CIP SCIENCE WEEK

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Assessing the Impact of CIP Genebank

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Background

Preserving plant diversity is a critical objective of a genebank. Genebanks provide breeding programs with new and crucial traits that can be incorporated into crops. Future food security relies on these traits, that can improve resilience to a changing environment and new pests.

Current varieties with traits for increased yield and improved quality are currently available and the capacity to store, study, and introduce them for improving agriculture is the basis for crop improvement. A rich pool of plant genetic resources (PGR) is necessary to provide variants that contribute to food security.

Fig. 1: Area with poor quality soil.

Genebanks safeguard plant biodiversity for the good of humanity
Genebanks protect biodiversity from threats such as: loss of soil quality, water scarcity, pollution, deforestation, and other unexpected changes in environmental conditions and the consequential loss of biodiversity.

Fig. 2: Potato plants conserved *in-vitro* at CIP

The International Potato Center (CIP) Genebank
CIP Genebank preserves one of the world's largest collections of potato, sweet potato, and Andean root and tuber crops (ARTC) germplasm.

The collections in the CIP genebank are a public-good resource for farmers, breeders, and researchers around the world. Much of the germplasm conserved would be very hard, if not impossible, and costly to get from natural sources outside of CIP genebank.

Genebanks do not have a direct value in the marketplace, and determining their economic benefit is a difficult task (Fig 3). More information is needed to separate the economic impact of genebank accessions and the economic impact from other sources of value such as breeding programs.

Goal: to assess the CIP genebank impact through an economic approach focused on evaluating selected improved potato varieties directly related to CIP Genebank material.

- First, evidence was collected on the benefits the CIP genebank provides to users and farmers such as savings in cost and time by using CIP genebank material in improved varieties.
- Second, to incorporate this information into an economic surplus analysis using selected varieties and determine which portion of the benefits corresponds to the contribution from the CIP genebank.

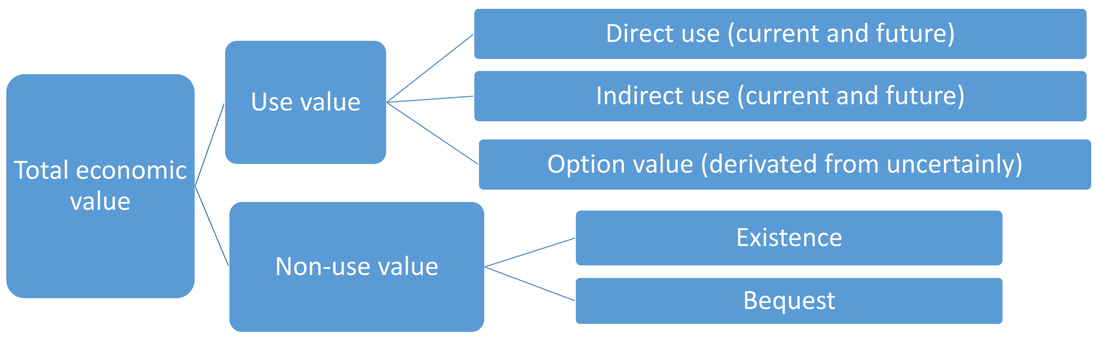

Fig. 3: Total economic value of PGR (Smale & Koo, 2003)

Methods

- User survey sent in 2015 to entities that requested material from CIP genebank between 1999 and 2014.
- Follow-up semi-structured interviews with key informants to collect further information (see Table 1) from experts.
- Pedigree information for selected varieties developed, associating to genebank accessions.
- Literature search of impact studies identifying adoption, yield changes and other benefits, of selected varieties.
- Economic surplus analysis will be performed and incorporated in order to estimate the contribution of CIP genebank to the overall economic benefit from these varieties.

Selected results

107 responses received from 550 questionnaires distributed to CIP genebank users. **87 %** of the responses were from users who requested potato germplasm (as opposed to germplasm for sweet potato or other roots and tubers). Based on surveys and complementary expert's opinion six varieties were identified.

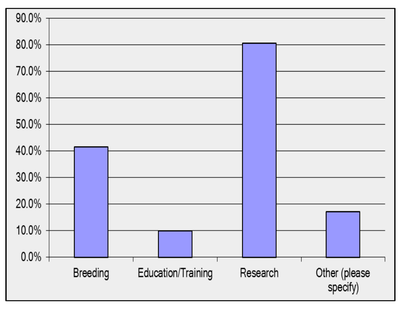

Fig. 4 Reason for requesting CIP germplasm from Genebank

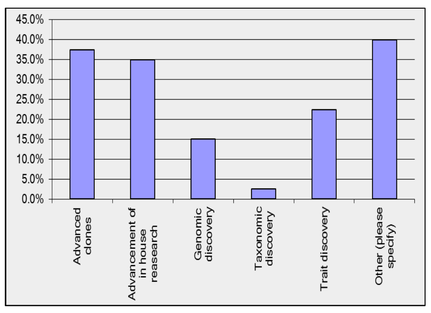

Fig. 5 Research outputs resulting from use of CIP germplasm

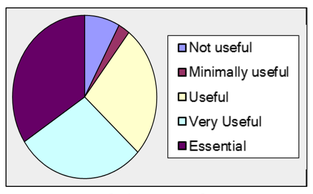

Fig. 6 Usefulness of CIP genebank material received

Table 1. Varieties selected economic surplus analysis.

Candidate variety	Release year	Country	CIP number	Economic surplus analysis
C-88	1996	China	CIP801176	(Robinson & Srinivasan 2013; Myrick 2017)
Victoria	1991	Uganda, others	CIP381381.20	Yes
Fripapa	1995	Ecuador	CIP388790.24	Yes
Libertad	2015	Ecuador	CIP386209.20	No (recent release)
Canchan	1990	Peru	CIP380389.1	Yes
Pallay Poncho	2007	Peru	CIP 399085.23	No (local release)

Most pedigrees for selected varieties show contributions from CIP genebank as well as from other sources. Pallay Poncho, developed by CIP breeders, is the only one obtained using only CIP genebank accessions - corresponding to landraces found in the Andes of Peru and Bolivia.

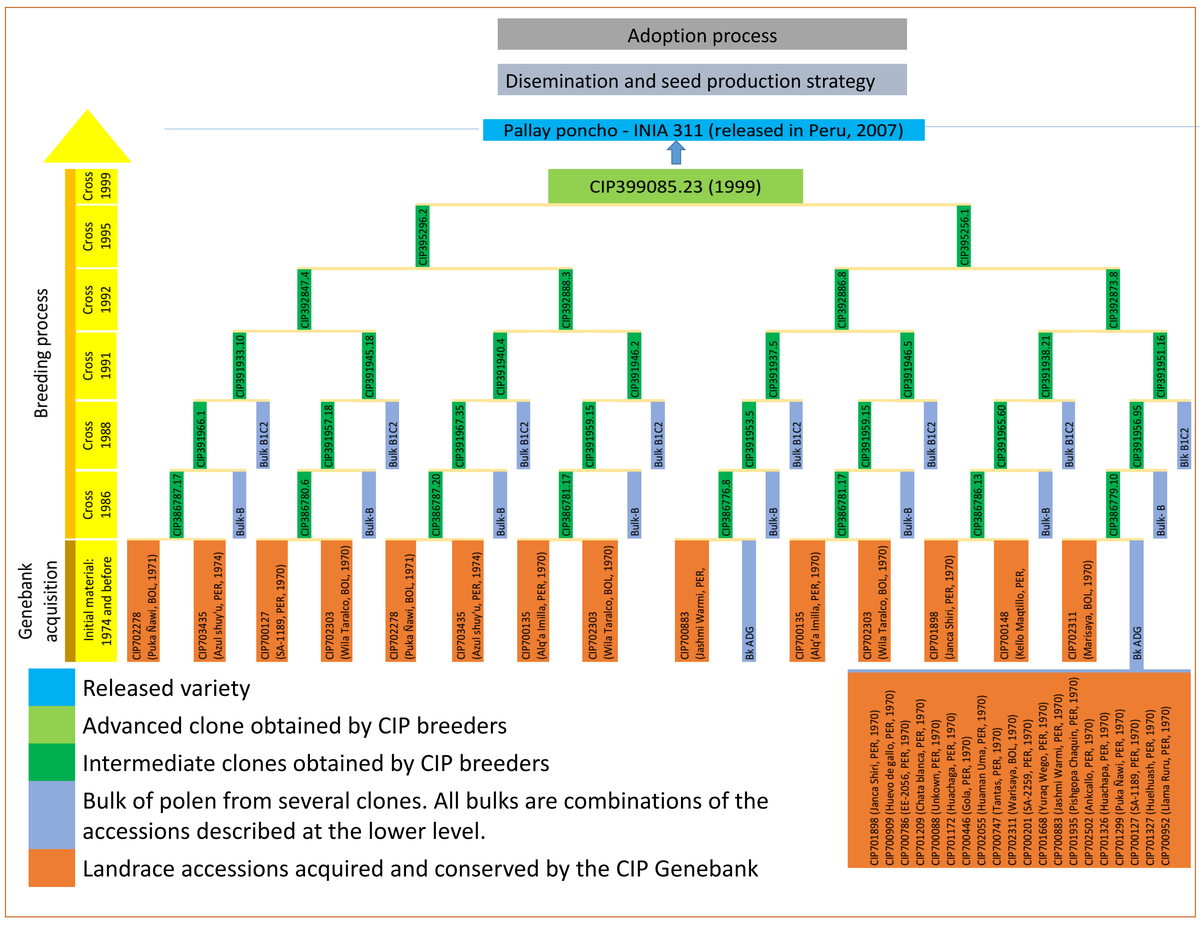

Fig 7. Pallay Poncho pedigree showing CIP Genebank contribution, genetic improvement and release (modified from: Landeo et al., 2007)

Preliminary conclusions

- CIP genebank contributes to several types of research. Researchers recognize the usefulness and quality of the germplasm conserved at CIP genebank and the genebank's role in its distribution.
- Selected improved varieties have diverse types of CIP genebank contributions distributed across the variety's development process (original germplasm collected from the field or other sources that breeders use in their processes).
- CIP genebank also plays a role as the final repository for advanced and other clones, and as facilitator of the distribution of germplasm.
- Economic surplus analysis for the contribution of CIP genebank is underway.