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State's potato genebank keeps world spud supply safe

Anita Weier — 2/08/2008 8:47 am

What would the world do without potatoes?

The Irish found out during a famine, and it was not a pretty picture.

But the U.S. Potato Genebank in rural Wisconsin is playing a major role in preventing a repeat of that tragedy.

The potato is one of the most vital crops in the world for feeding the poor, evidenced by the United Nations' declaration that 2008 is the Year of the Potato. But this versatile vegetable is susceptible to many pests, diseases, environmental stresses and quality problems.

So if the most widespread varieties were stricken with blight as deadly as the one that struck Ireland in 1845, what would the world do?

One place it would turn would be the genebank near Sturgeon Bay that has stored the genetic materials for hundreds of types of potatoes -- including the wild varieties that might save us in case of a worldwide catastrophe.

Wild and cultivated potato relatives have genes that can be hybridized with modern varieties to help them resist diseases and pests, said John Bamberg, project leader of the Potato Genebank at the University of Wisconsin's Peninsular Agricultural Research Station.

However, natural habitats for wild potato varieties have been lost to deforestation, grazing, alien plants and urbanization, so it is important that the genebank stores and keeps track of these many genetic varieties, Bamberg said.

Genetic materials also are distributed to researchers around the world -- without cost and postage-free -- in order to improve current varieties and create ever-better potatoes.

"We keep the material and make it readily available for people to use. It is continually being used because the potato is continually being improved," said Bamberg, who is a USDA Agricultural Research Service scientist as well as a professor in the UW-Madison's Horticulture Department.
"We also are saving it for a day sometime in the future when it may be easier to pluck out the useful genes and put them into a popular existing variety, instead of interbreeding."

The 60-year-old genebank is now a joint venture of the U.S. Department of Agriculture and the Cooperative States Research Education and Extensive Service, with support from the UW-Madison College of

The genebank started in 1948 as a regional project in the north central region, but then became administered by agricultural experiment stations in every state in 1950. The USDA's Agricultural Research Service stepped in during 1956 as a research partner with the genebank. The staff includes both federal and state employees.

"The genebank was instigated by Wisconsin people. That is why it is here, making a big contribution to potato science worldwide," Bamberg said.

The Sturgeon Bay genebank is the only federal facility designated to support the genetic needs of the U.S. potato industry, and has the most comprehensive and active collection in the world, Bamberg said.

The genebank now has about 5,600 items representing 150 species of potato, which can be used to improve the crop and to provide breeding options if existing varieties become obsolete.

The seven-person genebank staff coordinates importation, classification, preservation, documentation, multiplication and distribution of "germplasm" -- an umbrella term for genetic material that can be used to regenerate crops.

Complete online information about the collection is available on a USDA computer network, and researchers request and receive "germplasm" -- free and postage-paid.

The potato genebank distributes about 7,000 units to domestic and foreign scientists annually, in about 150 orders.

Those orders are used for breeding and breeding-related studies of genetics, pathology, physiology, entomology, horticulture, biochemistry, food science and other specialties.

Most of the genetic collection is preserved in the form of botanical seed. Named varieties and some unique breeding and genetic stocks are kept as small plants in test tube culture, and the staff sometimes generates tubers for clients who want to study them.

"This is not just a safe storehouse," Bamberg said. "It is a place where the material is groomed, evaluated and put in a form that a breeder in Michigan or Idaho can ask for and receive within a week."

If the central genebank were not available, individual researchers would have to duplicate expensive efforts to collect samples, gain government permits for importation and evaluate, document, preserve and multiply stocks in disease-free form, he said.

How others use the genebank

Michigan State University Professor David Douches, who researches plant genetics, has used materials from the Potato Genebank often during his 26-year career in potato breeding and genetics.

"We don't call every week, but it is a resource and if we need certain stocks or certain traits in wild material, that is where we go," he said.

"In late January I got a letter with some packets of seed from some wild species to start another study regarding virus resistance. Genetic improvement is what we are looking for, traits of interest that we can cross with ours."

The process of taking something from the genebank and getting it into use in some form is lengthy, often from 10 to 25 years, he stressed.
Work that began in the mid-1980s using a wild species from the genebank is now being released in a potato variety called the Kalkaska, which will be used in the potato chip industry, Douches said.

"We named it after a town in northern Michigan where they have grown some of the seed for this variety," he said. "We have been able to improve chip quality because this variety doesn't accumulate as much sugar in

And about 10 years ago, researchers at Michigan State found wild species at the genebank that resisted potato blight, Douches said.

"Now we are able to genetically map that resistance gene and are on the verge of cloning that gene so we can use it in our breeding efforts. We would genetically engineer it into other potato varieties," he added.

"It takes a while for the research to move along. When you are working with living organisms, it takes a long time to figure things out."

In Wisconsin, the genebank staff also works to find and characterize useful traits such as resistance to diseases, pests and stresses.

"We do research to determine how the collection should be classified and managed in order to acquire and keep the most genetic value by the most efficient means," Bamberg said.

For example, David Spooner -- also a USDA scientist and a UW professor -- collects materials in Latin America and also researches the best classification of the genebank's stocks into species.

The ultimate goal is to support breeding progress toward a higher-quality crop that is more nutritious, more resistant to disease and stress, with lower chemical needs and less environmental impact. Such crops are more attractive to consumers and more profitable for growers, said Bamberg, who has headed the genebank since 1989.

The U.S. Potato Genebank in Wisconsin cooperates with potato genebanks in Argentina, Bolivia, Chile, Colombia, Ecuador, Germany, India, Mexico, Russia, the Netherlands and the United Kingdom, and particularly with the International Potato Center in Lima, Peru.

"We exchange stocks, information and technology, and work on joint projects and research," Bamberg said. "We have done a lot of cooperative work, trying to make this a global effort."

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Submitted photo

Adele Douglass pollinates wild potato plants to produce botanical seeds.

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