T-PIRC

つくば機能植物イノベーション研究センター
Tsukuba-Plant Innovation Research Center

Tsukuba-Plant Innovation Research Center（T-PIRC）

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筑波大学
University of Tsukuba

Research Objectives

The University of Tsukuba has launched the Tsukuba-Plant Innovation Research Center (T-PIRC) in April, 2017. To address global issues on sustainable food and energy solutions, the center aims at supporting research and development on "food-security" and "eco-security", and at accelerating the process of its industrial applications, working together with domestic and international private and public sector. T-PIRC is composed of a center (including Joint Usage/Research Center, as a 'Plant Transgenic Design Initiative (PTraD)' appointed by MEXT), four divisions, and two units. By integrating these research units, we develop a "one-stop shop" for plant biotechnology and bioresource use/reuse covering basic and applied gene research to the industrial application, which will contribute to a sustainable society. In addition, the outcome of cutting-edge research activities for industrial applications is expected to contribute to human resource development.

For the further development of plant biotechnology, we will continue to increase our effort to build an important global base for research and development on plant biotechnology and bioresource use/reuse and its industrial applications. We would appreciate your continued support and encouragement.

1st April, 2017 Director of the Tsukuba-Plant Innovation Center, Tsukuba University

Gene Research Center:

The center explores and fosters research seeds that would lead to develop highly functional and highly value-added plants.

Plant Transgenic Design (PTraD) Initiative:

It is composed of six research group concerned with issues regarding from basic research on designing transgenic plants to transmission of information related to the plant biotechnology.

Smart and Sustainable Agriculture Research Division:

It promotes research on the development, production, and distribution of agricultural products using the latest technology to fulfill sustainable agriculture.

Genetic Resources and International Collaborative Research Division:

It receives commissions both from inside and outside the country. It is engaged in conservation and analysis of plant genetic resources. Making use of the findings at T-PIRC, it facilitates international collaborative research in cooperation with other divisions and partner organizations in Japan.

Informatics Division:

Handling big data for integrative uses and analyzing omics data offered by other divisions. It accumulates and fosters new knowledge in the field of plant sciences. It promotes research that would lead to innovate new research fields.

Collaborative Research Division:

It works together with domestic and international private and public sector on research and development. It will bring innovation in the plant and agricultural sciences for materializing industrial uses.

Corporate Social Partnership Unit:

It carries out public awareness and social partnership linkage. It also supports human resources development programs in cooperation with other divisions. Its duties include the publicity concerning the T-PIRC's research progress, the promotion of regional cooperation and the implementation of regional contribution activities.

Research and Education Support Unit:

It handles maintenance on each research base and equipment, and supports the research and educational activities of T-PIRC. It coordinates technical staffs and allocates research tasks to them.

Organization and management

T-PIRC Management Committee	It consists of the Chairperson (Director), Vice-Director, the Director of Gene Research Center, Research Division Director, Unit Director Staff designated by Director, Staff recommended by Research Division Director.
T-PIRC Management Council	Director, Vice Director, the Director of Gene Research Center, Research Division Director, Unit Director, and an external committee
T-PIRC Staff Members	Director, Professor(16people), Associate professor(11people), Lecturer(1person), Assistant Professor(13people), Administrative technical staff(19people)(As of October, 2017)
Research and education	[Joint usage staff] Faculty of Life and Environmental Sciences, Faculty of Pure and Applied Sciences, Faculty of Human Sciences, Faculty of Medicine, etc. [Student in doctoral courses] Graduate School of Life and Environmental Sciences, Graduate School of Comprehensive Human Sciences, Graduate School of Pure and Applied Sciences, etc. [Students in master's courses] Graduate School of Life and Environmental Sciences, Graduate School of Comprehensive Human Sciences, Master's Program in Education, etc. [Undergraduate Students] College of Biological Sciences, College of Agro-Biological Resource Sciences, etc.
Director of T-PIRC	Hiroshi Ezura, 2017〜

Information dissemination, outreach activities, etc.

Public open the days, extension courses, etc.

"Supporting Summer Vacation Research Projects"

For middle and high school students

"Agricaltural Education"

(Science & Technology Week (April))
For elementary and middle school students

Support for the attached schools

(Visiting research laboratories, training at farms, etc.)

"Let's actually see genetically modified plants!"

(Science & Technology Week (April))
For general public + school

For general public + school Extension course: Frontier of the studies on plant genetic resources

~From breeding to studies on plant molecular design~

Bio e Café

(Science Café for Life and Environmental Sciences)

Training teachers

Teacher's license renewal course

Experimental education workshop

Popularization of
"gene recombination experiments for educational purposes"

Technology workshop for agriculture

Council of University farms
in the Kanto and Koshinetsu regions

Supporting technical staff for partner colleges

Education for overseas and international students Management of genetic resources

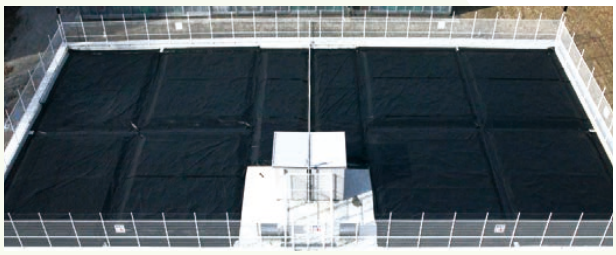
Bio-safety education overseas

Education for international students

Introduction of Japanese food culture
by making Japanese soba

Gene Research Center

Isolated fields



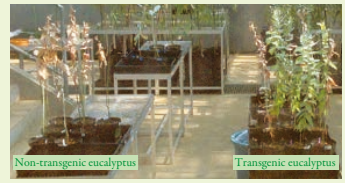
Cultivation / growth room

Special netted-house

Our center has the transformation technique for various plant species and the practical know-how for legal cultivation of living modified plants, and holds many cultivation facilities such as cultivation/growth room (P1P level), special-netted house and isolated field. These technique and facilities are open for all community members of plant science in Japan. These facilities will be expanded and utilized for the grobal community.

Research progress

Salt-tolerant transgenic *Eucalyptus* (left) and potato (right)



Genome-edited morning glory (left) and tomato (right)

Tomato varieties selected via the National BioResource Project


Fruit size


Fruit color


Fruit shape


Flower shape


Inflorescence shape


Ramification


Leaf surface


Leaf shape

Collaboration

National Institute of Agricultural Research of France – INRA-Bordeaux

National Genetic Resources Center of Mexico

Main projects funded by external funds

National BioResource Project (NBRP)
Development of base centered on tomato cultivation

NBRP-Tomato is one of national bioresource projects which aim to collect, preserve and provide bio-resources (animal, plants and other living materials) for promoting life science research supported by MEXT. The Gene Research Center plays a crucial role in contributing tomato bioresource.

Cross-ministerial Strategic Innovation Promotion Program (SIP)
"Technologies for Creating next-Generation Agriculture, Forestry and Fisheries"

We are developing high-functional and high-quality crops especially in tomato and melon of commercial varieties by applying genome editing techniques. We are also accumulating knowledge scientific analysis and social-scientific study for social-implementation of genome editing techniques.

French-Japanese Joint Laboratory (TIL)

We established University of Tsukuba-INRA Joint Laboratory (TIL) with French National Agricultural Research Institute (INRA) Bordeaux center in 2008 to promote research collaborations in plant science field, especially in tomato genomics. Through this flame-work, we promote students and faculty staff exchange and to development of human resources contributing to international research cooperation.

Science and Technology Research Partnership for Sustainable Development (SATREPS)

The project is named Diversity Assessment and Development of Sustainable Use of Mexican Genetic Resources: Bringing Stability to World Food Supplies with Japanese Technology and Mexican Resources.

TOMATO National BioResource Project　SIP　TIL University of Tsukuba and INRA Joint Lab　SATREPS Science and Technology Research Partnership for Sustainable Development Program

Plant Transgenic Design Initiative

Since 2010, the Gene Research Center has initiated activities in a Joint Usage/Research Center targeted for Japan as a "Plant Transgenic Design Initiative (PTraD)" in order to advance existing knowledge by promoting collaborative research and education. The center authorized by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) has been established to promote academic research on plant genes and to facilitate collaborative research among researchers in the related field in Japan. This center will become one of the global core institute for research on plant sciences and biotechnologies.

Research Objectives

Foundation

Application

Science communication

(1) Basic Technology Researches Group
Identify useful genes related to morphologic control, environmental responses and metabolism in plants

(2) Experimetal Plant Bioresource Group
Preservation of experimental strains of Solanaceous species (tomato, potato and tobacco), and international collaboration for establishing the preservation system and researches activities on classification and utilization of the plant bioresources

(3) Transformation Technology Researches Group
Collaborative researches concerning the development of transformation procedure and development of selection technology of transfectants

(4) Transgenic Plant Cultivation Technology Researches Group
Collaborative researches concerning the development of cultivation technology for transgenic and nontrans genic plants using the special netted-houses and the isolated fields under simulated environmental conditions

(5) Environmental Risk Assessment and Management Researches Group
Collaborative researches concerning the establishment of assessment concept and of management method of transgenic plants

(6) Information Transmission Technology Researches Group
Collaborative researches concerning the development of information transmission technology for research on transgenic plants, biosafety issues of genetically modified (GM) crops, and education for science literacy

Collaborative researches and its outcomes


Research regarding environmental stress response


Interaction of legume root and nodule bacteria


Protein expression system in plants


Tomato resource


Analysis of important traits in crop plants


Transformation method development


Cultivation trial in the specific netted-house


Cultivation trial in the isolation field


Field research for biodivesity impact


Development of stress tolerance assessment method


Genetically modified cyclamen (Multi-pedal cyclamen)

Development of scientific literacy educational materials

We have been holding lively discussions providing opinions and requests regarding directionality of shared use and cooperative hub activities while promoting interactive exchange within the researchers' communities.

Smart and sustainable Agriculture Research Division

Smart and Sustainable Agriculture Research Division develops researches to support food security and ecosecurity, and also conducts agricultural research by using research field for industrialization support researches. In this division, we use the latest technologies for agriculture, such as employment of robots, IT, and electronics for agricultural production and plant factories. Furthermore, we also develop researches for conservation of biological resources and diversity, diversification of resource usage, and functional improvement of bioresources for smart and sustainable agriculture. We also aim to integrate our research with the field of ecology, environmental sciences, and business administration.

Development of greenhouse equipped with AI and robots

In order to develop advanced cultivation technology that enhances both quality and productivity of vegetables and flowers, we are working on the development of a labor-saving AI system – which incorporates robots and AI technology – that can be applied to a wide variety of vegetables.

Research and development of high-performance cereal varieties

We are currently working on the development of high-yield varieties of buckwheat by using genomic selection; and also working on the development of high-performance buckwheat and hypoallergenic varieties.

Precision agriculture by implementation of electronically connected vehicles

We will provide support for implementation of precision agriculture technologies, which includes VR and AR technologies, use of electronically connected vehicles, and automatic collection of management information regarding harvest, irrigation and soil nutrition conditions.

Production environment and agriculture

Based on the academic framework centered on agricultural sciences such as agronomics, horticulture and thremmatology, we are conducting basic and applied research for smart and sustainable agriculture.

Animal life science

Based on animal husbandry, we are developing technology in order to elucidate life phenomena in animals and apply it to the industry.

Agricultural engineering

We are developing technologies of agricultural machinery, and informatization through the use of robots, IT and UAV, for precision agriculture.

Boundary agriculture

We are conducting a highly novel research which has the farm as its focus and links entomology and landscape science to ecology, soil science and environmental studies.

Introduction of Departments

Genetic Resources and International Collaborative Research Division

Based on the Convention on Biological Diversity and the Nagoya Protocol, we collect, preserve, and provide various genetic resources and support to access genetic resources oversea (upon consultation) under SATREPS and NBRP. Through SATREPS, the division acquired the nation's first approval on access to chayote, a botanical resource, under the Nagoya Protocol. Through NBRP, the division preserves a total of 16,600-mutation population of tomato Micro-Tom and distributes these mutants as a tomato bioresource hub.

Integrated Omics Analysis Division

The division is mainly specialized in metabolomics analysis using high-performance spectrometers. Through the integration of omic analysis and bioinformatics, the division aims to uncover key factors responsible for metabolic regulations contributing for growth and metabolite production for human health in plants. As applied science, the division is revealing useful metabolites involved in the tastes and flavors of utility plants and foods. Also, the division designs separation and analytical methods for chemical compounds on demand.

Collaborative Research Division

In order to share research/technology seeds with society, the division is working on issues requiring multifaceted research and development activities for commercialization, such as the development of plant-based biomaterial production technology beneficial to human health, the development of a smart production system for high-value added vegetables, etc., in collaboration with relevant organizations and private companies inside and outside Japan.

Corporate Social Partnership Unit

The center promotes following outreach activities i) training courses of Recombinant DNA experiment / teacher's license renewal for school teachers, ii) delivery lectures / seminars for citizens, iii) bio-safety training course in overseas, iv) acceptance of visitors etc. This unit supports establishment of cooperative relationship between the local community through publicity of activities.

Research and Education Support Unit

The unit consists of faculty staff of crop, horticulture, animal husbandry and gene research center. It supports research and education in T-PIRC.

Education and field practice

Specialized Field Practice IV (Faculty's Common Subjects)

'Trans-ASEAN Global Agenda Education Program' and 'Trans-ASEAN Global Agenda Human Resource Development Program' for foreign student

Field Studies in Bioresource Science

This class catches up on the outline of agricultural and forestry production by field practice.

Biological Material Processing Practice

Understanding the fundamentals of wood processing and acquisition of basic techniques

Field Practices in Agricultural Production Systems

Specialized practice related to the production of plant and animal resources

Biological Machine Engineering Practice

Learning about the agricultural machinery in general and understanding the importance of machines in biological production

Field Practices in Bioresource Production

This class increase the understandings and acquire the theory and technology systematically on agricultural production across understand by field practice




Access Map

T-PIRC Farm

1-1-1 Tennoudai, Tsukuba City, Ibaraki, 305-8577, Japan
TEL:029-853-2541　FAX:029-853-6205
E-mail:center-jimu@nourin.tsukuba.ac.jp

Gene Research Center

1-1-1 Tennoudai, Tsukuba City, Ibaraki, 305-8572, Japan
TEL:029-853-6006　FAX:029-853-7723
E-mail:webmaster@gene.tsukuba.ac.jp