農研機構
NARO 国立研究開発法人 農業・食品産業技術総合研究機構

NARO Genebank

https://www.gene.affrc.go.jp/

Genetic resources are a global heritage.
They are essential for sustainable development of human life.
All efforts are needed to conserve genetic resources
for future generations.

Dwindling genetic resources

Genetic resources are a human heritage. Biodiversity is essential for improving agricultural crops and animals, as a source of medicines and other bioactive compounds and also helps improve and protect the global environment.
However, environmental degradation and spread of a few popular varieties of crops and farm animals has resulted in the loss of genetic diversity. This threatens the ability of humans to improve future agriculture. Conservation of genetic resources for the well-being of humans in the future is a global imperative.

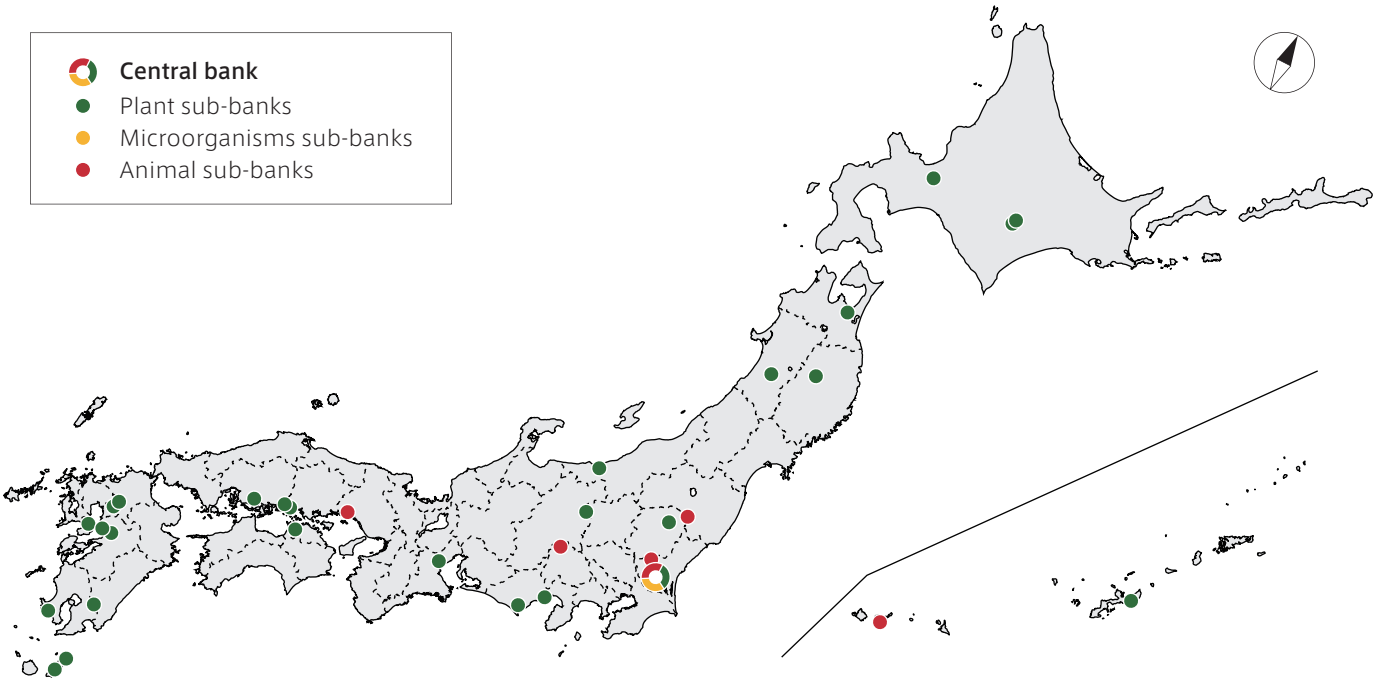
The role of the NARO Genebank

The genebank project is a national project of Japan with responsibility for collecting, conserving, characterizing and distributing genetic resources related to food and agriculture. These genetic resources include plants, microorganisms, animals including silkworm and DNA resources for agricultural research and use. The NARO Genebank has dispatched researchers to all parts of Japan and overseas to study and collect genetic resources. The collected genetic resources have been classified, evaluated, multiplied and preserved. Genetic resources in the public domain are distributed together with relevant information to users for breeding, scientific studies including genome research and educational purposes. These genetic resources are contributing to improvements in various agricultural products.

History

1903-6	Diverse rice landraces were systematically collected from various parts of Japan
1953	Key breeding laboratories are founded for major crops
1966	Seed preservation facilities were constructed at the National Institute of Agricultural Science located at Hiratsuka
1985	MAFF Genebank Project started as a national project, for plant, microorganism and animal genetic resources
1993	DNA Bank started as a new section of the MAFF Genebank Project (Distribution services ended in March 2021.)
2001	The project was renewed as the NIAS Genebank Project when national agricultural research institutes were reorganized as independent administrative organizations

NARO Genebank structure



Central bank (Research Center of Genetic Resources, NARO)

Plant Section	Microorganism Section	Animal Section
Sub-banks: NARO[1], JIRCAS[2], and NLBC[3], etc.	Sub-banks: NARO	Sub-banks: NARO and NLBC
Landraces, improved varieties, and wild relatives of rice, wheat & barley, pulses, fruit trees, vegetables, etc. about 240,000 accessions	Bacteria, fungi, yeasts and viruses of plant pathogens or symbionts and for food processing about 37,000 accessions	Germplasm of landraces and modern varieties of cattle, pigs and chickens, landraces and improved varieties of silkworm, useful insects and cultured cells derived from insects about 2,000 accessions

[1] National Agriculture and Food Research Organization [2] Japan International Research Center for Agricultural Sciences [3] National Livestock Breeding Center

(as of March 31, 2024)

International collaboration

NARO Genebank Project collaborates with Asian countries and several international organizations. Training courses on plant genetic resources are held for foreign researchers at Central bank and other related institutes and joint field expeditions are held in Asian countries under bilateral agreements.

Collaborative field study projects

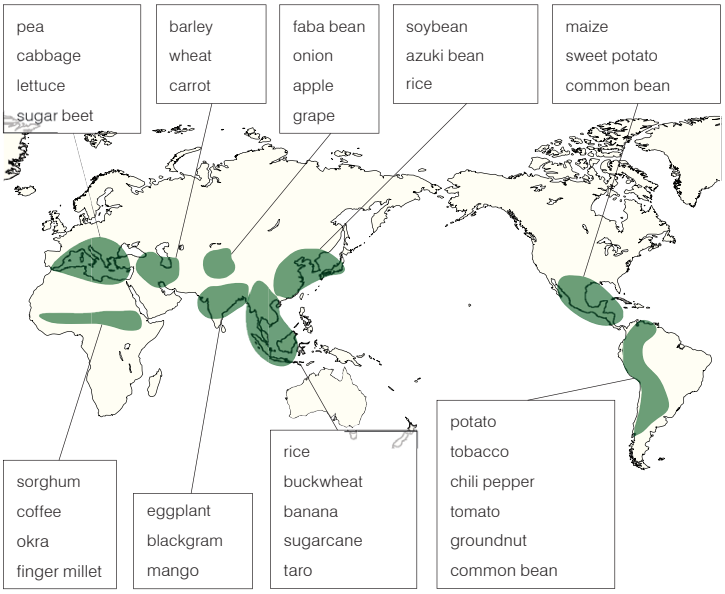
- ○ Lao PDR
- ○ Cambodia
- ○ Viet Nam
- ○ Kyrgyz Republic

Cooperation with international organizations

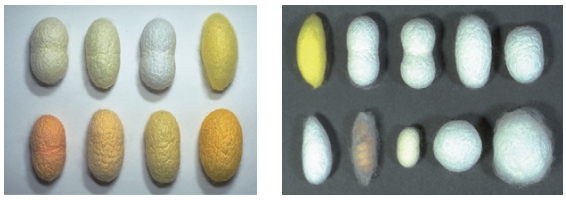
Plant:	Bioversity International, CG institutes, WBC
Microorganism:	ATCC, CBS, IMI, DSMZ, NRRL
Animal:	ILRI, RBST, AMBC

Genetic diversity

During the history of agriculture, humans have used various organisms and genetic diversity has accumulated in them. The rapid spread of a few improved varieties, environmental destruction has resulted in a loss of genetic diversity.

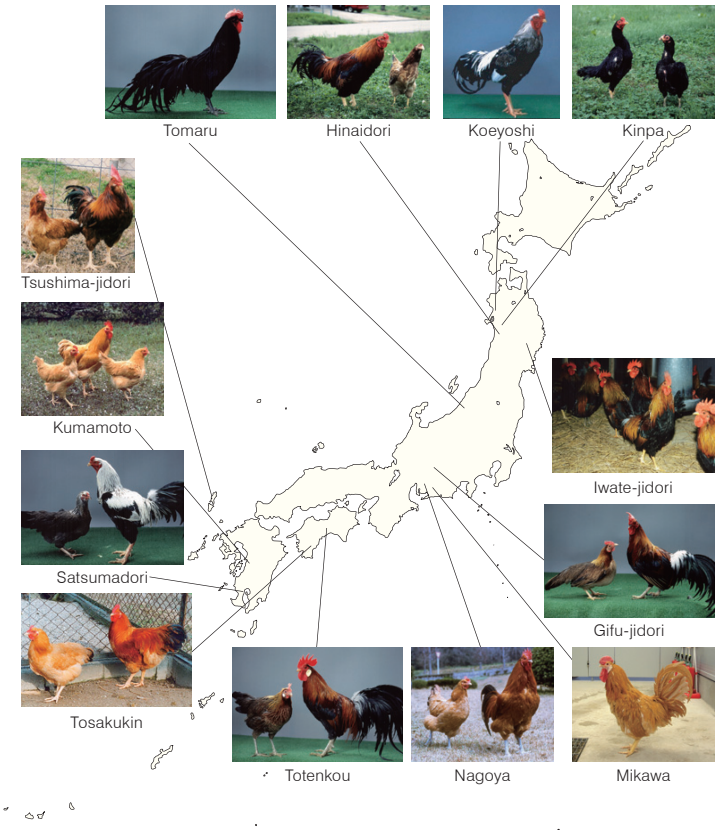


Centers of crop diversity



Various colors and shapes of silkworm cocoon

Local breeds of chickens in Japan



Field study and exploration

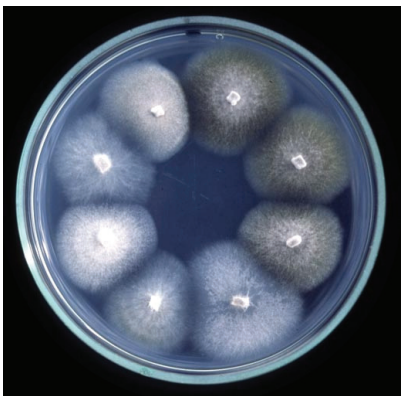
Exploration and collection of genetic resources is an important activity to conserve biological diversity. NARO Genebank emphasizes activities to collect and introduce plant, microorganism and animal genetic resources in collaboration with Japanese, foreign and international organizations.

Field study on wild rice in Papua New Guinea

Evaluation

NARO Genebank identifies, classifies, characterizes and evaluates preserved genetic resources to expand their utilization. For example, plant genetic resources are evaluated for morphological characters, stress tolerance, and quality. Microorganism genetic resources are investigated for culture characteristics, microscopic morphology, phytopathogenicity, and metabolic activity. DNA polymorphism is used to accurately classify and understand of intraspecific differentiation.

A rice field damaged by rice blast (upper) and germinating conidia of the pathogen (lower).



Different races of rice blast pathogen have been isolated and conserved, which are used for studies on blast resistance of rice in rice breeding programs.

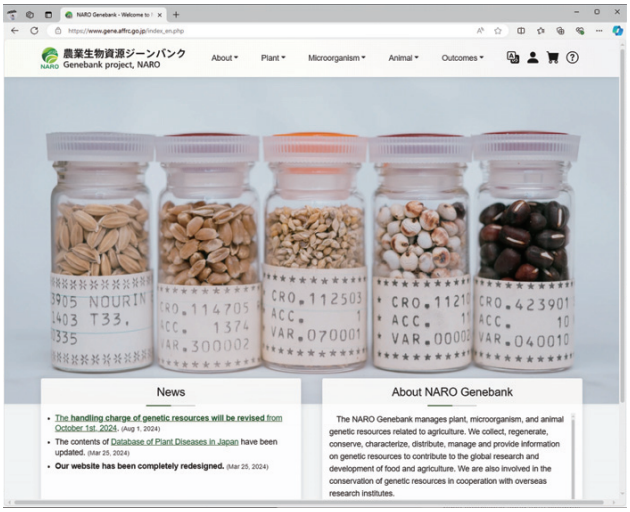
Blast resistant and susceptible varieties of rice in the field (upper) and investigation of field resistance in blast nursery (lower).

Provision of genetic resources and relevant ir

Genetic resources databases have been built based on information collected during exploration, evaluation and conservation management in the NARO Genebank, and this useful information is available through the internet.

Entry into the database

Release



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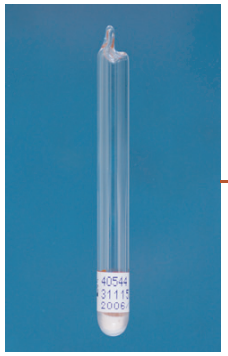
Conservation

NARO Genebank collections are conserved as active collections (short to medium term storage) and base collections (long term storage).

Animal germ cells are preserved for the long-term in liquid nitrogen at -196 °C.

Seed storage facilities for the active collection at -1 °C and 30%RH.



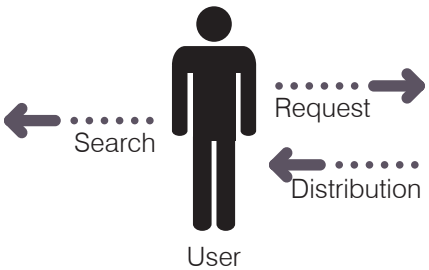
Freeze-dried micro-organisms are pre-served in a sealed glass ampoules.

nformation

Genetic resources conserved in NARO Genebank are distributed for research and educational purposes. Please search our web site, and send us your request online.

Example of available databases

- Search for available genetic resources
- Image database of genetic resources
- NARO core collection
- Database of Plant Diseases in Japan

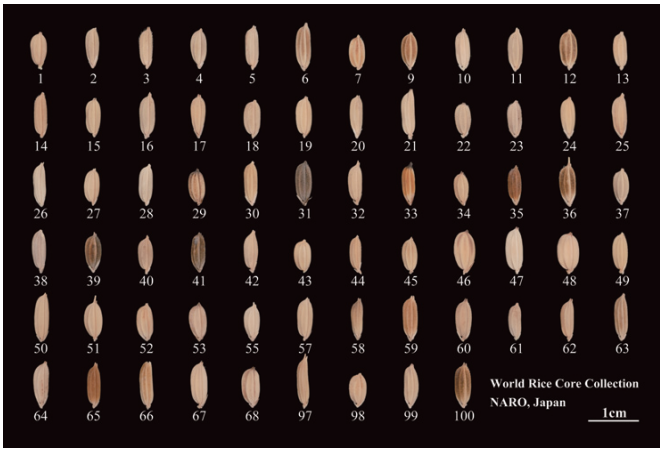


Preparation of seeds for distribution

Development of collections for diversity research

NARO Genebank is conducting genetic resources research and is developing collections for diversity research and breeding.

NARO Core Collection



• Global Rice Core Collection

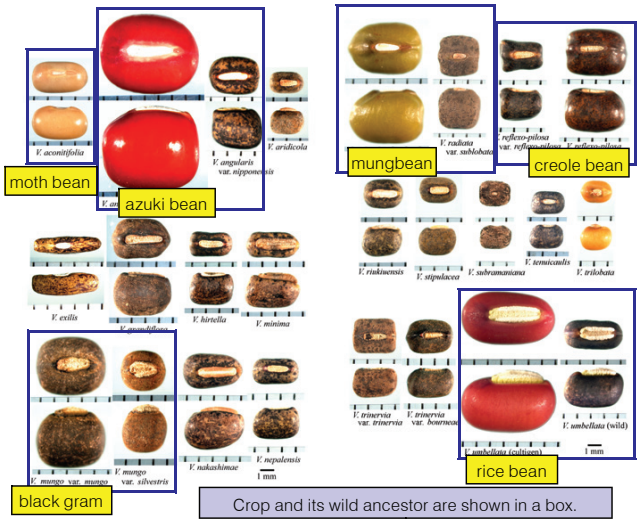
Only 69 rice accessions have been selected based on DNA polymorphism from about 300 accessions that were chosen according to passport data out of more than 30,000 accessions collected various parts of the world.

Examples of other core collections:

- Rice Core Collection of Japanese Landraces
- Maize Core Collection of Japanese Landraces
- Japanese Azuki bean Core Collection
- Japanese Wheat Core Collection
- World Soybean Core Collection
- World Eggplant Core Collection

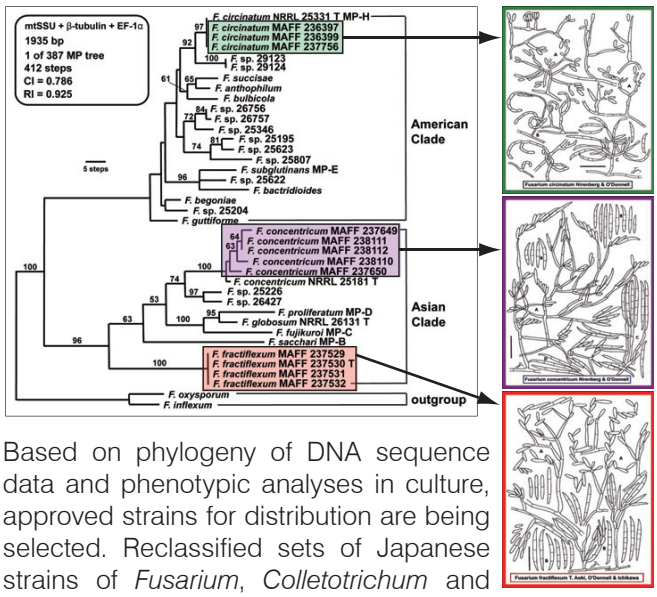
https://www.gene.affrc.go.jp/?ccol_e

Species diversity collection



Development of *Vigna* species diversity collection is undertaken for understanding and using diversity of crop wild relatives efficiently.

Approved Strains for Distribution



Based on phylogeny of DNA sequence data and phenotypic analyses in culture, approved strains for distribution are being selected. Reclassified sets of Japanese strains of *Fusarium*, *Colletotrichum* and phytopathogenic *Rhizobium* (formerly *Agrobacterium*) are ready for distribution.

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Institutions and facilities

Genetic resources management institutions

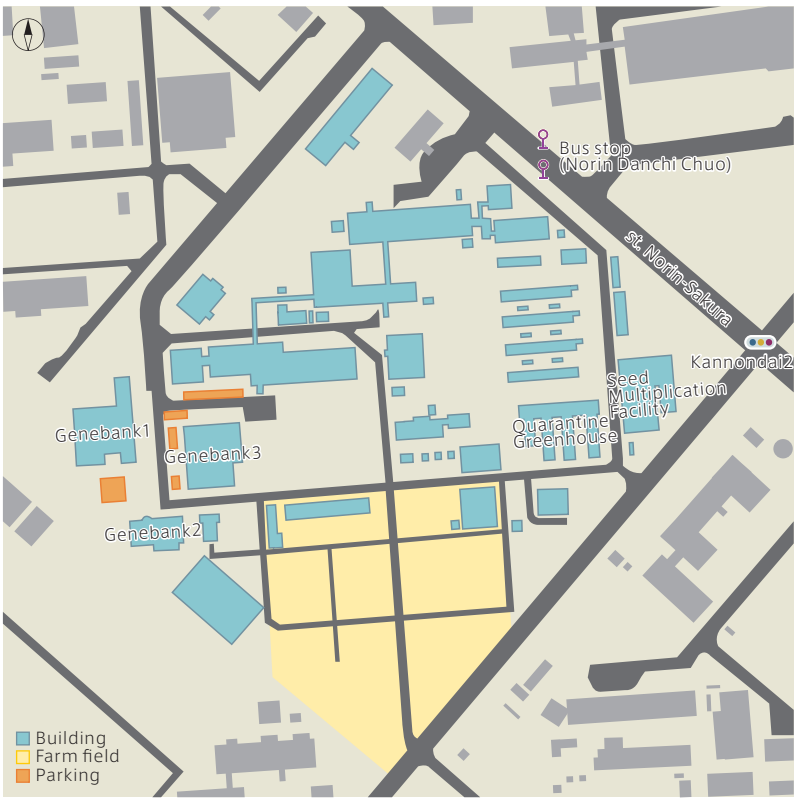
Genebank Building 1

Genebank Building 2

The main institutions for conserving, distributing and information on genetic resources. Seed storage and cryopreservers of microorganisms and animal germ cells are installed. There are experimental laboratories for analyzing preserved genetic resources in these institutions.

Long-term Seed Storage（Genebank Building 3）

Seeds are securely stored for long-term in decompressed and hermetically sealed tin cans at -18°C.



Quarantine Greenhouse

Rice genetic resources introduced from foreign countries are cultivated in the quarantine greenhouse.

Seed Multiplication Facility

Some plant genetic resources are hardly multiplied in Japanese natural condition. The facility enables such plant genetic resources to multiply with water culture, short-day treatment, etc.

Hokuto Campus

About 500 accessions of silkworm genetic resources are conserved and distributed to research institutes. Located in Yamanashi Prefecture.

Research Center of Genetic Resources, National Agriculture and Food Research Organization

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URL: https://www.gene.affrc.go.jp/

(2024.8)