

Michigan Regional Location

Local Coordinators:

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East Lansing, MI

Cooperating Grower:

Tim & Todd Young
Sandyland Farms LLC
Howard City, MI

Cooperating Chip Processor:

Herr Foods, Inc.
Nottingham, PA

Trial Information:

Planting Date:	May 13, 2013
Vine Kill Date:	August 25, 2013
Harvest Date:	October 3, 2013 (144 Days, Planting to Harvest)
Between Row & In Row	
Plant Spacing:	34" x 10"; irrigated
Plots:	Single rows for each entry, approximately 300' long
GDD, Base 40	2734 (105 Days, Planting to Vine Kill)

Trial Procedure:

Seed was mechanically cut on May 6, 2013, and delivered to the grower's seed storage three days later. No seed treatments were applied at the time of seed cutting.

Only one pre-harvest sugar profile was taken this season, on August 21st, for each variety three weeks prior to the expected vine kill date. The pre-harvest sugar profile protocol was as follows: obtained a minimum of 40 tubers from each variety, and took all the tubers from each hill, even if that required collecting more than 40 tubers. A canopy rating was taken for each variety as a percent rating of green foliage. Canopy uniformity was noted as a percentage of how uniform the foliage health appeared. The number of hills required to obtain 40 tubers was recorded, along with the total number of main stems harvested. From the tubers harvested, specific gravity, a glucose value (a percent by fresh weight), a sucrose rating (a percent by fresh weight X10) and an average tuber weight (in ounces) was established.

At harvest, three plot areas of 23 feet were harvested from each entry and were used to determine yield averages, size distribution, specific gravity and internal defects. Two, 40 lb. storage samples were collected from each entry and were placed in the grower's commercial storage for evaluation at a later date. One set of samples will be evaluated in the winter of 2013 and the other in the spring of 2014. Eighteen, 40 tuber samples were also collected for each variety at harvest. All eighteen samples were stored at the Michigan Potato Industry Commission's Cargill Demonstration Storage Facility at approximately 48°F or 54°F for a monthly sugar profile evaluation at Techmark, Inc. Nine, 40 tuber samples were stored at each temperature for evaluation, October 2013 through June 2014. The storage sugar profiles began October 7th, 2013. Two out-of-the-field chip samples were taken for each variety at harvest.

One was sent to Herr Foods, Inc. for processing and the additional sample was processed at Michigan State University.

A plant growth and vine vigor observation was made on June 18th, 2013. AC01151-5W, AF4157-6, CO03243-3W, MSL007-B, MSL292-A, Snowden, W5955-1 and W6609-3 appeared to have the slowest rate of vine growth, whereas, A00188-3C, A01143-3C and W6483-5 were the most vigorous on this date. A vine maturity rating was taken for each variety on August 27th, 2013, approximately 10 days prior to vine kill. A00188-3C, MSL007-B, MSL292-A and W5955-1 were the most mature varieties and AF4157-6 appeared to be the most immature on this date.

Growing Season Weather:

Weather conditions during the 2013 growing season were generally moderate, but there was a five day period during early bulking that exerted stress on the potato crop. This five day period from July 15th to July 19th recorded well over 35 growing degree days each day, six days of over 88 °F or greater daytime temperatures, reaching as high as 96 °F and over six nights with greater than 8 consecutive night time hours with temperatures above 65 °F. Growing degree days base 40 recorded from May 13th through August 25th were 2734. This was very similar to the five year average of 2788 GDD for this same time period. Total rainfall for this time period was approximately 13.02". The daytime temperatures during this growing period exceeded 88 °F on eight days. Nighttime temperatures of 65 °F that lasted for longer than 8 hours occurred on 24 nights. The tuber specific gravity, for potato production in Michigan, was above average as a result of the moderate nighttime heat stress. Commercial potato yields overall met average yield to above average yield projections.

Results:

Table 1 summarizes the yield, size distribution, and specific gravity data at harvest. NY148 and A01143-3C topped the yield table in 2013, followed by a group of lines that yielded above average. These lines were: NY140, CO03243-3W, MSL292-A, and Atlantic. W5955-1 had the largest percentage of recorded oversize tubers followed closely by Atlantic. AC01151-5W and W6483-5 recorded very low specific gravities. Additional lines with marginal specific gravities reported were MSL292-A, AF4157-6 and CO00197-3W.

Table 1. Yield , Size Distribution*, Specific Gravity								
Entry	Yield (cwt/A)		Percent Size Distribution					Specific Gravity
	US#1	TOTAL	US#1	Small	Mid-Size	Large	Culls	
NY148	542	614	89	10	83	6	1	1.082
A01143-3C	505	553	91	5	84	7	4	1.076
NY140	426	486	88	11	84	4	1	1.076
CO03243-3W	417	474	88	11	83	5	1	1.078
MSL292-A	395	439	90	10	85	5	0	1.075
Atlantic	395	432	92	7	84	8	1	1.084
W5955-1	331	389	85	12	76	9	3	1.080
A00188-3C	328	402	81	13	78	3	6	1.079
AF4157-6	324	415	78	21	78	0	1	1.074
MSL007-B	320	376	85	15	84	1	0	1.081
CO00197-3W	313	440	72	22	71	1	6	1.073
Snowden	291	380	77	23	76	1	0	1.078
MSR061-1	270	360	75	24	75	0	1	1.076
CO02321-4W	260	359	72	28	72	0	0	1.081
AC01151-5W	246	383	64	34	64	0	2	1.067
W6483-5	232	306	72	23	68	4	5	1.064
W4980-1	231	293	79	20	75	4	1	1.077
W6609-3	214	302	70	28	70	0	2	1.080
MEAN	336	411	80	18	77	3	2	1.077

*small <1 7/8"; mid-size 1 7/8"-3 1/4"; large >3 1/4"

Table 2 summarizes the at-harvest tuber quality. Internal quality across the trial was generally acceptable, but the evidence of in-season environmental stress was observed in some lines. Hollow heart was present in Atlantic and to a lesser extent in W5955-1 and AC01151-5W. CO00197-3W displayed a moderate level of internal brown spots. A00188-3C, MSL007-B and AC01151-5W each recorded above average amounts of vascular discoloration.

Table 2. At-Harvest Tuber Quality. Sandyland Farms, Howard City, Michigan.					
Entry	Internal Defects¹				Total Cut
	HH	VD	IBS	BC	
NY148	0	0	0	0	30
A01143-3C	0	4	0	0	30
NY140	0	1	0	0	30
CO03243-3W	0	1	0	0	30
MSL292-A	0	1	0	0	30
Atlantic	5	3	0	0	30
W5955-1	1	6	0	0	30
A00188-3C	0	10	0	0	30
AF4157-6	0	3	0	0	30
MSL007-B	0	10	0	0	30
CO00197-3W	0	5	3	1	30
Snowden	0	4	0	0	30
MSR061-1	0	2	0	0	30
CO02321-4W	0	3	0	0	30
AC01151-5W	1	10	0	0	30
W6483-5	0	3	0	0	30
W4980-1	0	3	0	0	30
W6609-3	0	0	0	0	30

¹Internal Defects. HH = hollow heart, VD = vascular discoloration, IBS = internal brown spot, BC = brown center.

Table 3 shows the post-harvest chip quality based on samples collected on October 3rd, 2013 and processed at Herr Foods, Inc. on October 8th. Chip color was generally acceptable across the trial, with CO02321-4W having the highest Agtron score of the trial at 69.1. The varieties, listed in ranked order based on quality observations from Herr Foods, Inc. are as follows: MSL292-A, MSL007-B, W6609-3, MSR061-1, W6483-5, Snowden, NY148, CO02321-4W, Atlantic, W4980-1, W5955-1, CO03243-3W, A00188-3C, CO00197-3W, AF4157-6, NY140, AC01151-5W and lastly A01143-3C.

Table 3. 2013 Post-Harvest Chip Quality ¹						
Entry	Agtron Color	SFA ² Color	Specific Gravity	Percent Chip Defects ³		
				Internal	External	Total
NY148	65.2	3.0	1.076	21.8	0.9	22.7
A01143-3C	62.0	3.5	1.071	0.0	6.3	6.3
NY140	63.8	3.0	1.070	25.8	20.5	46.3
CO03243-3W	62.6	2.0	1.074	6.8	22.5	29.3
MSL292-A	62.6	2.0	1.074	3.6	7.8	11.4
Atlantic	65.8	3.0	1.083	20.2	9.6	29.8
W5955-1	63.6	3.0	1.078	12.0	3.8	15.8
A00188-3C	67.1	2.5	1.077	12.9	2.9	15.8
AF4157-6	65.9	3.0	1.076	9.8	15.0	24.8
MSL007-B	64.2	3.0	1.075	4.9	2.0	6.9
CO00197-3W	63.7	3.0	1.077	17.3	13.1	30.4
Snowden	63.2	2.0	1.074	4.5	11.3	15.8
MSR061-1	61.9	2.5	1.070	3.0	4.1	7.1
CO02321-4W	69.1	2.0	1.078	4.5	13.0	17.5
AC01151-5W	59.0	3.0	1.072	16.0	11.6	27.6
W6483-5	67.0	2.0	1.062	0.0	0.0	0.0
W4980-1	64.1	2.5	1.075	22.9	4.1	27.0
W6609-3	66.8	2.5	1.077	9.1	0.0	9.1

¹Samples collected October 3rd and processed by Herr Foods, Inc., Nottingham, PA on October 8, 2013.

Chip defects are included in Agtron and SFA samples.

²SFA Color: 1= lightest, 5 = darkest

³Percent Chip Defects are a percentage by weight of the total sample; comprised of undesirable color, greening, internal defects and external defects.

Table 4 summarizes the results of the samples collected for black spot bruise. Two, 25 tuber samples were collected at harvest. One sample served as a check and the second sample was stored for at least 12 hours at 50 °F, then placed in a 6 sided plywood drum and rotated 10 times to produce a simulated bruise. Two to three weeks later, after holding the samples at room temperature, all samples were abrasively peeled and scored for the presence of black spot bruise. Among the “Simulated Bruise” samples, the best entries were W6483-5, CO02321-4W, MSR061-1, W6609-3, AC01151-5W, A00188-3C, W5955-1, Atlantic, Snowden and NY140. W4980-1, CO00197-3W, MSL007-B and NY148 showed the lowest percent bruise free.

Table 4. Black Spot Bruise Test																
Entry	A. Check Samples ¹							B. Simulated Bruise Samples ²								
	# of Bruises Per Tuber						Total Tubers	# of Bruises Per Tuber						Total Tubers	Percent Bruise Free	Average Bruises Per Tuber
	0	1	2	3	4	5		0	1	2	3	4	5			
NY148	13	11	1				25	3	5	11	3	1	2	25	12	2.0
A01143-3C	20	4	1				25	2	8	13	2			25	8	1.6
NY140	13	11	1				25	9	9	7				25	36	0.9
CO03243-3W	14	7	3	1			25	8	6	7	4			25	32	1.3
MSL292-A	22	2	1				25	6	5	8	5	1		25	24	1.6
Atlantic	18	5	2				25	12	8	5				25	48	0.7
W5955-1	25						25	16	6	2	1			25	64	0.5
A00188-3C	22	3					25	14	10		1			25	56	0.5
AF4157-6	21	4					25	6	9	7	2	1		25	24	1.3
MSL007-B	15	10					25	4	4	8	3	5	1	25	16	2.2
CO00197-3W	8	6	7	3	1		25		6	9	7	2	1	25	0	2.3
Snowden	21	4					25	8	14	2	1			25	32	0.8
MSR061-1	17	6	2				25	16	9					25	64	0.4
CO02321-4W	23	2					25	17	7	1				25	68	0.4
AC01151-5W	11	10	4				25	13	12					25	52	0.5
W6483-5	25						25	20	5					25	80	0.2
W4980-1	15	7	3				25			6	4	6	9	25	0	3.7
W6609-3	20	5					25	16	8	1				25	64	0.4

¹Tuber samples collected at harvest and held at room temperature for later abrasive peeling and scoring.

²Tuber samples collected at harvest, held at 50°F for at least 12 hours, then placed in a 6 sided plywood drum and rotated 10 times to produce simulated bruising. They were then held at room temperature for later abrasive peeling and scoring.

Table 5 summarizes the results of the pre-harvest panel data. A number of varieties exhibited both elevated sucrose and glucose values on this sample date; they are A01143-3C, A00188-3C, AF4157-6, CO00197-3W and AC01151-5W. These lines appeared to be chemically and physically immature on this date in the growing season. At Herr Foods, on October 8th, 2013, these same five lines ranked among the worst for out-of-the field chip quality (Table 4). A01143-3C and W5955-1 exhibited the largest average tuber size recorded on August 21st, 2013.

Table 5. Pre-Harvest Panel, 8/21/13

Entry	Specific Gravity	Glucose ¹ %	Sucrose ² Rating	Canopy		Number of		Average ⁵ Tuber Weight
				Rating ³	Uniform. ⁴	Hills	Stems	
NY148	1.087	0.002	0.548	75	95	3	21	3.16
A01143-3C	1.084	0.006	1.150	80	95	4	16	4.99
NY140	1.076	0.002	0.596	75	90	4	19	3.74
CO03243-3W	1.082	0.003	0.645	40	90	4	25	3.37
MSL292-A	1.076	0.002	1.094	25	85	4	11	4.03
Atlantic	1.082	0.002	0.593	80	95	4	14	3.91
W5955-1	1.080	0.003	0.636	85	90	6	16	5.10
A00188-3C	1.079	0.013	1.505	85	95	-	-	4.39
AF4157-6	1.073	0.006	1.021	10	95	3	14	2.82
MSL007-B	1.084	0.002	0.570	70	90	4	13	3.36
CO00197-3W	1.079	0.006	1.931	75	95	3	12	2.82
Snowden	1.080	0.002	1.023	75	95	4	17	2.78
MSR061-1	1.079	0.002	0.632	45	90	4	22	3.20
CO02321-4W	1.085	0.002	0.765	35	90	3	16	2.76
AC01151-5W	1.082	0.007	1.144	80	90	3	14	2.35
W6483-5	1.067	0.002	0.862	10	90	3	12	3.79
W4980-1	1.079	0.002	0.847	75	95	4	15	3.45
W6609-3	1.081	0.002	0.970	75	95	5	19	2.26

1 Percent Glucose is the percent of glucose by weight in a given amount of fresh tuber tissue.

2 Sucrose Rating is the percent of sucrose by weight in a given amount of fresh tuber tissue X10.

3 The Canopy Rating is a percent rating of green foliage (0 is all brown, dead foliage; 100 is green, vigorous foliage).

4 The Canopy Uniformity is a percentage of how uniform the foliage health is at the date of observation.

5 The Average Tuber Weight is the total tuber weight collected, divided by the number of tubers, reported in ounces.

Variety Comments:

NY148 (NYE106-4): This variety was the top yielder in the 2013 trial with a 542 cwt./A US#1 yield (Table 1). The specific gravity of this line was above average for the trial at 1.082. Raw internal tuber quality was excellent (Table 2). Chip quality ranking at Herr Foods on October 8th was slightly above average, ranking 7th, just behind Snowden. This variety exhibited an above average amount of black spot bruise susceptibility in 2013, recording on average 2.0 bruises per tuber (Table 4). NY148 has ranked among susceptible lines to black spot bruise for a number of years now. On August 21st, this variety appeared to have good vine vigor with a low sugar profile.

A01143-3C: This variety had an average yield of 505 cwt./A US#1 with a specific gravity of 1.076 (Table 1). It was the second highest yielding line in the 2013 variety trial. Raw internal tuber quality was good with only four tubers expressing vascular discoloration (Table 2). A01143-3C ranked 18th of 18 varieties at Herr's for chip quality out-of-the-field. This may be a reflection of some free reducing sugars as a result of tuber chemical immaturity at harvest. Of all the varieties in the 2013 trial, this variety had among the least amount of total defects of any variety processed at Herr Foods on October 8th, 2013 (Table 3). The variety exhibited an above average susceptibility to black spot bruise, with only 1.6 black spot bruises being recorded for each tuber observed (Table 4). This variety was very chemically immature on August 21st, with a 0.006 glucose and a 1.150 sucrose value recorded (Table 5). The vines still appeared quite green for this time in the season as well. The chip quality ranking for A01143-3C from Herr's reflected these chemical immaturity observations.

NY140: This was the third highest yielding variety in the 2013 variety trial with a 426 cwt./A US#1 yield and a slightly below average specific gravity at 1.076 (Table 1). This variety had only one tuber with vascular discoloration (Table 2). NY140 performed poorly at Herr Foods on October 8th, 2013, ranking 16th of 18. This variety recorded the highest percent of total chip defects of any variety, totaling 46.3 percent (Table 3). NY140 exhibited a moderate level of black spot bruise susceptibility (Table 4).

CO03243-3W: This variety was above the trial average with a 417 cwt./A US#1 yield. The specific gravity was slightly above the trial average at 1.078 (Table 1). Raw internal tuber quality was good with only one vascular discoloration recorded (Table 2). Chip quality at Herr Foods was below average, ranking 12th of 18 for overall appearance. CO03243-3W ranked as one of the more susceptible varieties to black spot bruise, recording 1.3 bruises per tuber on average (Table 4).

MSL292-A (Manistee): MSL292-A was above average in yield at 395 cwt./A US#1 with 5 percent oversize tubers recorded. The specific gravity for this variety was slightly below the trial average at 1.075 (Table 1). This variety exhibited no hollow heart at harvest, with only one tuber with vascular discoloration recorded (Table 2). Manistee recorded 11.4 percent total defects at Herr Foods on the 8th of October and receiving the top chip quality performance ranking (Table 3). MSL292-A was moderately susceptible to black spot bruise and ranked below the trial average, receiving a score of 1.6 bruises per tuber (Table 4). This variety appeared to be mature based on the pre-harvest panel data from August 21st, where the sucrose rating was 1.094, the glucose level was 0.002 and the canopy rating was 25 percent (Table 5).

Atlantic: This was a moderate yielding variety in the 2013 trial, yielding above the trial average at 395 cwt./A US#1. The specific gravity was above average at 1.084 (Table 1). This variety had eight percent oversize tubers, of which 17 percent of them were hollow. Herr's ranked Atlantic at the trial average for the out-of-the-field chip quality evaluation. From the 2013 black spot bruise test, Atlantic appeared tolerant, recording only 0.7 bruises per tuber (Table 4).

W5955-1: This variety had an average yield of 331 cwt./A US#1 with a specific gravity of 1.080 (Table 1). The tuber size distribution consisted of 85 percent A-size, 12 percent undersize and 3 percent cull tubers. This was the largest recorded amount of oversize in this year's trial. Raw internal tuber quality was acceptable with one tuber expressing hollow heart and six tubers with vascular discoloration (Table 2). W5955-1 ranked 11th of 18 varieties at Herr's for chip quality out-of-the-field. The variety exhibited a tolerance to black spot bruise, with only 0.5 black spot bruises being recorded for each tuber evaluated (Table 4). This variety had the largest tuber size profile on the August 21st pre-harvest panel evaluation date (Table 5).

A00188-3C: A00188-3C yielded slightly below the trial average at 328 cwt./A US#1. Specific gravity was above the trial average at 1.079 (Table 1). The tuber size distribution consisted of 81 percent A-size and 13 percent undersize tubers. The variety had ten tubers with vascular discoloration ranking among the highest in the trial (Table 2). Herr's ranked this variety 13 of 18 in chip performance out-of-the-field. A00188-3C appeared to have a low susceptibility to black spot bruising (Table 4). The plant canopy of this variety was very chemically immature on August 21st, recording a percent glucose of 0.013 and a sucrose rating of 1.505 (Table 5).

AF4157-6: This variety had a US#1 tuber yield, slightly below the trial average at 324 cwt./A and a tuber size distribution that consisted of 78 percent A-size and 21 percent undersize tubers (Table 1). The specific gravity was below the trial average at 1.074. Raw internal tuber quality was acceptable, with only 3 tubers with vascular discoloration reported (Table 2). The at-harvest chip fry test ranked this variety 15th out of 18 varieties for overall appearance. AF4157-6 had the 7th highest amount of total chip defects in the trial (Table 3). This variety had moderate susceptibility to black spot bruise, averaging 1.3 bruises per tuber (Table 4). The plant vines appeared to be physiologically mature on August 21st, but the high sugar values indicated some chemical immaturity and evidence for premature vine senescence (Table 5).

MSL007-B: The yield for MSL007-B was below average at 320 cwt./A US#1 with 15 percent B-size potatoes (Table 1). The specific gravity was above the trial average at 1.081. Internal tuber quality was concerning with ten tubers with vascular discoloration reported (Table 2). This variety ranked second for overall chip quality at Herr Foods on October 8th, just behind MSL292-A (Manistee). MSL007-B scored poorly in tolerance to black spot bruise, with an average of 2.2 bruises per tuber reported (Table 4).

CO00197-3W: This variety had a below average yield in the 2013 trial. The US#1 yield was 313 cwt./A, with a below average specific gravity (Table 1). The tuber size distribution consisted of 71 percent A-size and 22 percent undersize tubers. Five tubers with vascular discoloration in thirty cut tubers were observed, along with three tubers with internal brown spots and one tuber with brown center (Table 2). CO00197-3W ranked 14th of 18 lines tested at Herr Foods for overall chip quality and appearance on October 8th. CO00197-3W had the second highest amount of total chip defects in the trial at 30.4 percent (Table 3). The variety appeared to be susceptible to black spot bruise (Table 4). This line was chemically immature when the pre-harvest panels were collect on August 21st (Table 5).

Snowden: Snowden was a below average yielding variety in the 2013 variety trial with a 291 cwt./A US#1 yield and an average specific gravity of 1.078 (Table 1). Internal raw tuber quality was moderate at harvest with 13 percent vascular discoloration observed (Table 2). This variety was above average in chip performance at Herr Foods out-of-the-field fry test, ranking sixth in the trial overall. Snowden had an average susceptibility to black spot bruise (Table 4). On August 21st, the average tuber weight for this variety was 2.78 ounces (Table 5).

MSR061-1: The yield on MSR061-1 was below average at 270 cwt./A US#1 with 24 percent B-size potatoes and 75 percent A-size tubers (Table 1). The specific gravity was slightly below the trial average at 1.076. Internal tuber quality was good with few defects reported (Table 2). This variety ranked above average for chip quality at Herr Foods on October 8th, having only 7.1 percent total chip defects. MSR061-1 scored very well in tolerance to black spot bruise, with an average of 0.4 bruises per tuber reported (Table 4). This variety appeared to have a mid to late season maturity based on plant maturity on August 21st (Table 5).

CO02321-4W: This variety had a below average yield of US#1 tubers at 260 cwt./A and a tuber size distribution that consisted of 72 percent A-size and 28 percent undersize tubers (Table 1). The specific gravity was above the trial average at 1.081. Raw internal tuber quality was generally good (Table 2). The at-harvest chip fry test ranked this variety 8th out of 18 varieties for overall appearance. This variety exhibited good black spot bruise tolerance in the 2013 trial (Table 4). The vine maturity appeared to be mid-season for this variety (Table 5).

AC01151-5W: This variety recorded the fourth lowest yield in this year's trial (Table 1). AC01151-5W had a below average specific gravity of 1.067. The tuber size distribution consisted of 64 percent A-size and 34 percent undersize tubers. Internal tuber quality was poor with one tuber expressing hollow heart and ten tubers reported having vascular discoloration (Table 2). This clone ranked 17th at Herr's for chip quality and appearance on October 8th, 2013. AC01151-5W appeared to have a tolerance to black spot bruise (Table 4). This clone appeared to be immature on August 21th, 2013 (Table 5).

W6483-5: The US#1 yield for W6483-5 was below the trial average at 232 cwt./A. The specific gravity was the lowest of any variety in the trial at 1.064 (Table 1). Internal tuber quality was acceptable with only three tubers expressing vascular discoloration (Table 2). The chip quality at Herr's was reported as above average, ranking 5th of 18 varieties in out-of-the-field chip performance. W6483-5 was the only variety having no internal or external chip defects (Table 3). Black spot bruise tolerance was excellent with an average of only 0.2 bruises per tuber recorded (Table 4). The plant canopy was very mature on August 21st, with stable glucose and sucrose values observed (Table 5).

W4980-1: W4980-1 yielded 231 cwt./A US#1 with a specific gravity at the trial average of 1.077 (Table 1). This variety had three tubers with vascular discoloration (Table 2). Herr's ranked this variety 10th in the overall chip quality, recording the sixth highest percentage of chip defects at 27.0 (Table 3). The line appeared to be susceptible to black spot bruise, recording the highest number of bruises per tuber on average at 3.7 (Table 4).

W6609-3: The yield on W6609-3 was the lowest in the 2013 trial at 214 cwt./A US#1. The specific gravity was recorded at 1.080 (Table 1). Raw internal tuber quality was very good with no raw tuber defects being recorded (Table 2). Herr's ranked this variety third in overall chip quality appearance. Black spot bruise tolerance was good, averaging only 0.4 bruises per tuber (Table 4).