

Demand for and use of banana germplasm in Latin America and the Caribbean

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Introduction

Bananas (*Musa* spp.) are among the most consumed fruit worldwide. They are an important food source due to nutritional value and relative ease of production. In many rural areas of banana consuming countries, they can provide up to a quarter of people's daily calorie intake. In Latin America and the Caribbean alone, 20 million tons of bananas are locally consumed annually, in addition to being one of the world's most important regions for banana and plantain production and export.

Musa users need genetic material for their research. Obtaining clean, safe and healthy plant genetic material of new varieties from around the world was, in the past, a difficult task.

The purpose of this study was to obtain a clearer view of the various ways *Musa* is used, and how *in vitro* collections and genebanks like the ITC are essential to different areas of work, including but

HIGHLIGHTS

- We surveyed *Musa* users in the Latin America and the Caribbean region regarding the germplasm they received from the ITC in the past 15 years. A total of 18 users responded to the survey, out of 51 contacted.
- 65% percent of the top varieties adopted by the respondents were mainly used for food, followed by 15% commercial use, 14% research, 3% for export and 3% used for processing.
- Important traits identified included productivity (41%), good taste (23%), resistance to disease (11%), nutritional value (9%), and resistance to pathogens (6%).
- We developed three impact pathways to illustrate the flow of germplasm from ITC to users in different countries.

not limited to scientific research. We surveyed *Musa* users in the *Musa*LAC region about accessions they have received from the ITC in the past 15 years and how they have been utilised in each country. Countries in this region are some of the main producers and consumers of banana, and many research and educational institutes dedicate time and effort to learning more about the genus *Musa*, protecting its diversity and learning about new

varieties around the world.

Data and methods

This study was carried out in two parts. The first step was a survey of all requestors of material from 2000-2015 in the Latin America and Caribbean region (LAC). The second step focused on identifying key examples of important impacts of accessions originating at the ITC. Each organization received a copy of the *Musa* Usage Survey,

BOX 1 The *Musa* Germplasm Transit Centre

The purpose of Bioversity's International *Musa* Germplasm Transit Centre (ITC) is to provide such material. The ITC, established in 1985 under the auspices of FAO, is managed by Bioversity International and hosted at the Katholieke Universiteit in Leuven, Belgium.

The ITC has the world's largest *in vitro* collection of *Musa* germplasm in the world. Over 1,500 accessions are kept in medium-term storage *in vitro* and over 1,000 accessions are preserved in long-term storage by cryopreservation. Every year, hundreds of *Musa* accessions are shipped from the ITC around the world, clean of pests and diseases, to many different types of institutions including research centres, germplasm collections, and universities.



PHOTO: SHAWN LANDSEY/CROP TRUST

Users can request material from the ITC via the *Musa* Online Ordering System at <https://www.crop-diversity.org/mgis/moos/how-to-order>.

which requested information related to accessions originating from the ITC, requested by that user, and about local varieties and their current uses. A total of 57 individuals were contacted. We received 18 completed surveys, representing 32% response rate.

In the second part of the study, we identified three different institutes in three countries to better understand the how impacts flow from the gene-bank to end users. The institutions selected for the case studies are: the Corporación Bananera Nacional (CORBANA) in Costa Rica, the Instituto de Investigaciones de Viandas Tropicales (INIVIT) in Cuba, and the United States Department of Agriculture Tropical Agriculture Research Station (USDA-TARS) in Puerto Rico. All three are research institutes that work for the conservation and improvement of varieties of local importance. Each reported how the material from the ITC has affected the communities where they work in various ways.

For each case study, key informants were selected and interviewed and visited at field and production sites to gain better understanding of the dynamics of each institution and how the role of each *Musa* user fit into the pathway. Key informants included students, professors, researchers, farmers, producers and consumers, among others. We designed "impact pathways" after each visit. These flow charts describe the use of accessions originating from the ITC by different beneficiaries. At least one key informant at each level of the pathway was interviewed.

Main findings

Users were asked to list the top ten varieties of *Musa* used in their country and identify the main local uses and traits of these varieties. Eighteen users responded with a total of 98 top varieties mentioned. Sixty-five percent of the varieties were used mainly for food, followed by 15% commercial use, 14% research, 3% for export and 3% used for processing (Figure 1). Major traits of the top 10 varieties identified included 41% productivity, 23% good taste, 11% resistance to disease, 9% nutritional value, 6% resistance to pathogens. Other important traits represented less than 5% of the top varieties (Figure 2).

CORBANA is a public research centre focused on the study of edible

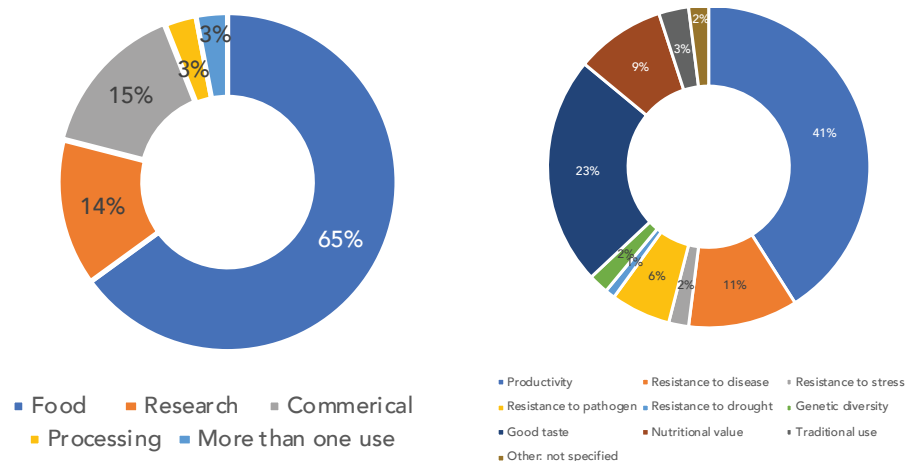


Figure 1. Uses of top varieties.

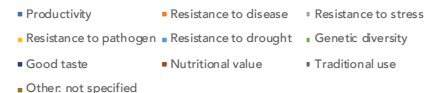


Figure 2. Major traits of top varieties.

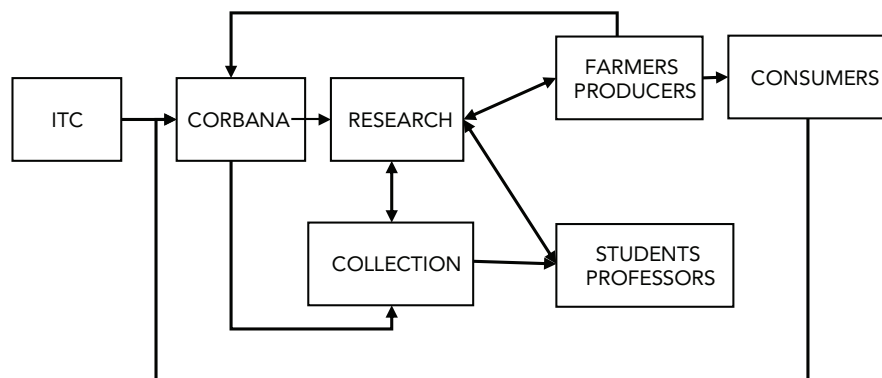


Figure 3. Impact pathway of ITC accessions in Costa Rica through CORBANA

bananas, and the development of new technologies to improve their production (Figure 3). CORBANA originally requested material from the ITC as part of a variety of research projects in collaboration with Bioversity International. These include the International *Musa* Testing Programme (IMTP) and the Taxonomic Reference Collection (TRC). Their research and evaluation using these accessions is not yet finished but many varieties from the ITC have been incorporated into their field collection.

CORBANA works directly with students and farmers. Students visit the collection to learn about diversity and the phylogenetic history of *Musa*. University students also have the opportunity to work in the laboratories at CORBANA as interns or graduate students. It is important to CORBANA that the community is aware and involved in the work they do, because farmers, large producers and consumers are their reason for existing. Farmers frequent the facilities at CORBANA for workshops and other educational opportunities, but mostly for the services CORBANA provides them. The scientists at CORBANA focus their work on finding ways to improve *Musa*

production and maintenance for farmers. Consumers are the last step of the pathway and the final beneficiary from CORBANA's work; therefore, consumer feedback is increasingly important to them for establishing research priorities

INIVIT is a national agriculture research centre that focuses on the research of roots, tubers and bananas (Instituto de Investigaciones de Viandas, 2017)⁷. Scientists at INIVIT carry out valuable research for their country's food production systems. They have received accessions from the ITC for their participation in IMTP and for their genetic improvement programmes. During the IMTP trials, they selected some varieties with useful traits to incorporate into their breeding programmes. Specifically, two accessions from the ITC, Zanzibar and Pisang Ceylan, were parent plants to two INIVIT hybrids that were subsequently widely distributed in Cuba and highly requested for their fast growth, taste and production levels.

Accessions from the ITC have impacted a broad spectrum of people and communities in Cuba due to the structure of INIVIT and its research programmes. INIVIT studies and

produces improved varieties of roots, tubers, and bananas, and distributes them according to climate, soil conditions, and consumer needs and preferences to each province.

TARS is the United States Department of Agriculture, Agricultural Research Service-Tropical Agriculture Research Station. It is their mission to research, preserve, introduce, evaluate and distribute tropical and subtropical crops. TARS collaborates with the Puerto Rican Department of Agriculture and with the University of Puerto Rico's Experimental Stations for agricultural education. TARS has received plant material from the ITC as part of IMTP, TRC and Field Verification experiments. Without the ITC, the research done on *Musa* would become much more difficult to accomplish.

Conclusion

This study demonstrates the value of having a safe place for *Musa* diversity in a fast-developing world that is increasingly reliant on monoculture practices. The more the needs of the germplasm users are understood, the better the services the ITC can provide. This study contributes to a better understanding of the relationships between *Musa* users and genebanks that provide the plant material.

The survey validated the actual use of accessions originating from the ITC in the different countries where accessions have been sent. The case studies demonstrated the diversity in local banana varieties and their main uses and traits. Cultural uses and tradition have strong influences on the varieties adopted by a community. In the *Musa*LAC Regional Network, the main varieties are used for food and selected

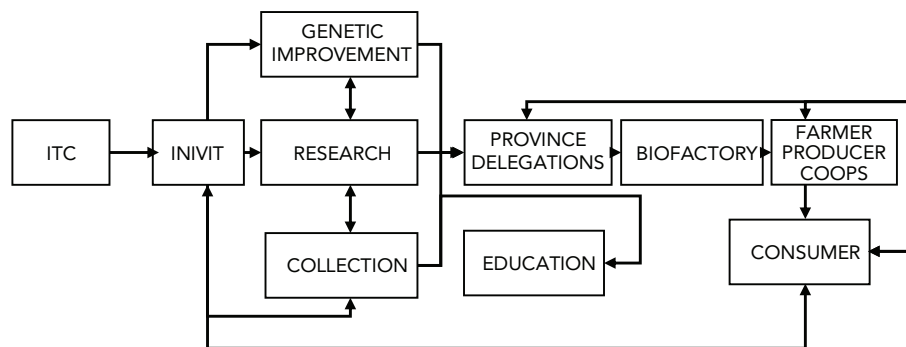


Figure 4. Impact pathway of ITC accessions in Cuba through INIVIT

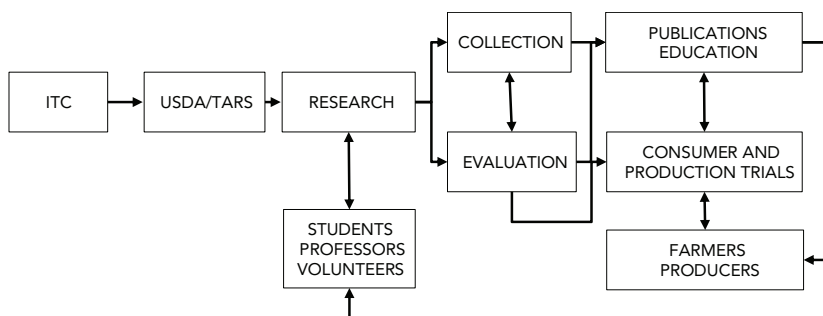


Figure 5. Impact pathway of ITC accessions in Puerto Rico through USDA-TARS

because of their productivity and taste, over varieties with stronger resistance to pathogens. The extended role the ITC in the use of *Musa* by various beneficiaries is also evident in the case studies. The accessibility to genebanks such as the ITC, where safe and clean plant material can be acquired, directly affects researchers, farmers, producers, educators, students and consumers of *Musa*.

Further reading

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Additional details can be found in the paper on which this brief is based: Montalvo-Katz, Sirena, Chase, Rachel, Van den houwe, Ines, Ruas, Max, Smale, Melinda, and Nicolas Roux. 2019. Impact and use assessment of genetic plant material from the Bioversity's International *Musa* Germplasm Transit Centre (ITC) in the Latin America and Caribbean Region. Genebank Impacts Working Paper No. 4. CGIAR Genebank Platform, Bioversity International, and the Crop Trust.

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