



Plant Genetic Resources

Extensive crop collections of global significance



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Photo: Apple orchard in Randwijk (WUR)

Genetic diversity is vital for a future-proof agriculture and horticulture. The Centre for Genetic Resources, the Netherlands (CGN) possesses an extensive collection of varieties and populations of cultivated crops and their wild relatives within its genebank. The aim is to gather as many varied characteristics as possible, which can serve as a foundation for new varieties. The collection can be freely accessed by breeders, researchers and experts from anywhere in the world.

Photo: Collecting crop-wild relatives on St. Pietersberg in Maastricht (WUR)



Why is genetic diversity important?

Genetic diversity enables plants to adapt to changing environmental factors such as climate change, diseases and pests. When plants are genetically diverse, it is more likely that some individual plants will have the necessary traits for survival and reproduction.

In agricultural and horticultural crops, genetic diversity is important for food security. For example, if a crop yields poorly due to a bad harvest, drought, or a plant disease, another crop with different genetic traits can compensate for this deficiency. Different climates and growing conditions also call for different varieties and traits.

Breeders use genetic resources to develop new and improved crops. They are a reservoir of genetic variation that can be used to find and transfer desirable traits in crops. Having a diverse genebank of cultivated varieties and wild relatives will ensure that we are also well positioned to respond to any new requirements that might emerge in the future. It reduces the risk of genetic erosion, which can occur when there is an excessive focus on a limited number of traits, eventually leading to a decline in genetic diversity among cultivated varieties.



Photo: Characterising radish varieties in the field (WUR)

Genebank for Plant Resources

CGN manages the genebank for agricultural and horticultural crops on behalf of the Dutch government. Almost 24,000 accessions have been stored. They include commercial varieties, landraces, farmer varieties, and the wild relatives of cultivated crops from over 150 countries. Breeders can draw from this collection to develop new varieties that are, for example, resistant to diseases or pests, or that are more resilient to drought.



Photo: Working in the cold store at -20 °C (WUR)

Managing a genebank is one of the ways in which CGN contributes to the conservation and application of plant genetic diversity in an international context. This work involves European partnerships as well as worldwide cooperation within the Global Crop Diversity Trust.

Seed storage

CGN's seed storage and processing facility is located in a specially insulated building made up of several different storage rooms: two cold stores (-20°C), a refrigeration room (4°C), a drying room (15°C, 15% relative humidity) and a work space. When seeds arrive, they are first tested to check their quantity, quality and germinating power. The seeds are then cleaned and dried, before being packed into aluminium foil bags and labelled. The bags are divided: one part goes into the freezers for users, and the other part into the cold storage for regeneration and long-term storage. For extra security, duplicates are always sent to a fellow genebank in Europe and to the Global Seed Vault in Svalbard.

How does the genebank work?

When seeds arrive, they are usually first sown in a greenhouse or in the field. This allows us to produce more seeds, and fresher ones, and to study and describe their traits (such as growth and resistance to disease). We then dry the seeds and store them in airtight bags in the freezer at -20°C. We can preserve most agricultural and horticultural crops for 20 to 50 years in this way. When there is a risk of the germinating power of the seeds declining, or of the seed running out, we sow out a portion and harvest new seeds. This fresh harvest of seeds will then see us through for many more years. All information about the collections is made available to any interested parties, and samples can be chosen and ordered online.

Collections

The seeds in the genebank are sourced from all sorts of places: breeding companies, wild populations in nature reserves, collecting missions in other countries, old working collections or botanical gardens. For each crop, the aim is to build a collection of varieties or wild populations representing as many different traits as possible. We carefully select new accessions, evaluate them for useful traits, describe them in detail, and store them in optimal conditions, working closely with breeders and partner genebanks.

Information about the traits of the material is stored in data files. Breeders and researchers can search this information and order seed samples online. Samples are issued once we have an electronic signature on a *Standard Material Transfer Agreement* (SMTA). The collections are freely available for the purposes of research and breeding within the Netherlands and abroad.

CGN also has special collections that are made available subject to specific conditions, such as 'Single Seed Descent' collections. Those conditions may vary for different collections.



Photo: Beans from the genebank in Albania (WUR)

Heritage varieties

CGN has selected 350 heritage varieties from the 'Orange List' of historic fruit and vegetable varieties. These are historical Dutch varieties that are rarely grown today. They include the bitter Brussels sprouts that people used to grow in their vegetable gardens, and the cabbages from Langedijk that were sold at auction from boats. CGN wants to restore access to these heritage varieties by sharing information, providing signposting to suppliers and making seed available through www.erfgoeddrassen.nl. This will enable home gardeners and schools to grow and taste a piece of history.

Wild relatives

Wild species related to our food crops can be an important source of new traits, such as resistance to changing climatic conditions, resistance to new diseases or adaptation to changes in what consumers want. However, the survival of many wild plant species in nature is far from assured. CGN therefore works with nature organisations, local administrators, volunteers and Het Levend Archief ('The Living Archive') foundation to collect and conserve Crop Wild Relatives (CWR) in the Netherlands. An overview of Dutch CWR can be found at www.cwrnl.nl.

Collections

- Potatoes
- Apple
- Asparagus
- Leafy vegetables e.g.
 - lettuce
 - spinach
 - cichorium
- Forage crops
- Grains:
 - oats
 - barley
 - wheat
- Caraway
- Crucifers
- Maize
- Legumes e.g.
 - faba beans
 - lupin
- Salsify
- Onion and leek
- Flax
- Fruit vegetables:
 - tomato
 - pepper
 - aubergine
 - cucumber
 - melon
- Carrots

Regeneration and research

Germination trials and regeneration of plant material

Seeds can age during long-term storage, so sometimes we need to regenerate seed samples. The seeds are sown and grown under specific conditions to ensure that the seeds we harvest have the same characteristics as the original population. The newly harvested seeds can then be stored again for an extended period.

Seed regeneration is necessary when the germination rate falls below an acceptable level or if there is a shortage of a particular seed sample. As a rule, the germination rate should be above 80%. Exceptions are made for accessions that are very difficult to regenerate, such as some wild species. For these species, rates between 60% and 80% are acceptable.

DNA research

Advances made over the past few decades enabled us to determine the DNA sequence of genebank material on a large scale. This has greatly enhanced our ability to study the relationship between accessions, and thereby determining their origins. This knowledge can help us improve the composition of the genebank collection. Furthermore, the prediction of traits based on DNA is becoming increasingly feasible.

This means we can open the 'treasure chest of genetic variation' and start making the best possible use of the diversity found among wild related species and exotic landraces from distant places.



Photo: Seedling trays with different types of lettuce (WUR)

Other research

In addition to DNA research, the CGN also conducts other types of research aimed at improving the preservation of its materials and the provision of services to its users. For instance, research has been conducted on the distribution of wild relatives in the Netherlands and their future under various climate change scenarios. There has also been investigation into various aspects of seed storage and germination capacity determination, as well as monitoring different processes within the genebank, allowing for better planning of our activities.

Knowledge base

Want to know more about a particular aspect of the collections, or about research on plant genetic resources? Visit our [online knowledge base](#).

Equitable use of genetic resources

Until a few decades ago, it was entirely normal to collect plants and seeds and take them to other countries, without any obligations or restrictions on the use of the collected material. But gradually a consensus emerged that genetic resources are valuable and should not be used without the consent of the country of origin. This led to the establishment of international agreements set out in the Convention on Biological Diversity (CBD) and the supplementary Nagoya Protocol.

These treaties regulate 'Access and Benefit-Sharing' (ABS). Users (such as breeders or researchers) often need to comply with certain regulations in order to gain access to genetic resources. Moreover, the benefits of using these resources often need to be shared. The outcome is that parties in the country of origin of genetic resources receive a fair share of the financial and/or non-financial returns arising out of the use of those resources. The sharing of non-financial benefits can include information exchange, technology transfer and capacity building.

The Centre for Genetic Resources, the Netherlands is the National Focal Point for ABS in the Netherlands. This role is performed on behalf of the Ministry of Agriculture, Fisheries, Food Security and Nature, and it means we are the point of contact for issues related to ABS in the broadest sense. We try to inform those who

make use of genetic diversity about the rules surrounding ABS, and to help them comply with those rules.

More information on [Access and Benefit-Sharing](#).

International collaboration and quality assurance

Fortunately, the CGN is not alone. Worldwide, there are hundreds of genebanks, all contributing to the preservation of the genetic diversity of our food crops. Within Europe, we work as part of the European Cooperative Programme for Plant Genetic Resources (ECPGR), where we facilitate data sharing, help improve each others' methodology and align our activities.

Outside Europe, many genebanks also perform important work. These include genebanks in international research institutions in developing countries (the CGIAR institutes), which manage very significant and extensive collections of food crops. CGN researchers are regularly involved in audits and peer reviews of these partner genebanks.



Photo: Diversity of melons, Uzbekistan (WUR)

Centre for Genetic Resources, the Netherlands

The Centre for Genetic Resources, the Netherlands (CGN) carries out statutory research tasks (WOT) on the preservation and promotion of the sustainable use of genetic resources on behalf of the Ministry of Agriculture, Fisheries, Food Security and Nature (LVVN). Genetic resources hold value for food production, agriculture and forestry, both now and in the future. The CGN is engaged in the preservation of genetic resources of crops, farm animals and trees.

Photo: Propagation of wild leeks (*Allium ampeloprasum*) (WUR)

Contact

Are you interested in collaborating with CGN or finding out more about plant genetic resources?

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