

Project Report

AAFC National Potato Variety Trial Results from CDCS, Brooks, AB 2015

Prepared for:
Funding agencies and industry sponsors

Prepared by:

Michele Konschuh¹ and Benoit Bizimungu²

¹Alberta Agriculture and Forestry
Crop Diversification Centre South
301 Horticultural Station Road East
Brooks, AB T1R 1E6

²Agriculture and Agri-Food Canada
Potato Research Centre
850 Lincoln Road P.O. Box 20280
Fredericton, NB E3B 4Z7

April 5, 2016



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 209 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 in Brooks, AB. Eptam (2.2 L/ac) and Sencor 75DF (150 g/ac) were applied pre-plant (May 4) to control weeds. Fertility (209 lbs/ac) was achieved through a combination of soil fertility (39 lbs/ac N; 342 lbs/ac P) and broadcast fertilizer (217 lbs/ac of 46-0-0 and 90 lbs/ac of 11-52-0) incorporated prior to planting and top-dressing prior to hilling. Varieties were planted in four replicate rows in a randomized complete block design along with standard varieties (Norland, Chieftain, 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 1).

Potatoes were planted May 20, 2015 approximately 5 to 5½” deep using a two-row wheel planter. Additional nitrogen was applied as a top-dressing (130 lbs/ac of 46-0-0) at hilling (June 9), for a total of 209 lbs/ac N. The plots were irrigated to maintain soil moisture in treatments between 65 and 80%. Foliar fungicides were applied several times during the growing season to prevent early and late blight from developing (Table 2). Insecticide was applied July 30 (Matador, 14 mL/ac) to control Colorado potato beetle.

Table 2: Foliar fungicides applied to the potato crop to prevent early and late blight development.

Date of Application	Fungicide	Rate
6 July	Bravo	0.64 L/ac
30 July	Dithane	900 g/ac
19 Aug	Bravo	0.64 L/ac



Figure 1: Variety evaluation trial at CDCS in Brooks, AB July 27, 2015.

Reglone was applied (1.0 L/ac) September 4 and again September 11. Potatoes were harvested September 21 and 23 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 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 27, 2015. Photos of the chipping cultivars are shown in Figure 2.

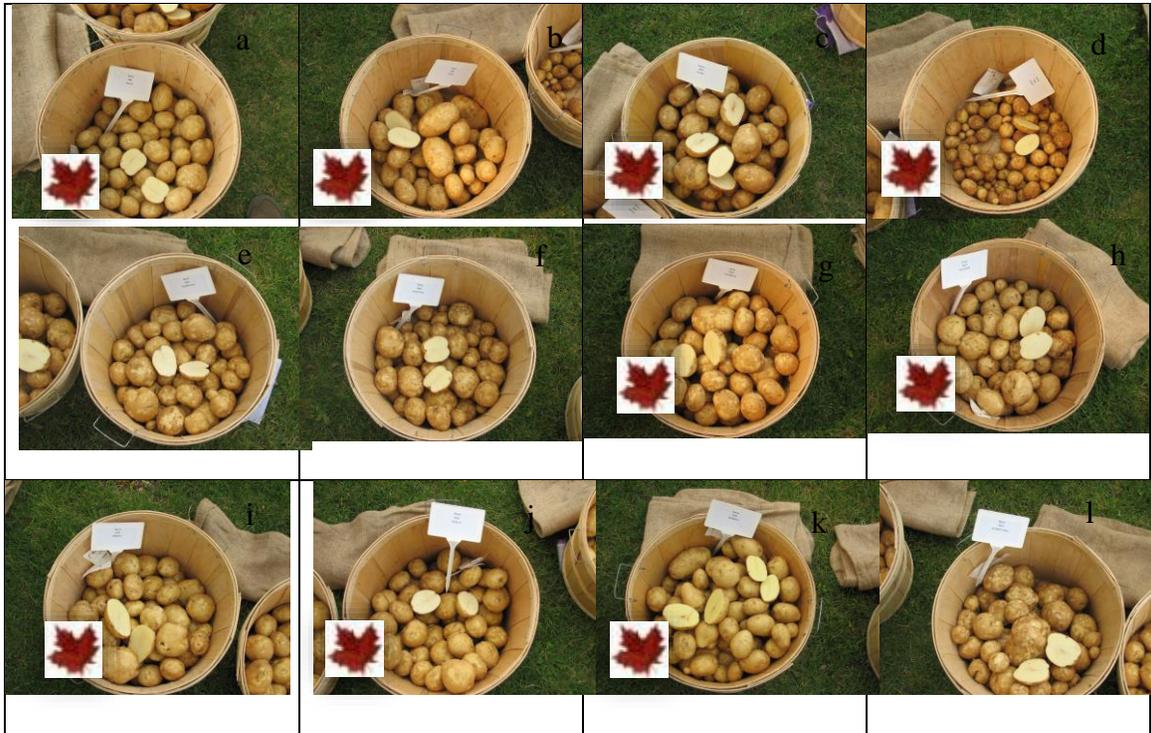


Figure 2. AAFC chipping cultivars at the CDCS field day August 27, 2015: a) F11011, b) F11012, c) F11013, d) F11017, e) Snowden East, f) Atlantic East, g) FV15568-30, h) FV15732-09, i) V08053-1, j) V1351-3, k) WV9890-2, l) Atlantic W.

Yield data (total yield; ton/ac) and specific gravities of each of the chipping cultivars are shown in Table 2. Yield ranged from 17.1 for F11017 to 29.3 ton/ac for Atlantic West. Specific gravity ranged from 1.068 for V08053-1 to 1.086 for Atlantic East.

Table 2: Estimated total yield (ton/acre) and specific gravity for each chipping cultivar grown at CDCS in Brooks, AB (approximately 209 lbs/ac nitrogen). Data shown is the mean of two replicates.

	Yield (ton/ac)	SG
Atlantic East	26.7	1.086
Atlantic West	29.3	1.081
F11011	24.3	1.085
F11012	26.2	1.082
F11013	24.4	1.076
F11017	17.1	1.078
FV15568-30	18.2	1.076
FV15732-09	27.7	1.083
V08053-1	27.3	1.068
V1351-3	24.4	1.075
WV9890-2	26.7	1.081
Snowden East	23.6	1.082

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 209 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	14	69	18	0
Atlantic West	12	65	21	2
F11011	15	78	7	0
F11012	17	75	7	1
F11013	16	80	3	1
F11017	27	71	1	1
FV15568-30	13	79	7	0
FV15732-09	10	79	10	1
V08053-1	17	71	11	1
V1351-3	7	85	8	1
WV9890-2	38	60	0	2
Snowden East	19	71	9	0

The yield of tubers (estimated ton/ac) of each chipping cultivar is shown by size category in Table 4. Marketable yield ranged from 14.1 ton/acre for FV15568-30 to 21.3 ton/ac for F11012 and FV15732-09.

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 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)
Atlantic East	0.7	16.3	9.7	0.0
Atlantic West	0.5	15.6	12.2	0.9
F11011	1.1	19.5	3.7	0.0
F11012	1.1	21.3	3.6	0.1
F11013	1.1	21.0	1.9	0.4
F11017	1.9	14.5	0.5	0.3
FV15568-30	0.7	14.1	3.4	0.1
FV15732-09	0.7	21.3	5.7	0.1
V08053-1	1.3	19.2	6.3	0.5
V1351-3	0.5	20.2	3.6	0.1
WV9890-2	4.1	21.0	0.4	1.2
Snowden East	1.3	17.3	4.9	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 each Atlantic

sample. Some tubers from each sample exhibited stem-end discoloration and this may be an indication that wilt organisms were present. Common scab lesions were noted on over 60% of the FV15568-30 tubers, 20% of FV15732-09 tubers and 36% of the V08053-1 tubers evaluated.

Results– French Fry Cultivars

Sample hills of each cultivar were dug for a field day August 27, 2015. Photos of the French fry cultivars are shown in Figure 3.



Figure 3. AAFC French fry cultivars at the CDCS field day August 27, 2015: a) F10008., b) F11009., c) F11001, d) F11004, e) F11005, f) F11006, g) F11007, h) CV08015-2, i) CV08032-1, j) CV08099-1, k) CV08104-5, l) CV08247-1, m) FV15223-09, n) V05060-2, o) V07087-1 (photo not available), p) Russet Burbank E, q) Russet Burbank W, r) Shepody E, and s) 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 19.5 ton/ac for CV08032-1 to 33.0 ton/ac for F11007. Specific gravity ranged from 1.060 for CV08015-2 to 1.083 for F10008 and CV08099-1.

Table 5: Estimated total yield (ton/acre) and specific gravity for each French fry cultivar grown at CDCS in Brooks, AB (approximately 209 lbs/ac nitrogen). Data shown is the mean of two replicates.

	Yield (ton/ac)	SG
F10008	26.2	1.083
F11009	29.9	1.071
F11001	28.8	1.072
F11004	31.3	1.071
F11005	27.3	1.071
F11006	30.3	1.073
F11007	33.0	1.066
CV08015-2	24.7	1.060
CV08032-1	19.5	1.070
CV08099-1	22.4	1.083
CV08104-5	30.6	1.077
CV08247-1	24.0	1.082
FV15223-09	24.3	1.077
V05060-2	21.4	1.075
V07087-1	20.3	1.073
R.Burbank East	27.7	1.068
R.Burbank West	27.2	1.068
Shepody East	30.3	1.072
Shepody West	32.1	1.067

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 209 lbs/ac. Data shown is the mean of two replicates.

	No. of <48mm	No. of 48 to 88mm	No. of > 88mm	No. of deformed
F10008	23	74	2	1
F11009	19	78	2	0
F11001	30	66	1	4
F11004	32	65	1	1
F11005	30	66	3	1
F11006	15	66	18	2
F11007	13	73	13	2
CV08015-2	23	74	1	2
CV08032-1	30	68	1	1
CV08099-1	30	65	3	2
CV08104-5	19	61	18	3
CV08247-1	26	73	0	1
FV15223-09	18	70	11	1
V05060-2	20	78	0	2
V07087-1	30	52	1	17
R.Burbank East	26	67	1	7
R.Burbank West	19	71	1	9
Shepody East	18	65	12	5
Shepody West	16	74	6	4

The yield of tubers (estimated ton/ac) of each chipping cultivar is shown by size category in Table 7. Yield of 48 – 88mm tubers ranged from 16.3 ton/ac of CV08032-1 to 25.7 ton/ac of F11004.

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 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)
F10008	1.3	22.2	2.0	0.7
F11009	2.2	25.1	1.9	0.3
F11001	2.8	23.6	0.9	1.5
F11004	3.3	25.7	1.5	0.7
F11005	3.4	21.5	5.5	0.8
F11006	0.5	17.8	11.5	0.7
F11007	0.7	22.0	9.6	0.7
CV08015-2	1.5	21.5	0.5	1.2

CV08032-1	2.1	16.3	0.9	0.3
CV08099-1	1.9	17.6	2.0	0.8
CV08104-5	1.4	24.6	3.2	1.4
CV08247-1	2.1	21.8	0.0	0.1
FV15223-09	0.5	18.1	5.6	0.1
V05060-2	1.4	19.4	0.0	0.6
V07087-1	1.9	12.6	0.6	5.2
R.Burbank East	2.6	22.2	0.6	2.3
R.Burbank West	1.2	21.1	0.9	4.0
Shepody East	1.1	19.1	7.9	2.2
Shepody West	1.2	24.2	4.6	2.1

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. Brown center was noted in one tuber of F11007, and several tubers of F10008 and Russet Burbank. Some tubers from each sample exhibited stem-end discoloration and this may indicate the presence of wilt organisms. Common scab lesions were only noted on one tuber of CV08104-5 and Russet Burbank and two tubers of FV15223-09.

Results – Fresh Market Cultivars

Sample hills of each cultivar were dug for a field day August 27, 2015. Photos of the yellow/white fresh market cultivars are shown in Figure 4.

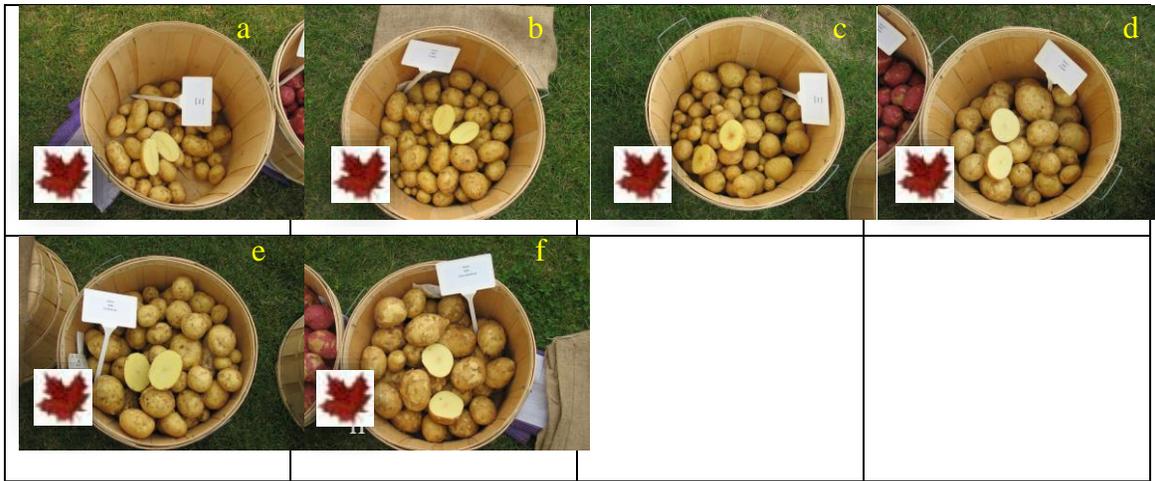


Figure 4. AAFC yellow/white fresh market cultivars at the CDCS field day August 27, 2015: a) F11021, b) F11036, c) F11037, d) F11044, e) FV15915-03, and f) Yukon Gold.

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

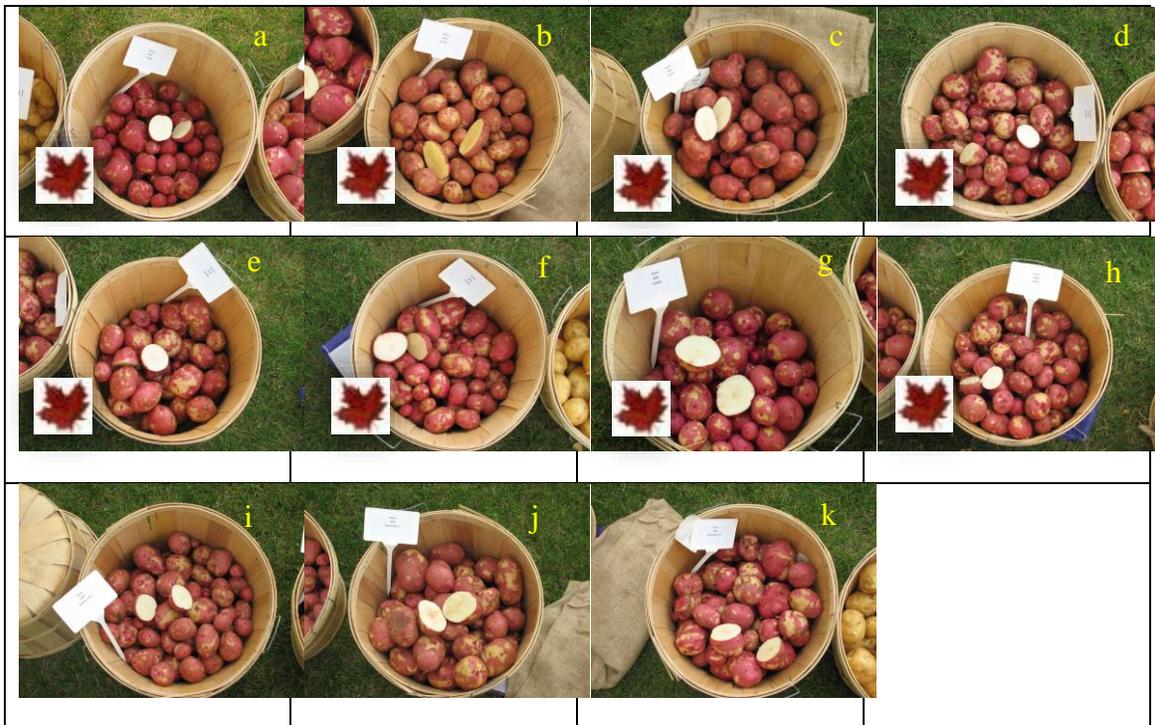


Figure 5. AAFC purple/red-skinned fresh market cultivars at the CDCS field day August 27, 2015: a) F11023, b) F11025, c) F11031, d) F11041, e) F11042, f) F11043, g) F11046, h) F11047, i) Chieftain, j) Norland E and k) Norland W.

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 CDCS in Brooks, AB (approximately 209 lbs/ac nitrogen). Data shown is the mean of two replicates.

	End Use	Yield (ton/ac)	SG
Yellow/white			
F11021	FM	24.4	1.061
F11036	FM	29.2	1.079
F11037	FM	29.4	1.077
F11044	FM	24.5	1.069
FV15915-03	FM	28.6	1.071
Yukon Gold East	FM CK	23.1	1.081
Red-skinned			
F11023	FM	27.4	1.063
F11025	FM	28.8	1.075
F11031	FM	31.3	1.074
F11041	FM	32.6	1.067
F11042	FM	29.5	1.062
F11043	FM	26.7	1.057
F11046	FM	29.1	1.074
F11047	FM	29.0	1.076
Chieftain	FM CK	35.7	1.064
Norland East	FM CK	29.4	1.065
Norland West	FM CK	27.2	1.064

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				
F11021	27	70	2	2
F11036	31	68	1	0
F11037	33	64	2	2
F11044	10	64	25	1
FV15915-03	34	65	1	0
Yukon Gold East	12	64	24	0
Red-skinned				
F11023	20	76	4	0
F11025	25	69	5	1
F11031	16	72	12	1
F11041	13	60	27	0
F11042	12	70	17	1
F11043	16	72	12	1
F11046	34	63	2	0
F11047	20	77	4	0
Chieftain	15	71	14	1
Norland East	11	71	18	0
Norland West	12	64	21	2

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				
F11021	1.5	15.2	1.1	0.5
F11036	3.5	27.0	1.1	0.0
F11037	2.5	22.0	1.6	0.9
F11044	0.4	13.6	11.9	0.3
FV15915-03	4.5	23.4	0.7	0.0
Yukon Gold East	0.4	12.3	10.3	0.0
Red-skinned				
F11023	1.8	23.4	2.8	0.0
F11025	1.9	21.6	3.6	0.3
F11031	0.9	21.6	8.2	0.3
F11041	0.7	14.6	16.4	0.0
F11042	0.6	20.6	10.9	0.6
F11043	0.8	18.7	6.6	0.2
F11046	3.2	20.7	2.3	0.0
F11047	1.6	25.0	2.8	0.0
Chieftain	1.2	24.7	9.4	0.4
Norland East	0.6	19.0	9.7	0.4
Norland West	0.6	15.5	10.5	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 or brown center was noted in at least one tuber of Chieftain, F11023, F110205, F11031, F11037 and several tubers of F11042. F10077 exhibited some purple pigmentation. Some tubers from each sample exhibited stem-end discoloration and this may indicate the presence of a wilt organism. Common scab lesions were only noted on one Norland tuber.

Conclusions

The 2015 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 9 chipping cultivars. Russet Burbank and Shepody were included in the trial as standard varieties to compare 15 French fry cultivars with. Yukon Gold, Chieftain and Norland were included in the trial as standard varieties to compare with 14 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 209 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.

References

- Love, S.L., 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.
- Westermann, D.T. 1993. Fertility management. In: Potato Health Management (R.C. Rowe, ed.). APS Press, St. Paul, MN. pp: 77-86.

Acknowledgements

Thank you to seasonal staff Mary-Lou Benci, Joanne Beecroft, Dustin Tillapaugh, Samantha Vogt, and Harlen Dahl for technical support throughout the trial. This project is generously funded through the Canadian Agri-Science Cluster for Horticulture 2, in partnership with Agriculture and Agri-Food Canada's AgriInnovation Program, a Growing Forward 2 initiative, the Canadian Horticultural Council, Alberta Agriculture and Forestry, the Potato Growers of Alberta and through cash and in-kind contributions from potato industry partners:

Alberta Seed Producers Inc.
ConAgra Foods, Lamb Weston Division
Edmonton Potato Growers
Little Potato Company
Old Dutch Foods
Parkland Seed Potatoes
Prairie Gold Produce
Solanum International Inc.
Tuberosum Technologies Inc.

Contact Information:

Michele Konschuh, Ph.D.
Potato Research Scientist
Alberta Agriculture and Forestry, CDCS
301 Horticultural Station Road East
Brooks, AB T1R 1E6
403-362-1314 phone
403-362-1306 fax
Michele.Konschuh@gov.ab.ca

and

Benoit Bizimungu, Ph.D.
Potato Breeder
Agriculture and Agri-Food Canada
Potato Research Centre
850 Lincoln Road P.O. Box 20280
Fredericton, NB E3B 4Z7
506-452-4880
506-452-3316
Benoit.Bizimungu@AGR.GC.CA

Appendix A Plot Plan

