

Each year, as part of the CGIAR annual performance measurement (PM) exercise, the Independent Science & Partnership Council (ISPC) receives and reviews a number of individual case studies of Center impact. From the 30 case studies submitted over the course of the 2009 and 2010 PM exercises, the ISPC's Standing Panel on Impact Assessment (SPIA) identified three case studies as being particularly meritorious in terms of quality of analysis and presentation. In recognition of these studies as good examples of emerging 'best practice', SPIA has, with the relevant Center's concurrence, prepared an ISPC/SPIA Brief on each. Publishing quality impact briefs responds to continued calls from donors to the CGIAR for more documented evidence of impacts to be made available in the form of such concise publications.



INDEPENDENT SCIENCE & PARTNERSHIP COUNCIL

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One million hectares of CIP potatoes

Potato is an important food crop in developing countries and is now planted across some ten million hectares. According to a survey of 23 countries in Africa, Asia, and Latin America, the area planted with potato varieties bred by or obtained through the International Potato Center (CIP) reached 1 million hectares in 2007. This represents 13% of the potato-growing area in these countries, up from 6.4% ten years earlier. This important milestone has come at least seven years earlier than predicted and represents a rate of return of approximately 20%, equating to US\$1.20 benefit for every dollar invested in research.

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Key facts and figures

- By 2007, breeding programs in 23 surveyed developing countries had released 681 new varieties, 251 of which had their origins in CIP germplasm.
- In Ethiopia, Kenya, Rwanda, Tanzania, and Uganda, the aggregate area under CIP-related varieties increased by more than 230,000 hectares between 1997 and 2007, equivalent to one third of the worldwide increase.
- CIP-related varieties are now planted on more than 100,000 hectares in Peru.
- In Asia, 10% of the potato-growing area was planted with CIP-related varieties by 2007, up from 3.5% in 1997.

Background

CIP's research activities promote the full potential of potato to contribute to the livelihoods of the poor in developing countries. Its initiatives range from genetic improvement, crop management, and pest/disease control to improving linkages to value chains. CIP focuses on providing diverse, improved genetic material to potato-growing regions in developing countries, so that national breeding programs can identify and develop varieties suited to the local conditions. Breeding is based on the use of broad genetic resources and concentrates on the inclusion of pro-poor traits such as resistance to late blight and viruses. Such resistance reduces the need for costly and potentially hazardous pesticides, as well as reliance on expensive seed.

During the 1990s, potato-crop improvement programs in 30 developing countries were surveyed to gather information about varietal change and ascertain CIP's contribution after 25 years of breeding (Walker et al., 2003). This survey found that about 50% of the area planted with potatoes in developing countries was of varieties bred by national agricultural research systems (NARS) alone. CIP, working in partnership with NARS, contributed about 6% of the area. This is a modest contribution compared to the area under cereal crops of Consultative Group on International Agricultural Research (CGIAR) origin. However, the figure still represents a respectable rate of return of about 15% on investments in potato breeding at CIP, given that varietal change is generally slower to achieve in potatoes than in cereals.

A more recent study (Thiele et al., 2008) updates these findings and throws new light on varietal release and adoption in developing countries, together with the returns on CIP's investment. This Brief summarizes the results of that study.

Adoption of CIP varieties

By 2007, breeding programs in the 23 surveyed countries reported the release of 681 potato varieties. Of these, 251 varieties had their origins in CIP germplasm. The share of released varieties related to CIP increased from 32% in 1997 to 37% ten years later, adding 131 new CIP-related varieties to the available stock of potato material in these countries.

Over the ten-year period, the total potato-producing area in the 23 countries increased by 25% and the

area under cultivation with CIP-related varieties expanded from 410,000 to over 1 million hectares. The share of the area planted with CIP-related varieties increased from 6.4 to 13.1%, making this category the second largest source of genetic material for planted varieties after developing-country NARS.

CIP-related germplasm has been adopted extensively in Africa, particularly in Ethiopia, Kenya, Rwanda, Tanzania, and Uganda. In these countries, the aggregate area under CIP-related varieties has increased by more than 230,000 hectares, a third of the worldwide increase in area reported since 1997. Together with China, where the increase is of more than 312,000 hectares, these countries represent more than 85% of the total increase in area under CIP-related varieties between 1997 and 2007. The most popular varieties include Tigoni in Kenya, Kirundo in Rwanda, and Victoria in Uganda.

In Latin America, CIP's contribution is especially strong in Peru, where CIP-related varieties have been planted across more than 100,000 hectares. The area in Bolivia has doubled since 1997 and CIP-related varieties have a significant presence in Ecuador (22% of the total potato-growing area).

In Asia, NARS varieties have predominated, including Kexin 1 in China, which is the world's most planted variety (over 900,000 hectares), and Kufri Bahar and Kufri Jyoti in India (over 400,000 hectares combined). In 2007, material from Chinese breeding programs accounted for a large share of the area (more than 77%); nevertheless, 10% of the potato-growing area was planted with CIP-related varieties, up from 3.5% in 1997.

The results suggest that rising adoption of CIP-related varieties is due to two main factors: an increase in the total potato-growing area and the success and popularity among farmers of specific varieties with particularly desired traits. For example, China alone accounts for 50% of the increase, with Cooperation 88 – a variety resistant to late blight, used for table consumption and processing into chips – contributing more than 118,000 hectares. Indeed, the 20 most popular CIP-related varieties account in total for almost 800,000 of the 1 million hectares planted. Late blight resistance is mentioned as the most appreciated trait. High yield is another primary consideration, closely followed by culinary quality and taste. Earliness and market/processing acceptability are also important.

Return on investment

The 1997 analysis assumed three different adoption growth scenarios: 5.8%, 10%, and 15% (Figure 1). According to the most ambitious rate predicted, there would be one million hectares under CIP-related varieties by 2014. However, the one million hectare milestone was actually reached in 2007, seven years earlier than predicted by the 'best guess' scenario. This represents a return on investment of 20%, or US\$1.20 benefit on every dollar invested, and net benefits generated by the breeding program of more than US\$120 million, much of it accruing to the poor (Table 1). The higher than expected rate of adoption increases the net present value because benefits are captured earlier, while a higher adoption ceiling at the end of the project increases the value of the benefits in later years due to a larger coverage area.

The good news is that if adoption rates of CIP-related varieties continue at present levels, they will generate a stream of net benefits that is enough to pay for not only CIP investment in potato breeding, but also all CIP resources allocated to potato research.

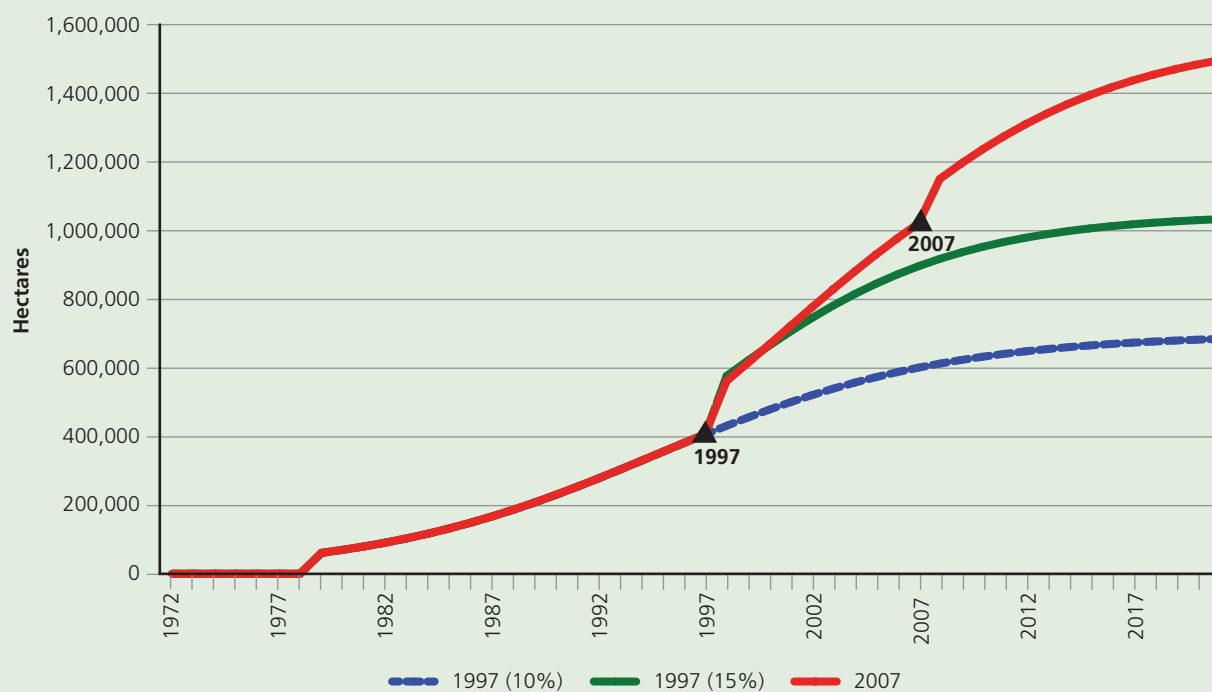
Table 1. Returns to CIP investment, 1997 vs 2007 estimations

	1997	2007
Area under CIP-related materials ('000 ha)	410.0	1,053.0
Adoption ceilings in 2021 (%)	15.0	18.5
Internal rate of return (%)	16.7	20.0
Net present value (US\$ million)	71.0	121.0

Conclusions

Reaching the one million hectare milestone earlier than previously forecasted has important implications. It seems to indicate that, as already suggested in Walker et al. (2003), diffusion of CIP-related material has picked up speed. If new materials are developed and are successful in responding to farmers' demands,

Figure 1. Adoption pattern of CIP-related varieties: best 1997 adoption ceiling scenarios vs 2007 scenario (5.8% growth line not shown)



the aggregate area under CIP-related varieties will continue to produce positive returns to investment in CIP's potato breeding programs. In addition to the returns from productivity gains, further benefits are generated by the reduction in external inputs and enhanced use of biodiversity in crop improvement.

Potato will continue to be an important source of food security and income for the poor. CIP-related varieties are making a significant contribution in some of the poorer countries, especially in Africa (e.g., Burundi, Democratic Republic of Congo, Rwanda, and Uganda). For an institution whose mandate is primarily pro-poor research, this result is encouraging. CIP is now responding to new challenges, such as breeding for drought tolerance, a trait of increasing importance in the face of global warming.

While this study shows the extent of worldwide adoption of CIP-related varieties, providing a finer-grained

analysis of the impact of CIP varieties on poverty in local contexts remains an important task for the future.

References

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