In Brief

Food livelihood and health

P. STAPLETON

Small-scale seed efforts with big results in Uganda

Without a laboratory facility or scientific equipment, two researchers working closely with national and CIP seed programs in Uganda are leading the production of improved basic seed potatoes in this African nation. The availability of disease-free seed has been one of the biggest constraints on Uganda's potato production. Although people depend more on beans, sweetpotatoes and field peas for food security, potatoes bring in scarce cash and, in some cases, are farmers' primary cash crop.

The clean seed produced by researchers William Wagoire and Rogers Kakuhenzire - who are working for Uganda's National Agricultural Research Organization (NARO) - is only a small part of the planting material used each year in Uganda. Yet this seed plays an important role in introducing new potato germplasm into the country's production system.

Lacking laboratory facilities and any sort of equipment for disease testing, Wagoire and Kakuhenzire choose mother plants that look to be free of virus and bacterial wilt symptoms, and then multiply cuttings from these plants to produce up to 100 tonnes of basic seed. This is enough for the farmers that they have trained in local workshops to produce about 1,000 tonnes of clean seed, which can then be sold to other farmers - enough to plant about 500 hectares. Many of the farmers trained to multiply the basic seed belong to nongovernmental organizations, farmers' associations and local government councils.

Although 500 hectares represent only about 1% of the area planted yearly in Uganda, it still provides an important mechanism for making new varieties available to other farmers. "The Uganda seed system is one of the best I've seen in the region," says CIP scientist Greg Forbes, who oversees CIP's pathology work on the destructive potato disease late blight. "It could be that the success of this program comes from its simplicity."

In addition to their seed production activities, Wagoire and Kakuhenzire collaborate on all CIP-supported activities with NARO and conduct experiments on late blight management. NARO researchers see successful disease management as the poor farmers' key to increasing productivity, reducing production costs, and reducing negative impacts on their health and environment.

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Maca gene could aid in fight against late blight

A prize-winning discovery of an anti-pathogen protein in a lesser-known Andean root is an important step forward in the work to control late blight, one of the deadliest potato diseases worldwide. Julio Solis, an MSc student of the San Marcos University Peruvian, won the prize for his work in isolating the gene in maca that codes for a defensin, a protein that proved to have activity against *Phytophthora infestans*, the microorganism that causes late blight.

The National Council of Science and Technology of Peru awarded Solis their 2004 Prize for Scientific Investigation. Solis won the prize in a contest against 80 other entries during the second National Fair of Science and Technology held in Peru in November 2004.

Late blight causes damage to potato crops worldwide worth more than US$2.5 billion a year. The discovery of this new defensin from maca could lead to the development of new control strategies for *P. infestans*. In his experiments, Solis, who carried out his research in CIP's Laboratory of Applied Biotechnology, showed that the defensin strongly inhibited the growth of a particularly virulent strain of *P. infestans*. Such a defensin will be effective against any strain of *P. infestans*. "This is the first time that a defensin gene or peptide sequence of maca, an Andean root that grows in Peru above 4,000 meters, has been reported worldwide," said Marc Ghislain, head of CIP's Biotechnology Laboratory, who directed this research. CIP was the main supporter of this investigation, providing the necessary infrastructure, equipment, materials and intellectual counseling.

R. KAPINGA

Enhancing the nutritional value of the potato and sweetpotato

Higher levels of iron and vitamin C in potatoes and sweetpotatoes came a step closer to reality in 2004. CIP scientists conducting a preliminary characterization of genebank accessions and breeders' lines during the past year confirmed their suspicions that Andean potatoes may be a prime source of nutritional traits for higher-than-expected levels of iron and vitamin C. Enhancing the nutritional value of root and tuber crops - while not sacrificing quality, value and consumer preference - continues to be one of the most complex

challenges for CIP breeders and geneticists today.

Screening potato and sweetpotato germplasm for higher levels of iron and vitamin C in Andean potatoes, and ß-carotene in sweetpotato, together with the selection of new breeding material, will allow scientists to estimate the extent to which these CIP mandate crops could help alleviate undernourishment and hunger in poor potato- and sweetpotato-producing regions around the world, where iron and vitamin A deficiencies continue to be the leading cause of malnutrition.

During 2004, CIP breeders confirmed that a yellow-fleshed Peruvian potato landrace contains 35 mg of vitamin C per 100 g of fresh weight—or almost twice the amount indicated in previous reports. Losses in cooking are variety-dependent, which, combined with the good heritability previously shown for vitamin C, is favorable for crop improvement. The highest iron content found so far is more than twice that previously known for peeled potatoes, although iron content seems to have been sacrificed during improvement for other important characteristics.

In sweetpotato, advanced orange-flesh selections have reached 8.5 mg of ß-carotene per 100 g of fresh weight, which is well above the previously recorded levels. Although the dry matter contents range from 22% to 39% in advanced breeding material, there is still a gap for those varieties with both elevated dry matter and ß-carotene content. So far, CIP breeders and geneticists have developed 'high dry/medium ß-carotene' varieties as well as 'medium dry/high ß-carotene' varieties with profitable yields. CIP is currently testing this material in elite demonstration trials, together with national agricultural research systems and CIP regional offices in the target regions of the world. Prospects are high for sweetpotato breeding to fill this gap without losses in yield and yield stability by simultaneous improvement of both nutritional quality and yield traits. Success here will eventually mean that the varieties will have a significant impact on the nutritional levels of people in many developing countries.

O. ORTIZ

Bringing together science and development

Development organizations are crucial in creating mechanisms to merge scientific information and farmer knowledge. These efforts are particularly important in poor economies with restricted governmental research and extension initiatives. "This is when non-governmental organizations become important providers of information and technologies to rural families, and thus key partners for the dissemination of research results," says Oscar Ortiz, leader of CIP's Integrated

Crop Management Division.

CARE, the humanitarian organization fighting global poverty, and CIP, in a collaboration that started 12 years ago, have been developing, testing and disseminating integrated pest management (IPM) of potato in small farming communities in the Peruvian Andes. In addition to the economic benefits for farmers, the experience has promoted IPM and participatory research and training in Peru.

The farmer field school approach to participatory research has turned out to be a good way to work with small farmers on potato-related problems, particularly late blight. In the highland region of Cajamarca, for example, the new knowledge and technologies gained through participation in farmer field schools have brought higher potato yields, and thus better food security and higher incomes for farmers.

The lessons learned by the CIP-CARE collaboration have already benefited other institutions, for example, in Ethiopia (Ethiopian Agricultural Research Organization and Self Help Development International), Uganda (National Agricultural Research Organization and AFRICARE), China (Chonqing Plant Protection Institute and Extension Service), Bangladesh (Tuber Crop Research Center and CARE-Bangladesh) and Bolivia (Programa de Investicacion de la Papa and local nongovernmental organization Asociación de Servicios Artesanales y Rurales).

CIP researchers plan to further disseminate the approach to other countries, such as Georgia, where CARE also operates, and Kenya and Ecuador, where a number of NGOs plan to participate during the next couple of years.

Meanwhile, CIP continues to enhance its partnership with CARE. In 2004, it signed a three-year agreement to continue conducting participatory research to find innovative ways to promote technological innovation on the potato crop in the Andes. Learning to face new challenges, such as improving farmer competitiveness in emerging markets, is another key goal of the agreement.

Efforts like this not only help teach research and development organizations how to work together for the benefit of resource-poor farmers, but also lead to a more efficient contribution to CIP's underlying development goal of poverty and hunger alleviation.

CIP ARCHIVES

Expanding potato production in Korea and Bhutan

A new CIP-led potato project launched in Korea and Bhutan last year is set to help rehabilitate and develop potato production in these two countries, where the potato is an important cash crop and a primary source of nutrition among rural households.

The project, aims to establish sustainable seed production and distribution systems, develop measures to reduce storage losses in ware and seed potatoes, and improve pest and disease control techniques. According to Fernando Ezeta, CIP's regional leader for East and South East Asia, the objective of the project is to help improve potato yields and increase areas planted to potato in the Democratic People's Republic of Korea (DP Korea) and Bhutan, and therefore ultimately improve the income and nutrition of resource-poor farmers.

In DP Korea, where the demand for potato is rising sharply, the total area planted to potato has already increased from 42,000 hectares in the mid-1990s to 187,000 hectares in 2002, which equals 9.4% of the country's total arable land. "Particularly in the country's mountainous areas, potato, with its strong tolerance to stress and relative high yields, is a substitute for major crops such as maize and rice," adds Fengyi Wang, project coordinator based in DP Korea.

In Bhutan, major emphasis is being given to seed-related issues, with the objective of helping potato producers capitalize on the opportunities for seed export to West Bengal. In Bhutan, as in Korea, efforts are being developed to rehabilitate seed-producing facilities, introduce improved methods for production of quality seeds and identify post-harvest storage and handling technologies suitable to the local climate and economic conditions.

Introducing germplasm, meanwhile, is one of the key activities of the CIP-led project in Korea. This includes new varieties that could be grown directly in DP Korea and valuable clones that could be used in breeding programs. Developing and implementing quick, low-cost and sensitive identification methods is also a project priority in DP Korea, where virus diseases are serious problems for potato and particularly seed production.

The Rehabilitation and Development of Potato Production for North Korea and Bhutan coordinates research and development activities among the different agencies and institutions involved in the project. In Bhutan, these include the Department of Agriculture and the Council of Renewable Natural Resources Research for Bhutan, and in DP Korea the Swiss Agency for Development and Cooperation, Cooperazione e Sviluppo Onlus, German Agro Action, as well as some institutes in northeast China. This project forms an integral component of the Bhutan Potato Development Program, established by the Department of Agriculture in June 2004 to coordinate all aspects of potato research, development, marketing and processing. The UN's Food and Agriculture Organization has been assigned a supervisory role.