TARC/NARO

Tohoku Agricultural Research Center,
National Agriculture and Food Research Organization

NARO
National Agriculture and Food Research Organization

Research to be carried out and the mission and vision of TARC

Creating innovation for combined farm management through smart production systems

In the Tohoku region, rice production utilizing vast paddy fields and vegetable production that takes advantage of the cool climate are thriving. However, in recent years, the environment surrounding agriculture in the Tohoku region has been changing drastically because of climate change, the rapid decrease in the number of farmers, the growing scale of farming, the decline in rice consumption, and the increase in imported agricultural products. Even though reconstruction of the areas affected by the Fukushima nuclear disaster has made great progress over the past 10 years, the resumption of farming has been delayed in some areas, and the situation before the disaster has not been restored.

To solve these issues involving agriculture in the Tohoku region, in the 5th Medium- to Long-Term Plan which started in April 2021, we are working on a number of different projects, including the construction of a highly profitable paddy-upland rotation system that introduces paddy rice, soybeans, and grain corn, the development of production stabilization technologies such as drainage improvement for paddies combined in parcels in hilly and mountainous areas, the development of seamless and stable vegetable production technology for onions and other products for year-round supply, and the promotion of the resumption of farming in the areas affected by the Fukushima nuclear disaster.

Research targets of TARC
A high-profit paddy-upland rotation system (left), labor-saving production through the consolidation of paddies (upper right), and seamless production technology for onions and strawberries (lower right)

As a core institution for agricultural research in the Tohoku region, we will promote efficient R&D by strengthening collaboration with prefectural agricultural research institutes and academia, such as universities in the Tohoku region. To contribute further to the realization of regional revitalization, the Technology Application Research Team will play a central role in strengthening collaboration with the Tohoku Regional Agricultural Administration Office and prefectural agricultural extension centers, as well as advanced farmers, private companies, consumers, and other individuals and organizations in the region, and will work to disseminate our research achievements widely. This will contribute to the further development of local communities through the revitalization of agriculture in the Tohoku region, as well as the stable supply of safe and secure food into the future.


Activities to disseminate developed technologies (on-site study meeting [left], cultivation technology seminar [middle], and technical seminar [right])

Organization Chart

2022.4.1

President　Auditor

Senior Vice President・Vice President

NARO Headquarters

Core Technology Research Headquarters
- RCAIT/NARO
- RCAR/NARO
- NGRC
- NAAC

Segment Ⅰ
- NFRI
- NILGS
- NIAH

Segment Ⅱ
- HARC/NARO
- **TARC/NARO**
- CARC/NARO
- WARC/NARO
- KARC/NARO
- IAM/NARO

Segment Ⅲ
- NICS
- NIFTS
- NIVFS
- NIAS

Segment Ⅳ
- NIAES
- NIRE
- NIPP

NCSS

BRAIN

Director

Department of Research Promotion
- Business Promotion Office
- Research Promotion Office
- Technology Application Research Team

Division of Crop Rotation Research for Lowland Farming
- Lowland Crop Rotation Group
- ICT Utilization Group
- Lowland Crop Breeding Group

Division of Field Cropping and Horticulture Research
- New Cropping Technique for Vegetable Group
- Horticultural Crop and Wheat Breeding Group

Division of Hillside Farming Research
- Productivity Reinforcement Group

Agricultural Radiation Research Center
- Coordinator, Agricultural Radiation Research Collaboration
- Farming Resumption Support Group

Division of Research

Division of Crop Rotation Research for Lowland Farming

Establishment of a highly profitable paddy-upland rotation system through direct sowing field management using information and communications technology (ICT)

In the Division of Crop Rotation Research for Lowland Farming, based on the National Agriculture and Food Research Organization (NARO)-style direct sowing technology for dry or flooded paddy fields that we have developed to date, we will develop field management technology utilizing ICT and farming management methods based on data analysis, as well as high-yielding and good-tasting rice varieties that are highly suitable for direct sowing and high-yielding soybean varieties with good processing quality.
By introducing and combining these technologies, we will evolve them into an efficient and stable crop rotation technology system that includes direct sowing technology for dry or flooded fields. At the same time, we will promote the social implementation of paddy-upland rotation technology that matches local farming conditions through field demonstrations and dissemination activities.

Lowland Crop Rotation Group

(Location: Daisen/Morioka)

Our goal is to improve the profits for farmers who rotate paddy fields by 10%. In the rotation system centered on the direct sowing of paddy rice in a dry field, we aim to achieve extreme labor savings through a combined operation method using large tractors, and to increase the yield of paddy rice, soybeans, and grain corn. In the rotation system centered on direct sowing cultivation using uncoated paddy rice seed in a flooded field, we will use ICT to achieve automatic variable fertilization and fertility management for rice and stabilize soybean production with an irrigation support system.

Combined work of plowing, soil crushing, and seeding in the direct sowing cultivation of paddy rice in dry fields

Sowing of uncoated paddy rice seeds using a submerged shallow soil seeder

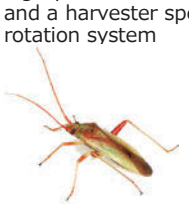
Soybean irrigation support system that can estimate drought damage in real-time (red circles indicate fields that require irrigation)
Added and displayed drought damage data on geographic information system (GIS) tiles

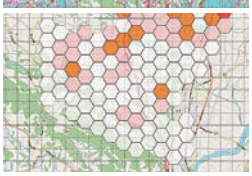
ICT Utilization Group

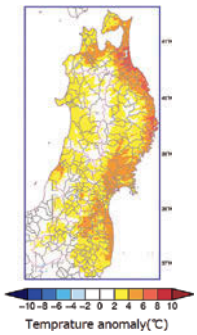
(Location: Morioka)

To establish a highly profitable paddy-upland rotation system in the Tohoku region, we will develop basic technologies, such as precision fertilization management technology using ICT, drainage improvement technology, and labor-saving field-leveling technology. Furthermore, we will develop cultivation technologies such as high-efficiency production for grain corn, which is expected to be a new type of land-use crop. We are also engaged in the development of a system to support the formulation of a working calendar that aids cultivation management based on information regarding meteorological, pest, and weed damage.

An unmanned labor-saving field leveler that enables high-speed and high-precision leveling using GNSS data and UAV acquisition images (left) and a harvester specific for grain corn (right) in the high-efficiency crop rotation system







Prediction system of pecky rice damage (center) caused by rice bugs (left) based on land use information
A support system for the formulation of a working calendar based on meteorological damage such as the degree and distribution of high- (right) and low-temperature critical periods for paddy rice using daily mean temperature deviations

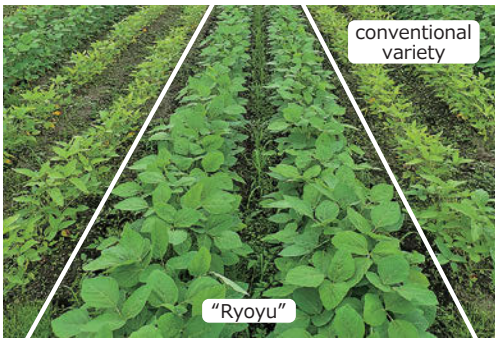
Lowland Crop Breeding Group

(Location: Daisen)

We aim to develop new varieties of paddy rice and soybeans to achieve labor-saving, low-cost, and stable production in response to the growing scale of paddy farming. As for paddy rice, we are promoting the development of high-yield and good-tasting rice varieties with a lodging resistance suitable for cold climates in cooperation with private companies and prefectural agricultural research institutes. As for soybeans, in addition to varieties with excellent processability and mechanical harvesting suitability, as well as enhanced resistance to pests and diseases, we are focusing on developing extremely high-yielding varieties with yields of 500kg/10a or more.

We are actively working on the development of DNA marker-assisted selection technology to ensure the efficient breeding of these excellent varieties.

"Shifukunominori" (right), a new high-yielding paddy rice variety with lodging resistance and good taste compared with a conventional variety, "Hitomebore" (left)



"Ryoyu" (left) , a new variety with enhanced resistance to soybean cyst nematodes, and a conventional soybean variety (right)

An original soybean variety (left) and a shattering-resistant breeding line (right) developed by DNA marker-assisted selection using quantitative trait loci controlling pod dehiscence

Department of Research Promotion

(Location: Morioka)

Technology Application Research Team

The technology application research team was established for the purpose of tuning the technology developed by NARO according to each region and disseminating the technology throughout Japan.

We are currently conducting a project entitled "Expanding the application of technology for the smart direct sowing of paddy rice (NARO-style direct sowing in dry and flooded fields) using digital management" with the aim of spreading "NARO-style direct sowing in dry fields" to over 2700 ha in the Tohoku region and "NARO-style direct sowing in flooded fields" to over 500 ha, mainly in eastern Japan. At the same time, we plan to collaborate with the four other regional agricultural research centers of NARO to accelerate the dissemination of NARO-style direct sowing technology nationwide.

NARO-style direct sowing in dry fields

NARO-style direct sowing in flooded fields

Division of Field Cropping and Horticulture Research

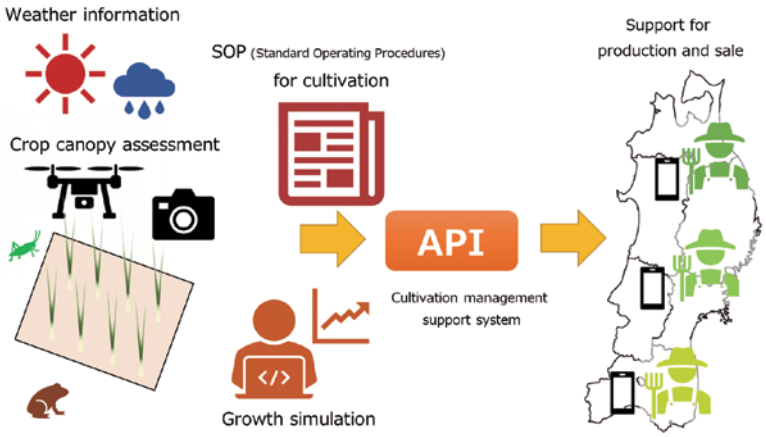
Transformation to highly profitable paddy field complex management through seamless year-round production technology for vegetables

We will contribute to the healthy and rich diets of people through the development of leading technologies and breeding for vegetables for processing and wheat that are suitable for the cold Tohoku region.
To achieve this goal, we plan to build an onion production system that enables continuous shipments by utilizing data-driven production management based on growth and yield predictions. We will also use smart breeding technology to develop new varieties of vegetables for processing and high-quality wheat that can be introduced over a wide area.

New Cropping Technique for Vegetable Group

(Location: Morioka)

Vegetable farming is expected to increase the profitability of paddy field complex management. We aim to establish a production system that enables continuous shipments to regain market share from imported onions by expanding the harvesting period of onions through onion bulb (set) cultivation technology, establishing a prototype web service that offers a cultivation management support system that leads to stable production, and working on environmental conservation such as the reduction of chemically synthesized pesticides and fertilizers.



An onion production system that enables continuous shipments using a cultivation management support system based on sensing data and growth simulation

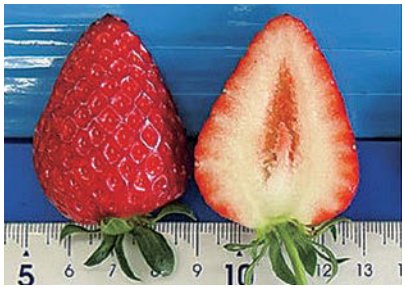
Onion cultivation technology that uses small bulbs (sets) instead of seedlings can be expected to expand the harvesting period

Horticultural Crop and Wheat Breeding Group

(Location: Morioka)

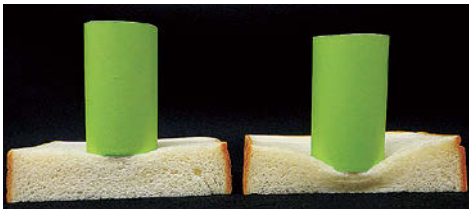
We are developing new varieties of onions, strawberries, Chinese cabbage, and wheat that are suitable for cold climates by devising DNA markers for selection, smart breeding technology using genomic information, image information processing technology, and sensing technology.
In addition, we will promote the popularization of the varieties we have developed and aim to improve profits through seamless vegetable production and expanded exports.

"Soyokano", a strawberry variety with large well-shaped fruits
This variety can be harvested from May to July (single-season harvest).



"Natsunoshizuku", a strawberry variety that has a higher yield than existing varieties and meets the demand for confectionery products
This variety can be harvested from June to November (almost year-round harvest).

"Natsukogane", a strong wheat variety with a good bread-making properties



"Yawarahime" (right), a wheat variety that enables making bread with a long shelf life
Left: a control variety

Division of Hillside Farming Research

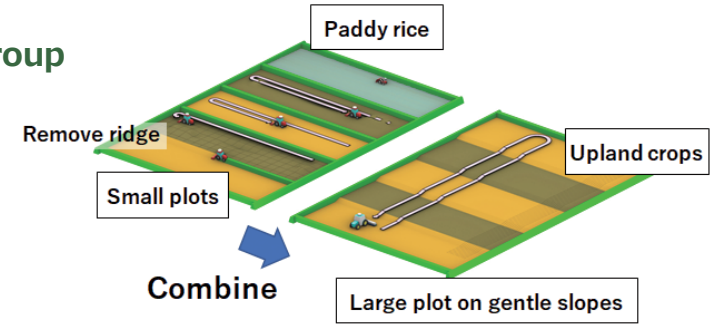
Productivity reinforcement of upland crops by combining small paddy fields on gentle slopes and introducing digital soil management in hilly and mountainous regions

In hilly and mountainous regions, which account for about 40% of the total cultivated area in the Tohoku region, it is necessary to increase productivity to prevent the devastation of farmland due to a shortage of farmers and to maintain and develop the regional economy. Therefore, we are working toward the establishment of a system that can efficiently produce upland crops (forage crops and soybeans) by combining small plots of rice fields to maintain farmland and improve profitability.
Our goal is to improve production work efficiency by 30% and the yield of grain corn, soybeans, and pasture grass by 15% to 50%.

Productivity Reinforcement Group

(Location: Morioka)

We will develop a production system for upland crops that will improve productivity and yield revenue by combining less productive paddy fields on gentle slopes.
The system will also be based on technologies for upland fields with improved drainage and for digitizing and quickly utilizing information on the heterogeneity of crop growth and soil fertility. At the same time, we will bring the spread of grasses that are suitable for the environment of the Tohoku region to fruition, and then revitalize mountainous areas.



Combining small plots to increase crop productivity

"Quattro-TK5", a new variety of Italian rye-grass *(Lolium multiflorum)*

Agricultural Radiation Research Center

Promoting the resumption of farming in the areas affected by the Fukushima nuclear disaster by mitigating radioactive cesium transfer from soil to crops

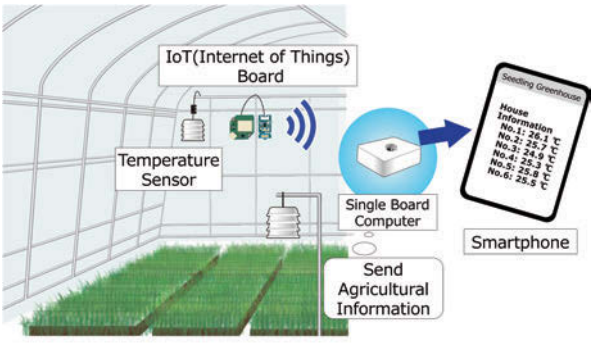
In response to the nuclear accident at Tokyo Electric Power Company's Fukushima Daiichi Nuclear Power Plant following the Great East Japan Earthquake in 2011, the Agricultural Radiation Research Center was established close to the disaster-affected areas in 2012.
Here, we develop technologies to evaluate the risk of radioactive cesium transfer to crops and countermeasures to ensure the safety of agricultural products and food from the disaster-affected areas.
In addition, we are developing technologies such as a labor-saving management system for farmlands and greenhouses to deal with the decreased population in the disaster-affected areas.

Farming Resumption Support Group

(Location: Fukushima)

We are also developing technology to assess the risk of radioactive cesium transfer from soil to crops and optimizing countermeasures to reduce radioactive cesium transfer.
As a countermeasure against the decrease in the number of farmers in the disaster-affected areas, we are also facilitating the networking of farmers by providing an information-sharing system in areas where farming has been resumed, and by developing a labor-saving field/greenhouse management system that enables management of cultivation remotely.

Analysis of radioactive materials with a germanium semiconductor detector



"Kayoinougyo Shien System", a remote monitoring system that supports farmers who commute from residences to distant farmlands.

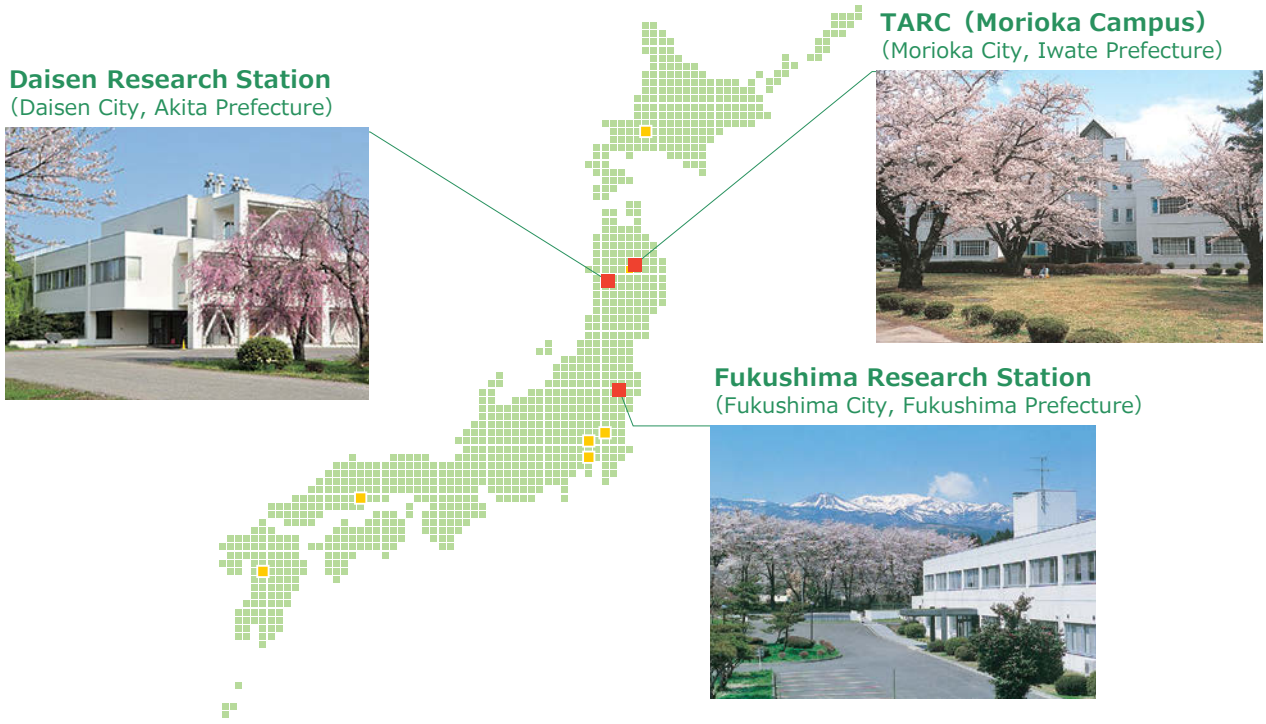
History and Location

History

1950	Founded as the Tohoku National Agricultural Experiment Station, Ministry of Agriculture and Forestry, after a reorganization of national research institutes
2001	Reorganized as the National Agricultural Research Center for the Tohoku Region of the National Agricultural Research Organization, an independent administrative agency formed as a result of Japan's administrative reforms
2006	Reorganized as the National Agricultural Research Center for Tohoku Region of the National Agriculture and Food Research Organization, an independent administrative agency, because of the integration of independent administrative agencies
2015	Reorganized as the Tohoku Agricultural Research Center of the National Agriculture and Food Research Organization, a national research and development agency

Map

■ **Tohoku Agricultural Research Center** ■ **Location of Headquarters, centers, and institutes**



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cover photo :
Rape blossom field in TARC/NARO against the backdrop of Mt. Iwate

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