

Project Report

AAFC National Potato Variety Trial Results from CDCS, Brooks, AB 2020

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 182 kg/ha 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 (182 kg/ha) was achieved through a combination of soil fertility (112 lbs/ac N; 347 lbs/ac P) and broadcast fertilizer (96 kg/ha of 11-52-0 and 130 kg/ha 46-0-0) incorporated May 13 prior to planting. 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 13) to control weeds. Seed of standard cultivars and test cultivars was provided by AAFC. Potatoes were planted May 28 approximately 12 to 15cm deep using a two-row tuber unit planter. Seed of French fry varieties was planted at 30cm spacing in 6m rows spaced 90cm apart. Seed of Chip and Fresh Market varieties were planted at 20cm spacing in 6m rows. Plots were hilled June 11 with a power hiller. Lorox (0.91 L/ac) was applied prior to emergence of the potatoes to assist with weed suppression. The plots were irrigated to maintain soil moisture close to 70%. Foliar fungicides were applied four 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 2020 to prevent early and late blight development.

<i>Date of Application</i>	<i>Fungicide</i>	<i>Rate</i>
8 July	Ridomil Gold and Bravo	0.64L/ac
31 July	Quadris	324mL/ac
19 Aug	Dithane	0.91 L/ac
26 Aug	Dithane	0.91 L/ac



Figure 1: Variety evaluation trial at CDCS in Brooks, AB July 15, 2020.

Reglone was applied (1.0 L/ac) September 18, 2020. Potatoes were harvested September 24 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 1.5", 1.5 to 2.25", 2.25: to 3.5", 3.5 to 4.5", over 4.5" and deformed). French Fries were graded by weight into categories (< 2", < 2" and 170g, 170 to 284g, 284 to 340g, > 340g and deformed). A sample of twenty tubers (1.5 to 3.5" or 170 to 340g) 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 virtual field day August 21, 2020. Photos of the chipping cultivars are shown in Figure 2.

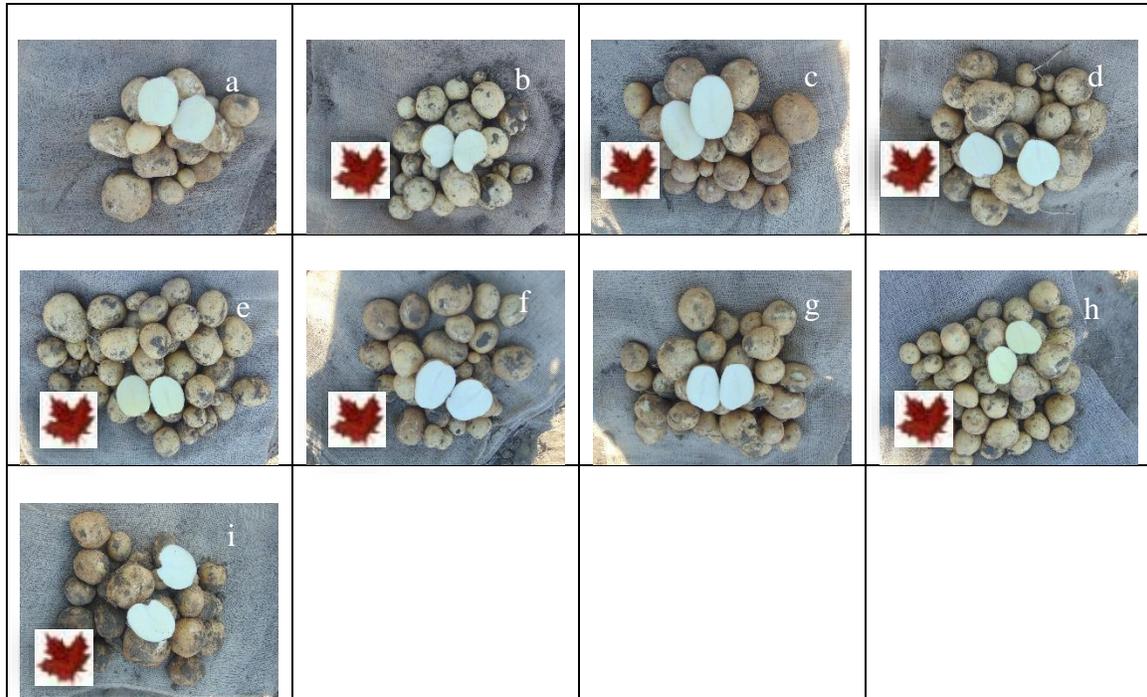


Figure 2. AAFC chipping cultivars at the CDCS field day August 21, 2020: a) Atlantic, b) CV10028-1, c) F150985-04, d) F150992-06, e) FV16324-08, f) FV16475-16, g) Snowden, h) Vigor, and i) WV10655-1.

Yield data (total yield; ton/ac) and specific gravities of each of the chipping cultivars are shown in Table 2. Yield ranged from 13.7 for F1150985.04 to 22.7 ton/ac for WV10655-1. Specific gravity ranged from 1.094 for FV16324.08 to 1.109 for Atlantic and F150985.04.

Table 2: Estimated total yield (ton/acre) and specific gravity for each chipping cultivar grown at CDCS in Brooks, AB (approximately 182 kg/ha nitrogen). Data shown is the mean of two replicates.

	Yield (ton/ac)	SG
ATLANTIC	18.07	1.109
CV10028-1	15.49	1.105
F150985-04	13.74	1.109
F150992-06	20.49	1.102
FV16324-08	12.85	1.094
FV16475-16	20.97	1.095
SNOWDEN	18.30	1.105
VIGOR	19.77	1.097
WV10655-1	22.72	1.097

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 (< 1.5", 1.5 to 2.25", 2.25 to 3.5", 3.5 to 4.5", > 4.5, and deformed) for each chipping cultivar grown at approximately 182 kg/ha N. Data shown is the mean of two replicates.

	No. of < 1.5"	No. of 1.5 to 2.25"	No. of 2.25 to 3.5"	No. of 3.5 to 4.5"	No. of > 4.5"	No of Def.
ATLANTIC	12%	37%	48%	2%	0%	1%
CV10028-1	16%	36%	35%	0%	0%	13%
F150985-04	12%	70%	18%	0%	0%	1%
F150992-06	9%	45%	44%	2%	0%	0%
FV16324-08	17%	54%	28%	0%	0%	1%
FV16475-16	9%	32%	57%	2%	0%	0%
SNOWDEN	10%	51%	39%	0%	0%	1%
VIGOR	8%	60%	31%	0%	0%	1%
WV10655-1	8%	32%	57%	3%	0%	0%

The yield of tubers (estimated ton/ac) of each chipping cultivar is shown by size category in Table 4. Yield of tubers 1.5" to 3.5" in diameter ranged from 11.9 ton/acre for FV16324.08 to 20.4 ton/ac for WV10655-1.

Table 4: Estimated yield (ton/ac) in each size category (< 1.5”, 1.5 to 2.25”, 2.25 to 3.5”, 3.5 to 4.5”, > 4.5, and deformed) for each chipping cultivar grown at approximately 182 kg/ha N. Data shown is the mean of two replicates.

	Yield of < 1.5” (ton/ac)	Yield of 1.5 to 2.25” (ton/ac)	Yield of 2.25 to 3.5” (ton/ac)	Yield of 3.5 to 4.5” (ton/ac)	Yield of > 4.5” (ton/ac)	Yield of deformed (ton/ac)
ATLANTIC	0.4	3.8	12.5	1.3	0.0	0.1
CV10028-1	0.6	3.7	8.6	0.0	0.0	2.6
F150985-04	0.6	8.6	4.6	0.0	0.0	0.1
F150992-06	0.3	4.5	14.3	1.4	0.0	0.0
FV16324-08	0.6	5.3	6.6	0.0	0.0	0.4
FV16475-16	0.4	3.3	16.3	0.9	0.0	0.1
SNOWDEN	0.5	6.6	11.2	0.0	0.0	0.0
VIGOR	0.4	8.7	10.4	0.0	0.0	0.3
WV10655-1	0.3	3.5	16.9	2.1	0.0	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. No hollow heart was noted in 2020 samples. Brown center was noted only in a few tubers. F14037 had internal necrotic lesions in almost half of the tubers. FV16324-08, CV10028-1 and AC Vigor had some black scurf. Tubers were not protected by seed treatments in the trial. No common scab lesions were noted. FV16324-08 seemed to have very short inherent dormancy.

Results– French Fry Cultivars

Sample hills of each cultivar were dug for a virtual field day August 21, 2020. Photos of the French fry cultivars are shown in Figure 3.



Figure 3. AAFC French fry cultivars at the CDCS field day August 21, 2020: a) CV12202-2, b) CV12267-1, c) CV13010-4, d) CV13010-5, e) F15019, f) Ranger Russet, g) Russet Burbank, h) Shepody, i) VF140855-03, j) VF140855-05, k) VF140855-07, l) VF140855-11, m) VF150081-01, n) VF150083-02, o) VF150086-02, and p) VF150091-01.

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 15.7 ton/ac for VF140855-05 to 24.8 ton/ac for VF150091.01. Marketable yield ranged from 10.0 ton/ac for CV13010-4 to

22.3 ton/ac for VF140855-11. Specific gravity ranged from 1.091 for CV13010-5 to 1.114 for VF140855-07.

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 182 kg/ha nitrogen). Data shown is the mean of two replicates.

	Total Yield (ton/ac)	Mkt Yield (ton/ac)	SG
CV12202-2	17.7	14.0	1.092
CV12267-1	19.4	17.8	1.108
CV13010-4	21.5	10.0	1.094
CV13010-5	19.7	13.1	1.091
F15019	16.0	11.8	1.098
RANGER RUSSET	21.4	18.2	1.099
RUSSET BURBANK	24.0	20.7	1.096
SHEPODY	21.3	18.6	1.096
VF140855-03	20.8	18.2	1.107
VF140855-05	15.7	14.1	1.101
VF140855-07	23.7	21.3	1.114
VF140855-11	24.5	22.3	1.095
VF150081-01	19.8	17.4	1.098
VF150083-02	19.4	15.8	1.109
VF150086-02	21.7	17.6	1.107
VF150091-01	24.8	21.8	1.105

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 (< 2.0”, > 2.0” and > 170g, 170 to 284g, 284 to 340g and > 340g, and deformed tubers) for each French fry cultivar grown at approximately 182 kg/ha. Data shown is the mean of two replicates.

	# of <2.0”	# of > 2.0; > 170g	# of 170-284g	# of 284-340g	# of >340g	# deformed
CV12202-2	42%	26%	24%	4%	3%	0%
CV12267-1	24%	20%	37%	9%	10%	0%
CV13010-4	68%	21%	9%	1%	0%	1%
CV13010-5	57%	19%	20%	2%	1%	0%
F15019	55%	21%	19%	5%	1%	0%
RANGER RUSSET	32%	16%	35%	8%	7%	2%
RUSSET BURBANK	30%	37%	22%	3%	7%	1%
SHEPODY	23%	17%	33%	7%	15%	5%
VF140855-03	28%	24%	34%	7%	7%	1%
VF140855-05	17%	12%	32%	15%	21%	3%
VF140855-07	24%	24%	31%	9%	7%	1%
VF140855-11	27%	24%	35%	8%	12%	0%
VF150081-01	33%	32%	29%	6%	6%	0%
VF150083-02	38%	32%	23%	4%	3%	1%
VF150086-02	41%	18%	26%	5%	9%	1%
VF150091-01	23%	15%	36%	13%	16%	1%

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 4.0 ton/ac of CV13010-4 to 9.9 ton/ac of VF140855-07. Yield of 284 to 396g tubers ranged from 0.4 for CV13010-4 to 4.7 for VF150091-01.

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 182 kg/ha. Data shown is the mean of two replicates.

	Yld of <113g	Yld of 113- 170g	Yld of 170-284g	Yld of 284- 396g	Yld of >396g	Yld def
CV12202-2	3.4	4.3	6.4	1.7	1.7	0.3
CV12267-1	1.7	2.8	8.0	2.6	4.4	0.0
CV13010-4	11.1	5.5	4.0	0.4	0.2	0.4
CV13010-5	6.4	4.3	6.9	1.3	0.7	0.2
F15019	4.2	3.8	5.4	2.2	0.6	0.0
RANGER RUSSET	2.5	2.8	9.1	2.8	3.6	0.6
RUSSET BURBANK	2.9	7.0	7.1	1.4	5.2	0.4
SHEPODY	1.5	2.4	7.4	2.2	6.6	1.2
VF140855-03	2.3	3.8	8.5	2.3	3.6	0.3
VF140855-05	0.8	1.1	4.3	2.8	5.9	0.8
VF140855-07	2.1	4.1	9.9	3.7	3.6	0.3
VF140855-11	2.2	4.3	8.0	3.0	7.0	0.0
VF150081-01	2.4	5.2	6.7	2.4	3.0	0.0
VF150083-02	3.4	5.8	6.9	1.6	1.4	0.2
VF150086-02	3.8	3.3	7.1	1.8	5.4	0.3
VF150091-01	2.0	2.4	9.3	4.7	5.5	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 only noted in a few tubers of CV12202-2. Common scab was not noted on any tubers and black scurf was present on some tubers of VF140855011 and CV12202-2.

Results – Fresh Market Cultivars

Sample hills of each cultivar were dug for a field day August 21, 2020. 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 21, 2020: a) F150128-01, b) F150130.04, c) F150919-03, and b) 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 21, 2020: a) FV16004-7 and b) Norland.

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 14.2 ton/ac for F150128-1 to 23.1 ton/ac

for F150919-03. Specific gravity ranged from 1.081 for FV16004-7 and Norland to 1.101 for Yukon Gold.

Table 8: Estimated total yield (ton/acre) and specific gravity for each fresh market FM cultivar grown at CDCS in Brooks, AB (approximately 182 kg/ha nitrogen). Data shown is the mean of two replicates.

	End Use	Yield (ton/ac)	SG
Yellow/White-skinned			
F150128-01	FM	14.2	1.098
F150130-04	FM	16.8	1.096
F150919-03	FM	23.1	1.085
Yukon Gold	FM	21.1	1.101
Red/Purple-skinned			
FV16004-7	FM	19.7	1.081
Norland	FM	20.2	1.081

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 (< 1.5”, 1.5 to 2.25”, 2.25 to 3.5”, 3.5 to 4.5”, > 4.5, and deformed) for each fresh market cultivar grown at approximately 182 kg/ha. Data shown is the mean of two replicates.

	No. of <1.5”	No. of 1.5 to 2.25”	No. of 2.25 to 3.5”	No. of 3.5 to 4.5”	No. of > 4.5”	No. of deformed
Yellow/White-skinned						
F150128-01	15%	61%	23%	0%	0%	1%
F150130-04	12%	47%	37%	1%	0%	3%
F150919-03	19%	46%	27%	0%	0%	8%
Yukon Gold	9%	26%	63%	1%	0%	1%
Red/Purple-skinned						
FV16004-7	9%	42%	48%	0%	1%	0%
Norland	8%	45%	47%	0%	0%	0%

The yield of tubers (estimated ton/ac) of each fresh market cultivar is shown by size category in Table 10. Yield of tuber between 1.5 and 3.5” in diameter ranged from 13.5 for F150128-1 to 20.1 for Yukon Gold. FV16004-7 was similar in size distribution to Norland.

Table 10: Estimated yield (Yld; ton/ac) in each size category (< 1.5”, 1.5 to 2.25”, 2.25 to 3.5”, 3.5 to 4.5”, > 4.5, and deformed) for each fresh market cultivar grown at approximately 182 kg/ha. Data shown is the mean of two replicates.

	Yld of <1.5” (ton/ac)	Yld of 1.5 to 2.25” (ton/ac)	Yld of 2.25 to 3.5” (ton/ac)	Yld of 3.5 to 4.5” (ton/ac)	Yield of > 4.5” (ton/ac)	Yld of def (ton/ac)
Yellow/White-skinned						
F150128-01	0.5	7.2	6.3	0.0	0.0	0.2
F150130-04	0.4	4.8	10.0	0.7	0.0	0.8
F150919-03	1.1	6.9	11.2	0.3	0.0	3.6
Yukon Gold	0.2	2.5	17.6	0.6	0.0	0.2
<hr/>						
FV16004-7	0.3	4.8	13.8	0.6	0.0	0.2
Norland	0.3	5.7	14.2	0.0	0.0	0.0

Tuber samples used to measure specific gravity were evaluated for hollow heart, other internal defects and scab. No hollow heart was observed in 2020 samples. Black scurf was present at a low percentage on all samples except F150919-03. No common scab was observed in 2020 samples.

Conclusions

The 2020 variety trial included a number of cultivars with potential in southern Alberta. Atlantic, AC Vigor and Snowden were included in the trial as standard varieties to compare to 6 chipping cultivars. Russet Burbank and Shepody were included in the trial as standard varieties to compare to 14 French fry cultivars. Yukon Gold and Norland were included in the trial as standard varieties to compare with 4 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 182 kg/ha, 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
Tuberosum Technologies

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Appendix A Plot Plan

AAFC - 2020 - Brooks				N 	
24 Seed pieces per row		Planted:			
10" spacing		28-May		12 x 30 = 360 m2	
Guard = Atlantic					
12	Guard	Guard	Guard	Guard	
11	1021 VIGOR	2021 F150985-04	1031 NORLAND	2031 F150130-04	
10	1022 FV16475-16	2022 FV16324-08	1032 F150128-01	2032 FV16004-7	
9	1023 FV16324-08	2023 SNOWDEN	1033 FV16004-7	2033 YUKON GOLD	
8	1024 SNOWDEN	2024 ATLANTIC	1034 F150919-03	2034 F150919-03	
7	1025 CV10028-1	2025 F150992-06	1035 YUKON GOLD	2035 F150128-01	
6	1026 F150992-06	2026 FV16475-16	1036 F150130-04	2036 NORLAND	
5	1027 ATLANTIC	2027 WV10655-1	1037 0	2037 0	
4	1028 WV10655-1	2028 VIGOR	1038 0	2038 0	
3	1029 F150985-04	2029 CV10028-1	1039 0	2039 0	
2	1030 0	2030 0	1040	2040	
1	Guard 6 m	Guard 6m Chippers	Guard 6m Fresh Market	Guard 6 m	

AAFC - 2020 - Brooks

20 Seed pieces per row
12 " spacing

Planted:
28-May



N

12 x 37 = 444 m²

Guard = Atlantic								
12	Guard		Guard		Guard		Guard	
11	1001 VF150081-01		1011 VF140855-03		2001 VF150091-01		2011 CV13010-5	
10	1002 SHEPODY		1012 VF140855-07		2002 VF140855-07		2012 VF140855-05	
9	1003 F15019		1013 RANGER RUSSET		2003 VF150081-01		2013 RANGER RUSSET	
8	1004 CV12267-1		1014 VF150091-01		2004 CV12202-2		2014 F15019	
7	1005 VF140855-11		1015 VF150083-02		2005 SHEPODY		2015 VF140855-11	
6	1006 RUSSET BURBANK		1016 CV13010-4		2006 VF140855-03		2016 VF150083-02	
5	1007 CV12202-2				2007 CV12267-1		0	
4	1008 VF140855-05				2008 CV13010-4		0	
3	1009 VF150086-02				2009 VF150086-02		0	
2	1010 CV13010-5				2010 RUSSET BURBANK			
1	Guard	3 m	Guard		Guard	3 m	Guard	
	7 m						7 m	
	French Fries							