Costa Rica's local potato species solve global problems

Although the Andes are known as the home of a large part of the genetic variation of potatoes, Costa Rica also has unique species and varieties, including wild relatives, that have not yet been characterized or exploited for breeding but are known to be adapted to adverse cold, heat and drought conditions This gives them the opportunity to play a big part in efforts to achieve food security and to face the looming problems associated with changing climates.

The Treaty Benefit-sharing Fund Project recognized that over the past three decades, Costa Rica and other Latin American countries have been subject to climate-related impacts and increased El Niño activities. This not only affects today's food harvests, it affects harvests of the future. The weather conditions have brought high rainfall and humidity and led to increased fungal diseases in potato. This has combined to heighten the vulnerability of Costa Rican farmers to natural disasters. Projected climate change scenarios show global potato yield decreasing by 18–32 percent without adaptation but by 9–18 percent with adaptation of varieties.

Agronomic Research Center (CIA) of the University of Costa Rica is taking advantage of the high variability of Costa Rica's potato wild relatives – which are the most important source of genetic diversity – through crossbreeding them with cultured varieties, creating new varieties with potential to adapt to extreme conditions. However, survival of wild relatives themselves is under threat from climate change, making the project's efforts to identify and conserve them even more critical.

Potatoes, crucial role in food security

The potato is on the front line in the global fight against hunger and poverty. Potato's ease of cultivation and high energy content have made it a valuable cash crop for millions of farmers, especially in developing countries which now account for more than half of the global harvest. It is the world's number one non-grain food commodity, rich in carbohydrates and protein as well as vitamins and minerals.

Germplasm collected by the project already includes 45 accessions of wild relatives and 13 of cultivated varieties. It also includes 29 accessions of native potato and 23 commercial varieties for comparison and testing which includes evaluations and results of tolerance to drought, cold and heat. The initial work was done through high-tech research facilities in Spain. Now, the knowledge gained will be disseminated to farmers in Costa Rica, with the potential to support more than 10 000 Costa Rican beneficiaries including farmers, industrialists and consumers.

Costa Rica

The International Treaty
ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

In just one year ...

Project objective I: Establishment of germplasm working collection and preparation of plant materials. The project has:

- established a collection of 110 varieties of *S. tuberosum* and other species of the *Solanum genus*,
- multiplied all of the material for use in field trials and bioassays,
- extracted DNA from each accession.

Project objective II: Evaluate accessions of *Solanum* wild species from Costa Rica for resistance or tolerance to biotic and abiotic stresses related to global climate change. The project has:

- evaluated resistance of accessions to pathogens, fungi, nematodes and viruses,
- evaluated 86 accessions for their efficient use of water and 30–44 accessions for cold and heat tolerance,
- identified 7 varieties tolerant to drought, 7 tolerant to cold and 4 tolerant to heat.

Project objective III: Detect useful candidate genes for abiotic stresses applying different molecular tools. The project has:

- identified 9 candidate genes with drought resistance for tolerance to drought, cold and heat.

Project objective IV: Develop molecular markers and molecular characterization of the plant materials with these markers. The project has:

- advanced development of molecular markers with identification of four candidate genes.

Project objective V: Pre-breeding activates to combine favourable characteristics and to improve adaptation to climate change applying the developed markers. The project has:

- crossed for different sources of resistance with favourable characteristics identified,
- made 393 crosses and obtained progenies in 46 families, creating 6 600 seeds.

Project objective VI: Disseminate and transfer project results and products (breeding clones). The project has:

- held open-door sessions with farmers and representative of a Spanish potato production company,
- held conferences and sponsored visits to field trials to transmit information to more than 100 farmers plus guests from the private sector and cooperatives,
- shared outcomes and methodologies developed by the project among beneficiary farmers, local authorities and communities in the project area,
- made all identified molecular markers available for researchers who wish to use them.

Still to come...

- Further testing will be done to identify resistance to fungus and viruses in the accessions and progenies, which will also help identify those that have resistance to multiple threats of extreme environmental conditions and pests.
- Workshops will be held to update farmers on new materials obtained and the advantage of the new crosses.

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