In brief

Varieties bring relief to Peruvian farmers

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

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

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

CIP and INIA, who together financed the project, officially released INA-100 and Huambachero in 1997 and 2001, respectively. By May 2002, the two varieties occupied 90 percent of the total

sweeetpotato cultivation area in Cañete Valley, approximately 6000 hectares. Jonathan and Milagrosa remained on less than 10 percent. The net value-added benefit of replacing Jonathan with INA-100 and Milagrosa with Huambachero is estimated at US$579 and US$328 per hectare, respectively, according to studies developed by INIA.

CIP scientists continue to search for and

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

New options for Kampala city farmers

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

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

In Kampala, there is concern that health hazards

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

Officers of the Kampala City Council participate actively in the SIUPA research teams. The health

impact study will help them to accurately assess risks associated with these urban farming practices, and to develop appropriate plans and by-laws to ensure that farmers' families and city residents eat better and more safely. SIUPA partners are also working to improve production systems through technical interventions and to identify better market opportunities for farmers.

In the long run, SIUPA hopes to use and adapt

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

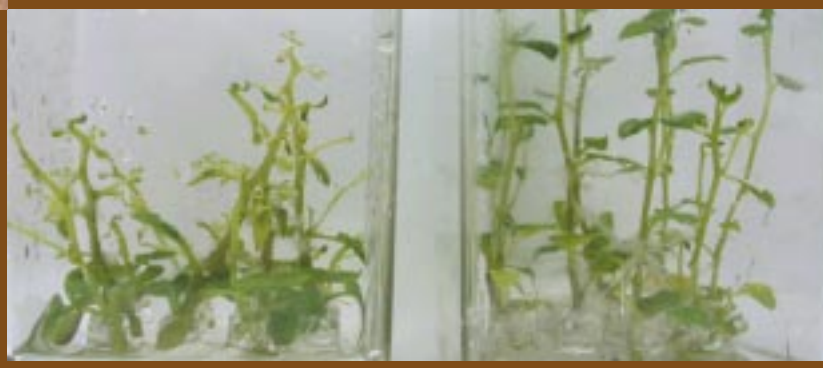
Powerful tools for plant improvement

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

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

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

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

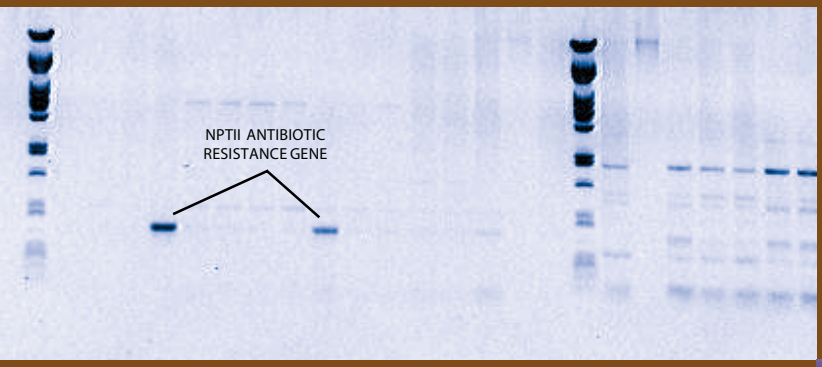


Regeneration of transgenic plants with this gene, however, occurs at a lower frequency than with antibiotic resistance genes. New support from the Rockefeller Foundation will give a significant impulse to this research, helping to overcome this drawback.

An equally important innovation, developed at CIP's Applied Biotechnology Laboratory, allows scientists to remove antibiotic resistance genes from transgenic potato plants using a heat-inducible self-excision system, which makes the gene "jump" out of the

genome and disappear completely. This method is currently being used by CIP in generating transgenic virus-resistant potato and sweetpotato varieties.

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



Ancient crop at the center of a heated debate

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

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

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

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

Given its wide experience in biodiversity

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

Currently no national or international regulations monitor the production of maca. Moreover, international law does not yet

recognize the legal validity of indigenous knowledge, so there is no forum to legally protest the patents. Only the World Trade Organization provides a legal framework for challenging trade issues.

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

A KEY FOR SWEETPOTATO PROBLEMS

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

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

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

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

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

A SWEET ALTERNATIVE

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

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

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

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

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

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