

Eiji Domon (National Institute of Agrobiological Sciences)

Introduction to the National Institute of Agrobiological Sciences (NIAS) Genebank

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Introduction to Resource Center <NO.59>

Introduction to the National Institute of Agrobiological Sciences (NIAS) Genebank

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Introduction

Through nearly 10,000 years of agricultural history, humans have used various genetic resources from plants, animals, and microorganisms (genetic resources for food and agriculture). Genetic resources for food and agriculture are not only the foundation for human existence at present but also are important as a means of supporting human prosperity in the future. As a result of this common recognition, gene banks for preserving and distributing genetic resources for food and agriculture through international cooperation have been gradually established in both advanced and developing countries.

As Japan's representative gene bank of genetic resources for food and agriculture, the National Institute of Agrobiological Sciences (NIAS) Genebank has been exploring, collecting, characterizing, and preserving agriculture-related plants, animals, and microorganisms. The NIAS Genebank has also been making these genetic resources, their passport information, and their characteristic information available in order to facilitate their uses for research and educational purposes, including breeding (Fig.1 and Fig. 2).

The NIAS Genebank has been performing activities relating to its comprehensive gene bank project for 30 years. These activities first began with the "Ministry of Agriculture, Forestry and Fisheries' gene bank project," which was launched in 1985.

Activities of the NIAS Genebank

The NIAS Genebank consists of plant, microorganism, animal, and DNA sections and, for all of these sections, the NIAS operates as the center bank. The NIAS Genebank has established a nationwide cooperative system in which agriculture-related research institutions, including the National Agriculture and Food Research Organization, are designated as sub-banks, and has been pursuing various projects related to genetic resources.

Traditional crop varieties from foreign countries are sources of genes that possess useful genetic characteristics that the crop varieties in Japan do not possess, such as resistance against insects that cause damage to crops and tolerance to certain stresses. These foreign varieties form part of the culture of the corresponding country.

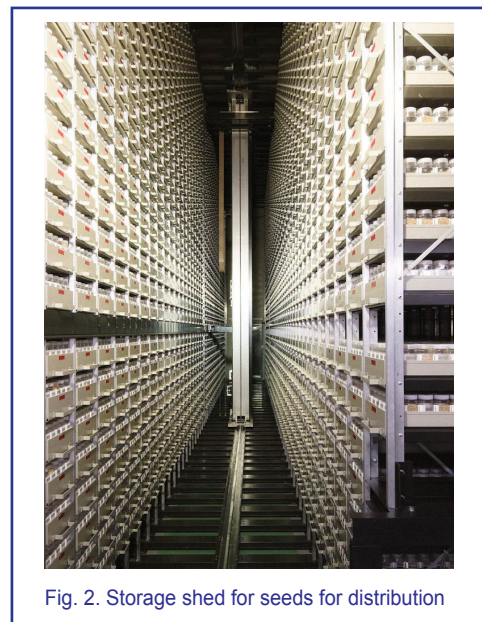


Fig. 2. Storage shed for seeds for distribution

However, in developing countries, because of changes to cash crops, the diffusion of modern varieties following the improvement in agricultural technology, rising sea levels and desertification due to climate change, and natural disasters, traditional crop varieties that have supported self-sufficient agriculture are being lost.

Through bilateral joint research with agricultural research institutions in developing countries, the NIAS Genebank has applied itself to perform exploration, characterization, and the *ex-situ* conservation of traditional crops that are being lost. The NIAS Genebank has also provided these genetic resources and their information to domestic and foreign researchers in order to allow them to use these genetic resources and crop varieties for research and educational purposes. At present, the NIAS Genebank preserves approximately 220,000 plant genetic resources and distributes approximately 8,000 plant genetic resources each year.



Fig. 1. External view of the facility for managing the genetic resources of organisms relating to agriculture, forestry, and fisheries.

In cooperation with the Japan International Cooperation Agency, the NIAS Genebank has been holding group-training courses relating to plant genetic resources for approximately 20 years. Thus, the NIAS Genebank has played an important role in cultivating human resources that are involved in the preservation and use of plant genetic resources in developing countries.

Regarding animal genetic resources, the NIAS Genebank has preserved and distributed precious genetic resources relating to fowl and silkworms, which were created and have been continuously bred in various parts of Japan and which are being neglected as a result of agricultural modernization. The NIAS Genebank has also developed methods of preserving these resources. At present, the NIAS Genebank preserves approximately 1,900 animal genetic resources, and distributes approximately 50 animal genetic resources each year.

Regarding microorganism genetic resources, the NIAS Genebank has classified and identified microorganisms and investigated their characteristics, particularly centering on microorganisms that cause diseases in animals and plants and those that are used to ferment food. The NIAS Genebank has accepted the deposit of strains of plant pathogenic organisms that have been isolated both inside and outside Japan. At present, the NIAS Genebank preserves approximately 30,000 microorganism genetic resources and has distributed approximately 1,000 microorganism genetic resources every year.

At present, the NIAS Genebank preserves approximately 460,000 DNA clones, centering on full-length cDNA clones of rice, pig, and silkworm that have been isolated by the NIAS. The NIAS Genebank also preserves yeast artificial chromosome (YAC), P1-derived artificial chromosome (PAC), and bacterial artificial chromosome (BAC) clones. The NIAS Genebank distributes approximately 300 DNA clones every year.

The NIAS Genebank has exhibited information about these genetic resources and received the application of these genetic resources from users through the Internet. Users can also search and inspect various types of information.

The NIAS Genebank can be accessed at the following website:
http://www.gene.affrc.go.jp/index_en.php



Fig. 3. External view of the facility for preserving genetic resources

Current Correspondence on International Treaties that concern the Access and Benefit-sharing of Genetic Resources

Various international treaties are involved in international transactions of genetic resources. These treaties include the Conservation on Biological Diversity (brought into effect in 1993), the Bonn Guidelines (adopted in 2002), the Nagoya Protocol on Access and Benefit-sharing (ABS) (brought into effect in 2014), and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR, brought into effect in 2004).

Regarding international transactions of genetic resources, the NIAS Genebank investigates the development of laws and regulations in the corresponding country and also whether the corresponding country has agreed to the above international treaties. The NIAS Genebank manages international transactions by following the ITPGR and the Bonn Guidelines. Therefore, regarding genetic resources from plants, animals, and microorganisms that are provided for research and education purposes, it is considered that appropriate relations of right concerning these international treaties have been established.

At present, in order to ratify the Nagoya Protocol on ABS, the relevant authorities in Japan have been cooperatively developing related domestic measures. Although it is still unknown how the domestic measures will be brought into effect, the NIAS Genebank will make every effort to collect information about genetic resources and pursue its activities in conformance with the Nagoya Protocol on ABS, etc., in order to continue smoothly collecting and distributing genetic resources after Japan joins the Nagoya Protocol on ABS in the future.

Prospects of the NIAS Genebank

The NIAS Genebank has consistently applied itself to explore, collect, characterize, and preserve genetic resources in Japan and foreign countries, to distribute genetic resources, and to provide information about genetic resources. As social infrastructures such as gas, electricity, and water supply are essential for our cultural lives, and as activities relating to the preservation and distribution of biological resources are indispensable for academic research in basic science, the NIAS Genebank provides an important research basis for the research and development of agriculture in Japan and foreign countries. In the NIAS Genebank, the facility for preserving genetic resources was launched in March 2015, in which seeds with 400,000 accession numbers can be preserved at -18°C for a long duration. Thus, the function of the NIAS Genebank has been further strengthened (Fig. 3).

Recently, following the improvement in research tools in molecular biology, such as next-generation sequencers, the genomic analysis of agricultural bioresources has greatly advanced. At present, the classification and identification of genetic resources preserved in the NIAS Genebank and the application of these genetic resources in the research of biological diversity and breeding can be positively promoted based on the research results obtained using genetic resources. The NIAS Genebank will positively pursue the further exploration and collection of international genetic resources in order to expand the number of genetic resources. The NIAS Genebank will also further perform an *ex-situ* evaluation of genetic resources using new research tools in order to raise the values of genetic resources.

Editor's Note

This newsletter introduces the Ministry of Agriculture, Forestry and Fisheries' National Institute of Agrobiological Sciences (NIAS) Genebank for the first time, so this month's newsletter is a memorial issue. If the National BioResource Project provides resources to support "basic research," the NIAS Genebank provides resources to widely support "agriculture." The NIAS Genebank has played a leading role in promoting rice and silkworm genome sequencing projects, thus contributing greatly to basic research. In the correspondence relating to international treaties, which are currently discussed by the authorities concerned, the International Relations Section for Genetic Resources, in which Dr. Domon serves as Section Head, plays an extremely important role, and many persons concerned rely on Section Head Domon. We are grateful to Section Head Domon for writing this article and the Director of the Genetic Resources Center for approving the introduction of the NIAS Genebank (Y. Y.).

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BioResource Information

(NBRP) www.nbrp.jp/
 (SHIGEN) www.shigen.nig.ac.jp/
 (WGR) www.shigen.nig.ac.jp/wgr/
 (JGR) www.shigen.nig.ac.jp/wgr/jgr/jgrUrlList.jsp