FUELING GROWTH, HEALTH, AND PROSPERITY

INTERNATIONAL POTATO CENTER • ANNUAL REPORT 2002

FUELING GROWTH, HEALTH, AND PROSPERITY
INTERNATIONAL POTATO CENTER • ANNUAL REPORT 2002

Fueling growth, health, and prosperity

Preserving the core, stimulating progress

Neighbors helping neighbors: A strategy for sub-Saharan Africa

Global cooperation needed to combat leafminer fly

New tools simplify decision making in complex mountain ecosystems

Late blight research zeroes in on a moving target

Scientists prepare for new era of CIP–China cooperation

Ways of working

Swimming against the tide: Integrating biological and social science

Partnerships for the new millennium

Shuttle seed production aids Afghan potato farmers

In brief

CIP in 2002

In memory of David MacKenzie

Board of trustees

Donor contributions

Financial report

The research program

Selected publications by CIP staff

Training highlights

CIP's partners

Staff

Global contact points

Future Harvest

Credits

CIP. 2002. FUELING GROWTH, HEALTH, AND PROSPERITY.
INTERNATIONAL POTATO CENTER ANNUAL REPORT 2002.

Fueling growth, health, and prosperity

Although in many ways 2002 was a year of struggle for the International Potato Center, it was also one of revitalization. Decreases in funding forced us to make difficult choices involving staff reduction and program restriction, which were offset by a drive to heighten efficiencies and build up fundraising efforts. The result, for which all of CIP staff deserves great credit, was positive. We reached the end of the year with a much smaller deficit than we had anticipated (see *A shared effort to sustain impact*, page 85) and were able to rebuild our reserves to a level that we could feel comfortable with. All of this set the stage for a balanced budget for 2003 and a period of solid reconstruction.

CIP's Fifth External Program and Management Review (EPMR), conducted in early 2002, acknowledged the Center's "significant achievements" and signaled the

FUELING GROWTH, HEALTH, AND PROSPERITY

strengths that have contributed to these, as well as areas that required improvement. The CGIAR interim Science Council (iSC) endorsed the EPMR's findings with a call for greater support to CIP "as the key supplier of international public good research for roots and tubers."

One of the key responses to the EPMR recommendations was the decision to embark upon a CIP Vision exercise (see *A new CIP Vision*, page 55). For this exercise, which will culminate in 2003, we are using the roadmapping approach introduced to CIP by David MacKenzie. Throughout the six years he served on our Board of Trustees, David was a tremendous source of guidance, inspiration, and encouragement for the Center, and his unexpected illness and death in the course of the year signified a great loss to the CIP community. His keen insight, nonetheless, continues to guide us.

At CIP, we are convinced that roots and tubers are the foods of the future. In an era when these crops are clearly growing in importance as sources of food, nutrition, and improved livelihoods, especially in the countries we serve, we are committed to working effectively to realize their enormous potential in fueling growth, health, and prosperity. They are tremendously adaptable, demonstrate high production efficiency, provide flexibility for responding to health concerns, are versatile as income generators, and, perhaps most important, have a potential for improvement in productivity that is nowhere near being exhausted.

In 2002 we also confirmed the importance of our work in the areas of natural resource management and urban agriculture. CIP participated actively in the CGIAR systemwide process of identifying high priority Challenge Programs, in particular through the formulation of two proposals centered on efforts led by us: the Global Mountain Program and the Strategic Initiative for Urban and Peri-urban Agriculture. Although these two initiatives were not chosen within the first group of Challenge Programs to be launched, the iSC, donors, and other stakeholders insisted that we sustain and strengthen them to guarantee an enhanced response to the real and actual global challenges they address. As we did so, CIP scientists continued to explore ways of contributing to the Challenge Programs that have gone forward: Biofortified Crops for Improved Human Nutrition, principally with the work of the Vitamin A for Africa (VITAA) partnership to combat vitamin A deficiency; Water and Food, with our growing capabilities in natural resource management and development of modeling tools; and Unlocking Genetic Diversity in Crops for the Resource Poor, an effort that has been at the heart of CIP's research since the Center's founding.

In addition, despite the increased demands on our staff, CIP made steady progress in research on many other fronts. This included outstanding advances, for instance, in bacterial wilt research involving rapid screening for resistance traits and improvements in integrated disease management. More than 20 years of investment in breeding for virus resistance also bore fruit with the incorporation of resistance to two major potato viruses—PVX and PVY—into our premier late-blight-resistant populations as well as other promising breeding lines. You will read about many other Center achievements in the pages that follow.

As CIP moves forward into 2003, we are concentrating on rebuilding our capabilities in Asia and Africa, some of which have been lost through downsizing, others through natural attrition. The Vision exercise will help us to target the areas of extreme need within those regions where CIP's contribution can make a distinct difference. As always, we thank the donors who have stood by us in 2002, especially those who provide the core funds that are the pillars of our research program, and we look forward to continuing to work with them for a promising—and fruitful—2003.

Hubert Zandstra
Director General

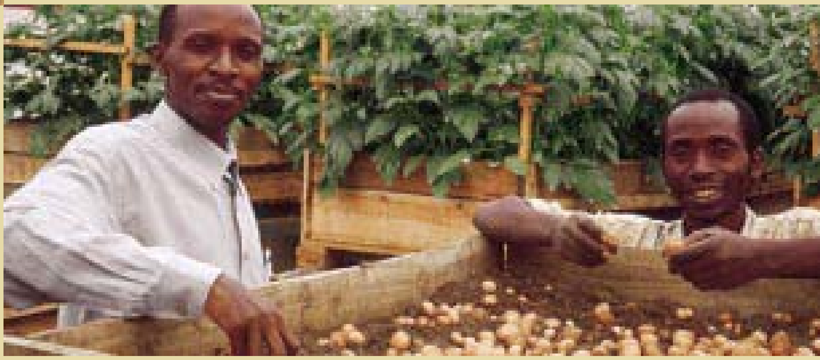
Preserving the core, stimulating progress This Annual Report provides an opportunity to reflect on the process in which CIP finds itself immersed: the creation of a new Vision for the Center. We see food security, human and environmental health, and adequate livelihoods as fundamental rights of all people, and our aim is to contribute to their fulfillment as effectively as possible. To do so, we must be selective. The Vision exercise will help us to focus our work and increase our impact on the interrelated challenges we face. Recognition of our core competencies—the pillars of our success—will help us to pinpoint the areas where we can make the biggest difference. At the same time, the analysis of emerging needs and opportunities in the light of these competencies will allow us to identify where we need renewed impetus.

In the following pages, you will read about activities that have been at the foundation of our research agenda from the outset, and also about areas where we are making new headway. Our work in conservation and breeding has paved the way for advances in combating important diseases such as late blight, contributing both to the development of new potato varieties with durable resistance and to the protection of biodiversity in this crop's center of origin (*Late blight research zeros in on a moving target*, page 35). More than 30 years of experience in participatory, integrated crop management has facilitated the application of new ways of dealing with emerging pest problems (*Global cooperation needed to combat leafminer fly*, page 21). And in Africa, two decades of cooperative networking has creating a crucial support system for VITAA (Vitamin A for Africa), a food-based approach to combating vitamin A deficiency that is offering hope to millions (*Neighbors helping neighbors*, page 11). Meanwhile, CIP researchers are developing innovative modeling tools for systems analysis that support sound decision making on technological change and resource investment (*New modeling tools simplify decision making in complex mountain ecosystems*, page 27). In Asia, a fortified regional approach promises to help us realize the enormous potential of root and tuber crops for responding to urgent food and income needs (*Scientists prepare for new era of CIP–China cooperation*, page 45).

We are pleased to share these accomplishments with you on behalf of all of our many stakeholders: the donors, researchers, agents of change, policy makers, and farmers throughout the world who we labor side by side with to make it all work, and to make it work for all.

Neighbors helping neighbors: A strategy for sub-Saharan Africa

For two decades, many of Africa's leading root and tuber crop scientists have worked together through a network considered to be one of the developing world's most successful research and development programs



In 1988, in an emergency effort to restart Uganda's national potato program, scientists working in Rwanda under the umbrella of PRAPACE (the French acronym for the Regional Network for the Improvement of Potatoes and Sweetpotatoes in Eastern and Southern Africa) supplied their Ugandan colleagues with 9 tons of high quality potato seed. At the time, Uganda was recovering from nearly 15 years of political upheaval that had left the country's once-thriving agriculture in disarray. Without an infusion of clean seed stocks and improved varieties, scientists feared that Ugandan potato farmers would be forced to plant deteriorated seed, all but guaranteeing poor yields and little return on investment. The effort was a success, and Uganda's potato program subsequently recovered.

Rwanda's generosity was repaid in 1994 following that country's own civil war. Weeks before the nation's farmers began returning from camps set up across the border in the

Since its founding 20 years ago, PRAPACE has helped to strengthen networking for root and tuber crop development in Africa.

Democratic Republic of the Congo, aid donors began looking for a source of high quality potato seed that could be supplied to thousands of returning refugees. Uganda's National Agricultural Research Organization—a PRAPACE member—helped avert a crisis by providing 20 tons of quality potato tubers as part of the CGIAR's Seeds of Hope Campaign. As it turned out, much of the material sent to Rwanda was derived from the emergency shipment Rwandan scientists had sent to Uganda six years before.

A good-news story

"This is the kind of good-news story that you don't hear much about in the media," says PRAPACE Coordinator Berga Lemaga, "but it's not all that unusual either. In Africa, when problems arise neighbors try to help neighbors."

Today, Rwanda produces nearly three times as many potatoes as it did 20 years ago, including large numbers of improved, CIP-derived varieties that have a broader genetic background than the potatoes grown in most industrialized countries. In Rwanda, as in much of eastern and southern Africa, potato is a basic food security crop and a major income generator for the poor. In 2001, per capita potato production equaled that of some of Europe's largest potato producing countries. German farmers, for example, produced about 11 million tons, while Rwanda—with one tenth of the population and less than 1 percent of the land—produced nearly 1 million tons.

Not just potatoes

Originally established as a potato research network, PRAPACE now covers sweetpotato as

PRAPACE MEMBER ORGANIZATIONS

Burundi	Institut des Sciences Agronomiques du Burundi (ISAR)
DR Congo	Institut National d'Etudes et de Recherches Agronomiques (INERA)
Ethiopia	Ethiopian Agricultural Research Organization (EARO)
Eritrea	Department of Agricultural Research and Extension of the Ministry of Agriculture and Extension (DRE)
Kenya	Kenya Agricultural Research Institute (KARI)
Madagascar	Centre National de la Recherche Appliquée au Développement Rural (FOFIFA/FIFAMANOR)
Rwanda	Institut des Sciences Agronomiques du Rwanda (ISAR)
Sudan	Agricultural Research Centre (ARC), Khartoum
Tanzania	Uyole Agricultural Research and Training Institute (UARTI)
Uganda	National Agricultural Research Organization (NARO)

well. The network invests nearly half of its US$400,000 annual budget in sweetpotato research and development, with highest priority directed to the distribution and testing of orange-fleshed sweetpotato varieties or OFSPs, which contain high levels of beta-carotene, used by the body to make vitamin A. "PRAPACE has been a key player in our efforts to promote OFSPs in the fight against vitamin A deficiency," says Regina Kapinga, Coordinator of the VITAA (Vitamin A for Africa) Partnership (see page 63). Vitamin A deficiency is one of Africa's most widespread public health problems, and also one of its most treatable, she says. For example, a CIP study presented at a recent meeting of the International Vitamin A Consultative Group

Continued on page 18

Detecting virus diseases

CIP has used enzyme-linked immunosorbent assay (ELISA) and nucleic acid spot hybridization (NASH) techniques to develop highly effective detection kits that are relied upon by PRAPACE seed producers and tissue culture laboratories to detect virus-infected seed tubers. The simple-to-use kits can detect, with high sensitivity and accuracy, the world's four leading potato viruses and the viroid PSTVd, which are transmitted by aphids and mechanically during tuber handling. Because African potato farmers use very little insecticide, and because there are few sources of genetic resistance to viruses available, control depends on eliminating infected seed before it reaches farmers' fields. The kits give seed producers the ability to detect viruses at high levels of efficiency, rivaling the standards obtained in sophisticated laboratories in developed countries.

A QUESTION OF SEED

Ask any African potato or sweetpotato farmer what they want most and their response will be "high quality seed." The better the seed, the greater the return on investment. Farmers who use superior quality seed can easily double or triple production.

Since its inception, PRAPACE has invested heavily in rural seed production projects in an effort to move improved varieties to where they are needed most. In 2002, more than 1.2 million farmers working through hundreds of nongovernmental and community-based organizations participated in PRAPACE seed programs.

- In Rwanda, 240 local seed associations distributed nearly 18,000 tons of superior quality potato tubers, almost doubling the amount distributed in 2001.
- In Burundi, government agriculturalists set rehabilitation of the country's national potato seed program as priority for the period 2002–2004. Burundi's goal is to produce 10,000 tons of high quality tubers by the end of 2004 using CIP/PRAPACE-released varieties.
- In support of that effort, government and private sector laboratories are producing large quantities of "basic seed," a product that is virtually pest- and disease-free. Basic seed, the highest quality seed, is normally provided in small quantities to top seed producers to produce seed for the market.
- In Ethiopia, the national potato program—a PRAPACE affiliate—established its first modern tissue culture laboratory. The new lab, which is multiplying four potato varieties for the Ethiopian highlands, has the capacity to produce up to 1 million ultra-high quality plants per year.
- To jump start potato breeding and development efforts in Sudan and Tanzania PRAPACE, in cooperation with CIP, provided researchers in those countries with a series of new breeding lines that have proven successful elsewhere in the region. The objective is to develop varieties that are well suited to local conditions in the shortest possible time and at limited expense.

Africa and the private sector

Economists and development experts agree that one of the best ways to promote rural development in sub-Saharan Africa is for farm enterprises to tap into local and international markets. For African farmers to take advantage of market opportunities, however, they will need to produce higher quality products that are delivered on time and in sufficient quantity. To link farmers and markets, PRAPACE encourages participatory research involving community-based organizations, the private sector, and national research and development programs.

- In 2002, investments in postharvest research by PRAPACE and Uganda's National Agricultural Research Organization led to the release of a highly nutritious porridge by the Maganjo Millers, a local food processor. The new high-protein, high-beta-carotene product, known as Nutri-Porridge, is made from a combination of orange-fleshed sweetpotato, maize, and groundnuts. It is reportedly outselling all of its competitors on the Kampala market and is already in short supply.
- A partnership established with the Uganda-based House of Quality Spices has opened up new opportunities for local farmers to export potato and sweetpotato flour to Europe. The company also plans to produce snack foods for sale to neighboring countries including Rwanda, where its products received high marks from the nation's President, Paul Kagame, after he performed a taste test.
- A Rwandan company, Potato Enterprises, recently announced that it would commence commercial chipping operations in 2003 using CIP potato varieties released through PRAPACE. The firm's long-term strategy calls for the manufacture of nearly 5,000 tons of chipped potatoes during its first year of operations, with a ten-year goal of 15,000 tons. Seventy-five percent of its output is slated for export.

- More than 20 Kenyan companies are currently involved in production of frozen potatoes and snack foods for the domestic market. One food processor, Mugumo Family Farms, produces 1.2 tons of processed products per week, mainly for the hotel and airline industries. Farmers who sell their potatoes to Mugumo receive twice the going price for their products.
- Researchers working for the commercial feed companies UGACHICK and NUVITA in Uganda are conducting studies to determine the feasibility of using sweetpotato as a principal ingredient in commercial animal feeds. If successful, their products will be sold in Burundi, the Democratic Republic of Congo, Rwanda, Tanzania, and Uganda. Processors are attracted to sweetpotato because of the productive potential of improved varieties and because of their early maturity, which helps farmers produce up to three crops per year. Many of the new varieties are also high in beta-carotene, an important ingredient in poultry feed.
- As Ugandan sweetpotato production reaches record levels, Maganjo Millers in Kampala has agreed to purchase all of the orange-fleshed sweetpotato produced by farmers in Uganda's Soroti and Kumi districts. The agreement is expected to remove a marketing bottleneck that has limited the crop's potential.
- Western Kenyan community-based organizations in three districts are involved in producing and marketing weaning foods that contain orange-fleshed sweetpotato. The NGO Appropriate Rural Development Agricultural Program, for example, works with local processors to supply charity homes and midwives with a product, attractively packaged in 1 kg packets, that they use to improve the health of their clients.

Continued from page 13

concluded that up to 50 million children under five would benefit if African farmers switched from traditional white-fleshed varieties to improved orange-fleshed sweetpotatoes.

"We have been working closely with PRAPACE to distribute orange-fleshed varieties to its member countries, and we expect that the network will play an important role in promoting a new generation of sweetpotatoes that is just now beginning to reach the region," Kapinga says. She notes that PRAPACE was an early proponent of orange-fleshed varieties, and invested significant resources to demonstrate the feasibility of using OFSPs to eliminate vitamin A deficiency among young children and their mothers. The early VITAA varieties were high beta-carotene lines selected from farmer varieties and genebank holdings.

CIP plant breeders have produced a new and improved set of OFSP materials that not only meet local market standards for taste and texture, but also can be harvested earlier—a factor that is important for pest control because it limits exposure in the field—and produce higher yields. The new plant types, which began shipping from CIP headquarters at the end of 2002, are the first to emerge from a six-year breeding program supported by the German Government's Ministry for Technical Cooperation (BMZ) and its operating arm, GTZ.

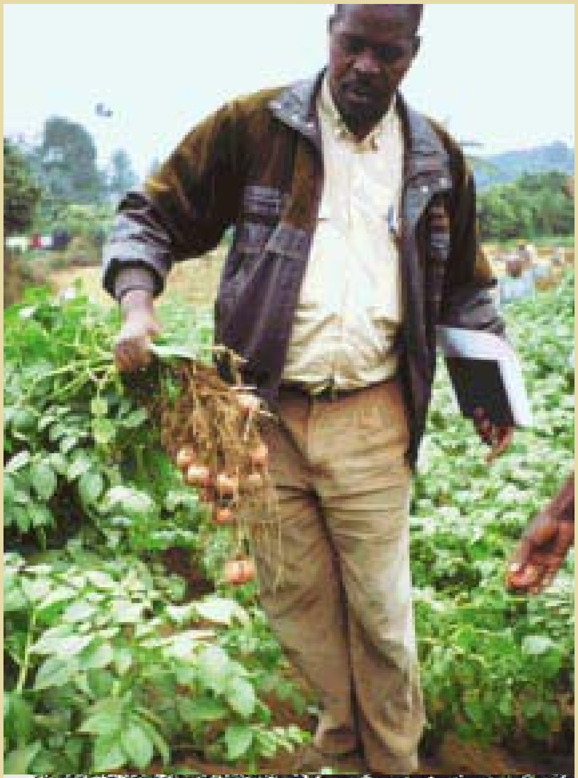
A shared mission

The PRAPACE network, which celebrated its twentieth anniversary in 2002, supports the region's farmers by providing a range of technical services through the combined efforts of the agricultural research and extension programs of its ten member countries.

PRAPACE membership is not automatic. To join, a prospective member must apply formally and then agree to commit staff and resources for research in a specific problem area. Scientists in Burundi, for example, play a lead role in integrated disease management focusing on bacterial wilt, while researchers in Uganda and Ethiopia work on varietal testing and late blight disease management. In this way, PRAPACE helps to pool resources and maximize benefits. Among its newest members, Tanzania joined in 1998 followed by Madagascar and Sudan in 1999.

"We estimate that the value of the services provided by PRAPACE members now totals more than US$1.0 million annually, roughly four times the amount provided by our international sponsors," Lemaga says. PRAPACE receives its principal funding from the United States Agency

Originally established as a potato network, PRAPACE now dedicates about half of its budget to sweetpotato, in particular to the new orange-fleshed varieties being promoted by the VITAA partnership (bottom).



for International Development (USAID), with complementary grants from Canada's International Development Research Center (IDRC) and the United Nations Food and Agriculture Organization (FAO). The network is governed by a steering committee composed of the leaders of the national potato and sweetpotato research programs of its member countries. CIP is the project's executing agency and provides technical backstopping.

ASARECA: A strengthening association

While PRAPACE's overarching mission is to promote root and tuber research and development among its members, the network members are particularly proud of their success in supporting linkages and communication between a range of different organizations. Such linkages are particularly important, Lemaga notes, as the world globalizes and as the region's environmental problems become more challenging. "No one nation or group of nations can go it alone and be successful," he says.

PRAPACE partner agencies currently include four Future Harvest Centers—CIAT, CIP, ICRAF, and IITA—and FAO, IDRC, and two dozen bilateral agencies and nongovernmental organizations. Its most important relationship, however, is with ASARECA, the Association for Strengthening Agricultural Research in Eastern and Central Africa. PRAPACE operates under the auspices of ASARECA and is one of its twelve commodity research and development networks.

ASARECA, established in 1993, is a regional coordinating body set up to improve the quality and cost-effectiveness of agricultural research, support regional collaboration, and improve information and technology delivery. It is considered one of Africa's most important research partnerships and an essential mechanism for agricultural development in the region.

Former USAID project officer Carole Levin says that her agency's decision to invest in ASARECA was originally linked to PRAPACE's early success and to its Directors Committee's willingness to lobby for a regional organization that would work with crops other than potatoes and sweetpotatoes. "The PRAPACE Steering Committee laid much of the ground work for ASARECA by demonstrating the value of regional cooperation and the benefits of pooling national resources," she says.

"We are extremely proud of our early links and our ongoing association with PRAPACE," adds ASARECA Director Seyfu Ketama. "PRAPACE is an example of what can be achieved when countries and international organizations work together to collectively and equitably promote regional economic growth through agriculture."

"PRAPACE is also an important part of our efforts to promote long-term sustainability of our natural resources," he says. "Maintaining the land and the water is not a foreign concept, it is very much in keeping with traditional African culture and traditions. Through PRAPACE and ASARECA we are working together to achieve a greater good by combining our traditions with science that serves the public's greater interest. We congratulate PRAPACE and all of its members on its twentieth anniversary."

CIP research in sub-Saharan Africa is broadly supported by the CGIAR donor community through nonrestricted funding and, in particular, by restricted projects financed by Germany and the United States. Other important donors include IDRC, the McKnight Foundation, and the UK's Department for International Development, which support research and development in the areas of postharvest utilization, peri-urban agriculture, and genetic conservation.

The tiny leafminer, sometimes known as the pea leafminer, emerged from its home in the Americas sometime in the 1970s, invading farms in Africa, Asia, and Europe. Once thought to have spread to developing countries from Europe, scientists now believe that the leafminer traveled

from its place of origin in Central America on vegetable and flower exports. It is now considered a significant threat to agriculture and the environment.

"Leafminer is nearly as serious a problem as the whitefly," says Pamela Anderson, the International Potato Center's Deputy Director General for Research. "It's found throughout the tropics and is fast becoming a leading cause of pesticide abuse." Anderson, an entomologist, was the head of the CGIAR Tropical Whitefly IPM Project until she joined the Center in June of 2002.

Global cooperation needed to combat leafminer fly

The leafminer fly (*Liriomyza huidobrensis*), an insect pest that attacks potatoes and a range of other horticultural crops, is fast becoming a worldwide cause for concern to farmers, consumers, and environmentalists

Test case in Cañete

CIP first began working on the leafminer fly problem in the 1990s in Peru's Cañete Valley, one of the country's leading agricultural zones. This work is well known in agricultural circles as the first successful test case of classical integrated pest management (IPM) for leafminer fly, says Aziz Lagnaoui, a former CIP IPM specialist now working with the World Bank's Department of Sustainable Development.

Yellow traps, first tested in Cañete Valley, are used to monitor leafminer fly populations.

"Cañete was a convenient place to start, and the problems we encountered there were significant. In many instances farmers' fields looked like they had been attacked by flamethrowers," Lagnaoui says.

At the time, the valley's potato producers were spraying pesticides in dangerous chemical cocktails, mixing compounds such as methyl parathion with other toxic insecticides. Virtually all of the chemicals being used in Cañete had been classified by the World Health Organization as "extremely hazardous." The Cañete studies, which were conducted in cooperation with the NGO Valle Grande and local farmers, showed that the valley's leafminer fly explosion was directly linked to pesticide misuse. Even so, as the problem intensified, farmers used increasing amounts of chemicals, in some cases spending up to US$800 per hectare. It was obvious, Lagnaoui says, that the insect had developed resistance and that the chemicals were no longer working.

Research in Cañete Valley eventually led to a major shift in strategy. Instead of attacking the pest during its adult stage, farmers were shown how to use parasitoid wasps to kill the larvae before they could grow to adulthood and

CIP researcher Warsito Tantowijoyo and farmer-researcher Gunawan inspect a field during a project planning workshop in Tanah Karo, North Sumatra.

highlands of Indonesia where they attacked potato and vegetable crops.

In each of the locations where it was found, the pest had become increasingly difficult to control with insecticides, and there were indications that the natural enemy complex had

reproduce. The tiny wasps, which feed only on leafminers, lay their eggs on or near the larvae, which serve as a food source.

Other measures that contributed to the success included the use of less toxic pesticides combined with crop rotation when possible, practices that help prevent the pest from developing resistance, or at least delay it. In addition, farmers were taught how to monitor infestation level before spraying. Valle Grande officials would later testify to the results: the research saved farmers a great deal of money and helped to promote a more sustainable way of controlling the pest.

Population dynamics

The progress made in managing the problem was encouraging, but by the mid-1990s the pest was spreading rapidly to other areas. Leafminers had become a problem in Southeast Asia, for example, and were already a major pest in the

been disrupted. It was agreed that basic studies on the population dynamics of the pest and its natural enemies would be needed to make informed recommendations for an integrated management scheme.

In 1997, CIP scientists initiated the first in a series of population dynamics studies. By collecting basic information about the pest and

Leafminer damage (above) is evident in the fields of Banjarnegara, Central java.

associated natural enemies, the studies provided a better understanding of the pest's biology and behavior, as well as its interactions in different farming systems and ecologies. Indonesia was considered an ideal location to conduct the studies because of its tropical environment and because the leafminer was a relative newcomer to the area.

"Population dynamics studies can be tedious and even back-breaking research, but without them you're working in the dark," says Anderson. "The natural tendency is to say that leafminer is a problem, so let's do something about it. Until you have a basic understanding of how the insect relates to the environment and to the farmers' production system, however, it's unlikely that you're going to make progress towards sustainable management."

Making way for natural enemies

Working with funds provided by the Australian Centre for International Agricultural Research, CIP scientists studied the leafminer and its natural enemies in close collaboration with local farm groups, national research institutes, and a variety of nongovernmental organizations. The trials, which are on-going, continue to provide important new information on the biology and ecology of the pest and its natural enemies. One key finding has been that in potato plots where no insecticides were applied over three cropping cycles, leafminer populations gradually decreased, along with damage to the crop. The studies also showed that parasitoid species emerging from leafminer pupae had become more diverse, increasing the chances of controlling the pest without insecticides.

In North Sumatra, where the pest was previously abundant, the studies showed that the insects had all but disappeared. Moreover, when farmers who had stopped potato production resumed growing the crop, the leafminer's natural enemies that had re-established themselves continued to suppress the pest. Equally encouraging was the fact that participating farmers began to recognize the negative link between pesticides and leafminer infestation.

Global project

"We've also learned from the studies that the best way to tackle leafminer fly is globally and collaboratively," Anderson adds. The problem is simply too big, too widespread, and too important for any one organization to handle it on its own.

Continued on page 26

Hope for a leafminer-resistant potato

The long-term goal of a population dynamics study is to set the stage for the development of recommendations for an integrated pest management (IPM) program that farmers can use to effectively and sustainably manage pest infestations. IPM "packages" typically include traps, biological control agents, selective insecticides, and, when available, resistant varieties.

At the present time, there are no commercial potato varieties with high levels of resistance to leafminers. Recent trials, however, have identified five advanced lines—two of them with high levels of resistance—that may prove useful in managing the pest.

"The resistance was discovered by chance when a series of CIP breeding lines entered standard evaluation trials in 2002," says Meredith Bonierbale, Head of CIP's Crop Improvement and Genetic Resources Department. "These particular lines were developed for other purposes, such as for resistance to late blight or production from true potato seed," she says. "Fortunately, the broad genetic base of CIP's breeding populations and their exposure to diverse stress conditions during selection enables us to identify varieties that will be robust in countering various pest and disease problems beyond our primary targets."

Experiments conducted with farmers in Peru's Cañete Valley will help to test whether or not the new lines can be used to produce a successful crop without resorting to pesticides. If the trials are successful, it should then be possible to boost the effectiveness of future IPM schemes by providing farmers with the option of planting resistant varieties.

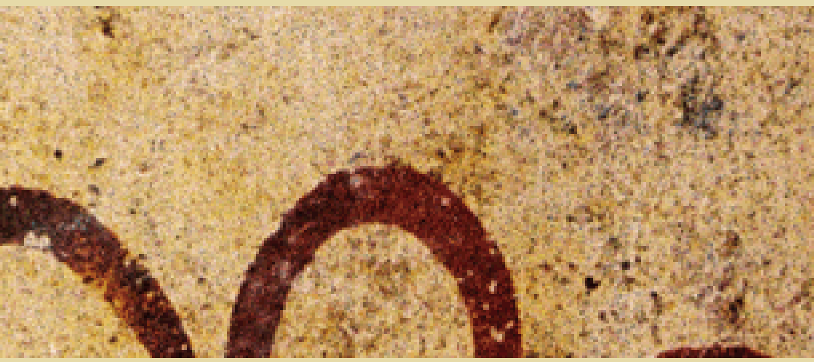
The availability of a leafminer-resistant potato, entomologists say, could reduce the number of times a farmer needs to apply insecticides by 70 or 80 percent.

For example, taxonomists estimate that there are approximately 3,000 different species of leafminers, although only four species cause serious damage to food crops. Those four, however, can be hard to distinguish. "To move forward, we will need the services of molecular taxonomists who can identify with certainty the existence of the pest at specific locations," says Anderson. Similar services would be required for leafminer predators and parasitoids, which are also difficult to identify.

"It's our hope that in the future leafminer research will be conducted globally so that we can attack the problem from a systems perspective," Anderson says. At the moment, CIP research is limited to the species that attack potatoes. A global project would address all major species across a range of cropping systems and ecologies. It would also involve researchers from many different national and international organizations, drawing in financial resources from multiple sources and eliminating duplication of effort.

"What we would like to see is a program that pulls together the best research currently available, fills in the gaps in our knowledge, and eventually provides us with a comprehensive overview of the problem," Anderson says. Critical to that effort would be the use of modern molecular techniques, geographic information systems, and computer modeling. The project, Anderson estimates, would cost approximately US$7.5 million over a five-year period.

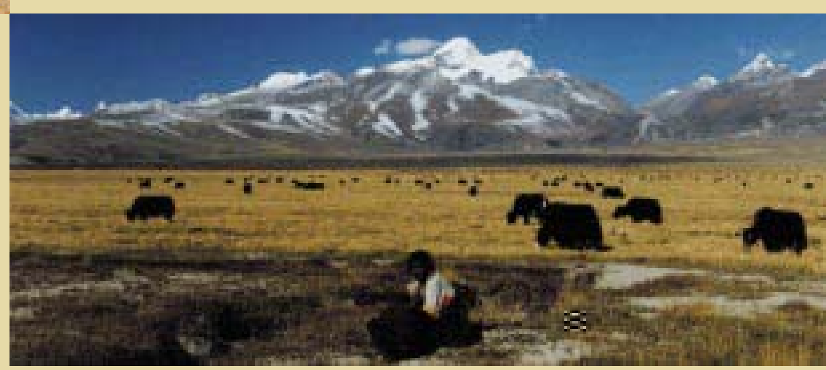
New tools simplify decision making in complex mountain ecosystems



> "If we want to crack the really hard poverty in marginal environments, the next logical step will be to move from our focus on the field to a broader view of the systems in which those fields are embedded"
>
> Pamela Anderson, CIP DDG for Research

Ji Qiumei is one of the first Asian researchers to be trained in the use of a new series of modeling tools designed to help policy makers make better decisions about the management of mountain ecosystems. Her training also makes her one of a small but growing cadre of Asian scientists equipped to take on the challenge of capturing the bigger picture of the systems in which agriculture is embedded.

In 2002, Ji completed 24 months of training at CIP headquarters as part of her PhD dissertation. Ji, who is Tibet's first woman to get a PhD in agricultural science, used her dissertation research to conduct an inventory of natural resources on the Tibetan Plateau.



"The Qinghai-Tibet Plateau is Asia's water tower," says Nyima Tashi, Director General of the Tibet Academy of Agricultural and Animal Sciences (TAAAS). "We once assumed that the best way to spend our resources would be in animal production and crops, but Ji's modeling

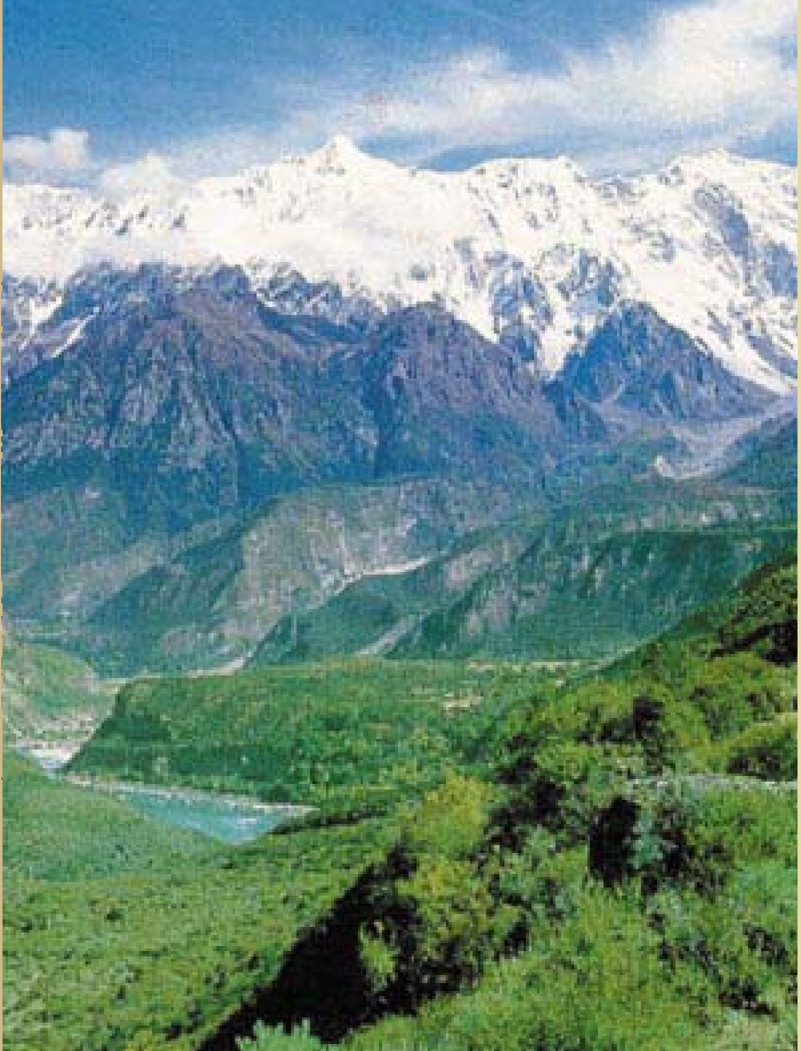
Hi-tech gear for highland research

The environmental health of mountain and hillside areas has a direct impact on the availability and safety of human drinking water, on our food supplies, and, increasingly, on political stability, says Hugo Li Pun, CIP's Deputy Director General for Corporate Development. In an address to a special session of the United Nations General Assembly at the launching of the International Year of the Mountains, Li Pun, an expert on highland agriculture, noted that the importance of mountain ecosystems was first highlighted at the Earth Summit in 1992. The major issues addressed there were summarized in Chapter 13 of Agenda 21, the Rio Declaration on Environment and Development.

"The Rio Summit generated the political will to undo hundreds of years of mismanagement and neglect. Ironically, at the time, we didn't really have the tools to act," he says. Since then, researchers have armed themselves with new hi-tech gear, including computer models that can accurately analyze the health of mountain ecosystems and help governments and local communities make more informed decisions about managing natural resources.

Some of the biggest improvements since Rio have been in the area of information and computers, Li Pun notes. E-mail and the worldwide web, combined with the development of computer simulation models, have created opportunities to exchange information and exciting new ways to solve problems.

Researchers are also better able to judge the potential of new technologies before they commit resources to them. For example, last year CIP social scientists, working in tandem with GIS specialists and crop scientists in Africa, used satellite imagery and newly installed geographic information software to calculate the potential of new crop varieties to alleviate malnutrition in the East African highlands. "In the past, it might have taken years to gather that kind of information, if it could have been done at all," Li Pun says.



The Qinghai-Tibet Plateau is Asia's water tower. What happens there directly affects the health of three of the world's major river systems.

work showed us that our priorities ought to be in maintaining the integrity of our water supplies."

Water is an important and sometimes controversial issue in the Himalayas. What happens on the Tibetan Plateau directly affects the health of three of the world's major river systems—the Yangtze, the Mekong, and the Brahmaputra.

"Our analysis showed that Tibet's farming systems are not designed to take advantage of our water resources in a way that benefits local people or our neighbors," Ji says. The country's strong focus on maximizing agricultural output is literally spending down its water resources and diminishing the quality of the supply for people downstream. Efforts to maximize the number of animals that farmers produce, she says, have led to overgrazing and soil compaction, which in turn increases run off and erosion.

Ji notes that if policy makers would encourage animal producers to operate only in those areas that are best suited to the task, and then factor into the analysis water-related revenues over time, the policy environment would likely change, as would Tibet's priorities for agricultural research.

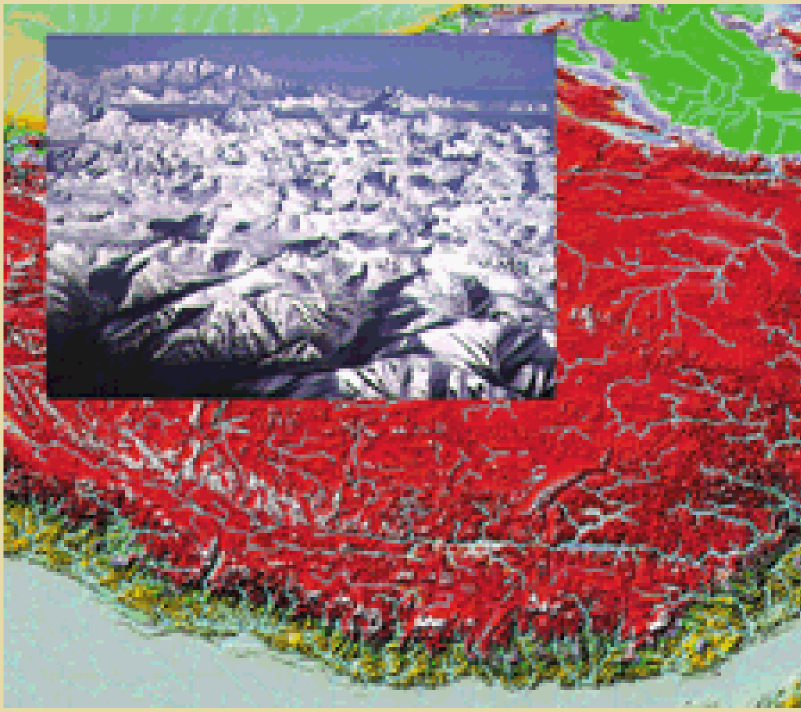
Honest brokers

"Modelers are like honest brokers," says CIP modeler Roberto Quiroz. "If they do their jobs correctly they'll come to the process without an agenda, without preconceived notions."

"With modeling you can test different options up front without committing resources," adds Quiroz. "It's a money saver, especially in mountain environments where it's often difficult to measure things in one place and extrapolate the data to another. With modeling you can look at things from a systems perspective."

Quiroz notes that until recently, modelers had little reason to take on assignments in highland areas. Changes began to occur with the political commitment provided by the 1992 Earth Summit in Rio, as well as the availability of new satellite images provided by NASA and the

Modeling tools—including satellite imagery and geographic information software—are helping scientists to understand complex systems, such as Tibet's hydrological network.



European Space Agency. Nonclassified satellite images, however, are not sufficiently detailed to allow scientists to draw accurate conclusions, Quiroz says.

Moving to another level

One of the key features of the CIP models is that they have the capacity to downscale satellite imagery to the watershed level and take into account tiny variations in terrain and climate. "What the CIP modeling team and its partners did was develop tools that can interpolate solar radiation, rainfall, and temperature data taken from historical weather station data and contrast it with the images derived from satellite photos. That was really the key," he says.

Case in point: For years, researchers used expensive and hard-to-construct runoff plots to measure soil erosion. If you want to measure runoff in a watershed accurately, however, you need an unmanageable number of such plots to account for changes in terrain. In this particular case, the breakthrough came with the construction of mathematical models that describe the energy released when a raindrop hits the soil and then contrasts this information with variables such as soil type, rainfall patterns, and plowing techniques. The variables are put into mathematical equations that eliminate the need to physically measure runoff. The model also tells you how long you can crop the area without eroding the land's capacity to produce food.

"We thought that if we developed tools that could help policy makers make better predictions we could increase the impact of traditional crop and animal research and in the process save development agencies a great deal of money. That's why we got into modeling: to build tools to help people who make difficult decisions," Quiroz says.

CIP's Deputy Director General for Research, Pamela Anderson, is emphatic about the need for

Nomad herders in Tibet are just one component of a diversified land use system that depends on—and affects—the stability of water supplies.

such tools. "I'm not suggesting that we should stop working in the traditional areas of plant breeding or integrated pest management," says Anderson. "We need to continue strengthening our core competencies. But, in addition, we need to target our work at the system level. That means developing analytical and modeling tools to increase our understanding of complex, dynamic systems, and training people to use those tools."

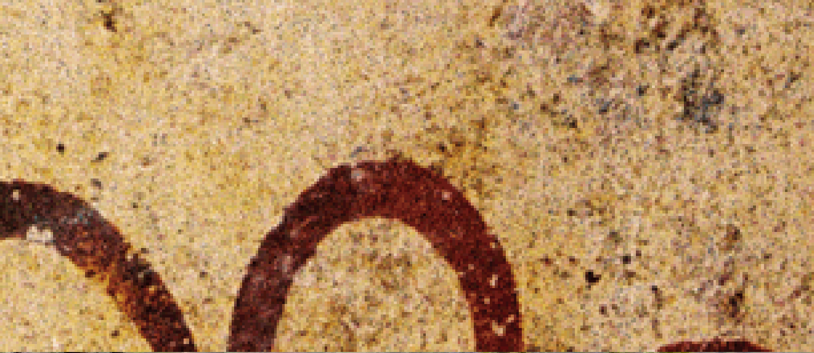
The Ecoregional Fund to Support Methodological Initiatives, the Swiss Agency for Development and Cooperation, and the CGIAR Systemwide Livestock Program are among those who have acknowledged this need by allocating funds to support the CIP modeling research.

And much more

"We're working in a lot of areas now, but we're probably best known for our tradeoff analysis work in Ecuador," says Quiroz (see *Tradeoff modeling helps make critical connections*, page 32). "Before that particular study was released two years ago, most people thought that the pesticides used on potatoes had their greatest impact on the environment. Tradeoff modeling showed, however, that human health is also affected, so that pesticide policies in the Andes needed to be redirected to prevent poisonings and that investment in health care for farm workers who are exposed to the chemicals is essential."

This is just one in a range of studies conducted by CIP modelers, including a project that produced a solar radiation atlas for the Peruvian national weather service. To construct the atlas, scientists gathered historical records from Peru's weather stations and ran them through CIP's climate interpolation model. Peru's Ministry of Energy and Mines is now using the atlas as a guidebook in a project that will put in place thousands of solar panels to bring

Continued on page 34



TRADEOFF MODELING HELPS MAKE CRITICAL CONNECTIONS

Following on the success of CIP's pesticide tradeoff work in Ecuador (see CIP's Annual Report 2001), project scientists are preparing to use the tradeoff analysis approach to demonstrate the importance of coordinating research on environment, health, and natural resources. "Our hypothesis is that if you want to crack the cycle of poverty and resource degradation, you need to look at the way that food production interacts with health and the environment," says John M. Antle, a production economist at Montana State University and long-time CIP collaborator.

Antle believes that there are substantial connections between crop productivity, the health of farm households, and soil and water degradation. Until now, however, each of these topics has been treated by separate scientific disciplines and diverse government agencies

operating with independent agendas. "There's a clear correlation between poverty and short-term planning horizons, which means that people often don't make the needed long-term investments. If you're an African farmer suffering from tuberculosis or parasites, let alone AIDS, it's unlikely that you'll have the inclination to do much about the long-term health of your soil," Antle says.

Starting in 2004, Antle proposes to use an upgraded version of the tradeoff simulation model used by CIP in Ecuador to make the case to policy makers. "What we are proposing are two contrasting studies. One will investigate economic–health–environment interactions associated with pesticide use in the intensive horticultural cropping systems typical of the peri-urban agricultural zone surrounding Nairobi. The other study will examine nutrition, infectious diseases, and land degradation in the Peruvian Andes, a more marginal agricultural environment." To accomplish these objectives the current generation of tradeoff modeling tools will be expanded and efforts will be made to acquire and use data more efficiently. Advances made in these areas over the past 5 years will be incorporated into existing software, Antle says.

The studies are unlikely to provide a quick technological fix, however. Rather, the research should facilitate a more complete understanding of existing strategies, as well as their limitations. "If a quick fix is out there we may find it, but a more likely outcome is that we can bring about a more realistic and balanced assessment of the technology and policy options that exist. That kind of assessment could help research administrators and policy makers take into account the health and environmental dimensions of agricultural systems."

To illustrate the point, Antle notes that if this type of integrated assessment of agricultural systems had been available in the 1970s or 1980s, agricultural policy makers might have invested more heavily in integrated pest management and natural resource management as complements to the introduction of high-yielding crop varieties. Those investments could have helped avoid some of the adverse consequences that are now associated with agricultural development based on intensively managed monoculture systems.

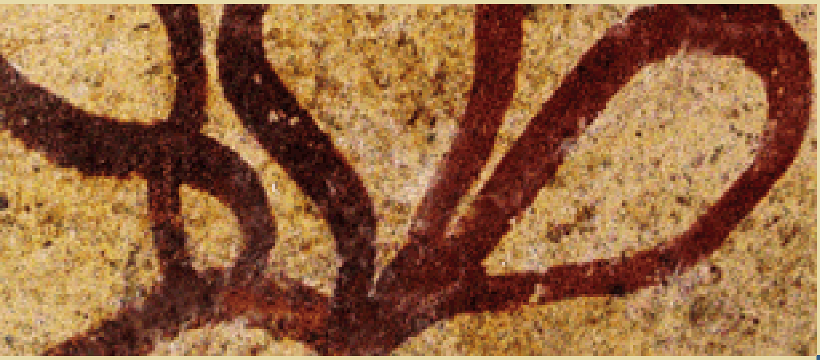
electricity to isolated mountain areas. The atlas will allow them to determine where solar radiation is sufficient to make investment in the panels worthwhile.

The atlas is also expected to benefit agriculture. Its maps will help agricultural policy makers target areas where Peru has potential to initiate intensive, competitive agriculture that will hopefully lift subsistence farmers out of poverty, Quiroz says.

CIP's modeling programs are available free of charge as CD-ROMs and on the internet, in interactive environments for distance education. To learn more, please visit CIP's Virtual World, an interactive website where researchers and development experts can communicate with CIP modelers and exchange experiences in a 3D environment (see http://inrm.cip.cgiar.org/res.htm).

Late blight research zeroes in on a moving target

Scientists worldwide have made notable advances in combating late blight, the most damaging potato disease known. But as this pathogen travels around the world and evolves, researchers are realizing that they must be as adaptable as their elusive enemy to keep it at bay

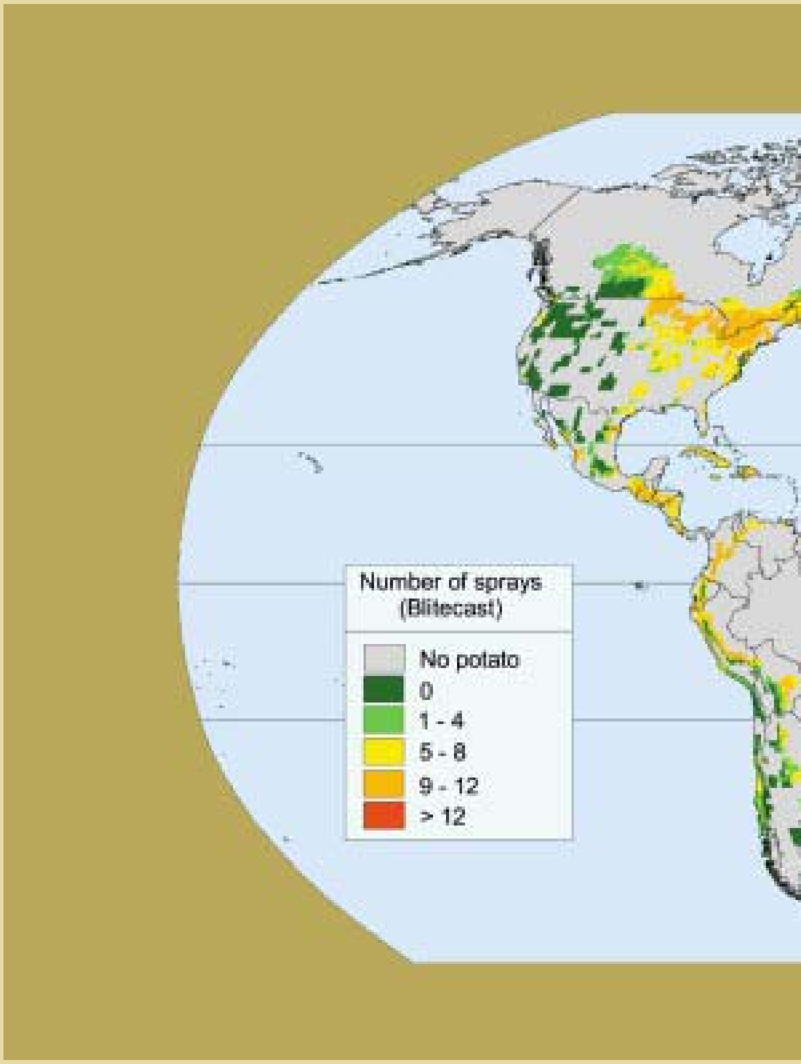


People thought they knew late blight. It has an infamous history as the disease that caused the Irish potato famine, and entire books have been written about it. But recent studies on the biology and population dynamics of *Phytophthora infestans*—the fungus-like organism that causes late blight disease—have demonstrated that the pathogen has far more genetic diversity than previously realized.

"Over the past three or four years we've been finding new forms of *P. infestans*—what scientists call isolates—that have never been seen before," says CIP late blight project leader Greg Forbes. "The pathogen is adapting faster than the control measures used to combat it, and new approaches are urgently needed." The picture is complicated by global warming, which is opening up new opportunities for *P. infestans* in areas where it was previously

not a problem, because low temperatures kept it under control.

Blitecast, a late blight forecasting model, has been linked with geographic information system technology to help researchers estimate potential global severity of the disease (expressed as the number of fungicide sprays required for control).

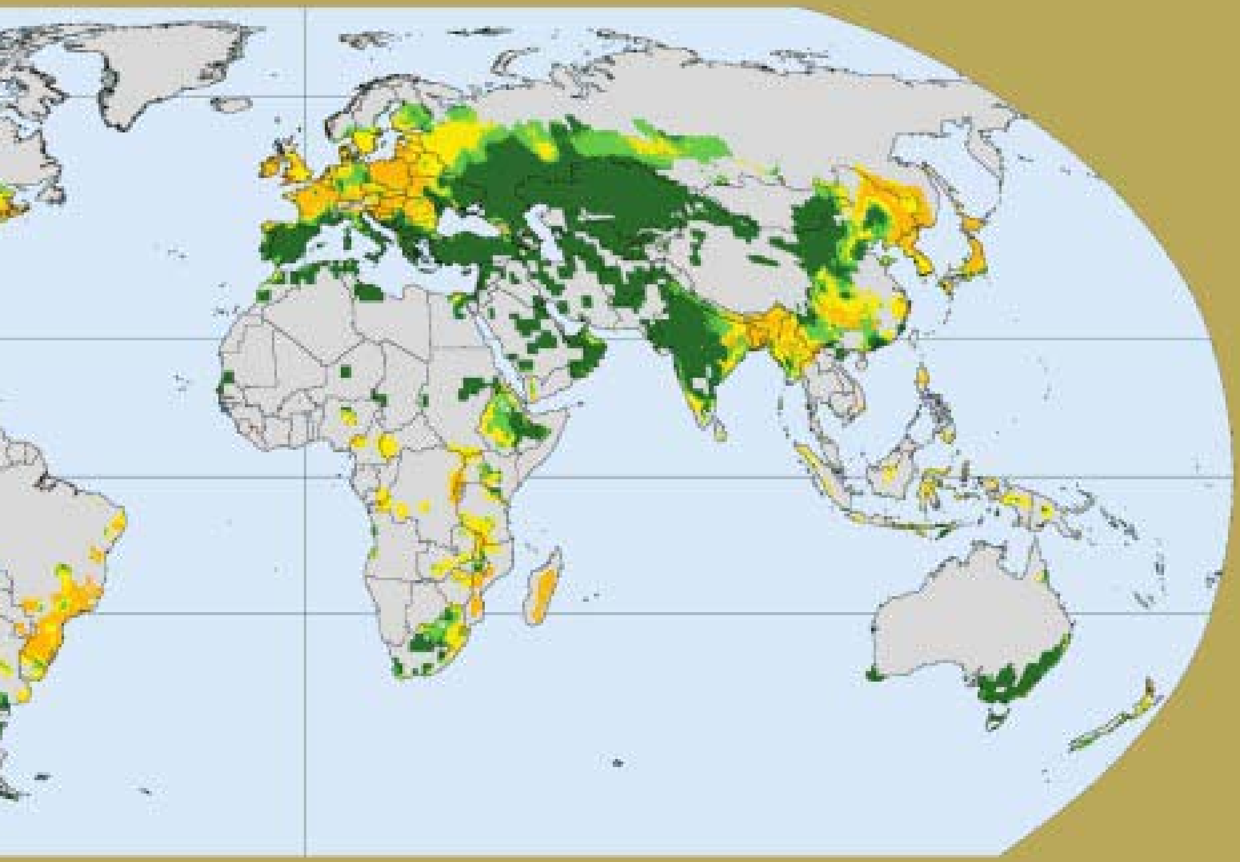


A history lesson

A review of late blight history helps to understand the evolving problem. Part of this pathogen's adaptability results from the fact that it can reproduce either asexually or sexually. To date science has recognized two main "mating types," commonly distinguished as "A1" and "A2." An emerging theory has it that these two types co-evolved with potato's wild relatives among the *Solanum* species—which include wild potatoes, tree tomatoes, pear melons, and numerous weedy species and woody vines—in the Andes. This contrasts with the commonly held view that *P. infestans* originated in the central highlands of Mexico, where it is thought to have "jumped" to cultivated potatoes. "There are many hypotheses about the origins of the pathogen," says Forbes, "and the evidence is still coming in. The fact is that to date, we've generated a lot more questions than answers."

At any rate, pathologists believe that the A1 mating type traveled from Mexico to northeastern USA sometime around 1840. It went on to Europe where, in the late 1840s, it caused one of the greatest famines in human history. The A1 type eventually made its way to Africa, Asia, and back to South America. The vehicle: potatoes being traded and sold to meet worldwide demand. It was not until the 1970s that the A2 mating type reached Europe, probably carried in a shipment of potatoes imported from Mexico to offset the effects of a major drought. From there, history was repeated as this "new" form of the pathogen spread around the world.

When A1 and A2 are present in the same environment they can "recombine" through



sexual reproduction. The result is an explosion of new types of the pathogen, which makes it even more difficult to manage. Almost all potato-growing countries are now affected by the problem. Even so, in North America and Europe farmers are willing to grow highly susceptible potato varieties that fetch good prices on the market, resorting to chemicals to control the disease. But as late bight evolves, these farmers are being forced to use increasingly large amounts of fungicides, and to use them with greater frequency. What's more, a class of chemicals that used to be considered invincible is losing its effectiveness in the face of the new disease types.

Continued on page 40

Late blight approaches a sexual frontier

Working from new data sets and reports of increasing late blight damage in highland areas of the Andes, CIP pathologists believe that the emergence of previously unknown forms of the late blight disease—and its appearance in areas previously unaffected—could have significant consequences for ancient potato varieties and the farmers who grow them. Their concern is focused on the Lake Titicaca region and surrounding areas. This region is thought to be the potato's genetic center of origin, a theory borne out by the significant diversity of potatoes found there.

"What we are seeing is the convergence of two mating types, one moving south from Colombia and Ecuador, and the other coming up through Bolivia from Brazil," says CIP pathologist and late blight project leader Greg Forbes. "Our fear is that farmers in the high Andes—the people who have served as the traditional custodians of potato biodiversity—may lose native varieties that have been grown for many centuries, and thereby their means of survival." Local consumers hold these potatoes in high esteem. Not only are their varied tastes, textures, and colors a source of culinary diversity, native potatoes are also important in traditional culture and are often used in ceremonies or as gifts.

Maria Scurrah, a CIP adjunct scientist who has spent years working with farmers in the high Andes, can testify that this is no longer just a theoretical problem. "Late blight is encroaching on areas that were rarely affected by it in the past. Essentially, the pathogen is moving up the mountainside, showing up in places where farmers have hardly ever encountered it."

Biodiversity fights back

"Traditional varieties are not going to disappear because of late blight," says CIP potato breeder Juan Landeo, "but it's likely that they will be under greater pressure than in the past." Landeo bred one of Peru's most popular and widely grown potatoes, known as Canchan. Depended on for years as a late-blight-resistant variety, Canchan's ability to withstand the disease has, in recent years, broken down. To help farmers cope, Landeo has developed a new series of blight-resistant potatoes, suitable for production under extreme highland conditions.

The new “populations”, now ready for selection and release, were derived from materials of the *andigena* subspecies collection held in CIP’s genetic resources complex in Lima. The genebank safeguards about 85 percent of all known native potato varieties, including 15,000 farmer-selected andigena potatoes collected in nine countries during the 1970s and 1980s. The CIP genebank collections, which also include sweetpotato and other Andean roots and tubers, are protected under an agreement with the UN Food and Agriculture Organization that charges the Center with conserving genetic resources so as to make them available equitably and without restriction. CIP uses these materials, for instance, to help preserve the diversity of native varieties in the Andes through restoration programs (see *Next steps for Chayabamba,* page 43).

Bred over a 12-year period using conventional plant breeding techniques, the new andigena plant types carry multiple late blight resistance genes, which should help them compete against many forms of the disease. Most native Andean varieties belong to the subspecies *andigena*, but generally lack such resistance. For this reason, the search for the resistance traits incorporated in the new varieties involved a long and careful process of screening and selection. The new materials have some added advantages: they produce higher yields than conventional varieties in less time, a characteristic that should reduce their exposure to the disease in farmers’ fields, while offering most of the eating and market characteristics valued by highland farmers.

“What we’ve tried to do is breed a highland-type potato that has most of the qualities that will make it acceptable to processors and allow it to compete in urban markets,” Landeo says. It is Landeo’s hope that these new andigena potatoes, now being distributed in the Andes through farmer field schools, will eventually enable people in Africa and Asia to enjoy the special taste and texture of native Andean potatoes. Because of their unique features, they are much better prepared to adapt to areas outside of their Andean home than their native relatives.

Late blight symptoms on tubers (below). At 3,500 masl, Huanuco, Peru, serves as a good testing ground for late-blight-resistant varieties and management practices (following page).

An expanding portfolio

The situation is even more complex in the potato-growing areas of the developing world, where seasons, day-length regimes, altitudes, and socio-economic and agro-ecological conditions are diverse, especially compared with those found in industrialized countries. "The solutions used in the northern hemisphere just don't work here," says Pamela Anderson, CIP's Deputy Director General for Research. "CIP has the mandate for late blight research in the tropics, and one of our main goals is to reduce farmer dependence on chemicals. This makes the replacement of susceptible varieties with more resistant ones a pivotal point of our late blight control programs."

CIP scientists are concerned that late blight is "moving up the mountainside," becoming a serious threat in places where it was rarely encountered in the past.

More than 20 developing countries—including major potato producers such as China, Peru, and Kenya—are in the process of releasing the latest lines of late-blight-resistant potatoes produced by CIP plant breeders in Lima (see *Late blight in China: A cause for concern,* page 47). Unlike early late-blight-resistant populations, these new potatoes carry multiple resistance genes to help them survive under high, and varied, disease pressure. But breeding is not a one-time fix, and there is no miracle potato. Disease resistance must not only be matched with local require-ments and preferences, it must also be continually improved to keep up with and withstand the evolving forms of the disease (see *Late blight approaches a sexual frontier,* page 38).

In a similar manner, resistant potatoes cannot do the job alone. Fungicides are still needed, but they need to be used rationally to protect the environment, human health, and the investments of resource-poor farmers. A recent study in developing countries revealed that the number of fungicide sprays used to control the disease is often far more dependent on purchasing power than it is on best practice recommendations. At the same time, farmers' decisions to use resistant

varieties may be overturned by local consumer preferences or by market considerations that affect the supply of high quality seed.

CIP scientists have made headway by developing and adapting integrated control programs using the farmer field school methodology. In these programs, variety introduction is balanced with discovery learning to increase farmers' understanding of control options that will enable them to use chemicals sparingly while protecting profits and productivity. Field schools have not only helped speed up location-specific selection and introduction of new varieties, farmer input has also contributed to reorienting ongoing breeding research.

Modeling research has also been integrated into CIP's late blight portfolio. For instance, tradeoff modeling is helping farmers to visualize how they can make better decisions about optimum use of pesticides and avoid unnecessary health risks (see CIP's Annual Report 2001). At the same time, disease forecast models are increasing researchers' understanding of relative late blight severity in the diverse agro-ecological areas of the developing world, where information of this sort is scarce. The data will serve as a guide for allocation of resources to the areas where they can make the biggest difference in production, food security, and poverty alleviation.

Recombining research

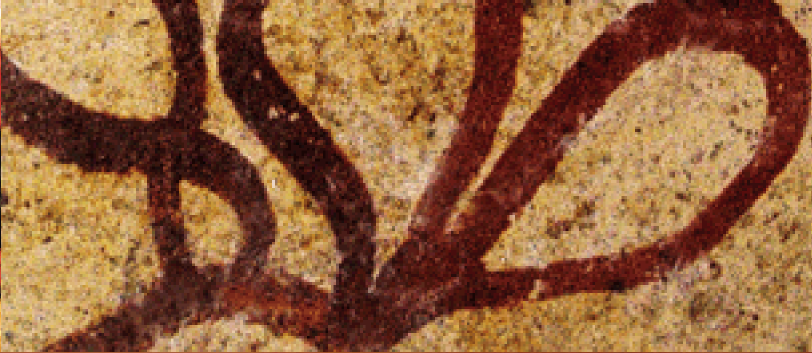
"We are just beginning to scratch the surface," says Forbes. "We need to move quickly because the picture is changing rapidly and there are new variables, like climate change, that need to be

factored in. Basically, we need to expect the unexpected. Innovative kinds of research—like modeling and pathogen studies—will help. The question is, how can we do it with the resources now at our disposal?”

Partnership will help to achieve some of these objectives. Simulations of management tactics and scenarios are being conducted, for example, through strategic alliances with researchers at Israel’s Volcani Institute, the Brazilian Agriculture Research Corporation (EMBRAPA), Plant Research International in the Netherlands and the USA’s Cornell University. The models, which allow scientists to process huge amounts of information, are helping researchers visualize how variables such as climate, socio-economic conditions, and local preferences can make or break a control strategy. The Global Initiative on Late Blight (GILB), a worldwide network of researchers, technology developers, and agricultural knowledge agents, lends communication and information support to these initiatives.

At the core of the problem, nonetheless, is the understanding of the elusive *Phytophthora infestans* pathogen and the way it reproduces and interacts with its host, and the fact that this information is still incomplete. Continued studies in population dynamics are fundamental if

Continued on page 44



Next steps for Chayabamba

The potato farmers of Chayabamba, an Andean community some 300 kilometers east of the old Inca capital of Cusco and more than 4,000 meters above sea level, are facing a period of consider-able uncertainty. Late blight not only cost them last year's potato harvest, it also devastated the stores of planting materials needed to sow next year's crop.

As a coping strategy, Chayabamba farmers would normally try to borrow seed from nearby communities, but neighboring farmers may have also suffered losses and have little seed to spare. A second possibility would be to purchase seed on the open market. Commercial seed suppliers, however, are unlikely to have the varieties that farmers need and want, and there are few guarantees that purchased seed will meet adequate quality standards.

The CIP genebank is poised to help by providing local communities with "starter seed" for their rebuilding programs. "One of the principal functions of a genebank is to guarantee that traditional varieties survive. When disaster strikes, as it did last year in Chayabamba, we are there to help," says Willy Roca, head of CIP's genetic conservation project.

Seed return programs are not just the right thing to do, Roca adds, they are also the smart thing to do. "We not only provide planting material, we also work with local NGOs and community groups to multiply seed at locations close to where it will be needed."

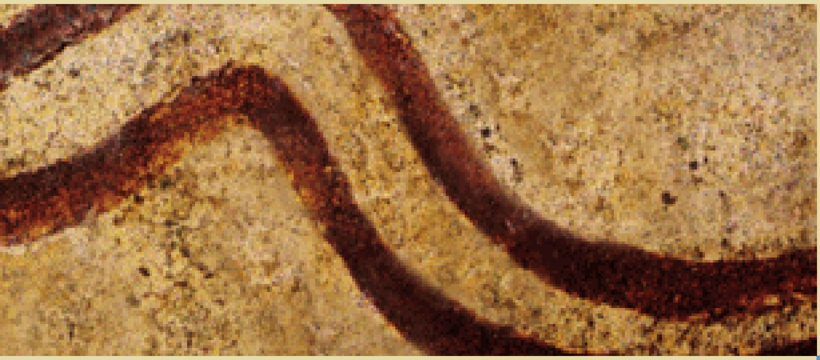
Future restoration efforts will be aided by the development of community field genebanks, closely linked to the CIP collections, in strategic microcenters of genetic diversity. According to Roca, "Traditional brick and mortar genebanks with their cold storage rooms are a last line of defense. If you want to maintain genetic diversity and encourage evolution, your best option is help farmers grow traditional varieties in the fields where they first evolved, rather than in test plots at an experiment station."

scientists are to fill the gap. Forbes notes, however, that it will take at least three years of additional research and more than US$1 million to fully understand the dynamics of the late blight pathogen in the Andes alone. Special project funding for population studies has thus far been provided by the Netherlands Ministry of Agriculture, Nature Management and Fisheries (LNV), the Swiss Agency for Development Cooperation (SDC), and the United States Agency for International Development (USAID).

"Late blight is CIP's biggest challenge," says Pamela Anderson. "It is also our biggest opportunity. It gives us a chance to show how all that we are doing—in conservation, characterization, and breeding; integrated crop management and systems analysis; and partnerships for development—can fit together to make a difference in people's lives and livelihoods."

Scientists prepare for new era of CIP–China cooperation

CIP and Chinese scientists are gearing up to begin work at a new research facility, the CIP-China Center for Asia and the Pacific, slated to begin operations in 2004



The new CIP-China Center will build upon more than two decades of research cooperation that have produced one of the highest rates of return on investment since the Green Revolution. In the early 1990s, CIP introduced virus cleanup technology that boosted Chinese sweetpotato production more than 30 percent on an estimated 600,000 hectares in Shandong. This increase was said to be equivalent to an almost 3 percent boost in food production worldwide.

According to the UN Food and Agriculture Organization (FAO), China is now the world's largest producer of potatoes and sweetpotatoes and, increasingly, one of its more efficient ones. Even so, the country faces numerous hurdles, including the need to raise rural income in several of its western provinces.

"The new Center will help meet China's challenges," says Yi Wang, CIP's resident scientist in Beijing. "We expect to have a seasoned team of experts on site once the Center is up and running." Counterpart staff will be drawn from a variety of Chinese agencies including the Chinese Academy of Agricultural Sciences, the Chinese Academy of Engineering, the Ministry of

Agriculture, and the Ministry of Science and Technology. The Center's research priorities will be established through participatory planning and project design, and all projects will be cofunded by CIP and national institutions.

Center research will focus initially on geographical areas where potato and sweetpotato can contribute most to hunger alleviation and income generation. Authorities in several provinces have already pledged human and financial support to the new venture.

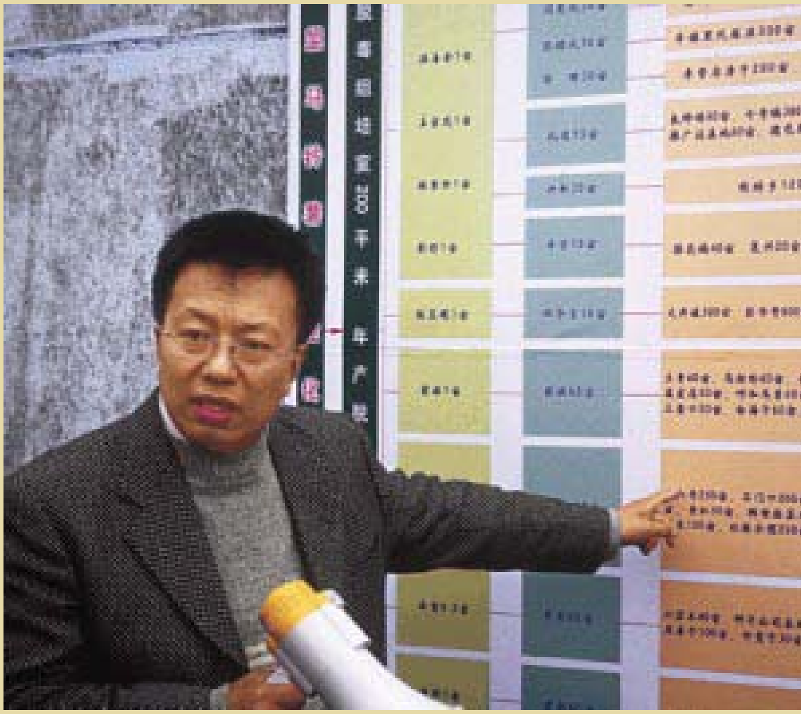
A plant breeder's dream

"One of the Center's top priorities," Yi notes, "will be to create a regional mechanism for the introduction, enhancement, and distribution of new potato and sweetpotato varieties." At the present time, most of the CIP-derived materials distributed in Asia originate in Lima, which involves high shipping costs and limits the scope of the materials that can be provided to regional cooperators.

"CIP plant breeders have often dreamed about establishing a plant breeding center on the Asian mainland," says Dapeng Zhang, CIP's senior sweetpotato breeder. Potatoes and sweetpotatoes, unlike grains, are not grown from conventional seeds, but from tubers and vine cuttings. This means that it takes considerable amounts of time to produce large quantities of planting material. The existence of such a facility in Asia should greatly speed up utilization by allowing for rapid, local multiplication of "seed."

In addition, a plant breeding center in China would provide access to the full range of biotic and abiotic stresses, many of which are not present at CIP headquarters in Lima. According to Zhang, "Scientists at CIP headquarters in Peru cannot efficiently breed for resistance to the bacterial, fungal, and viral diseases of

Continued on page 49



Yi Wang, CIP liaison scientist in Beijing, has laid important groundwork for the Center.

Late blight in China: A cause for concern

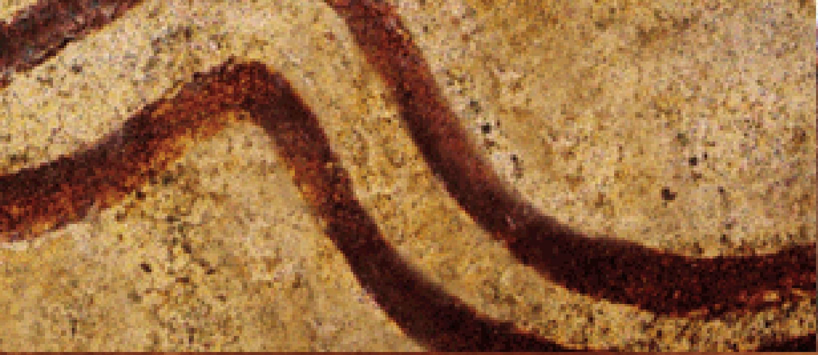
Chinese researchers working with the Global Initiative on Late Blight (GILB) report new evidence of greater virulence of the late blight pathogen and the increasing susceptibility of potato varieties previously considered resistant to the disease. According to He Wei of the Sichuan Academy of Agricultural Sciences, late blight is spread principally through infected seed stocks, and damage is concentrated mainly in the southwest and northeastern parts of the country. Yield losses have been estimated at US$170 million annually, a figure that does not include vast amounts of potatoes lost in storage.

Both the A1 and A2 pathogen types (see *Late blight research zeroes in on a moving target*, page 35) are present in China, although as yet there is no evidence that they have recombined into a more dangerous variant of the pathogen. The A2 type was first detected in northern China in 1996, and has since spread as far south as Yunnan, near the border with Vietnam.

With the breakdown of resistance in China's older varieties, CIP is working with Chinese scientists to evaluate large amounts of genetic material in the hope of identifying resistant potato lines. A number of potentially resistant potatoes are also being multiplied for use by farmers or are being utilized in breeding programs in Hubei, Yunna, Sichuan, and Chongqing provinces.

Meanwhile, Chinese researchers are alarmed by a reduction in the effectiveness of the popular fungicide metalaxyl, which is used throughout China as a primary defense against the disease. This situation, combined with the breakdown in resistance, means that farmers may soon be forced to turn to so-called contact fungicides, which adversely affect soil flora and fauna and can be hazardous to health. Contact fungicides also must be used more frequently than metalaxyl. The fact that China is committed to protecting the environment and reducing adverse effects associated with the use of agrochemicals makes this a highly unattractive scenario.

Derived from reports posted by the Global Initiative on Late Blight (GILB), which maintains a website with reports from researchers in 78 countries. For more information please visit http://www.cipotato.org/gilb



Potatoes: A North Korean obsession

Although he has no training in agriculture, North Korean leader Kim Jong Il is said to be obsessed with potatoes, spending weeks at a time providing guidance to his nation's farmers. According to reports broadcast by CNN, Kim is convinced that improved potato varieties will one day solve his country's food problems. In fact, he is so certain of the importance that potatoes will play in feeding his country that he once opened a restricted facility to international inspection in exchange for technical assistance that would aid Korea's potato farmers.

According to FAO, potato production in North Korea has increased more than four-fold since 1995, mainly through area expansion, and potatoes now rank third in importance after rice and maize. Today, North Korea produces potatoes on nearly 200,000 hectares with yields that average 9 tons per hectare. In neighboring China yields are, on average, 40 percent higher.

CIP has worked intermittently with North Korea since 1993, when diplomats visited Center headquarters in Lima and returned home with new potato varieties and large quantities of CIP publications. Collaboration increased 5 years later when CIP seed specialist Rolando Cabello visited the country. "I have never seen that kind of poverty or hunger even in the poorest communities in the Peruvian highlands," says Cabello, a Peruvian national.

CIP will provide every assistance that it can to aid North Korea's people," adds Roger Cortbaoui, CIP Director for International Cooperation. "In the months ahead we will be working to produce starter seed of improved varieties under a grant provided by the Common Fund for Commodities. In addition, we hope to reduce storage losses by introducing improved management practices and training people in their use."

The new CIP-China Center, Cortbaoui notes, will also provide much needed technical assistance to North Korea and will help to speed up the introduction of potatoes adapted to local conditions.

CIP scientists, such as seed specialist Fernando Ezeta, are working with colleagues in China to explore needs and opportunities for the new Center.

sweetpotato because the disease pathogens are not prevalent there." Such diseases, Zhang notes, represent serious constraints in China and other Asian countries where sweetpotato production is becoming increasingly important. Similarly, CIP potato breeders cannot test their most promising potato lines under the long-day conditions that typify places like Afghanistan and the new republics of Central and Western Asia.

The new Center will not only help to resolve these problems, it will also provide a platform for upgrading biotechnology research on root and tuber crops and for training large numbers of Asian researchers in the use of molecular marker technology and other genomic tools. "One of our most important goals for the Center is to work with China, where there is extensive experience in biotechnology, to build the capacity of Asian national research programs to use transgenic root and tuber crops safely and responsibly," Zhang says.

A Center for the region

By design, the benefits of the CIP-Asia Center are slated to extend beyond China, reaching many neighboring countries. "Our Chinese collaborators expect the Center will serve as a regional platform for research and development, building upon China's reputation for hard work, innovation, and impact while extending the benefits of an accelerated program of international cooperation to many of the country's neighbors," says Roger Cortbaoui, CIP Director for International Cooperation.

Current plans call for the establishment of a chain of research stations in the country's major potato- and sweetpotato-producing areas. The stations will allow researchers to test new breeding lines and management techniques in climates and conditions that are representative of Asia's predominant agro-ecologies. "The Government of China," Cortbaoui notes, "is eager to see CIP's capability to contribute to the region strengthened, and to facilitate this it will provide the Center with field, laboratory, and office facilities, as well as funding for in-country operations." Chinese researchers are also expected to play a major role in the Center's regional research and training activities.

The Center's annual operating budget, including the work at its ecoregional substations, is estimated at US$2.0 million, a quarter of which is slated for training and information activities. "We cannot emphasize strongly enough the importance of training and information, especially long-distance training using the Internet, video conferencing, and other forms of electronic technology," Cortbaoui says. "Asia is a big place and we will be relying on electronic communication to get information quickly and efficiently to where it is needed most." Thus far, Cambodia, Indonesia, Korea, Laos, Myanmar, Thailand and Vietnam have expressed interest in the Center, as have Australia and Austria.

A tradition of cooperation

Although informal contacts had been established in the 1970s, formal cooperation with China began in 1985 when CIP became the first Future Harvest Center to open a scientific liaison office in Beijing.

In 1978 China—which had once been entirely dependent on potatoes supplied by the Soviet block—received a disease-resistant potato from CIP that it subsequently named CIP-24. Although

THE NEW CENTER WILL ENABLE PLANT BREEDERS TO SPEED UP THE SUPPLY OF NEW POTATO VARIETIES TO CHINA AND NEIGHBORING COUNTRIES, WHERE THE DEMAND IS HIGH (BELOW AND PREVIOUS PAGE).

CIP-24 has since been surpassed by more modern varieties, it was considered highly successful in its day and continues to be grown on 70,000 hectares, principally in the country's drought-prone northern provinces. A more recent success story is Cooperation 88, an exceptionally high yielding potato with outstanding processing characteristics that is grown in Burma, China, and Vietnam (see CIP Annual Report 2001).

"The expectation is that the creation of the new Center will lead to many more success stories, and will multiply the effect of past achievements in China and throughout the region," Cortbaoui adds. "With the new Center we will be moving significantly beyond what is possible to achieve at the present liaison-office level." Once the Center is up and running, CIP plans to station most of its Asia-based staff in China and relocate additional staff from Lima, bringing together plant geneticists, seed specialists, pest control experts, and social scientists.

CIP scientist wins award for work in China

In November 2002, virologist Luis Salazar, head of CIP's Crop Protection Department, was presented with the prestigious Qilu Friendship Award by the Government of Shandong, China, for his contribution to the development of pathogen detection technology in the province. This technology has helped to eliminate virus disease in sweetpotato planting material in Shandong and neighboring provinces, and forms the basis for the largest economic impact in CIP's history. The value of this technology to date is estimated at well over US$550 million.

Salazar, who has been helping establish the Virus-Free Seed Production program in Shandong since 1985, was chosen for the prize from a list of 2000 nominees from all parts of the world. He was nominated for the award by the Shandong Academy of Agricultural Sciences (SAAS), which five years ago named him Principal Scientific Advisor for the same research.

China is the world's largest producer of root and tuber crops. Sweetpotato farmers are now planting an estimated 330,000 hectares of virus-free sweetpotato annually in Shandong Province alone, according to recent reports.

A new CIP Vision We are in times of dramatic change. Globalization, free trade, and increasing control of agricultural trade by multinationals are redefining needs and opportunities in agriculture. Funding from traditional public sector donors is declining, while investment by the private sector in agricultural research and development is growing dramatically. Meanwhile, there is increasing concern over rural-urban linkages, a new biotechnology revolution is underway—with proponents and opponents highly polarized—and issues of proper governance, transparency, and broad participation are becoming fundamental concerns.

One of the primary challenges that CIP and other research centers of excellence face is that of maintaining a relevant, coherent, high-quality research agenda in the context of an increasingly complex and dynamic external environment. A well-articulated vision—to support the definition of guidelines for decision making and to prevent compromising long-term strategic needs and responsibilities in the face of immediate, external pressures—is critical.

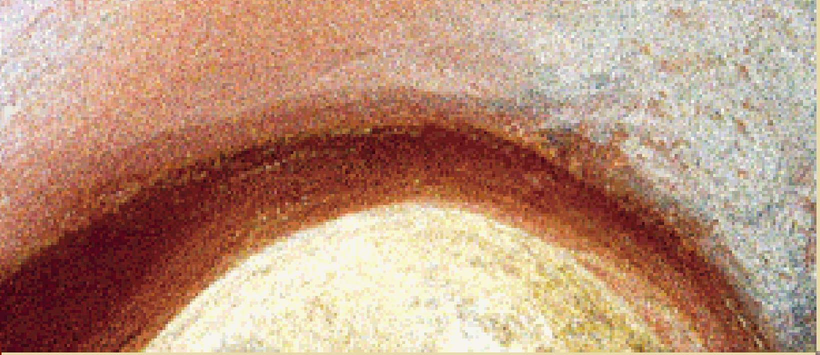
WAYS OF WORKING

With the endorsement of our Board of Trustees, CIP launched a vision and strategic planning exercise in October 2002. We recognized that our past priority-setting exercises had been primarily internal in nature. In order to open up the process and make it more participatory, we created a CIP vision plenary comprising CIP's Board of Trustees and staff, as well as representatives from our key stakeholders: donors, international organizations, advanced research organizations, regional research networks and organizations, national research systems, and nongovernmental organizations.

In October and November 2002, we conducted the first plenary consultation. The broad objectives were: to explain the process we were using for the visioning exercise; to agree upon the boundaries for the exercise; and, within the agreed boundaries, to generate a "map" of CIP's specific development challenges.

We proposed the Millennium Development Targets, which contribute to eight broad Development Goals, as the starting point for setting the boundaries for CIP's vision exercise. These 18 Development Targets—ratified in the year 2000 by 192 countries after several years of meetings and discussions—affirm, in quantitative terms, what the international development community within which we operate expects to accomplish in the decades to come. The vision plenary accepted the Millennium Development Targets as the general boundaries for the vision exercise. Within those boundaries, it selected eight development challenges to which the Center could make significant contributions (see *CIP's development challenges*, page 95).

CIP's Vision Statement, which will be published in 2003, will spell out our potential contribution to these challenges, forming the basis for our strategic research and implementation plan. An exercise on impact targeting and assessment, a needs and opportunities evaluation, and a realignment analysis will help us to answer the questions of *where* we should be working, *what* we should be doing, and *how* we realign to get there. These are also scheduled for 2003. The CGIAR priorities and strategy exercise being led by the Science Council will provide critical input during this process, allowing us to ensure that our new vision and strategy will continue to contribute to and support the overall vision and strategy of the CGIAR system. The following section illustrates some of the ways of working that have been hallmarks of CIP's past success and will surely contribute to the accomplishment of our challenges—and the fulfillment of our vision—in the years ahead.



Swimming against the tide: Integrating biological and social science

> "Of all the CGIAR centers that I have worked with, CIP demonstrates by far the closest integration of the social and the biological sciences"
>
> G. Edward Schuh, Chair, CIP External Program and Management Review, 2002

In what was a radical proposal in 1978, CIP's social scientists tried to convince a skeptical audience of biological scientists that technology development must go beyond simply addressing the biological constraints that limit food production to consider the social context in which agriculture takes place. First and foremost, they argued, this meant understanding and working with farmers, who they saw as innovators conditioned by social, cultural, and economic factors, as well as by their physical environment. That particular point of view contrasted with the predominant thinking then guiding CGIAR research, according to which centers were seen as the major source of innovation, producing technologies that were passed down to farmers through national research and extension programs.

"At the time, most CGIAR research was conditioned by notions that undervalued farmers' capacities and idealized the production of finished technologies," says anthropologist Gordon Prain. "In this way of thinking, farmers occupied the fields of tradition, while high-tech laboratories and experimental stations represented modernity."

Placing the focus on technology was difficult to resist. The Green Revolution was at its height and its results seemed almost miraculous. Even so, problems were emerging that raised important questions about the effects of technology on the environment and health, and the extent to which it was reaching poorer farmers who worked in complex, marginal farming systems.

Prain credits CIP's founding Director General Richard Sawyer—a powerful exponent of traditional biological science—and Gelia Castillo—the Center's first female board member and a rural sociologist—with the institutionalization of interdisciplinary methods at CIP. "Sawyer and Castillo were swimming against the tide," Prain says, "a fact that was evident in the Center's 1975 external program and management review which cautioned against using "core" resources to support noneconomist social science positions." Nevertheless, with Sawyer and Castillo's backing, CIP social sciences department head Douglas Horton was able to establish an eclectic mix of social science disciplines and methods within the Center's research program during the 1980s.

Farmer back to farmer

The first formal expression of CIP's new approach to the social sciences was the farmer-back-to-farmer (FBF) model developed by an anthropologist and a plant physiologist. The model holds that research begins and ends with the farmer and the community and, of necessity, involves an interdisciplinary focus. Within the FBF philosophy, research and technology transfer were seen as parallel activities rather than as sequential steps in which responsibilities were handed off from agency to agency as a technology moved through the so-called development pipeline.

Prain recalls that the FBF model grew out of work in the high Andes on potato management practices designed to reduce postharvest losses. In the early 1970s the Center's postharvest specialists, all of whom were trained in industrialized countries, recommended the purchase of solar dehydration machines, so-called "black box" drying units, to improve traditional processing of potato products. CIP social scientists, however, determined that farmers were unlikely to adopt the technology if it

Social scientist Thomas Walker exchanges views with plant breeder Juan Landeo and farmers during a field day in Huanuco, Peru, organized to celebrate the release of the Amarilis potato variety.

involved additional cost. Farmers reported that their most important constraint following the harvest was the time required to peel potatoes for processing. In short, what they needed was better peeling equipment, not black box dryers.

Research on storage issues provided similar results. While the initial focus of CIP's postharvest research was on reducing storage losses of potatoes headed for the consumer market, surveys by CIP anthropologists showed that seed deterioration was a far more urgent problem. The solution that emerged was diffused-light seed storage, which contributes to slower, sturdier sprout growth and toughening of the skin of the tuber. The inexpensive construction of household stores or the adaptation of existing spaces within the home led to significant reduction in losses and improvements in seed quality.

The lessons learned: farmers' involvement shortens the time needed to evaluate and eliminate unacceptable technologies that are not suited to the social context in which they live and operate, and farmer innovation improves adaptation to local conditions.

A geneticist's point of view

The FBF approach provided the first decisive example of how the social sciences could be integrated into and even help shape CIP's research portfolio. "Today, the social sciences are a basic part of how CIP plans, conducts, and evaluates its science," says plant breeder Meredith Bonierbale, who heads up the Center's crop improvement and genetic resources program. She points out that the Center's economists and anthropologists provide perspectives that help biological researchers to make better decisions and establish boundaries for priority setting. "Because of social science involvement in technical research at CIP, our biological scientists are working earlier with farmers than they might ordinarily. The result is that we can target resources more effectively and are far more likely to produce successful technologies," she says.

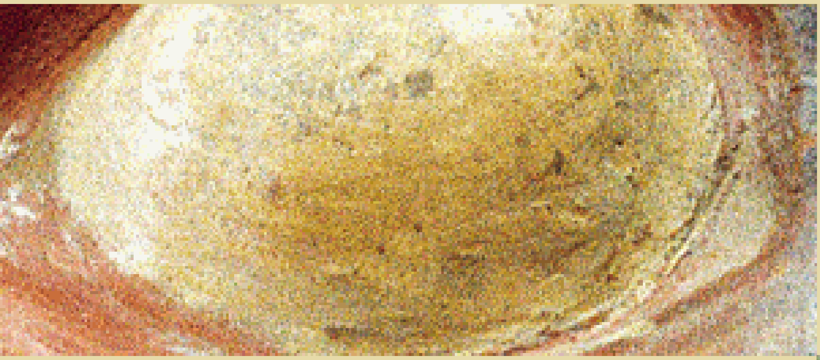
For example, in the Center's breeding program the perspective provided by social scientists greatly improves the chances of producing varieties that not only are suited to local conditions and constraints, but will also respond to farmers' particular circumstances and to the demands of the marketplace. "What we're trying to avoid is having a backlog of technologies on the shelf and the added expense of then finding ways of getting them out into the world," Bonierbale says. Interaction between the disciplines, and especially with farmers, Bonierbale says, also optimizes the time and resources of individuals with different but complementary points of view. In this way research products become collective outputs of scientists and farmers, and stand a better chance of succeeding.

New interdisciplinary experiences

In recent years CIP has worked hard to incorporate farmers into mainstream research through farmer field schools. This program, spearheaded by a social scientist specialized in extension, has been successful in advancing farmer selection of late-blight-resistant potatoes, integrated pest management, and sustainable urban agriculture. Bonierbale notes that the field school methodology—developed by the UN Food and Agriculture Organization for use with rice farmers—was first adapted to root and tuber crops by biological scientists working in Asia and was later championed at CIP headquarters by a plant pathologist.

In a similar vein, the Center's postharvest team of biologists and social scientists is using the concept of "positioning" products in the marketplace to safeguard biodiversity and reduce rural poverty. By creating product development models that link subsistence farmers to potential markets, they hope to improve rural livelihoods and at the same time contribute to conserving the diversity of traditional root and tuber crops by giving farmers an added incentive to grow them.

"The 2002 external program and management review," Bonierbale concludes, "was right to recognize CIP's integration of the biological and social sciences. At many research institutions the social sciences are considered to be a service activity; at CIP they are part of the mainstream, an irreplaceable part that we would not want to do without."



Unique in its time, CIP was designed as a decentralized organization with a minimum of facilities—what might now be called a center without walls—and a philosophy that placed a premium on teamwork and collaboration. “Partnership has always been a serious issue at

CIP,” says André Devaux, coordinator of the Center’s Papa Andina program. “It’s the way we do business and it’s an important part of our vision for the new millennium.” In 2002, CIP scientists partnered with colleagues working at more than 500 agencies and organizations in some 90 countries (see *CIP’s partners*, pages 100–103).

“Partnership is ingrained in the CIP psyche, but it requires special skills and extra effort to do it right,” Devaux adds. “For a partnership to succeed you need to have a culture of cooperation that supports actors with diverse interests and philosophies, and your approaches need to evolve over time.” Devaux points out that when CIP was established in 1971, Center

Partnerships for the new millennium

When CIP first opened its doors more than 30 years ago, partnership quickly became a hallmark of its corporate culture scientists and their partners in national research and development agencies focused primarily on increasing food production. Today, the issues they confront are vastly more complex.

"Our agenda now includes improving human health, combating poverty, and helping farmers to cope with global markets," Devaux says. "These are not the issues that CIP was set up to address, but they are part of today's reality and must be part of the solutions that we propose for the future." Devaux notes that to make progress in these areas, an international center such as CIP must find innovative ways of helping its national partners to evolve institutionally.

Papa Andina: Markets and poverty

This emphasis on local institutional development is one of the centerpieces of the Papa Andina program, in which CIP scientists join forces with researchers from Bolivia, Ecuador, and Peru to improve market access and income for smallholder farmers. Building on the success of three Swiss-sponsored national research projects conducted in the 1980s and 1990s, the partners promote cross-border technology and information exchange. One immediate priority is to help subsistence farmers—who are normally unable to compete in commercial markets—take advantage of growing urban demand for potatoes, especially traditional varieties. Poor farmers who grow potatoes above 3,500 meters are currently the only source of these varieties, almost all of which are grown without pesticides. "In the past, we thought this was a disadvantage because of the losses farmers incurred from insect pests," Devaux says. "Market studies conducted by Papa Andina, however, showed the opposite was true. Not only is there demand for traditional varieties, but, increasingly, for pesticide-free potatoes."

These are the types of findings that are derived from what Papa Andina refers to as "institutional platforms," or processes set up to support the exchange of views and experiences

Papa Andina is opening up market opportunities for products such as *chuño* and *tunta*, potatoes processed using a traditional freeze-drying technique developed in the altiplano of Peru and Bolivia.

among diverse actors in the food chain. "One of their most important contributions," says Devaux, "is that people who usually have no voice in decision making—such as subsistence farmers—are able to enter into the dialog." Wide participation in the fora helps producers and consumers, for instance, to work back from the known characteristics of a variety or management practice and develop strategies that can boost farm profits and overcome quality and delivery issues.

The platforms also help identify the need to further improve technology available to farmers and to refine program priorities. For example, Bolivian and Peruvian farm groups associated with Papa Andina have used information derived from the platforms to experiment with simple postharvest techniques that extend potato storage life. With the new practices, farmers can supply the market over an extended period of time and reserve a portion of their harvest until late in the season when prices tend to peak.

"What Papa Andina does is use "poverty filters" or "lenses" that help researchers spotlight strategies that build on whatever competitive advantage farmers might have," adds Graham Thiele, a Papa Andina scientist based in Ecuador. "Because potato is such an important commodity in the three countries where we operate, we are optimistic Papa Andina will help create a regional culture of cooperation among all the organizations that work within the agri-food chain, whatever their philosophy or specific interest."

Papa Andina partners include the Andean Products Research and Promotion Foundation of Bolivia (PROINPA), CIP, the National Root and Tuber Program of Ecuador (FORTIPAPA), the Swiss Agency for Development Cooperation (COSUDE), and the Technical Innovation and Competitiveness Project of Peru (INCOPA).

VITAA: Child and maternal health

CIP's partnership philosophy is also evolving in sub-Saharan Africa. Here, researchers from seven countries are working under the banner of the VITAA partnership (Vitamin A for Africa) to improve human health by reducing vitamin A deficiency, one of Africa's most serious public health problems.

"Until recently, no one gave much thought to using sweetpotatoes to achieve a public health objective," says VITAA coordinator Regina Kapinga. "Researchers focused their work on things like agronomy and plant heath, and gave little consideration to micronutrients," she says. All of that changed, however, with the establishment of VITAA.

Nutritionist Bernadeth Ekemu works through the VITAA partnership to promote the use of orange-fleshed sweetpotatoes among small-scale processors, particulary women.

During its first full year of operations in 2002, VITAA began the process of helping African farmers replace white-fleshed sweetpotatoes—which are grown entirely for their starch—with a new series of orange-fleshed, high-beta-carotene varieties. The body uses beta-carotene to synthesize the vitamin A needed to maintain the immune system. "Orange-fleshed sweetpotatoes are a novelty in this part of the world and they are attracting a lot of interest," Kapinga says. "Not only are the health benefits to children substantial, food products made from the new varieties are helping farmers to earn considerable cash income." VITAA partners, she notes, include agricultural researchers, nutrition experts, health professionals, and private sector food processors from seven sub-Saharan African countries. VITAA donors include the German Ministry for Technical Cooperation (BMZ), the Micronutrient Initiative, the OPEC Fund for International Development, the PRAPACE and SARRNET regional networks (see *Neighbors helping neighbors,* page 11), the Senior Family Fund (see *Donors large and small,* page 70), and the United States Agency for International Development's Micronutrient Program (MOST) and Micronutrient Global Leadership Project. While the partnership also includes a number of government ministries, a growing percentage of VITAA members are nongovernmental organizations (NGOs) and community groups that provide basic services to the region's poor (see *A royal sweetpotato,* page 65).

"What we are seeing in VITAA," Kapinga says, "is the coming together of agencies working in health and agriculture and an acknowledgement that difficult problems require innovative solutions." Kapinga notes that in the past, researchers looked upon farmers as clients. "Increasingly," she says, "we see them as important collaborators." Case in point: In 2002, farmers from Uganda's Lira District, one of the first areas to benefit from the new orange-fleshed

Continued on page 66

A royal sweetpotato

In 2002, nearly 40,000 Ugandan farmers received vine cuttings of improved orange-fleshed sweetpotatoes thanks to the personal initiative of Her Royal Highness the Queen of Buganda, and the Buganda Cultural and Development Foundation (BUCADEF), a royal NGO.

The Queen appealed to her subjects to fight malnutrition and poverty by growing and consuming the orange-fleshed varieties. Known locally as the Nabagereka, the Queen is the wife of the Kabaka, Buganda's traditional ruler. She is held in high esteem by Ugandans and plays a pivotal role in mobilizing development efforts throughout Buganda, Uganda's largest traditional kingdom. Because of her support, local officials have named one of Uganda's most popular orange-fleshed sweetpotato varieties in her honor.

The Nabagereka's initiative builds on the research and community mobilization efforts of the Child Health and Development Center of the Makarere University Health Department, together with partner agencies that include CIP, the National Agricultural Research Organization, the US Agency for International Development's Micronutrient Program (MOST) and Micronutrient Global Leadership Project, the Vitamin A for Africa partnership (VITAA), and a local NGO known as Volunteer Efforts in Development Concerns (VEDCO). In locations where farmers have planted improved varieties, on-farm yields have reportedly tripled.

The Ugandan school market

- In Uganda, schools and universities are major markets for sweetpotato roots and vines. One peri-urban farmer, Ruth Musoke, sells more than one ton of fresh roots to primary schools each week. Her net profit over a 16-week season is US$1,000, far above the annual per capita income in Uganda, which according to the World Bank is just US$310.
- In Kampala, commercial farmer Kakoza Mubirigi earns more than US$3,000 during Uganda's four- to five-month sweetpotato production season. Because of his success he was dubbed "Mr Sweetpotato" by residents of Nabyewanga, his home village. But Mubirigi was not content with simply supplying schools with orange-fleshed sweetpotatoes. He has used his earnings to build a modern boarding school, the Bwaise Parents' School, which is now home to over 600 students.

UPWARD partners in Indonesia (right) and Nepal (below) use farmer field schools to stimulate discovery-learning and technology dissemination.

varieties, provided more than 800,000 sweetpotato vine cuttings as planting material for distribution to refugees in war-torn parts of northern Uganda.

UPWARD: Emphasizing the users' perspective

The nature of CIP partnerships is likewise changing in Asia, where agro-ecological and socio-economic shifts are redefining the arena in which agricultural research takes place. "Government decentralization in many Asian countries and the mobilization of stronger community-based groups within civil society are reshaping the way agricultural researchers operate," says Dindo Campilan, coordinator of the UPWARD network (Users' Perspectives with Agricultural Research and Development). "New stakeholders need to be brought into existing partnerships if they are going to be effective in such a dynamic environment," Campilan notes. The 42 organizations currently involved in UPWARD projects include traditional partners—such as national agricultural research organizations—as well as NGOs, local government units, and community-based organizations.

Although their perspectives may vary, all contribute to forging the network's collective vision of sustainable development. Together, the partners carry out projects, many with strong gender components, which involve farmers, processors, and consumers in a range of research and development ventures focused on bringing the benefits of research to marginalized areas and to people who are frequently overlooked by mainstream development projects.

Industrialization and urban migration have also worked to realign food production priorities

in Asian societies, once anchored by cereal-based food systems. “Over the past two decades, the demand for roots and tubers has grown steadily throughout the region,” Campilan says. The UPWARD agenda has focused on root crops since the late 1980s, but the network’s systems approach has helped it to keep up with these trends, going beyond the bounds of conventional commodity research to look at the broader picture. For example, UPWARD facilitates the activities of the CGIAR Systemwide Program on Urban and Peri-urban Agriculture in the Philippines (see *Urban agriculture initiative gives Manila farmers “flower power”*, page 68).

UPWARD’s dynamic, hands-on approach to development allows the network to make the most of innovations developed elsewhere, adapting them to local needs and circumstances. In the Philippines, UPWARD partners are helping farmers take advantage of low-cost systems for producing virus-free sweetpotato planting materials. The new “cleanup” technology—which is already used on a vast scale in China—greatly increases production efficiency, but requires farm groups to acquire new knowledge and operating systems (see *Scientists prepare for new era of CIP–China cooperation,* page 45).

To that end, UPWARD partners are using farmer field schools—previously adapted to sweetpotato production by CIP researchers in Indonesia—to stimulate discovery-learning and technology dissemination. This not only helps local farmers to acquire the skills they need, it has also inspired researchers to redesign equipment using local materials to expand the benefits. By the end of 2002, more than 800 sweetpotato farmers and extension workers from 11 municipalities had learned the new virus cleanup techniques through participation in field schools and on-farm experiments. In addition, local stakeholders not only financed participatory research activities, they also established 46 community nethouses for use in the cleanup process. Preliminary economic analyses indicate that the use of virus-free planting materials has increased farmers’ net income by 40 percent.

UPWARD’s participating countries include China, Indonesia, the Philippines, Nepal, and Vietnam. The network is funded by the Government of the Netherlands through the Ministry of Foreign Affairs and its Directorate General for International Cooperation.

Urban agriculture initiative gives Manila farmers "flower power"

Researchers in the Philippines are helping improve the country's flower garland industry, a key income-generating activity for the urban and peri-urban poor, by incorporating production mechanisms that will enhance flower productivity and cut pesticide use. In the capital city of Manila and surrounding communities, it is estimated that over 100,000 households—from flower producers and traders to garland makers and street vendors—are involved in the *sampaguita* flower garland industry. Sampaguita, or local jasmine (*Jasminum sambac*), is the Philippines' national flower.

A sophisticated yet informal garland production system operates on a daily basis with great efficiency and coordination: in just 15 hours

the highly perishable flowers are harvested, transported, sold to wholesalers/retailers, made into garlands at the household level, passed on to garland wholesalers/retailers, and finally sold by street vendors to the local population—who value them for use in ceremonies, celebrations, and as bearers of good fortune—and to tourists. Though this complex production process—passed down from generation to generation—works quite well, the industry is beset by declining flower yield and excessive pesticide use.

Working with scientists from the University of the Philippines, farmers' groups, and traders' associations, the CIP-coordinated Strategic Initiative on Urban and Peri-urban Agriculture (SIUPA) launched a project in 2001 to analyze the industry and determine research needs and opportunities. Only one sampaguita variety is traditionally grown in the area. This limited genetic base has led to a drop in plant productivity and flower quality. The project has initiated on-farm trials to introduce new varieties, which offer a greater range of colors and sizes of flowers, in the hope of improving productivity while stimulating the market to put premium prices on these exotic alternatives.

Meanwhile, studies undertaken by the project detected pesticide residues in flower samples provided by farmers, garland markers, and even traders. Pesticide residues can have serious human health consequences. Industry workers reported symptoms of chemical poisoning such as skin allergies, vomiting, and dizziness. And the effects are probably much more widespread, since there is usually less than 24 hours from spraying to the time a customer inhales the fragrance of the flowers. In order to curb farmers' extremely high pesticide use, the project is developing low-cost integrated pest management mechanisms. The first step, already underway, is to determine seasonal occurrence and abundance of major pests.

SIUPA was launched by the CGIAR in 1999 in response to growing urbanization and increasing dependence of city dwellers on farming. It directs knowledge and technologies to urban and peri-urban issues though collaboration with many national and international efforts.

Donors large and small

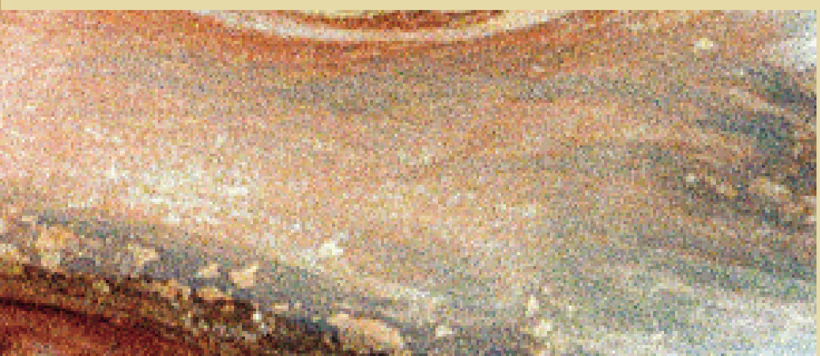
The Senior Family Fund is not only CIP's newest donor, it is also the Center's smallest. In 2002 the Fund, a small New England philanthropy, provided CIP's Vitamin A for Africa program (VITAA) with two grants totaling US$3,000, about 0.001 percent of the Center's budget.

"You can't always judge a donor's importance against the dollar amount of a contribution," says Hubert Zandstra, CIP's Director General and a former donor representative of Canada's International Development Research Center (IDRC). In 2002, the Senior family financed two field days in Uganda, including events in two war-torn provinces that are bringing improved sweetpotato planting materials to hundreds of refugee families.

"The amounts are small, but the money is being used in ways that support our collaborators and provide them with greater latitude to operate," Zandstra says. "The NGOs and community organizations that have received the Fund's support have expressed not only a feeling of gratitude, but also a sense of encouragement from the fact that people overseas are aware of the situation in rural Uganda and are willing to help."

Zandstra adds that contributions from private investors are likely to play an increasingly significant role at CIP in the years ahead. He notes that the CIP Board of Trustees recently approved a US$32 million fund-raising initiative for genetic conservation that will, in part, target smaller donors.

Shuttle seed production aids Afghan potato farmers



CIP has played an important role in numerous humanitarian relief initiatives. In the face of emergencies, the Center stands ready to relieve suffering and promote long-term recovery and economic growth through technical assistance to bolster agricultural production

In 2002, these efforts extended to Afghanistan, one of Central Asia's largest potato producers. Immediately following the cessation of hostilities, CIP researchers began planning an emergency program that would speed up the supply of quality potato seed to Afghan refugees returning from Pakistan. Seed quality, especially the absence of diseases and pests, is one of the major factors that determines the success or failure of a potato crop. Operating under the umbrella of the Future Harvest Consortium to Rebuild Agriculture in Afghanistan—an initiative

funded by the United States Agency for International Development—and in cooperation with colleagues from national and international organizations, CIP scientists began working in January to produce large quantities of superior quality potato seed adapted to Afghan growing conditions.

"Our first visit to Afghanistan in March 2002 confirmed our worst fears," says a CIP researcher associated with the project. "The country's potato seed stocks had not been regenerated in over a decade and there was no evidence of a seed supply system. In almost every field that we visited we found virus-infected plants, a sure sign that the country's potato producers were replanting contaminated seed stocks harvested from their own fields." Virus infection is a major yield reducer.

From the outset, the intention was to help Afghanistan's farmers produce their own seed rather than import from abroad. CIP scientists had concluded that without local capacity to produce quality planting materials, Afghan potato production was unlikely to recover. To initiate the process, in September project staff received 22 tons of commercial "starter" seed—enough to plant 7 hectares. Ninety percent of the shipment was brought in by road from Pakistan through the Khyber Pass, with the remainder coming in as air cargo from India. To ensure that the imported starter seed would be well used, seed production training programs were initiated for staff from Afghanistan's Ministry of Agriculture, local NGOs, and Kabul University. Course graduates, working alongside CIP scientists and researchers from Pakistan, in turn trained a small group of local farmers.

Shuttle seed production

Producing high quality potato seed is an exacting process. Only the best farmers can do it and even then it can be an extremely arduous job. For every tuber planted, a farmer generates just eight seeds that can be planted during the following season. In contrast, a maize farmer planting a single kernel can easily harvest a hundred or more seeds. The answer to the problem is "shuttle" seed production, a process in which potato seed tubers produced in one area are taken to a new location where weather conditions are suitable for a second planting. The

Continued on page 74

These farmers are participating in shuttle seed production training in Jalalabad, Afghanistan. From there, starter seed is taken to the highlands for spring planting.

Seeds of life for East Timor

Over the past two years, CIP researchers have worked with government and private voluntary agencies to introduce improved sweetpotatoes to the newly independent nation of East Timor. Working with funds from the Australian Centre for International Agricultural Research under the Seeds of Life project, CIP scientists provided local agencies with a small but select group of promising lines, a number of which out-produced the best local variety and received high marks from consumers.

In East Timor, as in much of Oceania, sweetpotato is an important food security crop. In the future, however, it will likely also prove to be a major contributor to improved human health. Although accurate figures are not available, vitamin A deficiency is one of East Timor's most challenging public health problems, affecting the eyesight and immune systems of thousands of children under the age of five. Researchers believe that this deficiency can be addressed through the regular consumption of small amounts of orange-fleshed sweetpotatoes, which are high in beta-carotene, a precursor of vitamin A, which the body uses to sustain the immune system. To help resolve the problem, plans are being made to introduce a series of locally adapted, orange-fleshed sweetpotatoes early in 2003.

CIP scientists are building on a lesson learned in Mozambique, where orange-fleshed sweetpotatoes were introduced as part of a disaster relief effort to assist families who had lost all of their sweetpotato planting materials to flooding. Mozambique is now a full member of the VITAA partnership (see page 63) and over 120,000 families have benefited from the introduction of the new materials.

objective is to compress two or three production cycles into the time normally used to produce just one seed crop.

In the case of Afghanistan, the key to the shuttle system is planting in the Jalalabad area in the southeast part of the country where potato can be grown in the mild winter season, and then taking the harvested seed to the highlands around the city of Bamiyan for spring replanting. Bamiyan, located in the Hindu Khush mountain range, was the site of the two ancient Buddhas which were destroyed in 2001.

A critical part of the process is avoiding late-season frost in Jalalabad. Before participating in seed production training, local farmers didn't know they could manage frost by planting early and irrigating the crop. Taken together, early planting and irrigation help avoid frost while eliminating the aphids that spread virus diseases and generally toughening the tubers for transport and storage. Adel El-Beltagy, Director General of the International Center for Agricultural Research in the Dry Areas (ICARDA), notes that shuttle seed production should go a long way towards developing a sustainable production system that addresses the seed requirements of Afghan farmers. ICARDA is the coordinating center of the Future Harvest Consortium to Rebuild Agriculture in Afghanistan.

"This is not a short-term effort," says El-Beltagy. "It is an example of innovative planning that will contribute to peace and security. I am confident that once a functioning seed production system is in place, Afghanistan's potato farmers will begin to see even bigger benefits in the form of better varieties, improved methods for controlling diseases and pests, and better harvesting and storage practices."

"The aim of the Future Harvest Consortium," he notes, "is to bring to bear the best that science has to offer in ways that will reduce poverty in rural Afghanistan, benefit consumers, and contribute to environmental well-being."

In brief

Varieties bring relief to Peruvian farmers

In an effort to reinvigorate the production of sweetpotato in Peru's Cañete Valley, CIP and a local research institution set out to find replacements for two of the valley's most popular sweetpotato varieties, whose yields had dropped drastically following the El Niño weather phenomenon in 1997. Unusual temperatures and rainfall caused by El Niño led to an outbreak of harmful pests and diseases; this in turn provoked a steep decline in the productivity of the traditional sweetpotato varieties that had dominated the valley, namely Jonathan and Milagrosa.

Sweetpotatoes are an important source of food and income for farmers in Cañete Valley. The crop also helps sustain the area's milk production, another important revenue-generating activity, as the vines are fed to dairy cows.

After years of testing and recombining material from the genebank collections held by CIP and the Peruvian Instituto Nacional de Investigación Agraria (INIA), scientists came up with INA-100 and Huambachero. These new varieties greatly resemble Jonathan and Milagrosa in terms of color, appearance, and taste. But more importantly, they produce higher yields than their counterparts and have good commercial and culinary characteristics.

CIP and INIA, who together financed the project, officially released INA-100 and Huambachero in 1997 and 2001, respectively. By May 2002, the two varieties occupied 90 percent of the total sweeetpotato cultivation area in Cañete Valley, approximately 6000 hectares. Jonathan and Milagrosa remained on less than 10 percent. The net value-added benefit of replacing Jonathan with INA-100 and Milagrosa with Huambachero is estimated at US$579 and US$328 per hectare, respectively, according to studies developed by INIA.

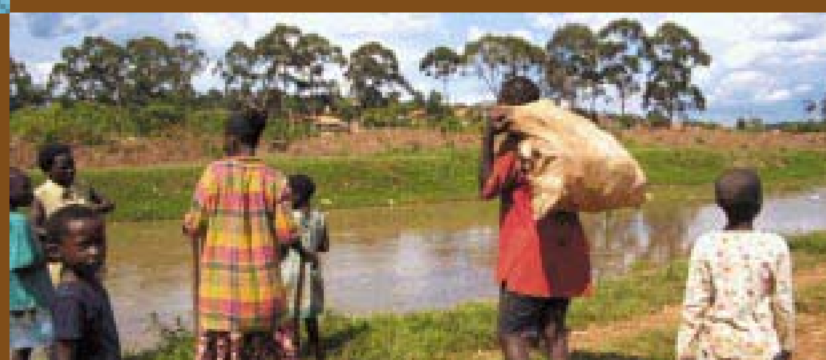
CIP scientists continue to search for and develop better adapted and higher yielding varieties that can resist the pests and diseases present in Cañete Valley, the country's largest sweetpotato-producing area. The most recently developed breeding line, 199062, is expected to gradually replace INA-100 because of its superior level of resistance to nematodes. In addition to 199062, several other breeding lines are in CIP's breeding pipeline for Cañete Valley.

New options for Kampala city farmers

Improving the livelihood of urban families through the development and dissemination of better farming techniques is the underlying objective of a number of projects being implemented in Kampala, Uganda through the CIP-coordinated Strategic Initiative for Urban and Peri-urban Agriculture (SIUPA). Food insecurity continues to threaten large numbers of low-income households in and around Kampala, and agriculture is a major source of food and income for them. Though the main crops in Kampala, which boasts a hilly and fertile terrain, are sweetpotato and plantain, most of the farming systems are based on complex interactions between multiple crops and livestock.

The economic sustainability of these agricultural activities, however, is under serious threat because of diminishing land availability, scarcity of quality seed, increasing presence of pests, and the use of inappropriate farming methods, among other things. In light of these concerns, SIUPA is spearheading efforts to determine the hazards and increase the benefits of urban agriculture in the Kampala area. At the forefront of these efforts is a health impact assessment study, which forms part of a three-year research project conducted jointly with the University of Toronto.

In Kampala, there is concern that health hazards may result from food being grown in unhealthy areas. As in many cities, the land available for agricultural activities has diminished tremendously, forcing many Kampala farmers, especially poor households, to seek other options for producing food and livestock feed. Crops are grown in polluted swamps and on lands previously used as dump sites or contaminated by other urban practices, while grass for animal feed is cut from the roadside or unused land.



Officers of the Kampala City Council participate actively in the SIUPA research teams. The health impact study will help them to accurately assess risks associated with these urban farming practices, and to develop appropriate plans and by-laws to ensure that farmers' families and city residents eat better and more safely. SIUPA partners are also working to improve production systems through technical interventions and to identify better market opportunities for farmers.

In the long run, SIUPA hopes to use and adapt

the knowledge gained in Kampala to develop similar programs in other countries.

Powerful tools for plant improvement

Molecular biologists at CIP have developed two systems for producing transgenic potatoes that are free of controversial antibiotic resistance genes. These genes are used as "selectable markers," which are key to the efficient production of transgenic plants with valuable properties ranging from pest and disease resistance to herbicide tolerance and increased robustness to permit cultivation on marginal or degraded lands.

Antibiotic resistance genes have been widely used as markers in plant transformation, and many of today's cultivated transgenic crops contain such genes. There is widespread concern among consumers, however, that infectious bacteria could become more resistant to these antibiotics, posing a threat to human health. Although extensive safety testing conducted by universities, regulatory agencies, and the private sector over the last decade has demonstrated that antibiotic resistance genes currently in use in plant transformation do not pose new or additional threats to human health, these concerns persist.

CIP biologists, recognizing that such concerns were limiting the use of plant transformation technology to solve urgent food problems in developing countries, began to search for options. After years of research and development, they came up with two highly effective breakthroughs.

The first system involves the use of a plant gene, originally isolated at a laboratory in Belgium, which confers resistance to toxic compounds. The main advantage of this system is that antibiotic resistance is no longer involved, hence the perceived threat to human health is reduced.

Regeneration of transgenic plants with this gene, however, occurs at a lower frequency than with antibiotic resistance genes. New support from the Rockefeller Foundation will give a significant impulse to this research, helping to overcome this drawback.

An equally important innovation, developed at CIP's Applied Biotechnology Laboratory, allows scientists to remove antibiotic resistance genes from transgenic potato plants using a heat-inducible self-excision system, which makes the gene "jump" out of the genome and disappear completely. This method is currently being used by CIP in generating transgenic virus-resistant potato and sweetpotato varieties.

These systems are complementary and are expected to provide genetically improved varieties that will be more readily accepted by consumers who seek freedom from antibiotic resistance genes in their food.

Ancient crop at the center of a heated debate

In an ongoing effort to increase the benefits of Andean plant genetic resources for the populations that have developed these resources over time, CIP was invited to participate in a coalition of Peruvian organizations to study, and to challenge if necessary, the patents of two US companies that claim maca-based processes and products.

Maca, a plant of the mustard family, was probably first domesticated in Peru's highlands between 1300 and 2000 years ago. Andean people have grown it for centuries as a food and medicinal plant. Local people claim it boosts physical and mental capacities and enhances fertility, which is naturally reduced at high altitudes.

Although Peruvian and international companies have marketed the root and its derivatives since 1995 as a nutritional supplement—which they have exported to Japan, Europe, and the USA—the granting of patents to two US companies in 2001 has concerned a number of Peruvian farming, cultural, and environmental organizations. The companies—which obtained patents on key components of the maca plant as well as on related processes, but not on the plant itself—allege to have found the best method to extract maca's active ingredients.

The basic argument for opposing the patents is that they claim ownership of products and processes that have been known for centuries by the Andean people. The group challenging the patents is actively seeking evidence to support this claim. The patents not only deny prior existence of knowledge, but perhaps more importantly, they potentially exclude from the market other maca products of similar composition by creating restrictions on the sale or use of maca and its derivatives.

Given its wide experience in biodiversity

conservation, genebank management, and utilization of Andean root and tuber crops, CIP's role in the broad-based group, led by Peru's Consumer Defense Institute, is to research, compile, and evaluate published technical information and analytical procedures that could be used in demonstrating prior knowledge, both traditional and contemporary, regarding the patents.

Currently no national or international regulations monitor the production of maca. Moreover, international law does not yet recognize the legal validity of indigenous knowledge, so there is no forum to legally protest the patents. Only the World Trade Organization provides a legal framework for challenging trade issues.

Through efforts similar to these, CIP will continue to contribute to—and influence—national and regional deliberations on access to and benefit sharing of genetic resources.

A KEY FOR SWEETPOTATO PROBLEMS

Under the coordination of the Australian Centre for International Agricultural Research, a multi-institutional team of scientists recently developed a comprehensive interactive tool that aims to improve the diagnosis and management of sweetpotato disorders. Scientists anticipate that the knowledge farmers and researchers gain from this tool—a multimedia product to be distributed as a CD-ROM and via the Internet—will result in better sweetpotato crops. (See http://www.cpitt.uq.edu.au/software/sweetpotato/)

Sweetpotato is an important source of food and income for farmers in developing countries, which account for 98 percent of the crop's global production. It is not only a staple crop for the poor, but is also rapidly becoming an important source of raw material for animal feed, starch, and industrial products. Despite its high versatility and adaptability, however, insect and pathogen attacks and nutritional disorders continue to have a devastating effect on the crop, significantly reducing its yield. Recognizing that the correct diagnosis of disorders can lead to better corrective management—and therefore improve yields and reduce economic and environmental costs—in January 2001 the team set out to develop a computerized diagnostic system for sweetpotatoes.

After two years of research and development, the scientists from CIP, the Centre for Pest Information Technology and Transfer (Australia), the University of Queensland (Australia), and the PhilRootcrops Center (Philippines) produced a diagnostic key that assists in identifying observed disorders and provides recommendations on appropriate management response. The project involved,

among other things: collecting and structuring existing information, images, and other relevant material; constructing and field testing the diagnostic key; and evaluating its usefulness. CIP's role was to provide expertise on insect and disease disorders, and to coordinate field tests.

As an added value, this project is expected to help in evaluating the usefulness of multimedia diagnostic keys as training and decision-support tools, and the potential for developing diagnostic keys for other crops.

A SWEET ALTERNATIVE

A sweetpotato-based nutritional supplement developed by CIP scientists is being introduced in Peru to help alleviate chronic malnutrition in young children. Close to 25 percent of Peruvian children under the age of five experience growth problems and one in every two suffers from anemia, a direct result of inadequate diet.

"Aside from breast feeding, many mothers have limited knowledge on how to properly nourish their infants," explains Nelly Espinola, CIP nutritionist. "Not only do they feed them too little and not frequently enough, but they feed them diluted pottages that are low in nutrients and minerals."

To confront this problem, a group of scientists from CIP and the Peruvian Instituto de Investigación Nutricional (IIN) began to search for an infant nutritional supplement that was easy to prepare, affordable, and that contained the proper balance of necessary nutrients. They came up with Nutriplús, a "just-add-water" powder concentrate comprised of sweetpotato, rice, corn, barley malt, animal protein, vegetable oil, and vitamins and minerals. Two daily portions of the product—formulated according to the Ministry of Health standards for nutrition of children from six months of age to three years old—cover close to 30 percent of the daily recommended dose of calories and proteins and 60 percent to 100 percent of the daily recommended dose of vitamins and minerals.

Unlike other baby food supplements, which contain added sugar, Nutriplús is sweetened naturally by the yellow- or orange-fleshed sweetpotatoes contained in the formula. This makes the mix even more effective, as these colored sweetpotatoes are rich in beta-carotene, a precursor of vitamin A.

Nutriplús is expected to serve as a substitute for similar products used in government programs that reach areas of extreme poverty to combat infant malnutrition. "Nutriplús's easy-to-package instant powder and locally available ingredients will make it highly competitive with the products usually offered through these government programs, as well as with similar imported baby food sold in local supermarkets," Espinola explains.

Studies suggest that 25,000 to 1 million children from 6 to 36 months of age living in Peru's poorest areas could benefit from this product. An added bonus of Nutriplús is the increased demand it is expected to create for local agricultural products, particularly sweetpotato, Espinola asserts.

A SHARED EFFORT TO SUSTAIN IMPACT In 2002, CIP and its sister centers continued to suffer the effects of diminishing financial support to international agricultural research, despite a renewed interest from investors in efforts to reduce poverty, promote social development, and protect the environment.

To cope with this situation, CIP took action on various fronts. We participated in the formulation of various Challenge Program proposals while continuing to seek support for the systemwide and ecoregional initiatives that CIP convenes or participates in. We stepped up fundraising efforts. We embarked on a stringent program to heighten efficiencies and underwent a painful downsizing process to reduce our budget deficit. Thanks to these efforts, we were able to rebuild reserves and produce a balanced budget for 2003. We thank all CIP staff for their tremendous dedication and decisiveness and their active participation in securing these achievements.

Over the years, CIP has placed emphasis on documenting the impact of its work. A series of case studies has been conducted, on the diffusion of new varieties (in six countries), the implementation of

CIP IN 2002

integrated pest management strategies (in four countries), and seed systems (in five countries). The composite net grand benefits from these investments alone are estimated at over US$155 million per year. These results are only partial and do not reflect the benefits accrued from many important areas, for instance in human resources development. CIP has trained more than 5,000 scientists and professionals involved in research and development in various parts of the world.

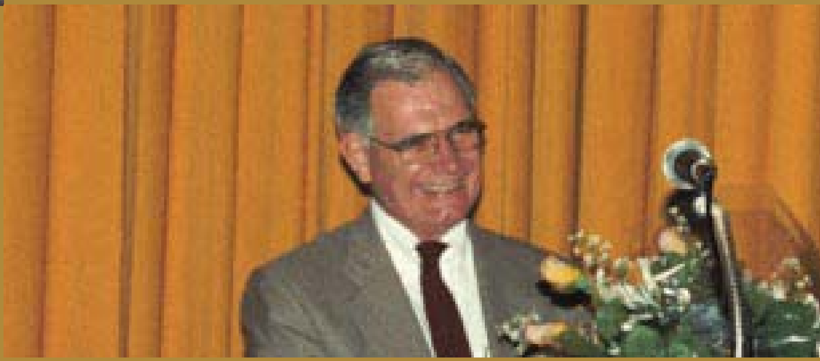
It is also important to note that it took more than 15 years of dedicated research to prepare the ground for this impact charted, mainly supported by unrestricted funding generously provided by our investors. CIP technologies did not begin to show impact until 1987, although the upward trend has continued steadily since 1993 (see *Annual net benefit from investments in CIP between 1971 and 2001*, page 91).

Unrestricted support to international centers is critical for long-term research whose payoff requires sustained efforts, such as the collection, characterization, and conservation of genetic resources. CIP holds in trust a world collection of over 20,000 accessions of potatoes, sweetpotatoes, and Andean roots and tubers. Some impact can be readily appreciated from these efforts, for example through the CIP program that has restored more than 2,000 potato accessions to 21 native communities in Peru to replace crops lost to climatic change, terrorism, and other disruptions. But there is also great promise for benefits in the longer term, for instance through the identification of genes that can help cope with the effects of climate change.

At CIP we believe that impact is the result of a collective effort by investors, scientists, development agents, farmers, and support staff, and that all of us deserve to be proud of it. Patient and systematic research and training does pay off for the poor in developing countries.

CIP thanks the investors who have contributed with unrestricted and restricted funding over the years, as well as our partners in research. Without their strong commitment to research for development, their sustained support, and their efforts to diffuse and promote new technologies, these accomplishments would not have been possible.

In memory of David MacKenzie



David Robert MacKenzie was CIP Board member from 1996, and Chair of the Board from 1998 until his death on 23 October 2002. CIP remembers with gratitude David MacKenzie's personal and professional contributions, which will continue to bear fruit at the Center for many years to come. His vision, wisdom, personal warmth, and gentility were appreciated by all who were fortunate enough to know him. The Center is currently carrying out a vision exercise, based on his roadmapping approach, which is inspired by and dedicated to his memory.

BOARD OF TRUSTEES

Donor contributions

The International Potato Center is grateful for the generous support of all its donors, particularly those who contribute with unrestricted donations. The funding received enables CIP to carry out high quality research and training designed to contribute to reducing poverty and achieving food security on a sustained basis in the poorest countries of the world.

CIP's revenues in 2002 were lower than in 2001, which shows a continuing general trend of decreasing funding to agricultural research. CIP is actively seeking new partners and additional sources of funding to maintain operations at a sustainable and stable level. This will enable us to make a solid contribution in the years to come to our goal: food security, healthy environments, and less poverty through research, training, information, and technical assistance on potato, sweetpotato, Andean root and tuber crops, natural resources, and mountain ecologies.

Donor (ranked by level of contribution)	US$000
Swiss Agency for Development and Cooperation (SDC)	2,701 [a]
International Bank for Reconstruction and Development (IBRD/World Bank Group)	2,268
United States Agency for International Development (USAID)	2,117 [a]
Department for International Development (DFID), UK	1,505
European Commission (EC)	1,422 [b]
Government of the Netherlands	1,064 [a]
Government of Japan	713
Government of Luxembourg	694
Swedish International Development Cooperation Agency (SIDA)	686
Danish International Development Agency (DANIDA)	612 [a]
Canadian International Development Agency (CIDA)	584
Government of Spain	486
Government of Peru	371
Australian Centre for International Agricultural Research (ACIAR)	358
Government of Germany	309
Government of Norway	267
International Development Research Centre (IDRC), Canada	252
Government of Italy	235
Rockefeller Foundation	202
The McKnight Foundation	148
International Livestock Research Institute (ILRI)	131
Government of the Republic of Korea	130
Government of China	120
Fondo Regional de Tecnología Agropecuaria (FONTAGRO)/Red Internacional de Metodología de Investigación de Sistemas de Producción (RIMISP)	106
Government of Belgium	103
Ford Foundation	85
Food and Agriculture Organization of the United Nations (FAO)	68
CARE Peru	68
Natural Resources Institute (NRI), UK	67
Swedish Agency for Research Cooperation (SAREC)	62
Organization of Petroleum Exporting Countries (OPEC) Fund for International Development	62
Micronutrient Initiative	58
Government of South Africa	50
Government of France	47
Government of India	37
Government of the Islamic Republic of Iran	35
United States Department of Agriculture (USDA)	26
National Oceanic Atmospheric Administration (NOAA), USA	25
International Research Institute for Climate Prediction (IRI)	21
Kenya Agricultural Research Institute (KARI)'s Agricultural Research Fund	18
Conservation, Food & Health Foundation Inc., USA	17
International Plant Genetic Resources Institute (IPGRI)	16
United Nations Environment Programme (UNEP)	14
International Center for Tropical Agriculture (CIAT)	10
International Foundation, USA	10
Centro de Investigación Agrícola Tropical, Bolivia	6
Government of Mexico	5
Servicio Nacional de Sanidad Agraria (SENASA), Peru	2
TOTAL	**18,393**

a Includes contributions for associate experts and/or university partners in the USA.
b Includes US$412,000 for conservation and characterization of root and tuber crops genetic resources, US$378,000 for gene discovery evaluation and mobilization for root and tuber crops improvement, and US$632,000 for integrated management on late blight.

A donation from the Senior Family Fund (see page 70) was received in 2002, but will appear in CIP's revenues in 2003.

Financial report

CIP's total revenues in 2002 were US$18.72 million, 2 percent lower than the 2001 revenues. Total revenues included US$8.36 million of unrestricted donations and US$10.36 million of restricted donations. At the end of 2002, US$4 million (21 percent of total revenues) had not been received.

CIP's donations are received in US dollars (40 percent, or US$7.54 million), euros (19 percent, or US$3.46 million), Swiss francs (12 percent, or US$2.20 million), yen (4 percent, or US$0.71 million), and various other currencies (25 percent). In 2002, the US dollar depreciated against the major currencies creating an exchange gain of US$0.32 million.

In response to the continuing drop in revenues, CIP underwent a downsizing exercise. In addition, the Center took measures to improve the operational efficiency, to closely monitor expenditures, and to raise efforts in fund raising. These actions were fundamental to reduce significantly the expected deficit to US$0.6 million.

Accumulated expenditures reached US$19.3 million in 2002, 8 percent below the total budget for the year. Expense reductions were possible in all categories, especially in those expense lines funded by unrestricted donations. Total savings achieved compared to the budget were US$1.3 million, which compensated falling budgeted revenues.

New project donation approvals increased substantially. During the year, donation approvals, excluding earmarked funding, reached US$10.8 million, 23 percent above the previous year and three times those approved in 1999. The backlog of projects pending approval from donors was fairly stable at US$19.5 million.

In addition, austere and prudent policies made it possible to reduce indirect costs from 14 percent in 2001 to 13 percent in 2002. It is expected that in the future, indirect costs will continue to decline as the center expands its research program.

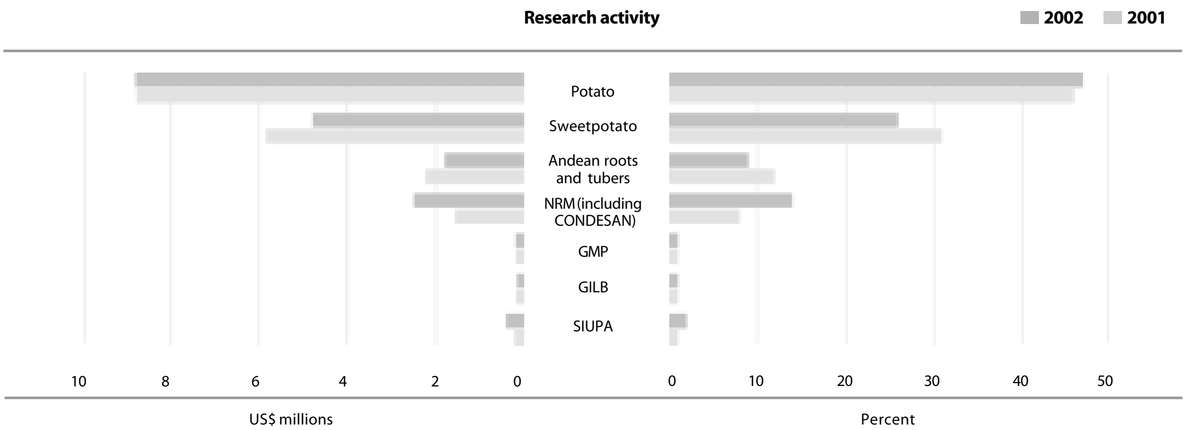
The financial results reduced the operating reserve from US$2.1 million in 2001 to US$1.8 million in 2002. In order to better align financial reserves to potential risks, the account accruals and provisions was redefined and a new target of US$0.95 million was established, in order for it to serve as a contingency reserve. The contingency reserve would cover unexpected risks that reduce revenues or increase expenses, such as donor cancellations, exchange rate losses, unplanned staff relocations, etc. The new definition made it possible to reallocate US$0.35 million from the account accruals and provisions to the operating fund.

The statement below summarizes CIP's financial position as of December 2002. A copy of the complete audited financial statements may be requested from the office of the Deputy Director General for Corporate Development at CIP headquarters in Lima, Peru.

Statement of financial position
Year ending 31 December 2002 (compared with 2001) **(US$000)**

	2002	2001
Assets		
Current assets		
Cash and cash equivalent	5,969	4,850
Accounts receivable		
Donors	4,025	4,052
Employees	311	368
Others	238	244
Inventories	489	667
Advances	432	324
Prepaid expenses	184	136
Total current assets	11,648	10,641
Property and equipment, net	2,860	3,274
Total assets	**14,508**	**13,915**
Liabilities and net assets		
Current liabilities		
Accounts payable		
Donors	1,063	1,030
Others	6,709	5,402
Accruals	1,201	1,575
Total current liabilities	8,973	8,007
Net assets		
Appropriated	3,736	3,846
Unappropriated	1,799	2,062
Total net assets	5,535	5,908
Total liabilities and net assets	**14,508**	**13,915**

Allocation of funds to CIP activities, 2002 and 2001



Annual net benefit from investments in CIP between 1971 and 2001 (in 1996 dollars)

Prepared by CIP's Social Science Department, based on CIP impact case studies

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)

SELECTED PUBLICATIONS BY CIP STAFF

Abidin PE, van Euewijk FA, Stam P, Struik PC, Zhang DP, Hermann M, and Carey EE. 2002. Evaluation of sweetpotato (*Ipomoea batatas* (L.) Lam) germplasm from North-eastern Uganda through a Farmer Participatory Approach. *Acta Horticulturae* 583: 61–68.

Adler NE, Chacón G, Flier WG, and Forbes GA. 2002. New disease report. The Andean fruit crop, pear melon (*Solanum muricatum*), is a common host for A1 and A2 strains of *Phytophthora infestans* in Ecuador. *Plant Pathology* 51: 802.

Bernet T, Hervé D, Lehmann B, and Walker T. 2002. Improving land use of slope farmers in the Andes: An economic assessment of establishing small-scale sprinkler irrigation to shift toward milk production. *Mountain Research and Development* 22: 375–382.

Bernet T, Lara M, Urday P, and Devaux A. 2002. El reto de vincular a los pequeños productores de papa con la agroindustria. *Revista Latinoamericana de la Papa* 13: 1–23.

Campilan D. 2002. Linking social and technical components of innovation through social learning: the case of potato disease management in Nepal. In: *Wheelbarrow full of frogs: Social learning in rural resource management. International Research and Reflections* (Cees Leeuwis and Rhiannon Pyburn, eds), pp. 135–146. Van Gorcum, Assen, The Netherlands.

Campilan D. 2002. The importance of local knowledge in conserving crop diversity. SciDevNet Indigenous Knowledge Policy Brief. www.scidev.net/dossiers/indigenous_knowledge

Clark CA, Valverde RA, Fuentes S, Salazar LF, and Moyer WJ. 2002. Research for improved management of sweetpotato pests and diseases: cultivar decline. *Acta Horticulturae* 583: 103–110.

Cole D, Sherwood S, Crissman C, Barrera V, and Espinosa E. 2002. Pesticides and health in highland Ecuadorian potato production: Assessing impacts and developing responses. *International Journal for Occupational and Environmental Health* 8: 182–190.

Devaux A and Thiele G. 2002. *Compendio de Papa Andina, logros y experiencias de la primera fase (1998–2002)*. CIP, Lima, Peru, 96 pp.

Fernández-Northcote EN (ed.). 2002. *Memorias del Taller Internacional: Complementando la resistencia al tizón (*Phytophthora infestans*) en los Andes [Proceedings of the International Workshop on Complementing Resistance to Potato Late Blight (*Phytophthora infestans*) in the Andes],* Cochabamba, Bolivia, February 2001. GILB/CIP, Lima, Peru. 214 pp.

Fonseca C, Zuger R, Walker T, and Molina J. 2002. Estudio de impacto de la adopción de nuevas variedades de camote liberadas por el INIA en la costa central, Perú. Caso del valle de Cañete. CIP, Lima, Peru. 24 pp.

Golmirzaie AM and Ortiz R. 2002. Inbreeding and true seed in tetrasomic potato. III. Early selection for seedling vigor on open-pollinated populations. *Theoretical and Applied Genetics* 104: 157–160.

Golmirzaie AM and Ortiz R. 2002. Inbreeding and true seed in tetrasomic potato. IV. Synthetic cultivars. *Theoretical and Applied Genetics* 104: 161–164.

Guarino L, Jarvis A, Hijmans RJ, and Maxted N. 2002. Geographic information systems (GIS) and the conservation and use of plant genetic resources. In: *Managing plant genetic diversity* (J.M.M. Engels, V. Ramantha Rao, A.H.D. Brown, and M.T. Jackson, eds), pp. 387–404. CABI, Wallingford, UK.

Hijmans RJ, Huaccho L, and Zhang DP. 2002. Description and analysis of a geo-referenced database of the global distribution of sweetpotato area. *Acta Horticulturae* 583: 41–45.

Hijmans RJ, Spooner DM, Salas AR, Guarino L, and de la Cruz J. 2002. *Atlas of wild potatoes*. International Plant Genetic Resources Institute, Rome, Italy. 130 pp.

Kumar A, Sarma YR, and Priou S. 2002. Detection of *Ralstonia solanacearum* in ginger rhizomes using post enrichment ELISA. *Journal of Spices and Aromatic Crops* 11: 35–40.

Livieratos IC, Müller G, Salazar LF, Eliasco E, and Coutts RHA. 2002. Identification and sequence analysis of potato yellow vein virus capsid protein minor gene. *Virus Genes* 25: 317–322.

Lizárraga C (ed.). 2002. Late blight: Managing the global threat. *Proceedings of the Global Initiative on Late Blight Conference*, Hamburg, Germany, July 2002. CIP, Lima, Peru.

Manrique K and Hermann M. 2002. Comparative study to determine stable performance in sweetpotato (*Ipomoea batatas* (L.) Lam.) regional trials. *Acta Horticulturae* 583: 87–94.

Muller G, Fuentes S, and Salazar LF. 2002. Detection of sweetpotato chlorotic stunt crinivirus (SPCSV) by non-radioactive nucleic acid spot hybridization (NAS). *Acta Horticulturae* 583: 129–133.

Mwanga ROM, Kriegner A, Cervantes JC, Zhang DP, Moyer JW, and Yencho C. 2002. Resistance to sweetpotato chlorotic stunt virus and sweetpotato feathery mottle virus is mediated by two separate recessive genes in sweetpotato. *Journal of the American Society of Horticultural Science* 127: 798–806.

Mwanga ROM, Moyer JW, Zhang DP, Carey EE, and Yencho GC. 2002. Nature of resistance of sweetpotato to sweetpotato virus disease. *Acta Horticulturae* 583: 113–119.

Olanya OM, Lambert DH, Johnson SB, and Dwyer JD. 2002. Assessment of the impact of mid-season late blight infection on disease development and yield of potato variety Russet Norkotah in Maine. *International Journal of Pest Management* 48: 139–146.

Oliva RF, Erselius LJ, Adler NE, and Forbes GA. 2002. Potential of sexual reproduction among host-adapted populations of *Phytophthora infestans* sensu lato in Ecuador. *Plant Pathology* 51: 710–719.

Ortiz O, Nelson R, Palacios M, and Orrego O (eds). 2002. *Guía para facilitar el desarrollo de escuelas de campo de agricultores: Manejo integrado de las principales enfermedades e insectos de la papa*. CIP/CARE-Peru. 264 pp.

Peters D, Nguyen TT, and Pham NT. 2002. Sweet potato root silage for efficient and labor-saving pig raising in Vietnam. *AGRIPPA Peer Reviewed Electronic Journal* www.fao.org/docrep/article/agrippa/554_en.htm

Pray CE and Fuglie K. 2002. *Private investment in agricultural research and international technology transfer in Asia.* CIP, Bogor, Indonesia; Rutgers University, and Economic Research Service. 155 pp.

Priou S, Salas C, de Mendiburu F, Aley P, and Gutarra L. 2001. Assessment of latent infection frequency in progeny tubers of advanced potato clones resistant to bacterial wilt: a new selection criterion. *Potato Research* 44: 359–373.

Priou S, Torres R, Villar A, Gutarra L, and de Mendiburu F. 2001. Optimization of sample size for the detection of latent infection by *Ralstonia solanacearum* in potato seed tubers in the highlands of Peru. *Potato Research* 44: 349–358.

Pumisacho M and Sherwood S (eds). 2002. *Technical guide to potato production in Ecuador.* INIAP-CIP. 320 pp.

Sherwood S and Pumisacho M. 2002. *Facilitators' guide for implementing farmer field schools in potato IPM.* FAO/CIP/INIAP. 120 pp.

Thiele G and Devaux A. 2002. Adding value to local knowledge and biodiversity of Andean potato farmers, the Papa Andina Project. *InfoAgrar News* No. 12/02, pp. 2–3.

Torres H. 2002. *Manual de las enfermedades más importantes de la papa en el Perú.* CIP, Lima, Peru.

Triki MA, Priou S, and El Mahjoub M. 2001. Effects of soil solarization on soil-borne populations of *Pythium aphanidermatum* and *Fusarium solani* and on the potato crop in Tunisia. *Potato Research* 44: 271–279.

Triki MA, Priou S, El Mahjoub M, and Baudry A. 2001. Leak syndrome of potato in Tunisia caused by *Pythium aphanidermatum* and *Pythium ultimum. Potato Research* 44: 221–231.

Trognitz F, Manosalva P, Gysin R, Niño-Liu D, Simon R, del Rosario Herrera M, Trognitz B, Ghislain M, and Nelson R. 2002. Plant defense genes associated with quantitative resistance to potato late blight in *Solanum phureja* x dihaploid *S. tuberosum* hybrids. *Molecular Plant–Microbe Interactions* 15: 587–597.

Van de Fliert E and Braun AR. 2002. Conceptualizing integrative, farmer participatory research for sustainable agriculture: From opportunities to impact. *Agriculture and Human Values* 19: 25–38.

Van de Fliert E, Dilts R, and Pontius J. 2002. Farmer researcher teams, farmer field schools and community IPM: different platforms for different research and learning objectives. In: *Wheelbarrow full of frogs: Social learning in rural resource management. International Research and Reflections* (Cees Leeuwis and Rhiannon Pyburn, eds), pp. 121–133. Van Gorcum, Assen, The Netherlands.

Zhang BY, Liu QC, Zhai H, Zhou HY, Zhang DP, and Wang Y. 2002. Production of fertile interspecific somatic hybrid plants between sweetpotato and its wild relative, *Ipomoea lacunosa*. *Acta Horticulturae* 583: 81–85.

Training highlights

The topics covered by CIP's training curriculum respond directly to the Center's main research areas centered on the production and use of CIP's mandate crops and the conservation and management of natural resources. There is a growing demand for training on natural resource management in mountain areas and on conservation of root and tuber genetic material.

CIP leads training sessions and workshops, organizes and sponsors international conferences, and develops training materials. The 32 main training events conducted across the world in 2002 were attended by participants from 64 countries. These activities focused on research methodologies, tools, and techniques for developing-country scientists, and on capacity building for sustainable production, targeted at NGOs, government organizations, and development agencies. At CIP headquarters, individual training was provided for participants from 23 countries. CIP also supported training at distant locations by distributing publications and manuals, as well as through the use of electronic media, including downloads of manuals, articles, and reports from CIP's training website (www.cipotato.org/training), and e-conferences and workshops.

CIP continues to develop its website and interactive CD-ROMs to support training activities organized by CIP headquarters and regional offices, and by CIP-related networks.

Main group training events

Event (number of participants in parentheses)	External sponsors	Participating countries
Workshop on bacterial wilt detection and its application to potato seed production (12)	TCRC	Bangladesh
Advanced virology course (5)		Bolivia, Costa Rica, Philippines
Systemwide Program on Integrated Pest Management: Annual meeting of the Inter-Center Working Group of the CGIAR (19)	CGIAR, SDC	Benin, Colombia, Ecuador, Indonesia, Italy, Kenya, Mexico, Peru, Philippines, Senegal, Syria, Tanzania, Tunisia, UK
Workshop on participatory research, integrated pest management and varieties for industry, harvest and postharvest (14)	Fundación para el Desarrollo Regional, INCAGRO	Peru
World Meeting on Mountain Ecosystems (278)	CAF, FAO, Peruvian Ministry of Foreign Affairs, SDC	Argentina, Belgium, Brazil, Canada, Chile, Colombia, Costa Rica, Ecuador, France, Germany, Ghana, Italy, Mexico, Nepal, Nigeria, Pakistan, Peru, Puerto Rico, South Africa, USA, Venezuela
Course on improved techniques of sweetpotato production (59)	TCRC	Bangladesh
Integrated management of potato late blight diseases: refining and implementing local strategies through farmer field schools (11)	IFAD	Bangladesh, Bolivia, China, Ethiopia, Peru, Uganda, UK
Steering committee meeting of Vitamin A for Africa (VITAA) (22)	ISTI, Micronutrient Initiative, OPEC, USAID	Brazil, Canada, Ethiopia, Ghana, Kenya, Mozambique, Peru, South Africa, Tanzania, Uganda, USA, UK
Course on integrated crop management (70)	ICARDA, Ministry of Agriculture, Afghanistan	Afghanistan
Workshop on statistical analysis and experimental design (17)	ICRAF, ILRI, PRAPACE	Kenya
Workshop on application of molecular markers in agrobiodiversity conservation and management (19)	CTB, FAO, IPGRI	Bolivia, Colombia, Ecuador, Peru, Spain

GILB conference: Managing the global threat (173)	DANIDA, Technical Centre for Agricultural & Rural Cooperation	Argentina, Austria, Belgium, Belarus, Brazil, Cameroon, Canada, China, Czech Rep., Denmark, Ecuador, Ethiopia, France, Germany, Hungary, India, Ireland, Israel, Italy, Japan, Kenya, Luxemburg, Mexico, Myanmar, Nepal, Netherlands, New Zealand, Norway, Pakistan, Peru, Poland, Romania, Russia, South Africa, Sweden, Trinidad and Tobago, Tunisia, Uganda, UK, Ukranian SSR, USA, Venezuela, Vietnam
Workshop on analysis of agroproduction systems (17)		Bolivia, Colombia, Costa Rica, Ecuador, Panama, Peru
Conference on alternatives for funding and investment in poor rural environments (62)	CONDESAN	Canada, Peru, Switzerland
Course on potato seed production in Afghanistan (38)	ICARDA	Afghanistan
Course on technology of autotrophic and hydroponic systems (8)		Argentina, Bolivia, Chile, Colombia, Venezuela
Workshop on genetic improvement and perspectives for the industrial use of potato (21)	FONTAGRO	Argentina, Bolivia, Chile, Colombia, Ecuador, Peru, Venezuela
Course on utilization and promotion of true potato seed (89)		India
Workshop on urban policy implications of enhancing food security in African cities (35)	FAO, SIUPA	Kenya
Course on cassava and sweetpotato research and development (30)	CRS	Uganda
Workshop on watershed management (25)	MANRECUR, PROMSA	Ecuador
Course on computer simulation and GIS (50)	DINAREN, INAMHI, INIAP, INPOFOS	Ecuador
International workshop of the China-ASEAN Potato Forum	Ministry of Agriculture, China	China
International conference on farmer field schools	FAO, Rockefeller Foundation	Indonesia
UPWARD annual review and planning meeting	UPWARD	Philippines
Course on participatory research and development	UPWARD	Philippines
Sweetpotato study tour		China
Workshop on sweetpotato IPM farmer field schools		Vietnam
Seminar-workshop on the potentials of sweetpotato in improving household income and nutritional status (15)	NVH Foundation	Philippines
Workshop on sweetpotato ICM project validation (12)	UPWARD	Philippines
Potato ICM project summative workshop (14)	UPWARD	China
Project team workshop for the development of an agrobiodiversity sourcebook (18)	IDRC	Philippines

Full names of external sponsors can be found in the list of CIP's partners (pages 100–103).

CIP's PARTNERS

AARI Aegean Agricultural Research Institute, Turkey • **AARI** Ayub Agricultural Research Institute, Pakistan • **AAS** Academy of Agricultural Sciences, North Korea • **AB-DLO** Institute for Agrobiology and Soil Fertility, Netherlands • **ACIAR** Australian Centre for International Agricultural Research • **ADT** Akukuranut Development Trust, Kenya • **AFRENA** African Resource Network in Agro-Forestry, Uganda • **AFRICARE**, Uganda • **AGDIA** Inc, USA • **AGERI** Agriculture Genetic Engineering Research Institute, Egypt • **A**gricultural Research Council, South Africa • **A**gricultural Research Institute, Tanzania • **A**griculture and Agri-Food, Canada • **AHI** African Highland Ecoregional Program, East Africa • **A**inshams University, Faculty of Agriculture, Egypt • **AIAT-WS** Agricultural Technology Assessment Institute West Sumatra, Indonesia • **AIT** Asian Institute of Technology, Thailand • **AKF** Aga Khan Foundation, Switzerland • **A**lemaya University of Agriculture, Ethiopia • **A**ngola Seeds of Freedom Project • **A**nhui Academy of Agricultural Science, China • **APPRI** Agricultural Plant Protection Research Institute, Egypt • **APROSEPA** Asociación de Productores de Semilla de Papa, Bolivia • **A**rapai College, Uganda • **ARARIWA** Association for Andean Technical-Cultural Promotion, Peru • **ARC** Agriculture Research Centre, Egypt • **ARC** Agricultural Research Corporation, Sudan • **ARC** Agricultural Research Council, South Africa • **ARCS** Austrian Research Centers Seibersdorf, Austria • **ARDC** Agricultural Research and Development Centre, Uganda • **AREA** Agricultural Research and Extension Authority, Yemen • **ARI** Agricultural Research Institute, Pakistan • **ARI** Agricultural Research Institute, Tanzania • **ARO** Agricultural Research Organization, Israel • **ASAR** Asociación de Servicios Artesanales y Rurales, Bolivia • **ASARECA** Association for Strengthening Agricultural Research in Eastern and Central Africa, Uganda • **ASPADERUC** Asociación para el Desarrollo Rural de Cajamarca, Peru • **ATDTP** Agricultural Technology Development and Transfer Project, Rwanda • **AT-**Uganda Appropriate Technology Uganda • **AVRDC** Asian Vegetable Research and Development Center, Taiwan • **A**wasa Research Centre, Ethiopia • **BADC** Bangladesh Agricultural Development Corporation • **BAR** Bureau of Agricultural Research, Department of Agriculture, Philippines • **BARI** Bangladesh Agricultural Research Institute • **BBA** Federal Biological Research Centre for Agriculture and Forestry, Institute for Biological Control, Germany • **BCNC** Baguio City Nutrition Council, Philippines • **BIOGEN** Biodiversidad y Genética, Peru • **BRAC** Bangladesh Rural Advancement Committee • **BRC** Biotechnology Research Center, Vietnam • **BRRI** Bangladesh Rice Research Institute • **BSU** Benguet State University, Philippines • **BTA** Biotecnología Agropecuaria SA, Chile • **BUCADEF** Buganda Cultural Development Foundation, Uganda • **B**vumbwe Research Station, Malawi • **CAAS** Chinese Academy of Agricultural Sciences • **CABI** Bioscience, Kenya, UK • **CAB** International, Kenya • **CAF** College for Agriculture and Forestry, Vietnam • **C**amBioTec, Canada • **CARDI** Caribbean Agricultural Research and Development Institute, Trinidad • **CARE** Cooperative for Assistance and Relief Everywhere, USA • **CARE**-Bangladesh • **CARE**-Kenya • **CARE**-Peru • **CARE**-Rwanda • **C**atholic University of Leuven, Belgium • **CAU** China Agricultural University, China • **C**avSU Cavite State University, Philippines • **CBC** Centro Bartolomé de las Casas, Peru • **CCAP** Chinese Center for Agricultural Policy, China • **CECOACAM** Central de Cooperativas Agrarias de Cañete y Mala, Peru • **CEDEPAS** Centro Ecuménico de la Promoción y Acción Social, Peru • **CEMOR** Cemor Editores & Promotores, Peru • **CENA** Civil Engineers Network Africa, South Africa • **C**endrawasih University, Indonesia • **C**entro de Investigación Agrícola Tropical, Bolivia • **C**entro de Investigación en Biotecnología, Costa Rica • **C**entros de Reproducción de Entomógenos y Entomopatógenos, Cuba • **CERGETYR** Centro Regional de Recursos Genéticos de Tuberosas y Raíces, Peru • **CFP** Cities Feeding People, Canada • **CGIAR** Consultative Group on International Agricultural Research, USA • **C**hiang Mai University, Thailand • **C**hristian AID, DR Congo • **CIAAB** Centro de Investigaciones Agrícolas A Boerger, Uruguay • **CIAD** Center for Integrated Agricultural Development, China • **CIAT** Centro Internacional de Agricultura Tropical, Colombia • **CICA** Centro de Investigación en Cultivos Andinos, Peru • **CIDA** Canadian International Development Agency • **CIED** Centro de Investigación, Educación y Desarrollo, Peru • **CIMMYT** Centro Internacional de Mejoramiento de Maiz y Trigo, Mexico • **CIRAD** Centre de coopération internationale en recherche agronomique pour le développement, France • **CIPDER** Consorcio Interinstitucional para el Desarrollo Regional Cajamarca, Peru • **CIRNMA** Centro de Investigación de Recursos Naturales y Medio Ambiente, Peru • **CLADES** Consorcio Latinoamericano de Agroecología y Desarrollo, Peru • **C**lemson University, USA • **CLSU** Central Luzon State University, Philippines • **CNCQS** Chinese National Centre for Quality Supervision and Test of Feed • **CNPH** Centro Nacional de Pesquisa de Hortaliças, Brazil • **CODESE** Comite de Semilleristas, Peru • **C**omunité de Yaounde, Cameroon • **CONAM** Consejo Nacional del Ambiente, Peru • **CONCYTEC** Consejo Nacional de Ciencia y Tecnologia, Peru • **CONDESAN** Consortium for the Sustainable Development of the Andean Ecoregion, Peru • **C**onservation, Food & Health Foundation Inc., USA • **C**onsorcio Surandino, Peru • **COPASA** Cooperacion Peruano Aleman de Seguridad Alimentaria, Peru • **C**ornell University, USA • **CORPOICA** Corporación del Instituto Colombiano Agropecuario, Colombia • **CPPS** Chongqing Plant Protection Station, China • **CPRA** Centre de perfectionnement et de recyclage agricole de Saïda, Tunisia • **CPRI** Central Potato Research Institute, India • **CPRS** Central Potato Research Station, India • **CRIBA** Centro Regional de Investigación en Biodiversidad Andina, Peru • **CRIFC** Central Research Institute for Food Crops, Indonesia • **CRIH** Central Research Institute for Horticulture, Indonesia • **CRP-CU** Centre de recherche public – Gabriel Lippmann, Luxembourg • **CRS** Catholic Relief Services, Kenya, Uganda, Sudan, Indonesia • **CTA** Technical Centre for Agricultural and Rural Cooperation • **CTB** Belgium Technical Cooperation • **CTCRI** Central Tuber Crops Research Institute, India • **DAE** Department of Agricultural Extension, Bangladesh • **DANIDA** Danish International Development Agency • **DARHRD** Department of Agricultural Research and Human Resource Development, Eritrea • **DECRG**, Development Economics Research Group, World Bank, USA • **D**epartment of Agriculture, Philippines • **D**epartment of Agriculture, Thailand • **D**epartment of Agriculture, Phichit Horticultural Research Center, Thailand • **DFID** Department for International Development, UK • **DINAREN**

Direccion Nacional de Recursos Naturales Renovables, Ecuador • **D**inas Peternakan Wamena, Indonesia • **D**irección Nacional de Sanidad Vegetal, Cuba • **D**irectorate of Root Crop Production, Ministry of Agriculture, Indonesia • **DPP** Department of Plant Protection, Ministry of Agriculture and Rural Development, Vietnam • **DRCFC** Dalat Research Center for Food Crops, Vietnam • **DRDS** Department of Research and Development Services, Bhutan • **EARO** Ethiopian Agricultural Research Organization (formerly IAR), Ethiopia • **E**ARRNET Eastern Africa Rootcrops Research Network, Uganda • **EC** European Commission • **ECABREN** Eastern and Central Africa Bean Research Network, Uganda • **EMBRAPA** Empresa Brasileira de Pesquisa Agropecuária, Brazil • **E**mpresas de Cultivos Varios del Ministerio de Agricultura, Cuba • **ENEA** Comitato Nazionale per la Ricerca e per lo Sviluppo dell'Energia Nucleare e delle Energie Alternative, Italy • **E**rbacher Foundation, Germany • **ESH** Ecole supérieure d'horticulture, Tunisia • **ETH** Eidgenoessische Technische Hochschule, Switzerland • **FAO** Community IPM Program, Vietnam and Indonesia • **FAO** Food and Agriculture Organization of the United Nations, Italy • **FAPESP** Fundação de Amparo à Pesquisa do Estado de São Paulo, Brazil • **FCRI** Food Crops Research Institute, Vietnam • **FDR** Fundación para el Desarrollo Rural, Peru • **FIELD** Farmer Initiatives for Ecological Livelihood and Democracy, Indonesia • **FOFIFA**/**FIFAMANOR** Centre national de la recherche appliquée au developpément rural, Madagascar • **F**ood Crop Research Institute, Vietnam • **FONTAGRO/RIMISP** Fondo Regional de Tecnología Agropecuaria/Red Internacional de Metodología de Investigación de Sistemas de Producción • **FOODNET** (ASARECA network implemented by IITA) • **F**ord Foundation • **FORTIPAPA** Fortalecimiento de la Investigación y Producción de Semilla de Papa, Ecuador • **FOVIDA** Fomenta de la Vida, Peru • **FSP** Forages for Smallholders Project, CIAT, Colombia • **FUNDAGRO** Fundación para el Desarrollo Agropecuario, Ecuador • **FUNDANDES** Fundación para el Ambiente Natural y el Desarrollo, Argentina • **GAAS** Guangdong Academy of Agricultural Sciences, China • **GILB** Global Initiative on Late Blight, Peru • **GKF** Grameen Krishi Foundation, Bangladesh • **GLKS** Institute of Plant Genetics and Crop Plant Research, Germany • **G**overnment of Belgium • **G**overnment of China • **G**overnment of France • **G**overnment of Germany • **G**overnment of India • **G**overnment of Italy • **G**overnment of Japan • **G**overnment of Luxembourg • **G**overnment of Mexico • **G**overnment of Norway • **G**overnment of Peru • **G**overnment of South Africa • **G**overnment of Spain • **G**overnment of the Islamic Republic of Iran • **G**overnment of the Netherlands • **G**overnment of the Republic of Korea • **HAAS** Heilongjiang Academy of Agricultural Sciences, China • **HARI** Humeng Agricultural Research Institute, China • **HAU** Hanoi Agriculture University, Vietnam • **H**ong Doc University, Vietnam • **H**ong Kong University, China • **HORDI**, Horticultural Research and Development Institute, Sri Lanka • **HRI** Horticulture Research Institute, Egypt • **HUAF** Hue University for Agriculture and Forestry, Vietnam • **H**uanzhong Agricultural University, China • **H**ubei Agricultural University, China • **H**ung Loc Agriculture Research Center, Vietnam • **H**asanuddin University, Indonesia • **IAC** International Agricultural Centre, Netherlands • **IAF** Inter-American Foundation, USA • **IAI-ISP** Inter-American Institute for Global Change Research, Initial Science Program, Brazil • **IAN** Instituto Agronómico Nacional, Paraguay • **IAO** Istituto Agronomico per l'Oltremare, Italy • **IAS** Institute of Agricultural Sciences, Ministry of Agriculture and Rural Development, Vietnam • **IASA** Instituto Agropecuario Superior Andino, Ecuador • **IAV** Institut Agronomique et Vétérinaire Hassan II, Morocco • **IBC** Institute for Breeding of Crop Plants, Federal Center for Breeding Research on Cultivated Plants, Germany • **IBRD** International Bank for Reconstruction and Development • **ICA** Instituto Colombiana Agropecuaria, Colombia • **ICAR** Indian Council of Agricultural Research, India • **ICASA** International Consortium for Agricultural Systems Applications, USA • **ICIMOD** International Centre for Integrated Mountain Development, Nepal • **ICIPE** International Centre for Insect Physiology and Ecology, Kenya • **ICO CEDEC** Instituto de Capacitación del Oriente, Bolivia • **ICRAF** International Centre for Research in Agroforestry, Kenya • **ICRISAT** International Crops Research Institute for the Semi-Arid Tropics, India • **ICRW** International Center for Research on Women, USA • **IDEA** Instituto Internacional de Estudios Avanzados, Venezuela • **IDIAP** Instituto de Investigación Agropecuaria de Panamá, Panama • **IDRC** International Development Research Center, Canada • **IEBR** Institute of Ecology and Biological Resources, Vietnam • **IESR/INTA** Instituto de Economía y Sociología Rural del INTA, Argentina • **IFAD** International Fund for Agricultural Development • **IFDC** International Fertilizer Development Center, USA • **IFPRI** International Food Policy Research Institute, USA • **IHAR** Polish Plant Breeding and Acclimatization Institute, Poland • **ISHS** International Society for Horticultural Sciences, Belgium • **IIN** Instituto de Investigación Nutricional, Peru • **IIRR** International Institute of Rural Reconstruction, Philippines • **IITA** International Institute of Tropical Agriculture, Nigeria • **ILRI** International Livestock Research Institute, Ethiopia and Kenya • **IMA** Instituto de Manejo de Agua y Medio Ambiente, Peru • **INAMHI** Instituto Nacional de Meteorología e Hidrología, Ecuador • **INCAGRO** Innovación y Competitividad para el Agro Peruano, Peru • **INERA**, Institut nationale d'etudes et de recherches agricoles, DR Congo • **INIA** Instituto Nacional de Investigacão Agronómica, Mozambique • **INIA** Instituto Nacional de Investigación Agraria, Peru • **INIA** Instituto Nacional de Investigaciones Agropecuarias, Chile • **INIA** Instituto Nacional de Investigaciones Agropecuarias, Uruguay • **INIA** Instituto Nacional de Investigaciones y Tecnologia Agraria y Alimentaria, Spain • **INIA** Instituto Nacional de Investigaciones Agrícolas, Venezuela • **INIAP** Instituto Nacional de Investigaciones Agropecuarias, Ecuador • **INIFAP** Instituto Nacional de Investigaciones Forestales y Agropecuarias, Mexico • **INIVIT** Instituto Nacional de Investigación de Viandas Tropicales, Cuba • **INPOFOS** Instituto de la Potasa y el Fósforo, Ecuador • **INRA** Institut national de la recherche agronomique, France • **INRA** Institut national de la recherche agronomique, Morocco • **INRAT** Institut national de la recherche agronomique de Tunisie, Tunisia • **I**nstituto Rural Valle Grande, Cañete, Peru • **INTA** Instituto Nacional de Tecnología Agropecuaria, Argentina • **I**nternational Accord, Rwanda, Uganda • International Foundation, USA • **IPAC** Instituto de Promoción Agropecuaria y Comunal, Peru • **IPB** Institut Pertanian Bogor Indonesia •

IPDA Instituto de Promoción y Desarrollo Agrario, Peru • **IPGRI** International Plant Genetic Resources Institute, Italy • **IPR** Institute for Potato Research, Poland • **IRA** Institut de recherche agronomique, Cameroon • **IRAD** Institut de recherche agricole pour le développement, Cameroon • **IRD** Institut de recherche pour le développement (formerly ORSTOM), France • **IRI** International Research Institute for Climate Prediction • **IRRI** International Rice Research Institute, Philippines • **ISABU** Institut des sciences agronomiques du Burundi • **ISAR** Institut des sciences agronomiques du Rwanda • **ISHS** International Society for Horticultural Sciences, USA • **ISNAR** International Service for National Agricultural Research, Netherlands • **ISTI** International Science and Technology Initiative • **ISTPC** Instituto Superior Tecnológico Público de Cañete, Peru • **IWMI** International Water Management Institute, Sri Lanka • **IZ** Instytut Ziemniaka, Poland • **JAAS** Jiangsu Academy of Agricultural Sciences, China • **J**erusalen de Porcon Cooperative, Peru • **JKUAT** Jomo Kenyatta University of Agriculture and Technology, Kenya • **JTTK** Jaringan Tani Tanah Karo, Indonesia • **KARI** Kenyan Agricultural Research Institute • Kaugu & Katheri Farmers, Kenya • **KEPHIS** Kenya Plant Health Inspectorate Service • **L**a Habana University, Chemistry Faculty, Cuba • **L**ake Basin Development Authority, Kenya • **LDI** Landscape Development Intervention, Madagascar • **L**ouisiana State University, USA • **L**ucana, Bolivia • **MAE** Ministère des affaires etrangères, France • **M**akerere University, Uganda • **MANRECUR** Manejo Colaborativo de Recursos Naturales en la Subcuenca del Río el Angel, Ecuador • **MARDI** Malaysia Agriculture Research Development Institute, Malaysia • **MARS** Mwara Agricultural Research Institute, Indonesia • **M**ax Planck Institute for Plant Breeding Research, Germany • **M**cMaster University, Canada • **MGL** USAID's Micronutrient Global Leadership Project • **M**ianning Agriculture Bureau, China • **M**ichigan State University, USA • **M**icronutrient Initiative, Canada • **M**inisterio Presidencia, Peru • **M**inisterio Relaciones Exteriores, Peru • **M**inistry of Agriculture, China • **M**inistry of Agriculture, Ecuador • **M**inistry of Agriculture, Eritrea • **M**inistry of Agriculture and Cooperatives, Division of Research and Development, Tanzania • **M**inistry of Agriculture and Land Reclamation, Egypt • **MIP** Programa de Manejo Integrado de Plagas, Dominican Republic • **M**ississippi State University, USA • **M**itra Tani, Indonesia • **MMSU** Mariano Marcos State University, Philippines • **M**ontana State University, USA • **MOST** USAID's Micronutrient Program • **M**ountain Forum, USA • **MSIRI** Mauritius Sugar Industry Research Institute • **M**unicipalidad Distrital Baños del Inca Peru • **NI** Vavilov Institute, Russia • **NAARI** Namulonge Agricultural and Animal Research Institute, Uganda • Nagoya University, Japan • **N**anchong Agricultural Research Institute, China • **NARC** National Agricultural Research Centre, Pakistan • **NARC** Nepal Agricultural Research Council • **NARO** National Agricultural Research Organization, Uganda • **NCGR** National Center for Genome Resources, USA • **NCVESC** National Center for Variety Evaluation and Seed Certification, Vietnam • **NIAH** National Institute of Animal Husbandry, Vietnam • **N**ijmegen University, Netherlands • **N**jabini Farmer Group, Kenya • **N**kozi University, Uganda • **NOAA** National Oceanic Atmospheric Administration, USA • **NOMIARC** Northern Mindanao Agricultural Research Center, Philippines • **N**omorionteetab Kibagenge, Kenya • **N**orth Carolina State University, USA • **NPRCRTC** Northern Philippines Root Crops Research and Training Center, Philippines • **NPRC** National Potato Research Centre Tigoni, Kenya • **NPRP** National Potato Research Program, Nepal • **NRI** Natural Resources Institute, UK • **NRSP-6** USDA Potato Production Introduction Station–Wisconsin, USA • **NUS** National University of Singapore • **ODER** Oficina de Desarrollo Rural–Chalaco, Peru • **O**hio State University, USA • **O**rganization of Petroleum Exporting Countries (OPEC) Fund for International Development • **O**regon State University, USA • **ORS** Oficina Regional de Semillas, Bolivia • **PCARRD** Philippine Council for Agriculture, Forestry and Natural Resources Research and Development, Philippines • **PDL** Proyecto Desarrollo Lechero, Bolivia • **PDP** Potato Development Program, Nepal • **REDCAPAPA** Red Estrategica para el Desarrollo de Cadena Agroalimentaria de la Papa, Ecuador • **PGS** Plant Genetic Systems, Belgium • **P**hilippine Root Crops Research and Training Center • **PIA** Programa de Investigación Agropecuaria, Bolivia • **PICA** Programa de Investigación de Cultivos Andinos, Peru • **PICTIPAPA** Programa Internacional de Cooperación del Tizón Tardío de la Papa, México • **P**lan International, Kenya • **P**lant Gene Expression Center, University of California–Berkeley, USA • **P**lant Research International, Netherlands • **PNS-PRODISE** Programa Nacional de Semillas del Proyecto de Desarrollo Integral de Semillas, Peru • **P**ontificia Universidad Católica del Ecuador • **P**otato Research Centre, Agriculture and Agri-Food, Canada • **P**otato Seed Program, Canary Islands, Spain • **PPD** Plant Protection Department, Ministry of Agriculture and Rural Development, Vietnam • **PPRI** Plant Pathology Research Institute, Egypt • **PRAPACE** Programme régional de l'amélioration de la culture de la pomme de terre et de la patate douce en Afrique centrale et de l'est • **PRCRTC**, Philippine Root Crop Research and Training Center • **PRECODEPA** Programa Regional Cooperativo de Papa, Mexico • **PREDUZA** Proyecto de Mejoramiento para Resistencia Duradera en Cultivos Altos en la Zona Andina, Ecuador • **PRGA** Program for Participatory Research and Gender Analysis, CGIAR, USA • **PROINPA** Fundación para la Promoción e Investigación de Productos Andinos, Bolivia • **PROMETAS** Promoción y Mercadeo de Tubérculos Andinos, Universidad Mayor de San Simón, Bolivia • **PROMSA** Programa de Modernización de Servicios Agropecuarios, Ecuador • **PRONAMACHCS** Proyecto Nacional de Manejo de Cuencas Hidrográficas y Conservación de Suelos, Peru • **P**royecto Papa Andina, Peru • **PROSHIKA**, A Centre for Human Development, Bangladesh • **PRP** Potato Research Programme, Nepal • **PSPDP** Pakistan-Swiss Potato Development Program • **RANTIK** Ltd, Bangladesh • **RAU** Rajendra Agricultural University, Bangladesh • **RDA** Rural Development Agency, Korea • **RDRS** Rangpur Dinajpur Rural Society, Bangladesh • **REFSO** Rural Energy and Food Security Organization, Kenya • **R**egional Agricultural Research and Development Centre, Sri Lanka • **RIAP** Research Institute for Animal Production, Indonesia • **RIFAV** Research Institute for Fruits and Vegetables, Vietnam • **RIFCB** Research Institute for Food Crops Biotechnology, Indonesia • **RILET** Research Institute for Legume and Tuber Crops, Indonesia • **RIV** Research Institute for Vegetables, (formerly LEHRI), Indonesia • **RCRC–VASI** Root Crop

Research Center, Vietnam Agricultural Science Institute • **RNC-RC** Jakar, Bhutan • Rockefeller Foundation • **R**othamsted Experiment Station, UK • **RUAF** Resource Centre for Urban Agriculture and Forestry, Netherlands • **SAAS** Shangdong Academy of Agricultural Sciences, China • **SARDI** South Australian Research and Development Institute, Australia • **SARDI–UMCOR** Sustainable Agricultural and Rural Development Initiative–United Methodist Committee on Relief, DR Congo • **SAREC** Swedish Agency for Research Cooperation • **SARIF** Sukamandi Research Institute for Food Crops, Indonesia • **SARRNET** Southern Africa Root Crops Research Network • **SASA** Scottish Agricultural Science Agency, UK • Sasakawa-Global 2000, Ethiopia • Save the Children (UK Ltd), Ethiopia • **SCRI** Scottish Crop Research Institute, **UK • SDC** Swiss Agency for Development and Cooperation • **SEAG** Servicio de Extensión Agrícola y Ganadera, Paraguay • **SEARCA** Southeast Asian Ministers of Education Organization (SEAMEO) Regional Center for Graduate Study and Research in Agriculture, Philippines • **SEMTA** Servicios Múltiples de Tecnologías Apropiadas, Bolivia • **SENASA** Servicio Nacional de Sanidad Agraria, Peru • **SENASAG** Servicio Nacional de Sanidad Agropecuaria e Inocuidad Alimentaria, Bolivia • **SENASEM** Service national de semances, DR Congo • **SEPA** Unidad de Producción de Semilla de Papa, Bolivia • **SESA** Servicio Ecuatoriano de Sanidad Agropecuaria, Ecuador • **SGRP** System-wide Genetic Resources Program, CGIAR • **SGUA** Support Group on Urgan Agriculture, Canada • **ShAAS** Shandong Academy of Agricultural Sciences, China • **SHDI** Self-Help Development International, Ethiopia • **SiAAS** Sichuan Academy of Agricultural Sciences, China • **SIDA** Swedish International Development Cooperation Agency • **SINITTA** Sistema Nacional de Investigación y Transferencia de Tecnología Agraria, Peru • **SITIOS** Servicios Inteligentes y Tecnologías Complejas Superiores Ltd, Bolivia • **SIUPA** Strategic Initiative on Urban and Peri-urban Agriculture • **SLART** Sociedad Latinoamericano de Raíces y Tubérculos, Peru • **SM-CRSP** Soil Management Collaborative Research Support Program, USA • **SNSA** Service national des statistiques agricoles, DR Congo • **SOCADIDO** Soroti Catholic Diocese Development Organization, Uganda • **S**okoine University of Agriculture, Tanzania • **S**outh China Agricultural University • **S**outh China Potato Center • **S**outhern Regional Agricultural Bureau, Ministry of Agriculture, Ethiopia • **S**outhwest Agricultural University, China • **SPG** Sociedad Peruana de Genética, Peru • SPI Smart Plant International, USA • **SPPC** Centro de Investigación de Semilla de Papa, Yemen • **S**ukarami Agricultural Technology Assessment Institute, Indonesia • **S**wedish University of Agricultural Sciences, Sweden • **SYNGENTA**, USA • **TAAS** Tianjing Academy of Agricultural Sciences, China • **TALPUY** Grupo de Investigación y Desarrollo de Ciencias y Tecnología Andina, Peru • **TARI** Taiwan Agricultural Research Institute • **TCA** Tarlac College of Agriculture, Philippines • **TCRC** Tuber Crops Research Centre, Bangladesh • **T**echnova Inc, Japan • **T**eso Community Development Project, Kenya • **TFNC** Tanzania Food and Nutrition Centre • **T**hai Nguyen University, Vietnam • **T**hang Binh District Agriculture and Rural Development Bureau, Vietnam • **T**he McKnight Foundation • The Sainsbury Laboratory, UK • **T**ibetan Academy of Agricultural and Animal Science, China • **TP4** Tim Petani Pemandu PHT Pengalengan, Indonesia • **UANRDEN** Urban Agriculture National Research, Development and Extension Network, Philippines • **U**gunja Community Resource Centre, Kenya • **UNDP** United Nations Development Programme • **UNEP** United Nations Environment Programme • **UNHAS** Hasanudin University, Indonesia • **UNIDO** United Nations Industrial Development Organization • **U**niversidad Austral, Chile • **U**niversidad Nacional de Cajamarca, Peru • **U**niversidad Católica de Santa Maria, Peru • **U**niversidad Central, Ecuador • **U**niversidad Central de las Villas, Cuba • **U**niversidad de Ambato, Ecuador • **U**niversidad de Caldas, Colombia • **U**niversidad de los Andes, Venezuela • **U**niversidad Federal Rio de Janeiro, Brazil • **U**niversidad Jorge Basadre Grohmann de Tacna, Peru • **U**niversidad Jujuy, Argentina • **U**niversidad Mayor de San Simón, Bolivia • **U**niversidad Nacional Agraria, Peru • **U**niversidad Nacional Daniel Alcides Carrión, Peru • **U**niversidad Nacional de Bogotá, Colombia • **U**niversidad Nacional de Cajamarca, Peru • **U**niversidad Nacional del Centro del Peru, Peru • **U**niversidad Nacional Hermilio Valdizan, Peru • **U**niversidad Nacional Mayor de San Marcos, Peru • **U**niversidad Nacional San Antonio Abad de Cusco, Peru • **U**niversidad Nacional San Cristóbal de Huamanga de Ayacucho, Peru • **U**niversidad Peruana Cayetano Heredia, Peru • **U**niversidad Politécnica del Ejército, Ecuador • **U**niversidad Privada Huánuco, Peru • **U**niversidad Ricardo Palma, Peru • **U**niversidad San Luis Gonzaga de Ica, Peru • **U**niversidad Tecnológica Equinocial, Ecuador • **U**niversity of Asmara, Eritrea • **U**niversity of Bangor, UK • **U**niversity of Birmingham, UK • **U**niversity of British Colombia, Canada • **U**niversity of California (Berkeley), USA • **U**niversity of California (Davis), USA • **U**niversity of Edinburgh, UK • **U**niversity of Georgia, USA • **U**niversity of Göttingen, Germany • **U**niversity of Hohenheim, Germany • **U**niversity of Kassel, Germany • **U**niversity of Kiel, Germany • University of Minnesota, USA • **U**niversity of Missouri, USA • **U**niversity of Nairobi, Kenya • **U**niversity of Naples, Italy • **U**niversity of New Brunswick, Canada • **U**niversity of Queensland, Australia • **U**niversity of the Philippines–Los Baños • **U**niversity of Tübingen, Germany • **U**niversity of Veszprem, Hungary • **U**niversity of Wisconsin, USA • **U**niversity of Yaounde, Cameroon • **UNSPPA** Uganda National Seed Potato Producers' Association, Uganda • **UPM** University Putra Malaysia • **UPWARD** Users' Perspectives with Agricultural Research and Development, Philippines • **USAID** United States Agency for International Development • **USDA** United States Department of Agriculture • **US** Potato Genebank, USA • **USVL** United States Vegetable Laboratory, USA • **VASI** Vietnam Agricultural Science Institute • **VECO/FADO**, Indonesia • **V**ietnamese–German Technical Cooperation Potato Promotion Project • **V**irginia Polytechnic Institute and State University, USA • **V**irus-free Potato Tubers and Cutting Production Centers of Yunnan Agricultural Department, China • **VISCA** Visayas State College of Agriculture, Philippines • **V**olcani Institute, Israel • **VSSP** Vegetable Seed and Seed Potato, Pakistan • **WE** World Education (and local partner NGOs) • **W**inrock International, Uganda • **W**orld Vision, Angola, Burundi, Kenya, Rwanda, Uganda, USA • **WRC** Wheat Research Centre, Bangladesh • **WUR** Wageningen University Research Centre, Netherlands • **XSPRC** Xuzhou Sweet Potato Research Center, China • **YPPP** Yemeni Plant Protection Project • **YPPSE** Foundation for Socio-Economic Development, Indonesia • **Y**unnan Agricultural University, China

Staff

CIP was forced to reduce its staff in 2002, as one of the measures to meet shortfalls in funding. As the members of the CIP community met with the demands of accommodating responsibilities and adjusting strategies to handle this downsizing, they also responded ably to the challenge of redoubling efforts in fundraising, thereby helping to achieve a more stable, financially secure base on which we can now move forward. All staff are thanked for their help in rising to this most difficult of challenges.

CIP's staff is comprised of a diverse group of highly qualified individuals with varied backgrounds and nationalities. This diversity is integrated into a coordinated effort to achieve a common goal: alleviate poverty and increase food security while protecting the earth's natural resource base. Each and every one of CIP's more than 400 employees worldwide, from scientists to clerical staff to field workers, contributes to this mission in the various functions they perform, and all form an essential part of CIP's working team. Because of space, we are not able to list all names in this Annual Report; nevertheless, we do recognize and greatly appreciate the efforts of all our staff.

Director General's Office

Director General—Hubert Zandstra
Mariella Altet, External Relations Manager
Gladys Neyra, Administrative Assistant
Deputy Director General for Corporate Development—Hector Hugo Li Pun
Marcela Checa, Administrative Assistant[2]
Amalia Lanatta, Administrative Assistant
María Inés Ríos, Business Development Associate[3]
Ana María Secada, Head, Travel Office
Haydée Zelaya, Administrative Assistant
Deputy Director General for Research—Wanda Collins[2]
Deputy Director General for Research—Pamela Anderson[1]
Carmen Dyer, Administrative Assistant
Bertha Ferreyros, Information System Analyst
Charlotte Lizárraga, Plant Pathologist, Assistant Coordinator, GILB
Lilia Salinas, Administrative Assistant
Director for International Cooperation—Roger Cortbaoui
Ruth Arce, Administrative Assistant[2]
Rosario Marcovich, Bilingual Secretary

Finance and Administration

Human Resources
Lucas Reaño, Human Resources Manager
Janneth Carballido, Compensation and Benefits Assistant[2]
Mónica Ferreyros, Auxiliary Services Supervisor
Sor Lapouble, Auxiliary Services Assistant
Gicela Olivera, Organization and Methods Assistant
Estanislao Pérez, Compensation and Benefits Assistant[2]
Martha Piérola, Social Worker, Supervisor
Lucero Schmidt, Nurse
María Amelia Távara, Bilingual Secretary
Yoner Varas, Compensation and Benefits Assistant
Logistics and General Services
Aldo Tang, Logistics and General Services Manager
Pilar Bernui, Bilingual Secretary
Silvia Córdova, Bilingual Secretary
Hugo Davis, Vehicle Maintenance Officer
Ximena Ganoza, Purchasing Supervisor
Atilio Guerrero, Vehicle Programmer
Jorge Locatelli, Security Supervisor
Jorge Luque, Warehouse Supervisor
Antonio Morillo, Maintenance Supervisor
José Pizarro, Purchasing Supervisor[2]
Gloria Solís, Administrative Assistant

Office of the Chief Financial Officer

Carlos Alonso, Chief Financial Officer
Martina Solís-Rosas, Bilingual Secretary
Accounting Unit
Miguel Saavedra, General Accountant
Eliana Bardalez, Senior Accountant[2]
Edgardo de los Ríos, Senior Accountant
Andrés García, Assistant Accountant
Denise Giacoma, Supervisor
Rodmel Guzmán, Assistant Accountant
Willy Hermoza, Assistant Accountant[1]
Blanca Joo, Accountant[2]
Eduardo Peralta, Accountant
Katrina Roper, Bilingual Secretary[2]
César Tapia, Assistant Accountant
Budget Unit
Alberto Monteblanco, Senior Accountant
Treasury Unit
Lenny Guazzotti, Treasury Assistant[2]
Milagros Patiño, Treasurer
Sonnia Solari, Chief Cashier

Crop Improvement and Genetic Resources Department

Merideth Bonierbale, Senior Potato Breeder, Head*
Walter Amorós, Agronomist, Research Associate
Carlos Arbizu, Andean Crops Specialist[3]
Hyun-Mook Cho, Potato Breeder[1]
Enrique Chujoy, Geneticist*
Stefan De Haan, Potato Breeder and Agronomist[1]
Ramzy El-Bedewy, Plant Breeder (CIP-Nairobi)[2]
Nelly Espinola, Nutritionist, Research Associate[3]
Anne Forbes, Plant Breeder, Associate Scientist (CIP-Quito)[2]
Marc Ghislain, Molecular Biologist
Michael Hermann, Andean Crops Specialist*
Miguel Holle, Andean Crops Coordinator[2]
Sven Jacobsen, Plant Breeder[2]

Regina Kapinga, Sweetpotato Breeder (CIP-Kampala)
Juan Landeo, Plant Breeder*
Rafael Mora, Visiting Scientist[1]
Carlos Ochoa, Taxonomist, Scientist Emeritus
William Roca, Plant Cell Physiologist*
Alberto Salas, Agronomist, Research Associate
Asep Setiawan, Sweetpotato Breeder (CIP-Bogor)
Mahesh Upadhya, Plant Breeder, Visiting Principal Scientist ad honorum[2]
Dapeng Zhang, Plant Breeder, Bioinformatics Unit Head*

Sammy Agili, Sweetpotato Breeder, Research Assistant (CIP-Nairobi)
Jairo Aginyah, Potato Breeder, Research Assistant (CIP-Nairobi)
Mercedes Ames, Biologist, Research Assistant[3]
Ciro Barrera, Plant Pathologist, Research Assistant[2]
Ida Bartolini, Biochemist, Research Assistant
Carolina Bastos, Research Assistant[3]
Jorge Benavides, Biologist, Research Assistant
Gabriela Burgos, Biologist, Research Assistant[3]
Rolando Cabello, Agronomist, Research Assistant
Giselle Cipriani, Biologist, Research Assistant[2]
Wilmer Cuéllar, Biologist, Research Assistant[2]
Lorena Danessi, Bilingual Secretary
Silvia de la Flor, Bilingual Secretary[=]
Felipe de Mendiburu, Statistician, Research Assistant
Luis Díaz, Agronomist, Research Assistant
Jorge Espinoza, Agronomist, Research Assistant[3]
Rosario Falcón, Biologist, Research Assistant
Manuel Gastelo, Agronomist, Research Assistant
René Gómez, Agronomist, Research Assistant
Enrique Grande, Technician
María Luisa Guevara, Biologist, Research Assistant[2]
Carmen Herrera, Biologist, Research Assistant[2]
María del Rosario Herrera, Biologist, Research Assistant
Oscar Hurtado, Research Assistant[2]
Fedora Itabashi, Systems Analyst, Research Assistant[2]
Philip Kiduyu, Technician, Plant Quarantine Station (CIP-Nairobi)
Mariana Martin, Bilingual Secretary
Iván Manrique, Research Assistant
Isabel Mel, Bilingual Secretary
Elisa Mihovilovich, Biologist, Research Assistant
María Cecilia Miki, Research Assistant[2]
Sam Namanda, Potato Breeder/Pathologist, Research Assistant (CIP-Kampala)
George Ngundo, Chief Technician, Plant Quarantine Station (CIP-Nairobi)
Luis Ñopo, Biologist, Research Assistant
Matilde Orrillo, Biologist, Research Assistant
Ana Luz Panta, Biologist, Research Assistant
Giovana Perazzo, Biologist, Research Assistant[2]
Leticia Portal, Biologist, Research Assistant[3]
Daniel Reynoso, Agronomist, Research Assistant
Flor de María Rodríguez, Research Assistant[2]
Genoveva Rossel, Research Assistant[3]
Rosa Salazar, Bilingual Secretary
Reinhard Simon, Visiting Scientist (University of Jena, Germany)
Tjintokohadi, Research Assistant (CIP-Bogor)
Judith Toledo, Biologist, Research Assistant[2]
Andrés Valladolid, Plant Breeder, Research Assistant[2]
Fanny Vargas, Agronomist, Research Assistant

Crop Protection Department

Luis Salazar, Virologist, Principal Scientist, Head
Nicole Adler, Plant Pathologist (CIP-Quito)
Jesús Alcázar, Agronomist, Research Associate
Gregory Forbes, Plant Pathologist*
Edward French, Scientist Emeritus
Segundo Fuentes, Plant Pathologist, Research Associate
Upali Jayasinghe, Virologist (CIP-Bogor)[2]
Magnus Kuhne, Entomologist, Associate Scientist
Aziz Lagnaoui, Entomologist*
Berga Lemaga, Agronomist, PRAPACE Coordinator (CIP-Kampala)[3]
Modesto Olanya, Pathologist (CIP-Nairobi)[2]
María Palacios, Biologist, Research Associate[2]
Sylvie Priou, Bacteriologist
Lod J Turkensteen, Adjunct Scientist (based in Netherlands)
Elske van de Fliert, IPM Specialist (CIP-Bogor)
Yi Wang, Plant Physiologist, Liaison Scientist (CIP-Beijing)
Ednar Wulff, Molecular Plant Pathologist

Pedro Aley, Plant Pathologist, Research Assistant[3]
Mónica Blanco, Bilingual Secretary
Verónica Cañedo, Biologist, Research Assistant
Maria Gabriela Chacón, Pathologist, Research Assistant (CIP-Quito)
Carlos Chuquillanqui, Agronomist, Research Assistant
Violeta Flores, Biologist, Research Assistant[2]
Soledad Gamboa, Biologist, Research Assistant
Govinda Guevara, Plant Pathologist, Research Assistant (CIP-Quito)
Liliam Gutarra, Agronomist, Research Assistant
Francisco Jarrín, Pathologist, Research Assistant (CIP-Quito)
Joseph Mudiope, Entomologist, Research Assistant (DFID-CRF Project, Soroti) (CIP-Kampala)[3]
Norma Mujica, Agronomist, Research Assistant
Giovanna Muller, Biologist, Research Assistant
Ricardo Orrego, Agronomist, Research Assistant
Wilmer Pérez, Plant Pathologist, Research Assistant
Karina Petrovich, Bilingual Secretary[2]
Magnolia Santa Cruz, Biologist, Research Assistant
Ana María Taboada, Biologist, Research Assistant[2]
Jorge Tenorio, Biologist, Research Assistant
Roger Torres, Research Assistant[3]
Alcira Vera, Biologist, Research Assistant
Warsito Tantowijoyo, Entomologist, Research Assistant (CIP-Bogor)
Julia Zamudio, Bilingual Secretary
Octavio Zegarra, Biologist, Research Assistant

Production Systems and Natural Resource Management Department

Roberto Quiroz, Land Use Systems Specialist, Head*
Sreekanth Attaluri, Sweetpotato Scientist (CIP-Delhi)[1]
Walter Bowen, Soil Scientist (IFDC) (CIP-Quito)[2,4]
Coen Bussink, Geographic Information Scientist
Hector Cisneros, Coordinator CONDESAN[1,*]
André Devaux, Agronomist, Coordinator, Andean Potato Project (Papa Andina, Peru)
Fernando Ezeta, Agronomist, CIP-LAC Regional Representative
Alberto Gonzáles, Phytopathologist, Research Associate[2]
Vital Hagenimana, Food Scientist (NRI) (CIP-Nairobi)[2,4]
Robert Hijmans, Geographic Information Scientist[2]
Sarath Ilangantileke, Postharvest Specialist, CIP-SWA Regional Representative (CIP-Delhi)
M S Kadian, Agronomist (CIP-Delhi)
Berhane Kiflewahid, ASARECA/CIP, Coordinator, Technology Transfer Project (CIP-Nairobi)[2,3]
Carlos León-Velarde, Animal Production Systems Specialist (ILRI)[4]
Elias Mujica, Anthropologist, Adjunct Scientist, CONDESAN[3]
P K Mukherjee, Sweetpotato Scientist (CIP-Delhi)[2]

Manuel Araujo, Research Assistant[1,2]
Sushma Arya, Accountant/Program Coordinator (CIP-Delhi)
Guillermo Baigorria, Climatologist, Research Assistant
Carolina Barreda, Agronomist, Research Assistant[3]
Jimena Bazoalto, Research Assistant[3]
Ghanashyam Bhandari, Accountant (CIP/SDC Project, Kathmandu)[3]
Musuq Briceño, Research Assistant[3]
Paola Campodónico, Bilingual Secretary[2]
Mariana Cruz, Biologist, Research Assistant[3]
Raúl Jaramillo, Soil Scientist, Research Assistant (CIP-Quito)[2]
Jose Jiménez, Computer Systems Specialist (CIP-Quito)
Henry Juárez, Agronomist, Research Assistant
María de los Angeles Laura, Bilingual Secretary, CONDESAN[3]
Kurt Manrique, Agronomist, Research Assistant[3]
Atif Manzoor, Accountant (CIP/SDC Project, Islamabad)[3]
L Mony, Secretary (CIP-Delhi)
Ana María Ponce, InfoAndina, CONDESAN[3]
Yasmín Raygada, Bilingual Secretary[1]
Zareen Siddiqi, Secretary (CIP/SDC Project, Islamabad)[3]
Fannia Virginia Suri, Seed Technologist, Research Assistant (CIP-Bogor)[2]
Ivonne Valdizán, Bilingual Secretary[3]
Siny Varughese, Program Associate (Publications and Documentation) (CIP-Delhi)
Percy Zorogastúa, Research Assistant

Social Sciences Department

Thomas Walker, Economist, Principal Scientist, Head*[2]
Thomas Bernet, Economist, Swiss Associate Expert[3]
Dindo Campilan, Sociologist, UPWARD Coordinator (CIP-Los Baños)
Charles Crissman, Economist, CIP-SSA Regional Representative (CIP-Nairobi)*
Rubén Darío Estrada, Natural Resources Economist (SDC Mountain Agriculture) (based at CIAT)[4]
Peter Ewell, Economist, CIP-SSA Regional Representative (CIP-Nairobi)[2]
Keith Fuglie, Agricultural Economist, CIP-ESEAP Regional Representative (CIP-Bogor)*
Diana Lee-Smith, Urban Agricultural Research and Development Coordinator for SSA (CIP-Nairobi)[1]
Oscar Ortiz, Special Project Coordinator
Gordon Prain, Social Anthropologist, SIUPA Coordinator*
Sonia Salas, Food Technologist, Research Associate
Steve Sherwood, Training Specialist (CIP-Quito)[2]
Graham Thiele, Participatory Technology Development Specialist, Andean Potato Project (CIP-Quito)[3]
David Yanggen, Agricultural Economist, Associate Scientist (Montana State University)[4]
Regula Zuger Caceres, Agricultural Economist

Jairo Anginyah, Potato Breeder, Research Assistant (CIP-Nairobi)
Mylene Aquino, Secretary, UPWARD (CIP-Los Baños)
Rini Asmunati, Socioeconomist, Research Assistant (CIP-Bogor)
Cherry Leah Bagalanon, Human Ecologist, UPWARD Program Associate (CIP-Los Baños)[2]
Carlos Basilio, Soil Science Specialist, UPWARD Research Fellow (CIP-Los Baños)
Lorna Belulia, UPWARD Accountant (CIP-Los Baños)[2]
Raúl Boncodin, Botanist, UPWARD Program Associate (CIP-Los Baños)
Patricio Espinoza, Agricultural Economist, Research Associate (CIP-Quito)
Cristina Fonseca, Agronomist, Research Assistant
Toteng Hidayat, Facilities Manager (CIP-Bogor)
Elijah Igunza, Administrative Assistant (CIP-Nairobi)
Dessy Kusbandi, Executive Secretary (CIP-Bogor)
Sukendra Mahalaya, Research and Information Management Officer (CIP-Bogor)
Luis Maldonado, Economist, Research Assistant
Ana Luisa Muñoz, Bilingual Secretary
Rosemary Muttungi, Secretary (CIP-Nairobi)
Mayette Nadal, Secretary, UPWARD (CIP-Los Baños)
Kusye Nawawi, Accountant (CIP-Bogor)
Emily Ndoho, Secretary (CIP-Nairobi)
Mary Njenga, Research Assistant, SIUPA (CIP-Nairobi)[1]
Alice Njoroge, Secretary (CIP-Nairobi)
Simon Obaga, Accounts Clerk (CIP-Nairobi)
Lorna Sister, Socioeconomist, UPWARD Research Fellow (CIP-Los Baños)
Víctor Suárez, Statistics Assistant
Zandra Vásquez, Bilingual Secretary
Caecilia Afra Widyastuti, Rural Sociologist, Researcher (CIP-Bogor)[2]
Yuan Jun Yang, Administrative Assistant (CIP-Beijing)
Pei Zhou, Secretary/Accountant (CIP-Beijing)

Communication and Public Awareness Department

Christine Graves, Head
John Stares, Managing Editor, Head of Publications Unit[2]
Candelaria Atalaya, Photographer[2]
Mariella Corvetto, Communication Services Coordinator
Ruth Delgado, Exhibits/Display Assistant
Nini Fernández-Concha, Graphic Designer
Milton Hidalgo, Graphic Designer
Cecilia Lafosse, Chief Designer
Godofredo Lagos, Print Chief[2]
Maria Elena Lanatta, Administrative Assistant
Paul Moncada, Webmaster
Anselmo Morales, Graphic Designer
Zoraida Portillo, Spanish Writer/Editor
Alfredo Puccini, Graphic Designer

Training Department

Patricio Malagamba, Head
Gisella Canessa, Training Liaison Officer[2]
Edda Echeandía, Multimedia Developer
Martha Huanes, Training Coordinator
Mercedes Suito, Bilingual Secretary

Library and Bookshop

Cecilia Ferreyra, Head Librarian
Rosa Ghilardi, Bilingual Secretary
Griselda Lay, Library Assistant
Félix Muñoz, Distribution Assistant[2]
Glenda Negrete, Library Assistant[2]

Information Technology Unit

Anthony Collins, Head
Liliana Bravo, Server Administrator
Andrea Cáceres, Systems Development Support
Oscar Carmelo, Helpdesk Administrator[2]
Moisés Fernández, Systems Analyst, Database Administrator[2]
Erika Orozco, Server Administrator
Dante Palacios, Systems Support
Giancarlo Rodríguez, Systems Support
Saúl Rodriguez, Web Systems Analyst
Edgardo Torres, Systems Development Administrator
Alberto Vélez, Systems and Network Administrator
Roberto del Villar, Maintenance Administrator
Diana Zevallos, Administrative Systems Analyst[3]

Field Research Support

Víctor Otazú, Head
César Aguilar, Agronomist, Field/Greenhouse Supervisor, Research Assistant (San Ramón)[2]
Magaly Aspiazu, Administrative Assistant (Santa Catalina) (CIP-Quito)
Susana Barriga, Accountant (Santa Catalina) (CIP-Quito)
Roberto Duarte, Agronomist, Field/Greenhouse Supervisor (La Molina)
Hugo Goyas, Agronomist, Field/Greenhouse Supervisor (Huancayo)
Carmen Lara, Secretary
Ricardo Rodriguez, Agronomist, Field/Greenhouse Supervisor (Santa Catalina) (CIP-Quito)[2]

* Project leader
1 Joined CIP in 2002
2 Left CIP in 2002
3 Funded by special project
4 Joint appointment
= Died 2002

Global contact points

CIP's main contact points are listed below. For more details, please contact the International Cooperation Office at the CIP Headquarters address below, or by email: cip-international-cooperation@cgiar.org.

CIP Headquarters

International Potato Center (CIP)
Avenida La Molina 1895, PO Box 1558
Lima 12, Peru
Tel: +51 1 349 6017
Fax: +51 1 317 5326
email: cip@cgiar.org
Website: www.cipotato.org

Latin America and the Caribbean (LAC)

Regional Office
(same address, telephone and fax as CIP headquarters)
All regional matters except Peru
Contact: Roger Cortbaoui
Director for International Cooperation
email: cip-international-cooperation@cgiar.org
Peru
Contact: Hugo Li-Pun
Deputy Director General for Corporate Development
email: cip-ddg-cd@cgiar.org

Ecuador Liaison Office
International Potato Center
Santa Catalina Experimental Station
Km 147.5 Panamericana Sur
Sector Cutuglagua Canton Mejía
Apartado 17-21-1977
Quito, Ecuador
Tel: +593 2 2690 362/363/923
Fax: +593 2 2692 604
email: cip-quito@cgiar.org
Website: www.quito.cipotato.org
Contact: Graham Thiele, Liaison Scientist

Sub-Saharan Africa (SSA)

Regional Office
International Potato Center
PO Box 25171
Nairobi 00603, Kenya
Tel: +254 20 632 054
Fax: +254 20 630 005/631 559
email: cip-nbo@cgiar.org
Contact: Charles Crissman, SSA Regional Representative

Uganda Liaison Office
International Potato Center
c/o PRAPACE (see address below)
email: r.kapinga@cgiar.org or r.kapinga@infocom.co.ug
Contact: Regina Kapinga, Liaison Scientist

South, West, and Central Asia (SWCA)

Regional Office
International Potato Center
c/o IARI Campus, Pusa
New Delhi 110012, India
Tel: +91 11 2585 0201/2582 3437
Fax: +91 11 2573 1481
email: cip-delhi@cgiar.org
Contact: Sarath Ilangantileke, SWA Regional Representative

East and Southeast Asia and the Pacific (ESEAP)

Regional Office
International Potato Center
Kebun Percobaan Muara
Jalan Raya Ciapus
Bogor 16610, Indonesia
Tel: +62 251 317 951
Fax: +62 251 316 264
email: cip-bogor@cgiar.org
Website: www.eseap.cipotato.org
Contact: Keith Fuglie, ESEAP Regional Representative

China Liaison Office
International Potato Center
c/o The Chinese Academy of Agricultural Sciences
Zhong Guan Cun South Street 12
West Suburbs of Beijing
Beijing, People's Republic of China
Tel: +86 10 6897 5504
Fax: +86 10 6897 5503
email: cip-china@cgiar.org
Contact: Yi Wang, Liaison Scientist

Global, Regional and Systemwide Initiatives

Andean Potato Project–Papa Andina
Peru
(same address, telephone and fax as CIP headquarters)
email: papa-andina@cgiar or a.devaux@cgiar.org or g.thiele@cgiar.org
Website: www.cipotato.org/papandina
Contact: André Devaux, Project Coordinator

Ecuador
(same address, telephone and fax as Ecuador Liaison Office)
email: g.thiele@cgiar.org
Contact: Graham Thiele

CONDESAN–Consortium for the Sustainable Development of the Andean Ecoregion
(same address, telephone and fax as CIP headquarters)
email: condesan@cgiar.org
Website: www.condesan.org
Contact: Héctor Cisneros, Coordinator

GILB–Global Initiative on Late Blight
(same address, telephone and fax as CIP headquarters)
email: gilb@cgiar.org
Website: www.cipotato.org/gilb
Contact: Gregory Forbes, GILB Coordinator

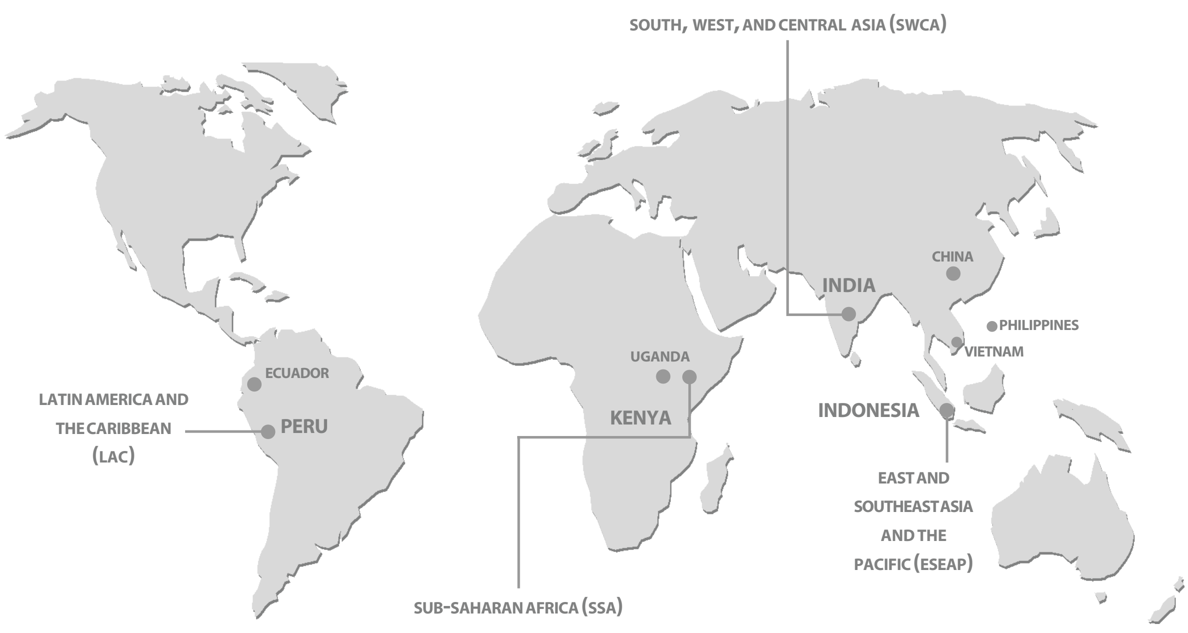
GMP–Global Mountain Program
(same address, telephone and fax as CIP headquarters)
email: r.quiroz@cgiar.org
Contact: Roberto Quiroz, Program Coordinator

PRAPACE–Regional Potato and Sweetpotato Improvement Program for East and Central Africa
Plot 106, Katalima Road, Naguru
PO Box 22274
Kampala, Uganda
Tel: +256 41 286 209
Fax: +256 41 286 947
email: prapace@infocom.co.ug or berga@imul.com
Contact: Berga Lemaga, PRAPACE Coordinator

SIUPA–CGIAR Strategic Initiative on Urban and Peri-urban Agriculture
(same address, telephone and fax as CIP headquarters)
email: g.prain@cgiar.org
Contact: Gordon Prain, SIUPA Coordinator

UPWARD–Users' Perspectives with Agricultural Research and Development
c/o IRRI
DAPO 7777
Metro Manila, Philippines
For courier: PCARRD Complex
Los Baños, Laguna, 4030 Philippines
Tel: +63 49 536 0235
Fax: +63 49 536 1662
email: cip-manila@cgiar.org
Website: www.eseap.cipotato.org/upward
Contact: Dindo Campilan, UPWARD Coordinator

CIP IN THE WORLD

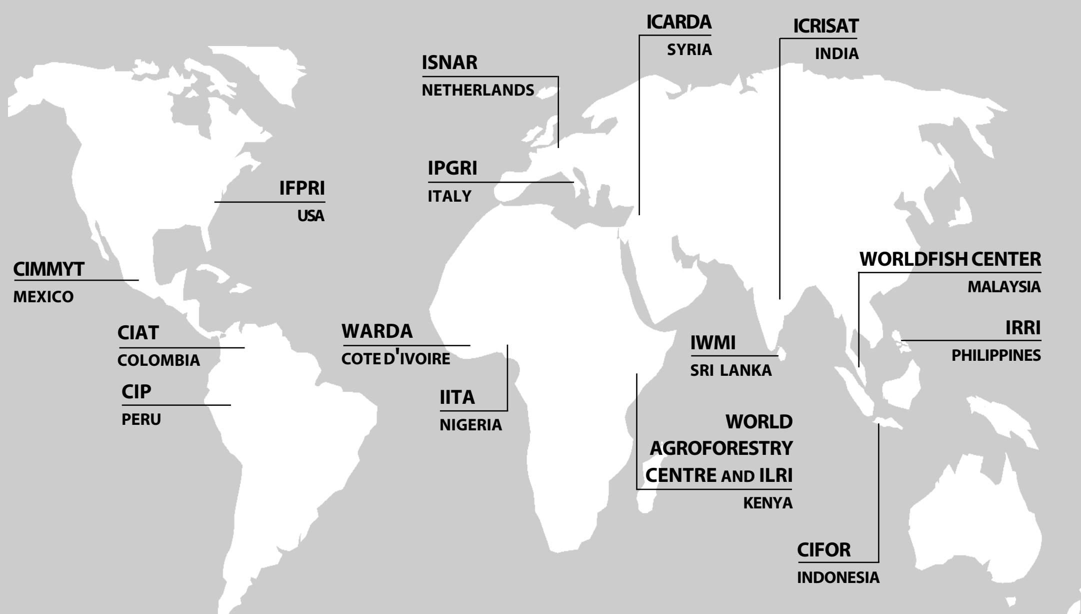


Future Harvest

CIP is one of 16 food and environmental research organizations known as the Future Harvest Centers. The centers, located around the world, conduct research in partnership with farmers, scientists, and policy makers to help alleviate poverty and increase food security while protecting the natural resource base. The Future Harvest Centers are principally funded through the 58 countries, private foundations, and regional and international organizations that make up the Consultative Group on International Agricultural Research (CGIAR).

In 1998 the Centers, supported by the CGIAR, created Future Harvest as a charitable and educational organization designed to advance the debate on how to feed the world's growing population without destroying the environment, and to catalyze action for a world with less poverty, a healthier human family, well-nourished children, and a better environment. Future Harvest reaches out to media, academics, scholars, and scientists in the world's premier peace, environment, health, population, and development research organizations, as well as to policy makers and civil society, and it enlists world-renowned leaders to speak on its behalf. Future Harvest raises awareness and support for research, promotes partnerships, and sponsors on-the-ground projects that bring the results of research efforts to farmers' fields in Africa, Asia, and Latin America. For more information visit www.futureharvest.org or www.cgiar.org

Future Harvest Centers



CIAT	**C**entro Internacional de Agricultura Tropical
CIFOR	**C**enter for International Forestry Research
CIMMYT	**C**entro Internacional de Mejoramiento de Maíz y Trigo
CIP	**C**entro Internacional de la Papa
ICARDA	**I**nternational Center for Agricultural Research in the Dry Areas
ICRISAT	**I**nternational Crops Research Institute for the Semi-Arid Tropics
IFPRI	**I**nternational Food Policy Research Institute
IITA	**I**nternational Institute of Tropical Agriculture
ILRI	**I**nternational Livestock Research Institute
IPGRI	**I**nternational Plant Genetic Resources Institute
IRRI	**I**nternational Rice Research Institute
ISNAR	**I**nternational Service for National Agricultural Research
IWMI	**I**nternational Water Management Institute
WARDA	**W**est Africa Rice Development Association
	World Agroforestry Centre
	WorldFish Center

CREDITS

Editor

Christine Graves

Writers

Christine Graves, Ed Sulzberger, Lisa Wing

Copy editor/proof reader

Anne Moorhead

Production coordinator

Cecilia Lafosse

Design and layout

Nini Fernández-Concha

Contributors

Carlos Alonso, Mariella Altet, Pamela Anderson, John Antle, Meredith Bonierbale, Rolando Cabello, Dindo Campilan, Roger Cortbaoui, Charles Crissman, André Devaux, Adel El-Beltagy, Nelly Espinola, Fernando Ezeta, Greg Forbes, Marc Ghislain, Sarath Ilangantileke, Regina Kapinga, Seyfu Ketama, Aziz Lagnaoui, Juan Landeo, Diana Lee-Smith, Berga Lemaga, Hugo Li Pun, Charlotte Lizarraga, Gordon Prain, Ji Qiumei, Roberto Quiroz, Lucas Reaño, Willy Rocca, Luis Salazar, Sonjia J. Scheffer, G. Edward Schuh, Maria Scurrah, Merle Shepard, Nyima Tashi, Graham Thiele, Elske van de Fliert, Surendra Varma, Hubert Zandstra, Haydée Zelaya, Dapeng Zhang, Regula Zuger

Photo credits: Front cover: C. Atalaya • 11, 19 (top), 32/33, 45, 46, 49, 50, 51, 57 C. Crissman • 12, 78 (right), 79 (left) D. Lee-Smith • 14, 42 A. Balaguer • 19 (bottom), 64 R. Kapinga • 21, 22, 23, 67 E. van de Fliert • 25 E. van de Fliert/W. Tantowijoyo • 27, 29, 30, 31 Ji Qiumei/Nyima Tashi • 32 S. Sherwood • 35, 40 (both), 59, 80 (right), 81 (right) CIP archives • 36/37 CIP GIS unit • 41 W. Perez • 48 R. Cabello • 61, 62 A. Devaux • 66 D. Campilan • 68, 68/69 C. de Guzman • 71 O. Hidalgo • 72 S. Ilangantileke • 77 H. Matos (INIA) • 78 (left), 87 C. Atalaya • 79 (right) G. Perazzo • 80 (left) D. Solorzano • 81 (left) Instituto de Fitoterapia Americano • 82 N. Espinola • 88 P. Baca