

Background

One of the key areas of research that the Alberta potato industry identified in industry-wide priority setting meetings in 2003 and 2004 is breeding for new potato varieties. This was reiterated in National industry consultation meetings held in 2011. For about 40 years now, Agriculture and Agri-Food Canada managed a potato breeding program in Western Canada focused on breeding and selecting varieties that would perform well under our environmental conditions. Alberta Agriculture facilitated the process by conducting regional trials, disease resistance trials, agronomic trials, culinary and storage trials with promising new varieties. In recent years, reductions in government staff and budgets put pressure on the support provided by both levels of government. The nature of potato breeding and selection has shifted. Industry participants are exploring varieties for different end-uses, such as gourmet and functional food uses. The potato breeding programs in Canada were consolidated into a National program in 2004 and there is now one National Potato Breeder based in New Brunswick. By necessity, less emphasis is directed at varieties best suited for Western Canada. Varieties from breeding programs in Europe and the United States are often being assessed by industry stakeholders.

Regional trials of potato varieties in Western Canada were funded in part by industry money collected through the Western Canadian Potato Breeding Consortium. This system was unique to Western Canada and served established industry stakeholders well. Newcomers to the industry were not easily able to participate. Even established stakeholders questioned whether they received sufficient value for the fees. The shift to an accelerated release mechanism moved the responsibility for the evaluations to industry and provides broader access to stakeholders initially. However, the window for evaluation of varieties is much narrower than in the Consortium and less data is available for decision makers.

Over the last 15 years, Alberta Agriculture and Rural Development staff worked with individual stakeholders in the potato industry to provide agronomic evaluations of potato varieties from various breeding programs. Public varieties are still widely grown, but not always as good a fit as private varieties for the same end use. Growing environments vary significantly among potato production regions in Canada. Alberta data is essential when selecting varieties appropriate for our climate, our customers and industry stakeholders.

Many breeding programs target disease resistance, nitrogen use efficiency and excellent storage potential in addition to increased yield. The challenge is often that impartial comparisons of the material with standards varieties are not available. Each stakeholder would have the responsibility to obtain seed, sign agreements, engage researchers, or evaluate varieties independently. Many are not equipped to conduct small-scale evaluations well and seed is not available for larger-scale evaluations. Breeder's seed also has higher tolerances for virus loads and producers evaluating this material on farm put the remainder of the crop at risk.

In Alberta, potato industry stakeholders are looking for replacement varieties that use less nitrogen, less water, less pesticide, yet yield superior processing or culinary quality and tonnage. Varieties from breeding programs in Canada, Europe and the United States are often being assessed. Many breeding programs target disease resistance, nitrogen use efficiency and

excellent storage potential in addition to increased yield. Tuber yield potential and nutritional requirements are impacted by variety characteristics and by environmental characteristics such as the length of the growing season (Westerman, 1993). As noted by Love et al. (2003), the full potential of a new variety may not be realized until proper management is implemented. There is increasing pressure on potato producers to utilize best management practices to reduce the environmental footprint for potatoes. The costs of such shifts in production practices will be borne primarily by producers.

An ideal French fry variety would have earlier maturity than Russet Burbank, be relatively tolerant of environmental fluctuations, have few defects, yield well and have specific gravity in the desired range (1.086 to 1.092). Good fry color out of the field is an asset, and good fry color out of storage is also very desirable. An ideal chipping variety would produce a good yield of medium sized tubers, be relatively tolerant of environmental fluctuations, have few defects, and have high specific gravity in the desired range (above 1.086). Chipping tubers with a good skin set, good maturity at harvest and low concentration of reducing sugars is also very desirable. Varieties that store well at cooler temperatures are an asset. Ideal fresh market varieties would produce a good yield of creamer or medium sized tubers, be relatively tolerant of environmental fluctuations, have few defects, and have an attractive appearance. Fresh market tubers with a good skin set that store well are very desirable.

The purpose of this project was to pool resources to evaluate potential varieties from a range of sources, using a cooperative approach. This trial was established to collect local agronomic data on varieties from breeding programs in Canada, the U.S. and elsewhere. Including agronomy in the evaluations allowed us to provide growers with additional relevant information when they consider producing new varieties. Often, there are economies of scale realized when varieties are evaluated collectively rather than individually. ARD was well positioned to provide regional data in an impartial setting. The varieties were planted in replicated plots at the Alberta Irrigation Technology Centre (AITC) in Lethbridge, AB and in demonstration plots at the Crop Diversification Centre South (CDCN) in Brooks, AB in 2014.

Project Overview

Potato variety evaluation trials were conducted at the Alberta Irrigation Technology Centre (AITC) in Lethbridge to provide data from an irrigated site in Alberta. Standard varieties were included to represent early French fry, full-season French fry, early chipper, full-season chipper, fresh market red, fresh market yellow classes. Sufficient potatoes were planted to provide replicated data from AITC and to host a demonstration field day at CDCS in 2014.

Material for these trials was provided by AAFC Potato Breeding Program and by industry stakeholders either through the AAFC Accelerated Release Program or by sourcing varieties from European, U.S. or other breeding programs. All import requirements were the responsibility of the stakeholder requesting evaluation.

At AITC, we set up a nitrogen response trial with moderate and reduced levels of nitrogen fertility. Stakeholders indicated whether or not they required fertility information and provided

sufficient seed (in-kind) and funds to include these evaluations. Some accommodations were made to ensure that all client sponsors found value in the data provided.

The leveraged funding from industry also provided resources for the regional evaluation of AAFC material prior to release to industry. Without funding from this project, there would not have been an opportunity to observe the breeding program cultivars in Alberta in 2014.

Variety trials were set up as randomized complete blocks. Guard rows were planted to minimize edge effects. Four replicate rows (6m) were harvested. The agronomic trials were set up as split plot designs with nitrogen level as the main plot and varieties as sub plots.

Data collected included emergence data, stand count, total yield, grade by size category relevant to end-use, specific gravity, internal defects, external deformities, and culinary evaluations. Samples were returned to stakeholders for bruise testing, storage assessments or acrylamide testing by the stakeholders. Local production data supports adoption of new potato varieties that will enhance the competitiveness of our potato industry.

A field day was hosted at CDCS in August to allow stakeholders to evaluate the response of cultivars to irrigated growing conditions in Alberta. There is no substitution for first-hand observation of potato varieties in the field.

Objectives:

- A. To evaluate potential new varieties for processing (fry and chip), creamer and other markets;
- B. To provide the potato industry an opportunity to assess varieties grown under local conditions;
- C. To compare varieties from European, Tri-State and National breeding programs (AAFC) under Alberta conditions; and
- D. To develop agronomic information on nitrogen response to support potato growers interested in producing new varieties.
- E. To evaluate the cooperative approach to variety development and develop a model that takes the industry beyond the current project.

Project Team Members

Alberta Agriculture and Rural Development, Crop Diversification Centre South, Brooks, AB

- Dr. Michele Korschuh, Potato Research Scientist – Project Lead
- Seasonal Technologists

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- Dr. Benoit Bizimungu, Plant Breeder
- Technologists

Executive Summary

In 2014, the first year of the trial, funding from 9 industry stakeholders plus the Potato Growers of Alberta (PGA) was leveraged to conduct replicated potato variety trials in southern Alberta. The trial was conducted under pivot irrigation at the Alberta Irrigation Technology Centre in Lethbridge, AB. More than 100 potato varieties were evaluated in 2014. Data collected was adjusted where possible to ensure that clients were provided with information useful for their organizations. A limited amount of agronomic data was also provided at the request of client sponsors.

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A few potato cultivars submitted by clients were intended for the French fry market. French fry varieties must yield well and have good fry characteristics. Specific gravity of the potatoes is an indirect measure of fry colour. In lieu of submitting additional cultivars, one client elected to evaluate several nitrogen fertilizer strategies for two varieties.

Eight chipping potato varieties were included in 2014. Old Dutch Foods, as well as seed growers and variety development firms provided chippers for evaluation. Chipping potatoes are graded by size rather than weight. As with French fry cultivars, good fry colour is essential and specific gravity is a good indirect measure of chip colour. Typically, chipping potatoes required less N than French fry cultivars and a comparison at a lower rate of N was requested for seven of the chipping entries. Chip colour scores were provided for varieties evaluated as chippers.

Fresh market potatoes were included in the 2014 trial as well. Although the fresh market sector of Alberta's potato industry is the smallest segment, there is a lot of growth potential even if we simply replace imported potatoes with locally produced ones. Sixteen fresh market cultivars and 2 checks were evaluated in 2014. Five entries were evaluated on a moderate rate of N, 5 entries were evaluated at a lower rate of N and 6 entries were evaluated at both rates to determine whether or not the varieties respond well to reduced N. Culinary data was provided as requested. For table potatoes, potatoes were evaluated as baked and boiled to determine the best fit for marketing purposes.

A special category of fresh market potatoes is the creamer potato market, made popular by the Alberta based Little Potato Company. Creamer potatoes are not smaller versions of other fresh market varieties; the varieties are selected for high tuber set and small tuber size intentionally to satisfy this market. These potatoes are prepared with the skin on and may be served with limited additional preparation. As such, skin set and tuber appearance are critical. Flavour is also very important for this class of potatoes. Forty creamer cultivars were included in the trial in 2014 and spacing was adjusted to reflect the special nature of this type of crop.

Agriculture and Agri-Food Canada (AAFC) has been involved in potato breeding for over 40 years. The National Potato Variety program includes selections that might be suitable for the French fry, chipping, or table market, including the creamer category. Industry participants are encouraged to view selections after one or two years of regional testing and to “pick up” the varieties for further testing. Without regional testing in Alberta and knowledge of how the cultivars perform in our growing environment, industry stakeholders would be hard-pressed to make selections. AAFC supplied test material for replicated trials and included entries suitable for all industry sectors. In 2014, 11 chipping cultivars, 13 French fry cultivars and 13 fresh market cultivars were evaluated along with relevant check material from eastern and western sources at AITC.

A field day was hosted at CDCS in August to allow stakeholders to evaluate the response of cultivars to irrigated growing conditions in Alberta. There is no substitution for first-hand observation of potato varieties in the field.

Customer specific reports were generated and provided. Client confidentiality was respected by coding entries prior to releasing reports more widely.