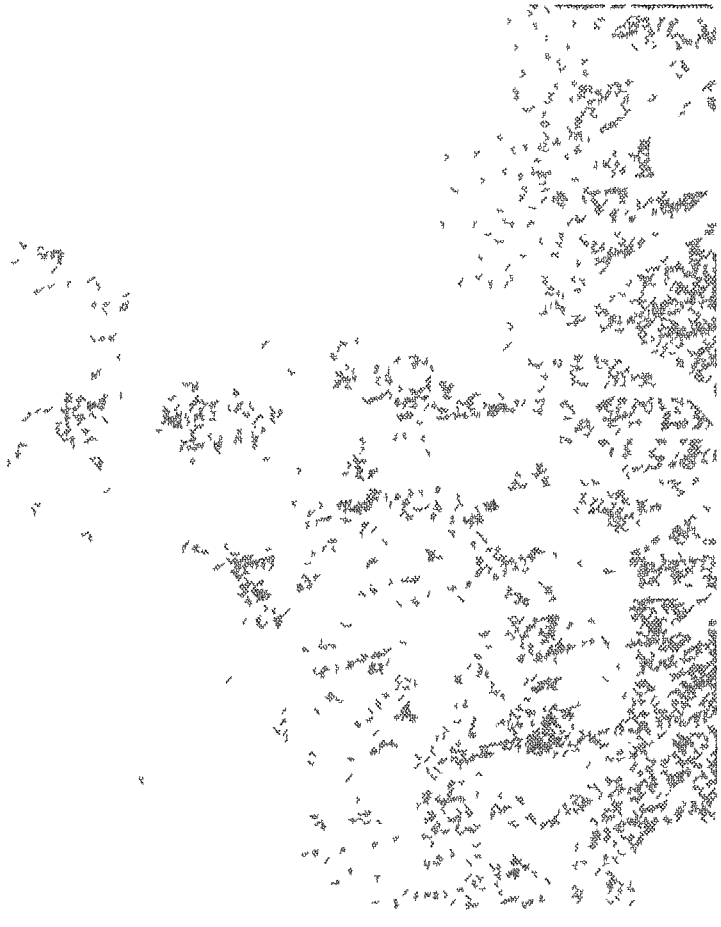
PN-ACD-682

International Potato Center
ANNUAL REPORT

CIP in 1997

International Potato Center Annual Report



BEST AVAILABLE COPY

International Potato Center
Av La Universidad 795 La Molina
Apartado 1558
Lima 12, Peru
E mail cip@cgnet com
On line at http //www cipotato org

CIP 1998
CIP in 1997
International Potato Center Annual Report
Lima Peru

ISSN 0256 6311
Press run 2 500
May 1998

Contents

A Year to Remember	4
El Niño A Dress Rehearsal for Global Warming?	6
Virus Cleanup Boosts Chinese Sweetpotato Production	10
Getting the Numbers Right	12
Milestone Reached in Bacterial Wilt Research	13
Integrated Control of Bacterial Wilt Paying Off in East Africa	14
Late Blight Project Initiated a Year Early, Damage Reports Increasing	16
Genotype X Environment	19
Biotechnology Speeds New Potato Development	21
Brazil Achieves Seed Self-Sufficiency	24
Producing Pesticide-Free Sweetpotatoes	26
TPS Hybrid May Eliminate Need for Seed Tubers	28
Breeding Deep-Rooted Potatoes	30
1997 Briefs	31
Board of Trustees	32
Donor Contributions in 1997	33
Finance and Administration	34
Staff in 1997	36
Selected Scientific Publications 1997	41
Research in 1997	44
Training in 1997	50
Research Partners	53
CIP's Global Contact Points	56
The Consultative Group on International Agricultural Research	58

A Year to Remember

The child shown in the photograph on the following page is symbolic of millions of poor people in developing countries who benefit from CGIAR research on root and tuber crops For producers and consumers, new root and tuber crop technologies represent alternatives for achieving food security and protecting the environment, both at an affordable price

This fact was underscored by a 1997 study that showed potatoes and sweetpotatoes account for a considerably greater percentage of the food grown in developing countries than was previously believed According to the study, produced by a CGIAR intercenter working group, annual growth rates for potato now stand at a remarkable 4% and show no sign of slowing down

Negative predictions for sweetpotato also appear to have missed the mark Not only is sweetpotato production increasing, production is taking place in some of Asia and Africa's poorest regions CIP scientists believe that with additional improvements, it will be possible to use sweetpotato for a greater number of industrial uses, thus creating a stronger and more lucrative market for farmers The use of sweetpotato for feeding animals may also relieve the pressure on the international grain market and possibly even stabilize the prices paid by developing countries for food and feed

To sustain these advances, however, will require continued technological innovation through research and training, along with stronger scientific partnerships An example of the type of effort that will be needed can be found on page 10 of this report Entitled *Virus Cleanup Boosts Chinese Sweetpotato Production,* the story describes how a brokered technol ogy developed in industrialized countries was adapted to developing world conditions and extended through one of CIP's training programs to low income farmers in China In this instance a tissue culture technique, well-known in the United States and Europe for controlling virus diseases, was used to boost sweetpotato production on an estimated 300,000 hectares CIP economists believe that the technology, which is currently being extended to other sweetpotato producing regions in China, may eventually account for the Center's single greatest impact in developing countries

The example of a brokered technology extended through CIP underscores the importance of maintaining strong relationships with a variety of partners It also demonstrates how it is possible for research centers such as CIP–all of which have limited resources–to provide investors with broad impact that meets CGIAR goals for productivity, sustainability, equity, and environmental friendliness The importance of such partnerships was further underlined this past year by El Niño

In Peru, CIP collaborated with the Ministry of Agriculture to alert farmers to the dangers of the El Niño and to provide technological options for dealing with major shifts in temperature and rainfall By all accounts, the 1997-98 El Niño created near-perfect conditions for late blight infection in the high Andes and may have helped to spread more virulent forms of the disease The virtual collapse of a CIP developed Peruvian potato cultivar (see page 20) high lights the dangers involved in dependence on just a few major cultivars and underscores the need for clones with more durable resistance Happily, field trials of the Center's second generation of late blight-resistant materials showed considerable promise during the year As a

result, the chances of achieving durable resistance that can be applied in a range of different environments appears to be better than at any time in recent years

Even so, improved varieties cannot be expected to do the job on their own In the future, farmers will need to combine the planting of disease-resistant cultivars with sound management techniques, a practice known as integrated disease management (IDM) IDM is now a major element of CIP's late blight work It is being pursued in cooperation with a variety partners, including many of the agencies working under the umbrella of the Global Initiative on Late Blight (GILB)

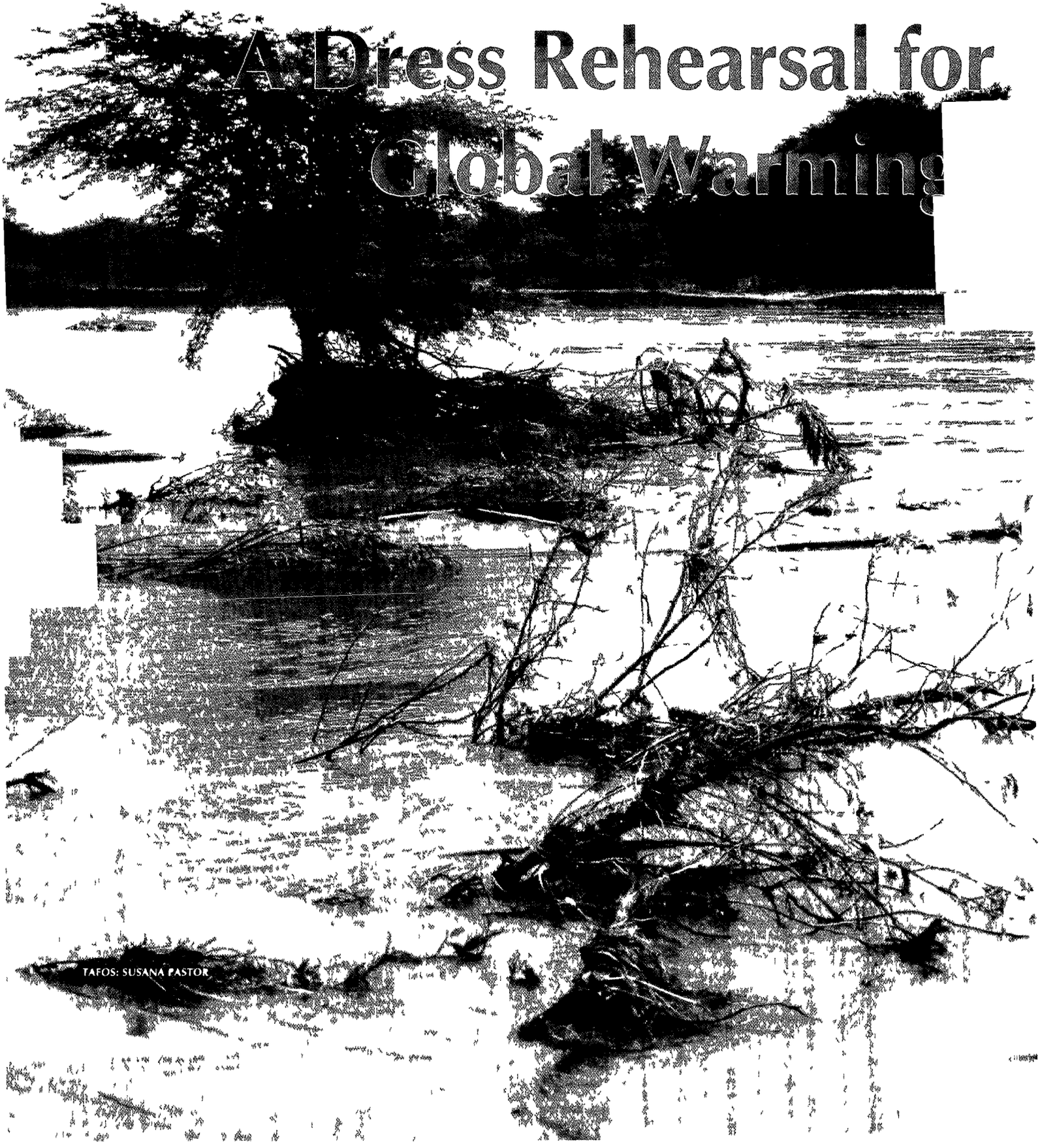
Through GILB, CIP is working to increase scientist-to scientist interaction and make better use of existing resources The first genotype by environment study involving a root and tuber crop, for example, will be generating results in 1998 with the cooperation of scientists in eight countries It is a striking example of how researchers, by pooling funds, facilities, and talent, can tackle a global problem that would have been beyond their individual resources

To achieve this type of integration across all elements of our research agenda, Center scientists worked throughout 1997 to put the final touches on the Center's project based man agement structure The new system, which is fully supported by our on-line project budgeting system and newly developed CIP management information software, is designed to bring greater focus to our research priorities and stimulate innovation by giving greater flexibility and responsibility to scientists on the front line

Starting in 1998, the new system puts day to day control of project funds and operations in the hands of some of our youngest and most capable researchers It should also help to create a broader base of research managers needed to tackle the difficult problems that lie ahead While it is too soon to show practical results early indications are that the system is stimulat ing innovation and new research partnerships If the experience of 1997 is any guide, innovation and partnership must go hand in hand if we are to achieve food security and environmental goals at affordable prices

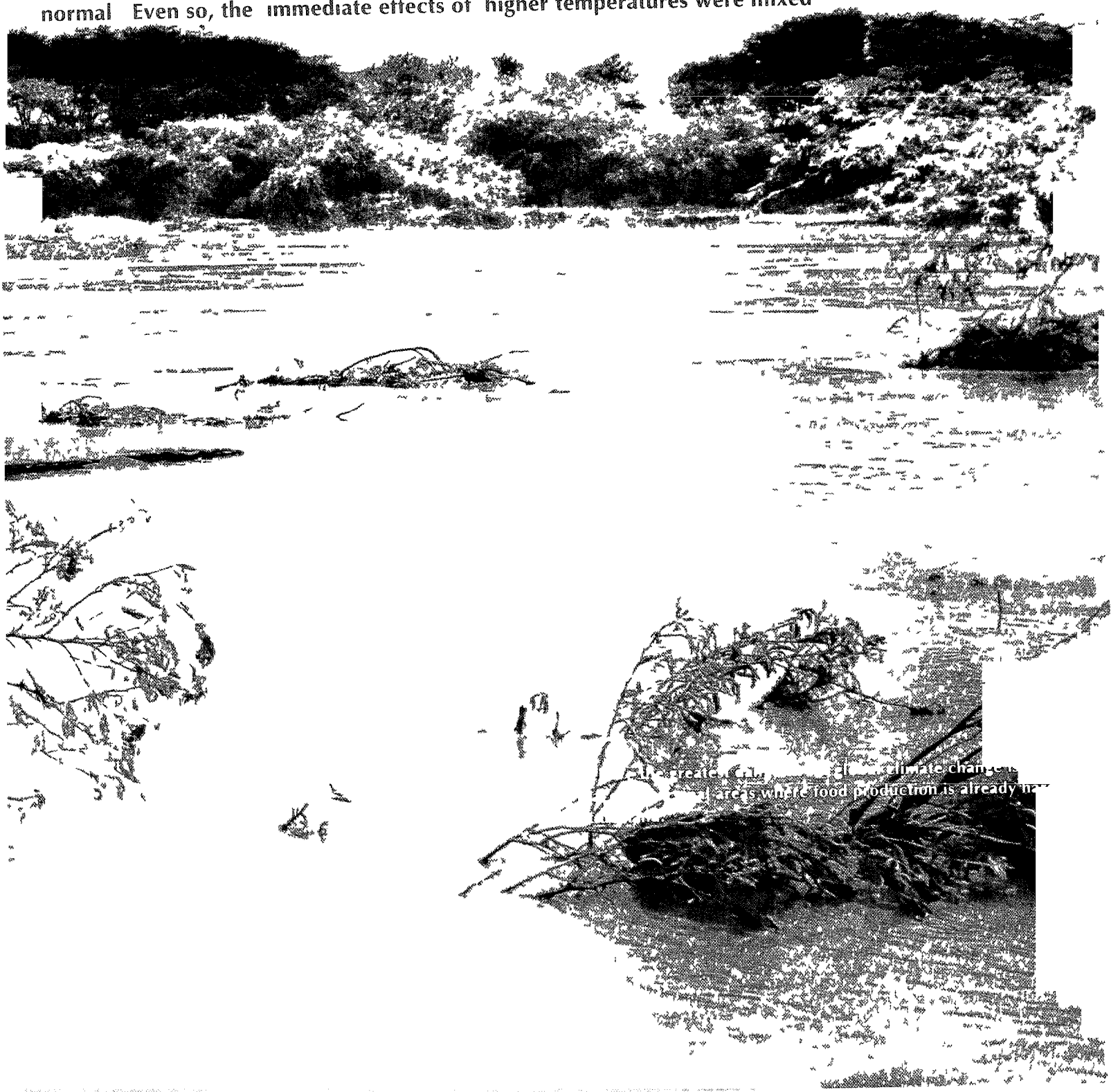
Hubert Zandstra
Director General

El Niño: A Dress Rehearsal for Global Warming



TAFOS: SUSANA PASTOR

In certain ways 1997-98 El Niño may be remembered as a dress rehearsal for global warming Along Peru's coastal desert, directly adjacent to the center of the El Niño phenomenon, farmers produce potatoes during the winter growing season and sweetpotatoes year-round This year temperatures were 3 to 5 degrees above normal Even so, the immediate effects of higher temperatures were mixed



El Niño: A Dress Rehearsal for Global Warming?

In the Cañete Valley south of Lima, potato yields were cut in half, but in other coastal areas they were essentially unchanged In the high Andes, two phenomena were observed In northern Peru, higher rainfall led to severe outbreaks of late blight And in the southern Andes drought and higher temperatures reduced frost damage, but led to early plant maturity and lower yields In the case of sweetpotato, the area planted in the Cañete Valley increased 50% and production was believed to be higher than any year in the past decade, probably in response to hotter weather and higher pest pressure on other crops

CIP economists believe El Niño provided an indication of what could be in store if global warming is severe If temperatures rise substan tially farmers will change how and where they grow potato and sweetpotatoes To accommodate climate change they will need varieties that are increasingly heat and drought tolerant and resistant to pests and diseases

Since the last El Niño in 1982 83 CIP plant breeders have been building a collection of potato varieties that are heat tolerant carry virus resis tance, and are early maturing Two clones bred for use along Peru s coastal desert look particularly promising, yielding 30 40 tons per hectare in just 100 days CIP scientists say that these potatoes require less water than the best commercial varieties and are suitable for processing Series of both improved potato and sweetpotato varieties have also been developed in cooperation with the Universidad Jorge Basadre Grohmann in Tacna Peru, and the European Economic Community Majes Project

Marginal Areas Facing Danger

It is impossible to say what the overall impact of climate change will be The secondary effects of global warming, such as changes in rainfall patterns and year to year temperature variability are not well understood and could have markedly different consequences in different places Some areas–regions prone to frost, for example–could benefit from warmer temperatures but suffer from drought Others areas such as tropical lowlands could suffer from heat stress but benefit from higher atmospheric levels of carbon dioxide Center economists believe however, if climate change is gradual, most farmers should be able to adapt by adjusting planting dates and changing crop varieties

'In general major production zones should not be adversely affected says Robert Hijmans, a CIP geographic information specialist The danger is in marginal areas where crops are already pushing the limits of heat, drought, and pests ' Hijmans says the extent of global warming remains unclear, but temperatures are predicted to rise between 2 and 5 degrees by the middle of the next century as they did in Peru during the 1997 El Niño Climate change appears not to have been much of a problem in the past But it might become one as population grows and if climate change is large and develops more quickly than expected In that event the flow of technologies will need to increase so that farmers can cope with more difficult problems Late blight disease, Hijmans notes would likely increase from a combination of higher temperatures and rainfall

CIP Advises Peru on El Niño

Much depends on the farmers skills says CIP Director General Hubert Zandstra Peruvian potato farmers were advised early by the Ministry of Agriculture of the onset of another Niño Knowing its effects many producers shifted their plantings to cooler, higher altitudes In doing so they kept production and prices at previous years' levels although the quality of the crop was poorer

Center scientists worked closely with Peruvian agricultural officials Zandstra adds "by recom mending specific management programs to farmers on how to deal with increases in heat and rainfall ' Aside from effects on yield higher

LARLPLBLA

During the 1997 98 El Niño, much of Peru's highly productive coastal desert farmland re sembled flooded Asian ricefields Potato yields fell by half in many locations

temperatures and humidity produced significant changes Farmers on Peru's central coast, for example, were forced to nearly triple pesticide use as insect populations exploded In southern Peru outbreaks of a traditionally minor aphid like pest (Russelliana solanicola) led to an increase in an unusual strain of potato virus Y, for which the insect is a vector

Insect Populations Expand

Almost all insect pests of potatoes do better in higher temperatures,' says CIP entomologist Fausto Cisneros Under normal conditions we might see three generations of a particular insect during the growing season When temperatures rise, the life cycle is shortened and there may be five generations of the same insect In some cases, insects that coexisted for years with a crop can suddenly become important problems Higher populations can also increase the speed at which pests adapt and become resistant to pesticides,' Cisneros adds

The most important lesson of this year's El Niño ' Zandstra concludes is that the entire agricultural community needs to be better pre pared and have access to a strategic reserve of technology that will allow farmers to adapt That means research new technological options and improvements in our ability to forecast change It also means better extension, so that farmers can access new technology and put it to work before disaster strikes '

Virus Cleanup Boosts Chinese Sweetpotato Production

China, the world's largest producer of root and tuber crops, is also the first developing country to benefit on a large scale from technology designed to eliminate virus diseases in sweetpotato planting materials According to recent reports, Chinese sweetpotato farmers are planting an estimated 330,000 hectares of virus-free sweetpotato annually in Shandong Province alone The value of this technology over the past four years is estimated at $80 million and growing

CIP economist Thomas Walker notes that the work is an excellent example of how international research centers can broker technologies from industrialized countries and extend them to the developing world The virus cleanup techniques being used in China, he says are based on high technology tissue culture techniques developed in industrialized countries CIP s role he says 'was to identify a technology that could be taken off the shelf adapt it to developing country needs and help China s scientists modify it to local conditions

Impact Through Training

The origin of the project dates back to 1987 when CIP conducted a small training course on virus detection techniques The next year Center scientists in cooperation with colleagues at the Asian Vegetable Research and Development Center, organized a tissue culture training work shop at the Xuzhou Sweetpotato Research Center on China s east coast According to Dapeng Zhang, who served as a translator and now heads CIP's sweetpotato breeding project 30 of China s top sweetpotato researchers attended Its main focus was on developing *symptom free* tissue culture plantlets He attributes the success of the course to the fact that most participants were young scientists eager to apply high technology to the country s agricultural problems We also had excellent instructors from CIP, he adds, among them John Dodds and Masa Iwanaga, both now directors of research at other CGIAR centers

M IWANAGA

Following a five year period of adaptive research by Chinese scientists closely supported by CIP virologists large scale planting of virus free sweetpotato began in 1994, mostly in Shandong Province Presently about 40 percent of Shandong's 700 000 hectare sweetpotato growing area is planted to virus free materials If extension targets are met that figure will rise to 80 percent covering more than half a million hectares by the end of 1998

The production of virus free cuttings begins with meristem tissue cultures that are used to produce virus free plantlets in heated greenhouses during the winter The plants are replanted to nethouses in the spring From there virus free seed roots are produced in the autumn to generate vine cuttings which then serve as a source of planting material for the summer crop Because two field multiplications per year are possible, 500 virus free plantlets are sufficient to produce planting material for 13 000 hectares within two years, a highly impressive field multiplication rate for a root crop

Impressive Yield Advantages

Yield advantages are equally impressive In tests conducted at nine sites with five varieties, average productivity gains were about 40 percent but ranged as high 160 percent But productivity gains disappear after three or four years For example, an older Chinese variety cultivar Xindazi showed a yield advantage of 350 percent in the first year, 130 percent in the second and third years, but only 14 percent in the fourth year At that point, farmers need to be resupplied with fresh planting materials

Walker notes that the program has been implemented without investment in specialized facilities You would be hard pressed to come up with better conditions for economic impact than those embodied in the Shandong virus free propagation program he says That includes a limited gestation time for research (the results he notes were achieved largely through training) swift transfer of technology, huge potential for area coverage, and relatively high unit benefits Added to that are high yields emerging export demand

CIP BEIJING

A single CIP training program in 1988 led to major increases in China's sweetpotato production

and the fact that farmers do not have to change any of their existing practices

A back of the envelope calculation gives the project a net present value of about $250 million at a 10 percent discount rate The estimated internal rate of return is 120 percent, with annual net benefits already exceeding $40 million calculated over 30 years

Assuming the diffusion data reflect reality, one could vary these assumptions by several orders of magnitude and still not affect the results all that much, Walker adds In all likelihood this work has had more economic impact than any other project, perhaps even more than the aggregate of all other CIP projects combined,' he says Walker notes that a formal impact case study will be conducted in 1998 by the CIP economics and virology groups, in association with biologists at the sweetpotato program of the Shandong Crops Research Institute and economists at the Center for Chinese Agricultural Policy

CIP has worked in China since the establish ment of its scientific liaison office in the 1980s Collaborative research is conducted under a formal agreement with the Chinese Academy of Agricultural Sciences of the Ministry of Agricul ture

Getting the Numbers Right

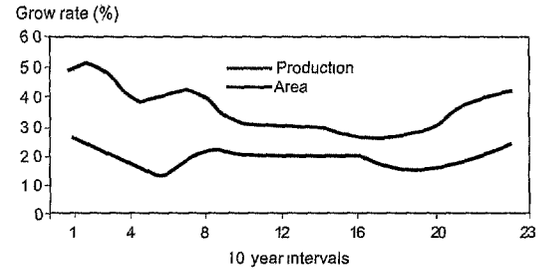
Revised projections for major food commodities, including roots and tubers, show a highly promising future for potatoes and sweetpotatoes in developing countries The new estimates indicate that the two crops taken together will account for at least 6 5 percent, and potentially as much as 9 9 percent, of the value of all major food commodities produced in the year 2020

The new numbers, says CIP economist Gregory Scott "demonstrate that potatoes and sweetpotatoes will maintain their relative importance and will increase in importance relative to cereals The projections were produced by the International Food Policy Research Institute and CIP in collaboration with the Centro Internacional de Agricultura Tropical

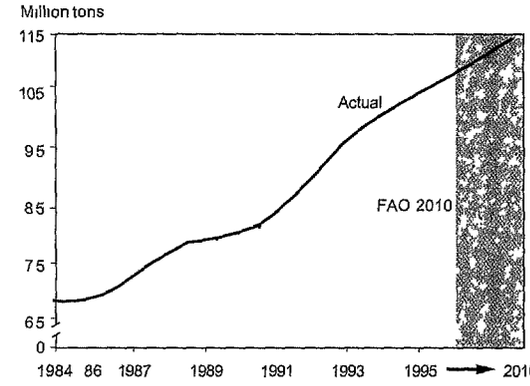
Growth rates for potato are particularly robust (about 4% annually) and show no sign of slowing down especially in Asia says Scott What is remarkable is that as potato production in developing countries increased from 75 million tons annually in 1988 to over 100 million tons today the average annual growth rate increased from 2 5% to more than 4% Growth in area and yield contributed to the increased production This contrasts with earlier projections founded on a 3 9% average annual rate of decline in area planted The discrepancy between past projections and actual trends has become increasingly apparent in recent years, he adds

Calculating for Poverty

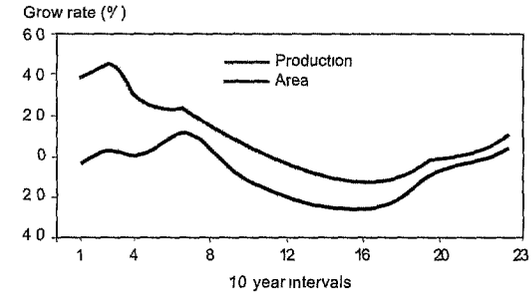
Recent FAO data also show a turnaround for sweetpotato Average annual growth rates in production are now close to 1 percent per annum and rising (figure right) The turnaround is largely because of the increasing use of sweetpotato in China for processing and for animal feed Because sweetpotato is grown mostly in China's poorer inland regions, these uses are helping to increase rural income and reduce poverty Given this fact, Scott believes the calculations previously used by the CGIAR to establish research priorities underestimated the importance of sweetpotato to the poor Moreover the massive use of sweetpotato for animal feed reduces grain imports and in the process, relieves the pressure on international grain prices for other developing countries, Scott says



Annual average growth rates for potato production and area (source FAO)



Actual and projected growth in potato production in developing countries (source FAO/CIP)



Annual average growth rates for sweetpotato production and area (source FAO)

( ) 1=1961 63 to 1971 73 23=1984 86 to 1994 96

Milestone Reached in Bacterial Wilt Research

CIP pathologists have reached a milestone in bacterial wilt research that vastly increases their ability to detect the bacterium responsible for the disease *(Ralstonia solanacearum)* The procedure, which multiplies the bacteria in samples to be tested in the standard NCM-ELISA technique (nitrocellulose membrane, enzyme-linked immunosorbent assay) was refined by CIP bacteriologist Sylvie Priou It is one million times more sensitive than previously available serological methods used to detect latent infection in potato tubers

Priou s research is part of a continuing effort at CIP to develop more effective and less expensive disease detection kits for developing countries The new kits are currently being distributed in 15 developing countries on three continents Because they are so simple to use they should play an important role in stimulating informal seed sys tems and in evaluating germplasm for resistance

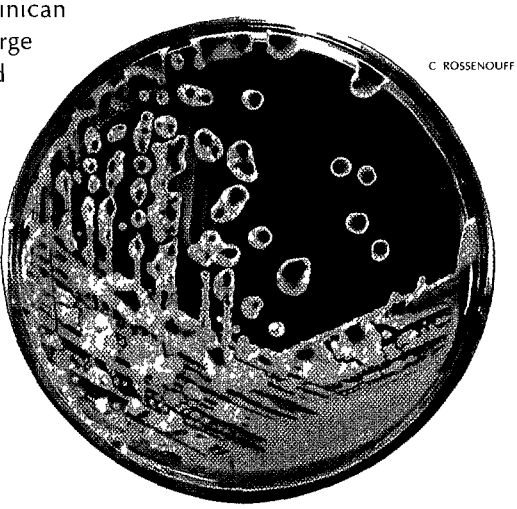
According to highly conservative estimates, the new kit, which costs $200 can be used to evalu ate the equivalent of 2,000 tons of seed tubers, enough to plant 1,000 hectares of bacterial wilt free potatoes

Bacterial wilt is considered to be the number two constraint to potato production in developing countries Yield loss estimates vary considerably, but can reach 95 percent when the disease is tuber borne "Bacterial wilt is most effectively controlled by eliminating infected tuber seed before it reaches farmers' fields says Priou Seed taken from infected fields often carries latent infection even if it comes from healthy looking plants

Bacterial wilt is difficult to control " Priou notes because it is transmitted not only by seed but is also found in the soil " Because there are no known chemicals that control bacterial wilt farmers must rely on clean seed as well as inte grated management practices to ensure a healthy crop ' she says Such management practices include crop rotation, minimum tillage the planting of tolerant varieties and general crop sanitation Precise methods for controlling the disease and for producing clean seed vary consid erably

For example in East Africa, national programs working in collaboration with the PRAPACE research and development network produce disease-free planting materials with cuttings from in vitro stock Another way to reduce the effects of bacterial wilt is by planting true potato seed, an approach that has been used successfully in Asia, most notably in the Red River Delta of Vietnam

Bacterial wilt is also an important drawback to potato production in Latin America According to recent reports, the disease is seriously limiting production in southern Brazil, northern Argentina Venezuela Peru and the Dominican Republic The movement of large quantities of seed from infected areas is believed to be respon sible In response, CIP has organized workshops and training courses to alert research institutions and government plant health services to the problem The workshops recommended actions to reduce disease outbreaks through integrated management, quarantine, and the production of healthy seed

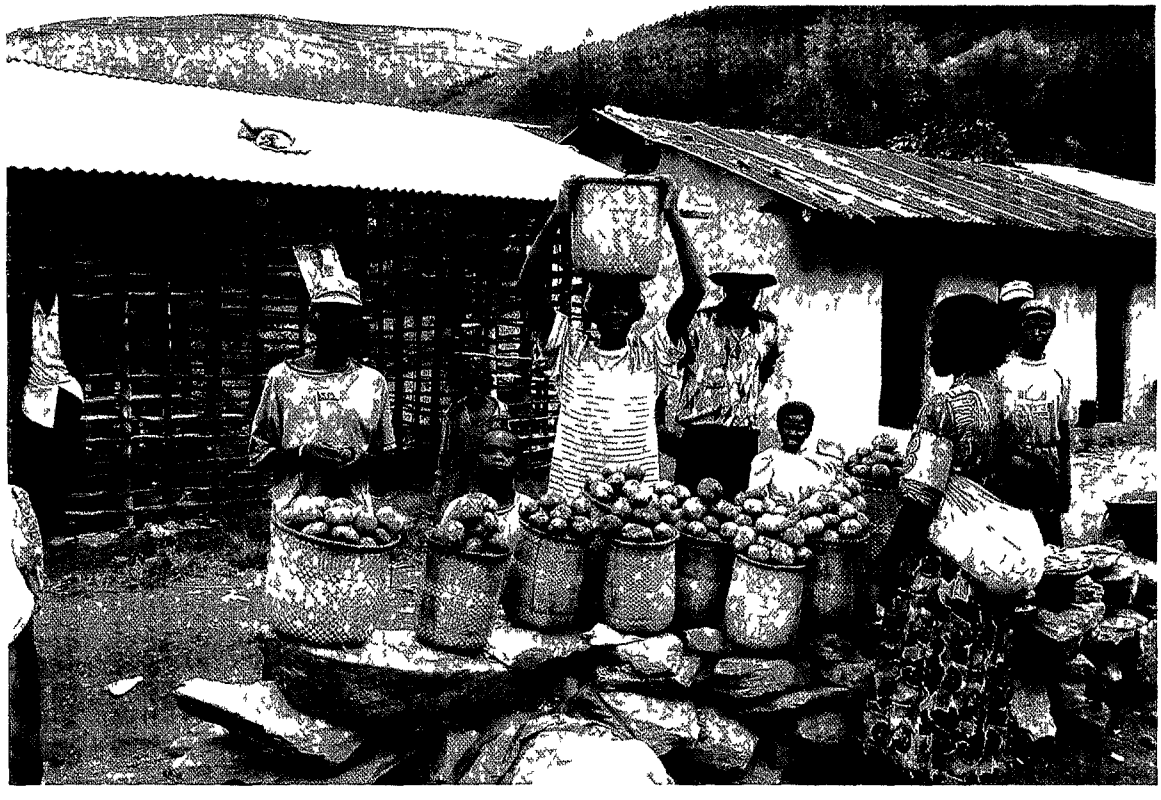


C ROSSENOUFF

A colony of *Ralstonia solanacearum,* the pathogen responsible for bacterial wilt A CIP developed process has vastly increased the accuracy of serological tests

"This last recommendation," says Luis Salazar, a CIP virologist and head of CIP s new Crop Protection Department would have been difficult to ensure without the new detection methods Salazar who was a member of the original team that developed the ELISA process in the 1970s notes that the refined techniques are extremely practical for developing countries Not only are they far more sensitive but they are more accurate and less expensive to use than the best previously available techniques

Integrated Control of Bacterial Wilt Paying Off in East Africa



Potatoes are a food security crop in East Africa production is increasing at an annual rate exceeding 4%

PRIOL

In Uganda's Kabale District nestled in the East African Highlands, rapid population growth has led to smaller, more fragmented farming plots, continuous cropping, and depleted soils Potato is Kabale's most important cash crop In the good years, growers plant 25,000 hectares and harvest between 150,000 and 200,000 tons, or a third of Uganda's total output The most serious production constraints are bacterial wilt, late blight, and the degeneration of seed stocks The problems are intertwined

To control the highland type of the disease, Berga Lemaga a CIP pathologist works on control strategies with the CGIAR and ASARECA African Highlands Initiative and Uganda s National Agricultural Research Organization (NARO) But progress has been slow Even if the disease could be eradicated aboveground, the bacteria can survive in the ground for long periods Consequently fighting bacterial wilt requires an integrated approach, no single measure is sufficient by itself

Affordable and User-Friendly

Working with farmers, Lemaga and his NARO counterparts have designed an affordable user friendly package of cultural practices "For healthy plants farmers should use wilt tolerant varieties and clean seed " he says They are taught to hill up around their seed tubers immediately after planting and uproot and destroy wilted plants immediately " Minimal cultivation is the rule a practice that avoids wounds which in turn promote infection On 46 farms where the new package was applied, yield increases averaged almost 50 percent over four seasons "The onset of bacterial wilt was delayed ' Lemaga said, "and the number of disease-free plants was much higher

To entirely rid the soil of the disease, Lemaga's team is evaluating rotation sequences that reduce the amount of bacteria in the soil and also im prove fertility The best cropping patterns so far combine maize, wheat, and beans Starting with fields that had a 90 to 100 percent infection rate Lemaga pointed out that just one maize or wheat crop reduced the rate to 79 percent, and that beans followed by maize in two successive seasons brought it down below 25 percent After such treatments, yields on test plots at NARO's Kalengyere Station went up dramatically, from 3 2 to 11 tons per hectare With low fertility soils additional measures are required A leguminous green manure crop adds nitrogen and organic matter to the soil The impact of such efforts will be short lived, however, if farmers reinfect the soil by planting infected seed potatoes

Breaking the Infection Cycle

In cooperation with the African Highlands Initiative NARO, NGOs such as Africare, and local seed growers, CIP is attempting to break the cycle of infected seed and low yields The strategy is to produce clean seed in quantity for three or four popular varieties in what is described as a farmer based flush out system That means a regular influx of virus free seed stocks each year, multipli cation by small scale seed growers, and then direct sale to farmers Seed stocks are continu ously replaced or "flushed out which reduces disease buildup

CIP initiated the farmer based seed project in 1996 Target countries include Ethiopia Kenya, and Uganda all are participants in the African Highland Initiative Together they produce 1 3 million tons of potatoes a year on approximately 215 000 hectares The project's initial virus free seed stock about 250 000 seedling tubers a year is produced at the Kenya Agricultural Research Institute s quarantine station at Maguga These stocks go to national programs in Ethiopia Kenya and Uganda for farmer based production In Uganda, the stock goes to NARO s Kalengyere research station

Dr J J Hakiza, head of NARO's potato program explains that the Kalengyere station multiplies the stock from Maguga by taking cuttings from virus free mother plants (100 mother plants can produce 50,000 seed tuberlets) The station does not, however, convert all the virus free seed tubers from Maguga to mother plants Most go directly to the field for traditional multiplication, which yields about 10 tuberlets for each seed tuber planted In this way the station has the flexibility to control costs by shifting to mother plants and rapid multiplication, Hakiza says NGOs like Africare got some of the seed but most is bought by members of Uganda's seed producers association

'When farmers buy seed directly from an established seed grower they know it is of high quality," says Steven Tindimobona, chairman of Uganda's National Seed Potato Producers Asso ciation "When they buy in the open market, likely as not, it is already infected with bacterial wilt and viruses Starting out with clean seed is a great advantage "

Farmers who invested in better seed showed a definite yield advantage In Uganda's Kabale District, multiplication rates increased from 3 to 6, and in Kenya farmers reported a multiplication rate as high as 7 up from 4 or 5 in previous years In Ethiopia yields went from 8 to 25 tons per hectare

Production of clean potato seed in the East Africa highlands is a key to controlling bacterial wilt

S PRIOU

Late Blight Project Initiated a Year Early; Damage Reports Increasing

Although research results are still coming in, CIP may look back on 1997 as pivotal in the fight to control late blight disease, says Wanda Collins, CIP deputy director general for research Because late blight was selected as the Center's number one research priority for the mid-term planning period beginning in 1998, it was decided to initiate work a year early As part of this effort new staff were recruited, funds redirected, and new facilities constructed Late blight research currently receives about 10% of the Center's resources

One of key the decisions made during the year was the appointment of Rebecca Nelson as late blight project leader Nelson, a research patholo gist leads a team of 20 national and international scientists working in 11 subprojects in Lima and at sites in Africa, Asia and other parts of Latin America 'We now have a team in place made up of specialists from pathology breeding molecular biology, geographic information systems and the social sciences says Collins

Late Blight Bad and Getting Worse

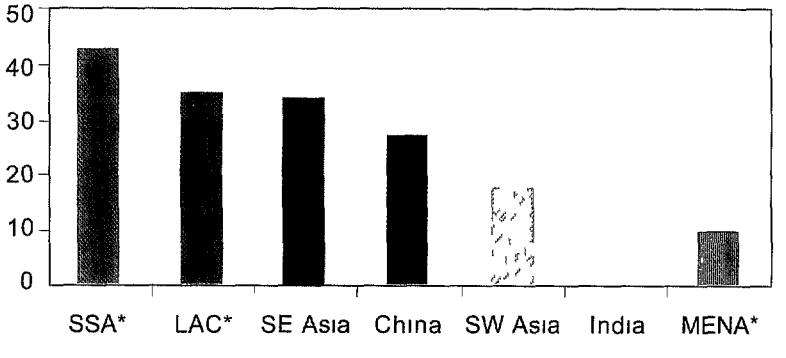
'Indications are that the late blight problem is bad and getting worse," says Nelson Throughout the Andean region, late blight was exacerbated in 1997 by a particularly severe El Niño event that brought with it above-average temperatures and rainfall conditions perfect for late blight "CIP cooperators throughout the world pretty much agree that we are dealing with a new far more destructive disease than ever before Chemicals that have proven effective in the past are not going to do the job in the future," she adds

Three developments over the past year were particularly troubling The first was a series of reports confirming a breakdown in the effective ness of the systemic fungicide metalaxyl Until now metalaxyl has been the potato farmers' most effective tool for combating older forms of the disease

The second was the continued spread of a new more aggressive form of the late blight fungus (*Phytophthora intestans*) Although the fungus in the Peruvian populations still showed the A1 mating type molecular marker work at CIP demonstrated that it belongs to one of two new migrant populations that have devastated potato crops worldwide The new populations show broad spectrum virulence believed responsible for the virtual collapse of a late blight resistant clone developed at CIP and widely known throughout Peru as cultivar Canchan INIA (see box page 20)

Late Blight Damage Estimates 1997

Country estimates of the economic importance of late blight assembled in a database at CIP show that the disease exacts it highest toll on poor potato producers in Sub-Saharan Africa (bar graph) Almost all losses attributable to the disease in the region are due to lost production (pie chart facing page) In contrast, the cost of fungicides in Latin America (middle chart) is substantially more important, contributing to the total economic price tag of the disease, exclusive of environmental damage The annual cost of late blight in developing countries is estimated overall at $3 25 billion (chart right)



Relative economic importance of late blight (% value of production)

( ) SSA = Sub Saharan Africa LAC = Latin America and the Caribbean MENA = Middle East and North Africa

Third and perhaps most disturbing was confirmation from CIP staff and national program cooperators in Bolivia that the two late blight mating types–the A1 and A2–have been identified in the same location near the center of origin of the crop It is feared that they will combine sexually and possibly form even more virulent forms of the disease

I have never seen a disease as devastating as late blight Nelson says It is shocking to see it in the field The upside is that CIP appears to be in an excellent position to do something about the problem To that end the Center s late blight team has developed a strategy that will attack the problem on four fronts farmer training breeding for resistance genetic studies and pathogen characterization

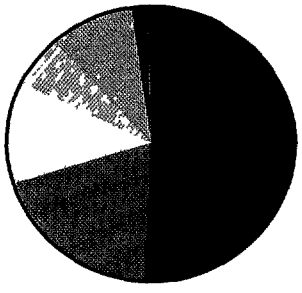
A GONZALES

At a field day in Huasa Huasi, Junin, Peru, farmers observe the results of a trial on integrated management of late blight where varieties and chemical sprays are compared

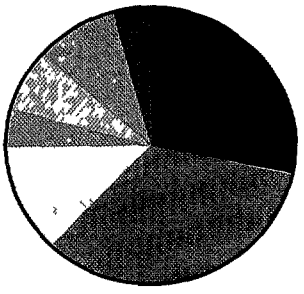
Farmer Field Schools

'With 20 years of late blight resistance breeding under our belts, Nelson says CIP has a reservoir of resistant clones that can be put into farmers fields almost immediately Center epidemiologists have also been studying how the disease works in the highland tropics Both are prerequisites for launching an integrated disease management effort 'Our strategy is to link up with extension services both government and non governmental that can deliver technologies to farmers over the next two or three years she says

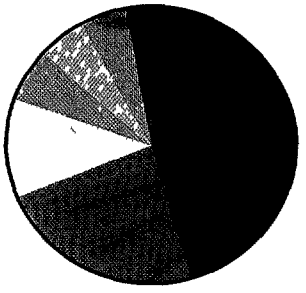
In 1997, CIP and CARE–an international nongovernmental organization (NGO)–began a pilot field school program in central Peru involving about 100 farmers at four highland locations The farmers worked directly with project personnel conducting experiments to test new varieties and management techniques The farmers benefit by receiving intensive training on disease management and access to state of the art potatoes CIP researchers benefit from quick feedback on Center technology at greatly reduced cost The field schools also set in motion the first steps for impact in the field



Loss in value of production US$ 2 5 billion



Fungicides costs US$ 750 million



Total economic cost of late blight US$ 3 25 billion

SSA LAC SE Asia China SW Asia India MENA

"Under normal circumstances says Nelson 'it takes 10 years to get new potato cultivars out to farmers We want to get them out in less than half that time Nelson foresees that the late blight field schools will spread to other Latin American countries and to Asia and Africa 'Given the dramatic nature of the disease we're going to need thousands of field schools based on the FAO rice model '

After just a year she adds, 'we ve succeeded in establishing highly effective collaboration with an international NGO capable of spreading new technology wherever the problem exists The unique thing is that CIP will be able to fulfill its research objectives through partnership with an extension agency and continue feeding the latest technology into the pipeline

To ensure long term success Nelson says, CIP also needs to understand the disease in diverse agroecosystems This includes the host the pathogen the environment and the human factor For example CIP social scientists are working to establish what farmers know about late blight and how they make decisions to control it This research is being conducted in three Andean countries as well as in Bangladesh and Uganda

The information collected along with data on weather water and soil is being used to design disease management strategies tailored to different agroecologies In December 1997 CIP s late blight team demonstrated to international experts the first use of this computer based technology, which combines the use of geographic information systems, crop modeling and late blight simulation

Breeding

After seven years of crop improvement work CIP scientists harvested the first agronomically suitable clones derived from the Center s second generation of late blight resistant potatoes Despite extremely high late blight pressure brought about by El Niño 60 clones with high resistance and good agronomic qualities were selected The new clones were developed using a breeding strategy that should provide stable resistance and elimi nate the boom and bust cycles that have bedev iled scientists and farmers for half a century In addition work was stepped up to screen for new sources of resistance in the collections held in trust in CIP genebanks

Genetics

To speed up the transfer of late blight resistance genes from wild and primitive relatives of potato scientists need to establish a better understanding of the genes involved the process In 1997 CIP scientists identified and located several chromo somal regions associated with resistance from a promising source The finding of resistance markers should increase the efficiency of CIP s breeding program by saving time and space during the selection process The markers should also help isolate resistance genes and speed their transfer into selected varieties

This work is expected to produce early results because of an effort within the project to bridge gaps between molecular genetics biochemistry, and physiology Using genes known or thought to be involved in plant defense in their genetic mapping efforts marker specialists have identified a variant of a defense gene that appears to be associated with resistance By cloning the best defense gene alleles scientists will be able to directly transfer resistance from wild species to commercial varieties without the difficulties inherent in conventional potato breeding

Understanding the Pathogen

To conduct an effective, long term breeding and integrated disease management program there is also a need to understand the pathogen To breed for resistance scientists need strains with known disease inducing properties To design effective control strategies they need to know the properties of the pathogen in the field For ex ample the application of simulation modeling will require pathologists to have data on local patho gen populations CIP is also supporting the development and characterization of local patho gen collections throughout the developing world thus eliminating the need to move pathogen strains across national borders

Genotype x Environment

Pooling resources and scientific talent, researchers in seven countries recently completed the first year of a comprehensive study to determine if late blight-resistant potatoes are equally disease resistant across different environments Whether they are or not will help determine the strategies that researchers use to attack the disease in the future

So called genotype by environment studies (G x E) are not uncommon with cereal crops However they pose special difficulties for com modities such as potato because of the dangers involved in moving live planting material across international borders According to Wanda Collins 'this is the first time we know of that late blight resistance has been tested systematically at so many locations " Collins is the coordinator for the Global Initiative on Late Blight (GILB), the international consortium responsible for the study

'By the end of 1998, the G x E study should provide us with solid data on how quantitative late blight resistance performs from Northern Europe to the southern latitudes of Argentina ' adds Merideth Bonierbale, who heads CIP s new Crop Improvement and Genetic Resources Department Quantitative or horizontal resistance does not confer extremely high levels of late blight protec tion, but it is considered more durable than resistance sources used in the past

"A comprehensive G x E study was something many researchers wanted but was difficult to organize says Greg Forbes CIP s lead scientist on the project "Things really came together with the establishment of GILB in 1996,' he adds 'Even so, G x E which was given a high priority by GILB cooperators, hasn't received additional support from donors "

Because there was no additional funding participants communicated primarily via e mail and through informal contacts at international meetings Eventually an electronic mailing list was set up at Cornell University which is used to send messages to the participants Researchers from eight countries are involved in the study Argen tina, Canada Denmark Ecuador France, the Netherlands United Kingdom and the United States The project also has links to PICTIPAPA, the cooperative late blight program located in Mexico s Toluca Valley which is believed to be the center of origin of the late blight pathogen (see SIFT)

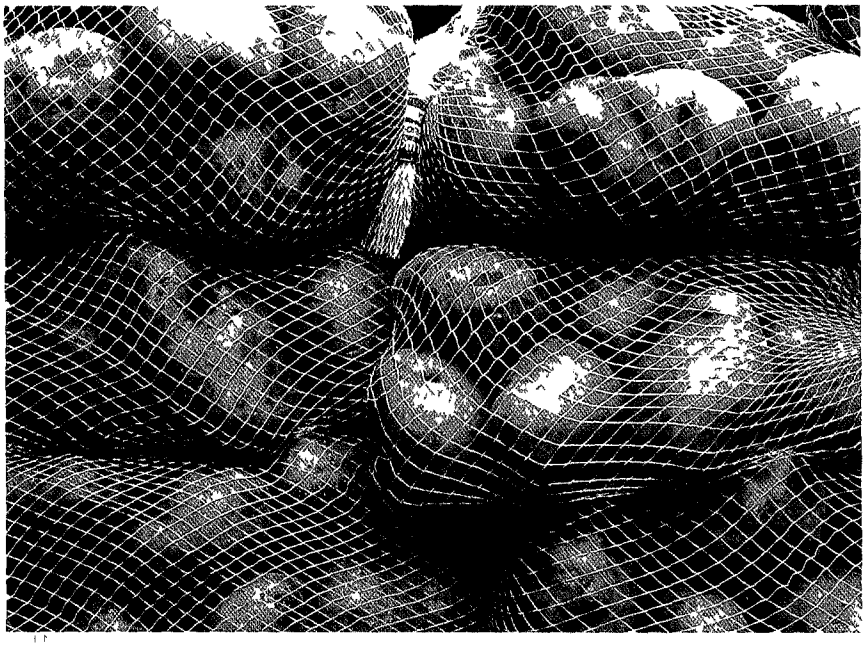
'This is exactly how GILB was designed to operate, Collins adds By bringing together the best minds in the field and combining existing financial resources, we are able to accomplish things together that even the best funded projects could not do on their own ' A final report on the study will be issued by the end of 1998

SIFT

In addition to G x E, CIP has agreed to coordinate a Standard International Field Trial (SIFT) for resistance to late blight The trials, which were delayed in 1997 because of El Niño, will help scientists test new late blight resistant clones in seven production zones in Africa Asia and Latin America Unlike G x E, which uses a fixed set of experimental materials SIFT will continually evaluate the best available late blight resistant breeding lines "The idea,' says Bonierbale, 'is to create a more solid link between the research pipeline and farmers " SIFT is a module of PICTIPAPA the late blight research program, with special funding through GILB

GILB
GLOBAL INITIATIVE ON LATE BLIGHT

Late Blight Claims Trusted Variety



Potato cultivar Canchan INIA

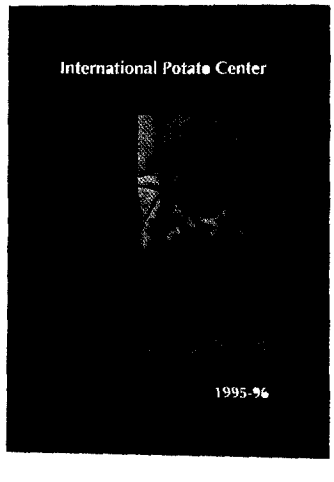
The potato cultivar Canchan-INIA, considered one of Peru's stars in providing high levels of resistance to late blight, has broken down under a combination attack of humidity from El Niño the appearance of a new, more aggressive form of the late blight fungus (*Phytophthora infestans*) and failure of a previously effective fungicide to control it

Until 1997 Canchan could apparently with stand a late blight attack and survive with a minimum of chemical sprays Developed jointly by Peru s national potato program and CIP, Canchan was released to farmers in 1990 It was progressively gaining in popularity among tradi tional Andean potato growers and commercial producers in coastal areas where it accounted for a fifth of the potatoes grown It also has wide consumer acceptance

"Despite the breakdown of Canchan, says Juan Landeo a CIP geneticist 'growers have available two other CIP bred Peruvian cultivars with late blight resistance–Amarilis INIA and Kori INIA In addition Landeo is testing 60 new late blight resistant clones under constant and heavy pressure of the fungal disease at two sites Oxapampa and Comas in the Peruvian rainforest margin Landeo believes that despite Canchan s declining late blight resistance Peruvian potato growers will continue to produce the variety because of market demand and high prices while looking for better performing, disease resistant cultivars "For the time being ' says Landeo farmers will have to spray more contact fungi cides and accept lower yields to stay in business In the end, the consumer will pay the difference "

CIP Program Report Available

CIP's 1995-96 Program Report, a 323 page publication, provides more than 50 research reports written by Center scientists and their collaborators Included are comprehensive overviews of the status of regional work and extensive reporting on such subjects as cryopreservation, molecular markers, and marketing The program report, issued every two years, is available for $25 plus postage from CIP It is also available free through the Center's home page on the World Wide Web at http // www cipotato org



Biotechnology Speeds New Potato Development

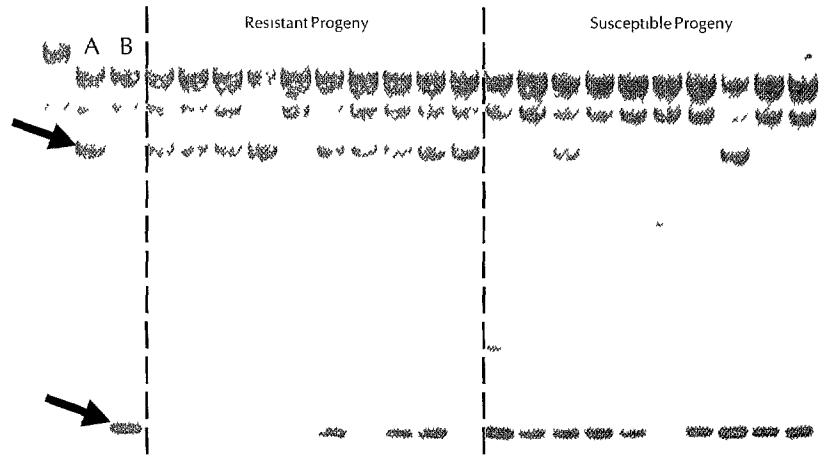
In seeking solutions to the most pressing problems of developing country potato producers, CIP scientists are using some of the most powerful techniques known to science, including DNA fingerprinting, genetic mapping, and gene technology

The potato is a near perfect candidate for this type of biotechnology notes Marc Ghislain who heads the Center s molecular biology work Unlike with many other crops that are inbred in potato genetic transformation is the fastest way that genes for a single new trait can be added to improve a variety without damaging its genetic makeup Attempts to make even small genetic changes by traditional breeding is likely to produce clones that have little resemblance to their parents That means breeding efforts to improve established varieties in one trait usually have a negative impact on others, such as genetic resistance and the cultivar s taste and appearance

Ghislain says that the new techniques should make it possible to insert disease or stress resistance into popular potato varieties without jeopardizing their desirable qualities or their market share As a result, geneticists will be able to respond quickly to new stresses without having to go through the difficult process of rebuilding consumer acceptance for an entirely new variety 'We're also interested in producing a cleaner potato says Wanda Collins CIP deputy director general for research More chemicals are used to produce potatoes than to produce any other food crop In an environmentally conscious world that is increasingly unacceptable

New Varieties in Five Years

With conventional breeding tools, it would take scientists 10 15 years simply to bring a potato variety to market and an equal amount of time for it to become popular with consumers Biotechnology makes it possible to maintain all of the desirable characteristics of a cultivar eliminate new problems as they appear and do so in less than five years Equally appealing is the possibility to bring back to the market traditional farmer varieties that are no longer grown because of their susceptibility to new more virulent diseases and aggressive pest problems

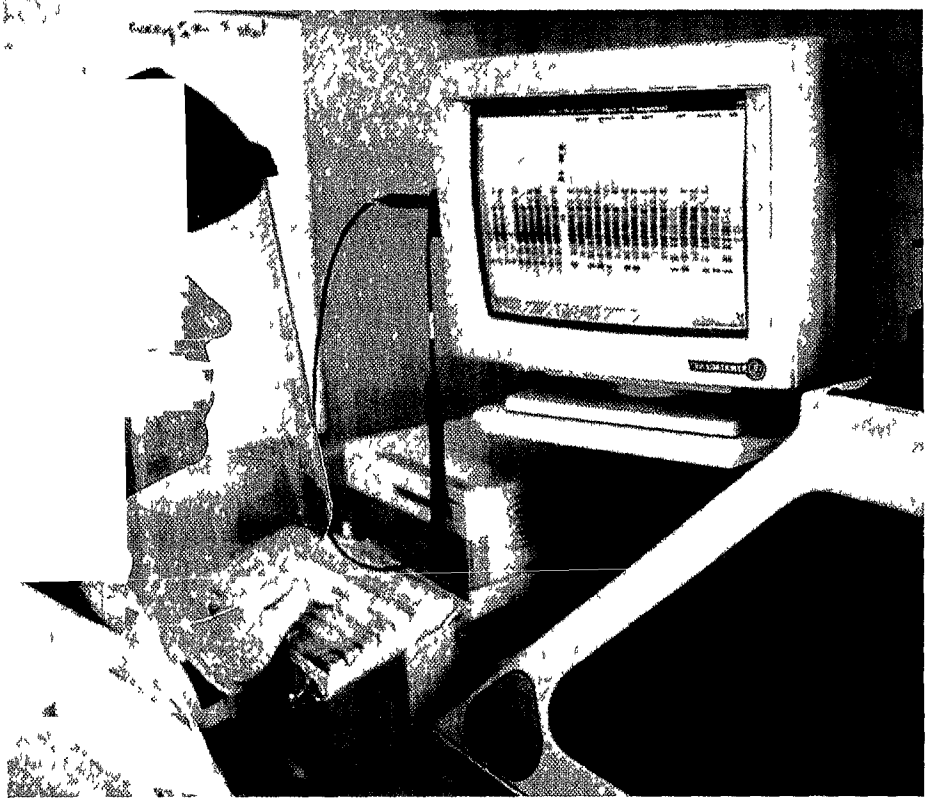


Using DNA molecular markers CIP scientists can identify genes conferring resistance to late blight Ultimately CIP's aim is to select positive alleles for late blight resistance and move them quickly into potato clones suitable for developing countries The high resolution photograph above shows molecular markers linked with late blight resistance in a diploid potato population The arrows point to DNA markers associated with late blight resistance deriving from a *Solanum phureja* parent (lane A) and a *S tuberosum* parent (lane B)

Currently, about 15 percent of the Center s international staff work in biotechnology projects In 1997, CIP virtually doubled its investment in biotechnological research Although this represents a dramatic shift in Center resources, CIP continues to rely on cooperative agreements with advanced laboratories to carry out much of its *high tech* research In addition to producing large savings this approach creates intellectual bridges between state of the art institutions in industrialized countries and CIP s principal partners–national research institutions in developing countries In the future Center scientists anticipate that contract research will increasingly involve advanced national centers in South Asia and the Southern Cone of Latin America

Impact in Four Areas

Advances in biotechnology are expected to have significant impact in at least four project areas during the Center s medium term research plan which runs through the year 2001 These include the search for stable late blight resistance application of transformation technologies for virus resistance in potato breeding of desirable quality traits for sweetpotato and integrated management of sweetpotato pests The following are examples of recent successes in biotechnology at CIP and of where the science is headed



CIP

A CIP scientist checks fingerprinting of potato DNA on a computer monitor The face screen protects scientists from ultraviolet light used to illuminate DNA gels

Sweetpotato Gains From Potato Biotechnology

CIP scientists are using biotechnology to develop protease inhibitors that inhibit the metabolism of sweetpotato weevils Recent progress in developing a transformation system and identifying effective protease inhibitors has established a base for creating host plant resistance, a long time goal of national sweetpotato improvement programs

Other objectives for sweetpotato include the mapping of alleles for virus and nematode resistance and for starch content The development of varieties with high dry matter is a major CIP priority

Molecular techniques are also being used to reduce the number of duplicates in the sweetpotato germplasm collections held at CIP and to assess the genetic diversity of the crop This work is considered important for advancing in situ conservation and to determine the need for new collecting expeditions

Collection Fingerprinted

In 1997 CIP reported the first use of molecular markers to fingerprint an entire cultivated potato collection The objective of this work was to assess the collection s genetic diversity and select a core sample comprising the widest possible genetic variation The native cultivated species, *Solanum phureja* is important to plant breeders because many of its accessions carry resistance to biotic and abiotic stresses, including late blight and bacterial wilt

Within the collection are 25 accessions labeled as *S phureja* but whose characteristics scientists suspected were closer to those of another species Because of the small size of the *S phureja* collection the species was selected to test the effectiveness of molecular markers for more extensive germplasm management The results demonstrated that the use of DNA molecular markers is superior to methods in which random selection is used for identifying a core collection with maximum genetic diversity This work clears the way for the application of marker technology in each of the nearly 100 potato species in collections held by CIP

Late Blight Control

Because late blight caused by *Phytophthora infestans* poses urgent problems in developing countries CIP gives high priority to biotechnological approaches that provide practical solutions and diminish farmer reliance on fungicides High levels of resistance identified in native cultivated potatoes (*S phureja* and *S andigena*) are being mapped and characterized using molecular markers This work is being conducted in collaboration with the Scottish Crops Research Institute and the Centro de Investigaciones de Ciencias Veterinarias in Argentina

In addition CIP is working with scientists at Kansas State University in the United States and the International Rice Research Institute in the Philippines to develop a large set of genes known or suspected to play a role in plant defense These *candidate genes* will be used as probes for

mapping potato and other root and tuber crops Those found effective against late blight will be isolated and used for direct transfer into suscep tible varieties These efforts will be augmented by the development of a composite potato map that shows where disease resistance occurs on the potato genome This information will be made available via the Internet to help scientists explore exotic germplasm for new sources of resistance

Virus Resistance Sought

A long term CIP goal is to produce potato varieties with stable resistance to the three major potato viruses Potato leafroll virus (PLRV) and potato viruses Y and X (PVY and PVX) These diseases cause severe crop losses and are the main cause of rapid seed deterioration Using a combination of molecular and conventional techniques CIP scientists have identified genes that confer high levels of resistance to PVY and PVX They are incorporating them into commer cial varieties–something that international seed companies who sell to developing country farmers have traditionally shunned

Transformation with natural resistance genes promises to be the fastest, most precise way to develop virus resistance in potatoes without resorting to the controversial process of viral gene insertion CIP and its collaborators at the Sainsbury Laboratory in the United Kingdom are therefore focusing their efforts on *plant-derived* transgenic resistance The success of this effort should significantly reduce developing country reliance on imports of nonadapted seed varieties grown in temperate regions

Controlling Insects

Although insect resistance presents particularly diffic ult challenges, CIP is moving forward in several areas that should confer insect resistance against potato pests The first is the transfer of a gene from *Bacillus thuringiensis*, a bacterium that produces a protein that acts as a natural insecti cide However, this proven technology may also speeds up the development of insect resistance The Center is therefore taking a cautious approach in building insect resistance Prominent among the alternatives is the use of glandular trichomes the sticky hairs found on the so called hairy potato

Intellectual Property Rights

At it most recent meeting the CIP Board of Trustees asked management to explore with stakeholders ways to protect CIP developed technologies from exploitation by commercial companies and assure that revenues generated from such technolo gies be used to support the Center's genetic resources programs

The resolution underlies the Board s belief that CIP will have to protect its technologies through various forms of intellectual property rights to sateguard the interests of its principal clients poor people in developing countries Although CIP scientists work from the premise that the poor should benefit significantly more from Center research than do others the demand for CIP breeding lines and related technologies by commercial companies is increasing Our fear," says CIP Director General Hubert Zandstra "is that as industry applies these advances to their own ends that will limit access to them in developing countries

With that point in mind the Board encouraged CIP to develop a policy framework for the possible patenting of intellectual property developed in Center laboratories The primary objective would be to ensure that developing country farmers continue to have free access to all CIP technologies Any income derived in return for the Center's intellectual property would be commit ted to the Center s genetic resources programs Such a policy is consistent with the provisions of FAO s Global Plan of Action for Plant Genetic Resources for Food and Agriculture

"It may just turn out ' Zandstra adds that if the new policy is approved it may actually encourage commercial interests to enter into direct joint ventures with developing countries making improved technologies available to our clients more rapidly and more cheaply than would otherwise be possible

Brazil Achieves Seed Self-Sufficiency

R ZA HMANN

Brazil has achieved self sufficiency in potato seed production, eliminating the dangers from imported seed borne pests and diseases

In 1983, Brazil began to build its own national potato seed program to reduce its dependency on the international seed trade Using virus detection technologies developed at CIP, Brazil now stands as one of the world's most advanced seed producers with annual production exceeding 72,000 tons per year

"Brazil recognized in the 1970s that seed imports represented a serious stumbling block to potato production," says Fernando Ezeta, CIP's regional representative for Latin America and the Caribbean "Not only do many shipments carry pests, imported seed is expensive, and frequently there is not enough to go around "

While a small producer compared with the major European and North American seed exporting countries, Brazil has achieved a level of self sufficiency unknown in most developing nations Disease- and pest-free seed is one of the farmers' most important inputs and also one of the most costly

Potato seed prices vary considerably from country to country, but can easily reach $1,200 per hectare for the best imports But imports are not always what they purport to be

Seed-Borne Pests

Noel Pallais, the head of CIP's Seed Unit, notes that pests and disease are routinely spread by imported seed "Even the best producers cannot guarantee that their product meets international standards," he says "Our concern, however, is not with the reputable producers The ones we worry about are those who ship poor quality seed because they fail to conduct sufficiently rigorous inspections Once infected seed is in the field, it is difficult to control the spread of imported pests and diseases '

Brazil is one of CIP's newest donors, having joined the CGIAR system in 1997

EMBRAPA and CIP

Cooperative activities between Brazil and CIP began in 1978 and were expanded in 1982 with the signing of a formal agreement with the Centro Nacional de Pesquisa de Hortaliças (CNPH) the national vegetable research program of Empresa Brasileira de Pesquisa Agropecuaria (EMBRAPA)

In the intervening years, CIP has helped train more than 150 Brazilian scientists in subjects such as tissue culture virology and breeding and genetics the basic building blocks of a seed industry 'Collaboration with CNPH EMBRAPA has been exceptional on many fronts but our biggest success says Ezeta, 'has been in seed production ' Today, Brazil is almost entirely self sufficient in seed potatoes by having adopted rapid multiplication schemes developed by CIP CIP economists estimate that the program saves $5 million in foreign exchange annually

Since the mid 1980s CNPH EMBRAPA scien tists have also worked to keep abreast of the latest developments in the Center s virology laborato ries As a result, Brazil now produces antisera and serological kits that can be used in the field by local seed producers One of CIP's roles was to ensure that Brazil s antisera were capable of detecting all virus variants

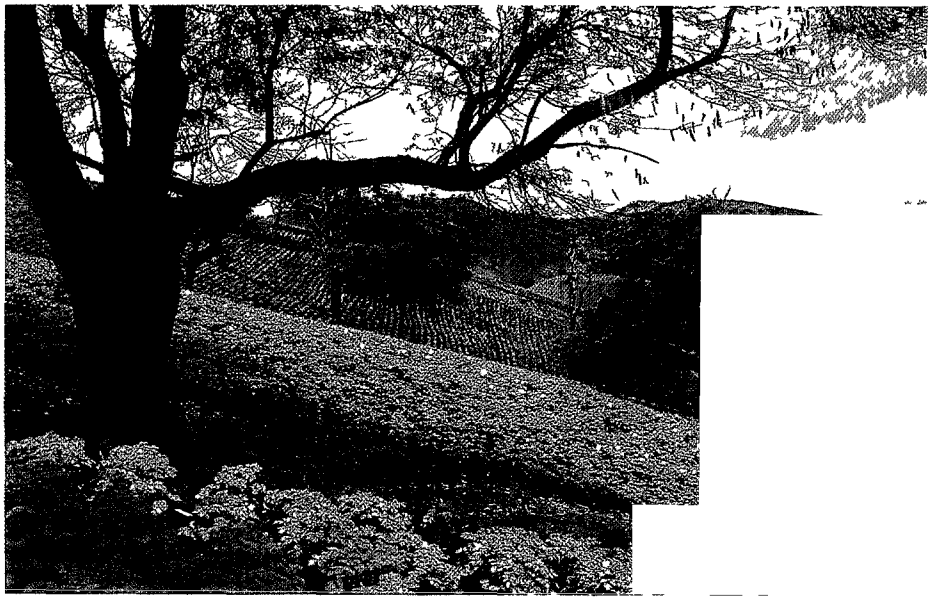
"This is high tech work says CIP virologist Maddalena Querci To adapt such a sophisti cated technology to local conditions is a major achievement To then go the next step and extend it in a country as large and as diverse as Brazil, speaks for itself "

Brazil also exports the serological kits to neighboring countries in the Southern Cone Chile's national seed program reportedly uses only Brazilian made kits for detecting viruses in its seed potatoes

Brazil: Facts and Figures

Since the early 1960s, Brazilian potato production has more than doubled from 1 1 million to 2 3 million tons And today s production is achieved on 30 000 fewer hectares than a generation ago Equally impressive yields rose from a meager 6 tons per hectare to a national average of 14 tons per hectare

While CIP seed production technologies have contributed to the increase CNPH EMBRAPA recognizes that sustaining produc tion growth will require continued investment in research and development To that end CNPH recently requested CIP collaboration in 10 new areas Among them are research on late blight true potato seed bacterial wilt and genetic conservation of sweetpotato In addition, CIP has been asked to assist CNPH in methods for detecting viruses on arracacha an Andean root crop similar to



carrot Brazil is the world s leading producer of arracacha which is used mainly in commercial baby foods Brazil is also one of CIP's newest donors having joined the CGIAR system in 1997

Producing Pesticide-Free Sweetpotatoes

Farmers and scientists regularly inspect pheromone traps used to attract weevils The area surrounding the traps is treated with the fungus *Beauveria bassiana,* which infects the weevils drawn to the traps

In 1991, Cuban farmers were suddenly cut off from agricultural pesticides supplied by the Soviet Union The result was major damage to the country's sweetpotato crop and the collapse of some of its largest sweetpotato plantations

With the elimination of Soviet subsidized pesticides, Cuba found itself in a situation that farmers in other countries could well face in the future says Fausto Cisneros, leader of CIP s integrated pest management project (IPM) for sweetpotato "Any number of things could happen that would deny farmers access to pesticides he says For example the effectiveness of a chemical could collapse because of a new insect biotype or a government may simply ban certain pesticides for environmental or health reasons

The Cuban Experience

In Cuba the loss of pesticides left no alternatives but to turn to IPM With chemicals Cuban farmers controlled the sweetpotato weevil (*Cylas formicarius*) the crop s principal predator with an average of 12 sprays per season Even then damage levels were about 8 percent high by many standards but acceptable to the Cubans In 1997 damage fell dramatically with the use of an integrated control approach Some fields registered just 2 percent infestation production tripled on many farms

Efforts to control weevils with IPM began in 1992 CIP scientists first visited the island in response to a call for help by colleagues at INIVIT the Cuban national agricultural research institute in charge of root crops and bananas

INIVIT scientists first task was to fill in gaps in the knowledge of the biology and seasonal behavior of the pest The second was to identify IPM component technologies that would control weevils Because of the emergency nature of the situation CIP entomologists suggested forgoing the standard pest evaluation and characterization phase of a normal IPM program

Effective Controls Identified

On farm research in Villa Clara and Cienfuegos, provinces in the central part of the island confirmed the effectiveness of four IPM control components predatory ants, the fungus *Beauveria bassiana* the mass capture of adult male weevils using sex pheromone traps and the planting of short season cultivars Added to this were cultural practices common to most other IPM

J ALCAZAR

Sweetpotato weevil infected with *Beauveria bassiana* fungus

programs such as the use of healthy planting materials crop rotation and destruction of crop residues

"A package of alternatives was offered to agrarian association farmers and technicians," remembers Dr Alfredo Morales subdirector of INIVIT and leader of Cuba s sweetpotato IPM program "Demonstrations first held at INIVIT experimental fields quickly spread to government farms cooperatives and private producers

According to one woman farmer working on Paso Bonito State Farm in Santa Clara it was impossible to continue to plant sweetpotato because of high levels of weevil infestation In the dry season, damage was almost total Following the introduction of the INIVIT CIP approach she says, infestation fell to just 2 percent and could eventually reach zero

How the System Works

The most important component of the package is the use of pheromone traps for the mass capture of male weevils In 1996 128,000 traps were used throughout the island, up from 6,500 three years earlier Normally farmers use 16 traps per hectare but some successful farmers were able to reduce that number to just five or six

But pheromones also represent a weak point in the program because they are imported from the Netherlands CIP is currently trying to broker an arrangement that will allow Cuban technicians to produce the pheromone under local license

Two other components of the program, how ever are totally home grown Predatory ants that attack weevil larvae are mass produced in artificial nests made of rolled banana leaves, the natural habitat of the predator This simple system, devised by INIVIT has proven highly effective Field trials have shown that as few as 60 nests per hectare can reduce weevil infestation 3 5 percent

The other component is the use of the fungus *B bassiana* a biological pesticide The fungus is applied around pheromone traps to kill escaping weevils *B bassiana* is produced in both liquid and solid form in more than 200 Cuban laboratories and processing, including breweries with idle capacity

The Cubans are extraordinary cooperators and excellent researchers says Cisneros CIP has learned a lot from its work in Cuba that can be applied in other parts of the Caribbean and in areas with similar ecologies "But perhaps the most important lesson of the Cuban program," he says 'is that farmers can produce abundant crops without the chemicals that they once relied upon " The IPM program will cover 30 000 hectares of sweetpotato in 1998, about 50 percent of Cuba s entire crop according to Cisneros

The Search for Weevil Resistance

The development of sweetpotatoes resistant to weevils is an additional goal of CIP's collaborative research program with INIVIT Cuba has developed six weevil resistant clones, but the process has not achieved all of the results that researchers would like One key objective is to develop sweetpotatoes that produce roots 15 cm below the soil surface, too deep for most weevils to attack the crop The Cubans are also paying close attention to CIP's resistance breeding program, which emphasizes the introduction of protease inhibitor genes, and the Center's work with wild relatives, efforts that one day may provide farmers with weevil resistant sweetpotatoes

TPS Hybrid May Eliminate Need for Seed Tubers

Sometimes, a production breakthrough can be achieved by taking an old technology and making it better In 1997, two CIP scientists demonstrated this axiom to potato farmers in Vietnam by upgrading the seed quality of two established hybrid true potato seed (TPS) varieties

The new technology allows farmers to produce a mature commercial crop of potatoes averaging 25 tons per hectare in just 90 days directly from potato seedlings After a year of testing Vietnamese farmers have already dubbed it Super Seed

The new seed technology eliminates the need for 17 000 farm families in the Red River Delta of Thai Binh Province south of Hanoi to store potato seed tubers during the hottest part of year Without refrigeration the heat takes a high toll on the quality of seed potatoes during the nine months that they must be stored on farm Potatoes in Vietnam are grown during the three month period between the country s two yearly rice crops

CIP plant breeder Mahesh Upadhya and physiologist Noel Pallais were alerted to the storage bottleneck at a seed workshop held in Hanoi in 1996 One possible solution, they believed would be to grow potatoes directly from TPS seedling transplants (see box) TPS is normally used to produce small tubers for planting What emerged from their research was a method for dramatically improving seed quality of existing hybrids The new technique resulted in larger, heavier botanical seeds that are more vigorous than those produced by conventional methods Because of their additional vigor the improved seeds produce potato seedlings that can be transplanted directly into the soil to grow a successful commercial crop

'The new seed is clearly superior to all competitors including Vietnam s two most popular CIP developed varieties says Peter Schmiediche the Center's former regional representative for East and Southeast Asia and the Pacific Vietnamese

agricultural officials believe that if the results of 1996 97 are reconfirmed potato production in the Red River Delta will be *revolutionized* by eliminating the need for farmers to store seed tubers Before the development of Super Seed, Vietnamese researchers had concluded TPS transplants could be used only to produce small seed tubers for planting And it was thought the tubers could not be used for more than two cropping seasons because of seed degeneration

The initial performance and popularity of Super Seed in Vietnam has already reached other national potato programs Pallais, who is also responsible for the Center s seed distribution unit, has had requests for information and seed from Cuba El Salvador Germany, Honduras and Nicaragua In Mexico Upadhya says Super Seed performance matched the two most popular potato varieties Atlantic and Frito Lay in uniformity and yield

N PALLAIS

TPS Popularity Predated 'Super Seed'

Even before the introduction of Super Seed TPS technology had been enthusiastically adopted by a growing number of Vietnam farm families in the rice based cropping system of the Delta The number of participating farmers rose from 275 in 1994 to 17 000 in 1997

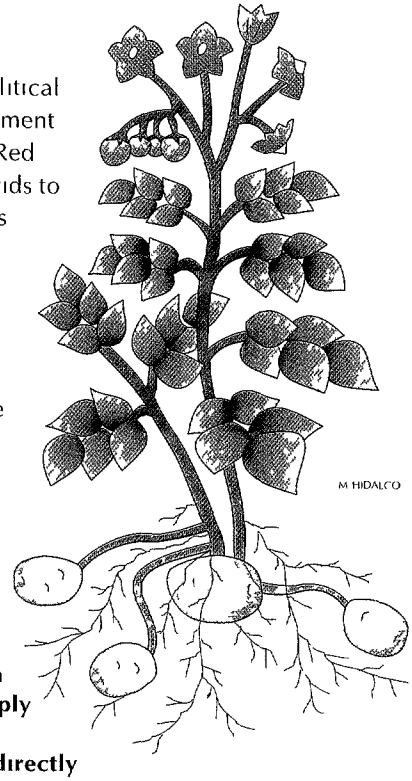
Potato yields obtained from TPS material are about double the Vietnamese average of 12 5 tons per hectare In 1996 potatoes produced from TPS derived tubers averaged nearly 24 tons per hectare across 13 sites in Thai Binh province compared with 11 tons per hectare of Ackersegen the country s most commonly grown potato variety

The spread of TPS technology has been nothing short of outstanding in the Delta where 26 000 hectares are suitable for potato production By the year 2000 Thai Binh agriculture officials anticipate sowing 150 kilograms of seed having 1,500 hectares in TPS transplants, and harvesting 15 500 hectares of TPS

TPS is a highly valuable commodity Farmers who normally pay up to the equivalent of US$800 per kilogram for ordinary hybrid seed are paying up to $1 300 per kilogram for Super Seed The government has recovered nearly all of the $24 000 it spent on importing TPS from India, and has set up a revolving fund to purchase new TPS for the 1997 98 crop Because TPS is not free Vietnamese farmers have been motivated to refine their nursery and seedling management As a result they have reduced the amount of TPS needed to plant a hectare from 270 grams to 100 grams in just three years Transplant survival rates are between 89 and 97 percent That is attributable to the sophisticated transplant management of highly experienced rice farmers

Researchers farmers and Vietnamese political leaders have urged CIP to continue development of new genetic combinations for use in the Red River Delta including shorter maturing hybrids to fit exactly between the two annual rice crops

The three year TPS hybrid project in Vietnam was successful because it met a specific need by offering an alternative seed system far superior to the old plan which relied on degenerated seeds of questionable origin Upadhya says



M HIDALGO

The tiny botanical seeds produced by the flower of the potato plant are known as true potato seed Farmers who normally plant a hectare of potatoes using 2 tons of seed tubers can now achieve the same result more cheaply by planting as little as 50 grams of TPS hybrids Traditionally, TPS is not sown directly into the field like maize or wheat seed, but planted into seedbeds, like tomatoes and then transplanted into the field as seedlings The small tubers produced from TPS seedlings are used as seed for planting the next potato crop (right)

Breeding Deep-Rooted Potatoes

C ROSSENQUIF

In a 1997 trial CIP scientists demonstrated that many germplasm accessions found in Center held germplasm collections have deeper and denser root systems that can help potatoes withstand long periods without water

Have plant breeders inadvertently developed potatoes that are overly dependent on water? In a dramatic field trial, CIP physiologists demonstrated that some potato cultivars can withstand long periods without water and still produce adequate yields

'Our hypothesis is that in searching for a better potato, modern plant breeders have inad vertently developed cultivars with shallow root systems, says CIP physiologist Noel Pallais Pallais believes the key to increasing potato yields in developing countries is to restructure the plant by expanding its root system

Immodest Goals?

CIP is increasingly concerned about water stress a relatively new area of research that Center scientists believe is within the reach of current technology The Center s goal, however is not immodest the first target is 1 million hectares in China that frequently suffer from a month of drought soon after crop establishment

It is widely known says Pallais, that cultivated potatoes are much more sensitive to soil water conditions than other crops Stress periods as short as one day can severely affect yield Studies show that cultivars differ in their susceptibility to water stress although all are affected significantly

One important and obvious physiological explanation for the acute sensitivity of potato to water stress stems from its notoriously shallow and sparse root system Pallais says Improvement programs aimed at traditional potato growing areas have accepted the status quo and use frequent shallow irrigations that penalize deeper more densely rooting cultivars

Sweetpotato Stress

Sweetpotatoes would also benefit from the new research Water stress tolerance is important not only for edible tuber yield but also–and perhaps more important from the small farmers point of view–for foliage maintenance during periods of stress One objective will be to ensure that farm ers particularly in sub Saharan Africa have sufficient seed cuttings for planting once the rainy season begins

Work in this area is already under way Over the past two years most of CIP's pathogen tested sweetpotatoes were evaluated at sites in sub Saharan Africa and in Lima with surprisingly similar results Among the clones selected for superior yields under severe water stress in Lima eight produced essentially the same results in Africa

To increase the efficiency of CIP germplasm cleanup efforts, all of the sweetpotato germplasm maintained by the Center is being prescreened under severe water stress in Lima Using this approach it should be possible to prioritize cleanup efforts and at the same time make available greater numbers of drought resistant varieties to national programs

CIP 1997 Briefs

Chacasina Proves Acceptable in Andean Highlands

A CIP true potato seed hybrid known as Chacasina has proven itself in the Peruvian highlands where consumer acceptance of new potatoes is hard to earn Chacasina is a cross between the most popular local variety produced in the central Andes Yungay and a CIP late blight resistant breeding line In a study on the impact and production potential of Chacasina, the TPS hybrid outperformed Yungay in almost all categories In extensive trials covering six produc tion zones in an impoverished region where potatoes are a subsistence food Chacasina produced average yields double that of Yungay and had a 17 percent lower incidence of virus infection What appealed most to farmers was that Chacasina could be harvested 45 days earlier than Yungay and was popular among consumers

Virus-Carrying Whiteflies Threaten Sweetpotatoes

In the Andes, the warm winter of 1997 acceler ated the spread of potato yellow vein, a virus disease carried by a whitefly (*Trialeurodes vaporariorum*) Until recently the disease was present only in Colombia and Ecuador In 1997 it was identified in the central Peruvian highlands and in Venezuela CIP plant pathologists expect it to eventually spread to the Southern Cone coun tries Whiteflies (*Bemisia sp*) are also known to carry one of the two viruses that cause sweetpotato virus disease If whitefly populations increase significantly so does the threat to sweetpotato That could be especially problematic in sub Saharan Africa, where sweetpotatoes are vital to food security and where a whitefly borne virus has already devastated cassava crops

True Potato Seed Gains Made in Egypt

Despite competition from overseas seed companies Egyptian potato producers made important gains in developing domestic seed supplies that use true potato seed (TPS) A study released in 1998 by CIP and the Egyptian Ministry of Agriculture shows that investments in TPS could provide $51 million in net benefits to Egyptian potato producers by the year 2015 Egypt's TPS project, begun in 1977, has produced annual net benefits to farmers of 28 percent, and has a net present value of nearly $3 million The figures do not take into account health and environmental benefits associated with growing locally produced, adapted seed that carries disease resistance and can be grown with fewer chemical sprays

Collins New Deputy Director General for Research

Dr Wanda W Collins, a plant breeder and geneticist, is CIP's new Deputy Director General for Research She is a leading expert on root and tuber crops Collins was professor of horticultural science at North Carolina State University at Raleigh in the United States before joining CIP in November 1997 Her new responsibilities include overall leadership of the Center s 17 major research projects and coordination of the Global Initiative on Late Blight

PROINPA Awarded Bolivian Prize

PROINPA Bolivia's collaborative potato research program supported by CIP and the Government of Switzerland, has received Bolivia s Award for Scientific Merit The citation was presented by the President of the country's National Academy of Sciences A World Bank report has termed PROINPA one of the country's outstanding agricultural research programs It was established in 1989 to revive Bolivia's national potato research program PROINPA technolo gies–including cultivars with resistance to late blight and insect pests and frost tolerance–are expected to reach subsistence farmers in the next three years CIP and PROINPA have a close working relationship CIP relies on PROINPA for drought frost and nematode research, while CIP provides PROINPA with technology in virology marketing biotechnology and resource manage ment

Board of Trustees

Mrs Martha ter Kuile*
Chairperson
Ashton Ontario Canada

Dr Adrian Fajardo Christen
Acting Chairperson
Ministerio de la Presidencia
Lima, Peru

Dr Alicia Barcena
United Nations Environment Programme
Mexico D F
Mexico

Dr Durward Bateman*
College of Agricultural and Life Sciences
North Carolina State University
Raleigh North Carolina, USA

Dr K L Chadha*
Vice Chairperson
Directorate of Horticulture
Indian Council of Agricultural Research
New Delhi, India

Dr M Sujayet Ullah Chowdhury
Bangladesh Rice Research Institute
Joydebpur Bangladesh

Dr Chukichi Kaneda
Association for International
Cooperation of Agriculture & Forestry
Tokyo, Japan

Dr David R MacKenzie
Chairperson as of March 1998
Executive Director
Northeastern Regional Association of
State Agricultural Experiment Station Directors
University of Maryland
Beltsville MD USA

Dr Moise Mensah*
Cotonou Benin

Dr Klaus Raven
Facultad de Agronomia
Universidad Nacional Agraria
Lima Peru

Dr Setijati Sastrapradja*
Indonesian Institute of Sciences
National Centre for Research in Biotechnology
Bogor Indonesia

Dr Lieselotte Schilde
University of Tubingen
Tubingen Germany

Dr Theresa Sengooba
Namulonge Agricultural and Animal Production
Research Institute
Kampala, Uganda

Dr Koenraad Verhoeff
Wageningen The Netherlands

Dr Ren Wang
Chinese Academy of Agricultural Sciences
Ministry of Agriculture
Beijing China

Dr Vo Tong Xuan
University of Cantho
Cantho Vietnam

Dr Hubert Zandstra
Director General
International Potato Center
Lima, Peru

* Term completed in 1997

A SOLIMANO

Front row left to right Theresa Sengooba Lieselotte Schilde
Vo Tong Xuan Alicia Barcena M Sujayet Ullah Chowdhury
Chukichi Kaneda Ren Wang
Second row Koenraad Verhoeff Hubert Zandstra Klaus Raven
Adrian Fajardo Christen David R MacKenzie

Donor Contributions in 1997

Donor (ranked by levels of contribution in US$000)	Unrestricted & Restricted	Non Agenda
Swiss Agency for Development & Cooperation	5 403*	550
European Union	1,900	
International Bank for Reconstruction and Development	1,800	
United States Agency for International Development	1 655	75
Japanese Government	1 375	
Netherlands Government	1 286	
Danish International Development Agency	1,221	
Federal Germany	1 062	
Swedish International Development Cooperation Agency	891	
United Kingdom Department for International Development	817	
Interamerican Development Bank	789	
International Development Research Centre	765	
Canadian International Development Agency	718	
Austrian Government	455	
Luxembourg Government	400	
Spanish Government	295	
Belgium Government	231	
Italian Government	200	
French Government	192	
Asian Development Bank	175	
Australian Centre for International Agricultural Research	155	
Norwegian Government	131	
Chinese Government	90	
International Centre for Research in Agroforestry	87	
Korean Government	80	
OPEC	70	
Brazil Government	60	
ICRISAT	60	
Mexican Government	60	
South Africa	50	
Government of India	38	
Weizmann Institute of Science	25	
Peru Ministerio de Economia y Finanzas		133
Natural Resources Institute NRI		17
The University of Georgia SANREM		20

Includes $3 2 million in network and country research projects

Finance and Administration

CIP's 1997 income totaled $24 7 million (contributions $23 3 million and $1 4 million other incomes) down 6% from an all time high of $26 3 million in 1996 Investments in potato research represented 59% of the Center s total income responding to continued growth in the demand for the crop in developing countries and the potential of CIP technologies to support this stimulated production Investments in sweetpotato totaled 23% of Center income Spending for the lesser known Andean roots and tubers natural resources management and the Global Mountain Program were 4% 11%, and 3%, respectively Center investment allocated according to CGIAR categories were increasing productivity 43% protecting the environment 26% saving biodiversity 9% improving policies 5% and strengthening national programs 17%

During the year the Center continued to improve its liquidity Since 1994 the use of

Operational expenses by activity (%) for 1997 and 1998 (estimated)

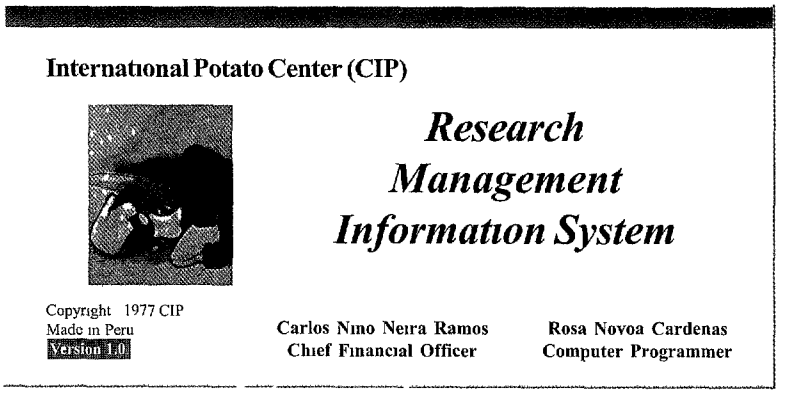
Area	1997	1998
Research	73	72
Training	5	4
Information	3	3
Research Management	9	9
Operations	7	8
Depreciation	3	3
Operating Fund	0	1
Total	100	100

BALANCE SHEET (US$000)	1997	1996
	Year ended 31 December	
Current Assets		
Cash and short term deposits	6 456	6,501
Securities	97	81
Accounts receivable		
Donors	5,605	3 485
Employees	320	388
Other	235	292
Inventories	837	863
Prepaid expenses	636	998
Total	14 186	12,608
Investments	503	483
Loans to employees	287	379
Fixed Assets		
Property plant, and equipment	21 752	21,365
Less accumulated depreciation	(12,050)	(11,502)
Total	9 702	9,863

extended credit has been limited to less than 25 days per year However because of funding reductions the Center was unable to expand its reserves as it has done over each of the past five years CIP reserves an equivalent of 17 days (US$1 1 million) which are insufficient to cope with the Center's liquidity or cash yearly needs Management will continue with its objective to improve CIP s financial reserves level

As of December 31 1997 CIP s financial statement showed a strong working capital position On the liability side, short term commitments and provisions are well covered by current Center assets

A project based Research Management Information System was developed by CIP during 1997 and implemented to support the 1998 project portfolio The new system, which complements CIPFIS, the Center's financial information system, is a powerful tool for project leaders and management to define project outcomes, estimate time and resources, schedule tasks, and bring projects in on time, on target and on budget



R NOVOA

The table below summarizes CIP's finances in 1997 A complete, audited financial statement by Coopers & Lybrand is published separately, and can be requested from the Chief Financial Officer at CIP headquarters in Lima Peru

BALANCE SHEET (US$000)	1997	1996
	Year ended 31 December	
Current Liabilities		
Short term loans	369	414
Advances from donors	7,097	5,834
Accounts payable		
Research contracts and organizations	1 910	1 554
Suppliers and taxes	1 011	1,010
Provisions for severance indemnities	52	52
Total	10,439	8,864
Long term Loan	271	515
Accruals and Provisions	659	672
Net Assets		
Capital invested in fixed assets	9 702	9 863
Capital fund	2 529	2 341
Operating fund	1,078	1,078
Total	13,309	13 282

Staff in 1997

Directors

Hubert Zandstra PhD Director General
Jose Valle Riestra, PhD Deputy Director General for Finance and Administration
Peter Gregory PhD Deputy Director General for Research[2]
Wanda Collins PhD, Deputy Director General for Research[1]
Roger Cortbaoui, PhD, Director for International Cooperation
Edward French, PhD, Associate Director for Research[2]

International Cooperation

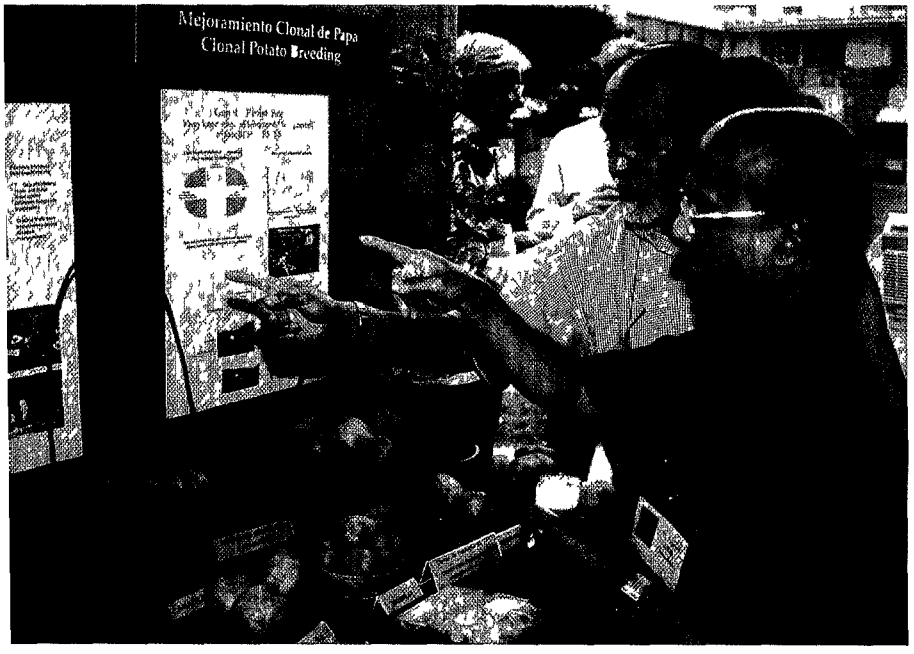
(*country*) = post location, but activity regional in scope
country = post location

Latin America and the Caribbean (LAC)
Fernando Ezeta PhD, Regional Representative (*Peru*)
Liaison Office–Ecuador
Charles Crissman PhD

Sub Saharan Africa (SSA)
Peter Ewell, PhD, Regional Representative (*Kenya*)
Liaison Office–Nigeria Cameroon
Humberto Mendoza PhD Associate Regional Representative[2 4]

Middle East and North Africa (MENA)
Liaison Office–Egypt
Ramzy El Bedewy PhD

C ROSSENOUFF



South and West Asia (SWA)
Sarathchandra Ilangantileke PhD Regional Representative (*India*)
Shushma Arya MS Accountant/Research Program Coordinator (India)

East and Southeast Asia and the Pacific (ESEAP)
Peter Schmiediche PhD Regional Representative (*Indonesia*)
Gordon Prain PhD, Regional Representative (Indonesia)[1]

Liaison Office–People's Republic of China
Song Bofu PhD
Yi Wang, PhD[1]

Liaison Office–Philippines
Gordon Prain PhD[2]

Program Leaders

Production Systems
Thomas S Walker PhD

Germplasm Management and Enhancement
Ali Golmirzaie PhD

Disease Management
Luis F Salazar PhD

Integrated Pest Management
Fausto Cisneros PhD

Propagation, Crop Management
Mahesh Upadhya PhD

Postharvest Management, Marketing
Gregory J Scott PhD

Internationally Recruited Staff

Departments

Breeding and Genetics
Merideth Bonierbale PhD Senior Potato Breeder Head of Department[1]

---

[1] Staff who joined during the year
Staff who left during the year
Staff funded by special projects
[4] Project leader

Edward Carey PhD, Regional Sweetpotato Breeder (*Kenya*)[4]
Enrique Chujoy, PhD Geneticist (*Indonesia*)
Juan Landeo PhD, Breeder[4]
Humberto Mendoza PhD, Geneticist (*Cameroon and Nigeria*)[2 4]
Il Gin Mok PhD Breeder (*Indonesia*)
Haile M Kidane Mariam, PhD, Regional Potato Seed Specialist/Breeder (*Kenya*)[4]

Genetic Resources
Ali Golmirzaie PhD Geneticist, Head of Department[4]
Carlos Arbizu PhD, ARTC Consultant[3]
Marc Ghislain PhD, Molecular Biologist[4]
Michael Hermann PhD, Andean Crops Specialist [1 4]
Miguel Holle, PhD Andean Crops Coordinator
Zosimo Huaman PhD, Germplasm Curator[4]
Carlos Ochoa, MS Taxonomist, Consultant
Bodo Trognitz PhD Geneticist[4]
Dapeng Zhang, PhD Breeder[4]

Nematology and Entomology
Fausto Cisneros PhD Entomologist, Head of Department[4]
Ann Braun PhD Ecologist (*Indonesia*) [4]
Aziz Lagnaoui PhD, Entomologist[1]
Nicole Smit MS Associate Expert, *Uganda*[3]
Jean Louis Zeddam PhD Entomovirologist

Pathology
Luis Salazar PhD Virologist, Head of Department
Gregory A Forbes PhD Plant Pathologist (*Ecuador*)[4]
Edward R French PhD, Bacteriologist [4]
Teresa Icochea, PhD Pathologist, Consultant[4]
Upali Jayasinghe PhD Virologist (*Philippines*)[4]
Rebecca Nelson PhD Molecular Pathologist[1]
Pedro Oyarzun PhD Mycologist (*Ecuador*)[3]
Sylvie Priou PhD Bacteriologist[3]
Maddalena Querci PhD Molecular Virologist[4]
Lod J Turkensteen PhD Adjunct Scientist (*Netherlands*)

Physiology
Mahesh Upadhya PhD Breeder Head of Department
Catherine Brabet PhD, Food Scientist[3]
Yoshihiro Eguchi MS Associate Expert (*Indonesia*)[3]
Ramzy El Bedewy, PhD Breeder, (*Egypt*)
Vital Hagenimana, PhD, Food Scientist (*Kenya*)
Oscar Hidalgo PhD Senior Seed Specialist[2 4]
Sarathchandra Ilangantileke PhD, Postharvest Specialist (*India*)[4]
Noel Pallais PhD Physiologist[4]
Marian Van Hal, MS, Associate Expert[3]
Christopher Wheatley, PhD, Postharvest Specialist (*Indonesia*)[2 4]

Social Science
Thomas Walker, PhD Economist, Head of Department[4]
Thomas Bernet, MS, Economist (Swiss Associate Expert)[1 3]
Johan Brons MS, Associate Expert (*Philippines*) [3]
Dindo Campilan, PhD Sociologist (*Philippines*)
Charles Crissman PhD, Economist (*Ecuador*)[4]
Peter Ewell PhD Economist (*Kenya*)[4]
Robert Jan Hijmans MS, Associate Expert[3]
Dai Peters PhD, Rural Sociologist (*Indonesia*)[3]
Gordon Prain PhD, Anthropologist (*Philippines*)[4]
Gregory Scott PhD Economist[4]
Paul Winters PhD Economist [1 3]

Training
Patricio Malagamba, PhD Head of Department

Communications
Steven Kearl MS, Senior Writer/Editor Head of Unit[1]
Bill Hardy PhD English and Spanish Writer/Editor

Information Technology
Anthony Collins, MS, Head of Unit

Directors' Offices
Office of the Director General
Edward Sulzberger, MS Senior Adviser

Office of the Deputy Director General for Research
Jose Luis Rueda PhD Coordinator Andean Natural Resources

Special Country Projects
FORTIPAPA, Ecuador
Corinne Fankhauser MS Associate Expert

PROINPA, Bolivia
Andre Devaux PhD Seed Specialist, Team Leader[3]
Enrique Fernandez Northcote PhD Virologist [3]
Javier Franco PhD, Nematologist [3 4]
Graham P Thiele PhD Technology Transfer Specialist[3]

Potato Development Proyect for Bhutan, Nepal and Pakistan
Oscar Hidalgo, PhD, Potato Specialist[1 4]

Uganda
Nicole Smit MS, Regional Entomologist and Liaison Scientist

Consortiums
CONDESAN
Robert Jan Hijmans, MS, Associate Expert[3]
Sven Jacobsen, Breeder[1]
Aart Osman Associate Expert[1 3]
Roberto Quiroz PhD Land Use Systems Specialist[3]

Joint Appointments with Other Institutions
Walter Bowen, PhD, Nutrient Cycling Specialist IFDC
Ruben Dario Estrada, MS, Natural Resources Economics, CIAT[3]
Carlos Leon-Velarde PhD, Animal Production Systems[3] ILRI

African Highlands Initiative
Berma Lemaga PhD Regional Research Fellow Agronomist

Networks
PRAPACE
N B Lutaladio, PhD, Coordinator

UPWARD
Dindo Campilan PhD, Coordinator *(Philippines)*[1]
Gordon Prain, PhD, Coordinator *(Philippines)*[2]

Controller's Office
Carlos Niño Neira CPA, Controller

Office of the Executive Officer
Jose Luis Rueda, PhD, Executive Officer[1]
Cesar Vittorelli Eng Agr Acting Executive Officer

Nationally Recruited Staff

Departments

Breeding and Genetics
Walter Amoros MS Agronomist
T R Dayal PhD Breeder *(India)*
Luis Diaz BS Agronomist
Jorge Espinoza, MS, Agronomist
Manuel Gastelo MS Agronomist
Simon Gichuki, MS Breeder *(Kenya)*
Elisa Mihovilovich MS Biologist
Daniel Reynoso, MS, Agronomist

Genetic Resources
Cesar A Aguilar BS Agronomist, Huancayo
Victor H Asmat BS Biologist[2]
Jorge Benavides Biologist
Raul Boncodin Program Assoc *(Philippines)*
Patricia G Cipriani BS Biologist
Walberto M Eslava Agronomist
Rene A Gomez Agronomist
Carmen Herrera Biologist[1]
Maria del Rosario Herrera Biologist
Luis H Ñopo, Biologist
Matilde Orrillo Biologist
Ana Luz Panta BS, Biologist
Leticia Portal BS, Biologist
Flor de Maria Rodriguez, BS Food Scientist
Alberto Salas Agronomist
Jorge Tenorio BS Biologist
Judith Toledo BS Biologist
Fanny Vargas BS Agronomist

Nematology and Entomology
Jesus Alcazar MS Agronomist[4]
Juan Cabrera MS Agronomist
Manuel Canto PhD Nematologist[3 4]
Veronica Cañedo Biologist
Veronique Gerard MS Biologist[1 3]
Erwin Guevara Agronomist[4]
Angela Matos, Agronomist[4]
Norma Mujica Agronomist
Maria Palacios Biologist[4]
Alcira Vera, Biologist

Pathology
Pedro Aley, MS, Plant Pathologist[4]
Ida Bartolini, MS, Biochemist
Rina Carhuaz, MS Biologist
Carlos Chuquillanqui BS, Agronomist
Christian Delgado, MS, Biochemist[4]

Judith Echegaray BS Agronomist[3]
Violeta Flores Biologist
Segundo Fuentes MS, Plant Pathologist[1]
Soledad Gamboa Biologist[3]
Liliam Gutarra, Agronomist
Ana Hurtado BS Biologist
Charlotte Lizarraga, MS, Plant Pathologist[4]
Giovanna Muller Biologist[3]
Peter Sande Ojiambo, MS Pathologist (*Kenya*)[1]
Ricardo Orrego, Agronomist
Willmer Perez, Agronomist[3]
Ana Maria Taboada BS, Biologist[3]
Hebert Torres, MS, Plant Pathologist[4]
Magnolia Santa Cruz, Biologist[3]
Ernesto Velit Biologist[2]
Octavio Zegarra, Biologist[3]

Physiology
Ciro Barrera, MS Plant Pathologist
Rolando Cabello, Agronomist
Nelly Espinola de Fong, MS, Nutritionist
Rosario Falcon, BS Biologist
M S Kadian PhD, Agronomist, (*India*)
John Kimani, MS, Agronomist, (*Kenya*)
Joseph Koi, MS Agronomist (*Cameroon*)
Jose Luis Marca, Agronomist
Jorge Roca BS, Biologist
Sonia Salas MS, Food Technologist[4]
K C Thakur PhD Breeder (*India*)

Social Science
Cherry Bagalanon MS Program Assoc (*Philippines*)
Rosario Basay BA Economist
Patricio Espinoza Economist (*Ecuador*)
Hugo Fano MS Economist
Cristina Fonseca MS Agronomist[4]
V S Khatana PhD Socioeconomist (*India*)
Luis Maldonado BA Economist
Victor Suarez Statistician

Training
Nelson Espinoza Training Specialist Biologist
Martha Huanes Training Logistics
Americo Valdez MS Training Material Specialist

Research Support
Lombardo Cetraro Biologist Field & Greenhouse Supervisor San Ramon
Roberto Duarte Eng Agr Field & Greenhouse Supervisor, La Molina
Hugo Goyas, Eng Agr , Field & Greenhouse Supervisor, Huancayo
Victor Otazu, PhD, Superintendent Support Unit

Statistics Unit
Alfredo Garcia MS, Experimental Statistics
Felipe de Mendiburu, Statistics Eng

Consortium
CONDESAN
Elias Mujica, MS, Anthropologist, Adjunct Scientist[3]
Ana Maria Ponce, Eng Infoandina[3]
Jorge Reinoso, MS, Agric Economist, *Puno Peru*[3]
Mario Tapia PhD, Agroecologist[3]
Roberto Valdivia, MS, Agronomist, *Puno Peru*[3]

Latin America and the Caribbean Regional Office
Alberto Gonzales, MS, Phytopathologist
Sven Villagarcia, PhD [4]

Communications Unit
Cecilia Lafosse, Chief Designer
Godofredo Lagos Production Chief

Information Technology Unit
Monica Arias Eng, Systems Engineer

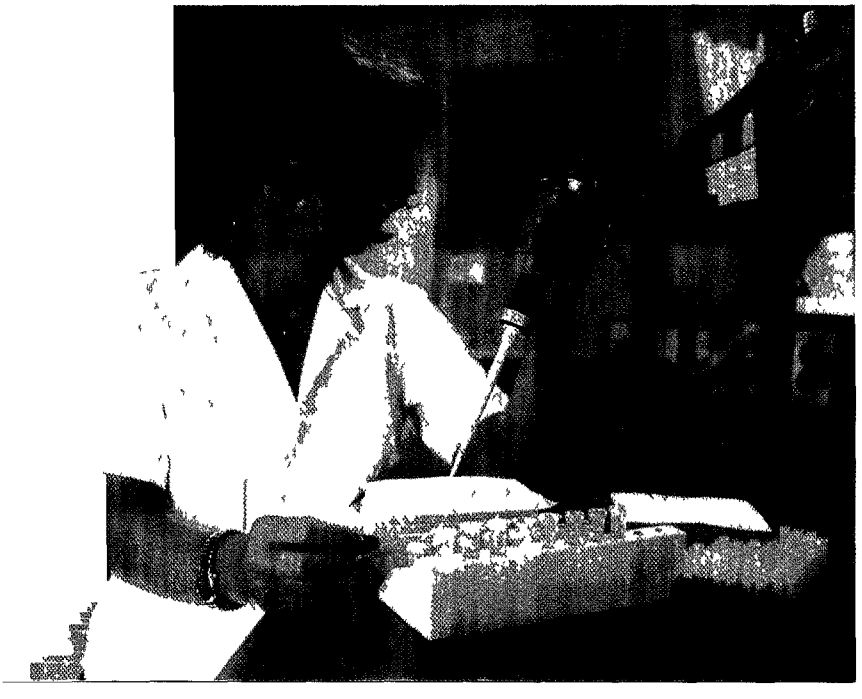
C ROSSENOUFF

Pablo Bermudez, Systems Analyst
Liliana Bravo BS, Systems Engineer
Roberto Castro, BS Systems Development
Jose Navarrete, Systems Analyst
Pia Maria Oliden Systems Analyst
Eric Romero Eng Systems Engineer
Alberto Velez, MS Systems Engineer

Library
Cecilia Ferreyra, Head Librarian

Chief Financial Office
Accounting Unit
Jorge Bautista Accountant
Edgardo de los Rios, CPA, Senior Accountant
Blanca Joo, CPA, Accountant
Rosario Pastor, CPA, Senior Accountant
Milagros Patiño BA Accountant
Eduardo Peralta, Accountant
Miguel Saavedra, CPA General Accountant
Budget Unit
Alberto Monteblanco, CPA Senior Accountant

C ROSSENOUFF



Treasury Unit
Denise Giacoma CPA Treasurer
Sonnia Solari Chief Cashier

Office of the Director General
Visitors' Office
Mariella Corvetto Supervisor

Travel Office of the Executive Officer
Ana Maria Secada, Supervisor

Human Resources
Lucas Reaño, CPC, Human Resources Manager
Auxiliary Services
Monica Ferreyros Supervisor
Sor Lapouble Assistant
Compensation
Estanislao Perez Supervisor
Medical Office
David Haltin MD
Lucero Schmidt Nurse
Social Work Office
Martha Pierola, Social Worker Supervisor

Logistics and General Services
Aldo Tang Comdr (r) Logistic and General Services Manager
Front Desk
Micheline Moncloa
Maintenance
Antonio Morillo Chief
Purchasing Supervisors
Arturo Alvarez
Jose Pizarro
Security
Jorge Locatelli Capt (r) Supervisor
Transportation
Hugo Davis Vehicle Maintenance Officer
Atilio Guerrero, Vehicle Programmer
Djordje Velickovich Pilot
Percy Zuzunaga Pilot
Warehouse
Jorge Luque MBA Supervisor

Selected Scientific Publications 1997

Ames, T , N E J M Smit, A R Braun, J N O'Sullivan, and L G Skoglund 1997 Sweetpotato Major Pests Diseases, and Nutri tional Disorders CIP Lima Peru 153 p

Arbizu, C , Z Huaman, and A Golmirzaie 1997 Other Andean roots and tubers *In* Biodiversity in Trust Conservation and Use of Plant Genetic Resources in CGIAR Centres In D Fuccillo, L Sears, and P Stapleton (eds) Cambridge Univer sity Press, Cambridge UK (4) 39 56

Campilan, D and G Prain 1997 Integrated pest management the view from below the role of users' perspectives and participation in agricul tural R&D *In* Integrated Management of Bacte rial Wilt of Potato In Pradhanang, P M and J G Elphingstone (eds) Lumle LARC p 87 100

Carey, T 1996 Not every clone is sacred Argu ments for the Increased Use of Seed Populations for the Conservation and Utilization of Sweetpotato Germplasm In Rao V R (ed) Proceedings of the workshop on the formation of a network for the conservation of sweetpotato biodiversity in Asia, Bogor Indonesia, 1 5 May 1996 International Plant Genetic Resources Institute, Rome p 100 106

Castillo, A , H Quispe, D Morales, and R Quiroz 1997 Los Sistemas de Produccion Agricola en los Andes de Bolivia In Mujica, E and J L Rueda (eds) La sostenibilidad de los sistemas de produccion campesina en los andes CONDESAN Lima, Peru p 163 214

Condori, B , A Devaux, P Mamani, J Vallejos, and J Blajos 1997 Efecto residual de la fertilizacion del cultivo de papa sobre el cultivo de haba (*Vicia faba* L) en el sistema de rotacion Revista Latinoamericana de la Papa Vol 9/10 No 1, 1996 97

Crissman, C C and P Espinosa 1997 "Papas Pesticidas y Politicas Investigacion y la agricultura sostenible In L Martinez (ed) El Desarrollo Sostenible en el Medio Rural Biblioteca de Ciencias Sociales No 2 Quito Ecuador FLACSO p 191 219

del Rio A , J Bamberg, and Z Huaman 1997a Assessing changes in the genetic diversity of potato gene banks 1 Effects of seed increase Theor Appl Genet 95 191 198

del Rio A , J Bamberg , Z Huaman, R Hoekstra, A Salas, and S Vega 1997b Assessing changes in the genetic diversity of potato genebanks 2 In situ vs Ex situ Theor Appl Genet 95 199 204

Devaux, A , J Vallejos, R Hijmans, and J Ramos 1997 Respuesta agronomica de dos variedades de papa (ssp *tuberosum* y *andigena*) a diferentes niveles de fertilizacion mineral Revista Latinoamericana de la Papa 9/10 (1) 123 139

Ewell, P T 1997 International cooperation for the improvement of potato and sweetpotato in sub Saharan Africa *In* Proceedings, 4th Triennial Congress of the African Potato Association (APA), Pretoria Agricultural Research Council p 157 164

Forbes, G A , X C Escobar, C C Ayala, J Revelo, M E Ordoñez, B A Fry, K Doucett , and W E Fry 1997 Population genetic structure of *Phytophthora infestans* in Ecuador Phytopathol 87 375 380

Ghislain, M , R Nelson, and T Walker 1997 Resistance to Potato Late Blight A Global Re search Priority Biotechnology and Development Monitor no 31 31 16

Ghislain, M , M Querci, M Bonierbale, A Golmirzaie, and R Nelson 1997 Biotechnology and the potato Application for the Developing World CIP Lima Peru 18 p

Gibson, R W , R O M Mwanga, S Kasule, I Mpembe, and E E Carey 1997 Apparent absence of viruses in most symptomless field grown sweetpotato in Uganda Ann Appl Biol 130 481 490

Golmirzaie, A M and A Panta 1997 Tissue culture methods and approaches for conservation of root and tuber crops *In* Conservation of Plant Genetic Resources in Vitro Volume 1 General Aspects M K Razdan and E C Cocking (eds) Science Publishers Inc U S A p 123 152

Hagenimana, V and C Owori 1997 Sweetpotatoes in Chapatis processing Feasibility and Accept

ability in Rural Areas Ed Journal of Food Technology in Africa Nairobi Kenya 2(1) 4 8

Hermann, M and J Heller (eds) 1997 Andean roots and tubers Ahipa, Arracacha Maca and Yacon Promoting the conservation and use of underutilized and neglected crops 21 Institute of Plant Genetics and Crop Plant Research Gatersleben/International Plant Genetic Resources Institute, Rome, Italy 256 p

Hermann, M , R Uptmoor, I Freire, and J L Montalvo 1997 Crop growth and starch productivity of edible canna *In* The International Potato Center Program Report 1995 1996 International Potato Center (CIP) Lima Peru p 295 301

Huaman, Z and D P Zhang 1997 Sweetpotato In Fuccillo D et al (eds) Biodiversity in Trust Conservation and Use of Plant Genetic Resources in CGIAR Centers Cambridge University Press p 29 38

International Potato Center 1997 Program Report 1995 1996, Lima, Peru 323 p

Jacobsen, S E 1997 Adaptation of Quinoa (*Chenopodium quinoa*) to northern European agriculture Studies on Developmental Pattern Euphytica 96 p 41 48

Jacobsen, E E , B Skadhauge, and S E Jacobsen 1997 Effect of dietary inclusion of quinoa on broiler growth performance Animal Feed Science and Technology 65, 5 14

Jacobsen, S E , O Stølen, and A Mujica 1997 Mecanismos de resistencia a sequia en la quinua (*Chenopodium quinoa* Willd) Libro de resumenes de ponencias Congreso Internacional de Agricultura para Zonas Aridas 14 16 May Arica Chile p 68

Korva, J T and G A Forbes 1997 A simple and low cost method for leaf area measurement of deteached leaves Experimental Agriculture 33 65 72

Lagnaoui, A 1997 Interference of fungicides with entomopathogens Effects on Entomophthoran Pathogens of Green Peach Aphid *In* Ecological Interactions and Biological Control D A Andow, D W Ragsdale, and R F Nyvall (eds) Westview p 301 320

Leon Velarde, C U , B Arce, and R Quiroz 1997 Modelacion de sistemas de produccion de leche descripcion de sus componentes e interacciones para el diseño de modelos de simulacion *In* Conceptos y Metodologias de Investigacion en Fincas con Sistemas de Produccion Animal de Doble Proposito Cali Colombia Centro Internacional de Agricultura Tropical (CIAT) Consorcio Tropileche p 95 116

Mujica, E and J L Rueda 1997 La Sostenibilidad de los Sistemas de Produccion Campesina en los Andes ed CONDESAN, Lima Peru 227 p

Ordoñez, M E , G A Forbes, and B T Trognitz 1997 Resistance to late blight in potato A putative gene that suppresses R genes and is elicited by specific isolates Euphytica 95 167 172

Peters, D and C Wheatley 1997 Small scale agro enterprises provide opportunities for income generation Sweetpotatato Flour in East Java Indonesia Quarterly Journal of International Agriculture 36(4) 331 352

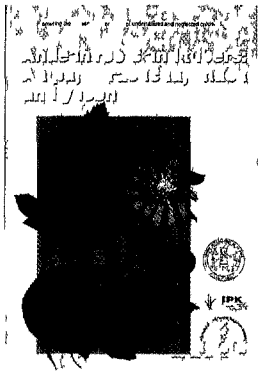
Priou, S , M A Triki, M El Mahjoub, M Fahem, and M Souibgui 1997 Assessing potato cultivars in Tunisia for susceptibility to leak caused by *Pythium aphanidermatum* Potato Research p 40 399 406

Priou, S , and E R French 1997 A simple baiting technique to detect and quantify *Pythium aphanidermatum* in soil Phytopathol 32 (3) 187 193

Querci, M , R A Owens, and L F Salazar 1997 Encapsidation of PSTVd in PLRV particles and its transmission by aphids p 150 155 *In* The International Potato Center Program Report 1995 1996 Lima Peru 323 p

Querci, M , R A Owens, I Bartolini, V Lazarte, and L F Salazar 1997 Evidence for heterologous encapsidation of potato spindle tuber viroid in particles of potato leafroll virus Journal of General Virology 78 1207 1211

Quiroz, R , D Pezo, D Rearte, and F San Martin 1997 Dynamics of feed resources in mixed farming systems in Latin America *In* Renard C (ed) Crop residues in mixed crop/livestock



farming systems CAB International, London UK p 149 180

Quispe, C , A Devaux, S Gonzales, C Tourneux, and R Hijmans 1997 Evaluacion comparativa del desarrollo y crecimiento de papa oca e isaño en Cochabamba Bolivia Revista Latinoamericana de la Papa 9/10 (1) 140 155

Scott, G 1997 "Le marche de la pomme de terre Paradoxes et previsions pour les annees Agriculture+Developpement Rural Germany 4(1) 57 59

Scott, G , R Basay, and L Maldonado 1997 "Comercio Exterior de Papa en las Americas Crecimiento, potencial y peligros " Comercio Exterior Mexico 7(12) 984 996

Scott, G and D Griffon (eds) Prix, Produits, et Populations Methodes pour analyser la commercialisation agricole dans les pays en developpement Une co publication du CIP et le Centre de cooperation internationale en recher che agronomique pour le developpement (CIRAD) 1997 Ed Karthala 500 p

Smit, N E J M 1997 The effect of the indigenous cultural practices of in ground storage and piecemeal harvesting of swetpotato on yield and quality losses caused by sweetpotato weevil in Uganda Agriculture Ecosystem and Environment 64/3 p 191 200

Smit, N E J M , M C A Downham, B Odongo, D R Hall, and P O Laboke 1997 Development of pheromone traps for control and monitoring of sweetpotato weevils *C puncticollis* and *C brunneus* in Uganda Entomologia Experimentalis et Applicata 85 p 95 104

Tenorio, J , V Cañedo, E Mihovilovich, A Golmirzaie, and F Cisneros 1997 Obtencion de clones de papa resistentes a mosca minadora *Liriomyza huidobrensis* e inmunes a los virus PVY y PVX *In* Resumenes de la XXXIX Convencion Nacional de Entomologia 26 30 Oct Piura Peru p 34

Thiele, G , G Gardner, R Torrez, and J Gabriel 1997 Farmer Involvement in selecting new varieties Potatoes in Bolivia Experimental Agriculture p 275 290

Triki, M A , and S Priou 1997 Using chemical and biological treatments to reduce the potential of potato leak caused by *Pythium aphanidermatum* in Tunisia Potato research 40 391-398

Trognitz, B , M Ghislain, G Forbes, P Oyarzun, M Eslava, R Herrera, L Portal, P Ramon, and G Chacon 1997 Evaluation of Late Blight resis tance in populations of diploid potato hybrids for genetic mapping Ed CIP Program Report 1995 1996 Lima, Peru p 132 137

Turyamureeba, G , R O M Mwanga, and E Carey 1997 Sweetpotato clonal evaluation for resis tance to sweetpotato diseases (SPD) and high yield *In* Proceedings of the 4th Triennial Con gress of the African Potato Association, Pretoria, South Africa, 23 28 Feb 1997 ARC-Roodeplaat, South Africa p 108 112

Valdivia Alatrista, R , R Quiroz, R Valdivia Fernandez, and V Choquehuanca 1997 Risk analysis of potato production in the Altiplano Quantifying Farmer's Beliefs CIP's program reports Lima, Peru p 29 33

Van De Fliert, E , A R Braun, R Asmunati, Wiyanto, and Y Widodo 1997 One step back, two steps forward Sweetpotato Integrated Crop Management Development in Indonesia *In* UPWARD Institutionalising Innovations in Rootcrop Research and Development UPWARD Los Baños, Philippines p 127 140

Van De Fliert, E 1997 Integrated pest management Springboard to Sustainable Agriculture *In* G S Dhaliwal and E A Heinrichs (eds) Critical Issues in Insect Pest Management National Agricultural Technology Information Centre, Ludhiana India 15 p

Wheatley, C , G Scott, R Best, and S Wiersema 1997 Metodos para agregar valor a raices y tuberculos alimenticios Manual para el Desarro llo de Productos Centro Internacional de Agricul tura Tropical (CIAT) Cali Colombia 187 p

Zhang, D P , A Golmirzaie, G Cipriani, A Panta, M Ghislain, N Smit, I Rety, and D Michaud 1997 Developing weevil resistance in sweetpotato with genetic transformation *In* CIP Program Report 1995 96 International Potato Center (CIP) Lima Peru p 205 210

This list includes selected journal articles book chapters and CIP publications CIP staff made many other contributions such as invited papers presented at meetings and published in proceedings CIP s Library can provide a complete list of publications generated by CIP in 1997

Research in 1997

Research Agenda 1997

In 1997 CIP reorganized its scientific activities into a project based management system designed to streamline Center research and broaden research leadership The restructuring took place following a formal reassessment of the Center s priorities and agenda by staff board and stakeholders The changeover is effective January 1 1998 to coincide with the CGIAR s next medium term plan

The new portfolio contains 17 projects versus 36 in 1996 Project leaders serve as the principal research managers in the new system In addition, a management team has been formed to provide oversight at the program level The projects are complemented by regional action plans that integrate specific regional needs with CIP strategic research capability at headquarters

Project Leaders 1998

Nº Pro	TITLE	LEADER
1	Integrated control of late blight	R Nelson
2	Integrated control of bacterial wilt	E Chujoy
3	Control of potato viruses	M Querci
4	Integrated management of potato pests	A Lagnaoui
5	Propagation of clonal potato planting material	U Jayasinghe
6	Sexual potato propagation (TPS)	M Upadhya
7	Global sector commodity analysis & impact assesment for potato	T Walker
8	Control of sweetpotato viruses	L Salazar
9	Integrated management of sweetpotato pests	F Cisneros
10	Postharvest utilization of sweetpotato	G Scott
11	Breeding for high dry matter in sweetpotato	Z Dapeng
12	Global sector commodity analysis & impact assesment for sweetpotato	G Scott
13	Potato production in rice wheat systems	T Walker
14	Sustainable land use in the Andes	R Quiroz
15	Conservation & characterization of potato genetic resources	Z Huaman
16	Conservation & characterization of sweetpotato genetic resources	Z Huaman
17	Conservation & characterization of Andean root and tuber crops	M Holle

Program, Project, and Activity	Locations and Partner Networks
Characterization of constraints and opportunities for potato production	
Farmer participation in clonal evaluation	• Bolivia
Characterization of potato production systems	• Ecuador • PRAPACE
Fate of soil conservation in the Andes	• Ecuador
Benchmark sites and database development	• Peru
Characterization of sweetpotato constraints and opportunities	
Sweetpotato characterization	• India • Southeast Asia • Sub Saharan Africa
Users' Perspective with Agricultural Research and Development (UPWARD)	• Asia • China • Netherlands
Sustainability of sweetpotato cropping systems	• Uganda
Adaptation and integration of potato production technologies	
Varietal adaptation to diverse agroecologies	• Bolivia • Cameroon • Chile • China • Indonesia • Peru • Philippines • PRAPACE
Expanding production to new regions	• India • China
Adaptation and integration of sweetpotato production technologies	
Varietal adaptation to diverse regions	• China • Egypt • India • Indonesia • Kenya • Peru • SARRNET • Tanzania • Uganda
Evaluation of the impact and sustainability of potato production technologies	
Impact assessment and size of NARS	• Argentina • Bangladesh • Bolivia • Chile • China • Colombia • Dominican Republic • Ecuador • Egypt • Ethiopia • India • Indonesia • Kenya • Madagascar • Nepal • Peru • PRAPACE • Sri Lanka • Taiwan • Vietnam
Pesticides and sustainability	• Canada • Ecuador • USA

C ROSSENOUFF

Program, Project, and Activity	Locations and Partner Networks
Potato collection and characterization	
Collection, characterization, conservation, and distribution	• Peru • USA
In vitro conservation	• Ecuador • Peru • Venezuela
Potato germplasm enhancement, application of molecular technology	
Germplasm enhancement	• Peru • USA
Application of molecular marker technology	• Argentina • Ecuador • Germany • Netherlands • Philippines • UK • USA
Genetic engineering for pest and disease resistance	• Belgium • Bolivia • Peru • UK • USA
Sweetpotato collection and characterization	
Collection, characterization conservation, documentation, distribution, and evaluation	• Brazil • China • Indonesia • Philippines—UPWARD,
In vitro conservation and virus eradication	• Austria • Peru • USA • Venezuela
Collection and evaluation of indigenous knowledge	• Indonesia—UPWARD
Sweetpotato germplasm enhancement and molecular techniques	
Combining traits using conventional techniques in diverse agroecologies	• Bangladesh • China • India • Indonesia • Kenya • Peru • Tanzania • Uganda • Vietnam
Utilization of wild relatives of sweetpotato	• Japan • Peru • USA
Molecular techniques for sweetpotato improvement	• Austria • Canada • China • Peru
Andean root and tuber crop collection and characterization	
Germplasm management in farmers' fields	• Peru • Bolivia
Development of a network for ex situ conservation	• Ecuador • Peru • Bolivia • Brazil
In vitro conservation and distribution	• Ecuador • Peru • Bolivia
Pathogen eradication and seed production	• Ecuador • Peru • Bolivia
Commodity systems analysis	• Ecuador • Peru • Bolivia
Control of potato late blight	
Breeding and screening for resistance	• Argentina • Bolivia • China • Colombia • Ecuador • Kenya • Mexico • Peru
Integrated control	• Bolivia
Fundamental host-pathogen research	• Ecuador • Kenya • Netherlands • Peru • Philippines • Scotland • USA
Integrated control of potato bacterial wilt	
Fundamental research for control strategies	• China • Colombia • England • Peru
Development of resistance	• Brazil • China • Indonesia • Nigeria • Peru • Philippines

C ROSSENOUFF

CIP's extensive research collaboration brings together many partners worldwide This table summarizes CIP's core research activities in 1997, and the principal places and networks involved

Program, Project, and Activity	Locations and Partner Networks
Integrated control	• Burundi • Kenya • Peru
Combining resistances to potato viruses and fungi	
Development of virus and viroid resistant materials	• Peru • Poland
Interaction of potato viruses and fungi	• Peru • Philippines
Selection of combined resistance to viruses and fungi	• Argentina • Brazil • Cameroon • Central America and the Caribbean • Colombia • East Africa • Ecuador • Egypt • Nigeria • Paraguay • Peru • Philippines • PROCIPA • Uruguay • USA • Venezuela
Detection and control of potato viruses	
Resistance to PLRV	• Peru
Detection of viruses and viroids	• Bolivia • Colombia • India • Peru
Transmission of potato viruses and viroids	• Peru • Philippines
Identification of potato yellow vein disease	• Colombia • Peru
Identification and control of sweetpotato viruses	
Detection identification, and eradication of viruses	• China • Peru • Uganda
Integrated control	• Kenya • Madagascar • Rwanda • Tanzania • Uganda
Control of bacterial and fungal diseases of sweetpotato	
Resistance to diseases	• Southeast Asia
Molecular approaches for detection and control of pathogens	
Genetic resistance and probe development	• England • Peru • USA
Virology of Andean roots and tubers	
Detection and characterization of viruses	• Bolivia • Ecuador • Peru
Elimination of pathogens	• Peru
Production loss by viruses	• Bolivia • Ecuador • Peru
Potatoes with resistance to major insect and mite pests	
Development of resistant genotypes for potato tuber moth and leafminer flies	• Peru
Potatoes with glandular trichomes	• Peru • USA
Transgenic potatoes with insect resistance	• Belgium • Peru
Field evaluation of resistant plants	• Peru
Integrated methods for control of potato tuber moth and leafminer fly	
Generation of technologies	• Bolivia • Colombia • Peru
Use of sex pheromones and granulosis virus	• Bolivia • Colombia, Ecuador & Peru—PRACIPA

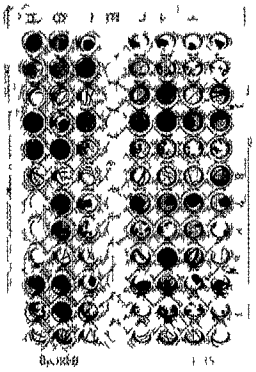
Program, Project, and Activity	Locations and Partner Networks
	• Dominican Republic • Egypt • Tunisia
Applied field management	• Bolivia • Colombia • Dominican Republic • Egypt • Kenya • Morocco • Peru • Tunisia • Yemen
Integrated methods for control of sweetpotato weevil	
Development of resistance	• Asia • Cuba • Kenya • Peru • USA
Use of sex pheromones	• Cuba • Dominican Republic • Uganda
Biological control	• Cuba
Applied field management	• Cuba • Dominican Republic • Indonesia • Kenya • Uganda
Integrated methods for control of sweetpotato nematodes	
Development of resistance	• Peru
Applied field management	• Peru
Integrated methods for control of Andean potato weevil	
Development of resistance	• Peru
Cultural and biological control methods	• Bolivia • Colombia • Ecuador • Peru
Applied field management	• Bolivia • Colombia • Ecuador • Peru
Integrated methods for control of potato cyst nematode and false root knot nematode	
Crop rotation schemes	• Peru
Applied field management	• Bolivia • Ecuador • Peru
Propagation of healthy clonal potato planting materials in diverse agricultural systems	
Research support to in country basic seed programs	• Bangladesh • Bolivia • Cameroon • Ecuador • Kenya • Philippines
Sexual potato propagation	
Breeding for improved TPS families	• China • India • Peru
TPS agronomic adaptation to diverse agroecologies	• Bangladesh • Brazil • China • Cuba • Egypt • India • Indonesia • Nepal • Nicaragua • Peru • Philippines • Sri Lanka • Sudan • Vietnam
Studies on TPS production	• Bangladesh • Chile • India • Nepal • Peru • Vietnam
Propagation of healthy clonal sweetpotato planting materials in diverse agricultural systems	
Crop management practices	• Burundi • Cameroon • China • Peru • Philippines
Management of forage-type sweetpotatoes	• Peru
Maintenance, international distribution, and monitoring of performance of advanced potato germplasm	
Ongoing activities (seed units)	• Kenya • Peru • Philippines

Program Project, and Activity	Locations and Partner Networks
Maintenance, distribution, and monitoring of performance of advanced sweetpotato germplasm	
Ongoing activities (seed units)	• Kenya • Peru • Philippines
Abiotic stresses and potato crop management	
Breeding and management for tolerance to abiotic stresses in potato	• Bolivia • Chile • Peru • Philippines • Southeast Asia
Studies on tolerance to abiotic stresses in sweetpotato	• China • Egypt • Peru
Propagation of Andean root and tuber crops and management of Andean natural resources	
Seed production Andean root and tuber crops	• Ecuador • Peru
Management of Andean natural resources	• Peru
Expanding utilization of potato in developing countries	
Marketing and demand for potatoes	• Bolivia • China • Colombia • India • Indonesia • Kenya • Morocco • Netherlands • PRECODEPA • Tunisia • UK • UPWARD • USA
Product development for sweetpotato in developing countries	
Evaluation and distribution of elite sweetpotato materials for processing	• China • Indonesia • Kenya • Peru • Philippines • Uganda • Vietnam
Marketing and demand for sweetpotatoes	• Bangladesh • China—UPWARD • Indonesia • Kenya • Malawi • Netherlands • Peru • Philippines—UPWARD • USA
Processing of sweetpotato	• China—UPWARD • Indonesia • Kenya • Malawi • Netherlands • Philippines • SARRNET • Uganda • Vietnam
Postharvest management of Andean food commodities	
	• CONDESAN in Bolivia, Ecuador, and Peru

C. ROSSENOUFF

Training in 1997

Program and Title	Countries Represented	Partner Institution
3rd International training course on sweetpotato production	Bangladesh China India, Sri Lanka	CTCRI/CIP
Workshop on the use of crop growth simulation models	Ecuador	CIP/INIAP
Workshop on the use of crop growth simulation models	Colombia Honduras, Nicaragua	Universidad de Caldas/CIP
Workshop on the use of crop growth simulation models	Bolivia	CIP/PROINPA
Potato cultivation with emphasis on seed production	Peru	CIP/INIA/UNALM CODIPAPA
Planning meeting for a regional initiative for the conservation and utilization of cassava, sweetpotato, and yam germplasm	Angola, Benin, Cameroon, D R Congo, Ethiopia Ghana Guinea, Ivory Coast, Kenya, Lesotho, Madagascar, Malawi, Mozambique, Nigeria, Philippines, Rwanda, South Africa, Tanzania Uganda Zambia	CIP/SGRP/ IITA/PRAPACE/ SARRNET
Study tour on sweetpotato breeding	Angola, Burundi D R Congo, Ethiopia Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda	CIP/PRAPACE/ SARRNET
ANSWER training course on maintenance, characterization, of enthomopathogens of potatoes	China, India, Indonesia, Japan Korea, Malaysia Philippines, Sri Lanka, Thailand Vietnam	CIP/IPGRI
Potato germplasm evaluation seed production, and virology	Angola Burundi Ethiopia	CIP/Seeds of Freedom
Workshop/Course on virus disease diagnosis	Colombia	Universidad Nacional de Colombia/CIP
International workshop on integrated control of potato late blight	Argentina Bolivia Colombia Costa Rica Ecuador Panama Peru, Venezuela	CIP
Detection of sweetpotato chlorotic stunt virus	Kenya	CIP/NARO



C ROSSENOUFF

Program and Title	Countries Represented	Partner Institution
International training course on the use of ELISA kits for the detection of viruses	Bangladesh, Nepal, Pakistan, Philippines Sri Lanka, Thailand, Vietnam	CIP/Thailand Agricultural Research Institute
Course on diagnosis, characterization, and multiplication of enthomopathogens of potatoes	Bolivia, Colombia, Panama Peru	CIP
International workshop on integrated pest management	Bolivia, Colombia, Guatemala	CIP/CORPOICA
Course on integrated pest management of potato with emphasis in the prevention and control of *Tecia solanirova*	Ecuador	CIP/FORTIPAPA
Regional workshop on integrated pest management of potato with emphasis in the prevention and control of *Tecia solanivora*	Peru	SENASA/CIP
Training of trainers course	Indonesia	CIP
Workshop on selection and evaluation of potato germplasm	Costa Rica	PRECODEPA/CIP
In country integrated crop management for sweetpotato	Ethiopia, Uganda	CIP/NARO
Potato germplasm evaluation and seed production	Nairobi	CIP/KARI
In country course on sweetpotato integrated pest management	Zambia	SARRNET
Course on potato production with emphasis on soil fertility management	Peru	CIP/UNA/ PROMESPA
Farmer based potato seed production and distribution	Ethiopia, Kenya, Uganda	CIP/IAR/ PRAPACE
International training course on non conventional approaches to seed potato production	Bangladesh India Nepal Philippines Samoa Sri Lanka, Thailand Vietnam	CIP
In country course on true potato seed	Egypt	CIP
Workshop on potato seed production and management	Peru	CIP/MEF

During 1997, training activities at CIP followed the research program structure according to priorities established for both research subjects and regional relevance In addition, 40 national scientists received individual training in specific disciplines

Program and Title	Countries Represented	Partner Institution
National seed production course	Peru	CIP/MEF
True potato seed field training course	Bangladesh Nepal	CIP
Course on potato crop management and seed production	Peru	CIP/PROMESPA
[illegible]	[illegible]	[illegible]
Course on agricultural marketing	Peru	CIP/Ministerio de Agricultura
International workshop on Andean foods postharvest, processing and marketing	Bolivia Colombia Ecuador Peru	COSEDU/ CONDESAN/CIP
Product and market development for root and tuber crops	Kenya	IITA/SARRNET/ PRAPACE
In country course on sweetpotato product development	Uganda	CIP/PRAPACE/ NARO
Root product processing technology	China	CIP
[illegible]	[illegible]	[illegible]
Short term training visit for SARRNET and PRAPACE Sweetpotato researchers	Angola, Burundi D R Congo Ethiopia, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda	CIP/SARRNET/ PRAPACE/Seeds of Freedom
Simulation models and data base management for research in mountain environments	Bolivia, Ecuador, Peru, The Netherlands	CIP/CONDESAN/ IFDC
Workshop on Andean watershed management	Argentina Bolivia, Ecuador, Peru	CIP/CONDESAN/ ADEFOR
International workshop on information technology as a tool to assess land use options in space and time	Bolivia, Brazil, Chile Colombia Costa Rica, Ecuador, Guatemala Mexico Peru, The Netherlands, USA	
Mountain forum workshop	Bolivia, Colombia Peru Venezuela	CIP/CONDESAN
Course on information and sustainable development techniques	Peru	CIP/CONDESAN
International course on molecular markers	Ecuador	CIP/INIAP
IX International congress on Andean root and tuber crops	Bolivia Brazil Colombia Ecuador, Peru Spain, Venezuela	

Research Partners

AARI	Aegean Agricultural Research Institute Turkey
ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
AGCD	Administration Generale de la Cooperation au Developpement Belgium
AIT	Asian Institute of Technology
ARC	Agriculture Research Center Egypt
ARCS	Austrian Research Centre at Seidersdorf
AREA	Agricultural Research and Extension Authority Yemen
ASPRAD	Asian Sweetpotato and Potato Research and Development
BARI	Bangladesh Agricultural Research Institute
	Benguet State University Philippines
BMZ	German Ministry for Economic Development and Cooperation
	Bogor Agricultural University Indonesia
BRC	Biotechnology Research Center Vietnam
CAAS	Chinese Academy of Agricultural Sciences
CARDI	Caribbean Agricultural Research and Development Institute Trinidad
CARE	Cooperative for Assistance and Relief Everywhere Inc
CBC	Centro Bartolome de las Casas Peru
CECOACAM	Central de Cooperativas Agrarias de Cañete y Mala Peru
CEMOR	Cemor Editores & Promotores S R L Peru
CGIAR	Consultative Group on International Agricultural Research USA
	Chiang Mai University Thailand
CIAAB	Centro de Investigaciones Agricolas A Boerger Uruguay
CIAT	Centro Internacional de Agricultura Tropical Colombia
CICA	Centro de Investigacion en Cultivos Andinos Peru
CIDA	Canadian International Development Agency
CIED	Centro de Investigacion Educacion y Desarrollo Peru
CIRAD	Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement France
CIRNMA	Centro de Investigacion de Recursos Naturales y Medio Ambiente Peru
CLADES	Consorcio Latinoamericano de Agroecologia y Desarrollo
CNCQS	Chinese National Centre for Quality Supervision and Test of Feed
CNPH	Centro Nacional de Pesquisa de Hortaliças Brazil
CONDESAN	Consortium for the Sustainable Development of the Andean Ecoregion
	Cornell University USA
CORPOICA	Corporacion del Instituto Colombiano Agropecuario
COTESU	Cooperacion Tecnica Suiza Switzerland
CPRA	Centre de Perfectionnement et de Recyclage Agricole de Saida Tunisia
CPRI	Central Potato Research Institute India
CPRO DLO	Centre for Plant Breeding and Reproduction Research Agriculture Research Department Netherlands
CRIFC	Central Research Institute for Food Crops Indonesia
CTCRI	Central Tuber Crops Research Institute India
EMATER	Empresa de Assistencia Tecnica e Extensao Rural do Estado de Minas Gerais Brazil
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuaria Brazil
ENEA	Comitato Nazionale per la Ricerca e per lo Sviluppo dell Energia Nucleare e delle Energie Alternative Italy
EPAMIG	Empresa de Pesquisa Agropecuaria de Minas Gerais Brazil
ESH	Ecole Superieure d Horticulture Tunisia
FAO	Food and Agriculture Organization of the United Nations Italy
FONAIAP	Fondo Nacional de Investigac ope Ag opecua a Venezuela
FORTIPAPA	Fortalecimiento de la Investigacion y Produccion de Semilla de Papa Ecuador
FUNDAGRO	Fundacion para el Desarrollo Agropecuario Ecuador
GAAS	Guandong Academy of Agricultural Sciences China
GTZ	German Agency for Technical Cooperation
IAN	Instituto Agronomico Nacional Paraguay
IAO	Istituto Agronomico per l Oltremare Italy
IAR	Institute of Agricultural Research Ethiopia
IAV	Institut Agronomique et Veterinaire Morocco

IBTA	Instituto Boliviano de Tecnologia Agropecuaria
ICAR	Indian Council of Agricultural Research
ICIPE	International Centre for Insect Physiology and Ecology Kenya
IDB	Inter American Development Bank
IDEA	Instituto Internacional de Estudios Avanzados Venezuela
IDRC	International Development Research Centre Canada
IESR/INTA	Instituto de Economia y Sociologia Rural del INTA Argentina
IFPRI	International Food Policy Research Institute USA
IIN	Instituto de Investigacion Nutricional Peru
IMA	Instituto de Manejo de Agua y Medio Ambiente Peru
INIA	Instituto Nacional de Investigacion Agraria Peru
INIA	Instituto Nacional de Investigaciones Agropecuarias Chile
INIA	Instituto Nacional de Investigaciones Agropecuarias Uruguay
INIAP	Instituto Nacional de Investigaciones Agropecuarias Ecuador
INIFAP	Instituto Nacional de Investigaciones Forestales y Agropecuarias Mexico
INIVIT	Instituto Nacional de Investigacion de Viandas Tropicales Cuba
INRA	Institut National de la Recherche Agronomique France
INRAT	Institut National de la Recherche Agronomique de Tunisie
INSA	National Root and Tuber Crop Improvement Institute Vietnam
INTA	Instituto Nacional de Tecnologia Agropecuaria Argentina
IPGRI	International Plant Genetic Resources Institute Italy
IPO DLO	Institute for Plant Protection Agriculture Research Department Netherlands
IPR	Institute for Potato Research Poland
IRA	Institut de Recherche Agronomique Cameroon
ISABU	Institut des Sciences Agronomiques du Burundi
IZ	Instytut Ziemniaka Poland
JAAS	Jiangsu Academy of Agricultural Sciences China
KARI	Kenyan Agricultural Research Institute
LAC	Latin America and the Caribbean CIP region
LEHRI	Lembang Horticultural Research Institute Indonesia
LSU	Louisiana State University USA
	Makerere University Uganda
MARS	Mwara Agricultural Research Institute Indonesia
	McMaster University Canada
MEF	Ministerio de Economia y Fiananzas Peru
MIP	Programa de Manejo Integrado de Plagas Dominican Republic
	Mississippi State University USA
MMSU	Mariano Marcos State University Philippines
	Montana State University USA
MPI	Max Planck Institute Germany
MSIRI	Mauritius Sugar Industry Research Institute
NAARI	Namulonge Agricultural and Animal Research Institute Uganda
	Nagoya University, Japan
NARO	National Agricultural Research Organization Uganda
NCSU	North Carolina State University USA
	Nijmegen University Netherlands
NOMIARC	Northern Mindanao Agricultural Research Center Philippines
NPRCRTC	Northern Philippine Root Crops Research and Training Center
NPRP	National Potato Research Program Nepal
NRI	Natural Resources Institute UK
OAS	Organization of American States
ODA	Overseas Development Administration UK
OPEC	Organization of Petroleum Exporting Countries
PCARRD	Philippine Council for Agriculture & Resources Research & Development, Philippines
PDP	Potato Development Program Nepal
PGS	Plant Genetic Systems Belgium
PICA	Programa de Investigacion de Cultivos Andinos Peru
PRACIPA	Programa Andino Cooperativo de Investigacion en Papa CIP network

PRAPACE	Programme Regional de l Amelioration de la Culture de la Pomme de Terre et de la Patate Douce en Afrique Centrale et de l Est CIP network
PRECODEPA	Programa Regional Cooperativo de Papa CIP network in Central America and the Caribbean
PROCIPA	Programa Cooperativo de Investigaciones en Papa CIP network in Southern Cone
PROINPA	Proyecto de Investigacion de la Papa Bolivia
PROMESPA	Proyecto de Mejoramiento de Papa Peru
PSPDP	Pakistan Swiss Potato Development Program
	Rothamsted Experiment Station UK
SAAS	Sichuan Academy of Agricultural Sciences China
SARIF	Sukamandi Research Institute for Food Crops Indonesia
SARRNET	Southern Africa Root Crop Research Network
SCRI	Scottish Crop Research Institute
SDC	Swiss Development Cooperation
SEAG	Servicio de Extension Agricola y Ganadera Paraguay
SEARCA	Southeast Asian Regional Center for Graduate Studies and Research in Agriculture Philippines
SEMTA	Servicios Multiples de Tecnologias Apropiadas Bolivia
SENASA	Servicio Nacional de Sanidad Agraria Peru
SINITTA	Sistema Nacional de Investigacion y Transferencia de Tecnologia Agraria Peru
SPG	Sociedad Peruana de Genetica
SPI	Smart Plant International USA
SPPC	Seed Potato Production Center Yemen
	Stanford University USA
TALPUY	Grupo de Investigacion y Desarrollo de Ciencias y Tecnologia Andina
TARI	Taiwan Agricultural Research Institute
TCRC	Tropical Crops Research Center Bangladesh
TFNC	Tanzania Food and Nutrition Centre
	Universidad de Ambato Ecuador
	Universidad Austral Chile
	Universidad Jorge Basadre Grohmann de Tacna Peru
	Universidad Mayor de San Simon Bolivia
	Universidad Nacional Agraria Peru
	Universidad Nacional de Cajamarca Peru
	Universidad Nacional del Centro del Peru
	Universidad Nacional Daniel Alcides Carrion Peru
	Universidad Nacional Mayor de San Marcos Peru
	Universidad Nacional San Antonio Abad de Cusco Peru
	Universidad Nacional San Cristobal de Huamanga de Ayacucho Peru
	Universidad Ricardo Palma Peru
	Universidad San Luis Gonzaga de Ica Peru
	Universidad Tecnica de Cajamarca Peru
	University of Birmingham England
	University of Georgia USA
	University of Nairobi Kenya
	University of Naples Italy
	University of Oxford UK
	University of the Philippines Los Banos
	University of Tubingen Germany
UCRI	Upland Crops Research Institute China
UNDP	United Nations Development Programme USA
UPWARD	Users Perspective with Agricultural Research and Development CIP network
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
USVL	United States Vegetable Laboratory
VISCA	Visayas College of Agriculture Philippines
	Wageningen University Netherlands
WE	World Education
XSPRC	Xuzhou Sweet Potato Research Center China
YGPPP	Yemeni/German Plant Protection Project

CIP's Global Contact Points

(as of April 1998)

Latin America and the Caribbean Regional Office/Headquarters

- Peru

International Potato Center
Apartado 1558
Lima 12, Peru
Phone (51-1) 349 6017/349 5783
Fax (51 1) 349 5638
E-mail cip@cgnet com or cip@cipa org pe

Research Stations

- Ecuador

Estacion Experimental INIAP Santa Catalina
Km 14 Panamericana Sur
Apartado 17 21 1977
Quito Ecuador
Phone (593 2) 690-362
Fax (593 2) 692 604
E mail cip quito@cgnet com

Special Projects

- Ecuador

FORTIPAPA (at Santa Catalina Station same as above)
Phone (593 2) 690 695/364
Fax (593 2) 692 604
E mail cip quito@cgnet com or fpapa@cip org ec

- Bolivia

PROINPA (IBTA CIP)
Man Cespedes 0293
Casilla Postal 4285
Cochabamba, Bolivia
Phone (591 42) 47925
Fax (591 42) 45708
E-mail proinpa@papa bo

Sub-Saharan Africa Regional Office

- Kenya

P O Box 25171
Nairobi, Kenya
Phone (254-2) 632 054
Fax (254 2) 630 005/631 499
E mail cip-nbo@cgnet com

Liaison Offices

- Cameroon

c/o Delegation of Agriculture
North West Province
P O Box 279
Bamenda Cameroon
Phone (237 36) 2289 (public booth)
Fax (237 36) 3893 or 3921 (public booth)
(237 36) 3284 (Skyline Hotel)
Telex 58442 (NWDA)
E mail cip cameroon@cgnet com

- Uganda

CIP c/o IITA
P O Box 7878
Kampala Uganda
Phone (256 41) 236 918
Fax (256 41) 236 918
E mail iita uganda@cgnet com

Network

- PRAPACE

PRAPACE/Uganda
P O Box 22274
Kampala Uganda
Phone (256 41) 235306
Fax (256 41) 341242
E mail nbluta@imul com

Liaison Office (for Middle East and North Africa)

- Egypt

P O Box 17
Kafr El Zayat, Egypt
Phone (20 40) 58 6720
Fax (20 40) 58 0800
Telex 23605 PBTNA UN
E mail cip egypt@cgnet com

South and West Asia Regional Office

- India

IARI Campus
New Delhi 110012 India
Phone (91 11) 574 8055
Phone/Fax (91 11) 573 1481
Telex 3173140 FI IN
Cable CIPAPA, New Delhi
E-mail cip-delhi@cgnet com

This list indicates CIP's principal contact points worldwide, by region. A more detailed list, including current staff contacts, can be obtained from the office of the Director for International Cooperation

EAST AND SOUTHEAST ASIA AND THE PACIFIC REGIONAL OFFICE

• Indonesia
c/o CRIFC
P O Box 929
Bogor 16309, West Java Indonesia
Phone (62 251) 317951/313687/333667
Fax (62 251) 316264
E mail cip bogor@cgnet com

Lembang Annex
P O Box 1586
Bandung 40391, Indonesia
For courier mail/packages to CIP
c/o Balai Panelitian Tanaman Sayuran Jl
Tangkuban Perahu 517
Cikole, Lembang, Bandung 40391, Indonesia
Phone (62 22) 278 8155
Fax (62 22) 278 6025
E mail cip indonesia@cgnet com

Liaison Offices

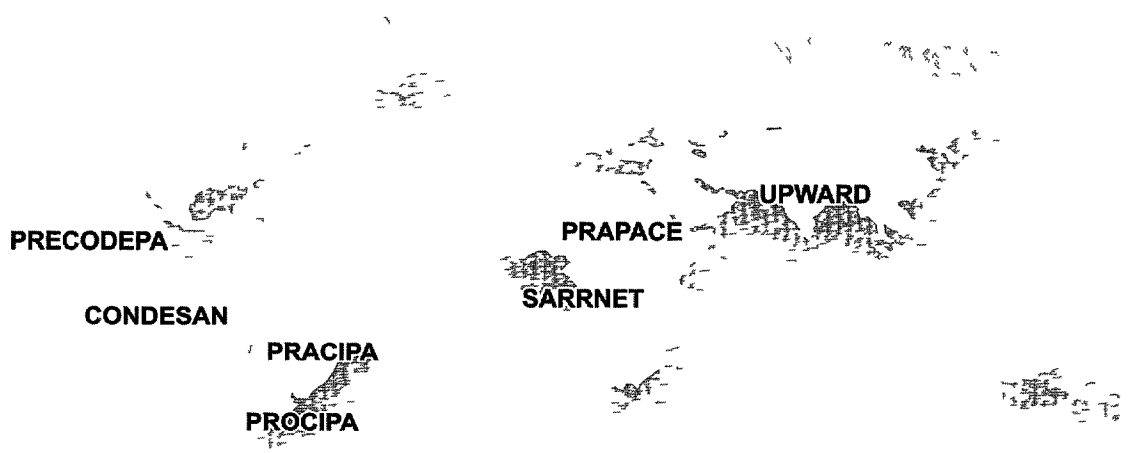
• Philippines
Los Baños Office
c/o IRRI
P O Box 933
Manila, Philippines
Phone (63 94) 536 0235/536 1662,
536 0015 ext 248/274
Fax (63 2) 891 1292
E mail cip manila@cgnet com
g prain@cgnet com

• Baguio Office
c/o NPRCRTC
P O Box 1051
2600 Baguio City, Philippines
Phone (63 918) 2808-688
Fax (63 918) 2811 600
E mail cip baguio@cgnet com

• China
CIP Liaison Office in Beijing
No 30 Bai Shi Qiao Road
Beijing 100081
P R China
Phone (86 10) 6217 9141
Fax (86 10) 6217 9135
Telex 22233 or 222720 CAAS
Cable AGRIACA
E mail cip china@cgnet com

Networks

• UPWARD
(same as Philippines Liaison Office, Los Baños)



M HIDALGO

CIP Participation in Global and Regional Networks

The Consultative Group on International Agricultural Research

Sixteen international agricultural research centers including the International Potato Center make up the global agricultural research network known as the Consultative Group on International Agricultural Research (CGIAR) The Group exists to mobilize the best in agricultural science on behalf of the world s poor and hungry Through its research the CGIAR seeks to promote sustainable agriculture for food security

For more than a quarter century, the CGIAR has brought together many of the world's leading scien tists and agricultural researchers in a unique commitment to reduce poverty and hunger in developing countries This focus is important because, of the 90 million children born every year 85 5 million of them live in developing countries

Whether researching food crops, forestry livestock, irrigation management, aquatic resources, or policy the CGIAR works in partnership with national governmental and nongovernmental organizations universities, and private industry The Group s research has contributed to global food security helped farmers meet the increasingly complex challenges of keeping the environment healthy and their farming sustainable, and leveraged research investments to achieve benefits many times over the amount of its investments

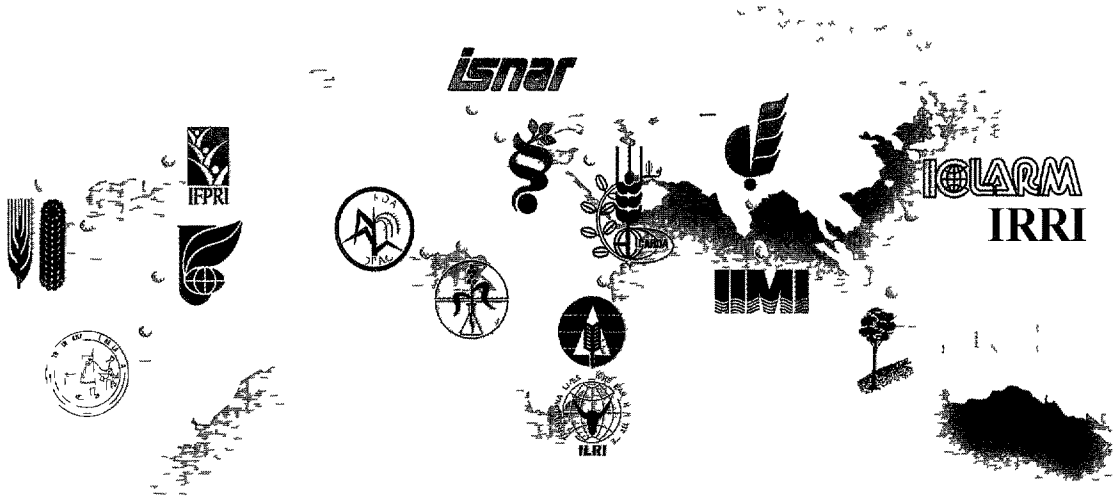
The United Nations Development Programme the United Nations Environment Programme, the World Bank and the Food and Agriculture Organization of the United Nations sponsor the CGIAR Ismail Serageldin, vice president for special programs at the World Bank serves as the Group's Chairman

The CGIAR's 57 members include developing and developed countries private foundations, and international and regional organizations Developing world participation has doubled in recent years All members of the Organization for Economic Cooperation and Development (OECD) Assistance Commit tee belong to the CGIAR

The CGIAR is actively planning for the world's food needs well into the next century It will continue to do so with its mission always in mind and with its constant commitment to scientific excellence

Peru Becomes 56th Member of CGIAR

Peru, CIP's host country, became the 56th member of CGIAR in September 1997 Peruvian President Alberto Fujimori pledged $500,000 to support the Group's international research agenda He is shown here meeting with CGIAR Chairman Ismail Serageldin in Lima



M HIDALGO

CGIAR Research Centers

CIAT	Centro Internacional de Agricultura Tropical	
CIFOR	Center for International Forestry Research	
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo	
CIP	Centro Internacional de la Papa	
ICARDA	International Center for Agricultural Research in the Dry Areas	
ICLARM	International Center for Living Aquatic Resources Management	
ICRAF	International Centre for Research in Agroforestry	
ICRISAT	International Crops Research Institute for the Semi Arid Tropics	
IFPRI	International Food Policy Research Institute	
IIMI	International Irrigation Management Institute	
IITA	International Institute of Tropical Agriculture	
ILRI	International Livestock Research Institute	
IPGRI	International Plant Genetic Resources Institute	
IRRI	International Rice Research Institute	
isnar	International Service for National Agricultural Research	
WARDA	West Africa Rice Development Association	

Writing
Steven Kearl
Jack Keyser
James Lang
Jon Miller
Edward Sulzberger

Editing
Steven Kearl
Bill Smith

Production Coordinator
Cecilia Lafosse

Design and Layout
Nini Fern ndez Concha B
Milton Hidalgo
Cecilia Lafosse
Alfredo Puccini B
Edward Sulzberger