Potato genebank is past, future of industry

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Perhaps one would expect the United States Potato Genebank to be located in a fancy, brick building full of bureaucrats. Perhaps one would expect that the germplasm of many of the world's potato varieties would be housed in sealed containers and maintained under heavy security.

Well, one would be wrong. The genebank – or National Research Support Program-6 (NRSP-6) – is housed in an unassuming metal building at the University of Wisconsin Peninsular Agricultural Research Station near Sturgeon Bay, Wis.

Inside, however, is a state-of-the-art seed processing and storage facility that allows collections to be stored for more than 25 years. Just five full-time employees perform the facility's five-fold approach: introduction, classification, preservation, evaluation and distribution of potato germplasm.

Dr. John Bamberg is the project leader of NRSP-6. It's mission is to facilitate improvements in the potato of the future by promoting the use of valuable exotic genes found in wild potato germplasm. The facility was established in 1947 when the Potato Association of America documented the need for a central location to import, classify and evaluate germplasm and then preserve, propagate and organize it for distribution to potato breeders.

The United States Department of Agriculture recognized the importance of the project in 1950 and named it the Inter-Regional Potato Introduction Project (IR-1). The current name was given in 1992. Services are provided without charge to federal, state and private potato researchers and breeders in the U.S. and throughout the world.

Botanical seed for more than 4,500 collections of potatoes are stored in sealed pouches at the NRSP-6 genebank in Sturgeon Bay, Wis. Dr. John Bamberg is the project leader.

The genebank is part of the U.S. National Plant Germplasm System. USDA/Cooperative States Research Service, Agricultural Research Service and the University of Wisconsin work cooperatively. Bamberg is the only federal employee on site.

Since potatoes are native only to Central and South America, there are hardly any potato genetic resources in the U.S., Bamberg said. "Our job is to coordinate collecting expeditions and get samples here that are valuable. The value of the germplasm is directly related to what we know about it. It's not very useful unless we have some information.

"We're not just a clerk, but a facilitator and promoter. We need to do basic research to find out what makes the germplasm work. How do we grow it? Cross it? What is its genetic makeup? We can help with that," he said. "Breeders have a huge job just working with the materials that are already available. There

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Charles (Chico) Fernandez is the long-time gardener at the genebank. Among his duties is the hand-pollinating of the potato plants. His hands are shown on the cover.

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is a need for people who do gene pool enhancement. It's an elemental concept of plant breeding to take the good from a wild species and put into a U.S. variety.

"Our job isn't to make a better variety, but to show the potential – to evaluate and promote. We're limited here as to what we can do," he said.

The genebank houses about 4,500 different collections (units), representing about 140 species of potatoes. They are propagated separately and each lineage represents an original collection.

Once samples arrive at NRSP-6, they are quarantined to prevent the introduction or spread of any of the many systematic diseases potatoes carry. The material is grown out in quarantine and leaf samples are sent to the ARS facility in Beltsville, Md., for testing. Materials are grown in the greenhouse in pots in units of 20 plants per family. The plants are hand-pollinated in hope of getting a good harvest of botanical seed.

Once the berries are mature, they are processed to remove the seeds. The true seed of the potato is very small and lives a long time. "The seed is easy to send out and most potatoes can be propagated by true seed," Bamberg said. "And most diseases aren't carried by the seed.

"Almost all wild species are kept as botanical seed and all work is done in-vitro in sterile culture so as not to pass on disease. You should have a program to make sure the crop is healthy, but you shouldn't have to worry about exotic diseases. If you multiply by seed, it eliminates most of the disease."

Every step is documented and the data entered into a computer database program.

Bamberg said the work done at this facility is unique in another way: the data is reliable and because the employees maintain the germplasm and work with it, they can provide information on how to grow the seed.

"We can give advise and be a resource on how to use the stuff," Bamberg said. "We've been told we are sort of a model in that regard, among the genebanks, because we are active in researching, publishing papers, going to meetings. We also provide some expertise and try to help people make the germplasm useful." ■

Genebank maintains 700 varieties of live tissue

Max Martin's job is to maintain the tissue culture collection at the United States Potato Genebank at Sturgeon Bay, Wis.

Under his care, nearly 700 genotypes are kept in sealed test tubes and stored at cool temperatures in industrial-size refrigerators.

Keeping potato stocks in sterile culture (in vitro) has some advantages and disadvantages compared to botanical seed. Stocks must be kept in vitro when one wants to preserve a unique individual potato plant or genotype.

Cultivars, for example, usually have a full set of descriptors documenting their requirements and characterstics of growth, tuber qualities and disease resistances. Their botanical offspring would contain the genes for all those traits, but in an unacceptable multitude of different combinations. In vitro maintenance is equivalent to preservation by year after year of tuber production, or by cuttings, but reduces the chance of disease spread.

Plants in vitro are quite capable of harboring a variety of potato diseases, however, so the cultures must be checked periodically.

In vitro preservation also allows the genebank to keep many individual genotypes in a smaller space and more highly controlled environment than would be possible in a greenhouse.

However, these plants are still more bulky to ship and more perishable in transit than dormant botanical seeds. They must be mailed in padded and insulated boxes when temperatures are not warm enough to prevent freezing.

By sealing the tubes, it reduces the rate of growth and the chance of contamination. "We know there aren't any insects getting into the tubes, so we know they are staying virus-free. Some of these plants have been in tissue culture for 15 years or more," he said.

The plants include 60 American varieties, 256 foreign varieties and 292 hard-to-flower, wild species. This collection is maintained as tissue culture

Martin maintains the tissue culture collection at the U.S. Potato Genebank in Sturgeon Bay, Wis.

plants for several reasons, he said. The wild species maintained in this collection have repeatedly failed to produce botanical seed in the greenhouse. Rather than lose the accession, the plants are put in tissue culture.

These are the named varieties that need to be maintained as tubers or tissue culture, he explained. Triplicates of each variety are maintained at Sturgeon Bay. Duplicates are kept at the University of Wisconsin, Madison.

The collection represents just a small percentage of the known potato varieties in the world. They are kept because they are good parents and in vitro plantlets are shipped all over the world for use as germplasm for breeding.

"These varieties are those used to aid in the development of new varieties," he explained. "Most varieties in the last 50 years have wild species in their pedigree." ■