

GENETIC VULNERABILITY IN POTATO
Potato Crop Germplasm Committee Report
August 27, 2004

The Potato Crop Germplasm Committee's 1992 status report indicated that 13 varieties made up 84% of U.S. certified seed acreage and 92% of Canadian seed acreage.

As of the 2002 season, 21 varieties occupied 85% of U.S. certified seed acreage (those with several line selections, i.e. Red Norland/Dark Red Norland, were counted as single varieties). 16 varieties made up 85% of the seed acreage in Canada. Ten of these 16 varieties are also on the top-21 list in the U.S. (National Potato Council Potato Statistical Yearbook).

In 1992, a single variety, Russet Burbank, occupied 32% of U.S. and 35.7% of Canadian seed acreage. In 2002 Russet Burbank had 31% of U.S. and 28% of Canadian seed acreage.

Thus, over the past decade, the dominance of Russet Burbank has declined slightly and the number of varieties making up the bulk of production has increased since the last status report. Still, a large proportion of our total potato production is based on relatively few varieties. Further, most of these varieties are not highly resistant to important potato pests and diseases, but are successful because of consumer preference, processing quality, and/or high yielding ability.

Some varieties released between 1992 and 2004 that incorporate wide germplasm are NorValley (*Solanum phureja*), Russet Nugget (*S. phureja*, *S. spegazzinii*, *S. raphanifolium*), Jacqueline Lee (Mexican variety Tollocan), Defender (European late blight resistant germplasm), and Eva (Group Andigena).

Since the Plaisted and Hoopes 1989 paper (Am. Potato J. 66:603-627) describing the use of exotic germplasm in North American potato breeding, several papers have been published to expand further on the subject. Love (AJPR 76:263-270) published an in-depth study of the parentage of North American potato cultivars, including the use of exotic progenitors. Pavek and Corsini (AJPR 78:433-442) detailed the use of genetic resources in variety development as of 2001. The latter paper describes the breadth of germplasm available in the world's genebanks, the efforts of many programs to incorporate traits from exotic sources into their breeding material, and the two USDA programs specifically created to incorporate exotic germplasm into material that can be readily used by variety breeders. In 2000, Jansky (Plant Breeding Reviews 19:69-155) summarized the status of breeding potatoes for disease resistance.

Even though there is somewhat more genetic diversity in the system today than in 1992, commercial varieties may be broadly susceptible to a new or expanding threat to the industry.

In the 1990's the potato industry was threatened with more aggressive races of the late blight pathogen, which did not respond to the most widely used systemic chemical. This threat has largely been contained, mainly by extensive use of fungicides at a high cost. It has stimulated much breeding activity which has resulted in the use of new germplasm in most programs and some progress has been made in developing commercial varieties with resistance to late blight resistance. The variety Defender, developed by the USDA/Idaho program, is a prime example of this, being resistant to both tuber and foliar late blight.

Increasing international travel and global trade facilitate the movement of pathogens from one part of the world to others. Some possibilities for new or increasing threats to the potato industry:

- Cyst nematode species other than *Globodera. rostochiensis* R01. *G. pallida* is very widespread in Europe and parts of South America. Some breeding is taking place at Cornell against this threat. The introduction of this pathogen would probably not have sudden, widespread consequences, but would require major new breeding efforts over time.
- Cool-season adapted races of the bacterial wilt pathogen. All of our varieties are likely to be quite susceptible. Breeding against this disease has not been particularly successful anywhere.
- Tuber necrotic strains of PVY. If normal seed production systems fail to control this, breeding would be necessary. Single gene inheritance makes it feasible.
- Wart. Resistance exists in much *Tuberosum* germplasm, and it would probably not be spread too rapidly.
- Mop top virus. The vector, *S. subterranea*, is present in most potato areas and the virus has been identified in at least one potato production zone.
- Tomato spotted wilt virus. Serious in South Africa, Australia. Present in the Southeast of the U.S.
- Phytoplasma-like organisms causing tuber disorders and foliar abnormalities appear to have spread from Mexico through Texas and into the Pacific Northwest in recent years. Varietal resistance is not known.
- Tobacco rattle virus, causing corky ringspot or spraing in tubers, has become more widespread and serious. Screening for resistance has taken place in Florida and Idaho.

There are numerous possibilities of diseases and/or pests which could become more of a threat to the North American potato industry. Breeding being a relatively long process, a significant time would be required to respond to most of these with resistant varieties.

Deliberate attempts to threaten the contribution of potatoes to the food supply can be envisioned. These could involve one or more of the following:

- The introduction of a new disease or pest into potato production areas. Genetic diversity in the variety portfolio may or may not be a deterrent to such acts, depending on whether some varieties or advanced breeding selections were resistance to the specific pathogen introduced.. Some strategies to do damage may fail to have a rapid, dramatic effect in a somewhat widely dispersed area, among growers who have considerable ability to treat for diseases and pests.

- Sabotage of a chemical product used in seed treatment, crop protection, or storage of the crop, making the product somehow harmful to the crop, the soil, the consumer. Products that are widely utilized but have components originating from single sources could be most vulnerable.

- Terrorism based on rumors designed to make consumers afraid of the potato or its processed products.