, 18 cultivars of NERICA suitable for upland condition have been selected. The upland NERICA cultivars are currently cultivated in 18 African countries, and the total cultivated area in 2006 was estimated to be 200,000 ha. The addition of further useful traits to NERICA, which already has shown superior adaptability to the African environment, is expected to contribute to the expansion of rice cultivation and to the stable production of rice in Africa. Since the majority of rice production in Africa relies on rainwater, drought tolerance is assumed to be one of the most important traits that require further improvement. Hence, we are working on the development of NERICA cultivars with higher drought tolerance by genetic transformation.

Genetic transformation is a technology that enables the transfer of a DNA fragment isolated from one species to the genome of another or of the same species. JIRCAS has successfully developed an efficient genetic transformation protocol for upland NERICA and has introduced 10 candidate genes for drought tolerance, including a dehydration responsive element binding protein 1 (DREB1-type) gene isolated into two cultivars of NERICA (NERICA1 and NERICA4) . Thus far, we have generated more than 3,500 primary transgenic plants and approximately 350 lines that have shown stable inheritance of the introduced genes to the progenies (Fig.1). Gene expression analysis of the introduced genes and evaluation of drought tolerance in greenhouse conditions are ongoing for these selected lines. Several lines have been identified as having higher biomass under drought conditions than non-transgenic lines, and we are currently proceeding with the detailed analysis of these promising lines. These works are being conducted within TARF's Plant Transformation Laboratory, which is a small building consisting of 2 laboratories, 4 confined greenhouse compartments, and 2 non-confined greenhouse compartments . In addition, the International Center for Tropical Agriculture (CIAT), located in Colombia, is evaluating drought tolerance of the transgenic NERICA in their confined field (Fig. 2). Our future plans include producing even more transgenic lines and selecting lines with superior yields under drought conditions. We are advancing our research in the hope of improving rice cultivation in Africa.

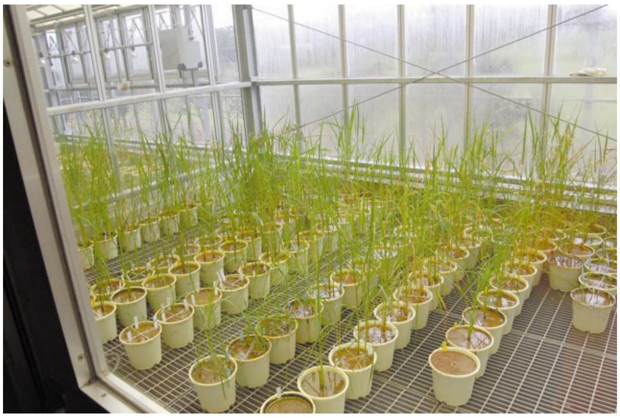

Fig. 1. Transgenic NERICA growing in a greenhouse

Fig. 2. Transgenic NERICA growing in the confined field in CIAT (Colombia)

Takuma Ishizaki
TARF, JIRCAS

Development of High-biomass Crops to Increase Food and Energy Production in Tropical and Subtropical Areas under Inferior Environmental Conditions

Food and energy production should be increased to meet increasing demand resulting from growing world population. However, future expansion of suitable farmlands is becoming difficult due to limited availability. To solve this problem, expansion of agriculture should consider areas under inferior environmental conditions. It is widespread in the tropics and subtropics where rainfall is insufficient and soils are degraded, resulting to poor harvest. By making these arable lands fully productive, a logical and practical solution to augment food and energy production can be achieved.

Sugarcane is an important agricultural crop for producing food (sugar) and energy (ethanol and electric power) in the tropics and subtropics. However, inferior environmental conditions such as poor soil quality and rainfall deficiency hinder the cultivation of current high-yield varieties.

Erianthus, a perennial grass (Poaceae), is a wild relative of sugarcane and miscanthus that grows between the tropics and the temperate regions. Biomass production is large because it is a C4 plant with high photosynthetic ability. It is also tolerant to drought and infertile soil conditions because of its big and deep root system (Photo 1). Furthermore, post-harvest regeneration of stubble is outstanding and multiple ratoon cultivation is possible.

Based on these observations, JIRCAS planned to develop a new type of sugarcane, which can increase food and energy production under inferior environmental conditions, by introducing the superior features of erianthus into sugarcane (Photo 2). This research is being implemented as a collaboration between JIRCAS and the Khon Kaen Field Crops Research Center, Department of Agriculture, Thailand. Khon Kaen is in northeast Thailand where genetic resources of erianthus are abundant and sugarcane yield is low because of drought and poor sandy soil conditions (Photo 3). Breeding materials are being developed in Thailand while the Tropical Agriculture Research Front (TARF) in Ishigaki Island focuses on basic technique development. This article introduces the hybridization techniques developed by TARF researchers and presents the use of erianthus itself.

Development of a crossing technique for sugarcane and erianthus, and evaluation of hybrid characteristics

In order to cross sugarcane and erianthus, their flowering periods must be synchronized. However, flowering periods of some erianthus clones arrive earlier than that of sugarcane, making crossing difficult under natural conditions. Therefore, a technique that delays the flowering period of erianthus by about one month through lighting (photoperiod) treatment was developed at TARF (Photo 4). Sugarcane and erianthus were then successfully crossed. Evaluation of sugarcane and erianthus hybrids crossed at TARF revealed that some hybrids had bigger and deeper root systems than mother sugarcane variety NiF8 in both plant and ratoon cultivation. This result suggests that erianthus is a possible breeding material for producing improved sugarcane varieties through introduction of its large and deep root system. This crossing technique will be brought to Thailand where hybrid characteristics will be assessed, promising materials will be selected, and

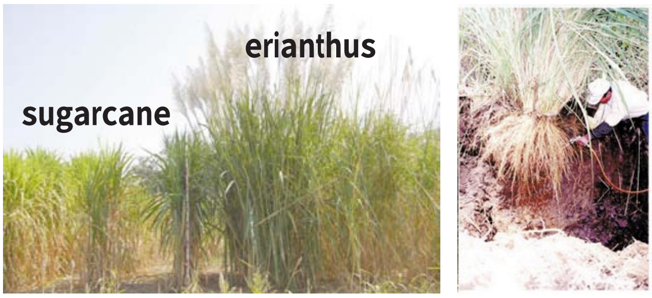

Photo 2. Plant type and root system of erianthus

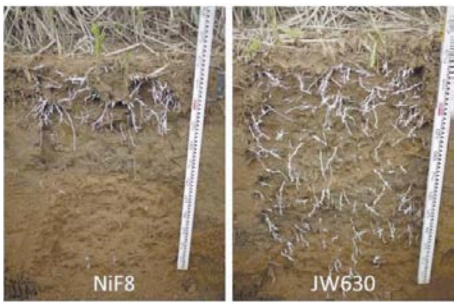

Photo 1. Root system comparison between sugarcane variety NiF8 and erianthus clone JW630 during the first ratoon cultivation

Photo 3. Dried sugarcane during dry season in northeast Thailand

Photo 4. Erianthus undergoes photoperiod control treatment in the field to delay flowering.

adaptability to drought and other stresses will be evaluated. Breeding materials developed in TARF will also be important for producing new sugarcane varieties in Japan.

Development of JES3, a new candidate erianthus variety, for utilization as high-biomass crop

At TARF-JIRCAS, research studies on practical uses of erianthus itself are also being conducted. Up until the last fiscal year, breeding and selection of erianthus were done at TARF under the "Development of biomass utilization for local revitalization" project of the Ministry of Agriculture, Forestry and Fisheries. Together with researchers from the Kyushu Okinawa Agricultural Research Center (KARC) and the Institute of Livestock and Grassland Science of the National Agriculture Research Organization (NARO), a new candidate erianthus variety, the JES3, was developed. It will become the first variety of erianthus in Japan. The New Energy and Industrial Technology Development Organization (NEDO), in its energy from biomass project, titled "Development project on innovative ethanol production system from cellulose", declared erianthus as a promising cellulosic grass biomass crop. TARF researchers are currently evaluating multiple ratoon productivity, developing sustainable and practical cultivation techniques, and investigating growth characteristics in order to develop a year-round cropping system.

While newly-planted erianthus produces a big root system on the first year, biomass of the aerial part is relatively small. However, by the second year (the first year of ratoon cultivation), biomass of the aerial part becomes very large. It has also been confirmed that dry matter production does not decrease after a four-year continuous ratoon cultivation. This proves that erianthus can be harvested for several years once it is planted; therefore, it can be grown at low cost, making it suitable for cultivation as a biomass energy crop.

Dry matter yield of JES3 during the second year was more than 30 t/ha in TARF (Ishigaki, Okinawa) and KARC (Koshi, Kumamoto). It is comparable to that of switchgrass, which was named as a promising biomass crop by the United States and Europe. JES3 possesses many characteristics of a valuable biomass crop: plant type is erect and suitable for machine harvest; and it has no mature seed at the Kyushu region and northward with low potential to become a weed because its flowering time is late. Overwinter and ratoon cultivation is possible at the north Kanto region and southward. For stable propagation of JES3, it is planned that self-pollinated seedlings are raised from mother plant and transplanted to the field.

From the "Comprehensive strategy of biomass Nippon" policy outline issued after a Cabinet meeting in December 2002, cultivation of plants for biomass energy production shall be implemented by 2020. Under the "Fundamental plan to promote biomass utilization", decided at a Cabinet meeting in December 2010, production of 400,000 t (in terms of carbon) are targeted from biomass crops in 2020. In order to materialize these plans, production of not only biomass food crops (such as sugarcane) but also cellulosic biomass energy crop (such as erianthus) should be increased.

Erianthus cultivated on underutilized arable land combined with unused biomass resources such as pruned branches are expected to provide stable supply of raw materials to the biomass industry. Pellets made from erianthus are burned directly for heat utilization. Gasification of erianthus for methanol synthesis and power generation is also being studied. Because these proposed methods of erianthus utilization do not require cultivation of extensive agricultural lands nor the establishment of large industrial facilities, it is possible for erianthus to supplement energy production in Japan for local consumption and regional promotion. In Thailand, erianthus has been drawing attention as a cellulosic material for biomass energy production in a local area.

Overcoming inferior environmental conditions

In some parts of the tropics and subtropics, sugarcane cultivation is particularly difficult because of inferior environmental conditions. In such areas, erianthus is being considered as an alternative source of biomass energy materials (feedstocks). Research done by TARF scientists revealed that crossings among different types of erianthus, and between erianthus and miscanthus were possible. This implies plenty of possibilities for further improvement of erianthus.

Sugarcane and its closely-related germplasm contain many materials which possess useful characteristics; thus, future studies by TARF researchers will focus on accumulating and using these useful traits for breeding and crop development.

Yoshifumi Terajima, Shotaro Ando, and Akira Sugimoto
TARF, JIRCAS

◆Public Relations (PR) activities at TARF

The Tropical Agriculture Research Front (TARF) promotes agricultural research by carrying out various PR activities with the support and understanding of local residents. As part of publicity and promotion, TARF opens its doors and facilities to the public once a year. This annual event, called "Open Day", includes activities such as public lectures and agricultural technology training sessions. Furthermore, the establishment of a permanent exhibition room gives TARF a venue to introduce the research activities at JIRCAS.

◆The 2012 Open Day

TARF promotes sustainable development of agriculture in tropical and subtropical developing regions by developing technologies that contribute to the stability of crop production. Because Japan relies on 60 percent of its basic calorie needs from food coming from overseas, the role of agricultural research and development for tropical and subtropical regions has become increasingly important.

TARF held its annual Open Day last July 1st with the theme, "From Ishigaki to the World: A Better Environment for Agriculture". There were 819 visitors, mostly parents with their children. All in all, those in attendance were able to grasp and appreciate JIRCAS' research activities, making the event a success.

Date and time: July 1, 2012 (Sun), 10:00 to 16:00
Location: JIRCAS-TARF (1091-1, Maezato-Kawarabaru, Ishigaki, Okinawa)
Theme: From Ishigaki to the World: A better environment for agriculture

Main activities:

・Panel exhibits and materials display introducing the role and research activities at the Institute (Exhibition Room).
・Poster exhibitions of research results
・Plant protection exhibition
・Mini-lectures on the following topics:
"Examining the characteristics of nitrogen runoff from farmland to the basement"
"Soil and environment"
"State of the radioactive contamination and decontamination measures in Iitate Village by JIRCAS "
"Development of dry cesium removal technology in contaminated soils"
・Canal water purification exhibition
・Cultivation field gradient exhibition
・Exhibition of sugarcane varieties (field cultivation and stem exhibition)
・Observation tour of tropical fruit tree house (acerola, cherimoya, white sapote, lychee, Indian jujube, mango, etc.;
cultivation exhibition)
・Demonstration on measuring sugar content and acidity in tropical fruits
・Technology workshops on tropical fruit trees
・Demonstrations on "How to sharpen grafting knives" and The grafting method "
・Pineapple cultivation exhibition
・Panel exhibit: " Rice around the world "
・Exhibition of African agriculture
・Distribution of JIRCAS-grown winged bean seedlings or "Urizun"
・Stamp rally with quiz
・Tasting corner: JIRCAS-grown papaya and pineapple, homemade brown sugar, ice zenzai, and shaved ice
・Flower picking: sunflowers and cosmos
・Exhibition of agricultural machines

Reception

TARF mascot "Netsuken-kun"

Mini-lecture

Shaved ice and ice zenzai corner


Tasting corner


Exhibition of the world's sugarcane


Plant protection exhibition


Technology workshop participants


Observation tour of the tropical fruit tree house


Questionnaire collection corner

◆Public lectures

As part of its PR activities and to further strengthen its relationship with the local community, TARF researchers delivered public lectures at the Ishigaki City Hall, covering five topics as listed below. TARF researchers also updated their audience on recent research advances and laboratory activities, the results of joint research being conducted in foreign countries, noteworthy information about foreign agriculture, and their experiences while living abroad.

・No. 21. Soil fertility management at the Sahel and the Savannas in Africa: The effective use of leguminous crops and organic matter (June 16)

・No. 22. Tropical fruit trees in Southeast Asia (September 13)

・No. 23. Production of disease-free sugarcane seedlings / The Introduction of sugarcane white leaf disease in Thailand and at Japan's National Center for Seeds and Seedlings (December 20)

・No. 24. The cowpea of West and Central Africa: Its role as a traditional crop and its future potential (January 17)

・No. 25. Food processing and quality technology: Exploring other uses for rice, rice flour and shiikuwasha (*Citrus depressa*) (January 30)

◆Agricultural technology workshops

TARF introduces and disseminates research results on a regular basis as part of its PR and community outreach activities. Three agricultural technology sessions were held at the TARF laboratory and at the Kohama Agricultural Technology Center focusing on tropical fruit cultivation, in line with TARF's aim to develop and disseminate practical techniques for improving tropical fruit production.

・No. 11. Grafting techniques for growing tropical fruit trees: Bud grafting challenge for beginners! (September 2)

・No. 12. Grafting techniques for cultivating tropical fruit trees: White sapote (*Casimiroa edulis*) grafting challenge!　(October 25)

・No. 13. Introduction of new varieties developed by TARF and cultivation technologies for locally grown papaya and banana (March 23)


Agricultural technology workshop (October 25)

Outdoor (weighing and non-weighing) lysimeters

Indoor (non-weighing) lysimeters

Artificial field slopes

Artificial channel

Underground instrumentation

Meteorological equipment

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