Activity 18.v10 – Potato 17.v10 Canadian Potato Variety Evaluation Program – Alberta 2014

2014 REPORT

Prepared for the
Potato Growers of Alberta
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By

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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.

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 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 trail 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.

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 Konschuh, Potato Research Scientist – Project Lead
- Seasonal Technologists

Agriculture and Agri-Food Canada, Potato Research Centre, Fredericton, NB

- Dr. Benoit Bizimungu, Plant Breeder
- Technologists

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.

AAFC National Potato Variety Evaluation

2014

Materials and Methods

The variety evaluation was conducted in small plots at the Alberta Irrigation Technology Centre in Letbridge, AB. Fertility (227 lbs/ac) was achieved through a combination of soil fertility (57 lbs/ac N; 23 lbs/ac P) and broadcast fertilizer (92 lbs/ac of 46-0-0, 162 lbs/ac of 11-52-0, 212 lbs/ac of 0-0-60 and 240 lbs/ac of 20.5-0-0-24) incorporated prior to planting. Varieties were planted in four replicate rows in a randomized complete block design along with standard varieties (Norland, Yukon Gold, Snowden, Atlantic, Russet Burbank and Shepody). Each block was planted adjacent to guard rows to reduce any edge effects (see plot plan, Appendix A1).

Roundup (1 L/ac) was sprayed prior to planting (May 21) to reduce weed pressure. Seed of standard cultivars was provided by Edmonton Potato Growers and seed of test cultivars was provided by each participant. Potatoes were planted June 5, 2014 approximately 5 to 5½"deep using a two-row tuber unit planter. Seed was planted at 30cm spacing in 6m rows spaced 90cm apart.

The potatoes were hilled June 27 with a power hiller. Sencor 75DF (100 g/ac) and Centurion (76 mL/ac) were applied prior to emergence (June 3) to control weeds. The plots were irrigated to maintain soil moisture close to 70%. Foliar fungicides were applied several times during the growing season to prevent early and late blight from developing (Table 1).

Table 1: Foliar fungicides applied to the potato crop in 2014 to prevent early and late blight development.

Date of Application	***Fungicide***	***Rate***
16 July	Bravo	1 L/ac
26 July	Dithane	900 g/ac
5 Aug	Bravo	1 L/ac
12 Aug	Dithane	900 g/ac
19 Aug	Dithane	900 g/ac
27 Aug	Bravo	1 L/ac
2 Sept	Bravo	1 L/ac
8 Sept	Bravo	1 L/ac

Reglone was applied (1.0 L/ac) September 15 and again September 19. Potatoes were harvested September 24 and 25 using a 1-row Grimme harvester.

Tubers were stored at 8˚C until graded. Tubers were graded into size categories (less than 48mm, 48 – 88mm, over 88mm and deformed). A sample of twenty-five tubers (48 – 88mm) from each replicate was used to determine specific gravity using the weight in air over weight in water method. These tubers were cut longitudinally to assess internal defects. Sub-samples of 48-88mm tubers were provided to Lethbridge Research Centre staff for culinary and post-harvest evaluations.

The data presented here have been statistically analyzed using ANOVA and Tukey's Multiple Comparison Test; (SPSS; $p \leq 0.05$). Statistical summaries are available upon request.

Results – Chipping Cultivars

Sample hills of each cultivar were dug for a field day August 27, 2014. Photos of the chipping cultivars are shown in Figure 2.

Figure 2. AAFC chipping cultivars at the CDCS field day August 27, 2014: a) Atlantic E., b) Atlantic W., c) F10031, d) F10034, e) F10035, f) F10037, g) FV15559-80, h) FV15568-30, i) GBB1-100, j) V05219-1, k) V07078-1, l) V08053-1, m) FV15720-18, n) Snowden E., and o) Snowden W..

Yield data (total yield; ton/ac) and specific gravities of each of the chipping cultivars are shown in Table 2. Yield ranged from 14.0 for Snowden E to 19.6 ton/ac for V05219-1. Specific gravity ranged from 1.079 for V07078-1 and V08053-1 to 1.099 for GBB1-100.

Table 2: Estimated total yield (ton/acre) and specific gravity for each chipping cultivar grown at AITC in Letbridge, AB (approximately 227 lbs/ac nitrogen). Data shown is the mean of two replicates.

	Yield (ton/ac)	SG
Atlantic East	16.6	1.098
Atlantic West	19.0	1.089
F10031	18.0	1.088
F10034	15.4	1.095
F10035	17.9	1.095
F10037	17.2	1.097
FV15559-80	14.5	1.085
FV15568-30	11.5	1.089
GBB1-100	19.2	1.099
V05219-1	19.6	1.084
V07078-1	18.3	1.079
V08053-1	17.3	1.079
FV15720-18	15.3	1.086
Snowden East	14.0	1.091
Snowden West	14.5	1.098

The mean percentage of total tuber number in each size category is shown in Table 3.

Table 3: Percentage of total tuber number in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed) for each chipping cultivar grown at approximately 227 lbs/ac. Data shown is the mean of two replicates.

	No. of <48mm	No. of 48 to 88mm	No. of > 88mm	No. of deformed
Atlantic East	11	79	10	0
Atlantic West	8	82	10	0
F10031	39	61	0	0
F10034	26	74	0	0
F10035	26	74	0	0
F10037	14	85	0	2
FV15559-80	18	81	2	0
FV15568-30	33	67	0	0
GBB1-100	15	82	2	0
V05219-1	34	64	1	1
V07078-1	19	76	3	2
V08053-1	34	66	0	1
FV15720-18	12	81	5	2
Snowden East	26	72	0	2
Snowden West	33	66	1	0

The yield of tubers (estimated ton/ac) of each chipping cultivar is shown by size category in Table 4. Marketable yield ranged from 9.7 ton/acre for FV15568-30 to 16.7 ton/ac for GBB1-100.

Table 4: Estimated yield (ton/ac) in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed tubers) for each chipping cultivar grown at approximately 227 lbs/ac. Data shown is the mean of two replicates.

	Yield of <48mm (ton/ac)	Yield of 48 to 88mm (ton/ac)	Yield of > 88mm (ton/ac)	Yield of deformed (ton/ac)
Atlantic East	0.6	12.9	3.0	0.1
Atlantic West	0.5	15.0	3.5	0
F10031	4.1	13.8	0.0	0.1
F10034	1.9	13.3	0.1	0.0
F10035	2.6	15.2	0.0	0.1
F10037	3.1	13.6	0.0	0.4
FV15559-80	1.1	12.7	0.7	0.0
FV15568-30	1.7	9.7	0.2	0.0
GBB1-100	1.3	16.7	1.2	0.0
V05219-1	3.2	15.6	0.6	0.3
V07078-1	1.2	14.9	1.7	0.5
V08053-1	3.0	14.0	0.0	0.4
FV15720-18	2.7	12.5	0.0	0.1
Snowden East	1.6	11.1	0.6	0.7

Snowden West	2.7	11.6	0.2	0.0

Tuber samples used to measure specific gravity were evaluated for hollow heart, other internal defects and scab. There were very few internal defects observed in the tubers examined. Hollow heart was noted in at least one tuber of the Atlantic, F10031, F10034, F10037, FV15720-18 and V05219-1. Some tubers from each sample exhibited stem-end discoloration and this may be an indication that plants were not fully mature prior to desiccation. Common scab lesions were not noted on any of the tubers evaluated.

Results– French Fry Cultivars

Sample hills of each cultivar were dug for a field day August 27, 2014. Photos of the French fry cultivars are shown in Figure 3.

Figure 3. AAFC French fry cultivars at the CDCS field day August 27, 2014: a) F10001., b) F10003., c) F10008, d) F10012, e) F10016, f) F10017, g) CV03155-2, h) CV03366-1, i) CV04144-1, j) CV05022-2, k) CV07180-1, l) FV15680-03, m) V1408-1, n) Russet Burbank E, o) Russet Burbank W, p).Shepody E, and q) Shepody W.

Yield data (total yield; ton/ac) and specific gravities of each of the French fry cultivars are shown in Table 5.

Table 5: Estimated total yield (ton/acre) and specific gravity for each French fry cultivar grown at AITC in Lethbridge, AB (approximately 227 lbs/ac nitrogen). Data shown is the mean of two replicates.

	Yield (ton/ac)	SG
F10001	22.4	1.081
F10003	21.8	1.096
F10008	19.0	1.098
F10012	17.9	1.085
F10016	17.2	1.087
F10017	19.7	1.088
CV03155-2	16.2	1.077
CV03366-1	17.0	1.096
CV04144-1	19.4	1.086
CV05022-1	18.7	1.077
CV07180-1	16.4	1.082
FV15680-03	15.9	1.092
V1408-1	17.4	1.080
R.Burbank East	19.0	1.082
R.Burbank West	23.1	1.078
Shepody East	19.3	1.079
Shepody West	18.7	1.086

The mean percentage of total tuber number in each size category is shown in Table 6.

Table 6: Percentage of total tuber number in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed) for each French fry cultivar grown at approximately 227 lbs/ac. Data shown is the mean of two replicates.

	No. of <48mm	No. of 48 to 88mm	No. of > 88mm	No. of deformed
F10001	20	75	0	4
F10003	19	78	1	2
F10008	24	76	0	0
F10012	40	60	0	0
F10016	32	58	9	1
F10017	32	68	0	0
CV03155-2	18	82	0	0
CV03366-1	54	46	0	0
CV04144-1	32	66	0	2
CV05022-1	41	59	0	0
CV07180-1	33	65	1	2
FV15680-03	40	57	0	3
V1408-1	15	84	0	1
R.Burbank East	55	43	0	2
R.Burbank West	37	60	0	3
Shepody East	21	73	2	3
Shepody West	25	72	0	3

The yield of tubers (estimated ton/ac) of each chipping cultivar is shown by size category in Table 7.

Table 7: Estimated yield (ton/ac) in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed tubers) for each French fry cultivar grown at approximately 227 lbs/ac. Data shown is the mean of two replicates.

	Yield of <48mm (ton/ac)	Yield of 48 to 88mm (ton/ac)	Yield of > 88mm (ton/ac)	Yield of deformed (ton/ac)
F10001	1.7	18.9	0.2	1.5
F10003	1.4	19.4	0.5	0.5
F10008	1.9	16.8	0.2	0.2
F10012	4.6	13.3	0.0	0.0
F10016	0.3	13.0	3.7	0.2
F10017	3.2	16.3	0.0	0.2
CV03155-2	1.2	14.9	0.0	0.1
CV03366-1	6.4	10.4	0.0	0.2
CV04144-1	3.0	15.6	0.0	0.9
CV05022-1	1.8	16.8	0.1	0.0
CV07180-1	2.2	13.3	0.5	0.5
FV15680-03	3.4	11.6	0.0	0.9
V1408-1	1.1	16.1	0.0	0.3
R.Burbank East	6.8	11.3	0.0	0.9
R.Burbank West	5.1	17.0	0.0	1.0
Shepody East	2.2	14.4	1.1	1.4
Shepody West	2.1	15.8	0.2	0.6

Tuber samples used to measure specific gravity were evaluated for hollow heart, other internal defects and scab. There were very few internal defects observed in the tubers examined. Hollow heart was noted in several tubers of F10001, F10003, F10008, CV04144-1, CV07180-1, Russet Burbank and Shepody. Some tubers from each sample exhibited stem-end discoloration and this may be an indication that plants were not fully mature prior to desiccation. Common scab lesions were not noted on any tuber in the evaluation.

Results – Fresh Market Cultivars

Sample hills of each cultivar were dug for a field day August 27, 2014. Photos of the yellow fresh market cultivars are shown in Figure 4.

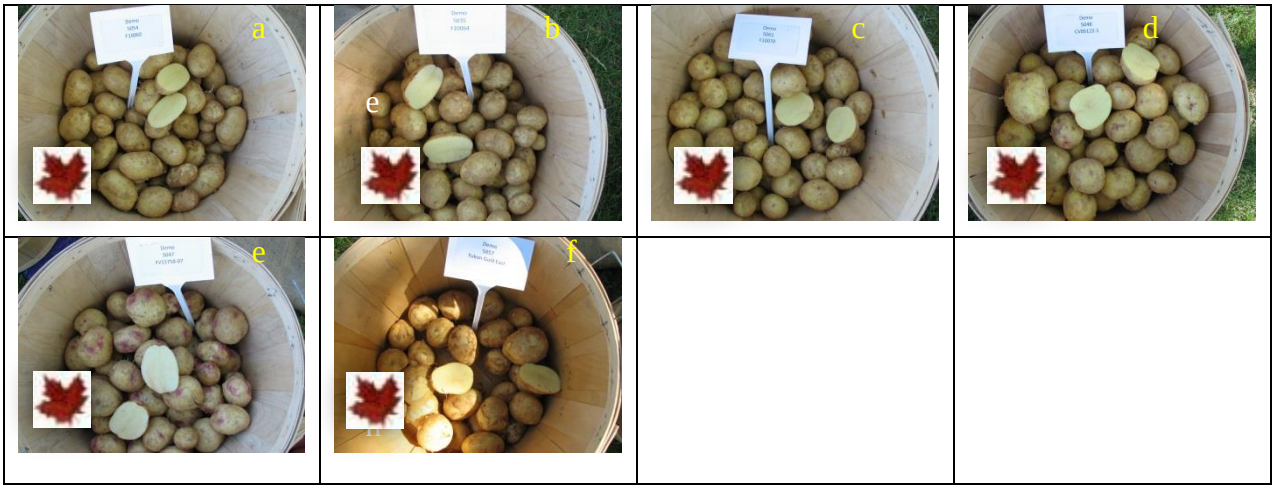


Figure 4. AAFC yellow/white fresh market cultivars at the CDCS field day August 27, 2014: a) F10060, b) F10064, c) F10070, d) CV05122-1, e) FV15758-07, and f) Yukon Gold.

Photos of the purple/red-skinned fresh market cultivars are shown in Figure 5.

Figure 5. AAFC purple/red-skinned fresh market cultivars at the CDCS field day August 27, 2014: a) F10066, b) F10075, c) F10077, d) V07047-2, e) V07116-1, f) V07148-2, and g) Norland.

Yield data (total yield; ton/ac) and specific gravities of each of the fresh market cultivars are shown in Table 8.

Table 8: Estimated total yield (ton/acre) and specific gravity for each fresh market FM) cultivar grown at AITC, Lethbridge, AB (approximately 227 lbs/ac nitrogen). Data shown is the mean of two replicates.

	End Use	Yield (ton/ac)	SG
Yellow			
F10060	FM	19.4	1.077
F10064	FM	19.7	1.081
F10070	FM	20.2	1.093
CV05122-1	FM	22.9	1.076
FV15758-07	FM	15.9	1.086
Yukon Gold	FM	17.0	1.088
Red-skinned			
F10066	FM	18.6	1.087
F10075	FM/CR/WR	17.5	1.082
F10077	FM/CR/WR	18.3	1.084
V0747-2	FM	21.9	1.066
V07116-1	FM	23.1	1.074
V07148-2	FM	21.7	1.070
Norland	FM	19.2	1.071

The mean percentage of total tuber number in each size category is shown in Table 9.

Table 9: Percentage of total tuber number in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed) for each fresh market cultivar grown at approximately 235 lbs/ac. Data shown is the mean of two replicates.

	No. of <48mm	No. of 48 to 88mm	No. of > 88mm	No. of deformed
Yellow				
F10060	44	56	0	0
F10064	25	75	0	0
F10070	26	74	0	0
CV05122-1	10	80	10	0
FV15758-07	12	81	5	2
Yukon Gold	10	84	4	1
Red-skinned				
F10066	29	71	0	0
F10075	23	77	0	0
F10077	40	60	0	0
V0747-2	24	66	0	10
V07116-1	19	79	2	1
V07148-2	17	81	2	0
Norland	15	83	0	1

The yield of tubers (estimated ton/ac) of each fresh market cultivar is shown by size category in Table 10.

Table 10: Estimated yield (ton/ac) in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed tubers) for each fresh market cultivar grown at approximately 227 lbs/ac. Data shown is the mean of two replicates.

	Yield of <48mm (ton/ac)	Yield of 48 to 88mm (ton/ac)	Yield of > 88mm (ton/ac)	Yield of deformed (ton/ac)
Yellow				
F10060	5.0	14.4	0.0	0.1
F10064	2.1	17.6	0.0	0.0
F10070	3.0	18.2	0.0	0.0
CV05122-1	0.6	17.9	4.3	0.0
FV15758-07	0.7	16.0	2.1	0.8
Yukon Gold	0.5	14.5	1.6	0.4
Red-skinned				
F10066	2.7	15.9	0.0	0.0
F10075	1.6	15.5	0.4	0.0
F10077	3.7	14.6	0.0	0.1
V0747-2	2.7	16.1	0.0	3.1
V07116-1	1.5	20.5	1.0	0.1
V07148-2	1.2	19.4	1.0	0.0
Norland	0.9	17.9	0.2	0.1

Tuber samples used to measure specific gravity were evaluated for hollow heart, other internal defects and scab. There were very few internal defects observed in the tubers examined. Hollow heart or brown center was noted in at least one tuber of F10075, FV15758-07, and Yukon Gold. F10077 exhibited some purple pigmentation. Some tubers from each sample exhibited stem-end discoloration and this may be related to vine maturity at the time of desiccation. Common scab lesions were not noted on any tubers in the evaluation.

Conclusions

The 2014 variety trial included a number of cultivars with potential in southern Alberta. Atlantic and Snowden were included in the trial as standard varieties to compare to 11 chipping cultivars. Russet Burbank and Shepody were included in the trial as standard varieties to compare 13 French fry cultivars with. Yukon Gold and Norland were included in the trial as standard varieties to compare with 11 fresh market cultivars.

The trial was designed to provide regional data for a wide range of potato cultivars. All cultivars were planted at the same in-row spacing, the N rate was approximately 227 lbs/ac, and harvest was scheduled for full-season varieties. Addressing the agronomic needs, such as plant density, fertility requirements, and harvest timing for each variety may well result in improvements to yield and size profiles when compared to the results in this trial.

French Fry Variety Evaluation

2014

Materials and Methods

The study was conducted in a split plot arrangement at the Alberta Irrigation Technology Centre in Lethbridge, AB. The main plots were based on nitrogen rates (see Table 11). Pre-plant N was applied as urea (44-0-0) or ESN (46-0-0) using a Conserva-Pak machine. Top-dressed N was applied as either urea or ESN manually just prior to hilling with a power hiller. Fertigation events were simulated by applying ammonium nitrate fertilizer and irrigating immediately afterward. Approximately 50 lbs/ac P was supplied to all treatments (11-52-0). Varieties were planted in the centre rows of 4 m blocks to ensure there were no edge effects for fertilizer treatments (see plot plan, Appendix A). Fertigation was simulated by applying ammonium nitrate immediately prior to an irrigation event.

Table 11: Fertilizer treatments (lbs/ac) applied to potato varieties in the 2014 trial.

				Simulated Fertigation		
Variety	**Treatment**	**Pre-plant N (urea)**	**Top-dressed N**	**July 22**	**Aug 8**	**Aug 21**
LW 08	1	115	135 Urea	0	0	0
LW 08	2	115	135 ESN	0	0	0
LW 08	3	150	100 ESN	0	0	0
LW 08	4	100	50 ESN	25	25	25
LW 04	3	150	100 ESN	0	0	0
LW 04	4	100	50 ESN	25	25	25
LW 04	5	150	0	25	25	25
LW 04	6	75/75 ESN	0	25	25	25

Treatment 1: Urea Split (45:55)
Treatment 2: Urea/ESN Split (45:55)
Treatment 3: Urea/ESN Split (60:40)
Treatment 4: Urea/ESN Split + fertigation
Treatment 5: Urea high + fertigation
Treatment 6: Urea/ESN + fertigation

Roundup (1 L/ac) was sprayed prior to planting (May 21) to reduce weed pressure. Seed of each cultivar was provided by Lamb Weston. Seed was received in early May and was cut (2 ½ to 3 oz) and suberized prior to planting.

Potatoes were planted May 23, 2014 approximately 5 to 5½"deep using a two-row wheel planter. Seed was planted at 12"spacing in 20' rows spaced 36" apart. Each treatment was replicated four times. Sencor 75DF (100 g/ac) and Centurion (76 mL/ac) were applied prior to emergence (June

3) to control weeds. The plots were irrigated to maintain soil moisture close to 70%. Foliar fungicides were applied several times during the growing season to prevent early and late blight from developing (Table 1).

Reglone was applied (1.0 L/ac) September 15 and potatoes were harvested September 19 using a 1-row Grimme harvester.

Tubers were stored at 46°F until graded. Tubers were graded into size categories (less than 4 oz, 4 to 6 oz, 6 to 10 oz and over 10 oz). A sample of twenty-five tubers (4 to 10 oz) from each replicate was used to determine specific gravity using the weight in air over weight in water method. These tubers were cut longitudinally to assess internal defects. The remainder of the 6 to 10 oz tubers were placed in storage at 46°F until transferred to a commercial storage facility for periodic evaluation by Lamb Weston. The trial should be conducted for at least one additional year to allow for differences in environmental conditions between years.

The data presented here have been statistically analyzed using ANOVA and LSD Multiple Range Test; ($p \leq 0.05$). Statistical summaries are available upon request.

Results and Discussion

Both varieties were harvested in mid-September and results for each variety grown with different nitrogen treatments were compared with one another.

Yield estimates were obtained by digging single rows from each replicate. It is important to note that both varieties were harvested September 19 to tease out differences, although more time bulking would be required to reach optimal yields.

Significant differences in yields of marketable and small tubers were observed between nitrogen treatments with LW 08 (Table 12). The total yield of the varieties were lower than expected, likely because of a cool spring, late planting and early harvest. The 2014 season in Lethbridge started with a cool, wet spring, and ended with fewer P days (830.5) through the season than is recommended for potato.

Optimal fertilizer rate and timing are affected by the length of the growing season and the maturity of the cultivar grown (Stark and Westerman, 2003). Management recommendations for seed, fertility, irrigation and storage are developed for new varieties and allow the varieties to be adopted in the growing region where the recommendations were developed. Alberta has a shorter growing season and longer day-lengths than many other potato growing areas and local recommendations for specific varieties may be needed.

The yield of LW 08 grown on all nitrogen strategies was affected by the shorter growing season. Of the strategies applied in 2014, the split urea treatment (Trt#1) and the fertigation approach (Trt#4) provided significantly greater marketable yields and significantly lower yields of small tubers. If the crop had been permitted to bulk up, these differences may have been even more evident. These strategies both involved providing less urea pre-plant, but urea worked as well or better than ESN for top-dressing. Fertigation was useful, especially if any of the spring applied

N was vulnerable to leaching. For this variety, though, fertigation did not appear to be required. Additional work may be required to determine whether even less upfront N provide better size profiles.

Very few deformed tubers were observed with this variety, regardless of the N treatments. Specific gravity was not significantly affect by the nitrogen application strategies used in the study.

Table 12: Yield (ton/ac) by size category and specific gravity of **LW 08** potatoes grown with different nitrogen application strategies. The percentage by weight of key categories is indicated in brackets. Categories marked with an asterisk contain data that are statistically significant at the $p < 0.05$ level. Data followed by the same letter in each section of the table are not significantly different at the $p < 0.05$ level.

Split Urea 45:55	Urea/ESN Split 45:55	Urea/ESN Split 60:40	Urea/ESN split plus 3 fert
Total Yield (ton/ac)			
13.71	13.91	12.13	14.53
Yield of Marketable Tubers (ton/ac)*			
9.56 a (70%)	8.21 ab (61%)	6.30 b (52%)	9.49 a (65%)
Yield of Tubers < 4 oz. (ton/ac)*			
4.15 b (30%)	5.63 a (38%)	5.63 a (46%)	4.73 ab (32%)
Yield of Tubers 4 to 6 oz. (ton/ac)			
4.39 (32%)	5.23 (38%)	3.81 (32%)	5.20 (36%)
Yield of Tubers 6 to 10 oz. (ton/ac)			
4.70 (34%)	2.71 (21%)	2.13 (17%)	3.57 (24%)
Yield of Tubers > 10 oz. (ton/ac)			
0.36 (3%)	0.27 (2%)	0.36 (3%)	0.72 (5%)
Yield of Deformed Tubers (ton/ac)			
0.00	0.07	0.21	0.31
Specific Gravity			
1.085	1.087	1.087	1.086

No significant differences in total yield or yields of size categories between nitrogen treatments with LW 04 (Table 13). The total yield of the varieties were lower than expected, likely because of a cool spring, late planting and early harvest. The 2014 season in Lethbridge started with a cool, wet spring, and ended with fewer P days (830.5) through the season than is recommended for potato.

Optimal fertilizer rate and timing are affected by the length of the growing season and the maturity of the cultivar grown (Stark and Westerman, 2003). Management recommendations for seed, fertility, irrigation and storage are developed for new varieties and allow the varieties to be adopted in the growing region where the recommendations were developed. Alberta has a shorter

growing season and longer day-lengths than many other potato growing areas and local recommendations for specific varieties may be needed.

The yield of LW 04 grown on all nitrogen strategies was affected by the shorter growing season. Of the strategies applied in 2014, the treatments including ESN and fertigation (Trt#4 and Trt#6) provided greater total and marketable yields. These strategies both involved providing less urea pre-plant. In 2014, applying ESN pre-plant with the urea or top-dressed at hilling gave similar results for total and marketable yield, but pre-plant ESN appeared to favor larger tuber size compared to the top-dressed ESN. Fertigation may be useful when less nitrogen is applied as urea pre-plant. Some of the spring applied urea may have been vulnerable to leaching as a large amount of rainfall was received prior to top-dressing and hilling. If the crop had been permitted to bulk up, these differences may have become significant.

Tuber deformities may have been affected by nitrogen strategies, but no significant differences were noted. Specific gravity was significantly affected by the nitrogen application strategies used in the study. Both treatments where ESN was applied as a top-dressing prior to hilling (Trt#3 and Trt#4) resulted in significantly higher specific gravity in the tubers.

Table 13: Yield (ton/ac) by size category and specific gravity of LW 04 potatoes grown with different nitrogen application strategies. The percentage by weight of key categories is indicated in brackets. Categories marked with an asterisk contain data that are statistically significant at the $p < 0.05$ level. Data followed by the same letter in each section of the table are not significantly different at the $p < 0.05$ level.

Urea/ESN Split 60:40	Urea/ESN split + 3 fert	Urea pre-plant + 3 fert	Urea/ESN pre-plant + 3 fert
Total Yield (ton/ac)			
11.11	12.67	10.91	12.36
Yield of Marketable Tubers (ton/ac)			
8.75 (79%)	10.56 (83%)	8.31 (76%)	9.79 (80%)
Yield of Tubers < 4 oz. (ton/ac)			
2.20 (20%)	2.07 (16%)	2.46 (22%)	2.06 (17%)
Yield of Tubers 4 to 6 oz. (ton/ac)			
3.05 (27%)	4.01 (31%)	3.01 (28%)	3.75 (30%)
Yield of Tubers 6 to 10 oz. (ton/ac)			
4.49 (40%)	5.57 (44%)	3.95 (36%)	4.62 (37%)
Yield of Tubers > 10 oz. (ton/ac)			
1.21 (11%)	0.98 (8%)	1.35 (12%)	1.42 (12%)
Yield of Deformed Tubers (ton/ac)			
0.16 (2%)	0.05 (0.5%)	0.14 (1%)	0.51 (4%)
Specific Gravity*			
1.085 a	1.086 a	1.082 b	1.082 b

Tuber samples used to measure specific gravity were also evaluated for hollow heart, stem-end discoloration and other types of defects. Very few internal defects were noticed in any

treatments. LW 08 tubers were more prone to hollow heart (4% in some treatments) than LW 04 tubers. Hollow heart is usually most severe under conditions that favor rapid growth, such as a cool dry period followed by a warm wet period (Hiller and Thornton, 1993).

Conclusions

The trial conducted in 2014 were designed to develop some recommendations for producers in southern Alberta regarding N fertilization strategies for new processing varieties. Studies from the Pacific Northwest provided general guidelines on the ratio of N products required to produce a quality processing crop. Questions remained about the effect of different timing of in-season fertilizer applications on yield, quality and specific gravity.

The 2014 season in Lethbridge started with a cool, wet spring, and ended with fewer P days (830.5) through the season than is recommended for potato, but the results provide some insights with respect to N fertilization strategies for each variety. The levels of N fertility used in this study were not dissimilar enough to pick up many differences in the yield or quality response of the tubers. In this study, the timing of the N applications was evaluated.

There were some significant differences in marketable yield between N treatments for LW 08. Of the strategies applied in 2014, the split urea treatment (Trt#1) and the fertigation approach (Trt#4) provided significantly greater marketable yields and significantly lower yields of small tubers than the other treatments. For this variety, fertigation did not appear to be required. Additional work may be required to determine whether even less upfront N provides better size profiles. There were no significant differences in specific gravity.

LW 04 seemed somewhat insensitive to N application timing in this study, although applications of ESN at hilling appeared to favor higher specific gravity than when N was applied pre-plant followed by fertigation.

Chipping Variety Evaluation

2014

Materials and Methods

The variety evaluation was conducted in small plots at the Alberta Irrigation Technology Centre in Letbridge, AB. Fertility for the low N rate (193 lbs/ac) was achieved through a combination of soil fertility (57 lbs/ac N; 23 lbs/ac P) and broadcast fertilizer (74 lbs/ac of 46-0-0, 130 lbs/ac of 11-52-0, 164 lbs/ac of 0-0-60 and 190 lbs/ac of 20.5-0-0-24) incorporated prior to planting. Fertility for the moderate N rate (227 lbs/ac) was achieved through a combination of soil fertility (57 lbs/ac N; 23 lbs/ac P) and broadcast fertilizer (92 lbs/ac of 46-0-0, 162 lbs/ac of 11-52-0, 212 lbs/ac of 0-0-60 and 240 lbs/ac of 20.5-0-0-24) incorporated prior to planting. Varieties were planted in four replicate rows in a randomized complete block design along with standard varieties (Atlantic and Glacier). Each block was planted adjacent to guard rows to reduce any edge effects (see plot plan, Appendix A).

Roundup (1 L/ac) was sprayed prior to planting (May 21) to reduce weed pressure. Seed of Atlantic was provided by Edmonton Potato Growers, seed of Glacier was provided by Rockyview Seed Potatoes and seed of test cultivars was provided by each Sponsor. Potatoes were planted June 4 and 5, 2014 approximately 5 to 5½"deep using a two-row tuber unit planter. Seed was planted at 30cm spacing in 6m rows spaced 90cm apart.

The potatoes were hilled June 27 with a power hiller. Sencor 75DF (100 g/ac) and Centurion (76 mL/ac) were applied prior to emergence (June 3) to control weeds. The plots were irrigated to maintain soil moisture close to 70%. Foliar fungicides were applied several times during the growing season to prevent early and late blight from developing (Table 1).

Reglone was applied (1.0 L/ac) September 15 and again September 19. Potatoes were harvested September 22, 23 and 25 using a 1-row Grimme harvester.

Tubers were stored at 10˚C until graded. Tubers were graded into size categories (less than 48mm, 48 – 88mm, and over 88mm). A sample of twenty-five tubers (48 – 88mm) from each replicate was used to determine specific gravity using the weight in air over weight in water method. These tubers were cut longitudinally to assess internal defects. A composite sample of 8 tubers (2 per rep) was stored at 10C until culinary analyses were performed. The compressor on our storage facility failed in the fall. A temporary system was put in place to hold temperatures. When the compressor was repaired, temperatures lower than the desired set point were achieved and fry colour was negatively affected. Samples were evaluated for chip color using a Hunter Colorimeter December 1, 2014.

The data presented here have been statistically analyzed using ANOVA and Tukey's Multiple Comparison Test; (SPSS; $p \leq 0.05$). Statistical summaries are available upon request. Comparisons for specific cultivars at two rates of N were analyzed using t-tests on a cultivar-by-cultivar basis (Excel; $p \leq 0.05$).

Results and Discussion

Sample hills of each variety were dug for a field day August 24, 2014. Photos of these varieties are shown in Figure 6.

Figure 6. Chipping varieties at the CDCS field day August 24, 2014: a) Glacier, b) Atlantic, c) AR2014-02, d) AR2014-03, e) EPG015, f) EPG016, g) EPG018, h) ODF003, i) RV 003, and j) RV 007.

Yield data (total yield; ton/ac) and specific gravities of each of the cultivars are shown in Table 14. At the moderate rate of N (227 lbs/ac), total yield of EPG018 was the highest, however it was only significantly greater than that of Glacier. Glacier appeared to have issues with emergence and plant survival. Yield of Glacier in 2014 was not typical of this variety. Total yield of all test entries were not significantly different from Atlantic. At the lower rate of N (193 lbs/ac) RV 007 produced the greatest total yield, but none of the test entries were significantly different from Atlantic. In t-test comparisons, the level of N only significantly affected total yield of EPG016.

Table 14: Estimated **total yield** (ton/acre) and **specific gravity** for each variety grown at moderate nitrogen (approximately 227 lbs/ac) and low nitrogen (approximately 193 lbs/ac). Data shown is the mean of four replicates. Data followed by the same letter in each column of the table are not significantly different at the $p < 0.05$ level.

	Yield (ton/ac)	SG
Moderate N		
Atlantic	14.7 abc	1.098 a†
Glacier	5.9 d	1.088 a-e
AR2014-02	14.0 bcd	1.093 abc
AR2014-03	12.9 bcd	1.083 b-f
EPG015	15.2 abc	1.076 e-h
EPG016	14.4 bcd†	1.083 b-f
EPG018	17.6 abc	1.093 abc
RV 003	16.8 abc	1.093 abc
RV 007	17.1 abc	1.093 abc
ODF003	16.0 abc	1.094 ab
Low N		
Atlantic	10.2 de	1.085 abc†
Glacier	6.9 e	1.088 a
AR2014-02		
AR2014-03	13.7 cde	1.075 b-e
EPG015	12.9 cde	1.076 b-e
EPG016	10.3 de†	1.074 cde
EPG018	15.7 b-e	1.085 abc
RV 003	18.7 a-d	1.089 a
RV 007	19.1 a-d	1.092 a
ODF003	14.9 cde	1.091 a

† Data between the regular and low N plots was statistically different at the $p \leq 0.05$ level.

Specific gravity of the chipping cultivars in this trial ranged from 1.076 for EPG015 to 1.098 for Atlantic from the moderate N plots and from 1.074 for EPG016 to 1.092 for ODF003 grown on lower N plots (Table 2). Potatoes selected as chipping cultivars, typically have specific gravities above 1.080 in Alberta and the majority of entries in this trial were well above this level of solids. Nitrogen level had a significant effect on specific gravity of Atlantic. Atlantic grown on lower N had significantly lower specific gravity that when grown on moderate N, which runs contrary to most trends.

The trial was designed to provide regional data for a wide range of potato cultivars. The N rate in the lower N plots was approximately 35 lbs/ac lower than the moderate rate. The N rates may not have been sufficiently different to impact yield and specific gravity of all cultivars tested. Addressing the agronomic needs of each cultivar may well result in improvements to yield and size profiles when compared to the results in this trial.

The mean percentage of total tuber number in each size category is shown in Table 15. Atlantic, Glacier and AR2014-02 produced a higher percentage of large tubers in the trial and that may be an indicator that these varieties are earlier maturing varieties. The greatest percentage of marketable tubers (48-88mm) was observed with Atlantic and RV 007 on moderate N and was not significantly different from AR2014-02, AR2014-03, RV 003 and ODF003. EPG015, EPG016, EPG018 and RV 003 had a significantly higher percentage of tubers under 48mm than Atlantic when grown on moderate N. For varieties grown on moderate N, only a small percentage of tubers were deformed. On low N, RV 007 and ODF003 produced the greatest percentage of 48-88mm tubers, and were not significantly different from RV 003, EPG018, AR2014-03, Glacier and Atlantic. EPG015 produced a significantly higher percentage of tubers less than 48 mm than Atlantic, AR2014-03, RV 007 and ODF003. Atlantic had significantly more oversized tubers at the low rate of N, but is considered an early maturing variety. EPG015 had a significantly larger percentage of deformed tubers when grown on low N, but seed of this variety appeared to be affected by herbicide carryover. Nitrogen level had a significant impact on the percentage of 48-88mm tubers for RV 003 and on the percentage of deformed Atlantic tubers.

Table 15: Percentage of total tuber number in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed) for each variety grown at moderate nitrogen (approximately 227 lbs/ac) and low nitrogen (approximately 193 lbs/ac). Data shown is the mean of four replicates. Data followed by the same letter in each column of the table are not significantly different at the $p < 0.05$ level.

	No. of <48mm	No. of 48 to 88mm	No. of > 88mm	No. of deformed
Moderate N				
Atlantic	19.3 f	71.9 a-d	8.7 a	0.0 e†
Glacier	35.1 b-f	59.0 b-h	5.5 abc	0.4 e
AR2014-02	30.9 def	63.9 a-g	4.6 abc	0.7 e
AR2014-03	32.3 c-f	67.1 a-f	0.4 c	0.1 e
EPG015	55.2 ab	44.2 gh	0.0 c	0.6 e
EPG016	40.3 a-e	59.3 b-h	0.2 c	0.2 e
EPG018	43.1 a-e	56.7 b-h	0.0 c	0.2 e
RV 003	46.8 a-d	53.2 d-h†	0.0 c	0.0 e
RV 007	27.8 def	70.1 a-d	1.9 bc	0.2 e
ODF003	31.8 b-f	66.2 a-f	1.4 bc	0.6 e
Low N				
Atlantic	18.3 def	68.3 abc	10.2 ab	3.2 ab†
Glacier	35.3 a-d	61.9 a-d	2.5 c	0.2 b
AR2014-02				
AR2014-03	28.0 b-f	71.4 abc	0.6 c	0.0 b
EPG015	52.6 a	41.9 e	0.2 c	5.3 a
EPG016	38.8 abc	55.7 cde	0.9 c	4.5 ab
EPG018	38.0 abc	61.9 a-d	0.1 c	0.0 b
RV 003	35.6 a-d	63.8 a-d†	0.0 c	0.7 b
RV 007	20.1 c-f	76.6 ab	2.4 c	0.9 b
ODF003	26.3 b-f	70.9 abc	2.1 c	0.7 b

† Data between the regular and low N plots was statistically different at the $p \leq 0.05$ level.

The yield of tubers (estimated ton/ac) of each variety is shown by size category in Table 16. At the moderate rate of N (227 lbs/ac), yield of 48-88mm RV 007 was significantly higher than that of Glacier, but was not significantly different from other cultivars. RV 003, EPG015 and EPG018 yielded significantly more small tubers (< 48mm) than Atlantic, Glacier and AR2014-02. EPG015 yielded significantly more tubers under 48mm than AR2014-03, EPG016, RV 007 and ODF003. Atlantic produced significantly more tubers over 88mm than AR2014-03, EPG015, EPG016, EPG018 and RV 003. At the moderate rate of N, there was no significant difference in yield of deformed tubers between cultivars.

On lower N plots, RV 007 produced the greatest yield of marketable tubers, significantly more than Glacier and EPG016. EPG015 and RV 003 produced a greater yield of small tubers than

Atlantic and Glacier. EPG015 produced significantly more deformed tubers on low N than Glacier, AR2014-03, EPG016 and ODF003.

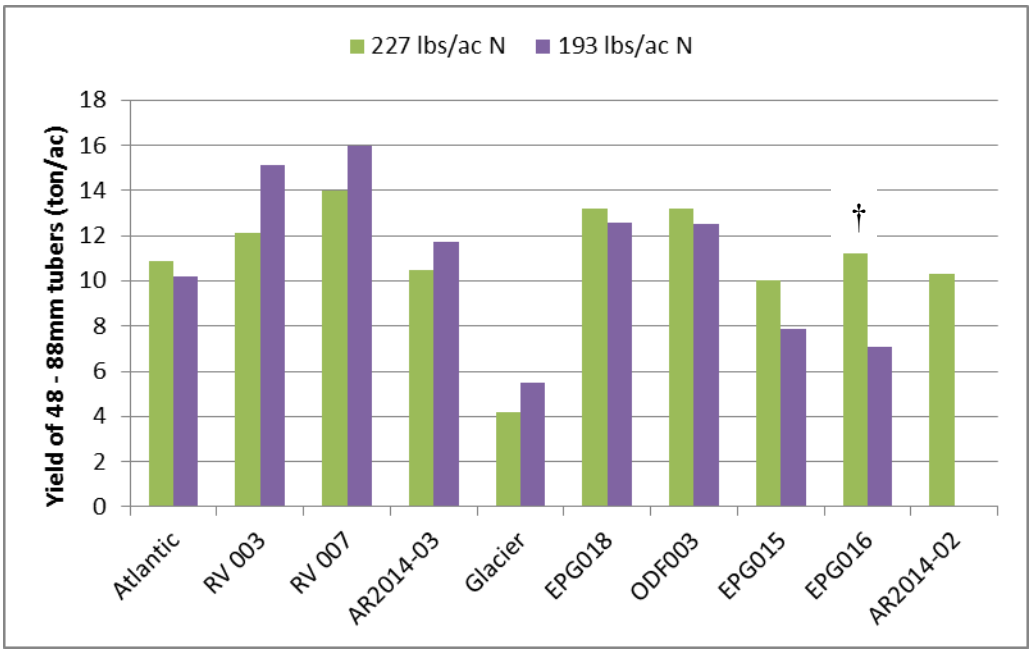
N level had a significant impact on the yield of small tubers for RV 003 and yield of marketable tubers for EPG016. Reduced N shifted the size profile of RV 003 toward the marketable category. Moderate N resulted in significantly greater yields of EPG016 than lower N.

Table 16: Estimated **yield** (ton/ac) in each **size category** (< 48mm, 48 to 88mm, > 88mm, and deformed tubers) for each variety grown at moderate nitrogen (approximately 227 lbs/ac) and low nitrogen (approximately 193 lbs/ac). Data shown is the mean of four replicates. Data followed by the same letter in each column of the table are not significantly different at the $p < 0.05$ level.

	Yield of <48mm (ton/ac)	Yield of 48 to 88mm (ton/ac)	Yield of > 88mm (ton/ac)	Yield of deformed (ton/ac)
Moderate N				
Atlantic	0.8 h	10.9 bc	3.0 ab	0.0 d
Glacier	0.7 h	4.2 c	1.0 bc	0.1 d
AR2014-02	1.8 c-h	10.3 bc	1.7 abc	0.2 d
AR2014-03	2.1 d-h	10.5 bc	0.2 c	0.1 d
EPG015	5.1 ab	10.0 bc	0.0 c	0.1 d
EPG016	3.0 c-g	11.2 bc†	0.1 c	0.0 d
EPG018	4.4 a-d	13.2 ab	0.0 c	0.1 d
RV 003	4.6 abc†	12.1 bc	0.0 c	0.0 d
RV 007	2.0 c-h	14.0 ab	1.1 bc	0.0 d
ODF003	2.1 c-h	13.2 ab	0.7 bc	0.1 d
Low N				
Atlantic	0.5 e	10.2 c-f	2.4 bc	0.5 ab
Glacier	0.9 de	5.5 f	0.4 bc	0.1 b
AR2014-02				
AR2014-03	1.7 b-e	11.7 c-f	0.3 bc	0.0 b
EPG015	3.8 ab	7.9 def	0.1 bc	1.2 a
EPG016	2.0 b-e	7.1 ef†	0.2 bc	0.9 ab
EPG018	3.1 a-d	12.6 c-f	0.1 bc	0.0 b
RV 003	3.5 abc†	15.1 a-e	0.0 c	0.2 ab
RV 007	1.5 b-e	16.0 a-d	1.4 abc	0.2 ab
ODF003	1.6 b-e	12.5 c-f	0.6 bc	0.2 b

† Data between the regular and low N plots was statistically different at the $p \leq 0.05$ level.

A comparison of medium potatoes (48 – 88mm) for each variety from regular and moderate N plots is shown in Figure 7.



† Data between the regular and low N plots was statistically different at the $p \leq 0.05$ level.

Figure 7: Yield (ton/ac) of potatoes (48 – 88mm) produced on moderate (227 lbs/ac) N and low (193 lbs/ac) N plots. For each variety, yield columns marked with † are statistically different ($p \leq 0.05$).

Medium tubers were assessed subjectively for Uniformity of Size and Overall Appearance. Scores are presented in Table 17. There were no significant differences between varieties either for uniformity of size or overall appearance at either rate of N.

Table 17: Subjective tuber assessments: **Uniformity of Size** was subjectively assessed on each replicate by the same individual during the grading process. **Overall Appearance** was based on uniformity of size and uniformity of shape, skin colour, deformities and eye depth. Data shown is the mean of 4 replicates.

	Uniformity of Size[1]	Overall Appearance[2]
Moderate N		
Atlantic	3.3 a	3.7 a
Glacier	3.0 a	3.3 a
AR2014-02	3.0 a	3.3 a
AR2014-03	4.0 a	4.0 a
EPG015	4.0 a	3.8 a
EPG016	4.0 a	4.0 a
EPG018	4.3 a	4.0 a
RV 003	3.5 a	3.8 a
RV 007	4.0 a	4.0 a
ODF003	3.8 a	3.8 a
Low N	3.7 a	
Atlantic	3.5 a	3.0 a
Glacier	3.3 a	3.3 a
AR2014-02		
AR2014-03	4.0 a	4.0 a
EPG015	3.8 a	3.8 a
EPG016	4.0 a	3.3 a
EPG018	4.0 a	4.0 a
RV 003	3.5 a	3.8 a
RV 007	4.3 a	4.3 a
ODF003	4.3 a	4.0 a

[1] Uniformity of Size: 1 (very variable) - 5 (very uniform)
[2] Overall Appearance: 1 (very poor) - 5 (outstanding)

Tuber samples used to measure specific gravity were evaluated for hollow heart, brown centre, stem-end discoloration, other types of internal necrosis and scab. At the moderate rate of N, approximately 10% of AR2014-02 tubers and 7% of Atlantic tubers had hollow heart. At the lower rate of N, 16% of Atlantic tubers exhibited hollow heart. Occasional tubers with hollow heart were found with ODF003 and EPG015 at both levels of N and RV 007 at the lower rate of N. Many of the samples had some level of stem-end discoloration and this may be related to vine maturity at the time of desiccation.

Chip colour scores of composite samples are presented in Table 18. All of the samples gave better chip scores than Atlantic, but none were great. The compressor on our storage facility failed in the fall. A temporary system was put in place to hold temperatures. When the

compressor was repaired, temperatures lower than the desired set point were achieved and fry colour was negatively affected. A higher L-value indicates a lighter chip. The lightest chips were produced from ODF003, Glacier, EPG016 and RV 003. ODF003 and EPG016 from the moderate N plots and RV 003 from the lower N plots produced good chip scores in spite of the cooler temperatures in storage.

Reducing the N applied to the crop resulted in lighter chip scores for Atlantic, Glacier, AR2014-03, and RV 003. These are composite samples from one year of testing and additional testing may be required to determine optimal agronomic conditions for chip quality.

Table 18: Chip colour scores from subsamples of each variety grown at moderate nitrogen (approximately 227 lbs/ac) and low nitrogen (approximately 193 lbs/ac). Data shown is the mean of duplicate analyses of a composite sample evaluated on a Hunter Colorimeter (L is a lightness score; higher numbers are lighter).

	L		L
Moderate N		*Low N*	
Atlantic	42.7	Atlantic	46.4
Glacier	53.5	Glacier	56.0
AR2014-02	49.4	AR2014-02	
AR2014-03	47.4	AR2014-03	49.2
EPG015	47.9	EPG015	34.9
EPG016	57.7	EPG016	
EPG018	44.5	EPG018	45.0
RV 003	53.4	RV 003	57.9
RV 007	49.5	RV 007	49.0
ODF003	58.7	ODF003	56.4

† Data between the regular and low N plots was statistically different at the $p \leq 0.05$ level.

Conclusions

The 2014 variety trial included eight chipping potato cultivars with potential in southern Alberta. Atlantic and Glacier were included in the trial as check varieties. All of the cultivars were included in plots fertilized with a moderate rate of N (227 lbs/ac) and seven were included in plots fertilized with a lower rate of N (193 lbs/ac) to determine the extent to which N may influence yield, size profile and chipping quality. Nitrogen, at the two rates tested, affected total yield and specific gravity for a couple of varieties. Also, there was a nitrogen response to size profile for some cultivars. RV 007 yielded well at both levels of N but was not significantly different from either check variety. RV 003 responded well to the lower level of N relative to the moderate rate. RV 007, AR2014-03 and EPG018 performed well in the trials. Chip color was not well evaluated because of an equipment failure during storage.

The trial was designed to provide regional data for a wide range of potato cultivars. Addressing the agronomic needs of each variety may well result in improvements to yield and size profiles when compared to the results in this trial.

Fresh Market Variety Evaluation

2014 – Lower N

Materials and Methods

The variety evaluation was conducted in small plots at the Alberta Irrigation Technology Centre in Letbridge, AB. Fertility (193 lbs/ac) was achieved through a combination of soil fertility (57 lbs/ac N; 23 lbs/ac P) and broadcast fertilizer (74 lbs/ac of 46-0-0, 130 lbs/ac of 11-52-0, 164 lbs/ac of 0-0-60 and 190 lbs/ac of 20.5-0-0-24) incorporated prior to planting. Varieties were planted in four replicate rows in a randomized complete block design along with standard varieties (Norland and Yukon Gold). Each block was planted adjacent to guard rows to reduce any edge effects (see plot plan, Appendix A).

Roundup (1 L/ac) was sprayed prior to planting (May 21) to reduce weed pressure. Seed of standard cultivars was provided by Edmonton Potato Growers and seed of test cultivars was provided by each participant. Potatoes were planted June 4, 2014 approximately 5 to 5½"deep using a two-row tuber unit planter. Seed was planted at 30cm spacing in 6m rows spaced 90cm apart.

The potatoes were hilled June 27 with a power hiller. The plots were irrigated to maintain soil moisture close to 70%. Sencor 75DF (100 g/ac) and Centurion (76 mL/ac) were applied prior to emergence (June 3) to control weeds. The plots were irrigated to maintain soil moisture close to 70%. Foliar fungicides were applied several times during the growing season to prevent early and late blight from developing (Table 1).

Reglone was applied (1.0 L/ac) September 15 and again September 19. Potatoes were harvested September 25 using a 1-row Grimme harvester.

Tubers were stored at 8˚C until graded. Tubers were graded into size categories (less than 48mm, 48 – 88mm, over 88mm and deformed). A sample of twenty-five tubers (48 – 88mm) from each replicate was used to determine specific gravity using the weight in air over weight in water method. These tubers were cut longitudinally to assess internal defects. Sub-samples of 48-88mm tubers were provided to the Food Processing Development Centre at Brooks for culinary evaluations.

The data presented here have been statistically analyzed using ANOVA and Tukey's Multiple Comparison Test; (SPSS; $p \leq 0.05$). Statistical summaries are available upon request.

Results and Discussion

Sample hills of each variety were dug for a field day at CDCS August 24, 2014. Photos of these varieties are shown in Figure 8.

Figure 8. Fresh Market varieties at CDCS field day August 24, 2014: a) SI 006, b) Yukon Gold, c) SI 007, d) SI 005, e) Norland, f) SI 008, g) EPG017, h) EPG018, i) RV 006, j) PL 006, k) TT007, l) TT008, and m) TT009.

Yield data (total yield; ton/ac) and specific gravities of each of the fresh market cultivars are shown in Table 19. The highest total yield at AITC was observed with SI 007. SI 007, SI 006, and TT07 yielded significantly more than most other fresh market cultivars in the evaluation, although not statistically higher than Norland. SI 007 and SI 006 yielded more than Yukon Gold, but SI 008 was not statistically different from either check variety.

Further addressing the agronomic needs of each variety may well result in improvements to yield and size profiles when compared to the results in this trial.

Specific gravity of tubers ranged from 1.058 for SI 007 to 1.087 for SI 005. The specific gravity of SI 005 and EPG018 exceeded that of Yukon Gold and may make these varieties less suitable for salad potatoes.

Table 19: Estimated total yield (ton/acre) and specific gravity for each fresh market variety grown on approximately 193 lbs/ac nitrogen. Data shown is the mean of four replicates. Data followed by the same letter in each column of the table are not significantly different at the $p < 0.05$ level.

AITC	Yield (ton/ac)	SG
Low N		
SI 005	17.4 a-d	1.087 ab
SI 006	25.0 ab	1.068 ef
SI 007	25.1 a	1.058 f
Norland	20.9 abc	1.069 def
SI 008	17.0 a-d	1.072 de
Yukon Gold	12.5 cde	1.082 bcd
EPG017	19.2 a-d	1.074 cde
EPG018	15.7 b-e	1.085 abc
RV006	15.3 cde	1.071 de
PL006	9.8 de	1.074 cde
TT007	24.8 ab	1.065ef
TT008	10.2 de	1.070 def
TT009	12.6 cde	1.070 def

The mean percentage of total tuber number in each size category is shown in Table 20. The majority of tubers for each variety fell into the marketable category (48 – 88mm). SI 005, SI 008, EPG017, EPG018, PL006, TT008 and TT009 also had a large percentage of tubers in the small size category. SI 007 and Yukon Gold had a significantly higher percentage of tubers in the oversized category which may be an indication that these cultivars are early maturing and an earlier harvest data may be more appropriate. None of the varieties had a large percentage of deformed tubers. SI 006 and SI 008 had significantly more deformed than many of the other varieties, but were not significantly different from the standards, Norland and Yukon Gold.

Table 20: Percentage of total tuber number in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed) for each fresh market variety grown on full nitrogen (approximately 193 lbs/ac). Data shown is the mean of four replicates. Data followed by the same letter in each column of the table are not significantly different at the $p < 0.05$ level.

AITC	< 48mm	48 to 88mm	> 88mm	Deformed
Low N				
SI 005	51.5 a	47.8 de	0.0 c	0.8 b
SI 006	26.3 b-f	71.8 abc	0.4 c	1.5 ab
SI 007	20.4 c-f	66.3 a-d	13.1 a	0.2 b
Norland	14.4 f	78.4 ab	5.2 bc	2.0 ab
SI 008	39.7 ab	58.4 b-e	0.5 c	1.3 ab
Yukon Gold	16.0 ef	74.3 abc	8.5 ab	1.3 ab
EPG017	31.7 b-f	68.1 abc	0.2 c	0.0 b
EPG018	38.0 abc	61.9 a-d	0.1 c	0.0 b
RV006	24.5 b-f	75.1 abc	0.0 c	0.5 b
PL006	34.1 a-e	65.9 a-d	0.0 c	0.0 b
TT007	15.5 ef	81.0 a	2.9 c	0.6 b
TT008	52.0 a	46.5 de	1.3 c	0.2 b
TT009	37.5 abc	61.0 a-d	1.2 c	0.3 b

The yield of tubers (estimated ton/ac) of each variety is shown by size category in Table 21. SI 005 yielded significantly more potatoes less than 48 mm than either check variety, but was not statistically different from SI 006, SI 008, EPF017, or EPG 018. Marketable yield ranged from 7.0 ton/ac of TT008 to 21.6 ton/ac of TT007. SI 006 and TT007 yielded significantly more marketable than Yukon Gold (check) in this trial, but were not statistically different from Norland. SI 007 yield significantly more oversized tubers than all other varieties, again possibly a reflection of an early maturing variety.

Table 21: Estimated yield (ton/ac) in each size category (< 48mm, 48 to 88mm, > 41mm, and deformed tubers) for each fresh market variety grown on full nitrogen (approximately 193 lbs/ac). Data shown is the mean of four replicates. Data followed by the same letter in each column of the table are not significantly different at the $p < 0.05$ level.

AITC	Yield of <48mm (ton/ac)	Yield of 48 to 88mm (ton/ac)	Yield of > 88mm (ton/ac)	Yield of deformed (ton/ac)
Low N				
SI 005	5.1 a	12.0 c-f	0.0 c	0.3 ab
SI 006	2.8 a-e	21.1 ab	0.4 c	0.7 ab
SI 007	1.2 cde	16.1 a-d	7.8 a	0.0 b
Norland	0.6 de	17.4 abc	2.3 bc	0.6 ab
SI 008	3.1 a-d	13.2 b-f	0.3 bc	0.4 ab
Yukon Gold	0.5 e	9.0 c-f	2.8 b	0.2 ab
EPG017	3.1 a-d	16.0 a-d	0.1 bc	0.0 b
EPG018	3.1 a-d	12.6 c-f	0.1 c	0.0 b
RV006	1.6 b-e	13.7 a-f	0.0 c	0.1 b
PL006	1.4 b-e	8.1 def	0.0 c	0.0 b
TT007	1.1 cde	21.6 a	2.0 bc	0.2 b
TT008	2.8 b-e	7.0 ef	0.4 bc	0.1 b
TT009	2.4 b-e	9.8 c-f	0.4 bc	0.0 b

Tubers were assessed subjectively for Uniformity of Size and Overall Appearance. Scores are presented in Table 22. SI 005, SI 008 and EPG018 scored very high for both uniformity of size and overall appearance. EPG017, TT009 and SI 006 scored high for overall appearance.

Table 22: Subjective tuber assessments: Uniformity of Size was subjectively assessed on each replicate by the same individual during the grading process. Overall Appearance was based on uniformity of size and uniformity of shape, skin colour, deformities and eye depth. Data shown is the mean of 4 replicates.

	Uniformity of Size[1]	Overall Appearance[2]
LowN		
SI 005	4.00	4.75
SI 006	3.25	4.00
SI 007	3.33	3.00
Norland	3.00	3.50
SI 008	3.75	4.00
Yukon Gold	3.25	3.33
EPG017	3.50	4.50
EPG018	4.00	4.00
RV006	3.50	3.75
PL006	3.50	4.25
TT007	3.50	3.00
TT008	3.50	3.75
TT009	3.50	4.25

[1] Uniformity of Size: 1 (very variable) - 5 (very uniform)
[2] Overall Appearance: 1 (very poor) - 5 (outstanding)

Tuber samples used to measure specific gravity were also evaluated for hollow heart, brown centre, stem-end discoloration, other types of internal necrosis and scab. There were few internal defects noted for tubers in this trial. Some internal pigmentation was noted for SI 005. Approximately 5% of Yukon Gold tubers had hollow heart. Some stem-end discoloration was evident in many of the samples, possibly as a result of vine maturity at the time of top-killing.

Varieties were evaluated in the Food Science lab at CDCS for culinary quality. Data from the boil and bake evaluations are presented in Table 23. EPG 018 was evaluated as a chipper rather than as a fresh market variety. After cooking darkening was not noted for any of the varieties after boiling or baking. None of the varieties displayed significant sloughing in the boiled potato evaluations. All of the cultivars evaluated scored mid-way between waxy and mealy, with none at the waxy end or the mealy end of the score sheet.

Table 23: Culinary evaluations of each fresh market variety grown at low nitrogen (193 lbs/ac) at CDCS). Data shown is the mean of duplicate analyses of a composite sample.

Boiled Potatoes

AITC	Flesh color	Waxiness†	Sloughing	After Cooking Discoloration
Low N				
SI 005	Deep yellow	2	Little or none	None
SI 006	Deep yellow	2	Little or none	None
SI 007	Yellow	2	Little or none	None
Norland	Off-white	2	Little or none	None
SI 008	Deep yellow	3	Little or none	None
Yukon Gold	Yellow	3	Little or none	None
EPG017	Off-white	3	Little or none	None
EPG018				
RV006	Deep yellow	2	Little or none	None
PL006	Deep yellow	3	Little or none	None
TT007	Yellow	3	Little or none	None
TT008	Off-white	2	Little or none	None
TT009	Yellow	3	Little or none	None

† Waxiness: 1 = very waxy (very clean cuts); 2 = waxy (clean cuts with some residue); 3 = slightly waxy (more mealy than waxy); 4 = not waxy (fluffy/mealy)

Table 23 continued.

Baked Potatoes			
AITC	Flesh color	Texture*	After Cooking Discoloration
Low N			
SI 005	Deep Yellow	2	None
SI 006	Deep Yellow	2	None
SI 007	Off-white	2	None
Norland	Off-white	2	None
SI 008	Deep Yellow	3	None
Yukon Gold	Yellow	3	None
EPG017	Off-white	3	None
EPG018			
RV006	Deep Yellow	2	None
PL006	Deep Yellow	3	None
TT007	Yellow	3	None
TT008	Off-white	2	None
TT009	Yellow	3	None

*** Texture: 1 = wet; 2 = slightly wet; 3 = slightly mealy; 4 = mealy**

Conclusions

The 2014 variety trial included eleven fresh market cultivars and two check varieties, Norland and Yukon Gold grown at 193 lbs/ac N. SI 006, TT007 and SI 007 yielded well in the 2014 evaluations for high total and marketable yield, with good boiling characteristics. SI 005 and EPG017 scored highest for overall appearance. Several varieties yielded well in both the small potato and marketable potato categories indicating their potential usefulness in dual purpose (gourmet and table) markets.

The trial was designed to provide regional data for a wide range of potato cultivars. Addressing the agronomic needs of each variety may well result in improvements to yield and size profiles when compared to the results in this year of the trial.

2014 – Moderate N

Materials and Methods

The variety evaluation was conducted in small plots at the Alberta Irrigation Technology Centre in Letbridge, AB. Fertility (227 lbs/ac) was achieved through a combination of soil fertility (57 lbs/ac N; 23 lbs/ac P) and broadcast fertilizer (92 lbs/ac of 46-0-0, 162 lbs/ac of 11-52-0, 212 lbs/ac of 0-0-60 and 240 lbs/ac of 20.5-0-0-24) incorporated prior to planting. Varieties were planted in four replicate rows in a randomized complete block design along with standard varieties (Norland and Yukon Gold). Each block was planted adjacent to guard rows to reduce any edge effects (see plot plan, Appendix A).

Roundup (1 L/ac) was sprayed prior to planting (May 21) to reduce weed pressure. Seed of standard cultivars was provided by Edmonton Potato Growers and seed of test cultivars was provided by each participant. Potatoes were planted June 5, 2014 approximately 5 to 5½"deep using a two-row tuber unit planter. Seed was planted at 30cm spacing in 6m rows spaced 90cm apart.

The potatoes were hilled June 27 with a power hiller. Sencor 75DF (100 g/ac) and Centurion (76 mL/ac) were applied prior to emergence (June 3) to control weeds. The plots were irrigated to maintain soil moisture close to 70%. Foliar fungicides were applied several times during the growing season to prevent early and late blight from developing (Table 1).

Reglone was applied (1.0 L/ac) September 15 and again September 19. Potatoes were harvested September 25 using a 1-row Grimme harvester.

Tubers were stored at 8˚C until graded. Tubers were graded into size categories (less than 48mm, 48 – 88mm, over 88mm and deformed). A sample of twenty-five tubers (48 – 88mm) from each replicate was used to determine specific gravity using the weight in air over weight in water method. These tubers were cut longitudinally to assess internal defects. Sub-samples of 48-88mm tubers were provided to the Food Processing Development Centre at Brooks for culinary evaluations.

Chipping tubers were stored at 10˚C until graded. Tubers were graded into size categories (less than 48mm, 48 – 88mm, and over 88mm). A sample of twenty-five tubers (48 – 88mm) from each replicate was used to determine specific gravity using the weight in air over weight in water method. These tubers were cut longitudinally to assess internal defects. A composite sample of 8 tubers (2 per rep) was stored at 10˚C until culinary analyses were performed. The compressor on our storage facility failed in the fall. A temporary system was put in place to hold temperatures. When the compressor was repaired, temperatures lower than the desired set point were achieved and fry colour was negatively affected. Samples were evaluated for chip color using a Hunter Colorimeter December 1, 2014.

French fry tubers were stored at 8˚C until graded. Tubers were graded into size categories (less than 48mm, 48 – 88mm, and over 88mm). A sample of twenty-five tubers (48 – 88mm) from each replicate was used to determine specific gravity using the weight in air over weight in water method. The tubers in the specific gravity sample were cut longitudinally to assess internal

defects. A composite sample of 8 tubers (2 per rep) was stored at 8˚C until culinary analyses were performed. Sub-samples of 48-88mm tubers were provided to the Food Processing Development Centre at Brooks for culinary evaluations.

The data presented here have been statistically analyzed using ANOVA and Tukey's Multiple Comparison Test; (SPSS; $p \leq 0.05$). Statistical summaries are available upon request.

Results and Discussion – Fresh Market

Sample hills of each variety were dug for a field day at CDCS August 24, 2014. Photos of these varieties are shown in Figure 9.

Figure 9. Fresh Market varieties at CDCS field day August 24, 2014: a) AR2014-04, b) AR1024-05, c) AR2014-06, d) AR2014-11, e) Norland, f) EPG017, g) EPG018, h) TT 008, i) PL 006, j) TT 007, k) TT 009, and l) Yukon Gold.

Yield data (total yield; ton/ac) and specific gravities of each of the fresh market cultivars are shown in Table 24. The highest total yield at this level of N at AITC was observed with TT 007. TT 007 yielded significantly more than Yukon Gold and some fresh market cultivars in the evaluation, although not statistically higher than Norland, AR2014-01, AR2014 -04, AR2014-05, AR2014-06, AR2014-11, EPG 017, and EPG 018.

Further addressing the agronomic needs of each variety may well result in improvements to yield and size profiles when compared to the results in this trial.

Specific gravity of tubers ranged from 1.068 for TT 009 to 1.093 for EPG 018. The specific gravity of AR2014-01 and EPG 018 exceeded that of Yukon Gold and may make these varieties less suitable for salad potatoes.

Table 24: Estimated total yield (ton/acre) and specific gravity for each fresh market variety grown on approximately 227 lbs/ac nitrogen. Data shown is the mean of four replicates. Data followed by the same letter in each column of the table are not significantly different at the $p < 0.05$ level.

AITC	Yield (ton/ac)	SG
Moderate N		
AR2014-01	18.15 abc	1.091 a-d
AR2014-04	20.97 ab	1.071 fgh
AR2014-05	16.07 abc	1.075 fgh
AR2014-06	17.26 abc	1.078 e-h
AR2014-11	16.31 abc	1.080 d-h
Norland	19.88 abc	1.075 fgh
EPG 017	19.40 abc	1.074 fgh
EPG 018	17.63 abc	1.093 abc
TT 007	23.38 a	1.070 gh
TT 008	11.69 cd	1.077 e-h
TT 009	14.21 bcd	1.068 h
PL 006	12.60 bcd	1.078 e-h
Yukon Gold	14.35 bcd	1.088 a-e

The mean percentage of total tuber number in each size category is shown in Table 25. The majority of tubers for each variety fell into the marketable category (48 – 88mm). PL 006, TT 008, EPG017, and EPG018 also had a large percentage of tubers in the small size category. AR2014-04, AR2014-06 and Yukon Gold had a significantly higher percentage of tubers in the oversized category which may be an indication that these cultivars are early maturing and an earlier harvest data may be more appropriate. AR2014-06 had a significantly higher percentage of deformed tubers than the others, but the variety may have been harvested too late for optimal yields.

Table 25: Percentage of total tuber number in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed) for each fresh market variety grown on full nitrogen (approximately 193 lbs/ac). Data shown is the mean of four replicates. Data followed by the same letter in each column of the table are not significantly different at the $p < 0.05$ level.

AITC	< 48mm	48 to 88mm	> 88mm	Deformed
Moderate N				
AR2014-01	32.8 c-f	64.7 a-f	1.3 c	1.3 cde
AR2014-04	24.2 ef	67.5 a-e	7.6 a	0.7 de
AR2014-05	33.0 c-f	66.0 a-f	0.3 c	0.7 de
AR2014-06	17.9 f	67.2 a-f	5.6 abc	9.4 a
AR2014-11	34.2 c-f	65.0 a-f	0.5 c	0.3 e
Norland	16.5 f	76.5 ab	3.9 abc	3.1 bcd
EPG 017	36.2 a-f	63.7 a-g	0.1 c	0.0 e
EPG 018	43.1 a-e	56.7 b-h	0.0 c	0.2 e
TT 007	16.3 f	79.8 a	2.0 bc	2.0 b-e
TT 008	52.5 abc	47.1 fgh	0.3 c	0.2 e
TT 009	36.6 a-f	62.3 a-h	0.3 c	0.8 de
PL 006	55.8 a	44.0 h	0.0 c	0.2 e
Yukon Gold	18.3 f	73.8 abc	6.5 ab	1.3 cde

The yield of tubers (estimated ton/ac) of each variety is shown by size category in Table 26. PL 006, EPG 017 and EPG 018 yielded significantly more potatoes under 48 mm than either check variety, but were not statistically different from many other varieties. Marketable yield ranged from 8.3 ton/ac of PL 006 to 20.6 ton/ac of TT07. TT07 yielded significantly more marketable tubers than Yukon Gold (check) in this trial, but was not statistically different from Norland. AR2014-04 yield significantly more oversized tubers than many other varieties, again possibly a reflection of an early maturing variety.

Table 26: Estimated yield (ton/ac) in each size category (< 48mm, 48 to 88mm, > 41mm, and deformed tubers) for each fresh market variety grown on full nitrogen (approximately 193 lbs/ac). Data shown is the mean of four replicates. Data followed by the same letter in each column of the table are not significantly different at the $p < 0.05$ level.

AITC	Yield of <48mm (ton/ac)	Yield of 48 to 88mm (ton/ac)	Yield of > 88mm (ton/ac)	Yield of deformed (ton/ac)
Moderate N				
AR2014-01	2.5 d-h	14.6 ab	0.8 bc	0.3 d
AR2014-04	1.5 fgh	15.4 ab	3.9 a	0.2 d
AR2014-05	2.4 d-h	13.3 ab	0.2 c	0.2 d
AR2014-06	1.0 gh	12.0 bc	2.2 abc	2.0 a
AR2014-11	2.5 d-h	13.5 ab	0.3 c	0.1 d
Norland	0.9 gh	16.2 ab	1.9 abc	1.0 bc
EPG 017	3.6 a-f	15.8 ab	0.1 c	0.0 d
EPG 018	4.4 a-d	13.2 ab	0.0 c	0.1 d
TT 007	1.0 gh	20.6 a	1.2 bc	0.6 cd
TT 008	3.2 b-f	8.4 bc	0.1 c	0.0 d
TT 009	2.5 d-h	11.5 bc	0.1 c	0.1 d
PL 006	3.8 a-e	8.3 bc	0.4 c	0.0 d
Yukon Gold	0.7 h	11.2 bc	2.2 abc	0.2 d

Tubers were assessed subjectively for Uniformity of Size and Overall Appearance. Scores are presented in Table 27. AR2014-05 and EPG018 scored very high for both uniformity of size and overall appearance. EPG017, TT 008 and PL 006 scored high for overall appearance.

Table 27: Subjective tuber assessments: Uniformity of Size was subjectively assessed on each replicate by the same individual during the grading process. Overall Appearance was based on uniformity of size and uniformity of shape, skin colour, deformities and eye depth. Data shown is the mean of 4 replicates.

	Uniformity of Size[1]	Overall Appearance[2]
Moderate N		
AR2014-01	3.25	3.50
AR2014-04	3.25	3.25
AR2014-05	4.00	4.00
AR2014-06	4.00	3.25
AR2014-11	4.00	3.75
Norland	3.67	3.67
EPG 017	3.75	4.00
EPG 018	4.00	4.25
TT 007	4.00	3.50
TT 008	3.75	4.00
TT 009	3.50	3.50
PL 006	3.75	4.50
Yukon Gold	3.75	3.75

[1] Uniformity of Size: 1 (very variable) - 5 (very uniform)
[2] Overall Appearance: 1 (very poor) - 5 (outstanding)

Tuber samples used to measure specific gravity were also evaluated for hollow heart, brown centre, stem-end discoloration, other types of internal necrosis and scab. There were few internal defects noted for tubers in this trial. Some internal pigmentation was noted for EPG017 and AR2014-05. Approximately 4% of Yukon Gold and 2% of AR2014-02 tubers had hollow heart. Some stem-end discoloration was evident in many of the samples, possibly as a result of vine maturity at the time of top-killing.

Varieties were evaluated in the Food Science lab at CDCS for culinary quality. Data from the boil and bake evaluations are presented in Table 28. AR2014-01 was evaluated as a French fry potatoes and EPG 018 was evaluated as a chipper rather than as a fresh market variety. After cooking darkening was only noted for EPG017 after boiling. AR2014-11 and Yukon Gold displayed moderate sloughing in the boiled potato evaluations. AR2014-04 scored as the waxiest potato and AR2014-11 scored as a mealy potato. All of the other cultivars evaluated scored mid-way between waxy and mealy.

Table 28: Culinary evaluations of each fresh market variety grown at low nitrogen (193 lbs/ac) at CDCS). Data shown is the mean of duplicate analyses of a composite sample.

Boiled Potatoes

AITC	Flesh color	Waxiness†	Sloughing	After Cooking Discoloration
Moderate N				
AR2014-01				
AR2014-04	Yellow	1	None	None
AR2014-05	Yellow	3	None	None
AR2014-06	Off-white	2	None	Moderate
AR2014-11	Yellow	4	Moderate	None
Norland	Off-white	2	None	None
EPG 017	Off-white	2	None	Moderate
EPG 018				
TT 007	Off-white	3	None	None
TT 008	Off-white	3	None	None
TT 009	Yellow	2	None	None
PL 006	Deep Yellow	3	None	None
Yukon Gold	Deep Yellow	3	Moderate	None

† Waxiness: 1 = very waxy (very clean cuts); 2 = waxy (clean cuts with some residue); 3 = slightly waxy (more mealy than waxy); 4 = not waxy (fluffy/mealy)

Table 28 continued.

Baked Potatoes			
AITC	Flesh color	Texture*	After Cooking Discoloration
Moderate N			
AR2014-01			
AR2014-04	Yellow	2	None
AR2014-05	Yellow	3	None
AR2014-06	Off-white	2	None
AR2014-11	Yellow	3	None
Norland	Off-white	3	None
EPG 017	Off-white	3	None
EPG 018			
TT 007	Yellow	3	None
TT 008	Off-white	3	None
TT 009	Yellow	2	None
PL 006	Deep Yellow	3	None
Yukon Gold	Deep Yellow	4	None

*** Texture: 1 = wet; 2 = slightly wet; 3 = slightly mealy; 4 = mealy**

AR2014-01 was evaluated as a French fry potatoes and EPG 018 was evaluated as a chipper rather than as a fresh market variety. After cooking darkening was not noted for any varieties after baking. Yukon Gold scored as a mealy potato after baking, but all of the other cultivars evaluated scored mid-way between waxy and mealy after baking.

2014 – N Response

Materials and Methods

The variety evaluation was conducted in small plots at the Alberta Irrigation Technology Centre in Letbridge, AB. Fertility for the low N rate (193 lbs/ac) was achieved through a combination of soil fertility (57 lbs/ac N; 23 lbs/ac P) and broadcast fertilizer (74 lbs/ac of 46-0-0, 130 lbs/ac of 11-52-0, 164 lbs/ac of 0-0-60 and 190 lbs/ac of 20.5-0-0-24) incorporated prior to planting. Fertility for the moderate N rate (227 lbs/ac) was achieved through a combination of soil fertility (57 lbs/ac N; 23 lbs/ac P) and broadcast fertilizer (92 lbs/ac of 46-0-0, 162 lbs/ac of 11-52-0, 212 lbs/ac of 0-0-60 and 240 lbs/ac of 20.5-0-0-24) incorporated prior to planting. Varieties were planted in four replicate rows in a randomized complete block design along with standard varieties (Norland and Yukon Gold). Each block was planted adjacent to guard rows to reduce any edge effects (see plot plan, Appendix A).

Roundup (1 L/ac) was sprayed prior to planting (May 21) to reduce weed pressure. Seed of standard cultivars was provided by Edmonton Potato Growers and seed of test cultivars was provided by each participant. Potatoes were planted June 4 and 5, 2014 approximately 5 to 5½"deep using a two-row tuber unit planter. Seed was planted at 30cm spacing in 6m rows spaced 90cm apart.

The potatoes were hilled June 27 with a power hiller. Sencor 75DF (100 g/ac) and Centurion (76 mL/ac) were applied prior to emergence (June 3) to control weeds. The plots were irrigated to maintain soil moisture close to 70%. Foliar fungicides were applied several times during the growing season to prevent early and late blight from developing (Table 1).

Reglone was applied (1.0 L/ac) September 15 and again September 19. Potatoes were harvested September 22, 23 and 25 using a 1-row Grimme harvester.

Tubers were stored at 8˚C until graded. Tubers were graded into size categories (less than 48mm, 48 – 88mm, over 88mm and deformed). A sample of twenty-five tubers (48 – 88mm) from each replicate was used to determine specific gravity using the weight in air over weight in water method. These tubers were cut longitudinally to assess internal defects. Sub-samples of 48-88mm tubers were provided to the Food Processing Development Centre at Brooks for culinary evaluations.

The data presented here have been statistically analyzed using ANOVA and Tukey's Multiple Comparison Test; (SPSS; $p \leq 0.05$). Statistical summaries are available upon request.

Results and Discussion

Sample hills of each variety were dug for a field day at CDCS August 24, 2014. Photos of these varieties are shown in Figure 10.

Figure 10. Fresh Market varieties at CDCS field day August 24, 2014: a) Norland, b) EPG017, c) EPG018, d) PL 006, e) TT 007, f) TT 008, g) TT 009 and h) Yukon Gold.

Yield data (total yield; ton/ac) and specific gravities of each of the fresh market cultivars are shown in Table 29. The highest total yield at this level of N at AITC was observed with TT 007. TT 007 yielded significantly more than Yukon Gold and some fresh market cultivars in the evaluation, although not statistically higher than Norland, EPG 017, and EPG 018.

Further addressing the agronomic needs of each variety may well result in improvements to yield and size profiles when compared to the results in this trial.

Specific gravity of tubers ranged from 1.068 for TT 009 to 1.093 for EPG 018. The specific gravity of EPG 018 exceeded that of Yukon Gold and may make this variety less suitable for salad potatoes.

Table 29: Estimated **total yield** (ton/acre) and **specific gravity** for each fresh market variety grown on Low N (193 lbs/ac) and Moderate N (227 lbs/ac) nitrogen. Data shown is the mean of four replicates. Data followed by the same letter in each column of the table are not significantly different at the $p < 0.05$ level.

AITC	Yield (ton/ac)	SG
Low N		
Norland	20.9 abc†	1.069 def†
EPG017	19.2 a-d	1.074 cde
EPG018	15.7 b-e	1.085 abc†
PL 006	9.8 de	1.074 cde
TT 007	24.8 ab	1.065ef†
TT 008	10.2 de	1.070 def
TT 009	12.6 cde†	1.070 def
Yukon Gold	12.5 cde	1.082 bcd
Moderate N		
Norland	19.88 abc†	1.075 fgh†
EPG017	19.40 abc	1.074 fgh
EPG018	17.63 abc	1.093 abc†
PL 006	12.60 bcd	1.078 e-h
TT 007	23.38 a	1.070 gh†
TT 008	11.69 cd	1.077 e-h
TT 009	14.21 bcd†	1.068 h
Yukon Gold	14.35 bcd	1.088 a-e

† Data between the regular and low N plots was statistically different at the $p \leq 0.05$ level.

The mean percentage of total tuber number in each size category is shown in Table 30. The majority of tubers for each variety fell into the marketable category (48 – 88mm). PL 006, TT 008, EPG017, and EPG018 also had a large percentage of tubers in the small size category. Yukon Gold had a significantly higher percentage of tubers in the oversized category which is related to being an early maturing cultivar and an earlier harvest data may have been more appropriate.

Table 30: Percentage of total tuber number in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed) for each fresh market variety grown on Low N (193 lbs/ac) and Moderate N (227 lbs/ac) nitrogen. Data shown is the mean of four replicates. Data followed by the same letter in each column of the table are not significantly different at the $p < 0.05$ level.

AITC	< 48mm	48 to 88mm	> 88mm	Deformed
Low N				
Norland	14.4 f	78.4 ab	5.2 bc	2.0 ab
EPG017	31.7 b-f	68.1 abc	0.2 c	0.0 b
EPG018	38.0 abc	61.9 a-d	0.1 c	0.0 b
PL 006	34.1 a-e	65.9 a-d	0.0 c	0.0 b
TT 007	15.5 ef	81.0 a	2.9 c	0.6 b
TT 008	52.0 a	46.5 de	1.3 c	0.2 b
TT 009	37.5 abc	61.0 a-d	1.2 c	0.3 b
Yukon Gold	16.0 ef	74.3 abc	8.5 ab	1.3 ab
Moderate N				
Norland	16.5 f	76.5 ab	3.9 abc	3.1 bcd
EPG 017	36.2 a-f	63.7 a-g	0.1 c	0.0 e
EPG 018	43.1 a-e	56.7 b-h	0.0 c	0.2 e
PL 006	55.8 a	44.0 h	0.0 c	0.2 e
TT 007	16.3 f	79.8 a	2.0 bc	2.0 b-e
TT 008	52.5 abc	47.1 fgh	0.3 c	0.2 e
TT 009	36.6 a-f	62.3 a-h	0.3 c	0.8 de
Yukon Gold	18.3 f	73.8 abc	6.5 ab	1.3 cde

The yield of tubers (estimated ton/ac) of each variety is shown by size category in Table 31. PL 006, EPG 017 and EPG 018 yielded significantly more potatoes under 48 mm than either check variety, but were not statistically different from many other varieties. Marketable yield ranged from 8.3 ton/ac of PL 006 to 20.6 ton/ac of TT 007. TT 007 yielded significantly more marketable tubers than Yukon Gold (check) in this trial, but was not statistically different from Norland.

Table 31: Estimated **yield** (ton/ac) in each **size category** (< 48mm, 48 to 88mm, > 41mm, and deformed tubers) each fresh market variety grown on Low N (193 lbs/ac) and Moderate N (227 lbs/ac) nitrogen. Data shown is the mean of four replicates. Data followed by the same letter in each column of the table are not significantly different at the $p < 0.05$ level.

AITC	Yield of <48mm (ton/ac)	Yield of 48 to 88mm (ton/ac)	Yield of > 88mm (ton/ac)	Yield of deformed (ton/ac)
Low N				
Norland	0.6 de†	17.4 abc†	2.3 bc	0.6 ab
EPG017	3.1 a-d	16.0 a-d	0.1 bc	0.0 b
EPG018	3.1 a-d	12.6 c-f	0.1 c	0.0 b
PL 006	1.4 b-e†	8.1 def	0.0 c	0.0 b
TT 007	1.1 cde	21.6 a	2.0 bc	0.2 b
TT 008	2.8 b-e	7.0 ef†	0.4 bc	0.1 b
TT 009	2.4 b-e	9.8 c-f†	0.4 bc	0.0 b
Yukon Gold	0.5 e†	9.0 c-f	2.8 b	0.2 ab
Moderate N				
Norland	0.9 gh†	16.2 ab†	1.9 abc	1.0 bc
EPG 017	3.6 a-f	15.8 ab	0.1 c	0.0 d
EPG 018	4.4 a-d	13.2 ab	0.0 c	0.1 d
PL 006	3.8 a-e†	8.3 bc	0.4 c	0.0 d
TT 007	1.0 gh	20.6 a	1.2 bc	0.6 cd
TT 008	3.2 b-f	8.4 bc†	0.1 c	0.0 d
TT 009	2.5 d-h	11.5 bc†	0.1 c	0.1 d
Yukon Gold	0.7 h†	11.2 bc	2.2 abc	0.2 d

† Data between the regular and low N plots was statistically different at the $p \leq 0.05$ level.

Tubers were assessed subjectively for Uniformity of Size and Overall Appearance. Scores are presented in Table 32. AR2014-05 and EPG018 scored very high for both uniformity of size and overall appearance. EPG017, TT 008 and PL 006 scored high for overall appearance.

Table 32: Subjective tuber assessments: **Uniformity of Size** was subjectively assessed on each replicate by the same individual during the grading process. **Overall Appearance** was based on uniformity of size and uniformity of shape, skin colour, deformities and eye depth. Data shown is the mean of 4 replicates.

	Uniformity of Size[1]	Overall Appearance[2]
LowN		
Norland	3.00	3.50
EPG017	3.50	4.50
EPG018	4.00	4.00
PL 006	3.50	4.25
TT 007	3.50	3.00
TT 008	3.50	3.75
TT 009	3.50	4.25
Yukon Gold	3.25	3.33
Moderate N		
Norland	3.67	3.67
EPG 017	3.75	4.00
EPG 018	4.00	4.25
PL 006	3.75	4.50
TT 007	4.00	3.50
TT 008	3.75	4.00
TT 009	3.50	3.50
Yukon Gold	3.75	3.75

[1] Uniformity of Size: 1 (very variable) - 5 (very uniform)
[2] Overall Appearance: 1 (very poor) - 5 (outstanding)

Tuber samples used to measure specific gravity were also evaluated for hollow heart, brown center, stem-end discoloration, other types of internal necrosis and scab. There were few internal defects noted for tubers in this trial. Some internal pigmentation was noted for EPG017. Approximately 4% of Yukon Gold had hollow heart. Some stem-end discoloration was evident in many of the samples, possibly as a result of vine maturity at the time of top-killing.

Varieties were evaluated in the Food Science lab at CDCS for culinary quality. Data from the boil and bake evaluations are presented in Table 33. EPG 018 was evaluated as a chipper rather than as a fresh market variety. After cooking darkening was only noted for EPG017 after boiling. Yukon Gold displayed moderate sloughing in the boiled potato evaluations. All of the cultivars evaluated scored mid-way between waxy and mealy.

Table 33: Culinary evaluations of each fresh market variety grown on Low N (193 lbs/ac) and Moderate N (227 lbs/ac) nitrogen. Data shown is the mean of duplicate analyses of a composite sample.

Boiled Potatoes

AITC	Flesh color	Waxiness†	Sloughing	After Cooking Discoloration
Low N				
Norland	Off-white	2	Little or none	None
EPG017	Off-white	3	Little or none	None
EPG018				
PL 006	Deep yellow	3	Little or none	None
TT 007	Yellow	3	Little or none	None
TT 008	Off-white	2	Little or none	None
TT 009	Yellow	3	Little or none	None
Yukon Gold	Yellow	3	Little or none	None
Moderate N				
Norland	Off-white	2	None	None
EPG 017	Off-white	2	None	Moderate
EPG 018				
PL 006	Deep Yellow	3	None	None
TT 007	Off-white	3	None	None
TT 008	Off-white	3	None	None
TT 009	Yellow	2	None	None
Yukon Gold	Deep Yellow	3	Moderate	None

† Waxiness: 1 = very waxy (very clean cuts); 2 = waxy (clean cuts with some residue); 3 = slightly waxy (more mealy than waxy); 4 = not waxy (fluffy/mealy)

Table 33 continued.

Baked Potatoes			
AITC	Flesh color	Texture*	After Cooking Discoloration
Low N			
Norland	Off-white	2	None
EPG017	Off-white	3	None
EPG018			
PL 006	Deep Yellow	3	None
TT 007	Yellow	3	None
TT 008	Off-white	2	None
TT 009	Yellow	3	None
Yukon Gold	Yellow	3	None
Moderate N			
Norland	Off-white	3	None
EPG 017	Off-white	3	None
EPG 018			
PL 006	Deep Yellow	3	None
TT 007	Yellow	3	None
TT 008	Off-white	3	None
TT 009	Yellow	2	None
Yukon Gold	Deep Yellow	4	None

*** Texture: 1 = wet; 2 = slightly wet; 3 = slightly mealy; 4 = mealy**

After cooking darkening was not noted for any varieties after baking. Yukon Gold scored as a mealy potato after baking, but all of the other cultivars evaluated scored mid-way between waxy and mealy after baking.

Conclusions

The 2014 variety trial included eleven fresh market cultivars and two check varieties, Norland and Yukon Gold grown at 227 lbs/ac N. TT 007 yielded well in the 2014 evaluations for high total and marketable yield, with a large percentage of tubers in the marketable category. PL 006, EPG018, EPG017, and TT 008 scored highest for overall appearance. Several varieties yielded well in both the small potato and marketable potato categories indicating their potential usefulness in dual purpose (gourmet and table) markets.

Norland produced significantly greater yield of marketable tubers at the lower N rate than on moderate N. TT08 and TT09 produced significantly greater yield of marketable tubers at the moderate N rate compared to the lower rate of N.

The trial was designed to provide regional data for a wide range of potato cultivars. Addressing the agronomic needs of each variety may well result in improvements to yield and size profiles when compared to the results in this year of the trial.

Creamer Variety Evaluation

2014

Materials and Methods

The variety evaluation was conducted in small plots at the Alberta Irrigation Technology Centre in Letbridge, AB. Fertility (193 lbs/ac) was achieved through a combination of soil fertility (57 lbs/ac N; 23 lbs/ac P) and broadcast fertilizer (74 lbs/ac of 46-0-0, 130 lbs/ac of 11-52-0, 164 lbs/ac of 0-0-60 and 190 lbs/ac of 20.5-0-0-24) incorporated prior to planting. Varieties were planted in skin colour blocks. Each colour block included four replicate rows in a randomized complete block design along with standard varieties. Each block was planted adjacent to guard rows to reduce any edge effects (see plot plan, Appendix A).

Roundup (1 L/ac) was sprayed prior to planting (May 21) to reduce weed pressure. Seed of standard cultivars was provided by Edmonton Potato Growers and seed of test cultivars was provided by each participant. Potatoes were planted June 12, 2014 approximately 10 to 12cm deep using a two-row tuber unit planter. Seed was planted at 15cm spacing in 5m rows spaced 90cm apart.

The potatoes were hilled June 27 with a power hiller. Sencor 75DF (100 g/ac) and Centurion (76 mL/ac) were applied prior to emergence (June 3) to control weeds. The plots were irrigated to maintain soil moisture close to 70%. Foliar fungicides were applied several times during the growing season to prevent early and late blight from developing (Table 1).

Reglone was applied (1.0 L/ac) September 15 and again September 19. Potatoes were harvested October 6-9, 2015 using a 1-row Checci harvester.

Tubers were stored at 8˚C until graded. Tubers were graded into size categories (less than 25mm, 25 – 41mm, over 41mm and deformed). A 4 kg sample of tubers (25 – 41mm) from each replicate was used to determine specific gravity using the weight in air over weight in water method.

The data presented here have been statistically analyzed using ANOVA and Tukey's Multiple Comparison Test; (SPSS; $p \leq 0.05$). Statistical summaries are available upon request.
Sub-samples of tubers from the 25 – 41mm category were made available to the sponsor for culinary evaluation. The results of the culinary evaluation are independent of this report.

Results and Discussion

Sample hills of each cultivar were dug September 2, 2014 from a demonstration trial at CDCS in Brooks, AB for an initial assessment of tuber set, yield potential and relative maturity. Photos of these potatoes are shown in Appendix B.

In season data is presented in Table 34. Approximately 22 days after planting, 50% of many of the plants in each row were visible (data not shown). Full emergence was reached between 22 and 40 days after planting. There was no significant difference in emergence dates from any of the cultivars planted. The mean number of stems per plant, tubers per stem and tubers per plant (tuber set) are shown in Table 34 as well. There were significant differences in each of these categories. For ease of comparison, cultivars have been grouped into categories and analyzed by skin-color.

The mean number of tubers per plant ranged from as low as 8.0 for L14-39 to as many as 44.7 for L14-6. It is my understanding that a target of 15 or more tubers per plant is desirable for the production of gourmet potato varieties (Joel Vander Schaaf, personal communication). If tuber set is too high, however, many tubers may not reach a marketable size prior to harvest in Alberta's short growing season. Most of the cultivars included in the trial exceeded tuber sets of 15. As tuber set is only an indication, marketable yield will be a better indicator than tuber set alone for the potential of these cultivars as gourmet varieties.

Yield data (total yield; ton/ac) and specific gravities of each of the gourmet cultivars are shown in Table 3. Total yield estimates ranged from 5.5 ton/ac to 16.2 ton/ac. In order for producers to achieve a realistic return on investment growing gourmet potatoes, yield must be above a threshold. There were no significant differences in total yield estimates between cultivars, possibly because of field variability. Further addressing the specific agronomic needs of each variety may well result in improvements to yield and size profiles when compared with the results in this trial.

Table 34: Field data and tuber set information for each variety grown at 135 lbs/ac N at CDCS. Data shown is the mean of three or four replicates. Data for each skin colour block followed by the same letter in each column of the table are not significantly different at the $p < 0.05$ level.

CDCS	Full Emergence DAP	Stems per Plant	Tubers per Stem	Tubers per Plant
Moderate N				
L14-1	28.5 a	4.0 a	2.7 d	11.1 f
L14-2	37.3 a	4.6 a	6.6 a-d	27.1 b-e
L14-3	32.8 a	4.3 a	5.2 bcd	22.2 def
L14-4	33.8 a	6.7 a	7.0 a-d	44.0 a
L14-5	40.0 a	3.9 a	11.7 a	38.7 ab
L14-6	37.0 a	4.6 a	10.0 ab	44.7 a
L14-7	29.8 a	7.3 a	3.7 cd	26.0 b-e
L14-8	33.8 a	5.8 a	4.8 bcd	26.7 b-e
L14-9	35.5 a	5.2 a	4.8 bcd	23.9 cde
L14-10	39.3 a	4.4 a	3.2 d	14.3 ef
L14-11	37.5 a	4.8 a	5.9 a-d	28.1 bcd
L14-12	38.8 a	5.0 a	6.6 a-d	32.1 a-d
L14-13	35.5 a	3.9 a	7.4 a-d	26.1 b-e
L14-14	39.3 a	5.7 a	7.1 a-d	36.8 abc
L14-15	33.5 a	4.9 a	9.7 abc	44.6 a
L14-16	39.8 a	5.9 a	4.0 bcd	22.6 def
L14-17	22.8 a	3.0 a	3.7 b	10.6 de
L14-18	28.3 a	3.2 a	2.7 b	8.7 e
L14-19	26.3 a	4.7 a	7.2 a	33.5 a
L14-20	22.0 a	3.8 a	5.1 ab	19.0 c
L14-22	22.8 a	3.3 a	4.1 ab	12.8 de
L14-23	22.0 a	2.7 a	5.4 ab	23.8 b
L14-24	26.0 a	3.9 a	3.8 b	14.9 d
L14-25	24.5 a	4.0 a	3.2 b	12.7 de
L14-26	22.0 a	4.7 a	2.0 b	9.6 e
L14-28	33.5 a	4.1 a	2.6 a	13.7 a
L14-29	38.0 a	6.6 a	2.8 a	14.1 a
L14-30	31.0 a	3.8 a	2.5 a	12.8 a
L14-31	30.0 a	5.3 a	3.5 a	18.0 a
L14-32	25.3 a	3.0 a	2.7 a	8.2 a
L14-33	36.0 a	4.7 a	3.7 a	14.1 bc
L14-34	40.7 a	2.3 a	4.3 a	9.4 c

L14-35	37.0 a	5.1 a	2.9 a	13.0 bc
L14-36	37.5 a	3.3 a	3.8 a	11.7 c
L14-37	41.0 a	4.2 a	6.5 a	24.2 ab
L14-38	41.3 a	5.5 a	3.0 a	16.2 abc
L14-39	37.5 a	2.8 a	2.9 a	8.0 c
L14-40	40.7 a	3.7 a	4.9 a	18.5 abc
L14-41	40.0 a	5.7 a	3.7 a	19.5 abc
L14-42	33.3 a	3.6 a	8.1 a	26.8 a

Specific gravity of tubers ranged from 1.074 for L14-25 to 1.110 for 425/09-06 (Table 35). The texture of 'new' potatoes often associated with gourmet size is consistent with specific gravity values of 1.06 to 1.08. Varieties with specific gravities above 1.085 often rival those of French fry varieties with a dry or mealy texture and may be less suitable for the gourmet market.

- Within the yellow-skinned category, L14-1, L14-5, L14-8 had the lowest specific gravities and were significantly lower than both check varieties. The specific gravity of L14-16, L14-3, L14-4, and L14-14 were significantly higher than both check varieties.
- Within the red-skinned category, the specific gravity of several cultivars, L14-19, L14-22, and L14-23, was significantly higher than for L14-25. None of the cultivars tested had specific gravities significantly lower than L14-25.
- There were no significant differences in specific gravity measurements for the purple-skinned cultivars.
- There were no significant differences in specific gravity measurements for the specialty cultivars.

Table 35: Estimated total yield (ton/acre) and specific gravity for each variety grown at 135 lbs/ac N at CDCS. Data shown is the mean of four replicates. Data within each colour block followed by the same letter in each column of the table are not significantly different at the $p < 0.05$ level.

CDCS	Yield (ton/ac)	SG
Moderate N		
L14-1	14.6 a	1.083 g
L14-2	11.6 a	1.100 bcd
L14-3	10.4 a	1.102 bc
L14-4	13.2 a	1.103 ab
L14-5	12.8 a	1.083 g
L14-6	13.6 a	1.095 c-f
L14-7	8.9 a	1.098 b-e
L14-8	9.3 a	1.083 g
L14-9	12.4 a	1.094 def
L14-10	10.0 a	1.091 f
L14-11	13.7 a	1.092 ef
L14-12	8.7 a	1.093 ef
L14-13	13.1 a	1.098 b-e
L14-14	13.6 a	1.105 ab
L14-15	13.0 a	1.099 b-e
L14-16	12.3 a	1.110 a
L14-17	16.2 a	1.085 ab
L14-18	12.1 a	1.079 ab
L14-19	13.6 a	1.093 a
L14-20	15.2 a	1.088 ab
L14-22	14.7 a	1.093 a
L14-23	11.4 a	1.090 a
L14-24	7.3 a	1.080 ab
L14-25	13.5 a	1.074 b
L14-26	9.2 a	1.081 ab
L14-28	14.1 a	1.091 a
L14-29	11.1 a	1.092 a
L14-30	12.7 a	1.088 a
L14-31	16.2 a	1.097 a
L14-32	13.9 a	1.091 a

L14-33	11.5 a	1.090 a
L14-34	6.6 a	1.093 a
L14-35	4.9 a	1.083 a
L14-36	12.3 a	1.086 a
L14-37	7.2 a	1.093 a
L14-38	7.4 a	1.082 a
L14-39	10.6 a	1.097 a
L14-40	8.5 a	1.089 a
L14-41	5.5 a	1.099 a
L14-42	7.2 a	1.088 a

Potatoes were sized into categories and the estimated number of tubers per acre in each size category is represented in Table 36. There were statistically significant differences in some size categories for each skin colour category.

- For the yellow-skinned potatoes, yield of 25 to 41mm tubers per acre ranged from 194,000 per acre to over 430,000 per acre. Several test cultivars produced significantly more tubers per acre than L14-10, but not were significantly different from L14-9. L14-10 produced significantly more tubers per acre in the > 41mm category, indicating that an earlier harvest may have been necessary for this variety. Tow cultivars, L14-15 and L14-4, produced significantly more tubers per acre in the < 25mm category than L14-9.
- In the red-skinned category, several cultivars produced significantly more 25 to 41mm tubers than either check. These include L14-19, L14-20, L14-23 and L14-24. Two of these cultivars also produced significantly more < 25mm tubers than L14-25 and L14-26.
- All of the purple-skinned cultivars tested produced more tubers per acre than L14-32. One cultivar, L14-29 produced over 260,000 tubers < 25mm per acre; significantly more than all of the other entries in this category.
- For the < 25mm and 25 to 41mm size classes, there were no significant differences between cultivars in the specialty category. Three cultivars, L14-33, L14-34, and L14-36, produced significantly fewer tubers per acre in the > 41mm size class than L14-39.

Table 36: Number of tubers per acre (x 1000) in each size category (< 25mm, 25 to 41mm, > 41mm, and deformed) for each variety grown at 135 lbs/ac N at CDCS. Data shown is the mean of four replicates. Data within each coolur block followed by the same letter in each column of the table are not significantly different at the $p < 0.05$ level.

CDCS	< 25mm	25 to 41mm	> 41mm	Deformed
Moderate N				
L14-1	29.2 e	194.0 c	75.1 b	1.8 a
L14-2	116.6 cde	438.0 a	29.0 cd	1.6 a
L14-3	185.5 de	381.3 abc	31.0 cd	2.2 a
L14-4	609.1 ab	416.2 ab	5.4 d	8.1 a
L14-5	457.1 bcd	251.4 abc	3.1 d	5.6 a
L14-6	492.6 bc	331.1 abc	2.0 d	4.3 a
L14-7	232.9 cde	424.0 ab	8.8 cd	4.2 a
L14-8	256.5 cde	405.8 abc	44.1 c	1.1 a
L14-9	216.1 cde	366.7 abc	25.9 cd	3.1 a
L14-10	42.3 e	207.5 c	105.2 a	0.4 a
L14-11	202.4 de	456.2 a	28.3 cd	2.9 a
L14-12	275.4 cde	305.6 abc	36.0 cd	2.0 a
L14-13	272.3 cde	374.4 abc	30.1 cd	0.2 a
L14-14	295.4 cde	268.5 abc	18.2 cd	2.0 a
L14-15	778.6 a	386.1 abc	0.7 d	0.9 a
L14-16	232.3 cde	278.8 abc	14.4 cd	2.0 a
L14-17	22.9 c	100.7 d	136.0 a	0.0 b
L14-18	13.5 c	100.0 d	98.5 ab	.9 ab
L14-19	327.6 a	456.9 a	17.5 b	0.9 ab
L14-20	80.3 bc	310.3 b	120.5 a	2.7 a
L14-22	43.8 bc	180.1 cd	111.3 a	0.2 b
L14-23	102.3 b	368.7 ab	57.3 ab	0.9 ab
L14-24	92.4 bc	284.6 bc	15.5 b	1.3 ab
L14-25	24.7 c	148.2 d	135.1 a	0.2 b
L14-26	14.6 c	93.9 d	150.0 a	0.9 ab
L14-28	34.4 bc	216.5 a	117.6 a	0.0 b
L14-29	261.7 a	256.8 a	1.3 b	5.6 a
L14-30	54.4 bc	215.8 a	73.5 a	0.7 b
L14-31	79.4 b	309.8 a	90.2 a	0.9 b
L14-32	4.0 c	88.8 b	125.2 a	2.9 ab

L14-33	157.1 a	141.2 a	5.7 b	1.5 abc
L14-34	55.5 a	44.4 a	9.6 b	0.6 bc
L14-35	91.7 a	167.3a	22.0 ab	1.3 bc
L14-36	50.3 a	152.4 a	7.9 b	7.6 a
L14-37	140.3 a	241.5 a	22.5 ab	2.2 abc
L14-38	53.1 a	283.6 a	23.1 ab	6.9 ab
L14-39	16.6 a	74.6 a	58.5 a	0.9 bc
L14-40	121.1 a	151.4 a	24.3 ab	2.4 abc
L14-41	38.4 a	139.4 a	35.1 ab	0.3 c
L14-42	194.3 a	192.5 a	17.3 ab	2.2 abc

The mean percentage of total tuber number in each size category is shown in Table 37. It is important to note that harvesting with small plot equipment and manual labour recovers all potatoes over 15mm in diameter. This tended to increase the yield (and percentage) of small potatoes relative to a commercial situation where more of these tubers may be left behind in the field. The percentage of tubers in each category gives an indication of which cultivars require the full season to reach their potential and which may be earlier maturing cultivars.

There were no significant differences in the percentage of tubers in each size class for the yellow-skinned, red-skinned or specialty entries. In the purple-skinned category, two cultivars produced a significantly higher percentage of tubers in the 25 to 41mm class than L14-32, L14-30 and L14-31.

Table 37: Percentage of total tuber number in each size category (< 25mm, 25 to 41mm, > 41mm, and deformed) for each variety grown at 135 lbs/ac N at CDCS. Data shown is the mean of four replicates.

CDCS	< 25mm	25 to 41mm	> 41mm	Deformed
Moderate N				
L14-1	34.5 a	59.8 a	5.4 a	0.3 a
L14-2	26.1 a	57.3 a	15.9 a	0.7 a
L14-3	31.2 a	46.6 a	22.2 a	0.1 a
L14-4	52.1 a	45.2 a	2.5 a	0.3 a
L14-5	28.6 a	61.7 a	9.5 a	0.3 a
L14-6	20.7 a	64.9 a	14.2 a	0.3 a
L14-7	49.8 a	47.9 a	2.1 a	0.3 a
L14-8	40.1 a	45.8 a	14.3 a	0.5 a
L14-9	35.5 a	56.5 a	7.5 a	0.7 a
L14-10	30.1 a	59.5 a	9.8 a	0.7 a
L14-11	19.6 a	54.9 a	25.2 a	0.4 a
L14-12	44.3 a	51.3 a	3.9 a	0.5 a
L14-13	56.9 a	42.1 a	0.9 a	0.1 a
L14-14	48.4 a	48.6 a	1.9 a	1.1 a
L14-15	33.8 a	60.7 a	5.2 a	0.3 a
L14-16	40.6 a	55.9 a	2.9 a	0.6 a
L14-17	19.1 a	57.8 a	22.8 a	0.3 a
L14-18	5.0 a	29.3 a	40.6 a	0.1 a
L14-19	9.1 a	47.6 a	18.1 a	0.2 a
L14-20	5.4 a	42.0 a	52.3 a	0.4 a
L14-22	14.4a	49.2 a	36.0 a	0.5 a
L14-23	16.7 a	62.0 a	21.2 a	0.1 a
L14-24	5.6 a	25.9 a	18.5 a	0.0 a
L14-25	24.7a	47.5 a	27.6 a	0.2 a
L14-26	17.7 a	47.9 a	9.2 a	0.2 a
L14-28	9.5 b	57.8 ab	32.8 ab	0.0 a
L14-29	49.5 a	49.0 ab	0.2 c	1.0 a
L14-30	16.0 b	63.3 a	20.8 bc	0.2 a
L14-31	16.3 b	64.5 a	19.0 bc	0.3 a
L14-32	5.8 b	44.8 b	48.5 a	1.0 a

L14-33	25.0 a	63.1 a	10.6 a	1.3 a
L14-34	23.9 a	69.8 a	4.6 a	1.8 a
L14-35	34.8 a	41.0 a	23.0 a	1.2 a
L14-36	26.3 a	68.1 a	4.5 a	1.1 a
L14-37	41.1 a	42.2 a	16.4a	0.3 a
L14-38	56.0 a	35.1 a	4.4 a	4.5 a
L14-39	36.9 a	59.2 a	3.1 a	0.9 a
L14-40	11.5 a	48.2 a	6.4 a	0.6 a
L14-41	11.8 a	39.7 a	14.0a	1.1 a
L14-42	25.3 a	59.7 a	14.8 a	0.3 a

The estimated yield of tubers in each category is represented in Table 38. In general, a good yield of tubers in the 25 – 41mm category would be the focus of cultivar evaluation, but, in this trial, a good yield of tubers over 41mm may also indicate that an earlier harvest may result in an increased yield of 25 to 41 mm tubers.

- The yields of tubers from yellow-skinned cultivars were not significantly different from the check varieties.
- There were no significant yield differences in the red-skinned category.
- Three entries, L14-29, L14-30 and L14-31, yielded significantly more tubers in the 25 to 41mm size class than L14-32.
- There were no significant yield differences in the specialty category.

Table 38: Estimated yield (ton/ac) in each size category (< 25mm, 25 to 41mm, > 41mm, and deformed tubers) for each variety grown at 135 lbs/ac N at CDCS. Data shown is the mean of four replicates. Data within each colour block followed by the same letter in each column of the table are not significantly different at the $p < 0.05$ level.

CDCS	Yield of <25mm (ton/ac)	Yield of 25 to 41mm (ton/ac)	Yield of > 41mm (ton/ac)	Yield of deformed (ton/ac)
Moderate N				
L14-1	1.7 ab	10.5 a	2.2 a	0.2 a
L14-2	1.1 ab	7.2 a	3.1 a	0.2 a
L14-3	1.3 ab	4.6 a	4.5 a	0.0 a
L14-4	3.0 ab	8.9 a	1.2 a	0.1 a
L14-5	1.5 ab	7.5 a	3.7 a	0.1 a
L14-6	1.0 b	8.8 a	3.7 a	0.1 a
L14-7	2.1 ab	6.1 a	0.6 a	0.1 a
L14-8	1.4 ab	5.0 a	2.9 a	0.0 a
L14-9	1.7 ab	8.4 a	2.2 a	0.1 a
L14-10	1.2 ab	6.9 a	1.9 a	0.0 a
L14-11	0.9 b	7.1 a	5.6 a	0.1 a
L14-12	1.7 ab	5.9 a	1.1 a	0.1 a
L14-13	4.2 a	8.5 a	0.4 a	0.1 a
L14-14	2.9 ab	9.6 a	0.9 a	0.2 a
L14-15	1.6 ab	9.4 a	1.9 a	0.1 a
L14-16	2.1 ab	8.9 a	1.2 a	0.1 a
L14-17	1.0 a	8.8 a	6.3 a	0.1 a
L14-18	0.1 a	2.5 a	9.4 a	0.0 a
L14-19	0.4 a	6.4 a	6.9 a	0.0 a
L14-20	0.2 a	4.5 a	10.4 a	0.0 a
L14-22	0.5 a	5.1 a	9.0 a	0.1 a
L14-23	0.5 a	5.6 a	5.2 a	0.1 a
L14-24	0.2 a	3.2 a	3.9 a	0.0 a
L14-25	1.1 a	5.9 a	6.5 a	0.0 a
L14-26	0.8 a	6.4 a	2.0 a	0.1 a
L14-28	0.3 b	5.8 c	7.9 a	0.0 a
L14-29	2.7 a	8.1 ab	0.1 b	0.2 a
L14-30	0.5 b	6.7 b	5.5 a	0.0 a
L14-31	0.7 b	9.2 a	6.2 a	0.1 a
L14-32	0.2 b	4.0 c	9.5 a	0.3 a

L14-33	1.3 a	7.6 a	2.3 a	0.2 a
L14-34	0.5 a	4.7 a	1.2 a	0.2 a
L14-35	0.5 a	2.8 a	1.6 a	0.1 a
L14-36	1.0 a	9.4 a	1.6 a	0.3 a
L14-37	1.8 a	4.1 a	1.3 a	0.1 a
L14-38	1.6 a	4.8 a	0.9 a	0.2 a
L14-39	1.9 a	7.2 a	1.3 a	0.1 a
L14-40	0.4 a	5.9 a	2.0 a	0.2 a
L14-41	0.2 a	2.5 a	2.7 a	0.1 a
L14-42	0.5 a	4.3 a	2.3 a	0.0 a

Conclusions

The 2014 variety trial included forty gourmet potato lines with potential in Alberta. A number of yellow-skinned cultivars showed promise and were comparable to L14-9 in yield, size profile and appearance. Several red-skinned entries also showed promise, but culinary evaluations may play a greater role than yield for these cultivars. Several purple-skinned cultivars showed promise in appearance, size profile and yield relative to L14-32. In the specialty category, the novel appearances will likely weigh more than the yield and class of potatoes in determining which cultivars move forward.

The trial was designed to provide regional data for a wide range of potato cultivars. The N rate of 193 lbs/ac is a moderate rate of N relative to processing cultivars, but possibly higher than required for some of the gourmet potato cultivars. Addressing the agronomic needs of each variety may well result in improvements to yield and size profiles when compared to the results in this year of the trial.

Overall Results

In 2014, data was provided for over 100 cultivars or varieties supplied by various client sponsors and an additional 25 standard varieties were also included. Of the 37 cultivars from the AAFC National Potato Breeding Program, the cultivars comprised 13 chipping clones, 11 French fry or dual purpose clones, and 13 fresh market clones.

The French fry industry supplied 2 French fry cultivars for evaluation in 2014 and requested data related to N fertilizer strategies. The chipping industry evaluated 7 cultivars. In the fresh market segment, 15 cultivars were evaluated for stakeholders pursuing the fresh market segment, and 40 creamer potato cultivars were evaluated along with relevant check varieties. Many of the entries were grown at two different levels of N to provide preliminary agronomic data for stakeholders. Some in-row spacing changes were made for specific categories of potatoes. After harvest and grading each year, potatoes were available to cooperators to allow them to conduct bruising, storage and culinary evaluations independently.

Conclusions

The potato variety evaluation trial was well supported by the Alberta potato industry. Ten key stakeholders participated in the trial in 2014. There has been interest expressed in adding clients and varieties in future years of the trial. It is important that this type of variety evaluation work continues to ensure impartial information is available to decision makers throughout the value-chain.

Recommendations

- Varieties should be grown in southern Alberta for at least 3 years to evaluate them fully.
- To establish better estimates of yield potential and size profile for the varieties, each variety should be grown under optimal agronomic conditions (fertility, plant density, etc.).

References

Love, SL, R. Novy, D. Corsini, and P. Bain. 2003. Variety Selection and management. In: Potato Production Systems (J.C. Stark and S.L. Love, eds.). University of Idaho Agricultural Communications, Moscow, ID. pp: 21-47.

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Presentations

The potato industry will have access to the project information in many ways. Growers and industry members were invited to see the varieties at a field day in Brooks (Crop Diversification Centre South) in August 2014. Dr. Konschuh prepared a poster for the Annual Meeting of the Potato Growers of Alberta about the trial. In Brooks, guests were invited to compare the unique performances of each variety in the field under local conditions. No field day was hosted at the Alberta Irrigation Technology Centre in Lethbridge, but several client sponsors toured the site throughout the season.

Data was collected, analyzed and presented in multiple reports to industry stakeholders in 2014. Each sponsor was provided with a client-specific report for each year of participation. Information will be available on the internet (ARD website, AAFC website and PGA website) for access by interested parties.

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