



Conserving Diversity for the Future: The CIP Genebank

View from the field: Challenges in international agriculture

Food production will be hard pressed to keep up with demand in the next 30 years. The world's population is expected to swell by some two billion by midcentury, chiefly in developing countries already struggling to feed their people. If unchecked, population growth and urbanization will encroach on productive farm lands and destroy the natural habitats and plant diversity essential for doubling the production of nutritious food on the same land area. The unpredictable impacts of political and social unrest, natural disasters, environmental threats, and a changing climate further obscure the certainty of a food-secure future. Fortunately, crop genetic diversity offers options to face these challenges.

Land traditionally suitable for potato and sweetpotato cultivation is becoming less so due to insect and disease pressures from warming climates, as cultivation is forced to move to elevations where centuries-old varieties and farming practices may no longer be tenable. As soil quality worsens, productivity and yields suffer. The complementary *in-situ* and *ex-situ* conservation of genetic diversity is critical for conserving and monitoring changes in the world's plant genetic resources for food and agriculture—the essential raw materials for helping farmers respond to climate change. Lost genetic diversity, particularly of crop wild relatives, would restrict how plant breeders, researchers, farmers, and conservationists use these resources to help enhance nutrition, income generation, and sustainability of farmers' livelihoods and in the feeding of growing populations. Hence, increasing the efficiency of genetic resources conservation and use is a requirement for the future.

Protecting the genetic diversity of potato and sweetpotato

The genebank is the engine that drives CIP's efforts to conserve for current and future use the world's genetic diversity of potato and sweetpotato—including cultivated, and wild accession as well as breeding material. It plays a critical role in facilitating the impact-oriented release of CIP innovations and products, particularly suitable varieties for farmers and consumers. Among its 21,000 accessions is the only secure long-term global collection of Andean root and tuber crops, which may hold unique invaluable genetic, physiological, and biochemical attributes. The collections illustrate the innovative, research-driven development and delivery of plant genetic diversity and related information and tools for global researchers. The genebank supports and enables the expedient use of diverse genetic building blocks to develop varieties that can ensure global productivity of healthy, abundant, and secure food. It will enhance the conservation and availability of valuable diversity through further rationalizing of global national collections.

The genebank will also serve as a model for global and national genebanks through advanced research, public database designs, and interactive genomic use of the collections. Genomic fingerprinting allows scientists to identify the diversity of these accessions rapidly and conclusively. The capture, generation, discovery, and compilation of trait-associated information will greatly help the scientific community to discover ways to strengthen food security in a changing environment (e.g., resistance to diseases and insects, tolerance to drought, cold, and heat).

Orange-fleshed sweetpotato (OFSP) is an excellent example of where the diversity in the genebank has and will continue to be used for biofortification and products with added nutritional content. The genebank holds numerous accessions of OFSP and purple-fleshed sweetpotato containing enhanced contents of vitamin A, antioxidants, and other important vitamins and energy sources. Leaves from the purple-fleshed sweetpotato can be used as an antioxidant source. (Read more about OFSP's contributions to health and nutrition in CIP's companion strategy on Resilient Nutritious Orange

Fleshed Sweetpotato and Strategy and Corporate Plan 2014-2023 documents).

A new level of partnership

CIP's unique contribution for increasing food security and enhancing food productivity is the knowledge and know-how held by the CIP community of breeders, researchers, curators, technicians, and network of partners. The genebank supports strategic collecting to supplement collections and partners with smallholder farmers for *in-situ* conservation and improving their livelihoods. Through collaborations with a wide spectrum of next and end users, CIP's genebank will maintain its world-class reputation for excellence, transparency, expertise, and germplasm management. Over the next several years the genebank will work with partners who have generated data on all known traits associated with accessions in order to create a publicly accessible database in an accession-associated and public format.

The genebank's unparalleled collection of potato and sweetpotato, coupled with CIP's core R&D mandate, offers unlimited possibilities for

global partnerships at all levels. One approach is the global harmonization of the collections by identifying the major collections and working with them one-by-one through DNA fingerprinting to define a collection's uniqueness. Another is to work with other genebanks to ensure that phytosanitary clean material is backed-up to prevent loss of diversity already in conservation. We will help to return this material to the original collections so as to ensure that these national collections have clean material to distribute to other Consortium Centers, regional programs, universities, and any number of national agricultural research systems and advanced research institutes. New partnerships also require supporting and strengthening genebanks in developing countries by building capacity in such areas as cleaning accessions of diseases, establishing national sustainable support systems, training staff, ensuring collections are secure and backed-up and implementing best genebank practices. A strategic partner will be the CGIAR Research Program on Roots, Tubers and Bananas, whose work will help to document and understand the temporal and spatial dynamics of

diversity conserved in situ, as well as expand the collections' utility.

Tapping the potential

DNA fingerprinting of the collections has already begun. By 2018 DNA fingerprints will be available to provide the tools needed to develop trait-by-genetic marker correlations in all accessions. Use of the collection and associated information to secure food supply and availability will be doubled through a number of initiatives and discovery research efforts. In keeping with the genebank's role as a vital research resource, CIP will develop progressive and interactive databases and catalogs to accelerate information exchange. Efficiencies are needed to allow the evolution of databases, cryobanking methodologies, phytosanitary cleaning, microtuber development, genomics

capacities, monitoring of in-situ sites, and other activities. The genebank intends to accelerate the phytosanitary cleaning of routine cultures and increase the cleaning throughput. This will greatly expedite the permitting and shipping of valuable germplasm and expand its use worldwide.

The CGIAR Research Program on Roots, Tubers and Bananas is an essential platform for Conserving Diversity for the Future: the CIP Genebank.

To learn more about Conserving Diversity for the Future: the CIP Genebank go to <http://cipotato.org/conserving-diversity-for-the-future/>



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