

**Project Report**

**Alberta Potato Variety Development 2017  
CDCS, Brooks, AB**

*Fresh Market Potatoes*

Prepared for:  
Various Sponsors

Prepared by:

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

April 10, 2018

## 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. An ideal fresh market variety would produce a good yield of 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. 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.

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 Centre in Brooks, AB and were provided with 180 lbs/ac N and, if requested, 100 lbs/ac N. Alberta data is essential when selecting varieties appropriate for our climate, our customers and industry stakeholders.

## Objectives

- A. To evaluate potential new varieties for fresh market processing;
- B. To provide the potato industry an opportunity to assess varieties grown under local conditions;
- C. To compare varieties from several breeding programs (including AAFC) under Alberta conditions; and
- D. To determine the response of new fresh market varieties to nitrogen fertilizer rates.

## Materials and Methods

The variety evaluation was conducted in small plots at the Crop Diversification Centre South in Brooks, AB. Fertility for the low N plots (100 lbs/ac) was achieved through a combination of soil fertility (83 lbs/ac N; 253 lbs/ac P) and broadcast fertilizer (90 lbs/ac of 11-52-0) incorporated prior to planting. Low N plots received an additional top-dressing (15 lbs/ac of 46-0-0) at hilling, for a total of 100 lbs/ac N. Moderate N plots received an additional top-dressing (189 lbs/ac of 46-0-0) at hilling, for a total of 180 lbs/ac N. Within each level of nitrogen, varieties were planted in four replicate rows in a randomized complete block design along with standard varieties (Atlantic, AC Vigor and Monticello). Each block was planted adjacent to guard rows to reduce any edge effects (see plot plans, Appendix A).

Eptam 8E (1.8 L/ac) was applied prior to planting (May 4) to control weeds. Seed of standard cultivars was provided by Edmonton Potato Growers and seed of test cultivars was provided by each participant. Potatoes were planted May 30, 2017 (Low N Main) and May 29, 2017 (Moderate N Main) approximately 12 to 15cm deep using a two-row tuber unit planter. Seed was planted at 30cm spacing in 6m rows spaced 90cm apart. 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>
7 July	Ridomil Gold/Bravo	0.83L/ac
25 July	Quadris	324mL/ac



**Figure 1:** Variety evaluation trial at CDCS in Brooks, AB July 14, 2017.

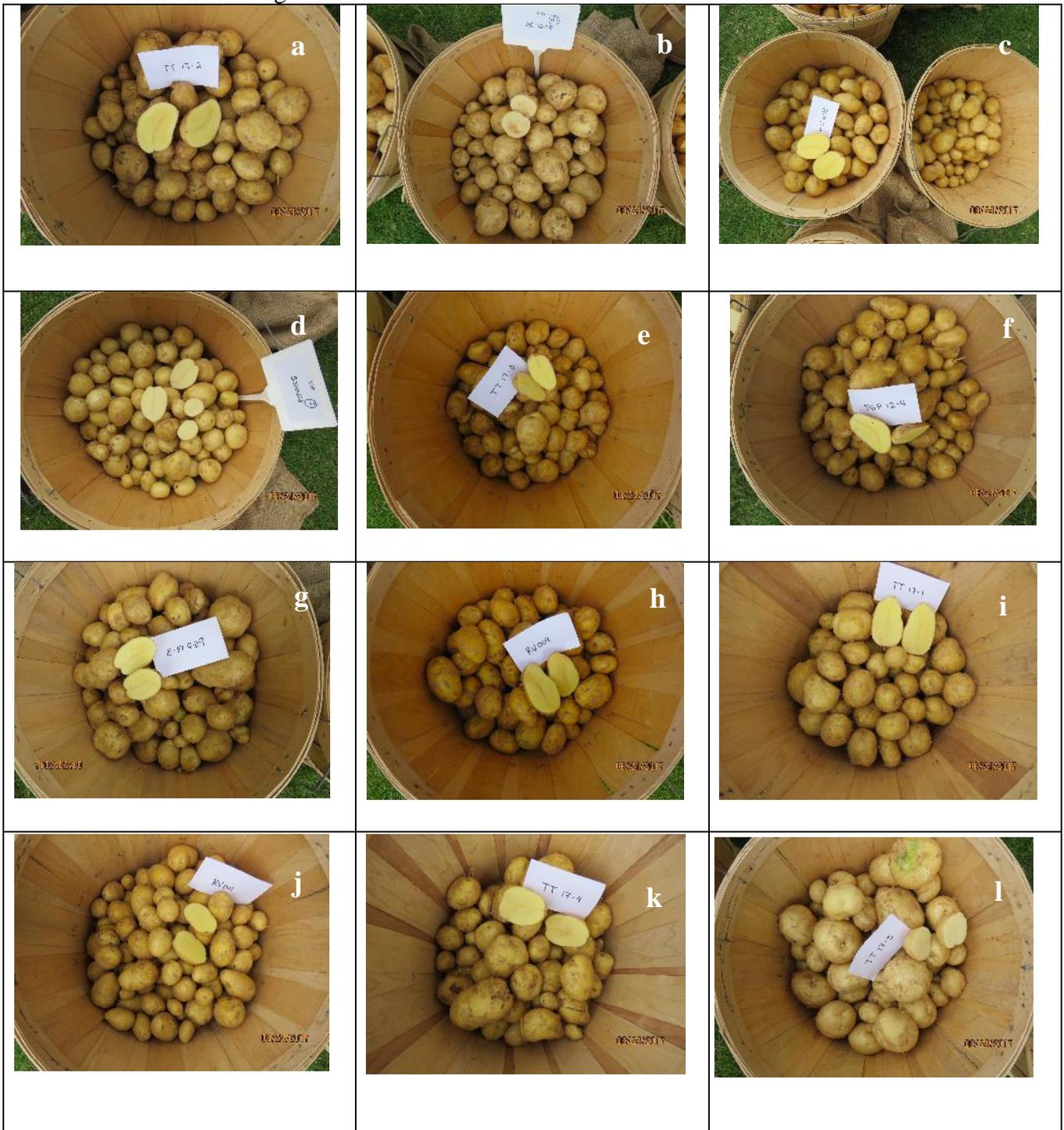
Reglone was applied (1.0 L/ac) September 1 to the Low N and Medium N plots. The Low N plots were harvested September 14 to 15, 2017 and Moderate N plots were harvested September 12 to 13 using a 1-row Grimme harvester.

Fresh market tubers were stored at 8°C until graded. Tubers were graded into size categories (less than 48mm, 48 to 88mm, over 88mm and deformed). A sample of twenty-five tubers (48 to 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 16 tubers (4 per rep) was stored at 8°C until culinary analyses were performed. Samples were evaluated for bake and boil by the Food Science and Technology Centre, Brooks, in November 2017.

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. T-tests were used to compare results for varieties grown at different levels of N.

Results and Discussion – Fresh Market

Sample hills of each yellow or white variety were dug for a field day at CDCS August 24, 2017. Photos of these varieties are shown in Figure 2.





**Figure 2.** Fresh market yellow or white varieties at CDCS field day August 24, 2017: a) TT17-2, b) AC Hamer, c) PGP17-1, d) Bonnata, e) TT17-3, f) PGP17-4, g) PGP17-3, h) RV009, i) TT17-1, j) RV011, k) TT17-4, l) TT17-5, m) Volare, n) Yellow Star, and o) Yukon Gold.

Sample hills of each red-skinned variety were dug for a field day at CDCS August 24, 2017. Photos of these varieties are shown in Figure 3.





**Figure 3.** Fresh market red-skinned varieties at CDCS field day August 24, 2017: a) EPG17-1, b) EPG17-4, c) EPG17-5, d) RV012, e) ASPI17-7, f) ASPI17-8, g) ASPI17-9, h) RV008, i) Cerata, j) PGP17-2, k) TT17-7, l) Norland, m) TT17-6, n) Red Apple, o) Rosa Gold, p) TT17-8, q) TT17-10, and r) TT17-9.

Yield data (total yield; ton/ac) and specific gravities of each of the yellow and white fresh market cultivars are shown in Table 2. Four cultivars were planted with little additional nitrogen and were harvested in August (Low N Early harvest). There were no statistical differences in total yield between cultivars in the early harvest. Specific gravity ranged between 1.061 for Volare and 1.089 for Yukon Gold.

Another ten cultivars were planted in low N plots (100 lbs/ac) and were harvested in September (Low N – main harvest). Total yield ranged from 16.4ton/ac for TT17-3 to 30.8 for PGP17-3 (Table 2). Specific gravities ranged from 1.078 for PGP17-4 to 1.123 for TT17-3.

Four cultivars were grown on a moderate level of N (180 lbs/ac) and harvested in September (Moderate N – main harvest). At this level of N, the total yield ranged from 22.8 ton/ac for Yukon Gold to 37.2 ton/ac for PGP17-1, although total yield is not always a good predictor of good marketable yield. Specific gravity of PGP17-1 was significantly lower than that of Yukon Gold, and other cultivars grown at moderate levels of N.

Yukon Gold was grown at two levels of N and harvested at two different times. Yukon Gold yielded better when grown at full season than when harvested early. Specific gravity of Yukon Gold was higher when harvested later. N level did not significantly affect yield or SG of Yukon Gold harvested in August or September in 2017 (Table 2).

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.

**Table 2:** Estimated total yield (ton/acre) and specific gravity for each **yellow or white** fresh market variety grown on approximately 180lbs/ac nitrogen (Moderate N) and 100 lbs/ac nitrogen (Early and Low N). 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.

CDCS	Yield (ton/ac)	SG
<i>Early harvest</i>		
Arizona	10.7 a	1.069 c
Volare	18.8 a	1.061 d
Yellow Star	16.7 a	1.082 b
Yukon Gold (Mod N)	12.8 a‡	1.089 a
Yukon Gold (Low N)	11.6 a‡	1.088 ab‡
<i>Low N – main harvest</i>		
TT17-2	23.2 b-e	1.089 bcd
TT17-3	16.4 e	1.123 a
PGP17-4	26.2 a-d	1.078 de
PGP17-3	30.8 ab	1.096 b
RV009	25.3 a-e	1.096 b
TT17-1	22.1 b-e	1.081 de
RV011	28.3 abc	1.086 b-e
TT17-4	21.4 b-e	1.087 b-e
TT17-5	29.9 abc	1.087 b-e
Yukon Gold	22.9 b‡	1.095 bc‡
<i>Moderate N – main harvest</i>		
AC Hamer	25.0 bc	1.094 b
PGP17-1	37.2 a	1.079 fg
Bonnata	31.8 abc	1.090 bcd‡
Yukon Gold	22.8 bc‡	1.092 bc

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

‡ Data between the early and main harvest plots was statistically different at the  $p \leq 0.05$  level.

Four cultivars were grown on low N (100 lbs/ac) and harvested in August (Early – Low N). There were no significant differences in total yield between these cultivars. Specific gravity of EPG17-5 was significantly higher than that of other cultivars harvest in August.

Yield data (total yield; ton/ac) and specific gravities of each of the red-skinned fresh market cultivars are shown in Table 3. Ten cultivars were planted in low N plots (100 lbs/ac) and were harvested in September (Low N – main harvest). Total yield ranged from 18.0 ton/ac for TT17-6 to 29.9 for Norland (Table 3). Specific gravities ranged from 1.076 for TT17-8 to 1.094 for TT17-7 and AR207-04.

Eleven cultivars were grown on a moderate level of N (180 lbs/ac) and harvested in September (Moderate N – main harvest). At this level of N, the total yield ranged from 24.6 ton/ac for EPG17-4 to 32.8 ton/ac for Norland. Specific gravities ranged from 1.071 for Norland to 1.108 for ASPI17-5.

Norland was grown at both levels of N and in Early and Late harvested trials. Yield of Norland was statistically higher when harvested in September rather than August. Specific gravity of Norland was higher in the later harvested material than when harvested in August. Total yield of Norland harvested in September was not statistically affected by N level, but SG was significantly higher when grown on low N compared to the moderate level of N (Table 3).

**Table 3:** Estimated total yield (ton/acre) and specific gravity for each **red-skinned** fresh market variety grown on approximately 180 lbs/ac nitrogen (Moderate N) and 100 lbs/ac nitrogen (Early and Low N). 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.

CDCS	Yield (ton/ac)	SG
<i>Early harvest</i>		
EPG17-1	14.5 a	1.073 c
EPG17-4	12.5 a	1.071 c
EPG17-5	14.7 a	1.086 ab
Norland	18.0 a‡	1.073 c‡
<i>Low N – main harvest</i>		
ASPI17-7	26.3 a-d	1.094 bc
ASPI17-8	24.4 a-d	1.089 bcd
RV008	28.5 bca	1.082 de
PGP17-2	33.5 a	1.078 de
TT17-7	22.1 b-e	1.094 bc
Norland	29.9 abc‡	1.084 cde‡
TT17-6	18.0 de	1.086 b-e
TT17-8	20.6 cde	1.076 e
TT17-10	23.6 b-e	1.089 bcd
TT17-9	27.7 abc	1.085 b-e
<i>Moderate N – main harvest</i>		
EPG17-1	32.0 abc	1.075 gh
EPG17-4	24.6 bc	1.073 gh
EPG17-5	25.3 bc	1.086 c-f
ASPI17-5	31.6 abc	1.108 a
RV012	28.2 abc	1.088 b-e
ASPI17-7	31.0 abc	1.088 b-e
ASPI17-8	27.7 abc	1.084 def
ASPI17-9	29.2 abc	1.087 b-e
Cerata	28.8 abc	1.080 efg
Norland	32.8 ab	1.071 h‡
Red Apple	28.8 abc	1.085 c-f

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

‡ Data between the early and main harvest plots was statistically different at the  $p \leq 0.05$  level.

The mean percentage of total tuber number in each size category for yellow and white cultivars is shown in Table 4. Of the four cultivars grown on low N and harvested in August, produced mostly small (<48mm) and marketable (48 to 88mm) tubers as expected. The percentage of Arizona and Volare tubers in various size categories were not statistically different from Yukon Gold. Yellow Star produced a significantly lower percentage of tubers 48 to 88 mm than Arizona and Yukon Gold, and a significantly higher percentage of tubers under 48mm than Arizona, Volare and Yukon Gold. Arizona and Volare produced a significantly higher percentage of jumbo (> 88mm) tubers than the other cultivars grown in these plots.

Of the ten yellow and white cultivars grown on low N for the full season, RV011 and PGP17-4 produced a greater percentage of tubers under 48mm in diameter than Yukon Gold (Table 4). TT17-5 and Yukon Gold produced a significantly higher percentage of tubers over 88mm than other cultivars from the low N full season plots.

At a moderate level of N, most of the cultivars produced a higher percentage of small tubers than Yukon Gold and a lower percentage of marketable and jumbo tubers (Table 4).

Yukon Gold was grown at low and moderate N for the early and the full season plots. The only statistical difference observed for these cultivars was that Yukon Gold produced a significantly higher percentage of tubers under 48mm when grown at a lower N and a correspondingly higher percentage of 48 to 88 mm tubers at the moderate level of N (Table 4).

**Table 4:** Percentage of total tuber number in each size category (< 48mm, 48-88mm, > 88mm and deformed) for each fresh market yellow or white variety grown on moderate nitrogen (approximately 180 lbs/ac) and 100 lbs/ac nitrogen (Early and Low N). 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.

CDCS	< 48 mm	48 – 88mm	> 88mm	Deformed
<i>Early harvest</i>				
Arizona	42.5 b	54.8 a	2.8 a	0.0 a
Volare	37.5 b	60.8 a	1.5 a	0.0 a
Yellow Star	75.8 a	24.3 b	0.0 b	0.3 a
Yukon Gold (Mod N)	46.3 b¥	53.8 a	0.3 b¥	0.0 a¥
Yukon Gold (Low N)	43.7 b¥	55.8 a	0.3 b¥	0.3 a¥
<i>Low N – main harvest</i>				
TT17-2	33.3 b-f	65.8 ab	0.5 b	0.3 ab
TT17-3	39.5 bcd	57.3 ab	0.0 b	3.3 ab
PGP17-4	45.0 bc	51.8 b	0.0 b	3.0 ab
PGP17-3	40.8 bcd	57.3 ab	0.8 b	1.5 ab
RV009	37.8 bcd	62.3 ab	0.0 b	0.0 b
TT17-1	37.0 b-e	59.5 ab	1.0 b	2.5 ab
RV011	46.5 bc	53.0 b	0.0 b	0.5 ab
TT17-4	34.0 b-f	64.5 ab	2.5 b	1.3 ab
TT17-5	19.8 ef	68.5 ab	9.0 a	2.5 ab
Yukon Gold	22.8 def‡¥	62.0 ab‡	10.8 a¥	4.5 a¥
<i>Moderate N – main harvest</i>				
AC Hamer	50.0 b	47.5 e	1.0 c	1.5 ab
PGP17-1	41.2 bcd	58.0 b-e	0.0 c	0.5 ab
Bonnata	35.0 b-f	64.3 a-d	0.5 c	0.5 ab
Yukon Gold	14.5 g‡¥	74.8 a‡	8.8 a¥	2.3 ab¥

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

¥ Data between the early and main harvest plots was statistically different at the  $p \leq 0.05$  level.

The mean percentage of total tuber number in each size category for red-skinned cultivars is shown in Table 5. EPG17-5 produced a significantly higher percentage of potatoes under 48mm in the early harvested plots indicating the potential for creamer potato production.

On low N, the majority of cultivars tested produced over 50% of the tubers in the middle-size category (48 to 88), but TT17-7 yielded a significantly higher percentage of small tubers.

At the moderate level of N, there were statistical differences in the percentage of tubers in each size category, (Table 5). Red Apple produced a significantly higher percentage of small potatoes than any other cultivar. EPG17-1, EPG17-4, Cerata and Norland produced a greater percentage of medium-sized tubers and Norland produced the highest percentage of jumbo (> 88mm) tubers on moderate N.

EPG17-1, EPG17-4, EPG17-5, and Norland were harvested in early and full-season plots. The length of growing season significantly affected the percentage of EPG17-1 tubers in the medium, jumbo and deformed categories. A greater percentage of tubers in the larger categories were harvested from the full-season plots. For EPG17-4, significantly fewer tubers were small in the full-season plots and significantly more tubers were jumbo in the full-season when compared to the early harvested plots. EPG17-5 produced significantly fewer small tubers and significantly more medium sized tubers when grown full season than when harvested early.

ASPI17-7, ASPI17-8, and Norland were grown full-season at both levels of N. There were no significant differences in the percentage of ASPI17-7 tubers in each size category as a result of the different N fertility, ASPI17-8 produced a higher percentage of small tubers on moderate N than on low N, and Norland produced a significantly greater percentage of jumbo tubers on moderate N than low N (Table 5).

**Table 5:** Percentage of total tuber number in each size category (< 48mm, 48-88mm, > 88mm and deformed) for each fresh market red-skinned variety grown on moderate nitrogen (approximately 180 lbs/ac) and 100 lbs/ac nitrogen (Early and Low N). 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.

CDCS	< 48 mm	49 – 88mm	> 88mm	Deformed
<i>Early harvest</i>				
EPG17-1	55.0 b	44.5 a¥	0.3 b¥	0.3 a¥
EPG17-4	40.5 b¥	58.5 a	0.0 b¥	1.3 a
EPG17-5	81.8 a¥	18.3 b¥	0.0 b	0.0 a
Norland	46.5 b¥	53.5 a¥	0.0 b¥	0.0 a¥
<i>Low N – main harvest</i>				
ASPI17-7	35.5 b-f	62.8 ab	1.0 b	0.5 ab
ASPI17-8	35.0 b-f	62.0 ab	1.3 b	1.8 ab
RV008	30.5 b-f	66.8 ab	1.0 b	1.3 ab
PGP17-2	28.3 c-f	69.6 ab	1.3 b	1.0 ab
TT17-7	79.0 a	19.8 c	0.0 b	0.8 ab
Norland	19.3 f	75.3 a	3.3 b‡	2.3 ab‡
TT17-6	38.3 bcd	58.8 ab	1.0 b	2.0 ab
TT17-8	42.3 bc	55.8 b	0.3 b	2.3 ab
TT17-10	47.5 b	52.5 b	0.0 b	0.0 b
TT17-9	45.2 bc	53.3 b	0.3 b	1.3 ab
<i>Moderate N – main harvest</i>				
EPG17-1	25.3 efg	71.3 ab¥	2.8 bc¥	0.8 ab¥
EPG17-4	26.0 efg¥	68.3 abc	5.3 b¥	0.8 ab
EPG17-5	48.3 bc¥	50.7 de¥	0.3 c	0.3 ab
ASPI17-5	33.5 c-f	65.0 a-d	1.0 c	0.5 ab
RV012	42.3 bcd	57.3 b-e	0.3 c	0.0 b
ASPI17-7	36.8 b-e	61.5 a-e	1.0 c	0.8 ab
ASPI17-8	46.8 bc	52.8 c-e	0.5 c	0.0 b
ASPI17-9	39.0 b-e	59.8 a-e	0.5 c	0.0 b
Cerata	27.3 d-g	71.3 ab	1.5 c	0.3 ab
Norland	20.8 fg¥	70.0 ab¥	9.3 a¥	0.3 ab¥
Red Apple	68.0 a	29.3 f	0.0 c	2.8 a
Rosa Gold	42.0 bcd	57.0 b-e	0.5 c	0.5 ab

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

¥ Data between the early and main harvest plots was statistically different at the  $p \leq 0.05$  level.

The yield of tubers (estimated ton/ac) of each yellow or white variety is shown by size category in Table 6. There were significant differences in yield by size category between the four cultivars grown in the Low N plots and harvested in August. Yellow Star yielded significantly more tubers under 48mm in diameter than other cultivars in these plots.

For varieties grown on low N and harvested in September, a significantly greater yield of tubers under 48mm for cultivars such as PGP17-4 and RV011, suggest that these may be suitable for marketing in more than one size category. Yield of tubers 48 to 88mm ranged from 12.6 ton/ac for TT17-7 to 24.2 ton/ac for PGP17-3 (Table 6). Yield of marketable PGP17-3 was significantly greater than that of Yukon Gold, but not significantly different from the other cultivars. TT17-5 and Yukon Gold produced significantly greater yield of tubers over 88mm than other cultivars in these plots.

Four yellow or white cultivars were grown on moderate N and harvested in September. Yield of tubers under 48mm ranged from 0.9 ton/ac for Yukon Gold to 6.7 ton/ac of PGP17-1 (Table 6). Yield of 48 – 88mm tubers ranged from 1536 ton/ac of Yukon Gold to 30.1 ton/ac of PGP17-1.

Yukon Gold was grown in early and full season plots at both levels of N. Yukon Gold yielded significantly more tubers in all categories when grown full season compared to early harvest (Table 6). Yield of Yukon Gold tubers seemed unaffected by the level of N within a particular harvest window.

**Table 6:** Estimated yield (ton/ac) in each size category (< 4 oz, 4 to 6 oz, 6 to 10 oz, > 10 oz, and deformed) for each fresh market yellow or white variety grown on moderate nitrogen (approximately 180 lbs/ac) and at a lower rate of N (100 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.

CDCS	< 48 mm	48 – 88mm	> 88mm	Deformed
<i>Early harvest</i>				
Arizona	1.5 c	7.7 ab	1.4 a	0.0 a
Volare	3.0 bc	14.9 a	1.0 a	0.0 a
Yellow Star	9.3 a	7.4 ab	0.0 a	0.0 a
Yukon Gold (Mod N)	2.7 bc	10.0 ab	0.1 a	0.0 a
Yukon Gold (Low N)	2.4 c‡	9.1 ab‡	0.1 a‡	0.1 a
<i>Low N – main harvest</i>				
TT17-2	3.3 e-h	19.2 bcd	0.5 b	0.1 a
TT17-3	3.1 e-h	12.6 de	0.1 b	0.6 a
PGP17-4	6.2 bc	18.6 bcd	0.2 b	1.3 a
PGP17-3	5.3 b-e	24.2 ab	0.8 b	0.5 a
RV009	5.1 b-f	20.2 bcd	0.0 b	0.1 a
TT17-1	2.5 gh	17.6 bcd	1.3 b	0.7 a
RV011	6.9 b	20.9 a-d	0.1 b	0.4 a
TT17-4	2.7 fgh	18.1 bcd	0.2 b	0.4 a
TT17-5	1.4 h	20.4 bcd	7.5 a	0.6 a
Yukon Gold	1.2 h‡	14.3 cde‡	6.2 a‡	1.1 a
<i>Moderate N – main harvest</i>				
AC Hamer	5.1 bc	18.2 bcd	1.2 de	0.5 b
PGP17-1	6.7 b	30.1 a	0.2 e	0.3 b
Bonnata	4.5 bcd	26.5 ab	0.5 e	0.2 b
Yukon Gold	0.9 e	15.6 de	4.9 ab	0.5 b

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

‡ Data between the early and main harvest plots was statistically different at the  $p \leq 0.05$  level.

EPG17-1, EPG17-4, EPG17-5 and Norland were grown in early harvest plots as well as full season plots. EPG17-1 and Norland yielded significantly better in all size categories on full season plots than on early harvested plots (Table 7). For EPG17-4 and EPG17-5 yield of middle-sized tubers was greater in full season plots.

Red-skinned potatoes were grown on low N, moderate N or both and harvested in September. Yield results by size category are shown in Table 7. On low N, TT17-7 produced a significantly higher yield of tubers under 48mm than other cultivars and significantly lower yield of tubers 48 to 88mm in diameter. Marketable yield of other cultivars were not significantly different from one another at this level of N.

On moderate N, Red Apple yielded significantly higher yield of tubers under 48mm. Norland yielded significantly greater yield of jumbo tubers (Table 7). Marketable tubers ranged from 15.6 ton/ac for Red Apple-15 to 27.0 ton/ac for ASPI17-5.

ASPI17-7, ASPI17-8 and Norland were grown at both level of N. Norland yielded more jumbo tubers on moderate N than on low N. ASPI17-8 yielded more small tubers when grown at moderate N than low N (Table 7).

**Table 7:** Estimated yield (ton/ac) in each size category (< 4 oz, 4 to 6 oz, 6 to 10 oz, > 10 oz, and deformed) for each fresh market red-skinned variety grown on moderate nitrogen (approximately 180 lbs/ac) and at a lower rate of N (100 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.

CDCS	< 48 mm	48 – 88mm	> 88mm	Deformed
<i>Early harvest</i>				
EPG17-1	4.3 b¥	9.9 ab¥	0.2 a¥	0.1 a
EPG17-4	2.2 c	10.2 ab¥	0.0 a¥	0.1 a
EPG17-5	9.2 a	5.4 b¥	0.0 a¥	0.0 a
Norland	4.4 b¥	13.6 ab¥	0.0 a¥	0.0 a¥
<i>Low N – main harvest</i>				
ASPI17-7	3.6 d-h	21.6 abc	1.0 b	0.1 a
ASPI17-8	3.4 d-h†	19.8 bcd	1.0 b	0.2 a
RV008	2.8 fgh	23.9 ab	1.2 b	0.6 a
PGP17-2	3.2 e-h	28.7 a	1.2 b	0.3 a
TT17-7	13.9 a	8.0 e	0.0 b	0.1 a
Norland	1.5 h¥	24.9 ab¥	2.6 b¥†	0.8 a¥
TT17-6	2.9 fgh	14.0 cde	0.6 b	0.5 a
TT17-8	4.0 c-g	15.5 cde	0.3 b	0.8 a
TT17-10	5.8 bcd	17.8 bcd	0.0 b	0.0 a
TT17-9	5.7 bcd	21.0 abc	0.4 b	0.6 a
<i>Moderate N – main harvest</i>				
EPG17-1	2.7 cde¥	25.9 abc¥	2.8 cd¥	0.5 b
EPG17-4	1.8 cde	19.3 bcd¥	3.3 bc¥	0.2 b
EPG17-5	6.3 b	18.5 bcd¥	0.3 e¥	0.2 b
ASPI17-5	3.6 b-e	27.0 ab	0.9 de	0.1 b
RV012	4.4 bcd	23.6 a-d	0.2 e	0.0 b
ASPI17-7	4.2 b-e	25.4 abc	1.2 de	0.2 b
ASPI17-8	6.3 b†	21.0 a-d	0.5 e	0.0 b
ASPI17-9	4.1 b-e	24.5 a-d	0.6 e	0.0 b
Cerata	2.4 cde	24.9 a-d	1.4 cde	0.1 b
Norland	1.5 de	24.7 a-d	6.6 a†	0.1 b
Red Apple	11.6 a	15.6 d	0.1 e	1.5 a
Rosa Gold	3.8 b-e	17.0 cd	0.5 e	0.2 b

Tuber samples used to measure specific gravity were evaluated for hollow heart, brown center, stem-end discoloration, other types of internal necrosis, scab and black scurf. For cultivars grown on low N and harvested in August, very few tubers exhibited internal defects. For tubers grown on low N and harvested in September, a few tubers exhibited stem-end discoloration and vascular discoloration, but tubers were not tested for wilt organisms. At the moderate rate of N, many of the samples had some level of stem-end discoloration or vascular discoloration but tubers were not tested for wilt organisms. Black scurf was noted on several cultivars, such as Yukon Gold, PGP17-4 and Bonnata, however no seed treatment was used in the trial.

Red Apple had some anthocyanin pigment in the flesh of some tubers. PGP17-2 broke dormancy in December and would need sprout inhibition to store longer. At the low and the moderate rate of N, many of the samples had some level of stem-end discoloration or vascular discoloration but tubers were not tested for wilt organisms. Black scurf was noted on a number of red-skinned tubers, such as EPG17-4, EPG17-1, EPG17-5, ASPI17-7, ASPI17-8 and Norland, however, no seed treatment was used in the trial.

Subjective assessments of yellow and white tubers are shown in Table 8. For the early harvested trial on low N, there were no significant differences in uniformity of size or overall appearance. RV011, PGP17-3 and RV009 scored significantly better than Yukon Gold for uniformity of size and overall appearance when grown on low N. Bonnata scored higher than Yukon Gold for uniformity of size and Bonnata and PGP17-1 scored higher than Yukon Gold for overall appearance when grown on moderate N.

**Table 8:** Subjective tuber assessments for each fresh market yellow or white variety: 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 <sup>1</sup>	Overall Appearance <sup>2</sup>
<i>Early harvest</i>		
Arizona	2.00 a	4.3 a
Volare	2.00 a	3.5 ab
Yellow Star	2.00 a	3.8 ab
Yukon Gold (Mod N)	2.00 a	3.0 ab
Yukon Gold (Low N)	2.00 a	4.3 a†
<i>Low N – main harvest</i>		
TT17-2	3.50 ab	3.75 ab
TT17-3	2.25 b	2.25 d
PGP17-4	3.00 ab	3.25 a-d
PGP17-3	3.75 a	3.50 abc
RV009	4.00 a	3.75 ab
TT17-1	2.75 ab	3.00 a-d
RV011	3.75 a	4.00 a
TT17-4	2.75 ab	2.50 cd
TT17-5	2.75 ab	2.75 bcd
Yukon Gold	2.25 b	2.25 d†
<i>Moderate N – main harvest</i>		
AC Hamer	3.00 abc	3.00 ab
PGP17-1	3.25 abc	4.00 a
Bonnata	3.75 ab	3.75 a
Yukon Gold	2.0 c	2.25 b

<sup>1</sup>Uniformity of Size: 1 (very variable) - 5 (very uniform)

<sup>2</sup>Overall Appearance: 1 (very poor) - 5 (outstanding)

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

Subjective assessments of red-skinned cultivars are shown in Table 9. In the early harvest plots, there were no significant differences between cultivars for uniformity of size or overall appearance. At the low rate of N, there was no significant difference between cultivars for uniformity of size. TT17-10 rated highest for overall appearance. At the moderate rate of N, EPG17-5 rated higher than Norland for uniformity of size and EPG17-5 and Red Apple were rated highest for overall appearance.

**Table 9:** Subjective tuber assessments for each fresh market red-skinned variety: 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 <sup>1</sup>	Overall Appearance <sup>2</sup>
<i>Early harvest</i>		
EPG17-1	4.00 a	3.0 ab
EPG17-4	4.00 a	3.5 ab
EPG17-5	4.00 a	3.8 ab
Norland	4.00 a	2.3 b†
<i>Low N – main harvest</i>		
ASPI17-7	3.00 ab	3.00 a-d
ASPI17-8	3.25 ab	3.00 a-d
RV008	3.00 ab	3.25 a-d
PGP17-2	3.00 ab	3.00 a-d
TT17-7	3.00 ab	3.25 a-d
Norland	3.00 ab	3.00 a-d†
TT17-6	3.00 ab	3.25 a-d
TT17-8	3.50 ab	2.75 bcd
TT17-10	4.00 a	4.00 a
TT17-9	3.25 ab	3.50 abc
<i>Moderate N – main harvest</i>		
EPG17-1	3.25 abc	3.25 ab
EPG17-4	3.00 abc	3.50 a
EPG17-5	4.33 a	4.00 a
ASPI17-5	3.25 abc	3.75 a
RV012	3.67 ab	3.33 ab
ASPI17-7	3.00 abc	3.25 ab
ASPI17-8	3.00 abc	3.00 ab
ASPI17-9	3.50 abc	2.75 ab
Cerata	3.50 abc	3.25 ab
Norland	2.50 bc	3.00 ab
Red Apple	3.50 abc	4.00 a
Rosa Gold	3.00 abc	2.75 ab

<sup>1</sup> Uniformity of Size: 1 (very variable) - 5 (very uniform)

<sup>2</sup> Overall Appearance: 1 (very poor) - 5 (outstanding)

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

Culinary evaluations were conducted on all cultivars in the trial. Results for the yellow and white cultivars are presented in Table 10. There was variation in flesh colour and tuber texture noted after boiling and baking samples. Moderate sloughing was observed after boiling Yukon Gold grown on moderate N and for PGP17-3, and TT17-5 grown on low N. Yukon Gold TT17-3 grown on low N exhibited severe sloughing. No after cooking discoloration was observed for any of the cultivars in the trial..

**Table 10:** Culinary evaluations of each yellow or white fresh market variety grown on moderate nitrogen (approximately 180lbs/ac) and low nitrogen (approximately 100lbs/ac) at CDCS. Data shown is the mean of duplicate analyses of a composite sample.

**Boiled Potatoes**

CDCS	Flesh color	Waxiness†	Sloughing	After Cooking Discoloration*
<i>Early harvest</i>				
Arizona	Yellow	1	3	3
Volare	White	1	3	3
Yellow Star	Yellow	2	3	3
Yukon Gold (Mod N)	Yellow	4	2	3
Yukon Gold (Low N)	Yellow	4	3	3
<i>Low N – main harvest</i>				
TT17-2	Yellow	2	3	3
TT17-3	Yellow	4	1	3
PGP17-4	Yellow	2	3	3
PGP17-3	Yellow	4	2	3
RV009	Deep Yellow	3	3	3
TT17-1	Deep Yellow	2	3	3
RV011	Deep Yellow	3	3	3
TT17-4	Deep Yellow	2	3	3
TT17-5	Off-white	4	2	3
Yukon Gold	Yellow	4	1	3
<i>Moderate N – main harvest</i>				
AC Hamer	Off-white	3	3	3
PGP17-1	Deep Yellow	1	3	3
Bonnata	Yellow	2	3	3
Yukon Gold	Yellow	4	2	3

† 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)

\* After Cooking discoloration and sloughing: 1 = severe; 2 = moderate; 3 = none

**Table 10 continued.****Baked Potatoes**

CDCS	Flesh color	Texture*	After Cooking Discoloration†
<i>Early harvest</i>			
Arizona	Yellow	2	3
Volare	Yellow	1	3
Yellow Star	Yellow	3	3
Yukon Gold (Mod N)	Yellow	3	3
Yukon Gold (Low N)	Yellow	3	3
<i>Low N – main harvest</i>			
TT17-2	Yellow	1	3
TT17-3	Yellow	3	3
PGP17-4	Deep Yellow	2	3
PGP17-3	Yellow	3	3
RV009	Deep Yellow	3	3
TT17-1	Deep Yellow	2	3
RV011	Deep Yellow	2	3
TT17-4	Yellow	2	3
TT17-5	Off-white	2	3
Yukon Gold	Yellow	3	3
<i>Moderate N – main harvest</i>			
AC Hamer	Off-white	3	3
PGP17-1	Deep Yellow	2	3
Bonnata	Yellow	2	3
Yukon Gold	Yellow	3	3

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

† After Cooking discoloration: 1 = severe; 2 = moderate; 3 = none

Results of the culinary evaluation of red-skinned cultivars are presented in Table 11. Flesh colour and texture differences were noted after boiling and baking. Moderate sloughing was observed for ASPI17-7, TT17-7 and TT-11-012/2012-01 grown on low N. No after cooking discoloration was noted for any of the red-skinned cultivars in the trial after boiling or baking.

**Table 11:** Culinary evaluations of each yellow or white fresh market variety grown on moderate nitrogen (approximately 180lbs/ac) and low nitrogen (approximately 100lbs/ac) at CDCS. Data shown is the mean of duplicate analyses of a composite sample.

<b>Boiled Potatoes</b>				
CDCS	Flesh color	Waxiness†	Sloughing	After Cooking Discoloration*
<i>Early harvest</i>				
EPG17-1	Off-white	3	3	3
EPG17-4	Off-white	1	3	3
EPG17-5	Off-white	2	3	3
Norland	Off-white	2	3	3
<i>Low N – main harvest</i>				
ASPI17-7	Off-white	4	2	3
ASPI17-8	Off-white	3	3	3
RV008	Deep Yellow	3	3	3
PGP17-2	Off-white	2	3	3
TT17-7	Yellow	4	2	3
Norland	Off-white	2	3	3
TT17-6	Off-white	2	3	3
TT17-8	Yellow	2	3	3
TT17-10	Yellow	3	2	3
TT17-9	White	1	3	3
<i>Moderate N – main harvest</i>				
EPG17-1	Off-white	3	3	3
EPG17-4	Off-white	1	3	3
EPG17-5	Off-white	2	3	3
ASPI17-5	Yellow	4	3	3
RV012	Off-white	4	3	3
ASPI17-7	Off-white	4	3	3
ASPI17-8	Off-white	2	3	3
ASPI17-9	Off-white	3	3	3
Cerata	Off-white	3	3	3
Norland	Off-white	2	3	3
Red Apple	Yellow	2	3	3

† 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)

\* After Cooking discoloration and sloughing: 1 = severe; 2 = moderate; 3 = none

**Table 11 continued.****Baked Potatoes**

CDCS	Flesh color	Texture*	After Cooking Discoloration†
<i>Early harvest</i>			
EPG17-1	Off-white	3	3
EPG17-4	Off-white	2	3
EPG17-5	Off-white	2	3
Norland	Off-white	1	3
<i>Low N – main harvest</i>			
ASPI17-7	Off-white	1	3
ASPI17-8	Off-white	2	3
RV008	Deep Yellow	2	3
PGP17-2	White	2	3
TT17-7	Yellow	2	3
Norland	Off-white	1	3
TT17-6	Off-white	2	3
TT17-8	Deep Yellow	2	3
TT17-10	Off-white	2	3
TT17-9	Off-white	2	3
<i>Moderate N – main harvest</i>			
EPG17-1	Yellow	3	3
EPG17-4	Off-white	2	3
EPG17-5	Yellow	2	3
ASPI17-5	Yellow	3	3
RV012	Off-white	3	3
ASPI17-7	Off-white	3	3
ASPI17-8	Off-white	2	3
ASPI17-9	Off-white	3	3
Cerata	Off-white	2	3
Norland	Off-white	2	3
Red Apple	Yellow	2	3

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

† After Cooking discoloration: 1 = severe; 2 = moderate; 3 = none

**Conclusions**

The 2017 variety trial included 16 yellow or white potato cultivars and 18 red-skinned potato cultivars with fresh market potential in southern Alberta. Yukon Gold was included in the trial as a check variety for early harvested cultivars grown on low N and full-season standards at both rates of N. For early harvested cultivars on low N, Yellow Star produced the highest yield of creamer sized potatoes. Volare produced the greatest yield of medium sized tubers from early harvested plots. In the full season plots grown on low N, PGP17-3 produced the greatest yield of medium sized tubers. At the moderate rate of N, PGP17-1 yielded very well compared to other white and yellow entries. Arizona, Yukon Gold (early on low N), RV011, and PGP17-1 scored very well for overall appearance. Many cultivars had different culinary attributes that will need to be considered when developing a marketing approach. A few cultivars in the trial had issues with sloughing and internal defects, but none showed after-cooking darkening.

Yukon Gold was grown at more than one level of N. Although the level of N affected the percentage of tubers in small and medium categories, yield was not significantly affected by N level in 2017.

Norland was included in the trial at both levels of N as a check in the early harvested trial. In the early harvested plots, EPG17-5 produced the greatest yield of creamer sized red potatoes. In the low N full season plots, PGP17-2 produced the greatest yield of medium sized red tubers, but not statistically more than Norland. ASPI17-5 yielded the greatest of the red cultivars at the moderate rate of N, however, none of the red entries yielded significantly more than Norland. TT17-10, EPG17-5, and Red Apple scored very well for overall appearance. Many of the red-skinned cultivars had different culinary attributes that will need to be considered when developing a marketing approach. A few cultivars in the trial had issues with sloughing and internal defects but none showed after-cooking darkening.

Norland was grown at both levels of N. Only the yield of jumbo tubers was significantly affected by the N level.

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.

#### Recommendations

- Varieties should be grown in southern Alberta for at least 3 years and these results need to be compiled to ensure a reasonable evaluation.
- 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.).

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## Acknowledgements

Thank you to seasonal staff Mary-Lou Benci, William Lai, Rebecca Pemberton, Kaylene MacKinnon and Anneliese Gietz 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 Agri-Innovation 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  
McCain Foods  
Parkland Seed Potatoes  
Prairie Gold Produce  
Rockyview Seed Potatoes  
Solanum International Inc.  
Tuberosum Technologies Inc.

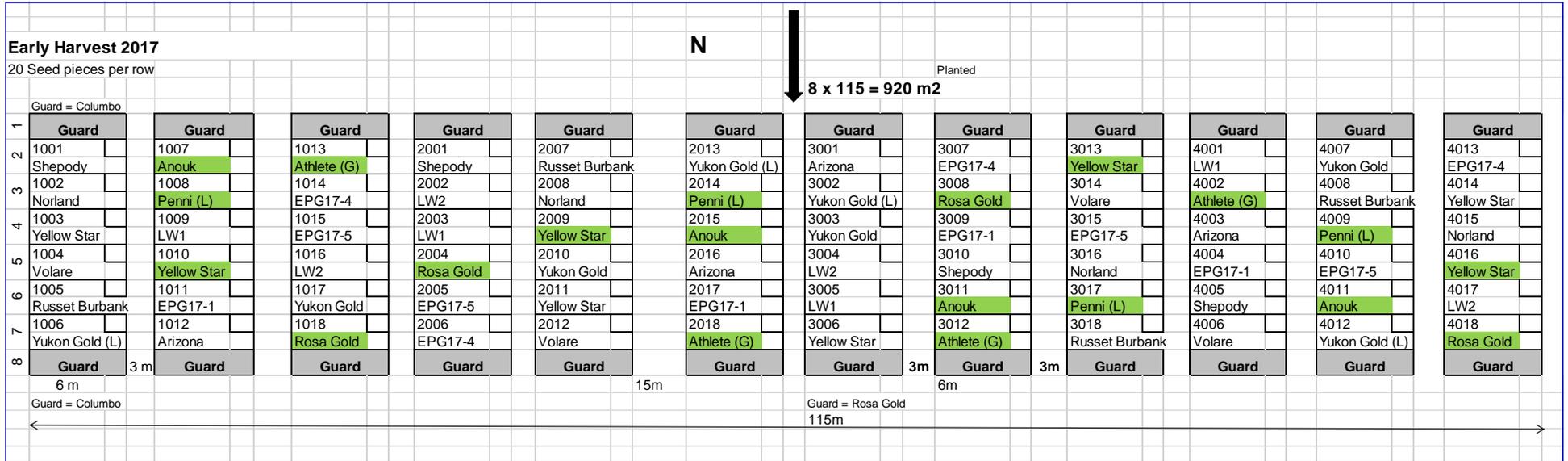
## Contact Information:

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](mailto:Michele.Konschuh@gov.ab.ca)

# Appendix A Plot Plan



**Low N Variety Trial 2017 - September harvest**

20 Seed pieces per row

**24 X 66 = 1584 m<sup>2</sup>**

**N**

Guard = Russet Burban

24	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>
23	1001 PGP17-2	1011 TT17-3	1021 TT17-2	1031 Monticello	2001 TT17-10	2011 ODF009	2021 RV013	2031 Yukon Gold
22	1002 TT17-5	1012 EPG17-3	1022 TT17-7	1032 Shepody	2002 TT17-7	2012 TT17-1	2022 EPG17-2	2032 PGP17-2
21	1003 PGP17-4	1013 RV008	1023 AC Hamer	1033 EPG17-2	2003 AC Hamer	2013 Destiny	2023 PGP17-3	2033 Norland
20	1004 TT17-9	1014 ODF007	1024 Blazer Russet	1034 RV013	2004 RV008	2014 Kennebec	2024 EPG17-3	2034 TT17-9
19	1005 TT17-10	1015 RV014	1025 TT17-4	1035 PGP17-3	2005 PGP17-4	2015 ODF010	2025 TT17-4	2035 Monticello
18	1006 AC Vigor	1016 Kennebec	1026 Destiny	1036 RV010	2006 RV011	2016 AC Vigor	2026 Shepody	2036 ODF007
17	1007 Norland	1017 ODF009	1027 TT17-6	1037 Yukon Gold	2007 Lollipop	2017 Blazer Russet	2027 ASPI010	2037 TT17-6
16	1008 RV011	1018 ASPI010	1028 RV009	5001 ODF007	2008 ASPI17-2	2018 TT17-2	2028 TT17-5	5004 AC Hamer
15	1009 TT17-8	1019 ODF010	1029 Atlantic	5002 ODF009	2009 Atlantic	2019 TT17-3	2029 RV009	5005 Destiny
14	1010 ASPI17-2	1020 TT17-1	1030 Lollipop	5003 ODF010	2010 TT17-8	2020 RV014	2030 RV010	5006 AC Vigor
13	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>
	3 m	3 m						6 m
	6m							6m
12	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>
11	3001 AC Vigor	3011 Destiny	3021 TT17-2	3031 PGP17-2	4001 ASPI010	4011 TT17-9	4021 PGP17-2	4031 TT17-6
10	3002 AC Hamer	3012 Shepody	3022 ASPI010	3032 TT17-4	4002 TT17-1	4012 Monticello	4022 Kennebec	4032 TT17-10
9	3003 TT17-6	3013 PGP17-3	3023 ASPI17-2	3033 Norland	4003 Norland	4013 TT17-5	4023 Shepody	4033 PGP17-4
8	3004 Atlantic	3014 RV014	3024 ODF009	3034 Yukon Gold	4004 TT17-4	4014 TT17-3	4024 TT17-2	4034 EPG17-2
7	3005 ODF007	3015 TT17-8	3025 Lollipop	3035 TT17-9	4005 RV011	4015 PGP17-3	4025 ODF007	4035 ODF009
6	3006 Kennebec	3016 EPG17-3	3026 Monticello	3036 RV010	4006 ASPI17-2	4016 TT17-7	4026 EPG17-3	4036 Yukon Gold
5	3007 TT17-3	3017 EPG17-2	3027 TT17-10	3037 RV008	4007 AC Vigor	4017 RV014	4027 ODF010	4037 Lollipop
4	3008 RV011	3018 RV009	3028 TT17-5	5007 Atlantic	4008 Destiny	4018 Atlantic	4028 RV009	
3	3009 Blazer Russet	3019 PGP17-4	3029 TT17-7	5008 Monticello	4009 TT17-8	4019 RV013	4029 AC Hamer	
2	3010 RV013	3020 ODF010	3030 TT17-1		4010 RV010	4020 Blazer Russet	4030 RV008	
1	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>	<b>Guard</b>
	3 m	3 m				3m	3m	3m
	6m							6m

