Understanding potato seed degeneration, Ecuador

The food security of Andean small-scale potato farmers is dependent on the quality of their planting materials. Potatoes are susceptible to pathogen and pest accumulation in seed tubers over successive cycles of vegetative propagation, leading to seed degeneration and falling yields. This project aims to improve the resilience of local seed systems by addressing the causes of potato seed degeneration.

Background

The sustainability of potato-cultivation in the Andes is highly dependent on maintaining plant health, particularly the quality of the seed tubers. Andean farmers tend to use part of their harvest as seed, creating a high risk of potato seed degeneration (PSD). PSD is defined as pathogen and pest accumulation in seed tubers over successive cycles of vegetative propagation. It not only reduces yields, but also renders potato vulnerable to stresses such as adverse climatic conditions. PSD is influenced by biophysical factors—such as variety type, altitude at which it is grown, pest and pathogen incidence and severity—and socio-economic factors—such as consumer and producer preferences and market prices. These biophysical and socio-economic factors are highly variable in Ecuador’s Andean region, and little is known about how their interaction affects PSD.

Funded by the McKnight Foundation, the project aims to generate greater understanding and encourage better management of PSD, thus improving potato productivity in the Ecuadorian Andes. It also contributes useful knowledge on building more resilient seed systems. The results will help researchers to design a functional ‘integrated seed health strategy’ for the management of PSD, combining host plant resistance and on-farm management practices with the use of high-quality seed.

Objectives

- Strengthen research capacity to study potato seed systems in the Andes.
- Generate greater understanding of how biophysical and socio-economic factors affect PSD.

Approach

The project will build research capacities of a PhD student (Israel Navarrete) and selected Ecuadorian farmers to collect and analyze data. Scientists will characterize the seed systems of the main potato-producing areas in Ecuador, investigate the main drivers of PSD at farm level, and test traditional and improved tactics for managing PSD. Farmers will collect data in their fields and transmit it via mobile phones, involving ‘farmers’ web’ of at least 100 households. A multi-stakeholder framework will guide activities including rapid appraisal, formal surveys and fact-finding workshops.

On-farm experiments with local varieties will assess the effects of biophysical drivers on PSD, with experiments and evaluation criteria defined by members of the farmers’ web. Weather station and geographic information system data will be used to monitor environmental effects. Farmers’ decision-making processes will be investigated through focus groups to identify their current seed sources, tactics for managing PSD, and relevant social factors.

Working closely with Wageningen University, national research institutions, such as the Instituto Nacional de Investigaciones Agropecuarias and Universidad Técnica de Cotopaxi, and local farmer associations, the project will complement recent government investment in certified seed.

Expected outcomes

The PhD student will complete the doctoral program at Wageningen University and internships at additional universities to learn about network analysis and modelling. Additional students will be involved through BSc or MSc theses or internships. The analytical
capacities of lead farmers will also be improved through participation in workshops and focus groups. At least 100 farmers will learn how to perform sampling techniques, monitor pests and pathogens, assess productivity, and use mobile devices for data collection. In addition, 30 or more technicians and extension workers will improve their capacities to adapt an integrated seed health strategy to local conditions and promote its use.

Knowledge products produced by the project will include peer-reviewed papers on Andean potato seed systems, biophysical and socio-economic drivers of PSD, and the effects of improved approaches to managing PSD. Training guides will be designed for farmers and extension workers, plus at least two policy briefs.

Over the longer term, information generated by the project will be used by decision-makers to design and implement interventions within an integrated seed health strategy, aiming to improve the quality of seed potato, disseminate improved varieties, and conserve native landraces. If sufficient farmers in Ecuador adopt such a strategy, it is hoped to raise yields by around 30%. The new knowledge may also be used to benefit additional seed systems and vegetatively propagated crops in other developing countries.

Achievements

Understanding and management of the PSD among Ecuadorian research partners, NGOs and farming groups has been enhanced through collaboration with the Community of Practice of the Andes of the McKnight Foundation, which includes CIP, the International Livestock Research Institute and the NGO Statistics for Sustainable Development. As part of the development of strategies for improved management in Cotopaxi province, over the last 12 months, scientists have characterized different potato seed systems and predominant seed-borne diseases and pests.

Good partnerships with local stakeholders have led to the establishment of working groups to monitor significant emerging threats to potato production: *Bactericera cockerelli* (insect carrying pathogens) and two phytoplasmas (bacterial parasites) which cause potato purple top, a devastating disease resulting in great economic loss through substantially reduced tuber yield and quality.

Key knowledge products produced by the project can be viewed here: https://sites.google.com/view/degeneracion-semilla-papa

<table>
<thead>
<tr>
<th>Outputs</th>
<th>N°</th>
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<tbody>
<tr>
<td>Farmers with improved capacity to collect and analyze data</td>
<td>100</td>
</tr>
<tr>
<td>Technicians and extension workers with improved capacity to adapt seed health strategy to local conditions</td>
<td>30</td>
</tr>
<tr>
<td>Improvement in farmer yields as a result of adopting an improved seed health strategy</td>
<td>30%</td>
</tr>
<tr>
<td>Decision-makers promoting integrated seed health strategy</td>
<td>No specific target</td>
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USD 222,300

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