Late Blight Breeding

Gene holds promise for entire industry

By Greg Brown
Managing Editor

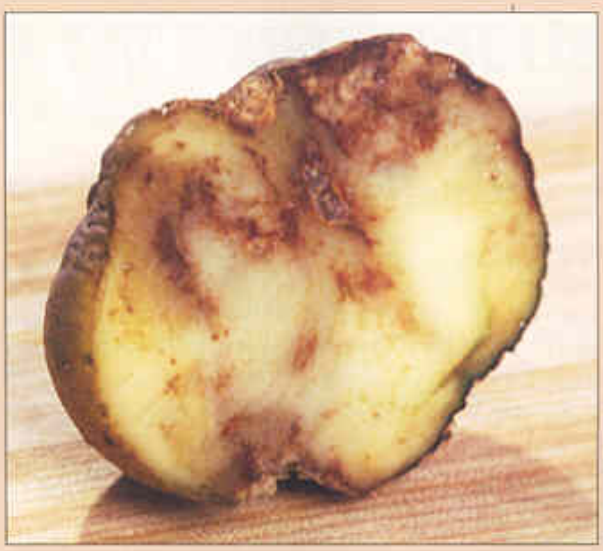
Potato breeding programs see several bright spots in the future for genetically modified (GM) potatoes. The program is pursuing the use of newly discovered genetic potato material that researchers hope will reduce public fear of GM potatoes while saving potato growers millions of dollars.

One reason breeders will use genetic modification techniques are that they take much less time than traditional breeding techniques that are still useful.

"It takes 10 to 12 years to create a new variety through conventional breeding," said Dave Douches, associate professor of Crop and Soil Sciences at Michigan State University (MSU), whereas his transgenic potato project has a four-year target.

Douches discussed the prospect of improving popular potato varieties growing in Michigan with newly discovered and proven late blight resistant material at the MSU/Michigan Potato Industry Commission variety day held in December in Lansing, Mich.

Douches is seeking an answer to growers problems through biotechnology rather than traditional methods of plant breeding. Traditional breeding has limitations such as the amount of time needed to raise and cross plants, the limited gene pool and the uncertain traits and yields associated with an intermediate breeding stock.



The late blight resistant gene protects potatoes from the late-blight fungus. The gene comes from a plant that co-evolved alongside the pathogen.

Douches has begun work to incorporate genetic potato material found by University of Wisconsin (UW) researchers who scoured the genome of a wild Mexican potato. Those researchers discovered a gene that protects potatoes against late blight, the devastating disease that caused the Irish potato famine.

The identification of the gene, found in a species of wild potato known as solanum bulbocastanum, holds significant potential. All of the varieties now cultivated commercially on more than 1.5 million acres in the United States are highly susceptible to potato late blight, a family of fungal pathogens that wreaks havoc in the field, turning tubers to mush and invariably killing any plant it infects.

"We think this could be very useful," said John Helgeson, a UW-Madison professor of plant pathology, a research scientist with the U.S. Department of Agriculture and a senior author of the PNAS paper. "No potato grown in the United States on any scale at all has resistance to this disease."

With the blight-resistant gene in hand, the Wisconsin team, which also includes Jiming Jiang, a UW-Madison professor of horticulture, was able to engineer potatoes that survived exposure to the many races of phytophthora infestans. The insertion of a single gene, according to Jiang and Helgeson, effectively protects plants from the range of late blight pathogens.

"So far, the plants have been resistant to everything we have thrown at them," said Helgeson.

The world's most serious potato disease, late blight is best known as the cause of the Irish potato famine. Seeming to appear from nowhere in 1845, the fungus wiped out the staple crop of the densely populated island nation, causing mass starvation over five years, killing more than a million people and sparking a wave of immigration that had worldwide social consequences.

The gene that protects potatoes from the fungus comes from a plant that scientists believe co-evolved in Mexico alongside the late-blight pathogen. It was discovered, ironically, as a result of the emergence of a new strain of P. infestans that swept through the United States in 1994. At UW-Madison's Hancock Agricultural Research Station, the only plants to survive were the wild Mexican species and its progeny in Helgeson's test plots.

"We can do it by conventional breeding, but we can't move it into the standard cultivated varieties without losing them," he said. "It is almost impossible to create another Burbank variety, for example, through conventional breeding. Your odds of getting the one gene in would be like winning the lottery."

While Douches' initial efforts will focus on promising varieties of potatoes grown in Michigan, he said he believes that the discovery of the gene could be a foot in the door to acceptance of GM crops. He said he bases that theory on the idea that this gene is from a potato, not a jellyfish as GM bashers often claim.

The Wisconsin group also plans to develop engineered varieties for the garden. The hope, they said, is to develop the technology that will gradually win consumer acceptance and, perhaps someday, go where no GM has gone before.

For farmers, "getting biotech is like buying insurance," said C. Ford Runge, director of the Center for International Food and Agricultural Policy at the University of Minnesota. According to Runge, "assessing the risk" of a growing season is the most difficult part of farming.