Investment priorities

Investments should contribute to an overall integrated approach and be aware of the timeframes required to realize the intended climate-adaptation outcomes. Accelerated breeding techniques now mean new varieties can be available within five years, while initiatives to reach scale can require an additional 5 - 10 years.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Region</th>
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<tbody>
<tr>
<td>- Accelerated and enhanced development of climate-smart varieties.</td>
<td>Latin America</td>
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<tr>
<td>- Andean initiative to research climate adaptation and agrobiodiversity.</td>
<td>and the Caribbean</td>
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<tr>
<td>- Conservation, use and evaluation of genetic resources.</td>
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<tr>
<td>- Cross-breeding with the potato’s wild relatives for climate-smart traits.</td>
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<tr>
<td>- Research and development of varieties resistant to late blight disease, which costs developing countries up to USD 15 billion per year.</td>
<td>Africa:</td>
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<tr>
<td>- Development and validation of climate-smart seed production and dissemination systems.</td>
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<tr>
<td>- Promotion of climate-smart varieties among farmers and consumers.</td>
<td></td>
</tr>
<tr>
<td>- Extension services to support farmers with quality planting material and training with climate-smart farming practices.</td>
<td>Asia:</td>
</tr>
</tbody>
</table>

1. Genetic diversity: conservation, management and DNA sequencing
2. Breeding: nutritional improvement, increased yields, climate-resilient participatory varietal selection
3. Seed system development: seed production, multiplication, distribution and quality control
4. Sustainable intensification: nutrition education, agronomic training and post-harvest handling and storage
5. Value chains: business training, improved product processing, enhanced market linkages
6. Inclusion: technologies and methods targeted particularly at women and young people
7. MEL: assessing and validating scaling tools and impact assessment methods

Case for investment:

Climate change adaptation

Overview

- Potatoes and sweetpotatoes are relatively climate-hardy and rapidly-growing crops.
- Crop breeders are using next-generation technologies to develop climate-smart varieties that mature quickly, resist many pests and diseases, and tolerate heat, drought or saline to provide more nutritious food and better incomes in extreme climates.
- The International Potato Center (CIP) has also pioneered new agronomic techniques to improve the production of quality planting material.
- CIP seeks to accelerate the breeding and adoption of new climate-smart varieties and agronomic technologies.
- Investment priorities include:
  - Tools and training for accelerated and demand-driven breeding of climate-resilient varieties;
  - Enhanced seed systems to make those varieties available;
  - Improving training and technologies available to farmers for climate adaptation.

SUCCESS STORY:

New heat-tolerant potato variety allows early planting in India

Potato is a winter crop in India, where CIP-bred Kufri Lima, a heat-tolerant potato variety released in 2018, can be planted up to a month earlier than most varieties. Because it matures in just 90 days, Kufri Lima is ready to harvest when potatoes are scarce and can fetch up to 50 percent more in price than potatoes during peak harvest. Kufri Lima is also resistant to potato viruses, which can cause losses of up to 50 percent. This resistance allows farmers to select seed potatoes from their harvests rather than buying commercial seed potatoes each year.
Increasing potato yields, while also improving resistance to disease and tolerance for heat, salt, and drought, can significantly improve farmer incomes and enhance their resilience in the face of climate change.

The CIP genebank safeguards a collection of potato and sweetpotato that is among the world’s most extensive. Scientists study and use that germplasm to breed more resilient crop varieties. Recent field collections in Peru significantly expanded the genebank’s collection of potato wild relatives, many of which have climate-smart traits that can be crossbred into cultivated potato to develop climate-resilient varieties.

Recent breakthroughs

Climate-smart varieties

Dozens of CIP-bred, climate-smart potato and sweetpotato varieties have been released around the world and are helping farmers cope with increasingly frequent weather extremes. Other varieties are currently in the pre-release phase. In 2018, CIP and its partners produced the first reference genome for sweetpotato, which will allow scientists to more accurately breed for climate-resilient traits, using conventional genomics-assisted breeding approaches.

Accelerated breeding

Faced with accelerating climate change, scientists have accelerated the process of breeding and selecting potential climate-resilient varieties by using molecular markers and simultaneous field trials in varied environments. They are currently developing genomic tools to further accelerate this process. A proof-of-concept for a sweetpotato hybrid breeding scheme demonstrates that the time needed to achieve genetic gains can be reduced by sevenfold.

Participatory varietal development and selection

Multi-disciplinary teams from CIP have identified the varietal needs and preferences of men and women in target populations and are working with crop breeders to incorporate those characteristics into climate-smart varieties. By actively soliciting farmer input on desired crop varieties, we can increase the probability that those varieties will be widely adopted.

Enhanced agronomic approaches

Scientists have developed and disseminated improved technologies and approaches to help farmers cope with challenges such as prolonged drought or increased pest and disease pressure. An example is the Triple S technique in which farmers store sweetpotatoes during dry months and use them to produce vines for planting when rains resume. The method enables farmers to produce enough vines in time for early planting, which means they can harvest early when food is scarce and market prices are high.

Climate-smart seed systems

Access to quality potato or sweetpotato planting material of improved varieties boosts harvests and climate resilience, thus climate-smart seed systems are essential for getting resilient varieties to farmers. Work with research institutes, and public and private sector partners has expanded the use of cutting-edge technologies to produce potato or sweetpotato seed, including sandponics, aeroponics and rooted apical cuttings. Nevertheless, there is still a great need for more quality planting material in Africa and Asia.

Introduction

Climate change is predicted to reduce yields of staple crops in the coming decades, threatening rural incomes and food and nutrition security in developing countries. Climate change has already impacted many factors related to food production, including soil salinization, heat and water stress, shortened or interrupted growing seasons, and greater incidence intensity and distribution of plant pests and diseases.

Potatoes and sweetpotatoes are key dietary and economic staples for smallholder farmers in the Global South and have traits that breeders are using to develop more climate-resistant varieties. The agrobiodiversity of both crops conserved in genebanks and on farmer fields holds promise for significantly enhancing those climate-smart traits. Sweetpotato has greater heat tolerance and requires less rainfall than most staple crops, and drought-tolerant varieties often produce food when other crops wither and die. Early-maturing varieties are ready for harvest in less than four months, and their leaves can be eaten just two months after planting when food is scarce. Sweetpotato contributes to both food security and the reduction of vitamin A deficiency, one of the most harmful forms of undernourishment for children under five and women of reproductive age.

Early maturing potato varieties can be ready to harvest three months after planting, providing food when grains and other crops wither and die. Early-maturing varieties are still green. This trait also allows potato to be incorporated into fallow periods of cereal-farming systems in which farmers store sweetpotatoes during the dry months and use them to produce vines for planting when rains resume.

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SUCCESS STORY: Surviving drought in Malawi

Loveness and Lighton Kalira were among the 300,000 families to receive planting material for climate-smart sweetpotato after a devastating drought in 2016 that left 6.5 million Malawians dependent on food aid. The following year, their sweetpotato crop thrived despite another drought that wiped out their maize harvest. Their sales of surplus sweetpotato allowed the Kaliras to purchase enough corn for the year and pay school fees for their four children.

In situ conservation and use of genetic resources

CIP works with communities in the Peruvian highlands to conserve the region’s potato agrobiodiversity in the field and periodically repatriates disease-free planting material for native potato varieties safeguarded in its genebank. A new initiative is studying the relationship between climate change, agrobiodiversity, and indigenous health and diets to identify prospects for more resilient agriculture in a changing climate.

SUCCESS STORY:

Potato and sweetpotato varieties

Climate-smart potato varieties

Two climate-smart potato varieties originally bred and released in Peru are now popular in China. Virus-resistant, drought- and heat-tolerant Tacna and Unica were evaluated in Peru’s coastal desert before being shared with scientists in China, where they were released as national varieties in 2006 and 2011, respectively. In 2015, those two varieties were planted on a total of 250,000 hectares in China, where Tacna is especially popular in dry regions. Unica is also widely grown in Peru’s desert valleys, and since 2014, it has been grown in the dry lowlands of Tajikistan, during the months when it is too hot to grow wheat.

Potato species

of those wild

potato

in CIP genebank

samples collected

in Peru in 2018

Collect, conserve, crossbreed

337 wild potato samples collected in Peru

155 wild relatives growing in varied ecosystems across the Americas

The potato has 140 species safeguarded in CIP genebank

140 species safeguarded in CIP genebank

produces climate-smart potatoes

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**Latin America and the Caribbean:**
- Bolivia
- Ecuador
- Peru

**Africa:**
- Cameroon
- Democratic Republic of Congo
- Ethiopia
- Kenya
- Madagascar
- Malawi
- Mozambique
- Nigeria
- Rwanda
- Tanzania
- Uganda

**Asia:**
- Bangladesh
- China
- India
- Philippines
- Vietnam

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