

THE RESEARCH PROGRAM

CIP's research program comprises 13 projects that address the most pressing constraints to improving livelihoods through potato and sweetpotato production and use, managing natural resources in mountain ecosystems, and preserving and exploiting underutilized Andean root and tuber crops. Within the 13 projects are three that formally recognize CIP's increasing success in convening and facilitating research among a large number of partners around global (potato late blight and urban agriculture) and regional (Andean ecoregional) themes.

CIP's research projects and project leaders

Project	Leader
1 Integrated management of late blight	J. Landeo (until Sept 2002) / G. Forbes
2 Uptake and utilization of improved potato production technologies	C. Crissman
3 True potato seed	E. Chujoy
4 Integrated pest management for root and tuber crops	A. Lagnaoui
5 Sweetpotato improvement and virus control	D. Zhang
6 Postharvest quality, nutrition, and market impact of root and tuber crops	M. Hermann
7 Biodiversity and genetic resources of root and tuber crops	W. Roca
8 Integrated natural resource management in mountain agro-ecosystems	R. Quiroz
9 Gene discovery, evaluation, and mobilization for crop improvement	M. Bonierbale
10 Global commodity analysis and impact assessment of potato and sweetpotato technologies	T. Walker (until Nov 2002) / K. Fuglie (interim leader)
G1 SIUPA (Strategic initiative on urban and peri-urban agriculture)	G. Prain
G2 GILB (Global initiative on late blight)	G. Forbes
R1 CONDESAN (Consortium for the sustainable development of the Andean ecoregion)	H. Cisneros

PROJECT 1. INTEGRATED MANAGEMENT OF LATE BLIGHT

Late blight in potato, caused by the oomycete *Phytophthora infestans*, continues to be the most devastating potato disease worldwide and the cause of huge crop losses, particularly in less developed countries. CIP's highest research priority is to develop, adapt, and integrate technologies for managing late blight of potato. CIP scientists have already produced (through classical breeding techniques) and deployed improved populations and advanced clones with durable resistance to this disease, for utilization by developing countries in particular. Combined efforts by Projects 1 and 9 are being directed towards the development and use of state-of-the-art molecular tools for tapping newer sources of resistance. Components of integrated disease management (IDM) are being developed to complement host resistance in overall IDM strategies. The farmer field school participatory approach is being used to integrate components for disease control. Crop and disease

models linked to geographic information systems are being used to understand the complexities of the disease's epidemiology across diverse agro-ecologies and to develop simple decision-support systems for disease management.

PROJECT 2. UPTAKE AND UTILIZATION OF IMPROVED POTATO PRODUCTION TECHNOLOGIES

The aim of this project is to develop and disseminate production technologies that can improve on-farm yields and hence the welfare of farm families. The project is centered thematically and philosophically on seed potatoes, either clonal or true potato seed, as a delivery mechanism for new technologies. Because seeds transmit pests and diseases, improved production and management of seed potatoes, either in formal programs or in informal farmer systems, is a key factor in improving potato productivity. The

project is the venue in which clonal and true seed output from CIP breeding and biotechnology programs are introduced to countries, screened, tested in multiple locations, and entered into local variety release schemes. In addition to new genetic materials, our products include improved integrated bacterial wilt management, virus and bacterial wilt disease testing kits, and technical and institutional backstopping to seed systems and the potato sector.

PROJECT 3. TRUE POTATO SEED

True potato seed (TPS) enables a crop to be grown in areas where traditional production systems fail, for example where seed tubers are scarce or not available. By facilitating the transfer of improved TPS hybrids in such areas of the tropics and subtropics, CIP aims to expand potato cultivation and increase its efficiency (reduce production costs, increase yields). This project concentrates on breeding parents for hybrid TPS production and improving TPS hybrids for needed specific traits such as late blight resistance, earliness, and seed set. This research is backstopped by the TPS utilization activities in CIP's Project 2 and by the work of local organizations (private sector, nongovernmental organizations, national agricultural research systems) in efforts to commercialize TPS systems and thus underpin developing small industries.

PROJECT 4. INTEGRATED PEST MANAGEMENT FOR ROOT AND TUBER CROPS

Root and tuber crops are among the world's most important food crops, with a great potential to improve food security, eradicate starvation, and alleviate poverty in resource-poor countries. For many farmers, these crops are not only their food staple but also their principal source of cash income, because of the growing demand for tubers in the cities. Root and tuber crops are commonly grown in production systems where biotic factors such as weeds, nematodes, pests, and diseases limit yields and quality, reducing farmer income. In the developing world, insect pests pose a serious constraint to potato and sweetpotato production and hence to the capacity of farmers to secure a livelihood; losses in the field and in storage can easily reach 50 percent of total yield. Besides the economic losses, current farmer control practices rely on the use of highly toxic pesticides applied with little or no protective equipment, causing substantial damage to the health of people and the environment. And the use of chemical pesticides is increasing rapidly, particularly where farmers are intensifying production methods in order to sell in urban markets, and where the crops are expanding into agro-ecological regions and planting seasons outside their traditional range. To achieve its goal of increasing farmer income and food security by

reducing pest losses, while protecting the health of producers, consumers, and the environment, this project adopts a systematic and comprehensive approach to crop protection. More specifically, this implies maintaining pest populations at acceptable levels using combinations of control techniques and practices, giving emphasis to biological control agents and other nonchemical control measures, and with due consideration of the socio-economic (including aspects related to access to new markets) and environmental consequences.

PROJECT 5. SWEETPOTATO IMPROVEMENT AND VIRUS CONTROL

This project aims at improving the productivity, nutritional quality, and utilization of sweetpotato through the development and adoption of new varieties with enhanced postharvest characteristics and of technologies for controlling sweetpotato virus diseases. Current project activities include vitamin A biofortification through development and deployment of beta-carotene-rich sweetpotato in sub-Saharan Africa and southwest Asia, genetic improvement of dry matter and starch yields to facilitate diversified use of sweetpotato in China and Southeast Asia, and application of technologies for producing healthy planting material in regions where sweetpotato virus disease is an important production constraint.

PROJECT 6. POSTHARVEST QUALITY, NUTRITION, AND MARKET IMPACT OF ROOT AND TUBER CROPS

This project has two main objectives. The first is to alleviate rural poverty by linking farmers with markets and thus assisting them in income generation through diversified and expanded postharvest use of roots and tubers; in this context the identification of market opportunities, equitable rural enterprise development, and product development are central concerns. Project activities aim at improving processing technologies and farmer access to markets; identifying novel root and tuber products; developing methodologies for successful product and small agro-enterprise development; and increasing awareness of specific health benefits from eating roots and tubers. The second objective is to prevent vitamin A deficiency by promoting the increased use of orange-fleshed sweetpotatoes in regions where this nutritional disorder is rampant. Initially concentrating on East Africa, the project has established a partnership, called VITAA (Vitamin A for Africa), which engages the agriculture, health, and nutrition communities in seven sub-Saharan countries in an effort to boost the demand for, and use of, orange-fleshed sweetpotatoes by those most threatened by vitamin A deficiency.

PROJECT 7. BIODIVERSITY AND GENETIC RESOURCES OF ROOT AND TUBER CROPS

The overall objective of this project is to secure the long-term conservation of potato, sweetpotato, and other Andean root and tuber crop genetic resources through global and regional collaborative research on the management of seed, field, and in vitro genebanks. The project also includes research to explore technologies on cryopreservation methods for the long-term conservation of potato clones. Project activities include pathogen elimination and health assurance for worldwide distribution of healthy clones; linking collections with the conservation of biodiversity carried out by farmers (in situ/on farm conservation); rationalization of germplasm collections (coverage, redundancies, clonal identity, core collections) by integrating morpho-agronomic and molecular methods; promoting access to, and use of, genebank holdings by the identification and evaluation of new sources of priority traits; and upgrading the information and documentation of root and tuber crop genetic resources, and linking these databases to georeferenced and genetic information.

PROJECT 8. INTEGRATED NATURAL RESOURCE MANAGEMENT IN MOUNTAIN AGRO-ECOSYSTEMS

Mountain ecosystems are found on every continent and sustain an estimated 10 percent of the world's population. In addition, billions of people living in the lowlands depend on these ecosystems for food and other resources (water, raw materials, energy). Mountain areas are also important sources of plant and animal diversity, both wild and domestic. In the past few decades, environmental changes and rapid increases in population densities in mountain areas have increased problems for planning effective resource management strategies. Despite the global recognition of the importance of these areas following the lead of the United Nations Conference on Environment and Development in 1992, many mountain communities continue to live in poverty. Through integrated natural resource management research, CIP and other Future Harvest centers are working to alleviate poverty, increase food security, and protect the environment in mountain areas. The goal of this project is to contribute to more productive and sustainable natural resource management in selected mountain areas. The management practices, methodologies, policy recommendations, and analytical tools being developed jointly with national agricultural research systems, and complemented with appropriate training, will enhance the capability of local and national researchers and authorities to analyze their problems, search for windows of opportunity, and to assess, ex-ante, the tradeoffs of interventions.

PROJECT 9. GENE DISCOVERY, EVALUATION, AND MOBILIZATION FOR CROP IMPROVEMENT

Strategic germplasm evaluation is conducted in collaboration with CIP's biodiversity conservation project (Project 7) to identify and characterize new sources of resistance to late blight, bacterial wilt, and viruses; such new resistance sources are needed to develop broad-based potato varieties less dependent on pesticides and other inputs. The project's applied breeding program develops resistance to major potato viruses (potato leafroll virus, potato virus Y, and potato virus X) to protect crops from the degenerative diseases that are important in tropical lowland regions where vector pressures are high and capacity for the production of healthy vegetative seed is limited. Molecular tools and information are used to identify and monitor resistance to potato late blight and viruses and to help improve productivity, postharvest quality, and nutritional and market value of sweetpotato and potato through better understanding and more efficient manipulation of carbohydrate gene networks. In addition, novel resistance mechanisms are engineered, and foreign genes are mobilized to confront priority diseases and pests for which conventional breeding does not offer ready solutions. High levels of multiple virus resistance are developed in advanced potato clones and parental lines that also possess the productivity and use characteristics that are needed for variety development in collaboration with national breeding programs.

PROJECT 10. GLOBAL COMMODITY ANALYSIS AND IMPACT ASSESSMENT FOR POTATO AND SWEETPOTATO TECHNOLOGIES

This project generates information for scientists, research administrators, policy makers, and donors for decision making on technology design, resource allocation, policy formulation, and investment options related to potato and sweetpotato improvement and utilization. Some of the specific objectives are to: quantify the agronomic, economic, social, and environmental effects of improved potato and sweetpotato technologies; document the rate of return and the effect on poverty of CIP's research; assess the level and adequacy of investment in potato and sweetpotato crop improvement in developing countries; assemble and maintain price and production databases for priority setting; evaluate the effects of potato price instability on diverse groups in society; assist in improving domestic potato and sweetpotato marketing and international potato trade benefiting developing countries; and participate in generating the most informative commodity projections with specialized institutions.

PROJECT G1. SIUPA (STRATEGIC INITIATIVE ON URBAN AND PERI-URBAN AGRICULTURE)

The strategic initiative on urban and peri-urban agriculture (SIUPA) was launched by the CGIAR in late 1999 in response to growing urban populations and urban poverty and the increased dependence of city dwellers on farming. CIP is the convening center for the initiative. SIUPA's goals are to contribute to increased food security, improved nutritional status, and higher incomes for urban and peri-urban farmers while mitigating negative environmental and health impacts; and to establish the perception of urban and peri-urban agriculture as a positive, productive, and essential component of sustainable cities. SIUPA has established a set of research activities in regional sites collectively known as Urban Harvest. CIP is one of several Future Harvest centers implementing research activities with other international and national agencies in such fields as sustainable agroprocessing and livestock enterprises, quality aspects of vegetable production systems, and the contribution of urban agriculture to human nutrition.

PROJECT G2. GILB (GLOBAL INITIATIVE ON LATE BLIGHT)

The global initiative on late blight (GILB) was convened by CIP in 1996 in response to the escalating agricultural crisis brought about by the evolution of more aggressive and fungicide-resistant forms of the potato late blight pathogen, *Phytophthora infestans*. GILB stimulates collaborative and complementary research and technology transfer among developing and developed countries by improving communications among researchers and institutions. GILB has established regional and thematic linkage groups to encourage people to work together and to identify

additional opportunities for collaboration. To assist these groups, GILB has sponsored meetings and developed world wide web pages for each group. To facilitate access to information, a global late blight information system, with numerous resources and links, has been established online at the GILB web address. A newsletter is distributed three times a year to GILB members in 79 countries. GILB sponsored international conferences in 1999 and 2002. GILB is managed by a steering committee representing different regions of the world where late blight is important.

PROJECT R1. CONDESAN (CONSORTIUM FOR THE SUSTAINABLE DEVELOPMENT OF THE ANDEAN ECOREGION)

CONDESAN is an open and dynamic consortium of diverse organizations, each one contributing its knowledge and expertise on research and/or rural development, that works on the interlocking issues of sustainable natural resource management, increasing rural incomes, and social equity. The objective is to strengthen local capacity to understand natural resource management and to develop environmentally sound production systems and policies that can enhance life in the Andes. Focusing mainly on poor farmer groups of the highlands, CONDESAN concentrates its fieldwork at seven benchmark sites that broadly represent the major ecological zones. Cross-sectional and common themes, however, are promoted for the entire region. InfoAndina, the electronic information system, is a key component of the Consortium's team-building strategy. Through coordination and facilitation activities by a small coordination unit, the project aims to create effective and strong linkages between research and rural development partners.

CIP'S DEVELOPMENT CHALLENGES

- Contribute to halving, between 1990 and 2015, the proportion of the population in **extreme poverty** (Millennium Development Target 1)
- Contribute to halving, between 1990 and 2015, the proportion of people who suffer from **hunger** (Millennium Development Target 2)
- Contribute to reducing by two-thirds, between 1990 and 2015, the **under-five mortality rate** (Millennium Development Target 5)
- Contribute to reducing by three-quarters, between 1990 and 2015, the **maternal mortality ratio** (Millennium Development Target 6)
- Contribute to integrating the principles of **sustainable development** into country policies and programs and to reversing the loss of environmental resources (Millennium Development Target 9)
- Contribute, by 2020, to achieving significant improvement in the lives of at least 100 million **slum dwellers** (Millennium Development Target 11)
- Contribute to addressing the special needs of the **least developed countries** (Millennium Development Target 13)
- Contribute, in cooperation with the private sector, to making available the benefits of **new technologies**, especially information and communications technologies (Millennium Development Target 18)