

CIP's genebank

the future of potato and sweetpotato

Home of the largest *in vitro* genebank in the world



Breeding new varieties of food crops is essential to maintain and increase world food supplies. Developing these varieties depends on the biodiversity conserved and studied in genebanks. Genebanks conserve living samples of the world's huge diversity of crop varieties and their wild relatives. They ensure that the genetic resources that underpin our food supply are both secure in the long term and available for use by farmers, plant breeders and researchers.

However, areas rich in biodiversity are threatened all over the world by desertification, deforestation, disease, erosion, urban sprawl, monoculture farming and climate change. Conserving the genetic resources of potato and sweetpotato has been a major priority of the International Potato Center (CIP) since its founding in 1971. The Center holds the largest collections of potato and sweetpotato in the world, held as global public goods under the auspices of the United Nations International Treaty.

Banking on the future

The genetic resources maintained by CIP represent the heritage of many nations and the labor of countless farmers, plant explorers, and geneticists. The collections were made possible through the contributions of individuals and communities from scores of different countries.

CIP's genebank holds 7180 varieties of potato (2448 of them wild and 4732 native Andean varieties), 8026 varieties of sweetpotato (of which 1171 are wild) and 1556 varieties of Andean root and tuber crops. Endemic native cultivated potato varieties include 2700 from Peru and 900 from Bolivia and Ecuador and the rest from other Andean countries, and come in a huge range of shapes, sizes and colors, ranging from white to red to black. About 80 percent of the native cultivars and 50 percent of the wild relatives targeted for protection have already been collected and are now safe. The status of many others, however, is still in doubt.

CIP is the first genebank in the world to obtain ISO 17025 Accreditation



Testing Laboratory
N° 4229

CIP's genebank

The Model Genebank - a secure ark to house a priceless collection

CIP's earthquake-proof genebank features state-of-the-art conservation chambers and associated facilities, including germplasm laboratories, herbarium, pathogen testing and elimination, and germplasm distribution facilities. The complex houses the largest *in vitro* genebank in the world and the first to obtain an International Standards Organization 17025 Accreditation. The genebank uses barcode technology, resulting in a laboratory that can operate "without pens and pencils."

Lines of defense

To protect this invaluable and irreplaceable collection, CIP uses a range of failsafe conservation methods.

Field genebank: Potato varieties kept as tubers are annually propagated in the Center's field genebank at Huancayo, located 3200 meters above sea level in the Peruvian Andes, for characterization and evaluation purposes. The sweetpotato collection is kept as living plants in greenhouses.

In vitro conservation: Potato plantlets are kept for up to 2 years in test tubes, growing in specially developed sterilized semi-solid culture medium, which provides all the nutrients the plant needs. A low temperature of 6-8°C, low light and the use of an osmotic regulator slow down the plantlets' growth. When re-planted under normal light and temperature conditions, the plants re-grow normally. Sweetpotato plantlets are similarly maintained.

True seed conservation: Kept at around -20°C, the tiny seed from the potato's berry-like fruit are by far the cheapest and easiest kind of material to store as their lifespan is about 40 years. However, unlike asexually propagated tubers, the genetic make-up of cross-pollinated seed is unpredictable. Sweetpotato seed is kept with equal success.

Cryopreservation: Shoot tips are deep-frozen in a tissue-protecting solution at -196°C in vials in liquid nitrogen. At this temperature, all cellular functions theoretically cease, making it possible to keep plant material indefinitely and later revive it. The technology is now well advanced for potatoes, but is still developing for sweetpotatoes.

DNA genebank: Another unique method of conservation at CIP is the storage of DNA. Currently, DNA of more than 2400 varieties of CIP's germplasm collection has been extracted and kept in deep-freeze at -70°C. The aim is to have all accessions held in this form of conservation in the future.

Herbarium: CIP's Herbarium houses around 25 000 specialized specimens of potato, a result of the life-long labors of the famous Peruvian scientist

Professor Carlos Ochoa, sweetpotato and the Andean root and tuber crops.

Dynamic *in situ-ex situ* conservation: CIP collaborates with communities in Andean farming villages to establish community genebanks by repatriating disease-free germplasm from CIP to grow on communal land. This approach means that the natural processes of evolution and selection in response to changing conditions continue to operate on the plants in their environments. At harvest time, the villagers help themselves to tubers that they will use to grow their next crops and to distribute to neighboring communities. A good example of this approach is CIP's work at the Potato Park in Písaq, Cusco, Peru, with six communities and a local NGO, Asociación Andes.

Black box conservation: For added security, CIP maintains a duplicate set of its *in vitro* collections, so-called 'blackbox' conservation, at another site outside Peru, and in the seed collection at the Svalbard Seed Vault in Norway.

From the genebank to the farmer's field: how biodiversity is used

Extensive screening of thousands of individual accessions of wild and cultivated potato species from the Andes has helped scientists identify resistance to important potato diseases, such as late blight and virus diseases, which are the most harmful potato diseases in developing countries. Resistance to the potato tuber moth, the Andean potato weevil and to ten different potato viruses, is also being explored. Tolerance to frost, drought and salinity have also been identified. In sweetpotato, varieties with greater beta-carotene content, better disease resistance and higher salt and drought tolerance are being developed. These varieties will be ideal for cultivation in Africa and in many other places in the world.

The material in CIP's diverse germplasm collection is also used in various breeding programs around the world, with over 100 countries using the germplasm.

If you would like:

- further information
- to support the work of the genebank or
- to request germplasm

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