

THE CONSERVATION AND UTILIZATION OF CROP GENETIC RESOURCES IN THE TROPICS

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Summary

The tropics, as major centers of crop plant origin and diversity, have contributed a large number of crops to the worlds' food production and industry. The historical flow of crop biodiversity from their centers of origin throughout the world has lead to important additional centers of diversity and caused at the same time, that most countries became interdependent on plant genetic resources for food and agriculture. Many developed and developing countries have established germplasm collections in genebanks, as a resource for sustaining crop productivity, food security and their industrial utilization. Conservation methods have been developed aimed at securing the viability of living collections on the long-term. National and international programs have been recently developed to support and promote cost-effective rational conservation systems. Based on the experience gained with root and tuber crops, this chapter summarizes the basic elements of crop genetic resources conservation, including the methods and techniques utilized in germplasm conservation, with special attention paid to *in vitro* culture methods and genebank management, and the valorization of genetic resources. Finally, the challenges and opportunities posed by current global trends, by developments of modern science and technology and the evolving regulatory framework, to crop genetic resources conservation and utilization are summarized.

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Biographical Sketches

William Roca Pizzini is currently a Consultant with the International Potato Center (CIP), Lima, Peru. Until the end of 2006, Dr. Roca has been leading CIP's Genetic Resources Research Division, hence his work at CIP largely focused on the conservation and characterization of root and tuber crop biodiversity. He received his PhD from Cornell University in Plant Cell Physiology under Professor F.C. Steward. After obtaining his PhD in 1973, Dr. Roca spent 5 years at CIP, Lima, Peru, working on the development of *in vitro* technologies for potato genetic resources conservation; then he moved to the International Center of Tropical Agriculture (CIAT) in Cali, Colombia, where he stayed during 22 years. While at CIAT, he established, and became the first Head of CIAT's Biotechnology Research Unit, and worked on biotechnological applications to the understanding and utilization of the biodiversity of cassava, common beans, rice and tropical pasture species. In 1995, Dr. Roca was awarded with the REDBIO/FAO Medal, and the CIAT's Outstanding Senior Scientist Award. Currently he is a Visiting Professor at Universidad Nacional Agraria La Molina, Lima, Peru and Coordinator of REDBIO, Peru. He has authored and co-authored nearly 40 refereed publications on a range of genetic resources and biotechnology topics, as well as 15 book articles and related publications. Dr. Roca has guided and advised numerous students for Doctorate, Master and Bachelor research theses, particularly in Colombia and Peru.

Cecilia Ynouye is a biologist graduated in 2000 from the Universidad Nacional Agraria La Molina in Lima Peru. She started her research career studying the biochemical composition of yacon, an Andean crop, to improve its knowledge and utilization. Since 2003, she is working as a Research Assistant at CIP in the Genetic Resources Conservation and Characterization Division. Her main duty is the co-management of potato *in vitro* genebank, which includes the production of virus-free accessions for national and international distribution, and the development of a potato cryobank for long-term conservation. Besides, she is involved in a project funded by the World Bank dealing with the safe movement of germplasm. She is currently finishing her MSc studies on Natural Resources and Environmental Economics at the Universidad Nacional Agraria La Molina. Her research interest is to improve the conservation and utilization of biodiversity to enhance the livelihoods of rural communities.

Catherine Espinoza is currently a Research Assistant at the International Potato Center (CIP) in the Genetic Resources Conservation and Characterization Division in Lima, Peru. She has contributed to ECLAC, CAF and CIP with a study on biotechnological capacities of Andean Community countries; and the National Institute for the Defense of Competition and Intellectual Property Protection (INDECOPI) and CIP for scientific analysis of patents referring to *Lepidium meyenii* (maca). She received her BSc degree in Biological Sciences and her licentiate in Biology from Federico Villarreal University (Lima, Peru) in 2003 and 2005, respectively. Her professional experience includes conservation of plant genetic resources of potato, sweetpotato and other Andean root and tuber crops, with especial emphasis on *in vitro* conservation, genetic integrity assessment, and issues of intellectual property rights, access to genetic resources and benefit sharing.

Cinthya Zorrilla is currently a Research Assistant in the Genetic Resources Conservation and Characterization Division at the International Potato Center (CIP), Lima, Peru. She is in charge of the molecular characterization of potato and other root and tuber biodiversity involved in the study of genetic diversity, genetic integrity and molecular systematics. She obtained her Bachelor in Sciences degree in Biology in 2003, and her Biologist title in 2006, from the Universidad Nacional Agraria La Molina, Lima, Peru. She also obtained a Diploma on “environmental development, biodiversity, genetic resources, indigenous knowledge and intellectual property” in 2005. She has trained numerous Peruvian students and researchers in the use of basic DNA marker techniques.

Alberto Salas is currently a Research Associate at the International Potato Center (CIP), Lima, Peru. He is the Curator of the wild potato collection maintained in CIP genebank. His work at CIP largely focuses on the exploration, collection, conservation, characterization and evaluation of wild potato germplasm. A. Salas received his MSc degree from the Universidad Nacional Agraria La Molina in 1974. From 1969 to 1976, he worked in the Peruvian National Potato Research Program at the Universidad Nacional Agraria La Molina. Since 1976, he has contributed to the collection and conservation of wild and cultivated potato germplasm. In 2001 he was named Honorary Life Member of the Potato Association of America (PAA), at its 85th Annual meeting in the USA. In 2006, he received an official distinction by the Peruvian Government “In merit to Diplomatic Service from Peru José Gregorio Paz Soldan”. The same year, he was awarded by the International Symposium on Conservation of Agricultural Biodiversity held in Tenerife, Spain. He has authored and co-authored nearly 50 refereed publications related to germplasm exploration, collection, maintenance, conservation, characterization and evaluation of *Solanum* Section *Petota*. He has guided and advised numerous students for Doctorate, Master and Bachelor research theses, particularly in Peru, as well as has guided numerous pre- professional trainees.

René Gómez is currently the Curator of Potato Landraces at the International Potato Center (CIP), Lima, Peru. He obtained an Agronomist degree from the Universidad Nacional San Antonio Abad, Cusco, Peru; he worked in Cusco for 5 years in research to develop activities in rural communities. He obtained his MSc degree from the Universidad Nacional Agraria La Molina. Since 1989, he works in CIP Genebank on the conservation, management, characterization, evaluation, documentation and distribution of potato agrobiodiversity. He also conducts collaborative work with farmers' communities and NGOs on *ex situ* and *in situ* conservation, community seed banks, repatriation and restoration of virus-clean potatoes. R. Gómez has also been involved in a project to homologate potato genebanks from Bolivia, Ecuador and Peru aimed at achieving a rational management strategy for conservation. In alliance with other local institutions, he has participated in the development of *in situ* conservation areas such as the Potato Park in Cusco, Peru, and has been involved in the creation of the National Potato Day in Peru. He is author and co-author of more than 20 publications, related mainly to potato genetic resources, and has sponsored

several research theses with Peruvian students.

Ana Panta currently is responsible for the *in vitro* Genebank of the International Potato Center (CIP), Lima, Peru. She got a Biologist degree in 1984, and worked for 3 years in establishing sweetpotato and citrus *in vitro* banks in the National University Pedro Ruiz Gallo, Lambayeque, Peru. Then, she carried out Phytopatology MSc studies in the Universidad Nacional Agraria la Molina, Lima, Peru. In 1989 she started working at CIP on the development of sweetpotato virus elimination methods and genetic engineering for potato virus resistance and sweetpotato weevil resistance. Since 1997 she has focused on *in vitro* conservation, pathogen elimination, and cryopreservation in CIP genebank. Currently, A. Panta is conducting a PhD work on Biological Sciences Applied to Agriculture in the Catholic University of Leuven, Belgium. Her research deals with the development of potato cryopreservation methods. Her activities in CIP include training of national and international students and scientists in genetic resources conservation. She received the “Merit Award” from the Agriculture Ministry of Peru for her contribution to potato seed national programs. She has authored about 50 publications and supervised several BS and MS theses, on genetic resources and biotechnology topics. Currently she is an invited Professor in two Peruvian Universities.

Iván Manrique is a Research Assistant in the Genetic Resources Conservation and Characterization Division at the International Potato Center (CIP). His research area deals with the analysis of nutritional, functional and health related compounds in the germplasm collections maintained in CIP genebank: potato, sweet potato and other Andean roots and tubers. He received his MSc in plant breeding from Universidad Nacional Agraria la Molina in 2000. From 2000 to 2004, he worked in post harvest, nutrition and market impact of Andean root and tuber crops. In 2000, he won the national contest on Agro industrial Technological Innovation (ITA2000) for his contribution to the study and agro industrial transformation of yacon, a less known Andean root crop. His experience also includes studies on the resistance of potato to late blight. He is author and co-author of many scientific publications related to the valorization of Andean root and tuber crops. Additionally, he has advised and guided many Master and Bachelor research theses students.