

Project Report

AAFC National Potato Variety Trial Results from CDCS, Brooks, AB 2018

Prepared for:
Funding agencies and industry sponsors

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Introduction

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 (Westermann, 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). 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. 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. The varieties were planted in replicated plots at the Crop Diversification in Brooks, AB and were provided with 200 lbs/ac N. Alberta data is essential when selecting varieties appropriate for our climate, our customers and industry stakeholders.

Objectives

- A. To evaluate new cultivars for French fry processing;
- B. To evaluate new cultivars for chip processing;
- C. To evaluate new cultivars for fresh consumption; and
- D. To evaluate cultivars from AAFC's National Potato Breeding Program under Alberta conditions.

Materials and Methods

The variety evaluation was conducted in small plots at the Crop Diversification Centre South in Brooks, AB. Fertility for the AAFC plots (200 lbs/ac) was achieved through a combination of soil fertility (40 lbs/ac N; 26 lbs/ac P) and broadcast fertilizer (90 lbs/ac of 11-52-0) incorporated May 8 prior to planting. AAFC plots received an additional top-dressing (326 lbs/ac of 46-0-0) at hilling (June 7), for a total of 200 lbs/ac N. Entries were planted in duplicate 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).

Eptam 8E (1.8 L/ac) and Sencor (150g/ac) were applied prior to planting (May 7) to control weeds. Seed of standard cultivars and test cultivars was provided by AAFC. Potatoes were planted May 17 approximately 12 to 15cm deep using a two-row tuber unit planter. Seed was planted at 30cm spacing in 6m rows spaced 90cm apart. Plots were hilled June 7 with a power hiller. The plots were irrigated to maintain soil moisture close to 70%. Foliar fungicides were applied twice during the growing season to prevent early and late blight from developing (Table 1).

Table 1: Foliar fungicides applied to the potato crop in 2017 to prevent early and late blight development.

<i>Date of Application</i>	<i>Fungicide</i>	<i>Rate</i>
11 July	Ridomil Gold/Bravo	0.83L/ac
30 July	Quadris	324mL/ac



Figure 1: Variety evaluation trial at CDCS in Brooks, AB July 27, 2018.

Reglone was applied (1.0 L/ac) August 23, 2018. Potatoes were harvested September 5 and 6 using a 1-row Grimme harvester.

Fresh market and French fry tubers were stored at 8°C until graded. Chipping tubers were stored at 14.5°C until graded. Chipping and Fresh Market tubers were graded into size categories (less than 48mm, 48 – 88mm, over 88mm and deformed). French Fries were graded by weight into categories (< 113g, 113 to 170g, 170 to 284g, 284 to 396g, > 396g and deformed). A sample of twenty tubers (48 – 88mm or 113 to 396g) 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 marketable tubers were provided to Lethbridge Research Centre staff for culinary and post-harvest evaluations.

The data presented here have not been statistically analyzed. Data reported are the mean of two replicate rows.

Results – Chipping Cultivars

Sample hills of each cultivar were dug for a field day August 14, 2018. Photos of the chipping cultivars are shown in Figure 2.

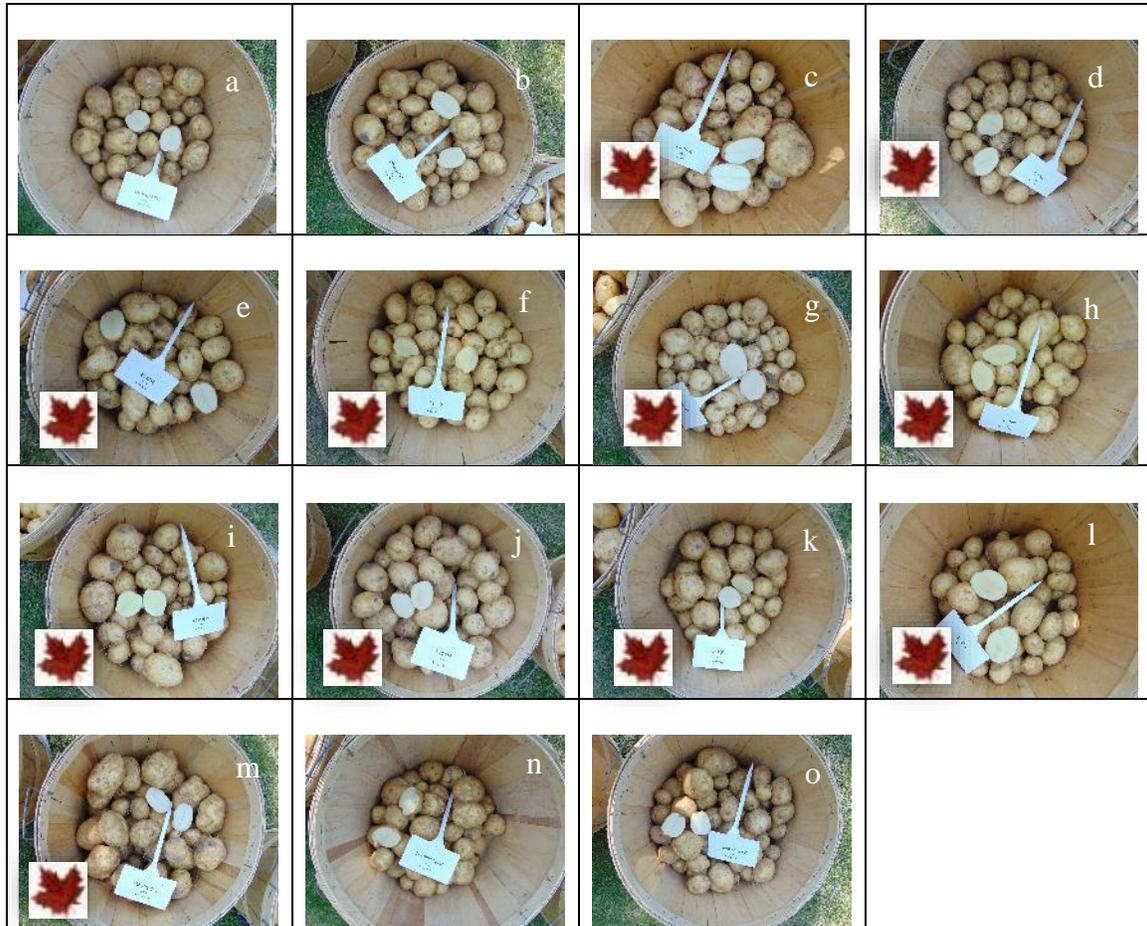


Figure 2. AAFC chipping cultivars at the CDCS field day August 14, 2018: a) Atlantic E, b) Atlantic West, c) F14025, d) F14026, e) F14028, f) F14030, g) F14031, h) F14032, i) F14034, j) F14035, k) F14036, l) F14037, m) WV10655-1, n) Snowden East, and o) Snowden West.

Yield data (total yield; ton/ac) and specific gravities of each of the chipping cultivars are shown in Table 2. Yield ranged from 24.2 for F14030 to 37.2 ton/ac for F14036. Specific gravity ranged from 1.083 for WV10655-1 to 1.109 for Atlantic East.

Table 2: Estimated total yield (ton/acre) and specific gravity for each chipping cultivar grown at CDCS in Brooks, AB (approximately 200 lbs/ac nitrogen). Data shown is the mean of two replicates.

	Yield (ton/ac)	SG
Atlantic East	32.0	1.109
Atlantic West	36.1	1.107
F14025	27.6	1.096
F14026	34.7	1.088
F14028	31.8	1.093
F14030	24.2	1.106
F14031	34.7	1.101
F14032	33.9	1.092
F14034	32.7	1.099
F14035	24.6	1.100
F14036	37.2	1.100
F14037	31.2	1.106
WV10655-1	29.0	1.083
Snowden East	27.2	1.105
Snowden West	28.7	1.104

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 200 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	7	82	10	0
Atlantic West	11	81	8	0
F14025	10	67	22	0
F14026	18	79	3	0
F14028	17	77	5	1
F14030	37	62	0	1
F14031	20	78	2	0
F14032	13	81	6	0
F14034	17	72	10	2
F14035	16	80	4	0
F14036	13	79	8	0
F14037	19	76	5	0
WV10655-1	29	47	21	7
Snowden East	11	81	7	0
Snowden West	11	84	4	0

The yield of tubers (estimated ton/ac) of each chipping cultivar is shown by size category in Table 4. Marketable yield ranged from 13.1 ton/acre for WV10655-1 to 29.6 ton/ac for F14036.

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 200 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	24.5	6.9	0.1
Atlantic West	0.9	29.0	6.1	0.2
F14025	0.5	15.2	11.7	0.1
F14026	1.9	28.2	3.6	0.0
F14028	1.0	26.8	3.8	0.2
F14030	3.8	19.4	0.4	0.7
F14031	2.3	31.3	0.7	0.3
F14032	1.1	28.6	4.3	0.0
F14034	1.2	23.1	7.1	1.3
F14035	1.3	20.8	2.2	0.3
F14036	1.1	29.6	6.6	0.0
F14037	1.8	25.6	3.7	0.0
WV10655-1	1.6	13.1	13.7	0.6
Snowden East	0.9	22.5	3.8	0.0
Snowden West	1.1	24.8	2.5	0.2

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 a few tubers. F14037 had internal necrotic lesions in almost half of the tubers. Snowden and WV10655-1 seemed somewhat susceptible to black scurf. No common scab lesions were noted.

Results– French Fry Cultivars

Sample hills of each cultivar were dug for a field day August 14, 2018. Photos of the French fry cultivars are shown in Figure 3.

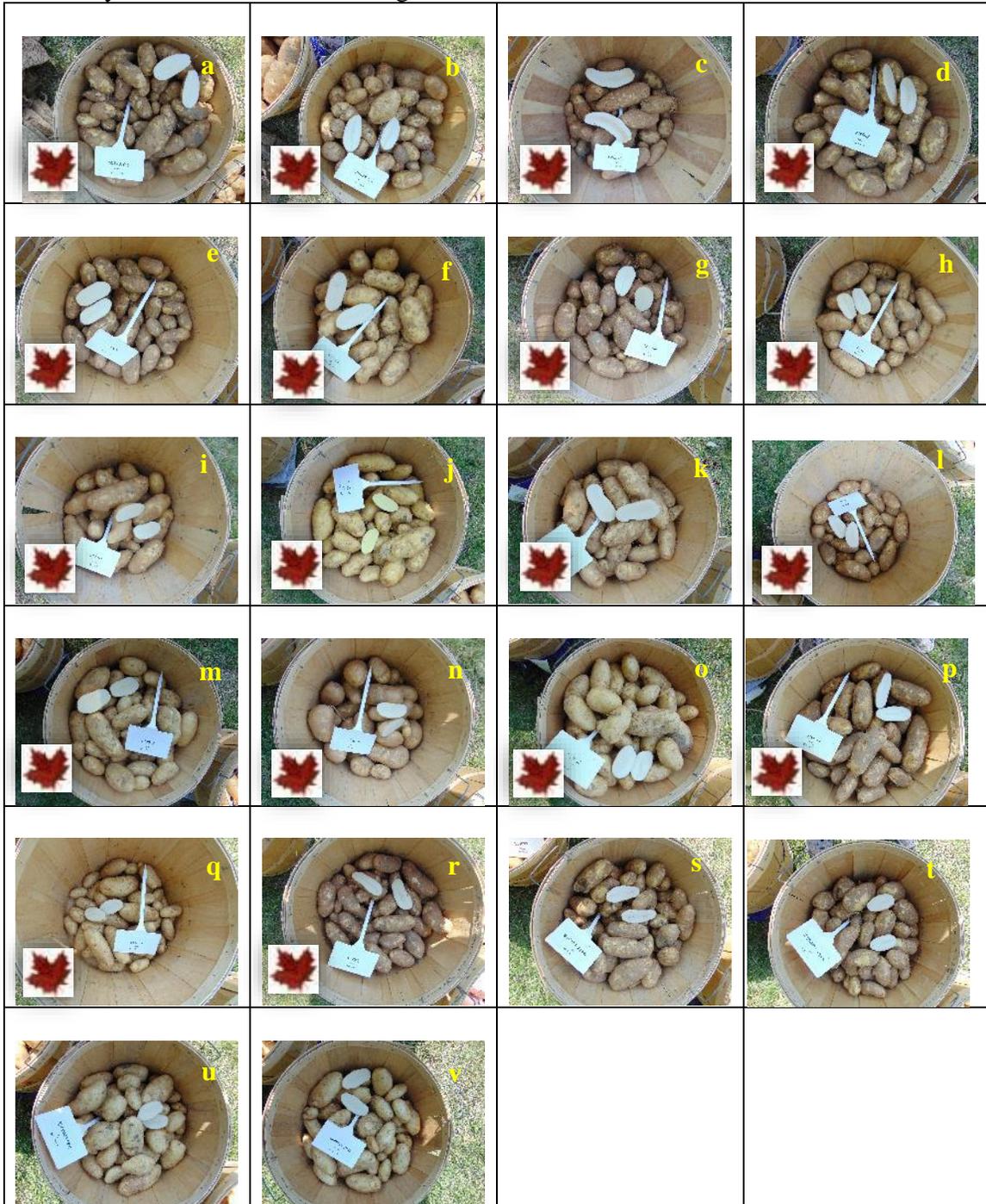


Figure 3. AAFC French fry cultivars at the CDCS field day August 14, 2018: a) CV011010-2, b) CV011238-1, c) CV08212-1, d) F14002, e) F14003, f) F14005, g) F14008, h) F14010, i) F14011, j) F14015, k) F14016, l) F14017, m) F14018, n) F14020, o) F14021, p) F14022, q) F14023, r) F14057, s) Russet Burbank E, t) Russet Burbank W, u) Shepody E, and v) Shepody W.

Yield data (total yield; ton/ac) and specific gravities of each of the French fry cultivars are shown in Table 5. Total yield ranged from 31.2 ton/ac for F14057 to 47.7 ton/ac for F14021. Marketable yield ranged from 24.7 ton/ac for CV08212-1 to 44.4 ton/ac for F14021. Specific gravity ranged from 1.079 for F14003 to 1.117 for F14023.

Table 5: Estimated total yield and marketable yield (ton/acre) and specific gravity for each French fry cultivar grown at CDCS in Brooks, AB (approximately 200 lbs/ac nitrogen). Data shown is the mean of two replicates.

	Total Yield (ton/ac)	Mkt Yield (ton/ac)	SG
CV011010-2	46.9	40.9	1.085
CV011238-1	40.3	37.0	1.094
CV08212-1	30.9	24.7	1.095
F14002	40.4	37.8	1.094
F14003	33.0	29.5	1.079
F14005	39.2	35.5	1.089
F14008	31.9	29.9	1.086
F14010	37.4	32.8	1.088
F14011	39.0	35.7	1.088
F14015	41.6	39.6	1.094
F14016	39.4	33.9	1.105
F14017	32.5	29.1	1.091
F14018	37.6	33.9	1.090
F14020	34.6	31.0	1.082
F14021	47.7	44.4	1.089
F14022	36.6	33.7	1.091
F14023	33.5	28.9	1.117
F14057	31.2	28.9	1.106
R.Burbank East	44.2	39.1	1.096
R.Burbank West	36.9	31.5	1.088
Shepody East	37.2	32.2	1.088
Shepody West	40.6	35.7	1.092

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 (< 113g, 113 to 170g, 170 to 284g, 284 to 396g and > 396g, and deformed tubers) for each French fry cultivar grown at approximately 200 lbs/ac. Data shown is the mean of two replicates.

	% of <113g	% of 113-170g	% of 170-284g	% of 284-396g	% of >396g	% deformed
CV011010-2	8	10	26	26	26	5
CV011238-1	8	16	37	25	14	0
CV08212-1	13	12	21	19	28	7
F14002	6	11	33	29	20	0
F14003	10	22	46	15	6	1
F14005	5	6	20	28	37	4
F14008	6	9	34	25	26	1
F14010	7	13	25	22	27	6
F14011	7	9	22	28	32	2
F14015	5	8	22	27	37	0
F14016	7	7	20	30	30	7
F14017	10	14	36	25	15	0
F14018	7	14	35	27	14	2
F14020	7	8	20	24	37	3
F14021	7	8	27	31	27	0
F14022	8	11	32	28	22	0
F14023	14	15	27	24	21	0
F14057	7	17	41	17	18	1
R.Burbank East	9	13	27	25	24	2
R.Burbank West	10	14	40	18	14	4
Shepody East	6	10	20	23	34	7
Shepody West	10	15	31	19	23	3

The yield of tubers (estimated ton/ac) of each French fry cultivar is shown by size category in Table 7. Yield of 170 to 284g tubers ranged from 6.3 ton/ac of CV08212-1 to 15.3 ton/ac of F14003. Yield of 284 to 396g tubers ranged from 5.1 for F14003 to 14.8 for F14021

Table 7: Estimated yield (ton/ac) in each size category (< 113g, 113 to 170g, 170 to 284g, 284 to 396g and > 396g, and deformed tubers) for each French fry cultivar grown at approximately 209 lbs/ac. Data shown is the mean of two replicates.

	% of <113g	% of 113-170g	% of 170-284g	% of 284-396g	% of >396g	% deformed
CV011010-2	3.6	4.5	12.1	12.1	12.2	2.4
CV011238-1	3.4	6.0	14.9	10.5	5.7	0.0
CV08212-1	4.0	3.6	6.3	6.1	8.7	2.2
F14002	2.6	4.5	13.3	11.6	8.3	0.0
F14003	3.4	7.2	15.3	5.1	1.9	0.2
F14005	2.0	2.7	8.0	10.8	14.1	1.7
F14008	1.8	2.8	10.7	8.1	8.2	0.3
F14010	2.5	5.0	9.4	8.3	10.1	2.1
F14011	2.7	3.6	8.8	10.8	12.6	0.6
F14015	2.0	3.5	9.3	11.4	15.4	0.0
F14016	2.8	2.7	7.7	11.7	11.8	2.7
F14017	3.3	4.4	11.8	8.2	4.7	0.0
F14018	2.8	5.1	13.1	10.4	5.3	0.9
F14020	2.3	2.9	6.9	8.1	13.1	1.2
F14021	3.2	3.8	12.7	14.8	13.1	0.0
F14022	2.9	4.1	11.4	9.9	8.3	0.0
F14023	4.5	5.1	8.8	8.0	7.0	0.0
F14057	2.1	5.4	12.8	5.2	5.6	0.2
R.Burbank East	4.0	5.8	11.9	10.8	10.5	1.1
R.Burbank West	3.8	5.2	14.7	6.5	5.0	1.6
Shepody East	2.2	4.0	7.3	8.6	12.5	2.8
Shepody West	3.9	6.2	12.5	7.9	9.2	1.1

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 was noted in approximately 25% of CV08212-1 and F14057 tubers and a couple of Russet Burbank tubers. Black scurf was not noted on any tubers but several tubers of F14005 had common scab lesions.

Results – Fresh Market Cultivars

Sample hills of each cultivar were dug for a field day August 14, 2018. Photos of the yellow/white fresh market cultivars are shown in Figure 4.



Figure 4. AAFC yellow/white fresh market cultivars at the CDCS field day August 24, 2017: a) F14057, b) F14067, c) F14068, d) F14126, e) F14128, f) F14132, g) Kennebec, and h) Yukon Gold East.

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

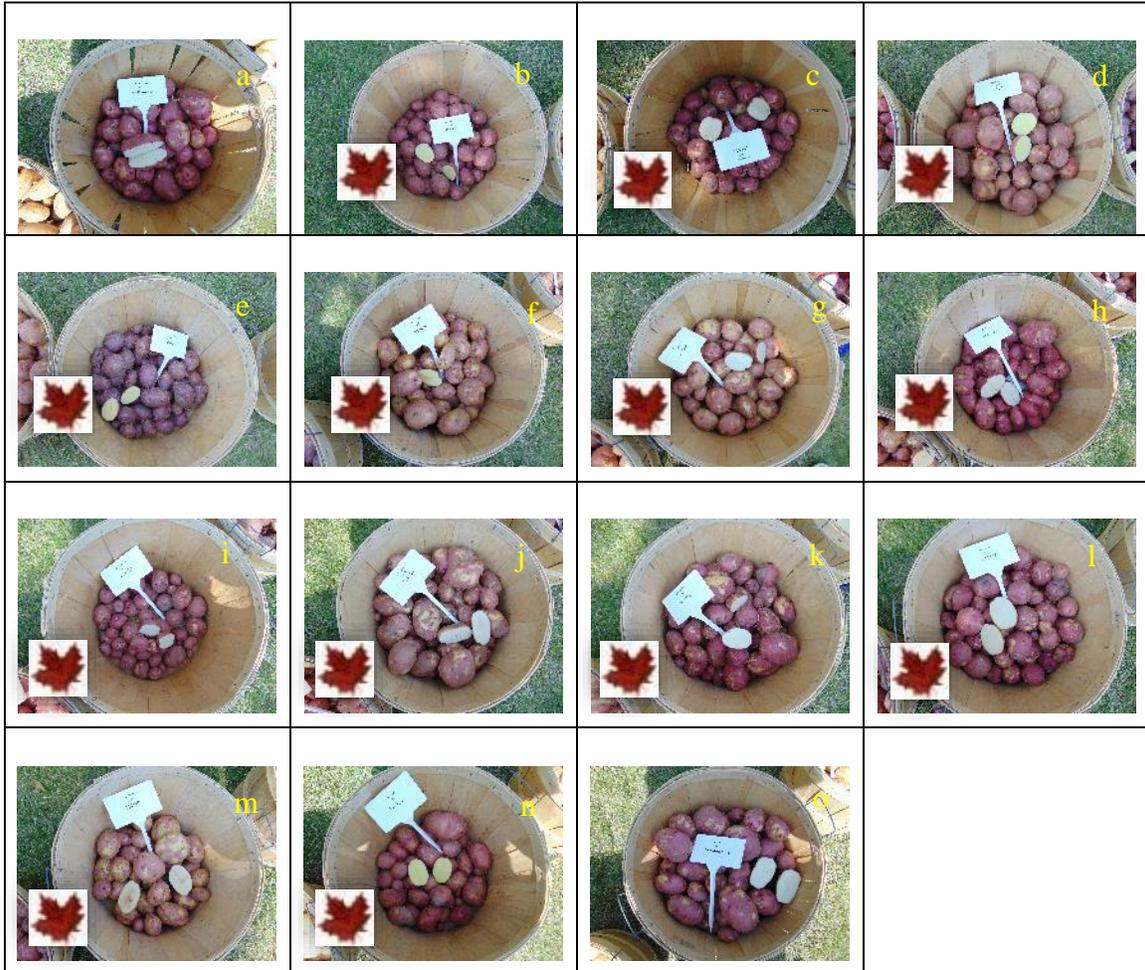


Figure 5. AAFC purple/red-skinned fresh market cultivars at the CDCS field day August 14, 2018: a) Chieftain E, b) F14052, c) F14071, d) F14075, e) F14085, f) F14090, g) F14096, h) F14100, i) F14112, j) F14114, k) F14118, l) F14119, m) F14120, n) F14134, o) Norland E.

Yield data (total yield; ton/ac) and specific gravities of each of the fresh market cultivars are shown in Table 8. Total yield ranged from 23.0 ton/ac for F14067 to 40.9 ton/ac for F14118. Specific gravity ranged from 1.076 for F14119 to 1.106 for F14057.

Table 8: Estimated total yield (ton/acre) and specific gravity for each fresh market FM) cultivar grown at CDCS in Brooks, AB (approximately 200 lbs/ac nitrogen). Data shown is the mean of two replicates.

	End Use	Yield (ton/ac)	SG
Yellow/White-skinned			
F14057	FM/FF	31.4	1.106
F14067	FM	23.0	1.093
F14068	FM	35.2	1.089
F14126	FM	30.8	1.071
F14128	FM	42.5	1.076
F14132	FM	30.3	1.095
Kennebec	FM CK	39.7	1.087
Yukon Gold East	FM CK	30.9	1.095
Red/Purple-skinned			
F14052	FM	24.3	1.096
F14071	FM	29.5	1.099
F14075	FM	30.8	1.079
F14085	FM	24.0	1.094
F14090	FM	32.9	1.095
F14096	FM	30.0	1.085
F14100	FM	32.1	1.087
F14112	FM	24.5	1.091
F14114	FM	37.8	1.089
F14118	FM	40.9	1.081
F14119	FM	33.4	1.076
F14120	FM	31.6	1.084
F14134	FM	31.7	1.084
Chieftain East	FM	36.0	1.081
Norland East	FM	36.8	1.080

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 200 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/White-skinned				
F14057	20	80	0	0
F14067	35	65	0	0
F14068	12	85	3	0
F14126	22	76	1	0
F14128	14	73	11	1
F14132	15	84	1	0
Kennebec	11	69	19	2
Yukon Gold East	10	69	20	0
Red/Purple-skinned				
F14052	39	61	0	0
F14071	16	82	1	1
F14075	11	70	19	0
F14085	26	74	0	0
F14090	11	70	18	1
F14096	16	67	18	0
F14100	13	82	4	1
F14112	35	65	0	0
F14114	21	70	8	1
F14118	14	74	13	0
F14119	11	79	9	1
F14120	6	55	34	5
F14134	23	71	5	2
Chieftain East	8	85	6	0
Norland East	15	74	11	0

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 209 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/White-skinned				
F14057	2.4	28.7	0.0	0.2
F14067	3.1	19.7	0.2	0.0
F14068	1.1	31.4	2.7	0.0
F14126	2.2	27.5	1.1	0.0
F14128	1.3	29.3	11.0	0.9
F14132	1.4	27.7	1.2	0.0
Kennebec	0.7	23.8	14.3	1.0
Yukon Gold East	0.5	18.0	12.2	0.2
Red/Purple-skinned				
F14052	3.9	20.4	0.0	0.0
F14071	1.9	26.8	0.6	0.2
F14075	0.7	18.5	11.5	0.1
F14085	2.3	21.6	0.2	0.0
F14090	0.8	21.4	10.4	0.3
F14096	1.0	18.2	10.8	0.0
F14100	1.2	27.8	2.9	0.2
F14112	3.9	19.6	0.9	0.0
F14114	1.8	28.4	7.2	0.4
F14118	1.0	26.9	13.0	0.0
F14119	0.9	25.4	6.3	0.7
F14120	0.3	12.8	16.8	1.6
F14134	2.0	24.8	4.0	0.9
Chieftain East	0.7	30.0	5.2	0.1
Norland East	1.2	25.9	9.5	0.2

Tuber samples used to measure specific gravity were evaluated for hollow heart, other internal defects and scab. Approximately 25% of F14057 tubers displayed hollow heart while brown center and hollow heart were only observed in individual tubers of other lines. F14071 and F14120 tubers were affected by internal necrotic lesions, over 50% for F14071 and 25% for F14120. Black scurf was mostly absent, F14085 seemed susceptible to common scab.

Conclusions

The 2018 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 18 French fry cultivars with. Yukon Gold, Chieftain, Kennebec and Norland were included in the trial as standard varieties to compare with 18 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 200 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.

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Alberta Seed Producers Inc.
ConAgra Foods, Lamb Weston Division
Edmonton Potato Growers
Old Dutch Foods
Parkland Seed Potatoes
Rockyview Seed Potatoes

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Appendix A Plot Plan

