In Peru, Even Potato Research Is High Risk

Dodging guerrilla attacks and inflation that runs at 2000% a year, researchers high in the Andes are improving the potato

AGRICULTURAL RESEARCHERS of the sort who generated the Green Revolution normally find a welcome in developing countries, but they sometimes must face hardships that have nothing to do with natural hazards and much to do with human nature.

In Peru, the scientists who work for the International Potato Center (CIP) have come in for more than their share of trouble. CIP's security chief in the Andean highlands was killed by guerrillas in 1988, and last December part of a CIP field station near the town of Huancayo, high in the Andes where potatoes were first cultivated in ancient times, was bombed and burned.

Fortunately, no scientists—indeed, no personnel—were harmed in the incident. But the message was clear, and CIP director general Richard L. Sawyer and the CIP board heeded it. They ordered all international staff out of the area and put the station on what he calls "complete standby."

Who would attack a scientific laboratory? The blame is being placed on guerrillas of the revolutionary Sendero Luminoso (Shining Path) movement, a Maoist group with an ideology described as a mix of Marxist and mystical elements and a record of extreme violence. Working for over a decade now to topple Peru's government (currently a democratically elected civilian regime), Sendero has caused havoc throughout the highlands, including around Huancayo.

But why the CIP? Sendero has frequently targeted research facilities it associates with the government. But the Potato Center isn't actually a creature of the Peruvian government; rather, it is 1 of 13 international centers that make up the Consultative Group on International Agricultural Research (CGIAR), a network sponsored by United Nations organizations and funded mainly by the United States and other industrialized countries to the tune of almost $300 million this year. With an annual budget of about $20 million, CIP is of middling size among the centers.

The Potato Center has made major contributions to Peruvian agriculture, but the guerrillas do not make fine distinctions in their campaign to destabilize the government.

Despite its troubles, CIP has been forging ahead. Take sweet potatoes. In the 1980s, recognizing the potential of this humble but increasingly popular tuber, CIP began research in hopes of building a germ plasm reservoir, improving disease and pest resistance, and raising the yield.

CIP

Fries of the future. *Staffers at the International Potato Center in Peru maintain stocks for a global network of researchers.*

This is a logical extension of CIP programs designed to help farmers—particularly poor ones. From the time the Potato Center was established in 1972, an intensive effort has been made to collect and preserve potato genetic materials because wild varieties were disappearing rapidly. The Huancayo station, located in the region where the potato originated and was first cultivated, has always been central to this mission.

The CIP World Potato Collection, which includes both primitive cultivars and wild species, included some 13,000 specimens at one point, but rigorous analysis made it possible to identify duplicates and reduce the collection to about 6,500 varieties. The full collection in a "cleaned up" state, free of viruses and pests, is now held in several places in seed, tissue culture, and tuber forms, says CIP director general Sawyer.

CIP defines its role as an agricultural research wholesaler in the sense that it distributes germ plasm that can be adapted by other plant breeders to local conditions.

To further this aim, CIP has gone beyond most CGIAR centers in establishing regional operations to enable CIP scientists to collaborate with their counterparts in national programs in developing countries. CIP has eight regional operations spread throughout the world.

Since CIP emphasizes helping poor farmers, it has had to contend with an inherent drawback with potatoes: they require relatively high inputs of fertilizers and pesticides to achieve good yields. For this reason CIP has put a major effort into developing integrated pest control and breeding disease-resistant plants.

According to Sawyer, however, "Inputs have to be balanced off against return." He argues that the potato repays every bit of investment, for it gives "one of the highest returns. If you look at the developing world, potato farmers—even though they may be very poor—tend to become fairly quickly the well-to-do farmers of the community. That's because there's a ready market for their crop."

Sawyer, who is anything but neutral on the subject, sees a further expansion of the potato market as the fast food industry reaches out to new markets around the world. "What has taken place with the fast food industry in Europe and North America is taking place in many developing countries. And almost every fast food plate will have a helping of potatoes."

In many developing countries, frozen French fries have to be imported, says Sawyer. "Companies like McDonald's and Pepsico want to be there for the long haul. They've got to do things that are good for local agriculture and local farmers, and so they are helping CIP develop potatoes which will produce well in all climates and cook to their processing specifications," says Sawyer. "The processor is continuing the job that Columbus started almost 500 years ago in distributing potatoes around the world."

But McDonald's and Pepsico can't help ease research conditions for CIP in revolution-torn, inflation-wracked Peru. To date, Sawyer has kept the institute one step ahead of disaster. The key work at Huancayo—to

maintain the germ plasm collection by annual planting—has now been turned over to a new CIP facility in Quito, Ecuador. And his Huancayo staff has been pulled back to Lima, where they merely have to keep pace with the 2000% annual inflation and stay clear of the burgeoning crime being created by economic hardship.

Sawyer says, "It's not terrorism per se, but we're living in a country where there are food shortages, shortages of a number of the basics." Lima now has an estimated 7 million inhabitants, one fifth to one quarter of the country's population—a large number of them poor people who have migrated from rural areas because of security problems. "Under such conditions you get the kind of crime that's very different from terrorism," says Sawyer.

For CIP, says Sawyer, keeping a low profile is the "principal security factor" in Peru. "If you're working in a developing country and want to drive the flashiest car and live in the best house on the street you're asking for trouble." That is why "we maintain a very low image," Sawyer explains. "Our buses have no names on them. We try to present a very modest face. Our facilities are not country-club style."

Inflation is a serious fact of life for CIP employees. Pay and privileges for the internationally recruited staff, about 100 of the 500 CIP total, are set according to international organization standards. Local hires—Peruvians—are not so well insulated from inflation.

But Sawyer says, "We have not had any trouble getting good staff. Whenever we advertise, we get large numbers of qualified applicants, including excellent candidates for my replacement."

If things continue to deteriorate, can CIP continue to operate in Peru, which Sawyer calls the home of the potato? "Periodically, there is a rumor that CIP is moving out of the country," he says. "But we have no intention of leaving." There is too much at stake.

Sawyer says that CIP has received "tremendous support" from the Peruvian government over the years, and he believes that CIP has made substantial contributions in return. Most important, he says, is that several hundred Peruvians at CIP have become "professionals in their own right because of on-the-job training and experience for the last 10 to 18 years. This would be something that would be very difficult to replace in a developing or a developed country." Sawyer hopes that civil strife can be brought to an end so that CIP and the people of Peru may resume their collaboration on potatoes of the 21st century.

■ JOHN WALSH

Gene Therapy Clears First Hurdle

"We want to do for our patients what they can't do for themselves," R. Michael Blaese said last week at a meeting of the National Institutes of Health's biosafety committee. Blaese is an authority on ADA (adenosine deaminase) deficiency, a rare but severe immune disorder that often leads to death in children who are born without a fully functioning gene for ADA.

Blaese appeared before the biosafety committee to ask permission to give his patients the ADA gene in the expectation that they will then be able to develop a healthy immune system. It is the first time anyone has submitted a proposal for real human gene therapy. After a review that lasted more than 2 hours, Blaese got a green light—the first of at least four more he and his colleagues will need before all the regulatory hurdles are cleared and the first patient can be readied for therapy.

Blaese, a National Cancer Institute scientist, is principal investigator on a protocol that includes Kenneth Culver of Blaese's lab, W. French Anderson of the National Heart, Lung, and Blood Institute, and Martin Eglitis of Genetic Therapy Inc.

For years, ADA deficiency has been high on the list of disorders that might yield to gene therapy. Researchers have assumed that the best strategy would be to insert the gene into the bone marrow stem cells, which give rise to all blood cells, including the white cells of the immune system. Armed with the ADA gene which they lack, the stem cells would go on to produce immune cells with plenty of ADA. However, stem cells have turned out to be incredibly difficult to harvest in therapeutic quantities, and that plan is now on hold.

R. Michael Blaese

What Blaese and Anderson are proposing is one step removed from that ultimate bone marrow approach. Their proposal is to insert the ADA gene in lymphocytes, which can be grown using interleukin-2 (IL-2) as a growth stimulant (*Science*, 10 November 1989, p.746). The ADA-bearing lymphocytes would then be infused into the patient.

During the past several months, Blaese, Anderson, and Steven A. Rosenberg of the cancer institute have gained considerable experience with this procedure, which is already the basis of ongoing gene transfer studies in patients with terminal melanoma. Using a marker gene rather than a potentially therapeutic one like ADA, the Rosenberg team has shown that a gene can be added to IL-2–stimulated tumor infiltrating lymphocytes (TIL) and safely administered to patients (*Science*, 23 June 1989, p. 1430.)

Says Blaese, "Our protocol for the ADA study is virtually identical to the protocol we have been following in the melanoma patients. We will use the same procedures and follow the patients in the same way."

None of the six melanoma patients treated so far has shown any evidence of toxicity from the transferred gene (in this case, the gene for neomycin resistance) and that study will be expanded to include as many as 40 additional patients.

A deficiency of the ADA gene accounts for about one quarter of the 70 children worldwide who are known to suffer from severe combined immunodeficiency disease (SCID). Blaese knows of only 15 who have no ADA at all, so the patient pool for this first test of human gene therapy is small. Although bone marrow transplantation from a matched donor sometimes succeeds as SCID therapy, Blaese reports that in the ADA-deficient group the failure rate is close to 60%, and for these children, he believes, there is no really effective alternative treatment. "As a physician, I feel very comfortable about going ahead," he told *Science*.

Blaese and his colleagues face their next review on 30 March at a joint meeting of the NIH's Recombinant DNA Advisory Committee (RAC) and the RAC's human gene therapy subcommittee. If those groups OK the test, approval must then come from the director of NIH and from the Food and Drug Administration. Anderson says he is optimistic.

■ BARBARA J. CULLITON