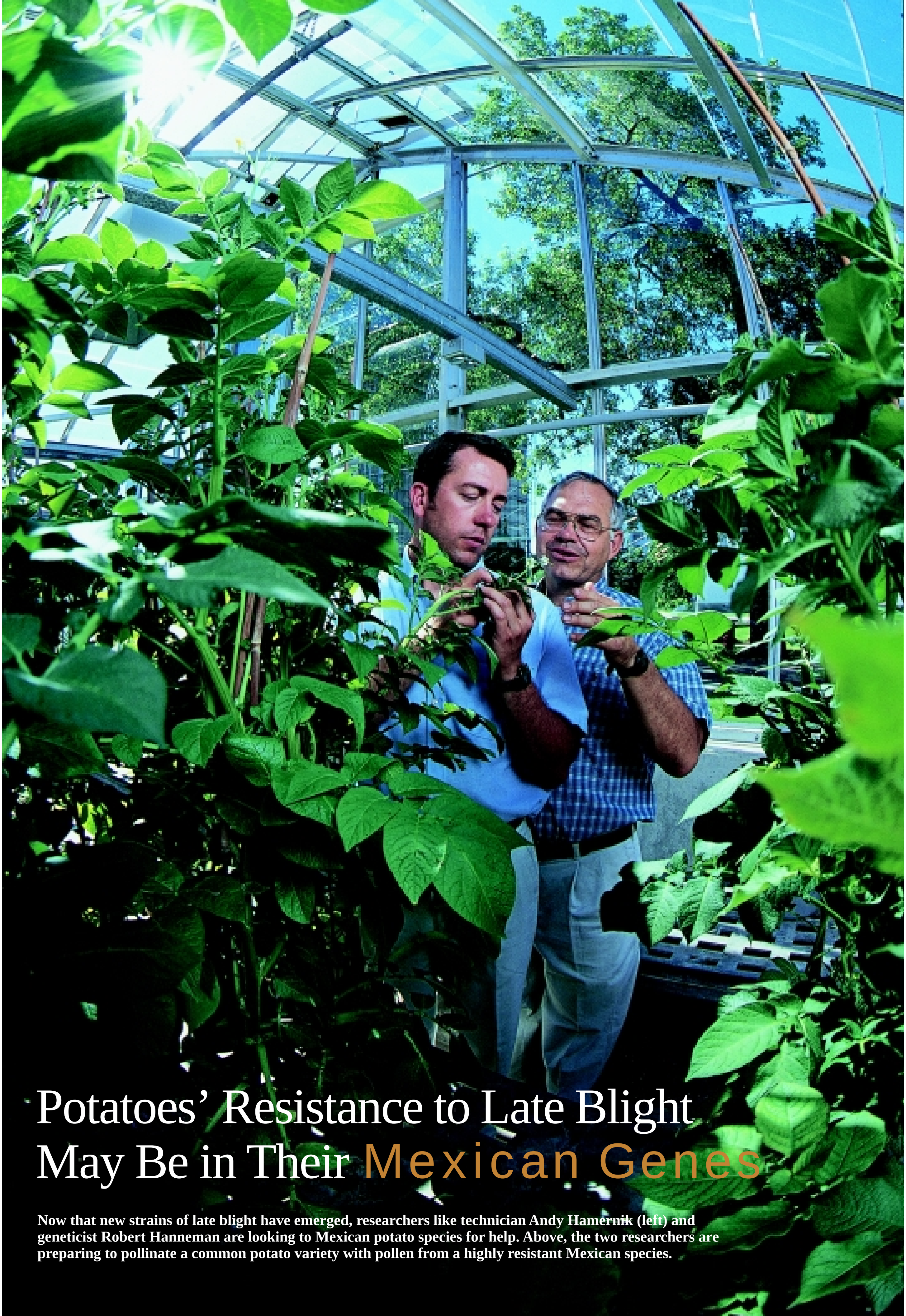

SCOTT BAUER (K9024-1)

Potatoes' Resistance to Late Blight May Be in Their Mexican Genes

Now that new strains of late blight have emerged, researchers like technician Andy Hamernik (left) and geneticist Robert Hanneman are looking to Mexican potato species for help. Above, the two researchers are preparing to pollinate a common potato variety with pollen from a highly resistant Mexican species.

Botanist David Spooner (right) and Alberto Salas, plant genetic resources specialist with the International Potato Center, Lima, Peru, collect potato germplasm in Peru for deposition in national and international gene banks.

All potatoes are related to each other, more or less. Some species are like brothers and sisters; others are distant cousins. One very wild Mexican cousin is *Solanum pinnatisectum*. Found in central Mexico, this species may be a good source of resistance against *Phytophthora infestans*—the fungus that causes late blight. This disease resulted in the 19th-century Irish potato famine.

Finding and making use of resistance to late blight is important because the disease costs potato growers worldwide about $3 billion annually, according to the International Potato Center in Lima, Peru. Using fungicides to control recent attacks has increased production costs by nearly $200 an acre for potato growers in Idaho, Washington, North Dakota, Colorado, Oregon, Minnesota, Michigan, Maine, and Wisconsin.

Now, new strains of late blight have emerged, the most recent being US 8. Chemical control of these new strains is more difficult and costly. That's why breeding resistance into potatoes is being explored.

New Ways To Incorporate Genes

ARS plant geneticist Bob Hanneman and University of Wisconsin graduate student Miguel Ramon in Madison, Wisconsin, have developed new ways to incorporate the natural resistance in wild Mexican species into commercial potatoes. They have crossed a sexual hybridization bridge: Mating the wild Mexican species—*S. pinnatisectum*—with a derivative of a commercial potato variety, using a technique known as embryo rescue. A hybrid from the rescue could be used as a maternal parent in a mating with the cultivated potato.

"The group of Mexican species we are interested in have two sets of chromosomes and are a rich genetic resource with extreme resistance to viruses, insects, fungi, and nematodes," says Hanneman. "But they are difficult to cross with the majority of other cultivated or wild species."

S. pinnatisectum is maintained at the U.S. Potato Genebank in Sturgeon Bay, Wisconsin. ARS potato geneticist John Bamberg manages the genebank, which receives and maintains wild species from plant collectors like ARS botanist and plant explorer David Spooner in Madison.

"The problem of incorporating useful genes from any wild species is the various barriers to crossing with the cultivated potato so that fertile hybrids can be obtained. Those hybrids must be used in a breeding scheme that eliminates undesirable traits contributed by the wild species," says Bamberg.

"To date, 16 wild species have been incorporated into commercial varieties, but many more species have potential for use in breeding," says Spooner.

Hanneman's early research crossed non-tuber-bearing wild potato species with other wild species to find a way to access their germplasm by sexual means. "*S. verrucosum* stood out as a potential parent because of the good embryo development of the hybrids," he says.

So Hanneman selected *S. verrucosum* to cross with the "uncrossable" Mexican potatoes. This mating yielded several new hybrids, which have since been crossed with a range of wild relatives and with derivatives of commercial varieties.

Lots of Good Traits To Choose From

The wild Mexican species also resist early blight, which is associated with dry weather. Typically, the disease is seen in August when plants start to mature. The fungus *Alternaria solani*—the culprit in early blight—causes problems similar to those of late blight. But late blight attacks quickly and is capable of defoliating a field within a matter of weeks. Early blight is slower and progressive. Resistance to both diseases is needed to reduce reliance on chemicals.

University of Wisconsin graduate student Joe Kuhl, working with Hanneman and ARS plant geneticist Michael Havey, has advanced the research by identifying the chromosome in *S. pinnatisectum* that confers resistance.

"We know there are a number of resistance genes in cultivated potatoes, but the fungus has matching genes that negate the action of the host's resistance genes. That means eventually the fungus may overcome this type of resistance. Ideally, we'd like to find combinations of multiple resistance genes, which could be more durable and not easily overcome by the fungus," says Kuhl.

The ultimate resistance test is always in the field. Last summer, the researchers challenged the *pinnatisectum* hybrid against late blight at the University of Wisconsin's Agricultural Research Station in Hancock. It showed nearly 100 percent resistance to late blight. In replicated trials, the hybrid was also resistant to Colorado potato beetle, an insect costing U.S. potato, tomato, and eggplant growers about $150 million annually.—By **Linda McGraw,** ARS.

This research is part of Plant, Microbial, and Insect Genetic Resources, Genomics, and Genetic Improvement, an ARS National Program (#301) described on the World Wide Web at http://www.nps.ars.usda.gov/programs/cppvs.htm.

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