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2009 USPB/SFA Chip Variety Trials

Sponsored by
The United States Potato Board
&
The Snack Food Association

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2009 USPB/SFA Potato Chip Trial Results

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INTRODUCTION

The search for new and improved potato varieties is an ongoing and challenging task. During 2002 the United States Potato Board joined with the Snack Food Association in sponsorship of these chip variety trials, which were initiated by the SFA in 1985. The ten trial locations in 2009 were California, Florida, Idaho, Maine, Michigan, Missouri, North Carolina, Pennsylvania, the Red River Valley, and Wisconsin.

This annual report is divided into two sections. The first section presents the clonal and variety yield performance data for the 2009 growing and harvest season at each of ten state trial locations. Six states also report out-of-field chipping data. The second section consists of the chipping data obtained on short and long term storage of 2008 trial samples from six states. This storage section includes extensive chip color and sugar data from large long-term, multiple temperature cold storage research conducted by Chris Long of Michigan State University, Nick David, UMN/NDSU, and Chuck Kostichka, University of Wisconsin. The USPB-SFA Potato Technology Committee has thoroughly discussed the need and value of storage data and this report represents the sixth annual report to include this data. Starting next year this annual report will be divided into two reports: (1) Yield trial data and field performance (including out of field chipping) notes available in January of each year; and (2) a storage report with chip color and tuber sugar data in June of each year to allow for inclusion of all storage data into one report.

**Table 1. TRENDS IN THE SEED ACREAGE OF CURRENT CHIPPING VARIETIES
 (Plus Breeding Lines in USPB/SFA Chip Trials)**

Variety	Year Released	2004	2005	2006	2007	2008	2009
1. Atlantic	1976	3635	2592	2693	2806	2604	2824
2. Snowden	1990	1627	1664	1847	1794	1477	1640
3. Dakota Pearl	1999	1868	1348	1388	1194	992	1344
4. Reba	1992	898	808	764	828	853	759
5. Pike	1995	883	878	730	669	613	647
6. Ivory Crisp	2001	187	207	272	326	331	555
7. Megachip	2008	19	50	134	279	361	385
8. Dakota Crisp	2005	89	102	161	218	316	376
9. Chipeta	1993	356	260	390	348	323	371
10. Marcy	2003	187	262	320	319	314	339
11. Andover	1995	393	399	382	364	282	300
12. Monona	1964	586	333	518	243	256	277
13. NorValley	1996	475	455	453	361	255	164
14. Norchip	1968	52	50	33	11	102	77

Variety	Year Released	2004	2005	2006	2007	2008	2009
15. Beacon Chipper	2005	n/a	n/a	10	25	62	76
16. Monticello	2004	12	20	43	59	78	72
17. Harley Blackwell	2003	71	160	174	105	87	70
18. Dakota Diamond	2005	0.5	5.9	31	232	84	31
19. NY138		n/a	n/a	n/a	n/a	4.0	23
20. CO95051-7W		n/a	n/a	n/a	0.7	2.3	13
21. CO96141-4W		n/a	n/a	n/a	1.2	6.4	10
22. MSJ147-1		n/a/	n/a/	n/a	4.2	1.9	8.1
23. Kalkaska	2008	n/a	n/a	1.1	10.5	21	7.4
24. NY139		n/a	n/a	n/a	n/a	0.5	5.5
25. W2133-1		n/a	n/a	n/a	n/a	1.3	5.2
26. MSJ126-9Y		n/a	n/a	n/a	n/a	2.0	5.0
27. CO97065-7W		n/a	n/a	n/a	1.0	0.5	0.2
28. CO97043-14W		n/a	n/a	n/a	n/a	0.2	0.2
29. W2324-1		n/a	n/a	n/a	n/a	n/a	0.1

Acreage data obtained from the PAA seed certification section.

PROCEDURE

Trial entries are selected for three years of USPB-SFA sponsored chip trials from candidates suggested by University and USDA potato breeders who have been strong collaborators in this project. The eleven advanced breeding lines and newly released varieties evaluated in 2009 were AF2291-10, CO96141-4W, CO97043-14W, CO97065-7W, Kalkaska (recently named from MSJ036-A), MSJ126-9Y, ND7519-1, NY138, NY139, W2324-1, and W2717-5 (see Table 2 for descriptions), which were compared with the chip industry standards Atlantic and Snowden. Trial coordinators established trials in ten states with grower or research farm plots where entries were grown using standard cultural practices. Note that while nine entries were tested in all ten states, ND7519-1 was only trialed in ND and MI and W2324-1 was only trialed in CA, FL, MO and NC. Observation on emergence, growth characteristics and maturity are made during the growing season. Yield, tuber size distribution, external and internal defects, specific gravity and other plant and tuber characteristics were evaluated. Storage samples were held in grower storages and university facilities and chip processors participated in chipping evaluations from various temperature and storage durations.

OVERVIEW

It is important to look at the performance of the individual entries at each location because of the variations in soil types, weather, growing conditions and crop management. This project hopes to identify entries with wide adaptation and also to identify the most suitable sites where an entry may have superior performance. State reports in pages 9-47 show the yield, percent size distribution, and specific gravity data obtained at each of the ten regional locations. Table 3 (pages 48-53) summarizes the overall average yield, percent size distribution and specific gravity for each of eleven clones grown in two to ten regional trial sites in 2009. The Colorado State

breeding line CO94141-4W completed three years of trials from 2007 through 2009 and will be replaced with a new entry in 2010. A three year summary of performance data is presented in Table 4a for CO94141-4W, including both annual and three-year averages for each regional location and reflect the stable or variable performance of this line over eleven locations (TX dropped out after 2007, and CA and MO were added in 2008). Kalkaska (MSJ036-A) will be finished testing in USPB-SFA chip trials after two seasons (2008-2009) and summary data are presented in Table 5. While W2324-1 completed its three years of trials (2006-2008) over all USPB-SFA trial sites, it has been kept in southern sites (CA, FL, MO and NC) in 2009 and summary data are presented in Table 6.

CO96141-4W – was developed by Colorado State University. In 29 trial sites during 2007-09 (see Table 4a), this clone averaged a marketable yield of 301 cwt/acre (95% of Atlantic's marketable yield) and a total yield of 346 cwt/acre (93% of Atlantic). CO96141-4W had its highest marketable yield of 428 cwt/acre in the Wisconsin trial in 2008. At only four locations were yields significantly lower (MO in 2009, PA2008, RRV-NI 2009 and TX 2007). These four locations were either very hot or had very low moisture (note: RRV-NI and PA trials were not irrigated), indicating the importance of maintain good soil moisture to get optimal yields with this line. It had an average specific gravity of 1.076, which is .012 units below Atlantic. Specific gravity was above 1.080 in 7 of 29 trials. CO96141-4W averaged an Agtron chip color value of 64.1 (out of the field), 3.2 units above Atlantic. In long-term storage trials in 2008 this clone had slightly better color than Snowden in the 40F ID trial, better than Snowden in the PA trial, better or equal to Snowden from 45F and 50F trials in the RRV, but darker than Snowden in WI trials at 42F, 45F and 48F.

Kalkaska (MSJ036-A) – was developed by Michigan State University. In 21 trial sites during 2008-09 (see Table 5), this clone averaged a marketable yield of 304 cwt/acre (93% of Atlantic's marketable yield) and a total yield of 357 cwt/acre (92% of Atlantic). Kalkaska had its highest marketable yield of 481 cwt/acre in the Wisconsin trial in 2008, and had its next best two yields in Michigan (454 cwt/acre in 2009 and 465 cwt/acre in 2008). The lowest yielding trial was in MO in 2008 that was flooded by rainfall, but that was the highest yielding entry in that trial. It had an average specific gravity of 1.083, which is .006 units below Atlantic. Specific gravity was above 1.080 in 12 of 21 trials. Kalkaska averaged an Agtron chip color value of 62 (out of the field), 0.6 units above Atlantic. In long-term storage trials in 2008 it had better chip color than Snowden in the ID trial, was one of the best in the ME trial, about equal to Snowden in PA, but significantly darker than Snowden in WI trials held at 42F, 45F and 48F. MI and RRV researchers did not place it into long-term trials due to early color problems.

Table 2. Characteristics of the 2009 USPB - SFA Chip Trials Entries

Advanced Seedlings	Characteristics	Seed Provided By
<p>AF2291-10</p> <p><i>Year 2</i></p>	<p>Parentage: SA8211-6 x EB8109-1. Mid-season maturity, round tubers, some misshapen tubers, with medium yield potential. Moderate to good resistance to internal heat necrosis, early blight and common scab. Chips from field and warm storage (50F), not a cold storage chipper. In two years of trials it averaged 279 cwt/acre marketable yield (85% of Atlantic) and had an average specific gravity of 1.089 (0.002 below Atlantic). Had second best chip color from 54F storage in Dec and Mar for 2008 MI trials but poor color in the RRV and WI trials in 2008.</p>	<p>Dr. Greg Porter University of Maine Orono, ME</p>
<p>CO96141-4W</p> <p><i>Year 3</i></p>	<p>A selection made in 1996 from a cross between BC0894-2W and AC87340-2W. Mid-season maturity, blocky tuber shape, good tuber size, resistant to hollow heart and blackspot bruise. In three years of trials (30 sites) it averaged 301 cwt/acre marketable yield (95% of Atlantic) with an average specific gravity of 1.076 (0.012 below Atlantic). It has chipped well from the field in seven states where tested and has chipped well from 48F or 50F storage in several states but had darker color in colder storages.</p>	<p>Dr. David Holm Colorado State Univ. Center, CO</p>
<p>CO97043-14W</p> <p><i>Year 2</i></p>	<p>Parentage: AC91817-5W x AC87340-2W. Mid-season maturity, round tubers, medium-long tuber dormancy, blackspot resistant, and low levels of external and internal defects. In two years of trials it has averaged 297 cwt/acre marketable yield (91% of Atlantic) with an average specific gravity of 1.080 (0.009 below Atlantic). Good out of field chip color, had good color from 50F to 54F storages in ME, MI, PA, and RRV, poor color from 42, 45 & 48F in WI.</p>	<p>Dr. David Holm Colorado State Univ. Center, CO</p>
<p>CO97065-7W</p> <p><i>Year 2</i></p>	<p>Parentage: AC92513-3 x Chipeta. Early to mid-season maturity, round tubers, long tuber dormancy, blackspot resistant, and low levels of external and internal defects. In two years of trials averaged 261 cwt/acre marketable yield (80% of Atlantic) and had an average specific gravity of 1.084 (.005 units below Atlantic). Had chip color as good or better than Snowden in ID, ME, MI, PA, RRV and WI trials held between 40F and 54F from the 2008 season.</p>	<p>Dr. David Holm Colorado State Univ. Center, CO</p>

<p>MSJ036-A Kalkaska</p> <p><i>Year 2</i></p>	<p>Parentage: B1254-1 x S440. Breeding line MSJ036-A has been named Kalkaska. Late maturity, excellent round tuber shape, good scab resistance, moderate specific gravity (averaged 1.083, 0.006 below Atlantic), but relatively good yield potential (averaged 298 cwt/a marketable yield, 91% of Atlantic). Had good chipping out of field scores in 9 of 11 sites. Reconditioned well from ID trial at 40F, very good color at 55F in ME, average color in PA and significantly darker color than Snowden from 42F, 45F and 48F storage in WI. (chip data on 2008 crop)</p>	<p>Dr. Dave Douches Michigan State Univ. East Lansing, MI</p>
<p>MSJ126-9Y</p> <p><i>Year 1</i></p>	<p>Parentage: Penta OP. Has mid-season maturity, smooth round tuber shape and yellow flesh. Strengths are scab resistance, low reducing sugars and the ability to store below 50F. Weaknesses are lower specific gravity and small vines. In first year of trials it averaged 230 cwt/acre marketable yield (72% of Atlantic) with an average specific gravity of 1.077 (0.012 below Atlantic).</p>	<p>Dr. Dave Douches Michigan State Univ. East Lansing, MI</p>
<p>ND7519-1</p> <p><i>Year 2 (only MI & ND)</i></p>	<p>Mid-season maturity, good specific gravity (similar to Atlantic), moderate yield potential, and prone to hollow heart and brown center. In the first year of USPB-SFA chip trials (10 states) it averaged 288 cwt/acre marketable yield (81% of Atlantic) and a specific gravity of 1.089 (.001 below Atlantic). Was only planted to MI and RRV sites in 2009 and averaged 286 cwt/acre (82% of Atlantic) and a specific gravity of 1.096 (0.001 below Atlantic). Had second best color from 40F in Idaho and best or second best color from 42F, 45F, 48F and 52F in WI trials. (chip data in 2008 crop)</p>	<p>Dr. Susie Thompson ND State Univ. Fargo, ND</p>
<p>NY138</p> <p><i>Year 2</i></p>	<p>Parentage: Marcy x NY115. Late maturity, round tubers, few external defects, less blackspot than Snowden, moderate scab resistance, resistant to race Ro1 of golden nematode, and long tuber dormancy. In two years of trials it averaged 313 cwt/acre marketable yield (95% of Atlantic) and had an average specific gravity of 1.077 (0.012 below Atlantic). In 2008 storage trials it had chip color better than Snowden in ID, PA, RRV and WI locations.</p>	<p>Dr. Walter De Jong Cornell University Ithaca, NY</p>
<p>NY139</p>	<p>Parentage: NY120 x NY115. Medium-late maturity, round tubers, few external defects, some internal necrosis, good resistance to</p>	<p>Dr. Walter De Jong Cornell University</p>

<p><i>Year 2</i></p>	<p>common scab, resistant to race Ro1 of golden nematode, and medium tuber dormancy. In two years of trials it averaged 307 cwt/acre marketable yield (94% of Atlantic) and had an average specific gravity of 1.085 (0.004 below Atlantic). In 2008 storage trials it had chip color equal or better than Snowden in ID, MI, PA, and the RRV locations.</p>	<p>Ithaca, NY</p>
<p>W2324-1</p> <p><i>Year 4 (only CA, FL, MO and NC)</i></p>	<p>A selection from a cross between Snowden and RHL166. Late maturity, round uniform tubers, and relatively high specific gravity. In three years of full trials (2006-2008) it had an average specific gravity of 1.085, which is 0.003 units below Atlantic. This clone had the highest average marketable yield in all three seasons of USPB-SFA testing. In 2009 in four southern states W23234-1 averaged 287 cwt/acre marketable yield (92% of Atlantic) and averaged a 1.077 specific gravity (0.004 below Atlantic). Chip color variable, ranging from poor to excellent, depending upon the trial site.</p>	<p>Dr. Jiwan Palta, Felix Navarro and Bryan Bowen University of Wisconsin Rhinelander, WI</p>
<p>W2717-5</p> <p><i>Year 2</i></p>	<p>Parentage: S440 x ND3828-15. Late maturity, round tubers of medium size, medium yield potential, medium to high specific gravity. Good internal quality, low sugars, medium term storability, good chipping ability. Moderate scab susceptibility. In two years of trials it averaged 232 cwt/acre marketable yield (71% of Atlantic) and had an average specific gravity of 1.091 (0.002 above Atlantic). In 2008 storage trials it had the best or second best chip color in IDA, RRV and WI trials. It had the lowest color in PA.</p>	<p>Dr. Jiwan Palta, Felix Navarro and Bryan Bowen University of Wisconsin Rhinelander, WI</p>

California Regional Trial

Project Leader:

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Cooperators:

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Trial Information:

Previous Crop: Potatoes have been grown in this field for at least the past 5 years.
Trial Location: Johnston Farms, Edison, CA.
Soil Type: Cajon Sand
Planting Date: 2/15/08
Vine Kill Date: 5/31/08
Harvest Date: 6/9/08
Plant Spacing: Hand Planted at 9 inch spacing
Plot Size: 20 ft row x 32 inch bed width, 4 replications
Irrigation: Solid set sprinkler, 40ft x 30 ft
Pest Management: Standard grower's practice

Procedure

Approximately 20 pound seed potato samples of the Snack Food Association chip trial were received by FedEx during the months of January and February from the chip trial breeders. The seed was held in a warehouse until seed was cut by hand. Twenty seven seed pieces were placed into a small paper bag and held until planted on 2/19/09. The Snack Food Association trial was hosted by Johnston Farms of Edison CA on one of their field sites.

Plots were marked off every 23 feet and the beds were opened up in the middle with a 2 row potato planter. The 27 seed pieces were dropped by hand into the opened beds with a 3 foot buffer between each plot. Once planted, the seed was cover with soil and the beds were reformed with a cultivator. The experimental design was a randomized complete block design.

The field trial received all standard growing practices for fertilization and pest management. There was no significant insect or disease pressure at the field site but it did receive regular

preventive fungicide treatments. Weeds were controlled with early season cultivation and use of Eptam herbicide.

The tops were beaten off on 5/29/09 and the plots were harvested on 6/8/09. A single row digger lifted the tubers and dropped them on the ground. The tubers were then picked up by a hand crew and placed into burlap sacks and transported to a nearby shop for grading. The tubers were graded the following day and a 12-15 lb sub-sample taken from each plot. From the sub-samples taken an 8 lb sample from each variety was taken to White Wolf Potato packing shed and specific gravity tests were performed. All data was analyzed using MSTAT-C.

2009 SFA Chip Trial Vigor Rating

ID#	Rep 1	Rep 2	Rep 3	Rep 4	AVG. Vigor	
1	4	3	3	3	3.3	
2	3	3	3	3	3.0	
3	3	3	3	2	2.8	Vigor Scale:
4	4	3	3	3	3.3	1 = Very poor
5	4	3	3	3	3.3	2 = Below average
6	4	3	3	3	3.3	3 = Average
7	3	3	4	4	3.5	4 = Above average
8	4	4	4	3	3.8	
9	4	3	4	3	3.5	
10	1	3	2	2	2.0	
11	3	3	2	3	2.8	
12	3	3	3	2	2.8	
13	3	2	3	n/a	2.7	

2009 SFA Chip Trial Specific Gravity

	Rep1	Rep2	Rep3	Rep 4	Average
1. Kalkaska	1.080	1.081	1.075	1.080	1.079
2. MSJ126-9Y	1.078	1.078	1.075	---	1.077
3. W22324-1	1.084	1.083	1.080	1.084	1.083
4. W2717-5	1.092	1.078	1.088	1.090	1.087
5. Atlantic	1.086	1.089	1.088	1.087	1.088
6. Snowden	1.080	1.082	1.080	1.080	1.081
7. AF2291-10	1.089	1.089	1.088	1.086	1.088
8. NY138	1.079	1.080	1.074	---	1.078
9. NY139	1.079	1.082	1.084	1.085	1.083
10. CO96141-4W	1.059	1.078	1.073	1.075	1.071
11. CO97065-7W	1.085	1.088	1.090	1.086	1.087
12. CO97043-14W	1.087	1.083	1.082	1.085	1.084
13. W2310-3	1.081	1.095	1.089	---	1.088

Table 1. California Trial 2009, Total and Marketable Yield, Culls, Specific Gravity, and Vigor.

ENTRY	Yield (cwt/acre)		Percent Size Distribution (ounces tuber weight)					CULLS	SP GR	VIGOR
	US#1	TOTAL	US#1	0 - 4	4 - 6	6 - 10	over 11			
Atlantic	383	499	77	7	22	55	14	1.6	1.088	3.3
Snowden	401	468	86	9	31	55	4	1.1	1.081	3.3
AF2291-10	287	324	89	9	36	53	2	0.7	1.088	3.5
CO96141-4W	288	338	85	12	23	63	2	1.3	1.071	2.0
CO97043-14W	342	385	89	8	32	56	3	0.4	1.084	2.8
CO97065-7W	303	380	80	12	28	52	8	0.4	1.087	2.8
Kalkaska	341	421	81	17	42	39	1	1.5	1.079	3.3
MSJ126-9Y	277	330	84	11	32	53	3	2.0	1.077	3.0
NY138	354	426	83	6	22	61	11	0.5	1.078	3.8
NY139	379	437	87	5	25	61	8	0.3	1.083	3.5
W2324-1	384	458	84	7	28	56	7	1.8	1.083	2.8
W2717-5	264	321	82	12	31	51	3	1.7	1.087	3.3
average:	334	399	84	10	29	55	6	1.1	1.082	3.1

Vigor rating scale: 1 = very poor, 2 =below avg., 3 = avg. and 4 = above avg.

FLORIDA REGIONAL LOCATION

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Cooperating Grower:

University of Florida/IFAS, Florida
Partnership for Water, Agricultural and
Community Sustainability at Hastings

Cooperating Chip Processor:

n/a, potatoes were fried on site.

Trial Data:

Planting Site:	University of Florida/IFAS, Florida Partnership for Water, Agricultural and Community Sustainability at Hastings Research and Demonstration Farm
Planting Date:	February 4, 2009
Harvest Date:	May 28, 2009 (113 days)
Growing Conditions:	Overall, weather conditions for the 2009 growing season were rated as fair. Six mornings had temperature readings at or below freezing from the planting date forward. February and March were mostly dry. April saw about normal precipitation. Seepage irrigation was started earlier than normal and ran almost constantly from about mid-late February until just prior to harvest. A significant rainfall event of 17 inches over a 12 day span in the 2 weeks prior to harvest greatly reduced total and marketable yields of most entries. Marketable yields are considered to be mostly below average. The higher percentage of total culls compared to more normal years was influenced by a large increase in the amount of rotten and sunburned tubers, which was caused by the increased soil moisture and eroded rows from the heavy rains. Specific gravities of most selections were also considerably lower compared to previous seasons.
Experimental Design:	Each variety/clone was planted in a single 250 ft row as directed by the SFA protocol. Four 20 ft sections of each row were harvested and graded. This was not a randomized and replicated experiment. Only means were calculated.
Row Spacing:	Machine planted. Approx. 8 inches in-row, 40 inches between-rows.
Fertilizer:	preplant:100-43-86/A; sidedress: 2 applications of 50-0-43/A (lb N-P-K/A)
Pest Control:	Pic-Clor 60 11 gpa, pre-plant Temik 15G, 20 lb/A, at planting Sencor DF, 16 oz/A and Dual Magnum, 16 fl oz/A at hilling Fungicides and Insecticides as needed. IPM program used.
Chip Ratings:	Potato sub-samples were fried directly from the field. Chips were prepared and rated following the procedures outlined in the Snack Food Association Chipping Potato Handbook (1995). Chip scores are presented in Table 2.

Table 1. Production statistics for SFA clones.

Clone	Tuber Yield			% Culls	Size Class Distribution ^{3,4} (%)					Size Class Range ⁴ (%)		Specific Gravity
	No.1 ¹ cwt/A	Total cwt/A	% No.1 ²		1	2	3	4	5	2 to 4	3 to 4	
Atlantic	226	350	93	30	7	52	28	13	0	93	41	1.066
Snowden	224	280	88	10	11	73	12	3	0	88	15	1.069
AF2291-10	205	262	91	14	10	64	21	6	0	91	27	1.073
CO96141-4W	339	390	90	4	9	72	16	2	0	90	18	1.063
CO97043-14W	301	346	91	4	8	62	18	11	0	91	29	1.066
CO97065-7W	288	325	92	5	7	77	14	1	0	92	15	1.075
Kalkaska	113	204	72	24	26	66	5	1	0	72	6	1.064
MSJ126-9Y	212	263	90	10	8	59	24	7	0	90	31	1.063
NY138	331	395	94	10	5	36	28	30	1	94	58	1.062
NY139	246	314	92	15	7	59	23	10	0	92	33	1.065
W2324-1	132	203	81	19	17	73	6	2	0	81	8	1.065
W2717-5	154	235	81	19	18	75	5	1	0	81	6	1.071
Average	231	297										1.067

¹**No.1 Yield:** marketable yield, size classes 2 to 4

²**Percent No. 1:** calculated based on weight using the formula, No. 1 Wt / Total Yield Wt

³**Size Class Distribution:** calculated based on weight using the formula, Class Wt / (Total Yield Wt – Cull Wt).

⁴**Size Classes:** 1 = 1.5 to 1 7/8", 2 = 1 7/8 to 2.5", 3 = 2.5 to 3.25", 4 = 3.25 to 4", 5 = > 4"; Class size C (<1.5") was recorded and is included in Total Yield but is not shown as a separate size category.

Table 2. Plant growth and tuber characteristics for SFA clones.

Clone	Plant Growth Characteristics ¹				Tuber Characteristics ²						
	Percent Stand	Early Vigor	Vine Type	Vine Maturity	IFC	SC	ST	TS	ED	APP	Chip Rating ³
Atlantic	76	6	9-6	3	2	5	5	3	5	6	2
Snowden	89	6.8	9	2.8	1	6	5	3	3	6	2
AF2291-10	75	6	9	3	1	6	5	3	5	3	3
CO96141-4W	83	6.8	5-8	1	1	7	6	4	5	4	1
CO97043-14W	69	6	6	2	2	7	5	3	6	6	1
CO97065-7W	69	6.5	9-6	2	2	7	5	3	6	5	1
Kalkaska	83	6	9	1	1	6	5	2	5	6	1
MSJ126-9Y	71	5	8	2	4	6	5	3	5	6	2
NY138	70	5.8	8-9	3	2	6	5	4	6	4	1
NY139	85	6.3	9-6	3	2	6	5	4	4	3	1
W2324-1	92	6	6	2	1	7	5	4	4	5	1
W2717-5	83	6	9-6	2	1	7	6	3	7	5	1

¹Plant Growth Characteristics.

Percent Stand: based on machine planted 8 inch in-row spacing, 20 ft plot.

Early Vigor: 1 = no emergence, 2 = leaves in rosette, 3 = plants < 2 in., 4 = plants 2 to 4 in., 5 = plants 4 to 6 in., 6 = plants 6 to 8 in., 7 = plants 8 to 10 in., 8 = plants 10 to 12 in., 9 = plants > 12 inches.

Vine Type: 1 = decumbent - poor canopy, 2 = decumbent - fair canopy, 3 = decumbent - good canopy, 4 = spreading - poor canopy, 5 = spreading - fair canopy, 6 = spreading - good canopy, 7 = upright - poor canopy, 8 = upright - fair canopy, 9 = upright - good canopy.

Vine Maturity: 1 = completely dead, 3 = yellow and dying, 5 = moderately senesced, 7 = starting to senesce, 9 = green and vigorous.

²Tuber Characteristics.

Internal Flesh Color (IFC): 1 = white, 2 = cream, 3 = light yellow, 4 = medium yellow, 5 = dark yellow, 6 = pink, 7 = red, 8 = blue, 9 = purple.

Skin Color (SC): 1 = purple, 2 = red, 3 = pink, 4 = dark brown, 5 = brown, 6 = tan, 7 = buff, 8 = white, 9 = cream.

Skin Texture (ST): 1 = partially russet, 2 = heavy russet, 3 = moderate russet, 4 = light russet, 5 = netted, 6 = slightly netted, 7 = moderately smooth, 8 = smooth, 9 = very smooth.

Eye Depth (ED): 1 = very deep, 3 = deep, 5 = intermediate, 7 = shallow, 9 = very shallow

Overall Appearance (APP): 1 = very poor, 3 = poor, 5 = fair, 7 = good, 9 = excellent.

³Chip Rating: Chips were prepared and rated following the procedures outlined in the Snack Food Association Chipping Potato Handbook (1995). A sub-sample of potatoes from the Chipping Trial was shipped to Wise Foods, chipped and rated on a 1-5 scale: 1 = outstanding, no blemishes and color variations; 2 = very good, minimal blemishes and color variations; 3 = good, acceptable blemishes and color variations; 4 = marginal acceptance, high levels of blemishes and color variations; 5 = not acceptable, high blemish and color variations.

Table 3. External and internal defects for SFA clones.

Clone	% External Tuber Defects ¹					% Internal Tuber Defects ²			
	Growth Cracks	Mis-shapen	Sun-burned	Rotten & misc.	Total Culls	HH	BR	CRS	IHN
Atlantic	0	0	12	18	30	6	0	0	0
Snowden	0	0	3	7	10	0	0	0	0
AF2291-10	0	0	3	11	14	0	0	0	0
CO96141-4W	0	0	1	3	4	0	0	0	0
CO97043-14W	0	0	2	2	4	0	0	0	0
CO97065-7W	0	0	3	2	5	0	0	0	1
Kalkaska	0	0	14	10	24	0	0	0	0
MSJ126-9Y	0	0	9	1	10	0	0	0	0
NY138	0	0	6	4	10	0	0	0	0
NY139	0	0	4	11	15	0	0	0	0
W2342-1	0	0	3	16	19	0	0	0	0
W2717-5	1	0	12	6	19	1	0	0	0

¹**External Tuber Defects:** Total Culls is sum of growth cracks, misshapen, sunburned and rotten/miscellaneous.

²**Percent Internal Tuber Defects:** percent of tubers showing defects; HH = hollow heart, BR = brown rot, CRS = corky ringspot, IHN = internal heat necrosis.

Idaho Regional Trial

Local Coordinator:

Jeff Stark
Peggy Bain
Melvin Chappell

**University of Idaho
Aberdeen R&E Center
Aberdeen, Idaho**

Trial Data

PLANTED 7-May-09
VINE KILLED 3-Sep-09
VINE KILLER (Reglone @ 2 pts/A)
HARVESTED 24-Sep-09

PLOT LENGTH	18'	HARVEST LENGTH	18'
HILL SPACING	10"	ROW SPACING	36"
HILLS PER PLOT	20	ROWS/ PLOT	1
REPS	4		

METHOD OF HARVEST Grimme Machine

IRRIGATION 16.59 inches sprinkler applied 4.55 inches rain
23 inches total water

FERTILIZER

115 N - 115 P - 0 K - 5 lb zinc– pre-plant
135 units injected through water

INSECTICIDES APPLIED/HILLING

Admire Pro (8 oz/A) - Shanked May 21

FUNGICIDES APPLIED

Dithane F-45 1.5 gts/Acre July 14
Equus 8 pints/A July 27

HERBICIDES APPLIED

Eptam 6.5 Pints/A; Matrix 1.5 oz/A; Metri DF 0.45 lb/acre
Spray Coupe- May 21

ENVIRONMENTAL FACTORS

Rainfall of 4.55 inches from June 1-June 22.

Table 1. IDAHO TRIAL 2009, Yield, Size Distribution, Specific Gravity								
Clone	Yield (cwt/A)		Percent Size Distribution				% Unusable	Specific Gravity
	US No1	Total	<1 ^{7/8} "	1 ^{7/8} "-2.5"	2.5-4"	>4"		
CO96141-4W	404	484	16	31	48	4	1	1.085
NY139	372	488	23	34	39	3	1	1.094
NY138	362	438	17	24	54	4	1	1.083
ATLANTIC	329	427	19	27	36	14	4	1.094
CO97043-14W	316	409	23	32	43	2	0	1.088
AF2291-10	283	327	9	20	49	17	5	1.093
W2717-5	275	388	27	32	33	6	2	1.094
SNOWDEN	270	385	26	26	32	12	4	1.092
MSJ036-A	257	368	29	33	36	1	1	1.094
CO97065-7W	213	393	46	44	10	0	0	1.089
MSJ126-9Y	185	332	44	39	16	0	1	1.089
Mean	297	404	25	31	36	6	2	1.090
LSD (.05)	59	65						0.004
LSD (.01)	78	87						0.006

Table 2. IDAHO TRIAL 2009, Vine and tuber characteristics.							
Clone	Vine Size ¹	Vine Maturity ²	Stems/Plant	Fresh Merit Score ³	Avg. Tuber Size (oz.)	Tuber Shape ⁴	
CO96141-4W	1.5	1.5	2.3	4.3	5.3	2.8	
NY139	2.5	3.0	2.5	3.5	4.8	1.8	
NY138	2.0	3.0	1.4	3.3	5.3	2.3	
ATLANTIC	2.0	2.0	2.8	2.5	5.3	2.0	
CO97043-14W	1.0	2.0	2.1	2.5	4.8	1.0	
AF2291-10	1.5	2.5	1.7	2.0	6.7	2.3	
W2717-5	2.5	2.0	2.2	2.8	4.6	2.0	
SNOWDEN	1.5	2.0	2.7	1.5	4.8	1.5	
MSJ036-A	2.5	2.5	1.8	3.3	4.3	1.3	
CO97065-7W	1.0	1.0	3.6	3.3	3.7	1.0	
MSJ126-9Y	1.0	2.0	2.4	3.0	3.7	1.0	
Mean	1.7	2.1	2.3	2.9	4.8	1.7	
¹ (1-5) 5=Large							
² (1-5) 5=Late							
³ (1-5) 5=Best Preference Score							
⁴ (1-5) 1=Round							

Table 3. IDAHO TRIAL 2009, External and Internal Defects.									
Clone	External defects ⁴				Eye Depth ⁵	Internal Defects ⁶			
	Scab	Growth Cracks	Knobs			% HH	% BC	% IBS	% VD
CO96141-4W	3.3	5.0	5.0		4.3	0	0	0	0
NY139	2.5	5.0	5.0		3.3	0	0	0	0
NY138	2.3	5.0	5.0		3.8	0	0	0	0
ATLANTIC	3.0	4.5	5.0		3.0	5	5	0	0
CO97043-14W	2.8	5.0	5.0		3.3	0	0	0	0
AF2291-10	4.5	5.0	4.8		2.8	3	3	0	0
W2717-5	3.5	5.0	4.8		4.3	8	0	0	0
SNOWDEN	3.5	5.0	4.8		2.0	0	0	0	13
MSJ036-A	3.5	5.0	5.0		3.3	3	0	0	0
CO97065-7W	3.0	5.0	5.0		3.5	0	0	0	0
MSJ126-9Y	4.5	5.0	5.0		3.5	0	0	0	0
Mean	3.3	5.0	4.9		3.4	1.7	0.7	0.0	1.2
⁴ (1-5) 5=None									
⁵ (1-5) 1=deep, 5=shallow.									
⁶ Percent of defects on 10 large tubers									
HH=hollow heart, BC=brown center, IBS=internal brown spot, VD=vascular discoloration									

Table 4. IDAHO TRIAL 2009, Harvest Quality Report and Field Diseases				
Clone	Appearance comments	Chip color	Early Blight ⁷	Verticillium Wilt ⁷
CO96141-4W	oval, white, nice, but scab	not available	1.5	1.5
NY139	oval, white, scab, varied sizes, flat		2.0	3.0
NY138	oval, lt buff, scab, deep ends		2.5	3.0
ATLANTIC	round, scaly buff, scab		2.0	2.0
CO97043-14W	round (almost Compressed), white, rot, ad stolons		1.5	2.5
AF2291-10	oval, buff, non uniform, deep ends		2.0	2.5
W2717-5	round, buff, flat, nonuniform, rot, shattered		2.0	2.5
SNOWDEN	lumpy, knobs, ugly, green		2.0	2.0
MSJ036-A	medium round, buff, ad stolons, deep ends		2.0	2.5
CO97065-7W	small, round, buff, scab		1.0	1.0
MSJ126-9Y	very small, round, scab		1.5	2.0
Mean			1.8	2.2
⁷ (1-5) 1=severe.				

Maine Regional Trial

Cooperators:

Local Coordinator:

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Cooperating Grower(s):

Aroostook Research Farm
University of Maine
59 Houlton Road
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Aroostook Produce Distributors
Gerry Miller
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Cooperating Processor:

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Dennis Deary, Process Mgr.
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SFA Coordinator:

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Variety Entries:

Atlantic (Field Std.)
Snowden (Storage Std.)
AF2291-10
CO96141-4W
CO97065-7W
CO97043-14W
Kalkaska (MSJ036-A)
MSJ126-9Y
NY138
NY139
W2717-5

ME, University of Maine, Greg Porter
CO, San Luis Valley Res. Ctr., David Holm
CO, San Luis Valley Res. Ctr., David Holm
CO, San Luis Valley Res. Ctr., David Holm
MI, Michigan State Univ., David Douches
MI, Michigan State Univ., David Douches
NY, Cornell University, Walter DeJong
NY, Cornell University, Walter DeJong
WI, University of Wisconsin, Jiwan Palta

Trial Information:

Location: Aroostook Research Farm, Presque Isle, ME
Soil Type: Caribou loam
Soil Test: pH 5.0 Avail P (MH), K (MH), Ca (L), Mg (M)
3.5% organic matter
Previous Crop: clover (2008), peas (2007)
Planting Date: May 22, 2009
Plot size/design: 36" row spacing, plots 2 rows x 30'
Randomized (RCBD), four replicates per variety

Trial Information (continued):

Fertilization:	168-168-168 at planting Foliar boron applied June 30
In-row Spacing:	10" except Snowden (14"), AF2291-10 (8"), NY138 (8")
Crop Management:	Typical of commercial production in the area
Sprout Inhibitor:	Maleic Hydrazide, August 13
Vinekill Date:	September 8, 2009 (109 DAP)
Harvest Date:	September 23, 2009
Processing Date:	September 30, 2009

Procedures:

Seed potatoes were received from the cooperating programs listed above and held under controlled storage conditions at Aroostook Research Farm, Presque Isle, ME. The seed potatoes were warmed and hand-cut about two weeks prior to planting. They were suberized in controlled storage and hand-planted without a commercial seed treatment.

The trial was managed using practices typical of the production area. Weeds were controlled with a standard herbicide program followed by normal cultivation and hilling. Insect pests were controlled with an in-furrow insecticide. Subsequent foliar insecticides were applied based on insect pressure determined by regular scouting for pests. Foliar diseases were controlled using a conventional spray program based on the University of Maine's IPM program. Late blight was not observed in this trial during 2009. Vine desiccation was accomplished using a standard chemical desiccant. Natural rainfall was abundant during the majority of the season, but became somewhat limiting late in August (Table 1). No supplemental irrigation was applied. The plots were harvested with a hand crew following lifting with a one-row, research-scale potato digger. All tubers were weighed and a 50-lb sample was graded for external defects and sized using a spool-type sizer. Ten tubers per size class were examined for hollow heart. Specific gravity was determined on a 5-kg sample using the weight-in-air/weight-in-water method. A 50-lb sample was collected at harvest and shipped to Frito-Lay's Dayville plant for evaluation of chip quality. Additional tuber samples were placed in controlled storage for evaluation of chip color during the storage season.

Table 1. Rainfall and temperature, 2009 Aroostook Research Farm, Presque Isle, ME

Month	<u>Week (inches)</u>				Total (inches)	<u>Average (°F)</u>	
	1	2	3	4		High	Low
May	1.07	1.60	0.83	0.96	4.46	69.6	44.7
June	0.94	0.84	1.41	1.41	4.60	71.8	51.3
July	1.16	0.27	0.80	2.72	4.95	74.1	55.9
August	0.31	0.52	0.94	0.47	2.24	78.3	56.7
<u>September</u>	<u>0.00</u>	<u>0.06</u>	<u>0.05</u>	<u>1.24</u>	<u>1.35</u>	<u>69.6</u>	<u>44.7</u>
Grand total					17.60		

Results:

There was ample early rainfall at the trial site followed by a relatively dry August (Table 1). Early crop growth was good and most of the clones were still growing quite vigorously at vinekill (Table 2). There were no significant problems with foliar diseases or early dying in this trial.

Table 2. Plant characteristics, UPSB/SFA Chip Variety Trial, Maine, 2009.

Variety/Clone	% Plant Stand		Vigor		Vine Mat.	Foliage Color	Foliar Disease Problems
	Stand		Early	Late			
AF2291-10	78		F	VG	Late	Med. green	None
CO96141-4W	92		F	G	Med. late	Dark green	None
Snowden	100		G	G	Med. late	Med. green	None
Kalkaska	78		F-P	VG	Late	Med. green	None
MSJ126-9Y	95		F	G	Med. late	Dark green	None
Atlantic	91		VG	G	Med. late	Med. green	None
CO97065-7W	97		VG	G	Med. late	Med. green	None
NY139	93		G	VG	Late	Light green	None
CO97043-14W	99		VG	F	Medium	Med. green	None
W2717-5	84		F	VG	Late	Med. green	None
NY138	82		F-P	G	Med. late	Med. green	None

AF2291-10, CO96141-4W, Snowden, and Kalkaska had the highest US#1 yields in the experiment (Table 3). CO97043-14W, W2717-5, and NY138 were relatively low yielding. W2717-5, Atlantic, Snowden, and AF2291-10 had particularly high specific gravity. All clones had acceptable tuber size profiles.

AF2291-10, CO96141-4W, Snowden, Kalkaska, and MSJ126-9Y had relatively low incidence of external tuber defects (Table 4). Atlantic, W2717-5, and NY138 had greater than 20% external tuber defects. Sunburn was the most prevalent external defect; however, off shapes (AF2291-10), growth cracks (W2717-5, Atlantic), and scab (W2717-5) were prevalent in several clones. Hollow incidence was low for all clones/varieties except Atlantic. Tuber characteristics are summarized in Table 5.

Chip color evaluations were conducted at the Frito-Lay plant in Dayville, CT (Table 6). Atlantic had a relatively high incidence of chip defects otherwise the chip samples were good (AF2291-10) to very good (all others). Only CO97043-14W and NY138 had total solids values below 18%.

Susceptibility to bruising was evaluated by tumbling tuber samples in a drum. Based on this evaluation NY138, NY139, and CO96141-4W were relatively resistant to bruise damage, while Atlantic and W2717-5 were quite susceptible (Table 7). AF2291-10, Snowden, Kalkaska, MSJ126-9Y, CO97065-7W, CO97043-14W fell into the intermediate ranges.

Table 3. Yield, size distribution, and specific gravity, UPSB/SFA Chip Variety Trial, Maine, 2009.

Variety/Clone	<u>Yield (cwt/A)¹</u>			<u>Size Distribution (% by weight)²</u>							Spec. Grav.
	Tot.	US#1	%Std	1	2	3	4	5	1-7/8 to 4"	2-1/2 to 4"	
AF2291-10	365	314	116	5	54	37	4	0	95	41	1.092
CO96141-4W	346	305	113	4	57	38	1	0	96	39	1.079
Snowden	359	299	111	7	64	28	1	0	93	29	1.093
Kalkaska	359	298	110	8	71	20	1	0	92	22	1.089
MSJ126-9Y	329	277	103	5	56	36	3	0	95	40	1.083
Atlantic	367	270	100	5	60	30	5	0	95	35	1.093
CO97065-7W	322	258	96	5	67	26	2	0	95	29	1.090
NY139	318	251	93	7	63	27	3	0	93	30	1.090
CO97043-14W	295	236	87	5	54	36	5	0	95	41	1.081
W2717-5	348	227	84	5	60	32	3	0	95	35	1.097
NY138	297	214	79	4	37	50	9	0	96	59	1.083
Mean	337	268							94	36	1.088
CV(%)	6.8	13.7							1.9	23.4	0.33
LSD(k=100)	33	58							3	12	0.005

¹US#1 yield was calculated as yield from 1 7/8" to 4" diameter, minus tubers with external defects.

²Size Classes: 1=1 1/2" to 1 7/8"; 2=1 7/8" to 2 1/2"; 3=2 1/2" to 3 1/4"; 4=3 1/4" to 4"; 5= over 4"

Table 4. External tuber defects and hollow heart incidence, UPSB/SFA Chip Variety Trial, Maine, 2009.

Variety/Clone	<u>External Defects (% by weight)</u>						<u>Hollow Heart by Size Class¹(%)</u>		
	Total	Sunb	Mshp	Grck	Scab	Rot	3	4	5
AF2291-10	9.8	2.6	5.7	0.3	1.2	0.0	0.0	0.0	11.1
CO96141-4W	7.9	4.3	1.7	0.0	1.8	0.1	0.0	0.0	0.0
Snowden	10.2	7.4	2.3	0.4	0.1	0.0	0.0	0.0	0.0
Kalkaska	9.6	6.3	1.3	1.4	0.0	0.5	5.0	2.5	0.0
MSJ126-9Y	11.9	6.9	1.9	1.5	0.9	0.8	0.0	0.0	0.0
Atlantic	23.2	15.0	2.5	3.3	2.4	0.0	0.0	0.0	38.5
CO97065-7W	16.1	10.8	1.8	2.0	1.2	0.2	0.0	0.0	0.0
NY139	14.6	11.9	0.5	0.2	1.9	0.2	0.0	0.0	0.0
CO97043-14W	16.2	11.7	2.8	0.8	0.9	0.0	0.0	0.0	0.0
W2717-5	31.5	11.4	3.7	4.8	11.4	0.3	0.0	0.0	0.0
NY138	25.2	22.4	0.0	1.3	1.5	0.0	0.0	0.0	0.0
Mean	16.0								
CV(%)	51.9								
LSD(k=100)	13.2								

¹Size Classes: 1=1 1/2" to 1 7/8"; 2=1 7/8" to 2 1/2"; 3=2 1/2" to 3 1/4"; 4=3 1/4" to 4"; 5= over 4"

Table 5. Tuber characteristics, UPSB/SFA Chip Variety Trial, Maine, 2009.

Variety/Clone	Shape	Skin Tex- ture	Eye Depth	Gen. Appear.	Flesh Col.	Comments
AF2291-10	R-O	M-S	M-S	F	Wh	bright, some mshp, lenticels
CO96141-4W	O-R	M-S	M-S	F-G	Wh	bright, trace russet scab
Snowden	R	Net	M-D	F	OW	dull, deep stem end
Kalkaska	R	Net	M-S	F-G	OW	ok, deep stem end
MSJ126-9Y	R	Net	M-D	F	YF1	some mshp, deep stem and apical ends, eye depth
Atlantic	R-O	Net	M-D	F	OW	dull, deep stem end
CO97065-7W	R	Sln.	M-D	F-G	OW	some mshp, deep stem end
NY139	R-O	M-S	M-S	F-G	OW	bright, trace lenticels and russet scab
CO97043-14W	R	S	M-D	F	OW	some mshp, deep stem and apical ends, lenticels, bright, compressed shape
W2717-5	O-R	M-S	M-S	F-G	Wh	bright, lenticels, some mshp
NY138	R-O	S	M-S	G	OW	bright, lenticels

Shape: R=mostly round; R-O=round to oblong; O-R=oblong to round; O=oblong
 Skin Texture: S=smooth; M-S=moderately smooth; Sln.=slight net; Net=strongly netted
 Eye Depth: S=shallow; M-S=moderate to shallow; M-D=moderate to deep; D=deep
 Flesh Color: Wh=white; OW=off white; YF=yellow fleshed, higher numbers indicate brighter yellow.

Table 6. Chip quality one week after harvest, UPSB/SFA Chip Variety Trial, Maine, 2009.

Variety/Clone	Frito-Lay Plant Data, Dayville, CT (September 30, 2009)					Comments
	Total Solids	Color ¹	Defects (%)			
			Ext.	Int.	Tot.	
AF2291-10	19.8	≥70	6.5	0.0	6.5	Nice, some sugar
CO96141-4W	18.1	≥70	0.7	0.0	0.7	Very nice
Snowden	20.7	≥70	0.6	0.0	0.6	Very nice
Kalkaska	19.5	≥70	0.7	0.0	0.7	Very nice
MSJ126-9Y	18.2	≥70	1.5	0.0	1.5	Very nice
Atlantic	21.1	≥70	14.9	5.1	20.0	
CO97065-7W	18.9	≥70	0.0	0.0	0.0	Very nice
NY139	19.2	≥70	0.0	0.0	0.0	Very nice
CO97043-14W	17.6	≥70	0.0	0.0	0.0	Very nice
W2717-5	20.7	≥70	0.0	0.0	0.0	Very nice
NY138	17.8	≥70	0.0	0.0	0.0	Very nice

¹Higher L-values indicate lighter color. All were very good at this sample date. All A-values were negative. Actual L- and a-values were not provided).

Table 7. Bruise susceptibility scores, UPSB/SFA Chip Variety Trial, Maine, 2009.

Variety/Clone	<u>Skinning & Bruise (tumble method)¹</u>			Comments on peeled tubers
	Index	% Incidence	% Surface	
AF2291-10	2.10	62.3	4.5	
CO96141-4W	1.80	50.0	2.8	
Snowden	1.27	72.3	5.3	
Kalkaska	1.63	77.1	5.6	
MSJ126-9Y	1.16	68.4	4.4	yellow fleshed
Atlantic	1.25	88.3	9.1	
CO97065-7W	2.57	66.7	5.8	
NY139	2.40	33.3	1.7	
CO97043-14W	2.22	59.0	3.2	stays rel. white
W2717-5	2.30	80.0	9.3	
NY138	1.75	33.3	1.8	speckled surface ²
Mean	1.86	62.8	4.8	
CV(%)	10.5	25.3	46.3	
LSD(k=100)	0.26	23.2	3.3	

¹Sixty tubers were evaluated per variety/clone. Fifteen tubers per plot were tumbled on October 15 (22 days after harvest) in a paddled drum for 1 minute at 15 rpm. Index scores indicate combined severity of skinning plus fresh bruise (higher values indicate more severe bruising) rated on October 15. Percent incidence (% of tubers with visible bruise) and surface area values are combined scores for shatter and blackspot rated on peeled tubers (October 27, 2009)

²Peeled tubers have many dark spots on surface, possible insect damage or physiological problem.

Variety/Clone Summary 2009:

AF2291-10: Late vine maturity, round to oblong tubers with moderately smooth skin, moderately-shallow eyes, and white flesh. Good yield, high specific gravity, good chip color, relatively low external defects incidence (predominant defect type was off shapes), low level of hollow heart observed in large tubers, intermediate bruise susceptibility.

CO96141-4W: Medium-late vine maturity, oblong to round tubers with moderately smooth skin, moderately-shallow eyes, and white flesh. Good yield, moderate specific gravity, very good chip color, relatively low external defects incidence (predominant defect type was sunburn), no hollow heart observed, relatively low bruise susceptibility.

Snowden: Medium-late vine maturity, mostly round, relatively small tubers with netted skin, moderately-deep eyes, deep stem end, and off-white flesh. Good yield, high specific gravity, very good chip color, relatively low external defects incidence (predominant defect type was sunburn), no hollow heart observed, intermediate bruise susceptibility.

Kalkaska: Late vine maturity, mostly round, relatively small tubers with netted skin, moderately-shallow eyes, deep stem end, and off-white flesh. Good yield, high specific gravity, very good chip color, relatively low external defects incidence (predominant defect type was sunburn), hollow heart observed in smaller size classes, moderately-high bruise susceptibility.

MSJ126-9Y: Medium-late vine maturity, mostly round tubers with netted skin, moderately-deep eyes, deep stem and apical ends, and pale yellow flesh. Moderate to high yield, moderate specific gravity, very good chip color, relatively low external defects incidence (predominant defect type was sunburn), no hollow heart observed, intermediate bruise susceptibility.

Atlantic: Medium-late vine maturity, round to oblong tubers with netted skin, moderately-deep eyes, deep stem end, and off-white flesh. Moderate to high yield, high specific gravity, defects incidence detracted from chip color, high external defects incidence (predominant defect type was sunburn), high hollow heart incidence observed in large tubers, relatively high bruise susceptibility.

CO97065-7W: Medium-late vine maturity, mostly round tubers with slightly netted skin, moderately-deep eyes, deep stem, and off-white flesh. Moderate to high yield, high specific gravity, very good chip color, intermediate external defects incidence (predominant defect type was sunburn), no hollow heart observed, intermediate bruise susceptibility.

NY139: Late vine maturity, round to oblong, relatively small tubers with moderately smooth skin, moderately-shallow eyes, and off-white flesh. Moderate to high yield, high specific gravity, very good chip color, intermediate external defects incidence (predominant defect type was sunburn), no hollow heart observed, relatively low bruise susceptibility.

CO97043-14W: Medium vine maturity, mostly round, compressed tubers with smooth skin, moderately-deep eyes, deep apical and stem ends, and off-white flesh. Moderate yield, moderate specific gravity, very good chip color, intermediate external defects incidence (predominant defect type was sunburn), no hollow heart observed, moderate to low bruise susceptibility.

W2717-5: Late vine maturity, oblong to round tubers with moderately-smooth skin, moderately-shallow eyes, and white flesh. Moderate yield, high specific gravity, very good chip color, high external defects incidence (predominant defect types were sunburn, growth cracks, and scab), no hollow heart observed, relatively high bruise susceptibility.

NY138: Medium-late vine maturity, round to oblong, relatively large tubers with smooth skin, moderately-shallow eyes, and off-white flesh. Moderate to low yield, moderate specific gravity, very good chip color, relatively high external defects incidence (predominant defect type was sunburn), no hollow heart observed, low bruise susceptibility.

Michigan Regional Location

Local Coordinators:

Chris Long
Dave Douches
Greg Steere
Michigan State University
East Lansing, MI

Cooperating Grower:

Tim & Todd Young
Sandyland Farms LLC
Howard City, MI

Cooperating Chip Processor:

Herr Foods, Inc.
Nottingham, PA

Trial Data:

Planting Date:	May 22, 2009
Vine Kill Date:	September 8, 2009
Harvest Date:	September 30, 2009 (131 Days)
Row & Plant Spacing:	34" x 10"; irrigated
Plots:	Single rows for each entry approximately 300' long
GDD, Base 40	2660

Trial Procedure:

Seed was mechanically cut on May 4, 2009 and delivered to the grower's seed storage three days later. No seed treatments were applied at the time of seed cutting.

One pre-harvest sugar profile was taken for each variety just prior to vine kill on August 24th. The pre-harvest sugar profile protocol was as follows: obtained a minimum of 40 tubers from each variety, 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 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, 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. One set of samples will be evaluated in the winter of 2009 and the other in the spring of 2010. Sixteen, 40 tuber samples were also collected for each variety at harvest. All sixteen samples were stored at the Michigan Potato Industry Commission's Cargill Demonstration Storage Facility at approximately 48°F or 55°F for a monthly sugar profile evaluation at Techmark, Inc. Eight, 40 tuber samples were stored at each temperature and

evaluated October 2009 through June 2010. The storage sugar profiles began the day of harvest. 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 vigor observation was made on June 29th. MSJ126-9Y appeared to have the slowest rate of vine growth where as ND 7519-1 was the most vigorous and was in flower at this date.

Growing Season Weather:

Weather conditions during the 2009 growing season were cooler than average. Growing degree days base 40 recorded for this time period was the lowest in six years at 2660. Total rainfall from May 22nd through September 8th was approximately 9.9". The daytime temperatures during this growing period exceeded 90°F on three consecutive days in late June. The Nighttime temperatures during this period, May through September, were below average recording no nights with temperatures over 70 °F during this growing period. The average specific gravity in Michigan was above average as a result of the reduced heat stress.

Results:

Table 1 summarizes the yield, size distribution, and specific gravity data at harvest. Atlantic and Snowden topped the yield chart in 2009 followed by a group of lines that yielded very similarly. These lines are: AF2291-10, NY139, CO97043-14W, Kalkaska and NY138. NY139 had a large percentage of recorded oversize tubers. The CO97043-14W, NY138, CO96141-4W and MSJ126-9Y had very low specific gravities.

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
Atlantic	498	523	96	2	80	16	2	1.087
Snowden	488	512	95	5	89	6	0	1.088
AF2291-10	466	480	97	3	86	11	0	1.089
NY139	455	462	99	1	73	26	0	1.087
CO97043-14W	455	472	96	3	85	11	1	1.073
Kalkaska	454	486	93	6	89	4	1	1.082
NY138	444	458	97	3	78	19	0	1.073
CO96141-4W	423	444	96	3	83	13	1	1.070
CO97065-7W	404	420	96	3	81	15	1	1.078
ND7519-1	387	414	93	5	90	3	2	1.092
W2717-5	361	395	91	4	82	9	5	1.085
MSJ126-9Y	342	370	92	3	81	11	5	1.071
MEAN	432	453	95	3	83	12	1.500	1.081

*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. Hollow heart was prevalent in Atlantic and to a lesser degree in W2717-5. W2717-5 also recorded nine brown centers in addition to the hollow heart. MSJ126-9Y had 11 tubers with vascular discoloration possibly due to this variety not being fully mature at vine desiccation.

Entry	Internal Defects ¹				Total Cut
	HH	VD	IBS	BC	
Atlantic	11	0	0	1	30
Snowden	1	7	0	0	30
AF2291-10	0	7	0	0	30
NY139	0	4	3	0	30
CO97043-14W	0	5	0	0	30
Kalkaska	0	5	0	2	30
NY138	0	0	0	0	30
CO96141-4W	1	3	0	0	30
CO97065-7W	1	0	0	6	30
ND7519-1	1	2	0	0	30
W2717-5	7	3	0	9	30
MSJ126-9Y	2	11	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 at harvest on September 29th and processed at Herr Foods, Inc. on October 1st. Chip colors were generally acceptable, with CO96141-4W having the highest Agtron score of 63.5. The varieties listed in ranked order based on observations from Herr Foods, Inc. are as follows: Snowden, ND7519-1, CO96141-4W, Atlantic, AF2291-10, NY138, NY139, CO97065-7W, W2717-5, CO97043-14W, MSJ126-9Y and Kalkaska.

Table 3. 2009 Post-Harvest Chip Quality¹.						
Entry	Agtron Color	SFA² Color	Specific Gravity	Percent Chip Defects³		
				Internal	External	Total
Atlantic	58.6	3	1.077	23.6	2.7	26.3
Snowden	61.5	2	1.081	7.3	6.7	14.0
AF2291-10	58.5	2	1.085	13.0	2.0	15.0
NY139	61.5	1	1.079	3.3	9.1	12.4
CO97043-14W	62.7	2	1.079	15.4	4.4	19.8
Kalkaska	58.1	4	1.076	26.2	1.0	27.2
NY138	63.1	1	1.068	8.5	3.5	12.0
CO96141-4W	63.5	2	1.073	10.0	4.9	14.9
CO97065-7W	58.5	2	1.078	12.7	6.1	18.8
ND7519-1	61.5	1	1.079	1.4	8.3	9.7
W2717-5	60.6	3	1.081	8.1	7.5	15.6
MSJ126-9Y	60.1	4	1.068	8.7	2.9	11.6

¹ Samples collected at harvest September 29th and processed by Herr Foods, Inc., Nottingham, PA on October 1, 2009 (2 days).
Chip defects are included in Agtron and SFA samples.

² SFA Color: 1 = lightest, 5 = darkest

³ Percent 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, all samples were abrasively peeled and scored for the presence of black spot bruise. Among the “Simulated Bruise” samples, the best entries were NY138, CO97065-7W and CO96141-4W. Snowden, NY139 and AF2291-10 showed the lowest percent bruise free.

Table 4. Black Spot Bruise Test																		
Entry	A. Check Samples¹								B. Simulated Bruise Samples²									
	# of Bruises Per Tuber					Total Tubers	Percent Bruise Free	Average Bruises Per Tuber	# 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
Atlantic	8	8	6	3		25	32	1.16	5	6	4	5	3	2	25	20	2.0	
Snowden	9	7	5	1	2	1	25	36	1.32	0	3	5	8	3	6	25	0	3.2
AF2291-10	8	11	4	1		1	25	32	1.08	2	7	6	6	1	3	25	8	2.2
NY139	16	7	1	1			25	64	0.48	1	13	4	5	2		25	4	1.8
CO97043-14W	7	7	6	4	1		25	28	1.40	4	6	7	3	2	3	25	16	2.1
Kalkaska	10	10	4	1			25	40	0.84	9	9	4	2	1		25	36	1.1
NY138	15	8	2				25	60	0.48	17	5	1	1		1	25	68	0.6
CO96141-4W	16	9					25	64	0.36	11	11	2	1			25	44	0.7
CO97065-7W	8	13	3	1			25	32	0.88	13	3	4	4		1	25	52	1.1
ND7519-1	12	10	2			1	25	48	0.76	6	5	8	5	1		25	24	1.6
W2717-5	12	6	3	2		2	25	48	1.12	9	8	4	4			25	36	1.1
MSJ126-9Y	9	7	4	3	1	1	25	36	1.32	10	8	1	4	1	1	25	40	1.2

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. Kalkaska was found to be immature on August 24th with a 1.077 specific gravity and a sucrose rating of 1.892. CO96141-4W and Atlantic were the earliest maturing varieties. Snowden, AF2291-10, NY139 and NY138, based on canopy rating, appeared to be late maturing lines. NY138 had the largest average tuber weight of 7.60 oz.

Entry	Specific Glucose ¹		Sucrose ² Rating	Canopy		Number of		Average ⁵ Tuber Weight
	Gravity	%		Rating ³	Uniform. ⁴	Hills	Stems	
Atlantic	1.080	0.001	0.381	85	90	3	17	5.50
Snowden	1.084	0.002	0.391	90	95	5	21	4.56
AF2291-10	1.086	0.005	0.748	90	95	5	16	5.92
NY139	1.079	0.003	0.613	90	90	4	11	6.01
CO97043-14W	1.076	0.005	0.559	80	90	4	15	5.62
Kalkaska	1.077	0.015	1.892	60	80	4	7	4.41
NY138	1.068	0.003	0.598	90	90	5	10	7.60
CO96141-4W	1.071	0.001	0.202	80	90	5	14	5.23
CO97065-7W	1.078	0.002	0.454	65	80	5	23	4.61
ND7519-1	1.091	0.002	0.686	75	50	3	15	4.26
W2717-5	1.082	0.004	0.735	70	90	4	10	4.31
MSJ126-9Y	1.067	0.002	0.716	60	90	6	15	5.42

¹Percent Glucose is the percent of glucose by weight in a given amount of fresh tuber tissue.
²Sucrose Rating is the percent of sucrose by weight in a given amount of fresh tuber tissue X10.
³The Canopy Rating is a percent rating of green foliage (0 is all brown, dead foliage, 100 is green, vigorous foliage).
⁴The Canopy Uniformity is a percentage of how uniform the foliage health is at the date of observation.
⁵The Average Tuber Weight is the total tuber weight collected, divided by the number of tubers reported in ounces.

Variety Comments:

Atlantic: This was the top yielding variety in the 2009 variety trial with a 498 cwt./A US#1 yield and an above average specific gravity at 1.087. This variety had a good percent of oversize tubers, but 33 percent of them were hollow. Chip quality at Herr Foods on October 1st ranked above average. Atlantic showed black spot bruise susceptibility with only 20 percent of the tubers being bruise free.

Snowden: Snowden was the second highest yielding variety in the 2009 variety trial with a 488 cwt./A US#1 yield and an above average specific gravity at 1.088. This variety had the best overall chip performance at Herr Foods at the out-of-the-field fry test. Snowden was the most susceptible line to black spot bruise in the trial.

AF2291-10: This variety yielded 466 cwt./A US#1 with a 1.089 specific gravity. The variety performed in the middle of the group at Herr Foods. AF2291-10 exhibited a very high level of bruise susceptibility with only 8 percent of the tubers being bruise free. It also appears to be a full season variety.

NY139: NY139 had a nice yield of US#1 tubers and a tuber size distribution that consisted of 26 percent oversize tubers. The specific gravity was above the trial average. The internal defects were good, but the at-harvest chip fry ranked this variety 7th out of the 12 varieties for overall appearance. This variety had the second greatest black spot bruise susceptibility in the 2009 trial.

CO97043-14W: The US#1 yield for this line was 455 cwt./A with below average specific gravity. Internal defects were low but the out-of-the-field chip quality was below average ranking 10th at Herr's. The variety appeared to be moderately susceptible to black spot bruise. This variety was mature at the time of vine kill and seems to have a mid season maturity.

Kalkaska: Kalkaska was above average in yield at 454 cwt./A US#1. The specific gravity for this variety was slightly above the trial average at 1.082. This variety exhibited slight brown centers in 2 out of thirty cut tubers. This variety ranked last at Herr's out-of-the-field chip evaluation. Kalkaska was moderately susceptible to black spot bruise and ranked near the trial average. This variety appeared to be the most immature based on the pre-harvest panel data from August 24th where the sucrose rating was 1.892 and glucose level was 0.015.

NY138: NY138 yielded slightly higher than the trial average at 444 cwt./A US#1. Specific gravity was just above average at 1.082. Tuber quality at harvest was excellent. No internal defects were observed. Herr's ranked this variety 6 of 12 in chip performance out-of-the-field. NY138 showed the lowest susceptibility to black spot bruising with 68 percent of the tubers being bruise free after simulated bruise testing.

CO96141-4W: This variety had a 423 cwt./A US#1 yield with the lowest recorded specific gravity in the trial at 1.070. Internal tuber defects were low at harvest. CO96141-4W ranked 3rd at Herr's for chip quality. The variety does not appear to be black spot bruise susceptible, receiving a 44 percent bruise free rating in the simulated bruise testing. The specific gravity of this line is out of tolerance for chip processing. This variety appeared to be very mature in the August 24th pre-harvest panel indicating that this variety is an early maturing line.

CO97065-7W: This variety had a 404 cwt./A US#1 yield with a below average specific gravity of 1.078. Six brown centers were observed in thirty cut tubers at harvest. Herr's ranked this variety 8th for overall chip quality. CO97065-7W had the second highest bruise free rating of 52 percent. The vine maturity appears to be mid season.

ND7519-1: The yield on ND7519-1 was below average at 387 cwt./A US#1. The specific gravity was excellent at 1.092. This was the highest specific gravity in the trial for 2009. Internal defects were low and the ranking at Herr's was excellent, ranking second of 16 varieties in out-of-the-field chip performance. Black spot bruise tolerance was average.

W2717-5: W2717-5 yielded 361 cwt./A US#1 with a specific gravity of 1.085. The variety had seven hollow, three vascular discoloration and nine brown centers in thirty cut tubers. Herr's ranked this variety 9th in the overall chip quality evaluation. The line appears to have an average tolerance of black spot bruise and was mature at the time of vine kill.

MSJ126-9Y: This variety recorded the lowest yield in this year's trial. MSJ126-9Y had the second to lowest specific gravity in the trial at 1.071. Internal tuber quality recorded 11 vascular discolorations out of thirty cut tubers. The clone ranked 11th place at Herr's in the chip quality. The bruise free rating was 40 percent which is above average.

Missouri Regional Trial

Black Gold Farms, Charleston, MO

Field Name: Stallings South Soil Type: Malden Loamy Fine Sand

Soil Test: pH: 6.3 P: 29 ppm K: 83 ppm OM: 0.6 %
 B: 0.63 ppm Mg: 114 ppm Ca: 552 ppm CEC: 3.8 meq

Tillage:	Date	Tool	Function
	11/28/08	Disk	Pre-plant tillage
	11/29/08	DMI Bedder	Pre-plant hilling
	04/01/09	Cultivator	Rehilling/fert.

Fertilizer:	Date	Method	Actual lbs/ac applied	Product Applied
	03/08/09	Preplant Broadcast	49-39-199-1B-2Zn	Dry Granular
	03/14/09	Planter	18-60-0	10-34-0 Liquid
	04/01/09	Cultivator	106-0-0	32-0-0 Liquid
	04/27-09	Post Emergent	43-0-0-49S	AMS
	05/10/09	Pivot	10-0-0	32-0-0 Liquid
	05/14/09	Plane	0-0-0-1Zn	Zn Citrix
	05/15/09	Pivot	18-0-0	32-0-0 Liquid
	05/17/09	Pivot	20-0-0	32-0-0 Liquid

	Date	Method	Rate	Product Applied
Herbicide:	03/19/09	Ground	1 Qt/ac	Roundup
	03/31/09	Ground	1 Pt/ac	Dual Magnum
		Ground	1.5 Pt/ac	Prowl 3.3 EC
	05/07/09	Ground	0.5 Oz/ac	Matrix
Fungicide:	03/14/09	Planter	6.1 Oz/ac	Quadris
	05/06/09	Air	2 lbs/ac	Manzate DF
	05/14/09	Air	2lbs/ac	Manzate DF
			6 Oz/ac	Tanos
	05/21/09	Air	2 lbs/ac	Manzate DF
	05/29/09	Air	2 lbs/ac	Manzate DF
	06/09/09	Air	2 lbs/ac	Manzate DF
Insecticide/ Nematicide:	11/29/08	Bedder	6.7 gal/ac	Telone II
	05/21/09	Air	3.8 OZ/ac	Leverage 2.7

Weather: Planting-cool and wet
 Emergence-cool and wet
 Tuber Initiation-cool and wet
 Tuber Bulking-hot and dry
 Harvest-hot and dry

Cultural notes:
 -cool, cloudy, and wet first half of season
 -very hot week of June 20th, sand went extremely hot
 -moderate pressure from pigweed

Missouri Regional Trial

Charleston, Missouri 2009

Black Gold Farms

Planting Date: 3/11/09

Harvest Date: 7/10/09

DAP: 121

Variety	Vine Vigor	Marketable Yield				Total Yield	Quality Assurance								
		1 - 2"		> 4"			2 - 4"		Gravity	Cook Sample Defects					
		tubers/ plant	Cwt/ac	tubers/ plant	Cwt/ac		tubers/ plant	Cwt/ac		Cwt/ac	CLR	% UC	% GRN	% ID	% ED
Atlantic	2.0	0.9	17	0.0	0.0	4.4	270	287	1.0916	64	23.3%	0.0%	0.0%	10.9%	34.2%
W2717-5	2.0	1.0	19	0.0	0.0	3.4	168	187	1.0884	64	21.3%	0.0%	4.6%	2.2%	28.1%
Kalkaska	2.0	1.7	33	0.0	0.0	5.4	281	314	1.0764	64	26.3%	0.0%	0.0%	8.1%	34.4%
MSJ126-9Y	2.0	0.7	13	0.0	0.0	2.4	110	123	1.0742	65	10.2%	0.0%	2.1%	2.1%	14.4%
NY138	2.0	0.6	26	0.0	0.0	3.6	226	252	1.0751	64	7.7%	0.0%	0.0%	5.1%	12.8%
NY139	2.0	0.6	8	0.0	0.0	3.9	204	212	1.0884	64	20.3%	0.0%	0.0%	8.5%	28.8%
CO96141-4W	2.0	1.0	22	0.0	0.0	3.1	158	180	1.0787	64	8.4%	0.0%	0.0%	13.8%	22.2%
CO97065-7W	2.0	0.7	11	0.0	0.0	2.8	136	147	1.0845	64	17.4%	0.0%	0.0%	2.1%	19.5%
CO97043-14W	2.0	1.7	38	0.0	0.0	4.5	201	239	1.0828	64	4.8%	0.0%	2.3%	7.2%	14.3%
AF2291-10	2.0	0.5	7	0.0	0.0	3.1	187	194	1.0868	64	17.1%	0.0%	9.0%	5.1%	31.2%
W2324-1	2.0	1.1	19	0.0	0.0	4.8	269	288	1.0828	64	14.0%	0.0%	5.1%	0.0%	19.1%

Vine & Vigor Rating:

1 = 100 % dead vines	6 = Green, no new growth, some lower leaves yellowing.
2 = 90% defoliated, 80-90% dead vines	7 = Green, no flowering
3 = 75% defoliated, 25-50% dead vines	8 = Green, vigorous, 0-10% flowering
4 = 25% defoliated, 10% dead vines	9 = Green, vigorous, 25% flowering
5 = 0-10% defoliated, yellowing leaves	10 = Green extremely vigorous vines, at least 50% flowering

Quality Assurance Key:

GRN = Greening	CLR = Color
UC = Undesirable Color	ID = Internal Defects
	ED = External Defects

North Carolina Regional Trial

Local Coordinators:

Dr. Craig Yencho
North Carolina State University
214A Kilgore Hall
Raleigh NC, 27695

Mr. Mark Clough
North Carolina State University
207 Research Station Rd.
Plymouth NC 27962

Cooperating Grower:

Chris Hopkins
Black Gold Farms
2815 N Gum Neck Road
Columbia, NC 27925

Cooperating Chip Processor:

Utz Quality Foods
Hanover, PA

Trial Data:

Planting Site:	Black Gold Farms, Gum Neck, Tyrrell County, NC
Planting Date:	March 10, 2009
Harvest Date:	June 22, 2009 (104 days)
Growing Conditions:	Planting was on time. Temperatures and rainfall were favorable for plant growth and tuber development for the majority of the season. In late May and early June, during bulking, conditions were slightly dryer than optimal. In mid to late June conditions became more wet overall.
Soil Type:	Cape Fear silt loam
Experimental Design:	Randomized complete block design with 5 replications.
Row Spacing:	28 hills, spaced 9 inches apart, 34" row width.
Fertilizer:	216 lbs N, 74 lbs P, 61 lbs K, 1lb Zn
Weed Control:	Metribuzin 1.1 lbs/A Intensity One 16 fl oz/A
Insect Control:	Spintor 2SC 5 fl oz/A Actara 2 oz/A
Disease Control:	Quadris 6.3oz/A Manzate Pro-stick 7.0 lb/A Curzate 60 DF 3.2 oz/A Revus Top 6 fl oz/A

Table 1. North Carolina. Total and marketable yield, percentage of total yield by size class, specific gravity and chip scores.

Clone	Total Yield cwt/A	Marketable Yield cwt/A	% Size Distribution by Class ¹						1 ⁷ / ₈ to 4"	2 ¹ / ₂ to 4"	Specific Gravity ²	Chip Color ³	
			1	2	3	4	5	Culls				24 to 48 hrs	5 to 7 days
AF2291-10	300	266	6	43	45	1	0	6	89	46	1.080	3	2
Atlantic	404	372	6	30	59	3	0	2	92	62	1.079	2	3
CO96141-4W	402	349	12	48	39	0	0	2	87	39	1.065	1	2
CO97043-14W	373	330	9	44	44	0	0	2	89	45	1.071	1	2
CO97065-7W	363	323	7	32	56	1	0	4	89	56	1.072	1	1
Kalkaska(MSJ036-A)	277	234	12	42	41	1	0	5	84	42	1.069	4	3
MSJ126-9Y	258	222	10	42	41	3	0	4	86	44	1.065	2	2
NY138	349	314	4	23	58	9	0	6	90	67	1.065	2	2
NY139	404	354	7	35	52	0	0	6	87	52	1.071	2	2
Snowden	412	380	7	44	47	1	0	1	92	48	1.074	2	3
W2324-1	433	364	7	36	47	1	0	10	84	48	1.075	2	2
W2717-5	226	192	8	44	41	1	0	7	85	41	1.080	2	1
Grand Mean	350	308											
CV(%)	12.68	14.42											
LSD(K=100)	52.7	53.2											

¹ **Size Classes:**

1's < 1 7/8"; 2's 1 7/8 to 2 1/2"; 3's 2 1/2 to 3 1/4"; 4's 3 1/4 to 4"; 5's ≥ 4"; Culls = all defective potatoes.

² **Specific Gravity**

Determined by weight in air/water method.

³ **Chip Color**

Ratings conducted by the NCSU Potato Breeding Program at the TRS/VGJREC within 48 hrs and again in 5 to 7 days after harvest: 1 = no defects, exceptionally bright; 2 = excellent, bright; 3 = good, light or golden; 4 = dark defects, marginal; 5 = not acceptable.

Table 2. North Carolina. Plant vine type, disease and air pollution scores, maturity at ca. 3 weeks prior to harvest, and external and internal tuber attributes.

Clone	Plant Data ¹				Tuber Data ²								% Internal Defects ³						
	TYPE	DIS	POLL	MAT	CLR	TXT	TCX	TSS	SHP	EYE	SIZE	DIS	APP	HN	HNR	HH	VR	BC	SR
AF2291-10	9	9	8	9	6	6	5	5	3	5	7	8	5	0	9.0	0	0	0	0
Atlantic	6	9	8	5	5	5	7	6	3	6	8	8	7	16	7.9	4	0	0	4
CO96141-4W	6	8	7	7	6	7	5	7	4	8	6	7	7	2	8.8	0	0	0	0
CO97043-14W	6	8	7	5	6	6	5	7	2	8	6	7	6	2	8.8	2	6	0	0
CO97065-7W	6	7	7	5	5	5	6	6	2	7	7	8	6	0	9.0	0	2	0	0
Kalkaska(MSJ036-A)	6	9	8	6	6	6	7	7	2	8	5	7	6	0	9.0	0	0	0	0
MSJ126-9Y	6	8	8	6	5	5	5	8	3	5	7	8	5	0	9.0	0	0	0	0
NY138	9	9	8	6	6	7	6	5	4	7	9	8	7	0	9.0	0	2	0	0
NY139	9	9	8	7	6	5	5	6	2	8	5	8	7	0	9.0	0	0	0	0
Snowden	9	8	7	7	5	5	7	7	2	3	6	8	5	0	9.0	0	0	0	0
W2324-1	8	8	8	6	5	5	7	6	2	3	6	6	3	2	8.8	0	0	0	0
W2717-5	6	8	7	7	9	8	6	6	3	8	7	8	6	0	9.0	6	8	2	0

¹ Plant Data:

Vine Type: 1 = decumbent –poor canopy, 2 = decumbent – fair canopy, 3 = decumbent – good canopy, 4 = spreading – poor canopy, 5 = spreading – fair canopy, 6 = spreading - good canopy, 7 = upright – poor canopy, 8 = upright – fair canopy, 9 = upright good canopy.

Vine Disease: 1 = very severe, 5 = moderate, 9 = none.

Vine Pollution: 1 = very severe, 5 = moderate, 9 = none.

Vine Maturity: 1= very early, 5 = mid-season, 9 = very late.

² Tuber Data:

Skin Color: 1 = purple, 2 = red, 3 = pink, 4 = dark brown, 5 = brown, 6 = tan to light brown, 7 = buff, 8 = white, 9 = cream.

Skin Texture: 1= partial russet, 2 = heavy russet, 3 = moderate russet, 4 = light russet, 5 = netted, 6 = slight net, 7 = moderately smooth, 8 = smooth, 9 = very smooth.

Cross Section: 1 = very flat, 3 = flat, 5 = intermediate to oval, 7 = mostly round, 9 = very round.

Skin Set: 1 = very poor, 5 = fair, 9 = excellent.

Shape: 1 = very round, 2 = mostly round, 3 = round to oblong, 4 = mostly oblong, 5 = oblong, 6 = oblong to long, 7 = mostly long, 8 = long, 9 = cylindrical.

Eye Depth: 1= very deep, 5 = medium, 9 = very shallow.

Size: 1 = small, 5 = medium, 9 = large.

Tuber Disease: 1 = very severe, 5 = moderate, 9 = none.

Overall Appearance: 1 = very poor, 5 = fair, 9 = excellent.

³ Internal Defects:

Percentage determined from 10 randomly selected potatoes /rep (40 total) in size classes 3 and 4. HN=heat necrosis; HNR=average heat necrosis rating (Rating Scale: 1= very severe to 9 = absent); HH=hollow heart; VR=vascular ring discoloration; BC=brown center; SR=soft rot

Table 3. UTZ Quality Foods Chip Data.

Clone	% Defects		%Total Defects	Specific Gravity	Defect Descriptions ¹		Chip Color ²		
	Internal	External			Internal	External	Hunter Lab	Agtron	Visual
AF2291-10	1%	0%	1%	1.091	HH	.	63.9	69.2	.
Atlantic	6%	0%	6%	1.089	HH,IHN,SB	.	62.4	64.5	.
CO96141-4W	1%	0%	1%	1.075	SB	.	62.4	64.5	.
CO97043-14W	0%	0%	0%	1.076	.	.	64.4	69.8	.
CO97065-7W	6%	0%	6%	1.088	ID	.	64.2	69.7	.
Kalkaska(MSJ036-A)	43%	0%	43%	1.077	VB,ID	.	60.6	60.1	.
MSJ126-9Y	0%	0%	0%	1.076	.	.	62.8	65.0	.
NY138	3%	0%	3%	1.074	HH,ID	.	62.9	65.3	.
NY139	0%	0%	0%	1.081	.	.	63.1	66.0	.
Snowden	0%	0%	0%	1.082	.	.	64.6	69.8	.
W2324-1	19%	0%	19%	1.082	VB,ID	.	61.2	61.0	.
W2717-5	3%	0%	3%	1.091	VB	.	61.5	62.1	.

¹ **Defect Descriptions:**

BR = Bruising; ED = External Discoloration; HH = Hollow Heart; ID = Internal Discoloration; IHN = Internal Heat Necrosis; SB = Stem End Browning; VB = Vascular Browning; WW = Wire Worm.

² **Chip Color:**

Hunter Lab Scores

Taken with defective chips included in sample

Visual Scores

Ratings conducted by the UTZ Quality Foods Inc. in Hanover PA with in 24 hrs of harvest. Visual Rating Score: 1 = no defects, exceptionally bright; 2 = excellent, bright; 3 = good, light or golden; 4 = dark defects, marginal; 5 = not acceptable. *= brightest chip in visual observation

Clone Summaries

AF2291-10: Maturity for this clone was late and emergence was delayed causing poor stands initially and very poor vigor. A late stand count averaged 95%. Shapes were round to oblong, size was medium to large and overall appearance was fair. Marketable yields were 72% of Atlantic, gravity was 1.080 and chip color was excellent in the 24 to 48 hour and good in the 5 to 7 day chip tests. No internal defects were recorded. External defects included misshapes, growth cracks, and sunscald.

CO96141-4W: Maturity for this clone was mid to late season with 93% stands. Plant vigor was better than fair. Shapes were oblong, size was medium, and overall appearance was better than fair. Marketable yields were 94% of Atlantic, gravity was 1.065, and chip color was exceptional in the 24 to 48 hour test and excellent in the 5 to 7 day chip test. External defects included sunscald, soft rot and common scab.

CO97043-14W: Maturity for this clone was slightly later than mid-season with 96% stands and good plant vigor. Shapes were mostly round, size was larger than medium and overall appearance was better than fair. Marketable yields were 90% of Atlantic, gravity was 1.071 and chip scores were exceptional for the 24 to 48 hour test and excellent in the 5 to 7 day chip tests. External defects included common scab, soft rot, misshapes, and sunscald.

CO97065-7W: This clone was mid-maturing and had 95% stands with better than fair plant vigor. Shapes were mostly round, size was medium to large, and overall appearance was better than fair. Marketable yields were 87% of Atlantic, gravity was 1.072 and chip scores were exceptional for both the 24 to 48 hour and 5 to 7 day chip tests. External defects were sunscald misshapes, common scab, and soft rot.

Kalkaska (MSJ036-A): This was a mid to late maturing clone with 87% stands and less than fair plant vigor. Shapes were mostly round, size was medium, and overall appearance was better than fair. Marketable yields were 64% of Atlantic, gravity was 1.069 and chip scores were acceptable in the 24 to 48 hour test and good in the 5 to 7 day chip test. External defects were sunscald and soft rot.

MSJ126-9Y: Maturity for this clone was later than mid-season, stands were 79% and plant vigor was less than fair. Shapes were round to oblong, size was medium-large and overall appearance was fair. Marketable yields were 60% of Atlantic, gravity was 1.065, and chip test scores for both the 24 to 48 hour and 5 to 7 day tests were excellent. External defects included high numbers of misshapes, sunscald, and skin blemishes due to Rhizoctonia.

NY138: This slightly later than mid-maturing clone had poor stands of 42% at six weeks with poor plant vigor. Shapes were mostly oblong, size was very large, and overall appearance was good. Marketable yields were 84% of Atlantic, gravity was 1.065, the chip scores were excellent for both the 24 to 48 hour and the 5 to 7 day chip tests. External defects included soft rot, misshapes, sunscald, growth cracks, and skin blemishes due to Rhizoctonia.

NY139: Maturity for this clone was late season, stands were 96% and vigor was fair. Shapes were mostly round, size was medium, and overall appearance was good. Marketable yields were 97% of Atlantic, gravity was 1.071, the chip scores were excellent for both the 24 to 48 hour and the 5 to 7 day tests. External defects included sunscald and misshapes.

W2324-1: This clone had stands of 96%, and was slightly later than mid-maturing with good vigor. Shapes were mostly round, size was slightly larger than medium and overall appearance was poor. Marketable yields were 99% of Atlantic, gravity was 1.075, and chip scores were excellent in both the 24 to 48 hour and the 5 to 7 day tests. External defects included soft rot, common scab, and misshapes.

W2717-5: This clone was mid to late maturing with 42% stands and poor vigor at six weeks. Shapes were round to oblong, medium to large size, and better than fair for overall appearance. Marketable yields were 52% of Atlantic, gravity was 1.080, and chip scores were excellent in the 24 to 48 hour and exceptional in the 5 to 7 day tests. External defects included growth cracks, air cracks, misshapes, sunscald, soft rot, and skin blemishes due to Rhizoctonia.

Pennsylvania Regional Trial

Chest Springs, PA

Table 1. Yield, size distribution, and characteristics of the 2009 USPB-SFA chip trial varieties.

Entry	Yield (cwt/A)		Percent Size Distribution					Characteristics			
	No. 1	Total	No. 1	Small	Mid-Size	Large	Culls	Agtron Score ^a	Specific Gravity ^a	% Internal Defects	Major External Defects
Kalkaska	314	352	89	5	89	1	4	60	1.078	1	SB MS SG GC
AF2291-10	306	335	91	2	91	2	4	56	1.082	1	SB MS WW
Snowden	304	355	86	2	86	2	11	57	1.090	0	SB MS
NY139	296	346	86	2	86	6	6	60	1.075	0	SB MS
CO96141-4W	251	311	81	5	81	0	14	57	1.068	2	SB
NY138	250	357	70	3	70	7	21	58	1.074	0	SB
MSJ126-9Y	227	266	86	5	86	3	7	56	1.070	0	SB WW
W2717-5	214	285	75	5	75	1	18	58	1.087	4	SB MS SG GC
CO97065-7W	200	218	92	3	92	0	5	57	1.086	0	SB SG GC
Atlantic	151	222	68	1	68	4	26	58	1.083	5	SB MS GC
CO97043-14W	144	169	85	3	85	0	11	59	1.074	0	SB PS
Mean	242	292						58	1.079		
Isd 0.05	54	48						^a Samples processed 7-Sep-09 by Snyder of Berlin			
CV%	16	11									

Defects:

SB = Sunburn

PC = Pressure Crack

GC = Growth Cracks

SG = Secondary Growth

MS = Mis-shapen

ST = Stone Damage

FR = Fusarium Rot

RH = Rhizoctonia

PS = Pitted Scab

WW = Wire worm damage

Internal Defects include Hollow Heart and internal Heat Necrosis; percentages calculated in Cwt/A

2009 Red River Valley Regional Trial

Dr. Nick David, Extension Potato Agronomist
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Technical Support

Mr. Duane Preston – Extension Potato Agronomist, University of Minnesota
Mr. Marty Glynn – USDA Potato Research Facility, East Grand Forks, MN
Mr. Dennis Olson – USDA Potato Research Facility, East Grand Forks, MN
Mrs. Becky Sayre – USDA Potato Research Facility, East Grand Forks, MN
Mr. Todd Schultz – USDA Potato Research Facility, East Grand Forks, MN

Site Locations

Non-irrigated site: Oberg Farms, Hoople, ND

Irrigated site: Forest River Colony (Northern Plains Potato Growers Assoc. Research Site), Inkster, ND

Procedures

Seed handling

Seed was stored at 50°F until it was hand cut into 2.0 – 2.5 oz pieces on May 12, 2009. Following cutting, seed was immediately treated with Maxim MZ and then suberized at 55°F and 95% RH until planting.

Planting and Harvest Operations

Irrigated Site: Potato seed pieces were planted with an in-row spacing of 9 inches and a between-row spacing of 36" on May 22 using a two-row assist-feed Harriston potato planter. Varieties were arranged in a randomized complete block design and replicated four times. A Dark Red Norland seed piece was planted at the beginning and end of each plot as a guard plant to minimize border effects. On October 2, a 1-row Grimme harvester was used to harvest the trial area. Yield and grade was determined immediately following harvest and subsamples for the long-term storage trial were placed in 50°F storage facilities.

Non-irrigated Site: Potato seed pieces were planted with an in-row spacing of 12 inches and a between-row spacing of 38" on June 3 using a two-row assist-feed Harriston potato planter. Varieties were arranged in a randomized complete block design and replicated four times. A Dark Red Norland seed piece was planted at the beginning and end of each plot as a guard plant to minimize border effects. On September 24, a 1-row Grimme harvester was used to harvest the trial area. Yield and grade was determined immediately following harvest and subsamples for the long-term storage trial were placed in 45 and 50°F storage facilities.

**Total Yield and Rank of 2009 USPB/SFA entries grown near
Hoople, ND (Non-irrigated) and Inkster, ND (Irrigated)**

Variety/Clone	Irrigated Site				Non-Irrigated Site			
	Total Yield (cwt/acre)	Rank	Percent Atlantic	Percent Snowden	Total Yield (cwt/acre)	Rank	Percent Atlantic	Percent Snowden
AF2291-10	351	13	88	83	211	7	113	94
Atlantic	398	7	100	95	187	9	100	83
CO96141-4W	420	3	106	100	125	16	67	56
CO97043-14W	390	10	98	93	222	5	119	99
CO97065-7W	396	8	99	94	112	17	60	50
Dakota Crisp	452	1	114	107	170	11	91	76
Dakota Diamond	421	2	106	100	283	2	151	126
Dakota Pearl	394	9	99	94	144	15	77	64
Ivory Crisp	406	6	102	96	296	1	158	132
MN99380-1	356	11	89	85	167	12	89	75
MSJ036-A	300	16	75	71	230	3	123	103
MSJ126-9Y	277	17	70	66	155	14	83	69
ND7519-1	330	15	83	78	196	8	105	88
NY138	420	3	106	100	200	7	107	89
NY139	340	14	85	81	185	10	99	83
Snowden	421	2	106	100	224	4	120	100
W2717-5	354	12	89	84	155	13	83	69
LSD $\alpha = 0.10$	NS				56			

**Total yield and size profile distribution of chipping varieties
grown under irrigation near Inkster, ND. 2009**

Variety/Clone	Total Yield (cwt/acre)	Size profile distribution (Percent of Total Yield in different size classes)				
		< 1 ^{7/8} "	1 ^{7/8} – 2 ^{1/4} "	2 ^{1/4} – 3 ^{1/2} "	3 ^{1/2} – 4"	> 4"
AF2291-10	351	4	17	71	9	0
Atlantic	398	7	25	52	16	0
CO96141-4W	420	7	30	55	8	0
CO97043-14W	390	8	21	56	15	0
CO97065-7W	396	7	22	66	5	0
Dakota Crisp	452	6	25	63	6	0
Dakota Diamond	421	6	38	48	8	0
Dakota Pearl	394	16	45	39	0	0
Ivory Crisp	406	8	30	59	3	0
MN99380-1	356	10	34	54	2	0
MSJ036-A	300	7	33	58	2	0
MSJ126-9Y	277	10	41	49	0	0
ND7519-1	330	10	38	52	0	0
NY138	420	6	13	61	18	2
NY139	340	12	38	47	4	0
Snowden	421	9	38	52	2	0
W2717-5	354	6	24	65	4	0
LSD $\alpha = 0.10$	NS	4	10	10	7	NS

**Total yield and size profile distribution of non-irrigated
chipping varieties grown near Hoople, ND. 2009**

Variety/Clone	Total Yield (cwt/acre)	Size profile distribution (Percent of Total Yield in different size classes)				
		< 1 ^{7/8} "	1 ^{7/8} – 2 ^{1/4} "	2 ^{1/4} – 3 ^{1/2} "	3 ^{1/2} – 4"	> 4"
AF2291-10	211	9	28	50	14	0
Atlantic	187	7	20	54	17	1
CO96141-4W	125	20	27	52	1	0
CO97043-14W	222	15	28	48	10	0
CO97065-7W	112	25	29	42	5	0
Dakota Crisp	170	12	21	54	14	0
Dakota Diamond	283	10	18	51	16	1
Dakota Pearl	144	25	38	36	1	0
Ivory Crisp	296	12	22	45	17	3
MN99380-1	167	17	25	51	7	0
MSJ036-A	230	7	22	49	21	0
MSJ126-9Y	155	18	35	46	2	0
ND7519-1	196	11	34	49	6	0
NY138	200	7	26	66	2	0
NY139	185	12	23	60	5	0
Snowden	224	16	30	47	6	0
W2717-5	155	18	38	38	4	0
LSD α = 0.10	56	7	9	12	6	NS

Wisconsin Regional Trial

Charles J. Kostichka and Mary LeMere

Hancock Agricultural Research Station, Hancock, WI 54943
 College of Agriculture and Life Sciences
 University of Wisconsin - Madison

Fertility: 0-0-60; 6-24-24; 0-0-0-17S-21Ca, 21-0-0-24S

Weed Control: Matrix, Sencor, Parallel

Insect Control: Coragen, Abba

Disease Control: Bravo ZN; Headline; Endura, Manzate, Tanos

Vine Kill: Reglone

Rainfall: 16.2 in

Irrigation: 26.1 in

Table 1. Internal defects, 2009.

Variety	No. Tubers Sampled	Internal Defects (%) ¹				
		BC	HH	IBS	VD	SED
Atlantic	30	6.6	3.3	0	0	0
Snowden	30	3.3	0	0	0	0
CO96141-4W	30	0	0	0	0	0
CO97065-7W	30	0	0	0	0	0
W2717-5	30	0	0	0	0	0
CO97043-14W	30	0	0	0	0	0
MSJ036A	30	0	0	0	0	0
MSJ126-9Y	30	0	0	0	0	0
NY138	30	0	0	0	0	0
NY139	30	0	0	0	0	0
AF2291-10	30	0	0	0	0	0

1. Internal defects: BC = brown center
 HH = hollow heart
 IBS = internal brown spot

VD = vascular discoloration
 SED = stem end discoloration

Wisconsin Regional Trial

Table 2. Total yield, U.S. No. 1 yield, <1 7/8, culls and specific gravity - 2009.

Variety	Total Yield (cwt)	U. S. No. 1 Yield		<1 7/8 in.	Culls	Specific Gravity
		(cwt)	(% of Total)			
Atlantic	430.4	321.2	74.6	2.0	23.4	1.0907
Snowden*	526.3	498.5	94.7	2.1	3.2	1.0893
CO96141-4W						1.0751
CO97065-7W						1.0812
W2717-5	363.0	311.9	85.9	1.7	12.4	1.0885
CO97043-14W						1.0786
MSJ036A	448.5	430.6	96.0	2.6	1.4	1.0865
MSJ126-9Y	320.4	302.9	94.6	4.7	0.8	1.0791
NY138						1.0751
NY139						1.0845
AF2291-10						1.0873

Table 3. U.S. No. 1 size distribution (percent of U.S. No. 1 yield) - 2009.

Variety	U. S. No. 1 Size Categories (% of U. S. No. 1 Yield)					
	2-4 oz	4-6 oz	6-10 oz	10-13 oz	13-16 oz	>16 oz
Atlantic	32.0	25.9	31.9	6.5	2.5	1.2
Snowden*	30.3	27.7	35.6	4.6	1.3	0.5
CO96141-4W						
CO97065-7W						
W2717-5	32.8	27.8	29.3	6.9	2.2	1.1
CO97043-14W						
MSJ036A	40.8	31.5	24.0	3.0	0.4	0.3
MSJ126-9Y	49.8	28.6	16.9	2.4	1.9	0.4
NY138						
NY139						
AF2291-10						

* Denotes yield data from 2008, Specific Gravity from 2009

Table 3. Overall average yield, percent size distribution and culls, specific gravity and out of field chip color for eleven lines and two standards grown in CA, FL, ID, ME, MI, MO, NC, PA, RRV and WI in 2009.

State	Clone or Variety	Yield (cwt/acre)		Percent of Categories					Specific Gravity	Field Chip Color	
		No.1	Total	No. 1	Small	Mid-Size	Large	Culls		Agtron	SFA
CA	AF2291-10	287	324	89	9	89	2	0.7	1.088		
FL	AF2291-10	205	262	78	10	85	6	14	1.073		3
ID	AF2291-10	283	327	87	9	69	17	5	1.093		
ME	AF2291-10	314	365	86	5	91	4	9.8	1.092	70	
MI	AF2291-10	466	480	97	3	86	11	0	1.089	59	2
MO	AF2291-10	187	194	96	4	96	0	na	1.087	64	
NC	AF2291-10	266	300	89	6	88	1	6	1.080		3
PA	AF2291-10	306	335	91	2	91	2	4	1.082	56	
RRV-I	AF2291-10	337	351	96	4	88	9	na	1.094	73	
RRV-NI	AF2291-10	192	211	91	9	78	14	na	1.108		
WI	AF2291-10	na	na	na	na	na	na	na	1.087		
	average:	284	315	90	6	86	7	5.6	1.088	64.4	2.7
CA	ATLANTIC	383	499	77	7	77	14	1.6	1.088		
FL	ATLANTIC	226	350	65	7	80	13	30	1.066		2
ID	ATLANTIC	329	427	77	19	63	14	4	1.094		
ME	ATLANTIC	270	376	72	5	90	5	23.2	1.093	70	
MI	ATLANTIC	498	523	96	2	80	16	2	1.087	59	3
MO	ATLANTIC	270	287	94	6	94	0	na	1.092	64	
NC	ATLANTIC	372	404	92	6	89	3	2	1.079		2
PA	ATLANTIC	151	222	68	1	68	4	26	1.083	58	
RRV-I	ATLANTIC	370	398	93	7	77	16	na	1.093	73	
RRV-NI	ATLANTIC	172	187	92	7	74	17	na	1.110		
WI	ATLANTIC	321	430	75	2	72	3	23	1.091		
	average:	306	373	82	6	79	10	14.0	1.089	64.8	2.3

Table 3. Continued: Overall average yield, percent size distribution and culls, specific gravity and out of field chip color for eleven lines and two standards grown in CA, FL, ID, ME, MI, MO, NC, PA, RRV and WI in 2009.

State	Clone or Variety	Yield (cwt/acre)		Percent of Categories					Specific Gravity	Field Chip Color	
		No.1	Total	No. 1	Small	Mid-Size	Large	Culls		Agtron	SFA
CA	CO96141-4W	288	338	85	12	85	2	1.3	1.071		
FL	CO96141-4W	339	390	87	9	88	2	4	1.063		1
ID	CO96141-4W	404	484	83	16	79	4	1	1.085		
ME	CO96141-4W	305	346	88	4	95	1	7.9	1.079	70	
MI	CO96141-4W	423	444	96	3	83	13	1	1.070	64	2
MO	CO96141-4W	158	180	88	12	88	0	na	1.079	64	
NC	CO96141-4W	349	402	87	12	87	0	2	1.065		1
PA	CO96141-4W	251	311	81	5	81	0	14	1.068	57	
RRV-I	CO96141-4W	391	420	93	7	85	8	na	1.076	73	
RRV-NI	CO96141-4W	100	125	80	20	79	1	na	1.099		
WI	CO96141-4W	na	na	na	na	na	na	na	1.075		
	average:	301	344	87	10	85	3	4.5	1.075	65.6	1.3
CA	CO97043-14W	342	385	89	8	89	3	0.4	1.084		
FL	CO97043-14W	301	346	87	8	80	11	4	1.066		1
ID	CO97043-14W	316	409	77	23	75	2	0	1.088		
ME	CO97043-14W	236	295	80	5	90	5	16.2	1.081	70	
MI	CO97043-14W	455	472	96	3	85	11	1	1.073	63	2
MO	CO97043-14W	201	239	84	16	84	0	na	1.083	64	
NC	CO97043-14W	330	373	88	9	88	0	2	1.071		1
PA	CO97043-14W	144	169	85	3	85	0	11	1.074	59	
RRV-I	CO97043-14W	359	390	92	8	77	15	na	1.084	73	
RRV-NI	CO97043-14W	189	222	85	15	76	10	na	1.096		
WI	CO97043-14W	na	na	na	na	na	na	na	1.079		
	average:	287	330	86	10	83	6	4.9	1.080	65.8	1.3

Table 3. Continued: Overall average yield, percent size distribution and culls, specific gravity and out of field chip color for eleven lines and two standards grown in CA, FL, ID, ME, MI, MO, NC, PA, RRV and WI in 2009.

State	Clone or Variety	Yield (cwt/acre)		Percent of Categories					Specific Gravity	Field Chip Color	
		No.1	Total	No. 1	Small	Mid-Size	Large	Culls		Agtron	SFA
CA	CO97065-7W	303	380	80	12	80	8	0.4	1.087		
FL	CO97065-7W	288	325	89	7	91	1	5	1.075		1
ID	CO97065-7W	213	393	54	46	54	0	0	1.089		
ME	CO97065-7W	258	322	80	5	93	2	16.1	1.090	70	
MI	CO97065-7W	404	420	96	3	81	15	1	1.078	59	2
MO	CO97065-7W	136	147	93	7	93	0	na	1.085	64	
NC	CO97065-7W	323	363	89	7	88	1	4	1.072		1
PA	CO97065-7W	200	218	92	3	92	0	5	1.086	57	
RRV-I	CO97065-7W	368	396	93	7	88	5	na	1.056	73	
RRV-NI	CO97065-7W	84	112	75	25	71	5	na	1.113		
WI	CO97065-7W	na	na	na	na	na	na	na	1.081		
	average:	258	308	84	12	83	4	4.5	1.083	64.6	1.3
CA	KALKASKA	341	421	81	17	81	1	1.5	1.079		
FL	KALKASKA	113	204	55	26	71	1	24	1.064		1
ID	KALKASKA	257	368	70	29	69	1	1	1.094		
ME	KALKASKA	298	359	83	8	91	1	9.6	1.089	70	
MI	KALKASKA	454	486	93	6	89	4	1	1.082	58	4
MO	KALKASKA	281	314	89	11	89	0	na	1.076	64	
NC	KALKASKA	234	277	84	12	83	1	5	1.069		4
PA	KALKASKA	314	352	89	5	89	1	4	1.078	60	
RRV-I	KALKASKA	279	300	93	7	91	2	na	1.099	68	
RRV-NI	KALKASKA	214	230	93	7	71	21	na	1.088		
WI	KALKASKA	431	449	96	3	95	1	1	1.087		
	average:	292	342	84	12	84	3	5.9	1.082	64.0	3.0

Table 3. Continued: Overall average yield, percent size distribution and culls, specific gravity and out of field chip color for eleven lines and two standards grown in CA, FL, ID, ME, MI, MO, NC, PA, RRV and WI in 2009.

State	Clone or Variety	Yield (cwt/acre)		Percent of Categories					Specific Gravity	Field Chip Color	
		No.1	Total	No. 1	Small	Mid-Size	Large	Culls		Agtron	SFA
CA	MSJ126-9Y	277	330	84	11	84	3	2.0	1.077		
FL	MSJ126-9Y	212	263	81	8	83	7	10	1.063		2
ID	MSJ126-9Y	185	332	56	44	55	0	1	1.089		
ME	MSJ126-9Y	277	329	84	5	92	3	11.9	1.083	70	
MI	MSJ126-9Y	342	370	92	3	81	11	5	1.071	60	4
MO	MSJ126-9Y	110	123	89	11	89	0	na	1.074	65	
NC	MSJ126-9Y	222	258	86	10	83	3	4	1.065		2
PA	MSJ126-9Y	227	266	86	5	86	3	7	1.070	56	
RRV-I	MSJ126-9Y	249	277	90	10	90	0	na	1.084	71	
RRV-NI	MSJ126-9Y	127	155	82	18	81	2	na	1.093		
WI	MSJ126-9Y	303	320	95	5	92	2	1	1.079		
	average:	230	275	84	12	83	3	5.2	1.077	64.4	2.7
MI	ND7519-1	387	414	93	5	90	3	2	1.092	62	1
RRV-I	ND7519-1	297	330	90	10	90	0	na	1.092	73	
RRV-NI	ND7519-1	174	196	89	11	83	6	na	1.105		
	average:	286	313	91	9	88	3	2.0	1.096	67.5	1
CA	NY138	354	426	83	6	83	11	0.5	1.078		
FL	NY138	331	395	84	5	64	30	10	1.062		1
ID	NY138	362	438	83	17	78	4	1	1.083		
ME	NY138	214	297	72	4	87	9	25.2	1.083	70	
MI	NY138	444	458	97	3	78	19	0	1.073	63	1
MO	NY138	226	252	90	10	90	0	na	1.075	64	
NC	NY138	314	349	90	4	81	9	6	1.065		2
PA	NY138	250	357	70	3	70	7	21	1.074	58	
RRV-I	NY138	386	420	92	6	74	18	na	1.063	75	
RRV-NI	NY138	186	200	93	7	92	2	na	1.096		
WI	NY138	na	na	na	na	na	na	na	1.075		
	average:	307	359	85	7	80	11	9.1	1.075	66.0	1.3

Table 3. Continued: Overall average yield, percent size distribution and culls, specific gravity and out of field chip color for eleven lines and two standards grown in CA, FL, ID, ME, MI, MO, NC, PA, RRV and WI in 2009.

State	Clone or Variety	Yield (cwt/acre)		Percent of Categories					Specific Gravity	Field Chip Color	
		No.1	Total	No. 1	Small	Mid-Size	Large	Culls		Agtron	SFA
CA	NY139	379	437	87	5	87	8	0.3	1.083		
FL	NY139	246	314	78	7	82	10	15	1.065		1
ID	NY139	372	488	76	23	73	3	1	1.094		
ME	NY139	251	318	79	7	90	3	14.6	1.090	70	
MI	NY139	455	462	99	1	73	26	0	1.087	62	1
MO	NY139	204	212	96	4	96	0	na	1.088	64	
NC	NY139	354	404	88	7	87	0	6	1.071		2
PA	NY139	296	346	86	2	86	6	6	1.075	60	
RRV-I	NY139	299	340	88	12	85	4	na	1.095	73	
RRV-NI	NY139	163	185	88	12	83	5	na	1.106		
WI	NY139	na	na	na	na	na	na	na	1.085		
	average:	302	351	87	8	84	7	6.1	1.085	65.8	1.3
CA	SNOWDEN	401	468	86	9	86	4	1.1	1.081		
FL	SNOWDEN	224	280	80	11	85	3	10	1.069		2
ID	SNOWDEN	270	385	70	26	58	12	4	1.092		
ME	SNOWDEN	299	359	83	7	92	1	10.2	1.093	70	
MI	SNOWDEN	488	512	95	5	89	6	0	1.088	62	2
MO	SNOWDEN	na	na	na	na	na	na	na	na	na	na
NC	SNOWDEN	380	412	92	7	91	1	1	1.074		2
PA	SNOWDEN	304	355	86	2	86	2	11	1.090	57	
RRV-I	SNOWDEN	383	421	91	9	90	2	NA	1.093	72	
RRV-NI	SNOWDEN	188	224	84	16	77	6	NA	1.114		
WI	SNOWDEN	499	526	95	2	93	2	3	1.089		
	average:	344	394	86	9	85	4	5.0	1.088	65.3	2.0

Table 3. Continued: Overall average yield, percent size distribution and culls, specific gravity and out of field chip color for eleven lines and two standards grown in CA, FL, ID, ME, MI, MO, NC, PA, RRV and WI in 2009.

State	Clone or Variety	Yield (cwt/acre)		Percent of Categories					Specific Gravity	Field Chip Color	
		No.1	Total	No. 1	Small	Mid-Size	Large	Culls		Agtron	SFA
CA	W2324-1	384	458	84	7	84	7	1.8	1.083		
FL	W2324-1	132	203	65	17	79	2	19	1.065		1
MO	W2324-1	269	288	93	7	93	0	NA	1.083	64	
NC	W2324-1	364	433	84	7	83	1	10	1.075		2
	average:	287	346	82	10	85	3	10.3	1.077	64.0	1.5
CA	W2717-5	264	321	82	12	82	3	1.7	1.087		
FL	W2717-5	154	235	66	18	80	1	19	1.071		1
ID	W2717-5	275	388	71	27	65	6	2	1.094		
ME	W2717-5	227	348	65	5	92	3	31.5	1.097	70	
MI	W2717-5	361	395	91	4	82	9	5	1.085	61	3
MO	W2717-5	168	187	90	10	90	0	NA	1.088	64	
NC	W2717-5	192	226	85	8	85	1	7	1.080		2
PA	W2717-5	214	285	75	5	75	1	18	1.087	58	
RRV-I	W2717-5	333	354	94	6	89	4	NA	1.096	73	
RRV-NI	W2717-5	127	155	82	18	76	4	NA	1.114		
WI	W2717-5	312	363	86	2	83	3	12	1.089		
	average:	239	296	81	10	82	3	12.0	1.090	65.2	2.0

Table 4a. One to three years of USPB-SFA data per state for the breeding line CO96141-4W from 2007 to 2009.

State	Year	Clone	Yield (cwt/acre)		Percent Grade and Size Distribution					Specific Gravity	Field Chip Color	
			No.1	Total	No.1	Small	Med.	Large	Culls		Agtron	SFA
CA	2009	CO96141-4W	288	338	85	12	85	2	1.3	1.071		
CA	2008	CO96141-4W	353	411	86	13	60	26	1	1.072		
FL	2009	CO96141-4W	339	390	87	9	88	2	4	1.063		1.0
FL	2008	CO96141-4W	294	358	82	15	83	1	1	1.075		3.8
FL	2007	CO96141-4W	312	379	83	16	82	0	1	1.080		4.0
ID	2009	CO96141-4W	404	484	83	16	79	4	1	1.085		
ID	2008	CO96141-4W	379	439	86	11	76	10	3	1.086		
ID	2007	CO96141-4W	354	436	81	15	77	4	4	1.084		1.6
ME	2009	CO96141-4W	305	346	88	4	95	1	8	1.079	70.0	
ME	2008	CO96141-4W	320	350	91	8	84	5	3	1.076	71.1	
ME	2007	CO96141-4W	273	280	98	3	98	0	0	1.065		
MI	2009	CO96141-4W	423	444	96	3	83	13	1	1.070	63.5	2.0
MI	2008	CO96141-4W	410	449	91	5	86	5	4	1.061	66.7	2.0
MI	2007	CO96141-4W	366	385	95	5	92	3	0	1.067	61.4	2.0
MO	2009	CO96141-4W	158	180	88	12	88	0	na	1.079	64.0	
MO	2008	CO96141-4W	226	315	72	28	72	0	na	1.062	67.0	
NC	2009	CO96141-4W	349	402	87	12	87	0	2	1.065		1.0
NC	2008	CO96141-4W	315	364	87	11	86	0	3	1.080	70.1	2.0
NC	2007	CO96141-4W	309	344	90	8	87	3	3	1.069		1.0
PA	2009	CO96141-4W	251	311	81	5	81	0	14	1.068	57.0	
PA	2008	CO96141-4W	147	183	80	9	80	2	9	1.089	53.0	
PA	2007	CO96141-4W	237	258	92	5	92	1	2	1.068	45.0	
RRV-I	2009	CO96141-4W	391	420	93	7	85	8	na	1.076	73.0	
RRV-NI	2009	CO96141-4W	100	125	80	20	79	1	na	1.099		
RRV	2008	CO96141-4W	259	285	91	9	91	0	0	1.094	64.0	2.0
RRV	2007	CO96141-4W	221	245	90	3	92	4	2	1.096	67.0	1.0
TX	2007	CO96141-4W	103	216	48	53	48	0	na	1.071	69.0	
WI	2009	CO96141-4W	na	na	na	na	na	na	na	1.075		
WI	2008	CO96141-4W	428	470	91	4	91	3	3	1.069		
WI	2007	CO96141-4W	401	432	93	6	93	0	1	1.072		
overall average:			301	346	86	11	83	3	3	1.076	64.1	2.0

Table 4b. One to three years of USPB-SFA data per state for the standard variety Atlantic from 2007 to 2009.

State	Year	Clone	Yield (cwt/acre)		Percent Grade and Size Distribution					Specific Gravity	Field Chip Color	
			No.1	Total	No.1	Small	Med.	Large	Culls		Agtron	SFA
CA	2009	ATLANTIC	383	499	77	7	77	14	1.6	1.088		
CA	2008	ATLANTIC	na	na	na	na	na	na	na	na		
FL	2009	ATLANTIC	226	350	65	7	80	13	30	1.066		2
FL	2008	ATLANTIC	285	343	83	12	84	2	3	1.088		3.9
FL	2007	ATLANTIC	298	337	93	7	88	4	5	1.086		2
ID	2009	ATLANTIC	329	427	77	19	63	14	4	1.094		
ID	2008	ATLANTIC	489	559	87	4	62	26	9	1.096		
ID	2007	ATLANTIC	428	527	81	15	75	6	4	1.095		1.6
ME	2009	ATLANTIC	270	376	72	5	90	5	23	1.093	70.0	
ME	2008	ATLANTIC	361	389	93	10	81	7	3	1.080	69.1	
ME	2007	ATLANTIC	147	157	94	4	94	2	0	1.083		
MI	2009	ATLANTIC	498	523	96	2	80	16	2	1.087	58.6	3
MI	2008	ATLANTIC	414	443	93	5	80	13	1	1.077	64.9	3
MI	2007	ATLANTIC	404	434	93	4	79	14	3	1.079	63.9	2
MO	2009	ATLANTIC	270	287	94	6	94	0	na	1.092	64.0	
MO	2008	ATLANTIC	248	308	80	20	80	0	na	1.082	67.0	
NC	2009	ATLANTIC	372	404	92	6	89	3	2	1.079		2
NC	2008	ATLANTIC	324	375	86	10	85	2	4	1.097	65.3	1
NC	2007	ATLANTIC	314	339	93	4	89	3	4	1.081		1
PA	2009	ATLANTIC	151	222	68	1	68	4	26	1.083	58.0	
PA	2008	ATLANTIC	287	336	85	6	85	3	7	1.096	44.0	
PA	2007	ATLANTIC	178	242	74	5	74	17	6	1.083	42.0	
RRV-I	2009	ATLANTIC	370	398	93	7	77	16	na	1.093	73.0	
RRV-NI	2009	ATLANTIC	172	187	92	7	74	17	na	1.110		
RRV	2008	ATLANTIC	339	355	96	5	96	0	0	1.104	42.0	4
RRV	2007	ATLANTIC	280	319	88	4	89	6	1	1.104	61.0	2
TX	2007	ATLANTIC	164	235	70	31	70	0	na	1.085	70.0	
WI	2009	ATLANTIC	321	430	75	2	72	3	23	1.091		
WI	2008	ATLANTIC	447	508	88	3	88	8	1	1.086		
WI	2007	ATLANTIC	459	488	94	3	94	0	3	1.087		
overall average:			318	372	85	8	81	8	7	1.088	60.9	2.3

Table 4c. One to three years of USPB-SFA data per state for the standard variety Snowden from 2007 to 2009.

State	Year	Clone	Yield (cwt/acre)		Percent Grade and Size Distribution					Specific Gravity	Field Chip Color	
			No.1	Total	No.1	Small	Med.	Large	Culls		Agtron	SFA
CA	2009	SNOWDEN	401	468	86	9	86	4	1.1	1.081		
CA	2008	SNOWDEN	na	na	na	na	na	na	na	na		
FL	2009	SNOWDEN	224	280	80	11	85	3	10	1.069		2.0
FL	2008	SNOWDEN	333	402	83	14	85	0	3	1.086		3.4
FL	2007	SNOWDEN	337	364	94	6	93	0	1	1.078		3.0
ID	2009	SNOWDEN	270	385	70	26	58	12	4	1.092		
ID	2008	SNOWDEN	333	449	74	25	71	4	1	1.092		
ID	2007	SNOWDEN	394	506	78	20	75	3	2	1.089		1.7
ME	2009	SNOWDEN	299	359	83	7	92	1	10	1.093	70.0	
ME	2008	SNOWDEN	390	406	94	10	89	0	1	1.085	70.8	
ME	2007	SNOWDEN	174	189	92	8	92	0	0	1.072		
MI	2009	SNOWDEN	488	512	95	5	89	6	0	1.088	61.5	2.0
MI	2008	SNOWDEN	569	598	95	4	85	10	1	1.081	61.3	2.0
MI	2007	SNOWDEN	487	501	97	3	81	16	0	1.078	61.8	2.0
MO	2009	SNOWDEN	na	na	na	na	na	na	na	na	64.0	
MO	2008	SNOWDEN	180	249	72	28	72	0		1.077	68.0	
NC	2009	SNOWDEN	380	412	92	7	91	1	1	1.074		2.0
NC	2008	SNOWDEN	261	315	83	17	83	0	0	1.094	64.5	2.0
NC	2007	SNOWDEN	309	342	90	8	90	0	1	1.082		1.0
PA	2009	SNOWDEN	304	355	86	2	86	2	11	1.090	57.0	
PA	2008	SNOWDEN	291	362	80	16	80	1	3	1.099	50.0	
PA	2007	SNOWDEN	283	326	87	8	87	1	4	1.077	44.0	
RRV-I	2009	SNOWDEN	383	421	91	9	90	2	na	1.093	72.0	
RRV-NI	2009	SNOWDEN	188	224	84	16	77	6	na	1.114		
RRV	2008	SNOWDEN	290	307	95	6	94	0	0	1.094	48.0	2.0
RRV	2007	SNOWDEN	270	298	91	5	92	3	1	1.097	64.0	2.0
TX	2007	SNOWDEN	119	218	55	46	55	0	na	1.082	70.0	
WI	2009	SNOWDEN	499	526	95	2	93	2	3	1.089		
WI	2008	SNOWDEN	493	526	94	2	94	1	3	1.080		
WI	2007	SNOWDEN	456	487	94	4	94	0	2	1.077		
overall average:			336	385	86	12	84	3	3	1.086	61.8	2.1

Table 5. Two years of USPB-SFA data per state for the variety Kalkaska (MSJ036-A) from 2008 to 2009.

State	Year	Yield (cwt/acre)		Percent Grade and Size Distribution					Specific Gravity	Field Chip Color	
		No.1	Total	No.1	Small	Med.	Large	Culls		Agtron	SFA
CA	2009	341	421	81	17	81	1	1.5	1.079		
CA	2008	208	313	66	32	59	7	2	1.085		
FL	2009	113	204	55	26	71	1	24	1.064		
FL	2008	302	361	84	14	84	1	2	1.087		
ID	2009	257	368	70	29	69	1	1	1.094		
ID	2008	413	495	83	14	80	4	3	1.096		
ME	2009	298	359	83	8	91	1	10	1.089	70	
ME	2008	381	412	93	11	86	2	0.4	1.075	69	
MI	2009	454	486	93	6	89	4	1	1.082	58	
MI	2008	465	512	91	9	90	1	0	1.078	61	
MO	2009	281	314	89	11	89	0	na	1.076	64	
MO	2008	58	124	47	53	47	0	na	1.068	63	
NC	2009	234	277	84	12	83	1	5	1.069		
NC	2008	306	355	86	12	86	0	2	1.086	70	
PA	2009	314	352	89	5	89	1	4	1.078	60	
PA	2008	228	266	86	12	86	0	2	1.093	47	
RRV-I	2009	279	300	93	7	91	2	na	1.099	68	
RRV-NI	2009	214	230	93	7	71	21	na	1.088		
RRV	2008	327	372	88	12	88	0	0	1.093	51	
WI	2009	431	449	96	3	95	1	1	1.087		
WI	2008	481	520	93	4	93	0	4	1.081		
overall average:		304	357	83	14	82	2	4	1.083	62	

Note: see Table 4b for Atlantic and Table 4c for Snowden performance for these trial sites listed above for Kalkaska.

Table 6. Summary of yield, size, and specific gravity of W2324-1 over four seasons (2006-2009).

STATE	YEAR	No.1	Total	Percent of Categories					Specific Gravity	Field Chip Color	
				No.1	Small	Mid-Size	Large	Culls		Agtron	SFA
CA	2009	384	458	84	7	84	7	2	1.083		
CA	2008	287	393	73	18	49	24	9	1.084		
FL	2009	132	203	65	17	79	2	19	1.065		1.0
FL	2008	275	314	88	8	84	6	3	1.089		3.4
FL	2007	365	388	96	3	88	8	2	1.082		4.0
FL	2006	359	413	94	6	87	7	5	1.081	64	
ID	2008	482	565	85	6	65	20	9	1.095		
ID	2007	570	667	85	11	77	9	3	1.092		1.3
ID	2006	601	670	90	7	65	25	3	1.095		3.0
ME	2008	436	463	94	4	90	3	3	1.080	70	
ME	2007	315	354	89	4	89	8	0	1.078		
ME	2006	178	310	57	2	48	10	41	1.072	70	
MI	2008	555	604	92	5	77	14	3	1.078	61	3.0
MI	2007	564	598	95	3	82	13	2	1.081	63	2.0
MI	2006	488	515	95	4	90	5	1	1.083	55	2.0
MO	2009	269	288	93	7	93	0	na	1.083	64	
MO	2008	225	312	72	28	72	0	na	1.071	69	
NC	2009	364	433	84	7	83	1	10	1.075		2.0
NC	2008	333	376	89	10	88	1	1	1.090	65	2.0
NC	2007	335	383	87	10	86	2	3	1.080		3.0
NC	2006	461	521	89	8	88	0	4	1.082	67	2.0
PA	2008	306	347	88	9	88	0	3	1.099	47	
PA	2007	258	326	79	4	79	2	15	1.082	39	
PA	2006	351	408	86	10	86	1	4	1.093		1.0
RRV	2008	353	373	95	5	95	0	0	1.096	53	3.0
RRV	2007	302	334	91	4	93	1	2	1.099	58	2.0
RRV	2006	296	328	90	4	89	4	3	1.086	62	
TX	2007	144	239	60	40	60	0	na	1.091	68	
TX	2007	150	253	60	40	60	0	na	1.083	68	
TX	2006	272	309	88	12	88	0	na	1.078	72	
TX	2006	243	301	81	19	81	0	na	1.083	72	
WI	2008	565	618	91	2	91	3	4	1.083		
WI	2007	530	569	93	2	93	1	5	1.082		
WI	2006	433	656	66	2	66	2	29	1.082	69	

OUT-OF-STORAGE CHIPPING EVALUATIONS

DATA FROM 2008 AND 2009 TRIALS

Idaho
Maine
Michigan
Pennsylvania
Red River Valley
Wisconsin

2008 USPB-SFA Chip Trial Grown at Aberdeen, Idaho.

Out of Storage Quality Report

CLONE	6 week cool down 6 weeks storage		3 week recondition	Percent Sugar Ends	Processing Defects
	Chip 40 F	Chip 50 F	Chip 40 F		
ATLANTIC	4.0	1.1	1.8	14	bruise
W2324-1	4.0	1.1	2.0	6	green
W2310-3	2.6	1.0	1.1	11	
CO97043-14W	2.7	1.0	1.3	0	
MSJ036-A	2.8	1.0	1.0	0	
NY138	3.0	1.0	1.2	3	
NY139	2.8	1.0	1.1	8	
CO96141-4W	3.6	1.0	1.0	3	
BEACON					
CHIPPER	4.0	1.0	1.6	18	dark vascular
CO95051-7W	2.8	1.0	1.1	0	bruise
SNOWDEN	4.4	1.0	1.0	3	
ND7519-1	2.3	1.0	1.0	0	
AF2291-10	3.6	1.0	2.0	17	green
MSJ147-1	2.6	1.0	1.0	0	rot
CO97065-7W	4.7	1.0	2.9	11	dark vascular
W2717-5	2.2	1.0	1.1	6	

Samples harvested September 24, 2008, and gradually cooled to 50°.

Samples stored at 40 and 50° for 6 weeks.

Samples reconditioned at 60° for 3 weeks.

**OUT OF STORAGE CHIP FRY TEST RESULTS
2008 USPB-SFA CHIP VARIETY TRIAL
MAINE**

Overview: Potato varieties were harvested and stored at the Dale Turner Farm in Washburn, Maine on September 13, 2008. The Samples were placed in Jute bags and co-mingled into a bin of Russet Burbank variety potatoes being held for French fry manufacture. Samples were held in storage at 48 to 50 degree F. and 90 percent RH until February when the bin was emptied for French fry processing. Samples were transferred to 55 degree storage at Aroostook Research Farm in Presque Isle and held until April 12, 2009. Samples were transferred to Bio-Ag Research Laboratory and were fried on April 22, 2009 following two weeks conditioning at room temperature.

Tuber samples were washed, sliced and fried in 100 percent corn oil for 3 minutes at 375 degrees F. Chip slices were evaluated for color using the SFA Chip Fry Chart and the USDA color chart as published in the USDA Agricultural Handbook, "Commercial Potato Production".

RESULTS: 2008 SFA/NPPB OUT-OF-STORAGE CHIP VARIETY TRIAL FRY TEST

VARIETY	SFA Chip Fry Chart	U.S.D.A. 1-10 Fry Chart	Chip Defects	
			External	Internal
1. Atlantic	2	4	0	3 dp
2. Snowden	2+	3	1	3 vr
3. AF2291-10	1	6	1	10 dao
4. MSJ147-1	2+	4	2 bs	1
5. MSJ036-A	1	7	1	15 dao
6. Beacon Chip	1	6	1	8 vr
7. NY138	3	2	0	3 vr
8. NY139	3++	2	0	0
9. ND7519-1	3	2	0	0
10. W2324-1	2	5	2	8 dao
11. W2310-3	3++	1	1	0
12. CO97043-14	3	2	0	0
13. CO95051-7W	3	2	0	0
14. CO96141-4W sample lost in storage				
15. CO97065-7W	1	6	2 bs	8 dao

Defect Code: dao = dark all over
vr = Vascular Ring
dp = Dark Pith
bs = Black spot

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OUT-OF-STORAGE CHIP QUALITY 2008-2009 MICHIGAN REGIONAL REPORT

Chris Long and Greg Steere, Michigan State University

Procedure:

The 2008 USPB / SFA Chip Trial was harvested on October 1, 2008 at Sandyland Farms LLC, Howard City, MI. Several chip storage samples were collected from each variety at harvest. Two, 40 pound samples were collected from each entry and placed in the cooperating grower's commercial storage for evaluation in December 2008 and March of 2009 at Herr Foods, Nottingham PA. The 40 pound tuber samples placed in the grower's commercial storage were removed from storage in late December 2008 with a pile temperature of 54 °F and in March 2009 with a pile temperature of 48 °F. For sprout control, CIPC was applied in the storage in November 2008.

Eighteen, 30 tuber samples were also collected from each trial entry at harvest and stored in two bulk storages at the Michigan Potato Industry Commission's (MPIC), Cargill Potato Demonstration Storage Facility. One set of nine samples were stored at approximately 54°F for monthly evaluation from October through June. The remaining nine, 30 tuber samples were stored at approximately 50°F and evaluated from October 2008 to January 2009. These samples from the MPIC storage were processed at Techmark, Inc. for a glucose value (a percent by fresh weight), a sucrose rating (a percent by fresh weight X10), an SFA color score and an undesirable chip color score. The undesirable chip color score is reported as a percentage, by weight, of the total chips that were evaluated. For sprout control, CIPC was applied in the MPIC storages in November 17, 2008.

Six varieties were dropped from the storage evaluation process due to the fact that they did not appear to have long term storage potential in Michigan. They are Atlantic, Beacon Chipper, Kalkaska and CO96141-4W. The specific gravity of NY138 was very low and further evaluation was not prudent. Also, the internal chip quality of W2324-1 was so poor that further investment in evaluation was not advantageous.

Results:

Tables 1 and 2 summarize the chip quality of the 40 pound samples after being processed at Herr Foods, Inc. on December 29th, 2008 and March 24th, 2009. The varieties are listed in yield order, high to low, top to bottom, based on the 2008 field trial data. As seen in Table 1, Beacon Chipper exhibited the least amount of tuber defects. MSJ147-1 and W2717-5 had the highest specific gravity of any lines in the group.

From Table 2, W2717-5 continued to show a low percentage of chip defects and had the highest specific gravity (along with MSJ174-1) but lower yield potential need to be factored into further consideration of these varieties.

Tables 3-38 summarize the 30 tuber chip quality samples collected at harvest from each entry and stored at the MPIC Demonstration Storage in the fall of 2008 at two temperatures. Two graphs are provided for each line at each temperature for a total of four graphs per line. During the 2008-2009 storage season, the 50 °F samples were not evaluated beyond January 13th, 2009 due to the lack of variability in the storage bin temperatures where the two sets of samples were being stored. Both sets of samples were in bulk bins that were held at 54 °F, thus only one set of samples were evaluated for the remainder of the storage season. The first graph in each temperature is the sugar concentration and average pile temperature curve, showing the relationship of the bin temperature on physiological age and chip quality of the variety. The second graph shows the change in SFA chip color and sugar related color defects over time in storage at the given temperature regime. The varieties are again reviewed in yield order, high to low, top to bottom.

Snowden: Snowden stored acceptably until mid February 2009 at 54 °F (Table 3). From Table 4, the chip quality in this variety was best from early January 2009 until mid March 2009. Snowden had an average chip quality performance at Herr Foods on both processing dates (Tables 1-2).

NY139: Table 8 shows acceptable chip quality for this variety until early May 2009. Table 7 shows a steady increase in sucrose from mid January through the end of the storage season. Glucose levels moved steadily upward in early March. Even with these sugar moves in early 2009, chip quality remained acceptable until early May. Herr Foods data in Tables 1-2 show this variety to have an average performance on both processing dates.

W2310-1: This Wisconsin variety had average to above average chip quality as shown in Tables 1-2. The March processing date shows this variety to have a very nice chip color (Table 2). W2310-1 stored well until late March when the sucrose levels rose quickly followed by the glucose levels in mid April (Table 11). Chip quality was acceptable until early to mid April (Table 12).

AF2291-10: AF2291-10 had above average chip quality performance at Herr Foods on both processing dates (Tables 1-2). Table 15 showed some variable sucrose levels early in the season. This elevated sucrose level appeared to have little effect on chip quality as shown in Table 16.

CO97043-14W: This variety exhibited above average chip quality at Herr Foods (Tables 1-2). The recorded AGTRON scores, for this variety, on both dates were the highest in the trial. There was some variability in sucrose and glucose levels through most of the storage season (Table 19). The chip quality remained acceptable until early May with no apparent impact from the variable glucose levels (Table 20).

ND7519-1: ND7519-1 appeared to have very good early season chip quality. This was confirmed by Herr Foods (Table 1) and the MPIC storage data (Tables 23-24). In January, the sucrose level rose quickly followed by the glucose level in mid February (Table 23). In mid February, the chip quality of this line declined quickly. Tuber rot was reported in this line during the March evaluation at Herr Foods. The warm storage temperature and the tuber rot may have played a major role in this variety not performing well late in the storage season.

W2717-5: W2717-5 had an average to above average chip quality at Herr Foods (Tables 1-2). The specific gravity was good and chip defects were below average on both dates. The sucrose level shown in Table 27 declined steadily October through mid February. The sugar stability and dormancy of this variety appear to be good when exposed to warm storage temperatures. Upon dormancy break in mid April, the chip quality declined quickly with rapid increases in sucrose and glucose levels (Table 28).

MSJ147-1: MSJ147-1 was an average performer at Herrs on both processing dates (Tables 1-2). The specific gravity was good with a below average size profile. A larger percentage of the tuber size profile of MSJ147-1 was below 2.5 inches. Some sucrose variability was evident October through February in Table 31, while glucose remained flat. Sucrose and glucose levels rose quickly in February and March resulting in poor chip quality in early April (Table 32).

CO95051-7W: This variety had average to above average chip quality at Herr Foods (Tables 1-2). Its yield was the lowest in the 2008 trial. The tuber size profile was smaller than average with most tubers being under 3 inches. In general, the variety had a low percentage of chip defects at Herrs. Sucrose levels were stable until mid February with a steady increase in concentration through the remainder of the season (Table 35). Glucose levels followed sucrose a month later, but overall, chip quality remained good into June (Table 36).

Table 1. 2008-2009 Out-of-Storage Chip Quality, December 29, 2008, Sandyland Farms, LLC ¹.							
Entry	Agron Color	SFA ² Color	Specific Gravity	Percent Chip Defects ³			Comments
				Internal	External	Total	
Snowden	60.2	3.5	1.079	8.0	18.6	26.6	Internals: Scab showing on chips. Externals: Pitted scab. Oversize to 4".
NY139	60.1	2.5	1.077	6.9	7.6	14.5	Internals: A few light shading & internal necrosis. Externals: Some external bruise, no scab. Nice size.
W2310-3	56.4	3.0	1.079	6.9	1.7	8.6	Internals: A few light vascular & shading. Externals: 1 or 2 bruise, otherwise nice. No scab. Good size; some large to 4"
AF2291-10	60.9	2.5	1.071	12.6	3.3	15.9	Internals: A few light internal chip color. Externals: Some mechanical injury. Oversize to 4".
CO97043-14W	62.7	2.5	1.069	6.4	2.5	8.9	Internals: Defects on a few chips, otherwise nice color. Externals: Nice, 1 or 2 mechanical injury. Oversize to 4 1/4".
ND7519-1	56.0	2.0	1.080	1.4	7.9	9.3	Internals: Just a few stem color in chips. Nice externals. Good size profile to 3 1/2".
W2717-5	58.1	3.0	1.085	17.8	4.0	21.8	Internals: A few stem-end & light shading. Externals: Some green & mechanical injury with dry rot. Nice size to 3 1/4".
MSJ147-1	54.4	3.5	1.085	4.9	8.9	13.8	Internals: Fusarium shown in chips. Externals: Some fusarium in bruise, green. Some under 2".
CO95051-7W	58.9	2.5	1.074	5.5	2.8	8.3	Internals: A few stem-end & vascular ring. Externals: A few bruise & stem-end rot. Small grade, some under 2".

¹ Samples removed from 54 °F storage and processed by Herr Foods Inc., Nottingham, PA on December 29, 2008.
Chip defects are included in Agron and SFA samples.
² SFA Color: 1 = lightest, 5 = darkest
³ Percent Chip Defects are a percentage by weight of the total sample; comprised of undesirable color, greening, internal defects and external defects.

Table 2. 2008-2009 Out-of-Storage Chip Quality, March 24, 2009, Sandyland Farms, LLC ¹.							
Entry	Agron Color	SFA ² Color	Specific Gravity	Percent Chip Defects ³			Comments
				Internal	External	Total	
Snowden	58.7	4.0	1.074	19.9	11.0	30.9	Internals: Shading in chips. Externals: Nice grade, low internals. Good size.
NY139	56.8	4.0	1.076	21.5	13.4	34.9	Internals: Shading & external defects show in chips. Externals: A few scab, fusarium, Large size some 4 1/2".
W2310-3	59.4	2.0	1.077	15.2	6.5	21.7	Internals: Nice chip color. A few with light shading and some stem-end vascular browning (light). Externals: A few scab with fusarium.
AF2291-10	59.7	3.0	1.074	4.8	9.3	14.1	Internals: Nice chip color. Externals: A few scab, bruise. Nice grade overall.
CO97043-14W	61.0	3.0	1.065	7.7	4.7	12.4	Internals: Very light shading. Not bad. Nice externals. Size good to 3 1/2".
ND7519-1	48.7	5.0	1.071	65.8	3.0	68.8	Internals: Poor chip color. Externals: A few bruise, tuber rot bad. Size to 3 3/4".
W2717-5	57.9	3.0	1.084	5.5	5.2	10.7	Internals: Not bad chip color. Externals: Some scab and bruise. Nice size to 3 1/2".
MSJ147-1	54.3	3.0	1.084	5.6	9.5	15.1	Internals: A few shaded chips from dry rot. Externals: Fusarium on some tubers. Small 1 1/2" 3". Too many 2".
CO95051-7W	56.2	3.0	1.068	8.3	5.2	13.5	Internals: Slight vascular, nice chip color overall. Externals: A few scab & bruise. Not too bad external. Small, 2 - 3". Low gravity.

¹ Samples removed from 54 °F storage and processed by Herr Foods Inc., Nottingham, PA on March 24, 2009.
Chip defects are included in Agron and SFA samples.
² SFA Color: 1 = lightest, 5 = darkest
³ Percent Chip Defects are a percentage by weight of the total sample; comprised of undesirable color, greening, internal defects and external defects.

Table 3.

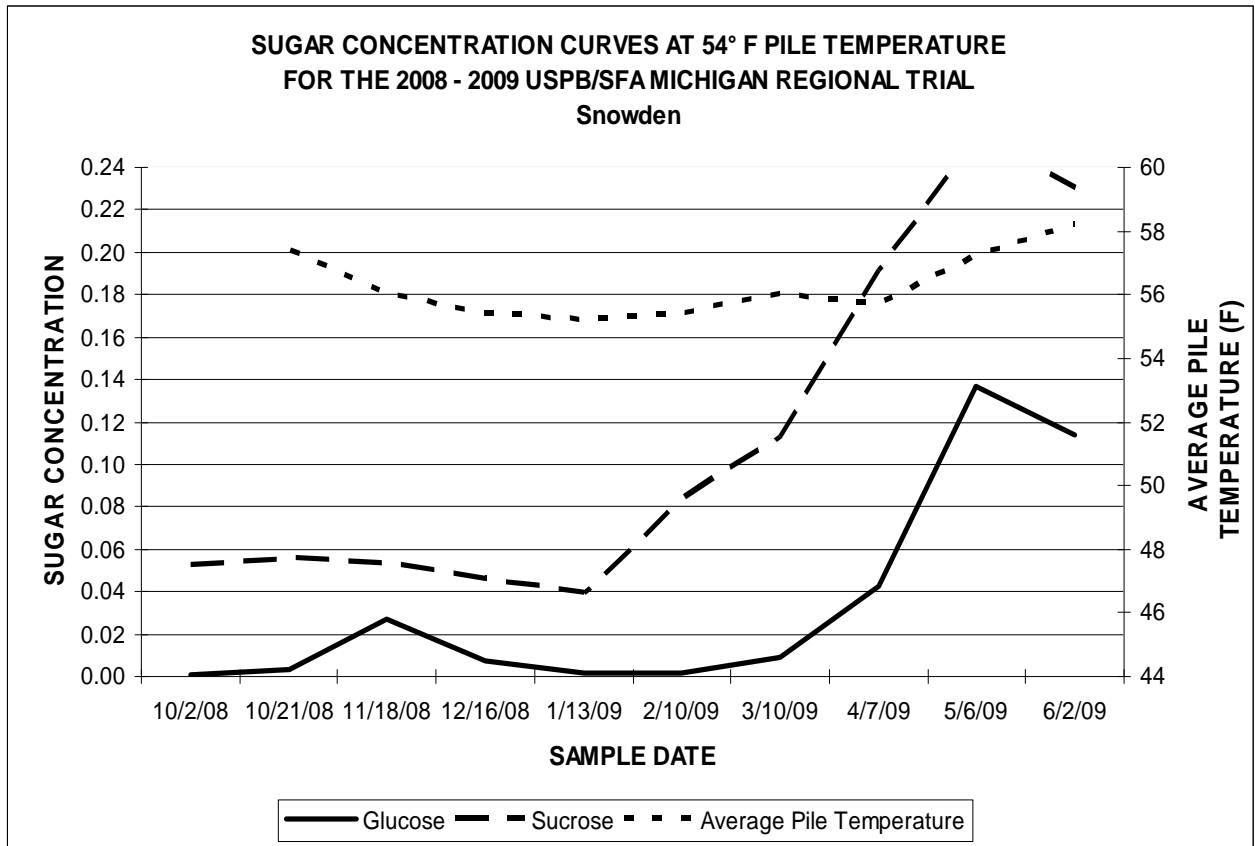


Table 4.

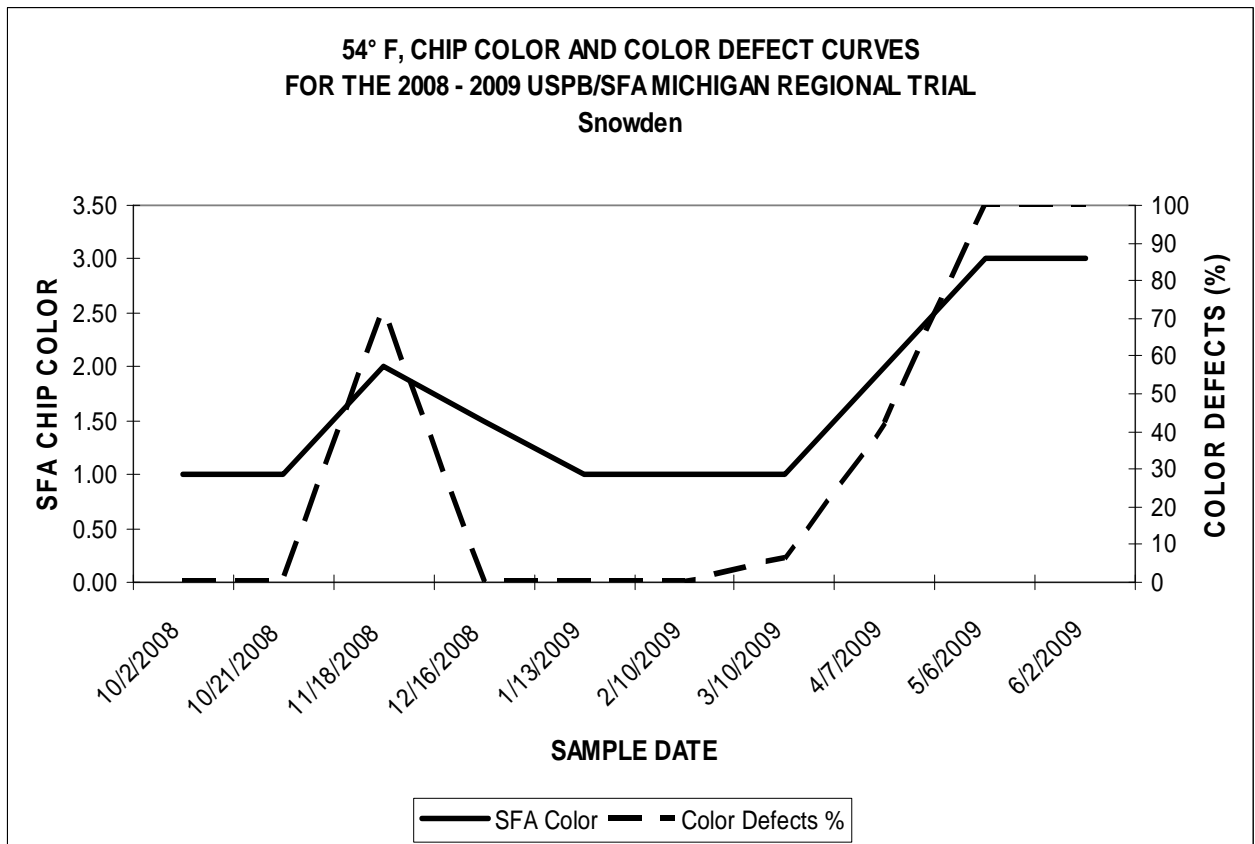


Table 5.

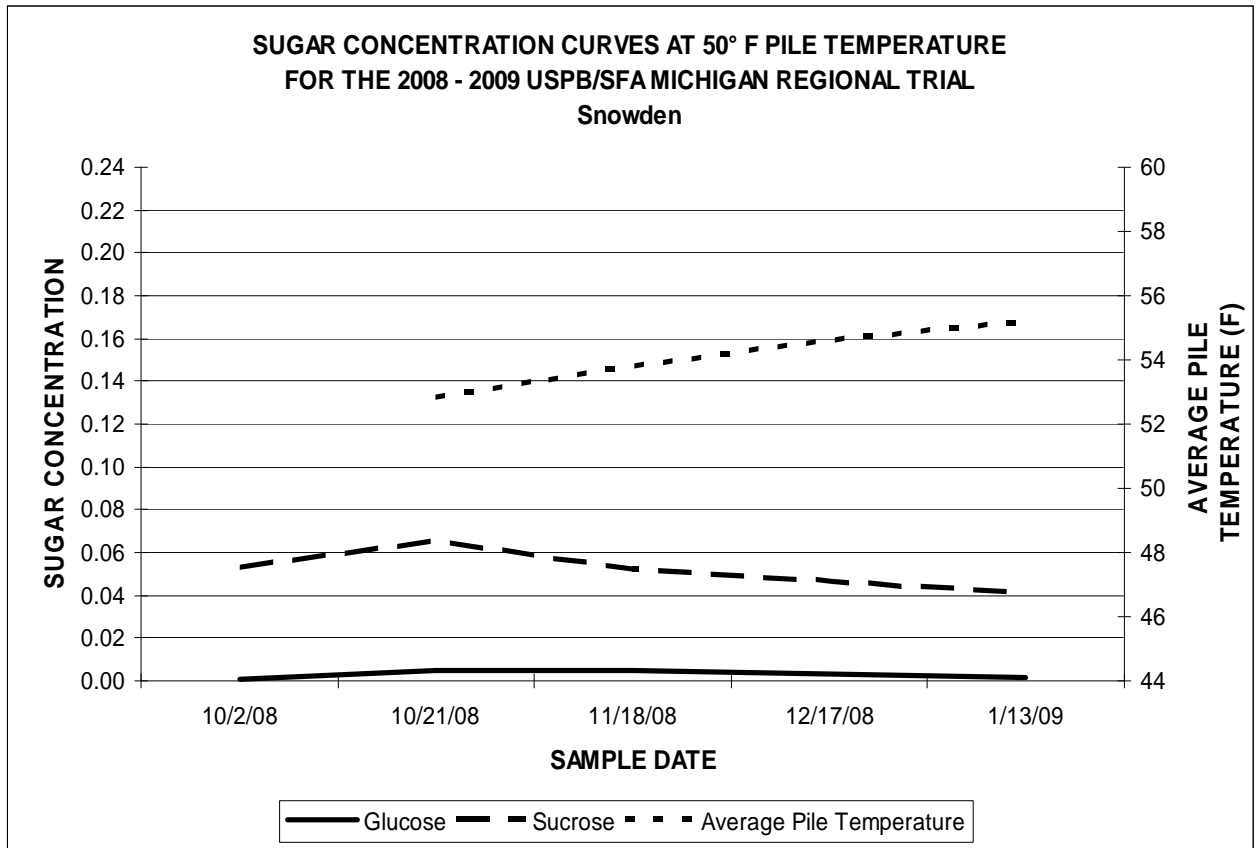


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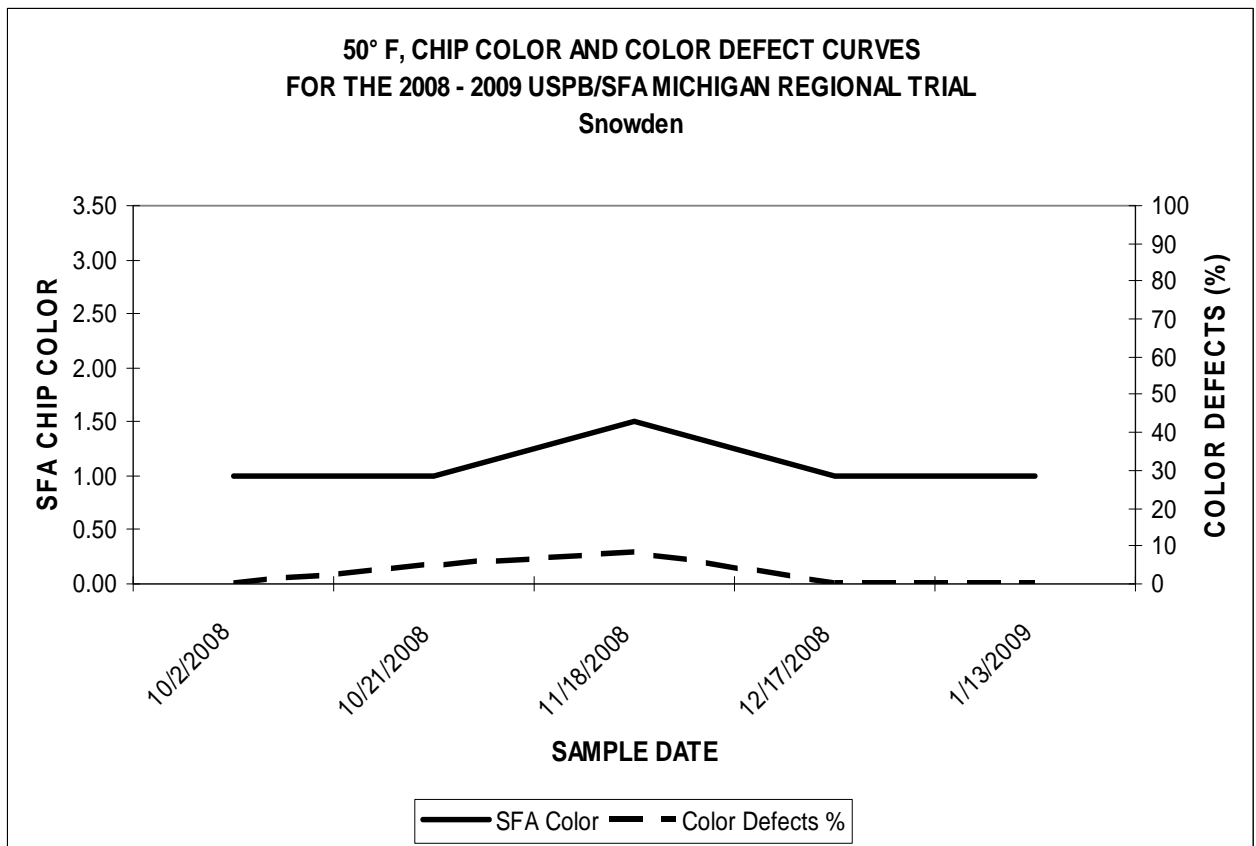


Table 7.

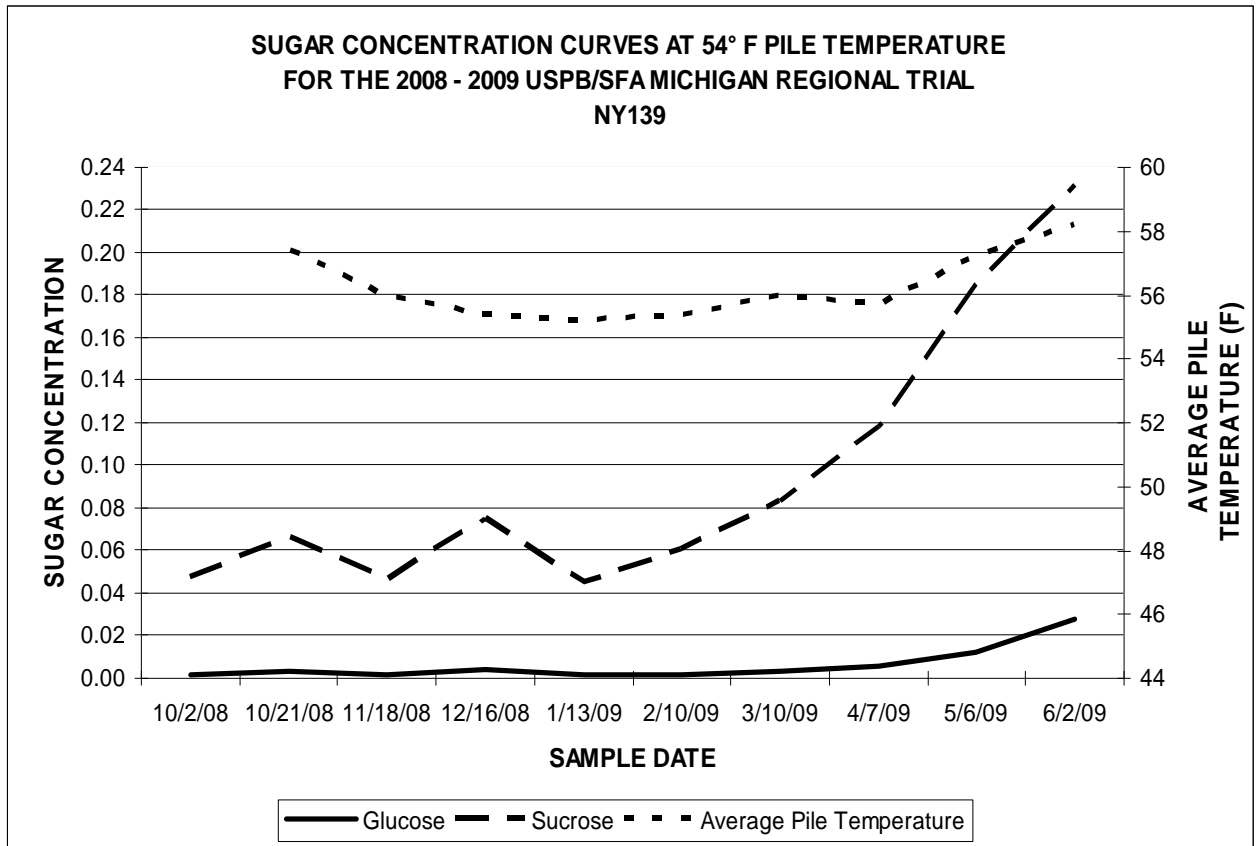


Table 8.

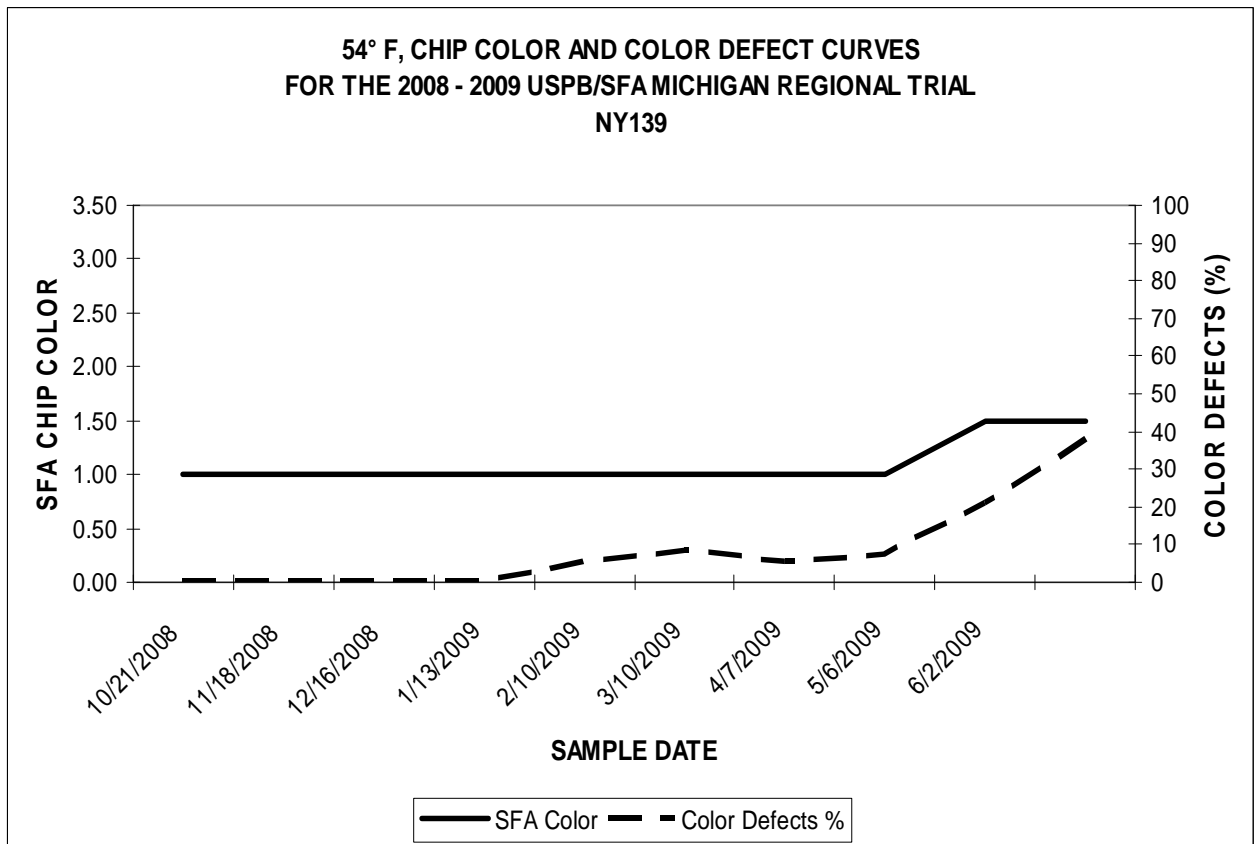


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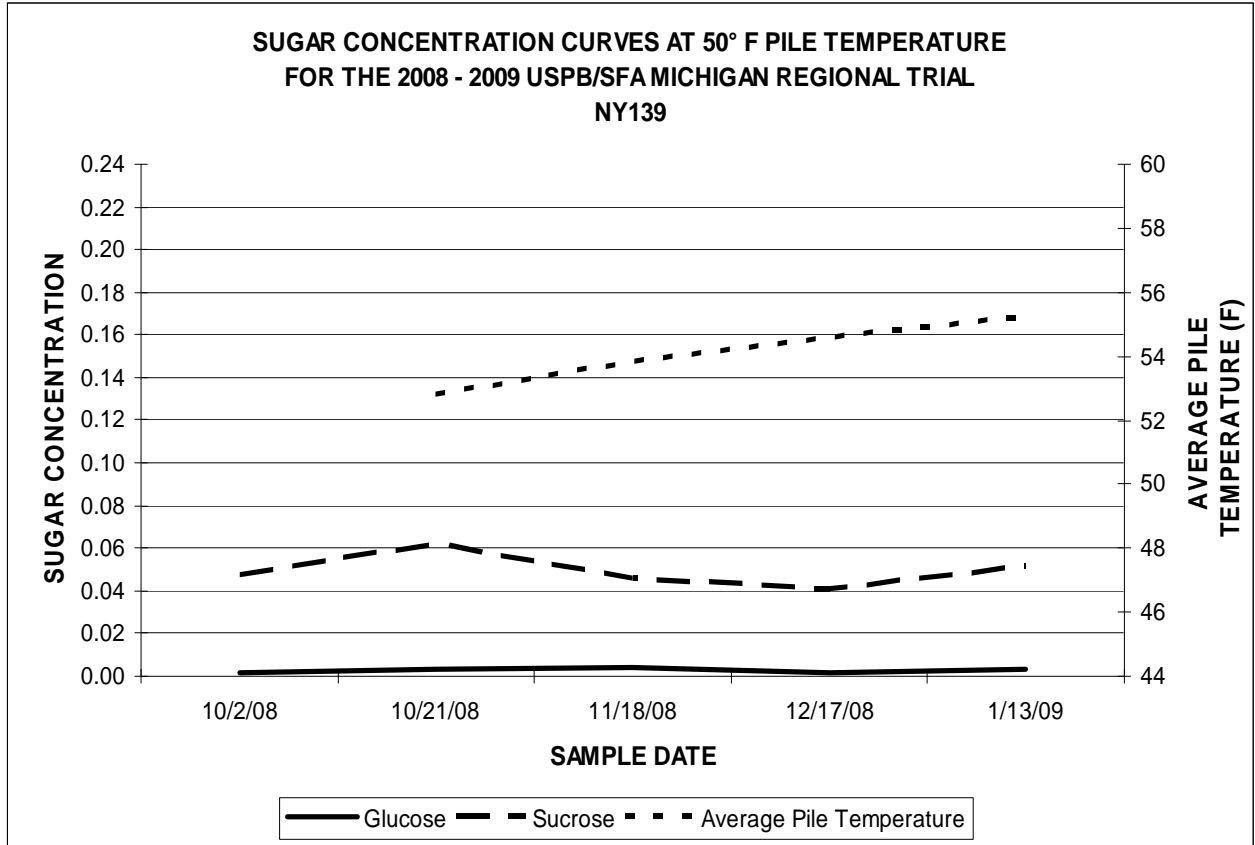


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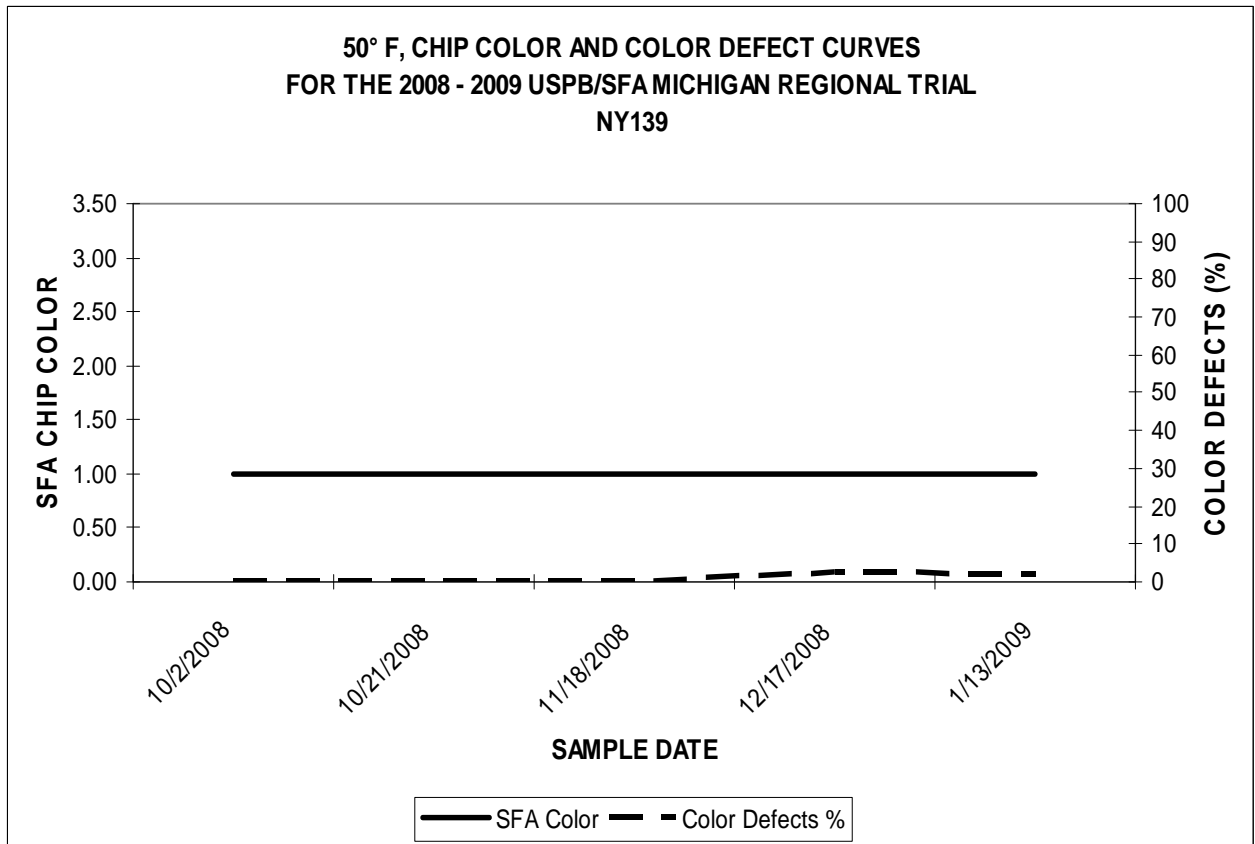


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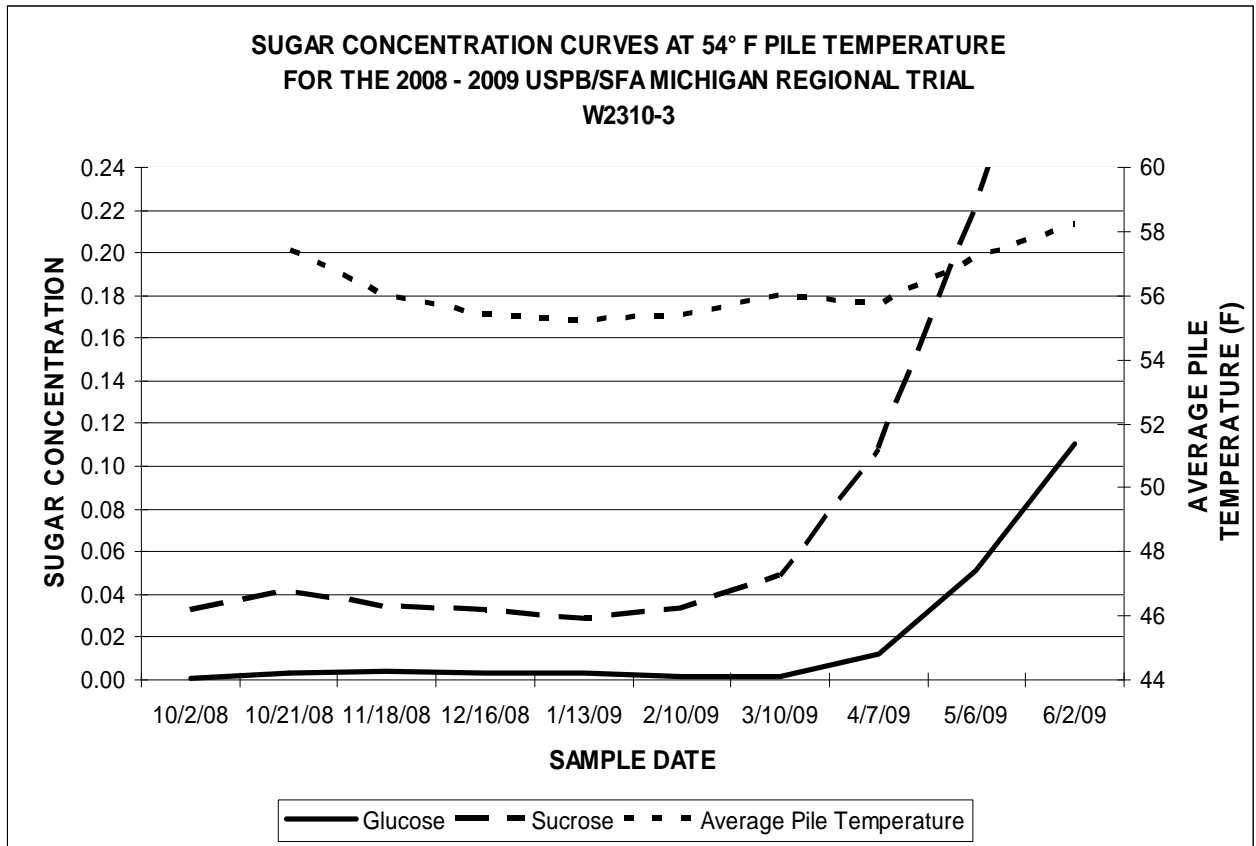


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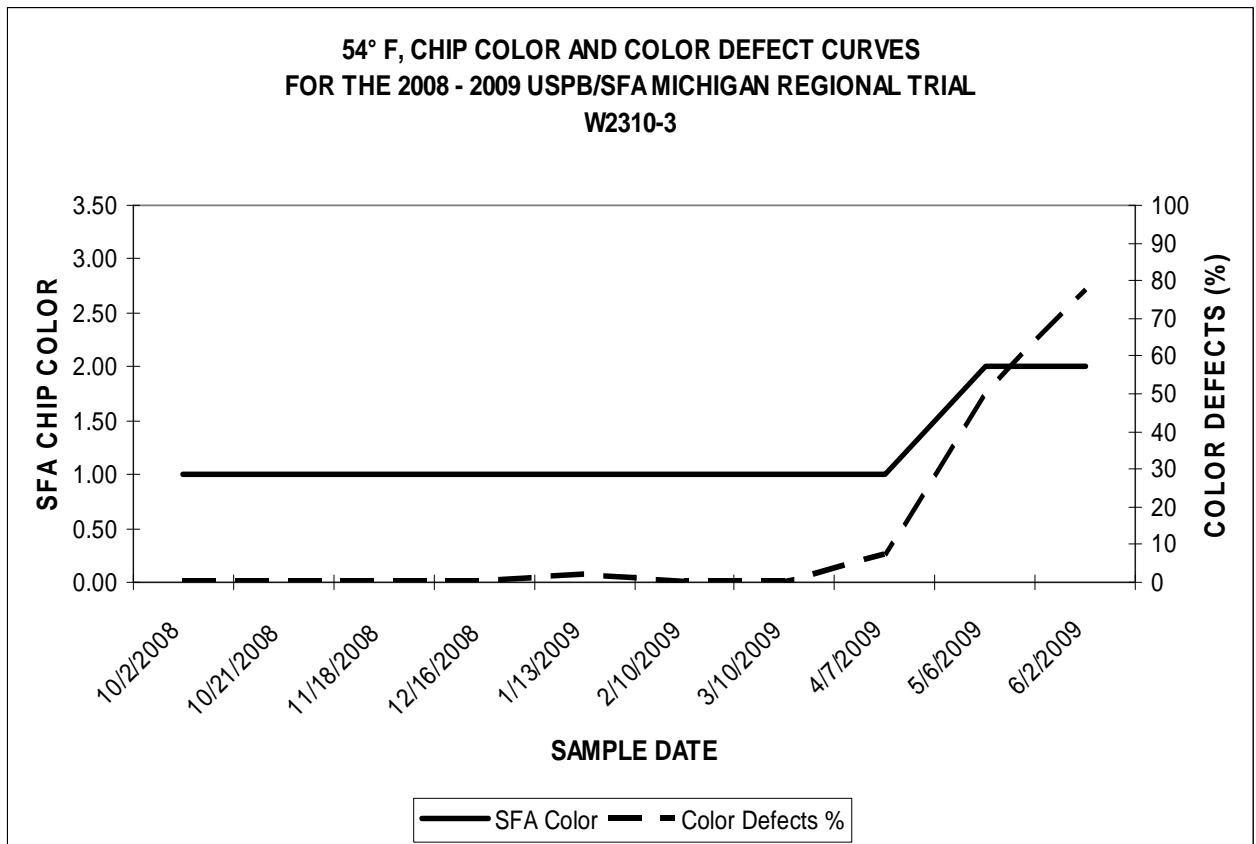


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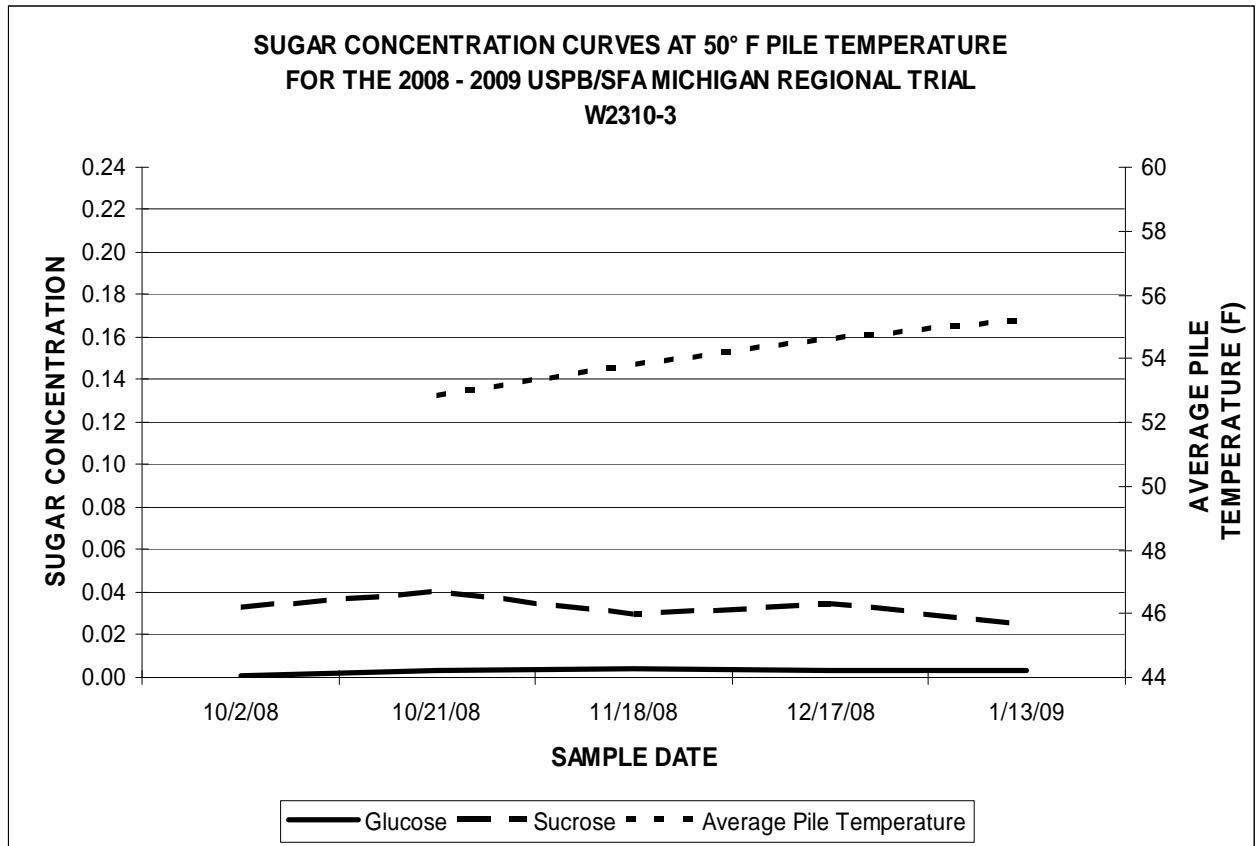


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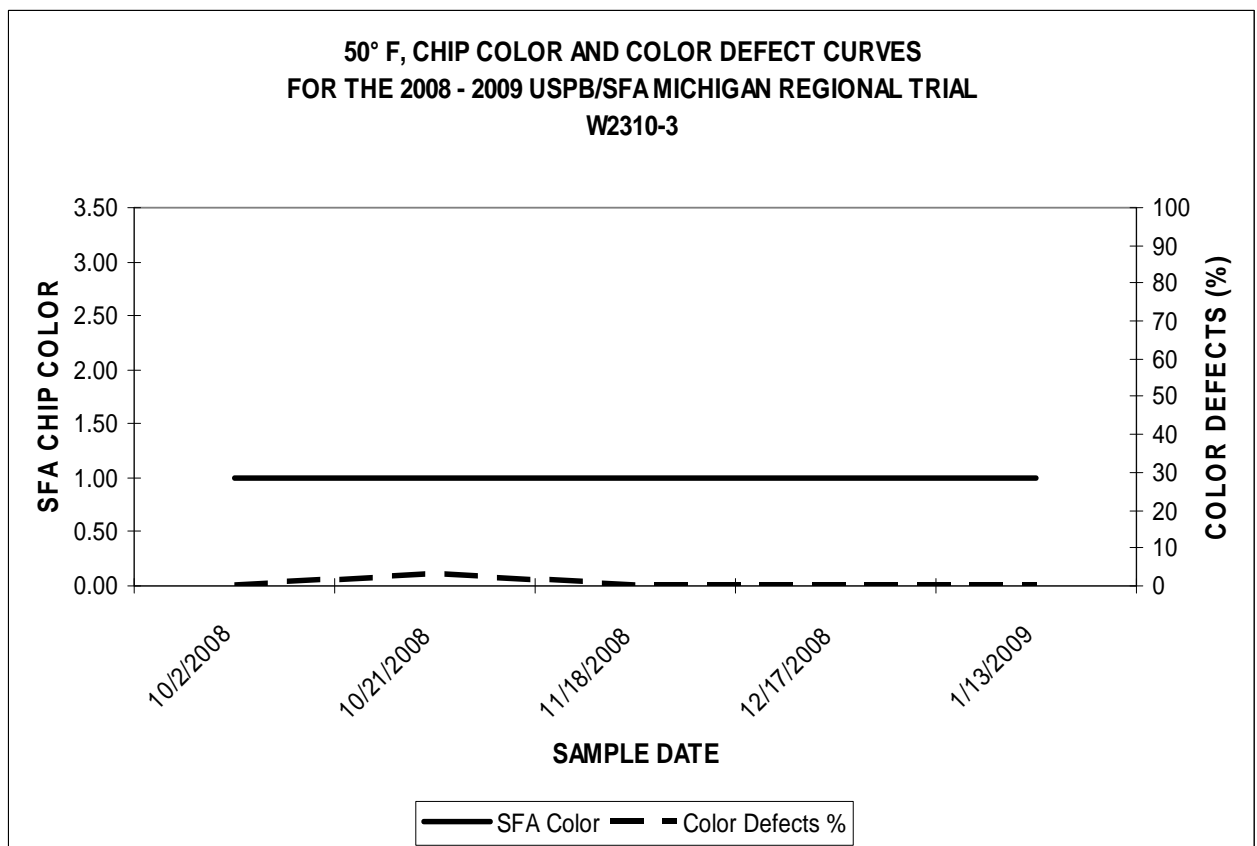


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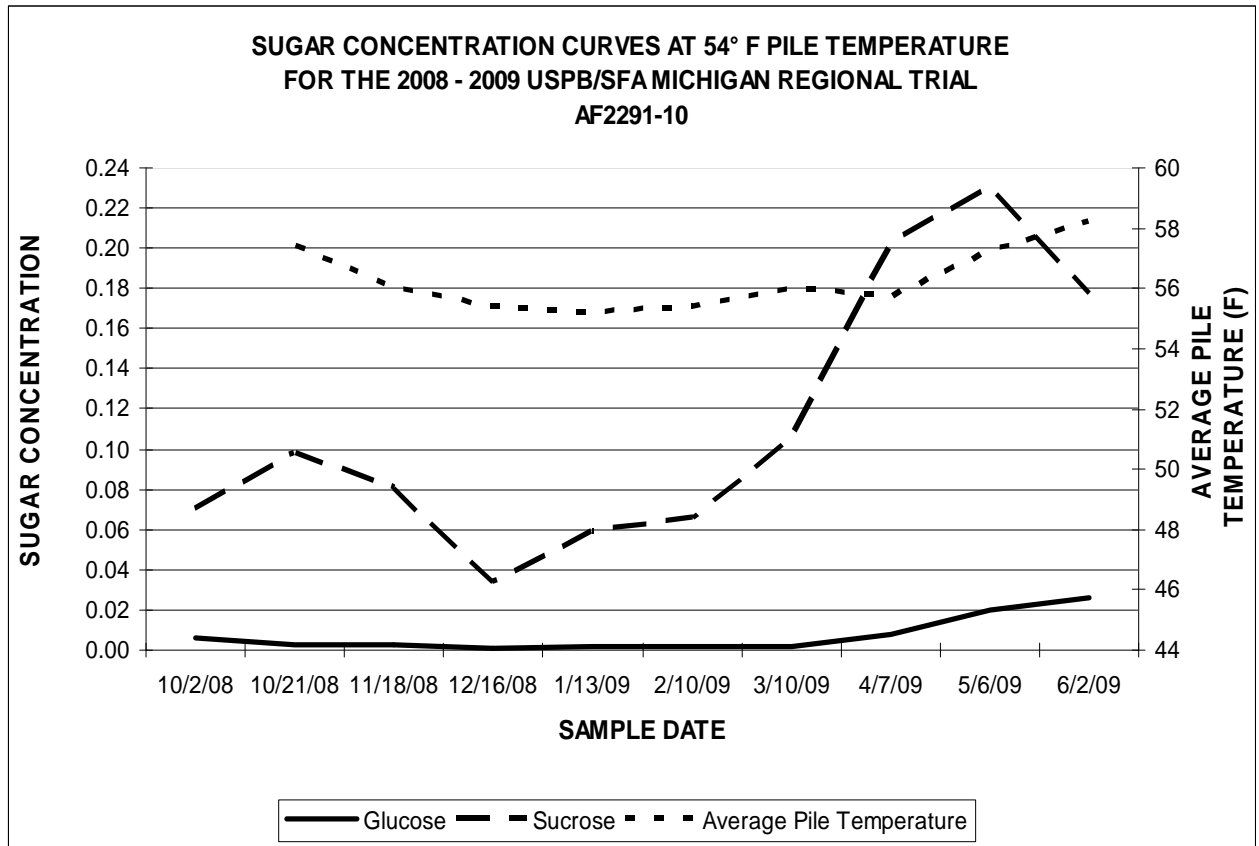


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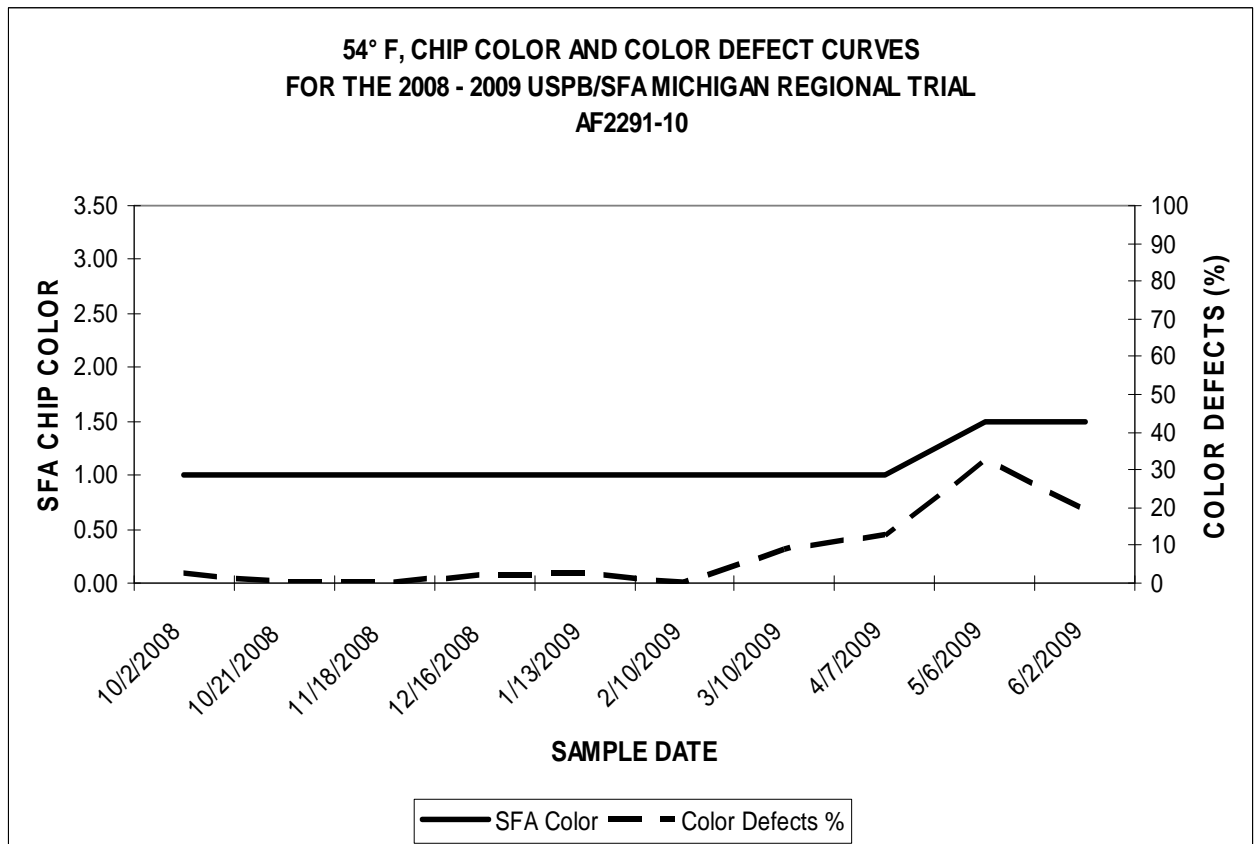


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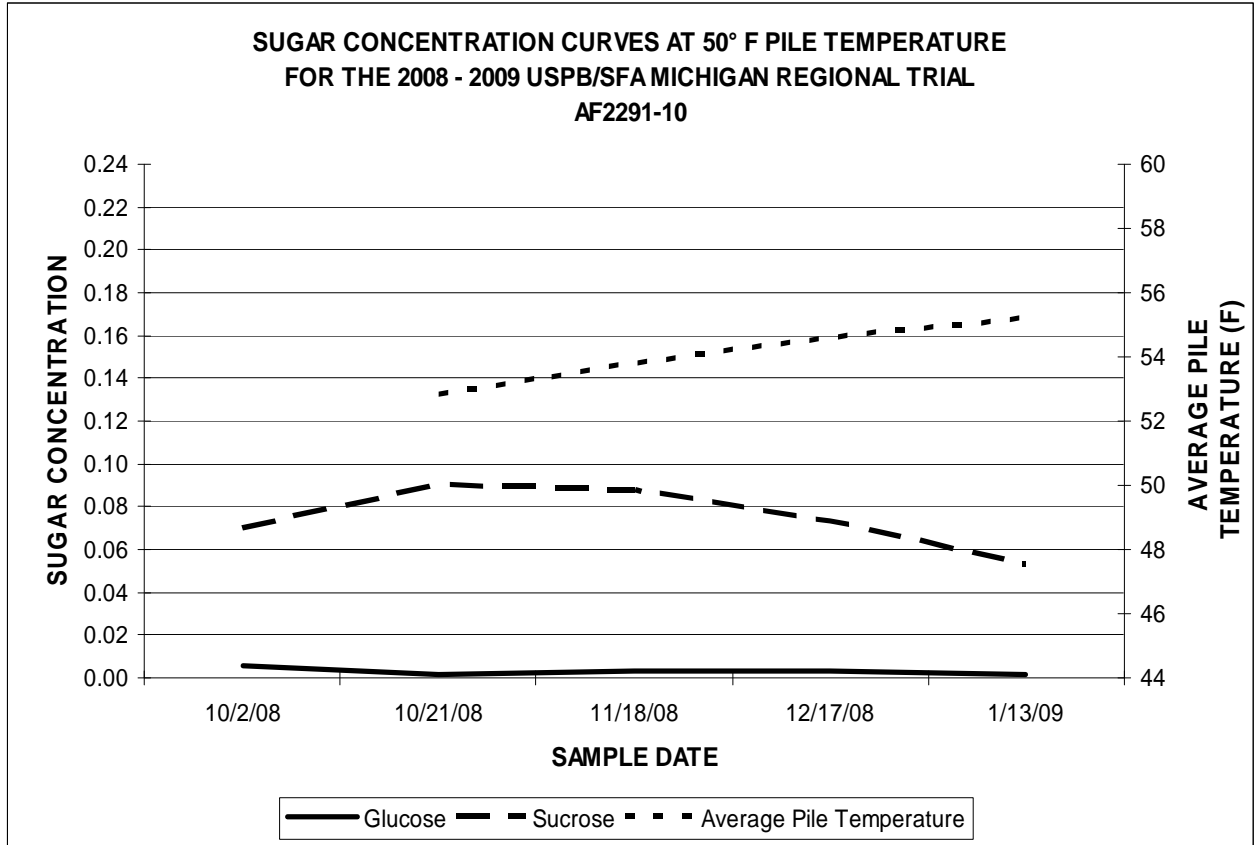


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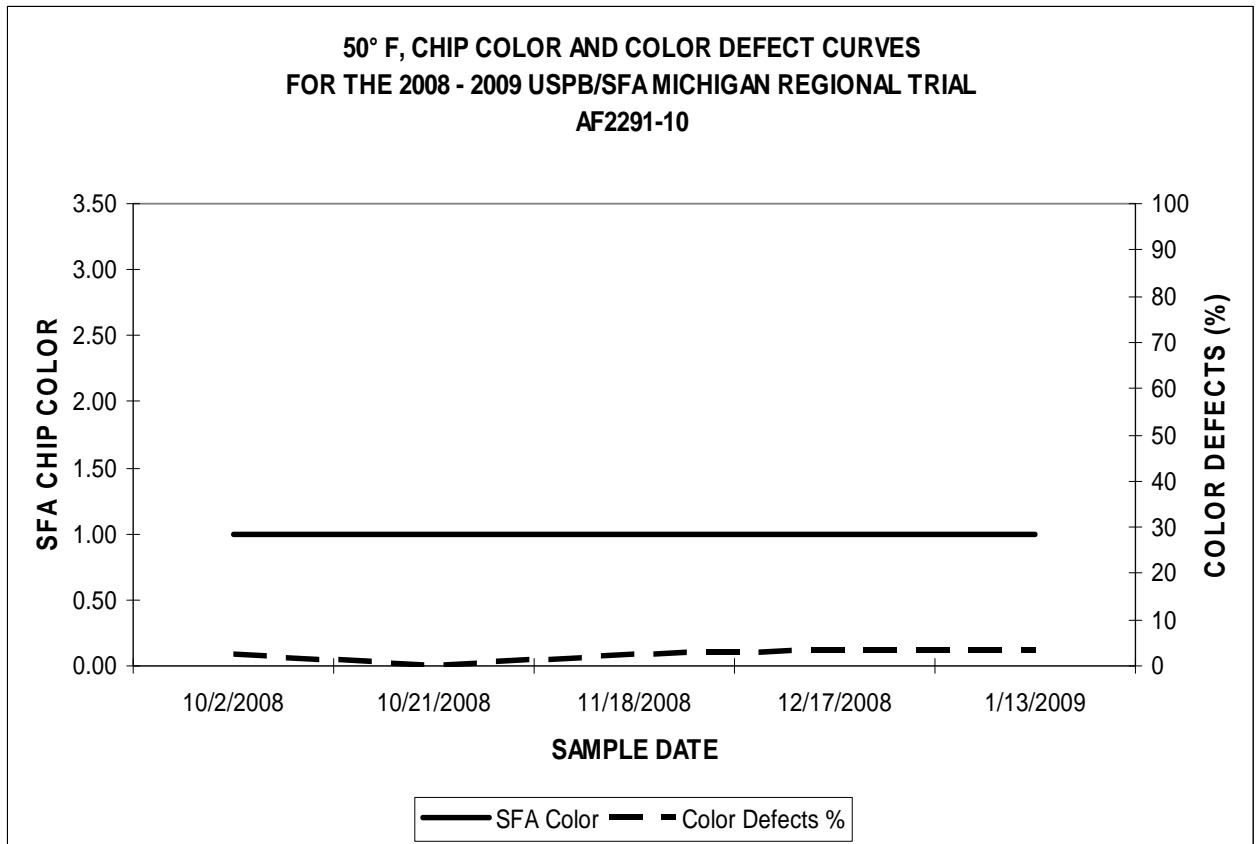


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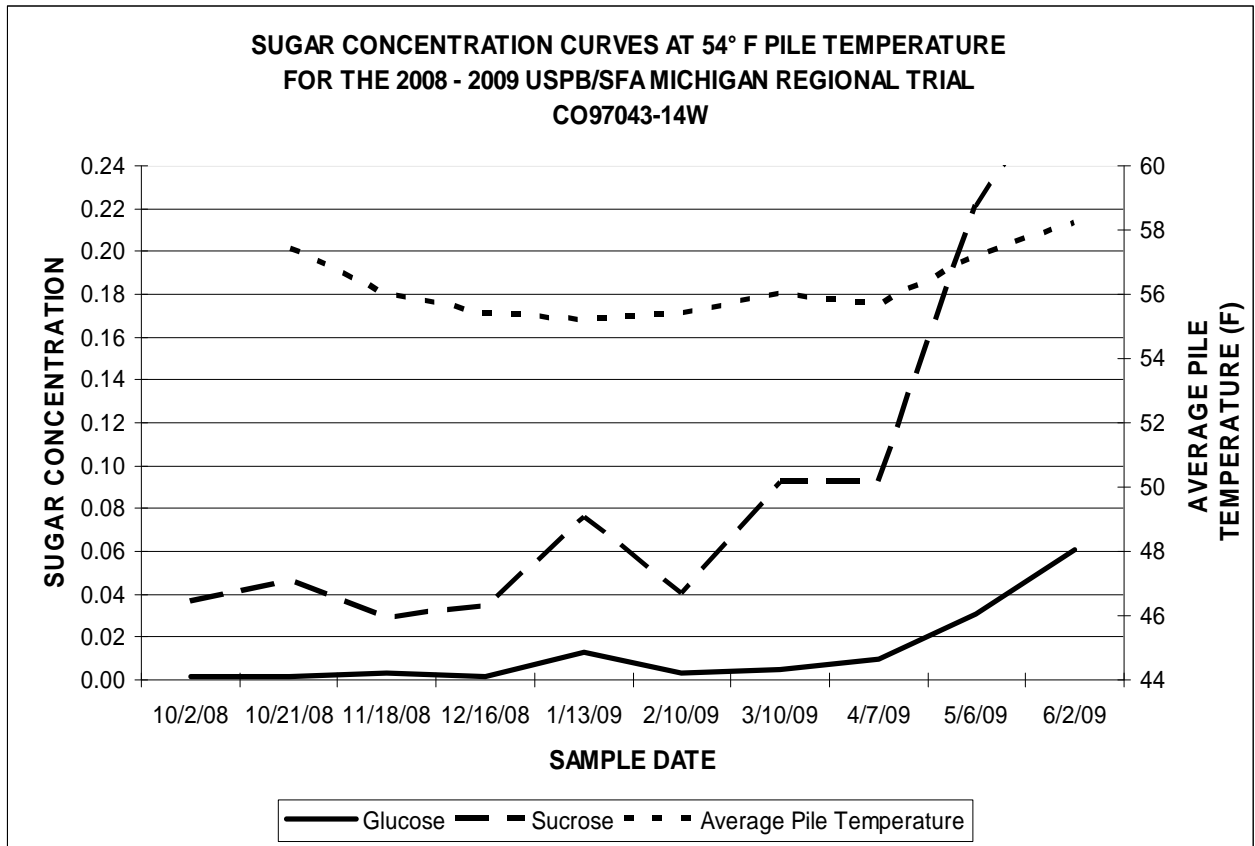


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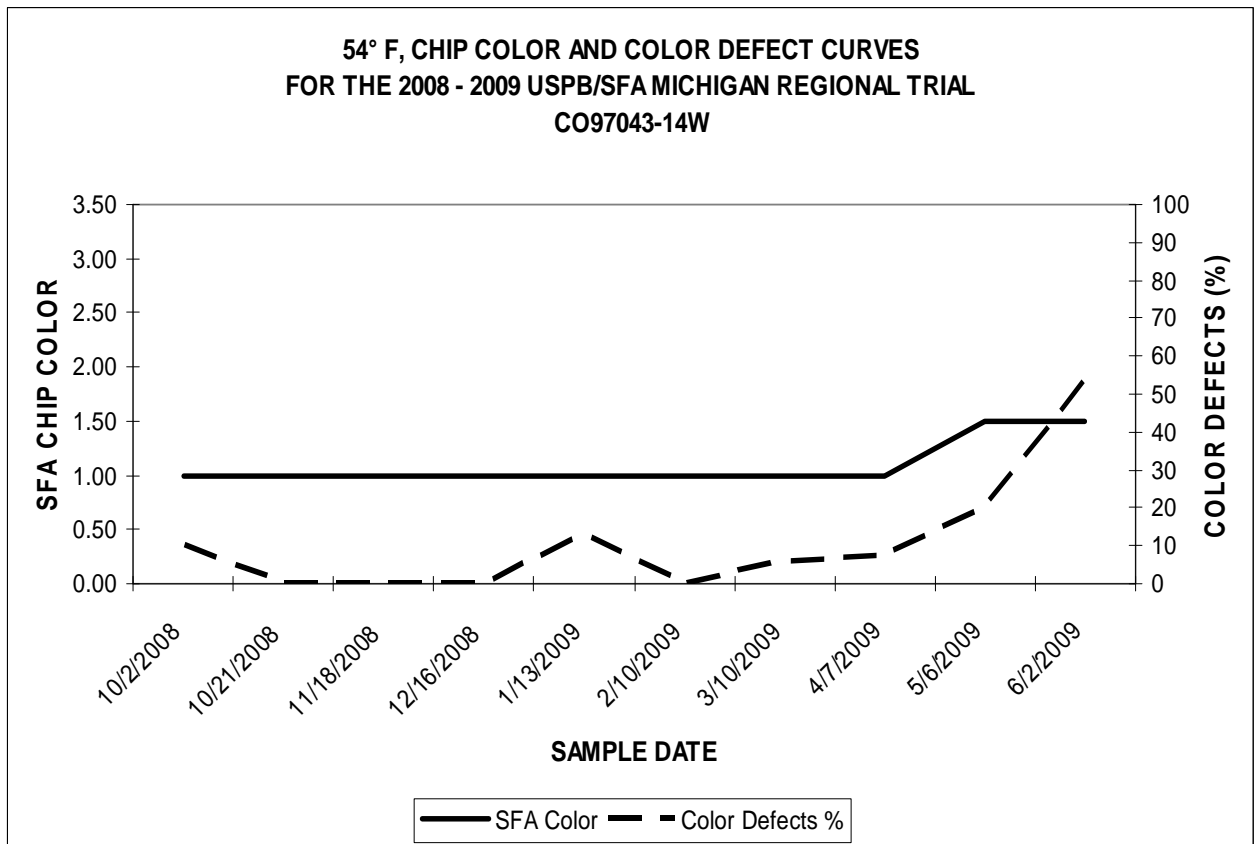


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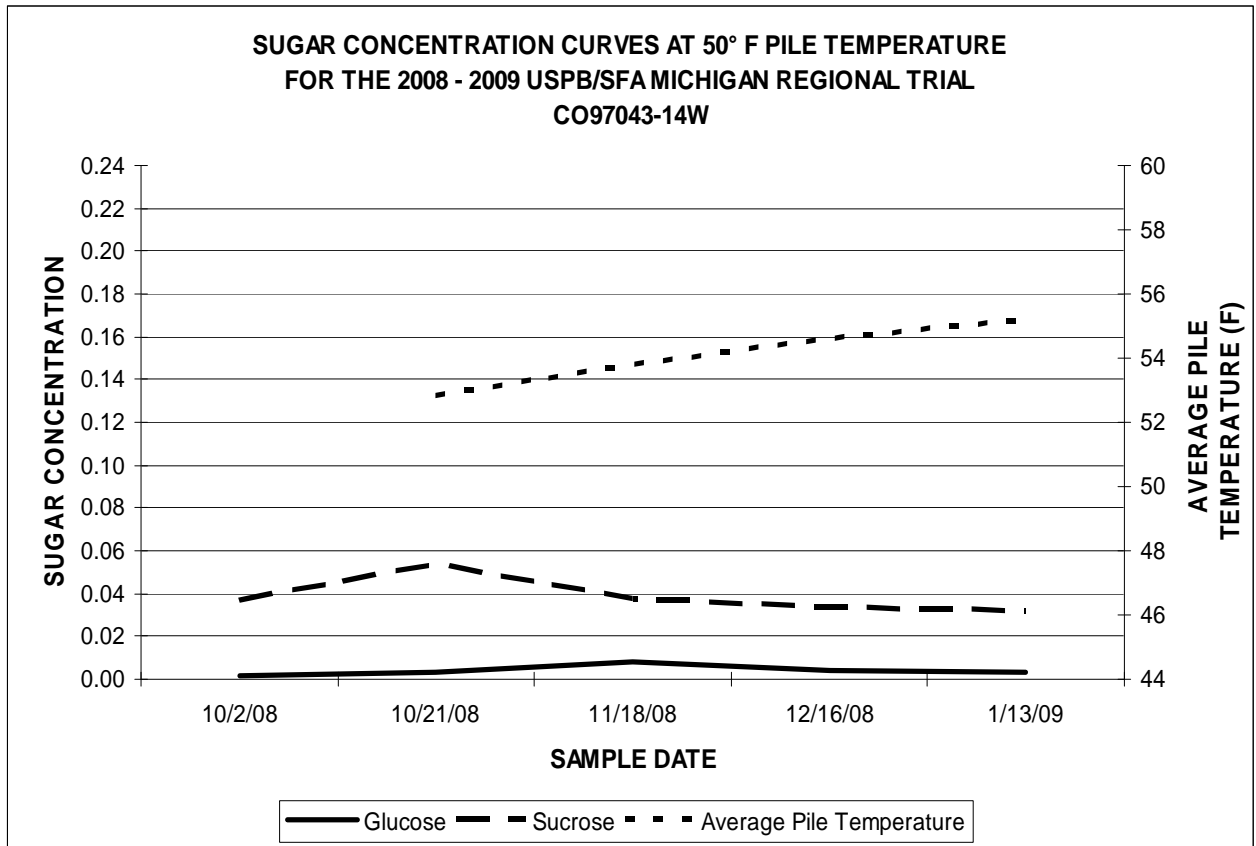


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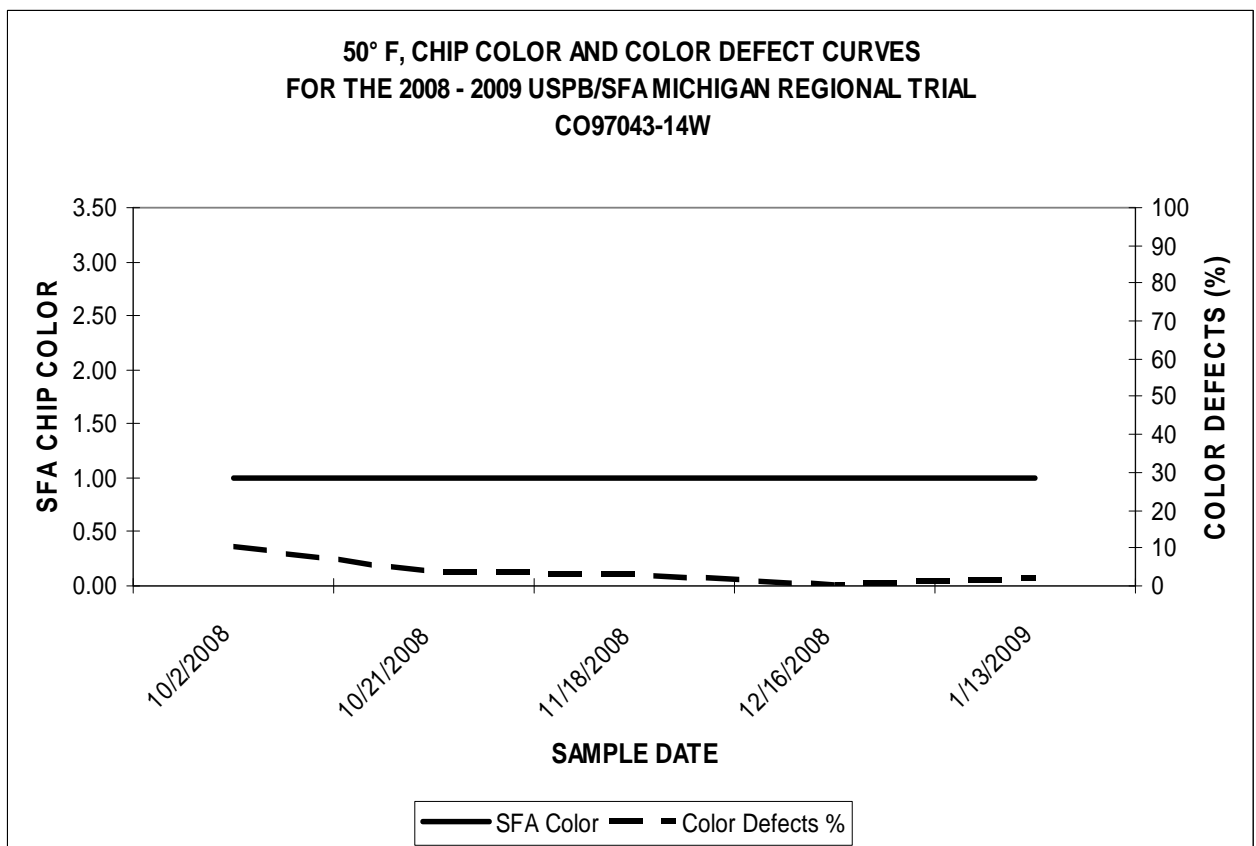


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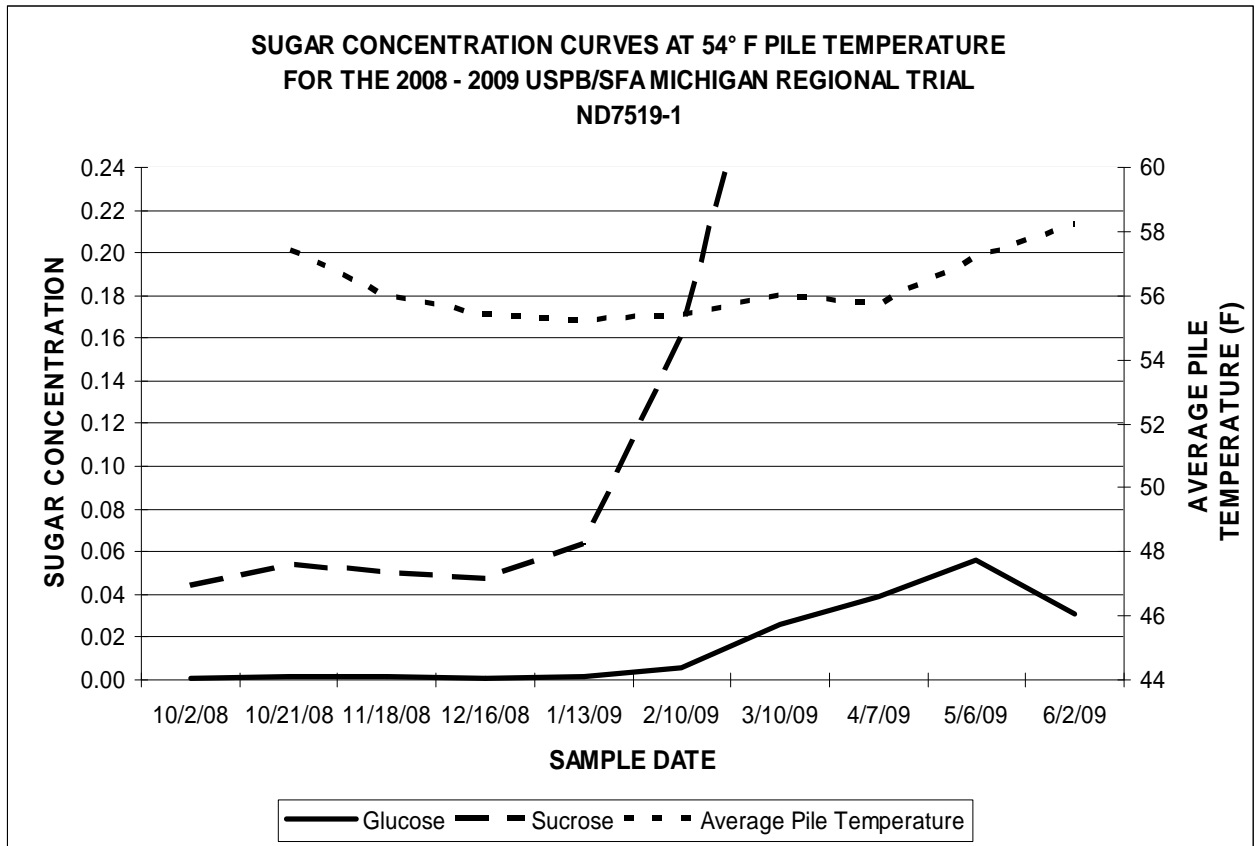


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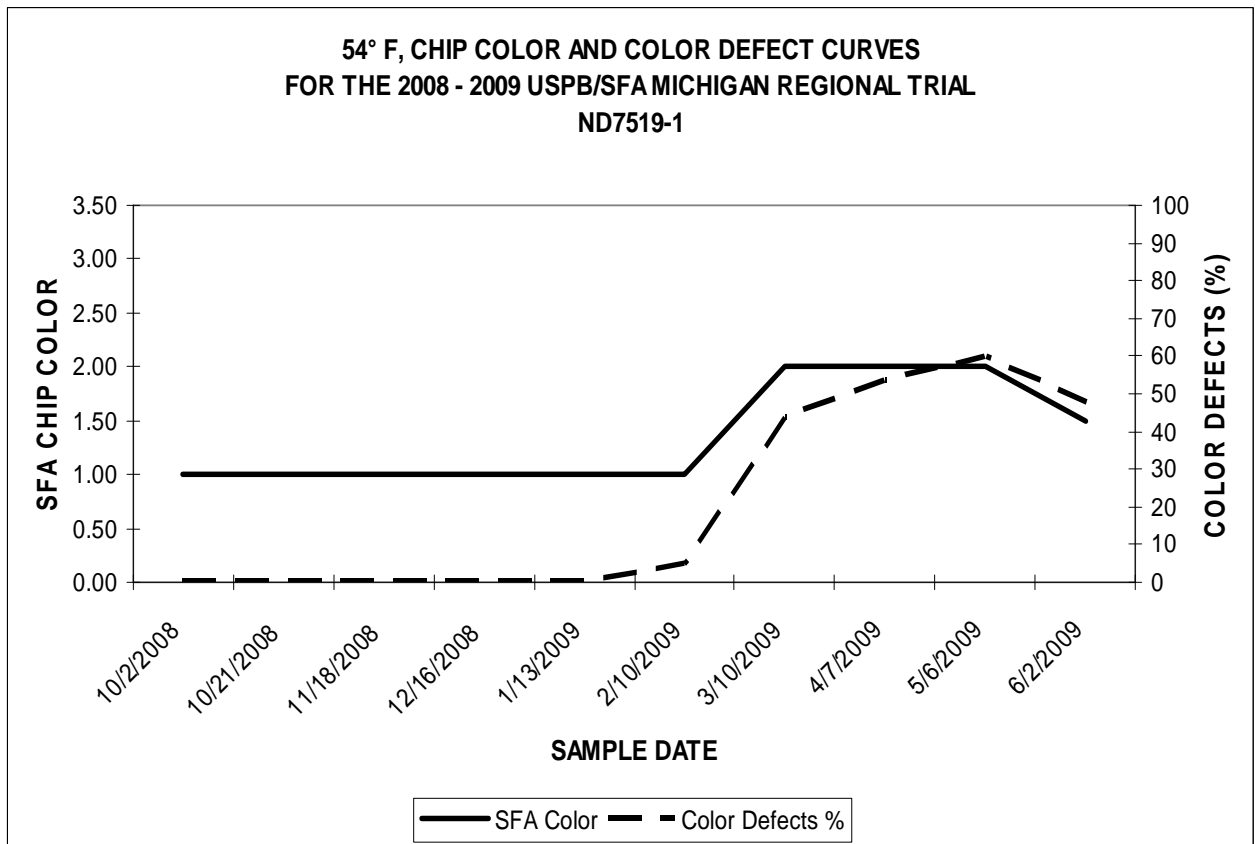


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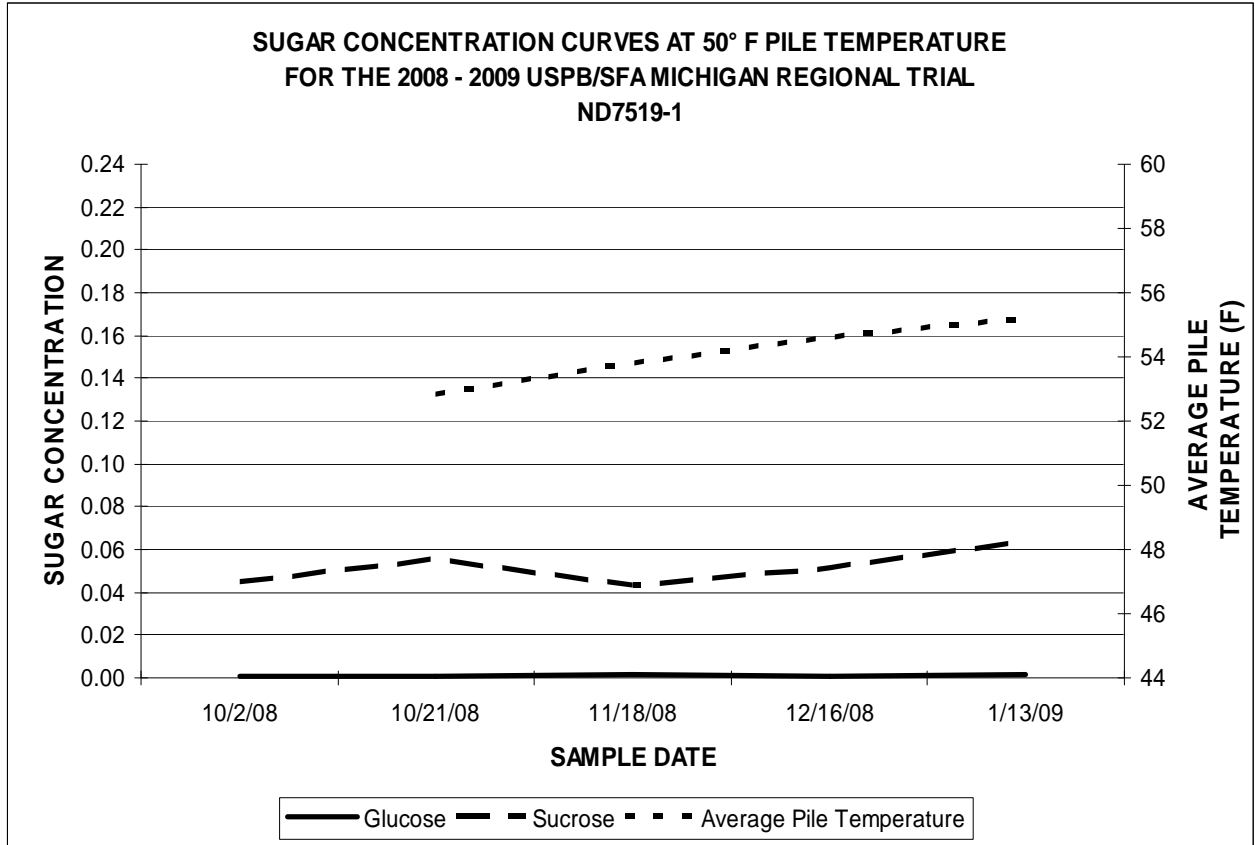


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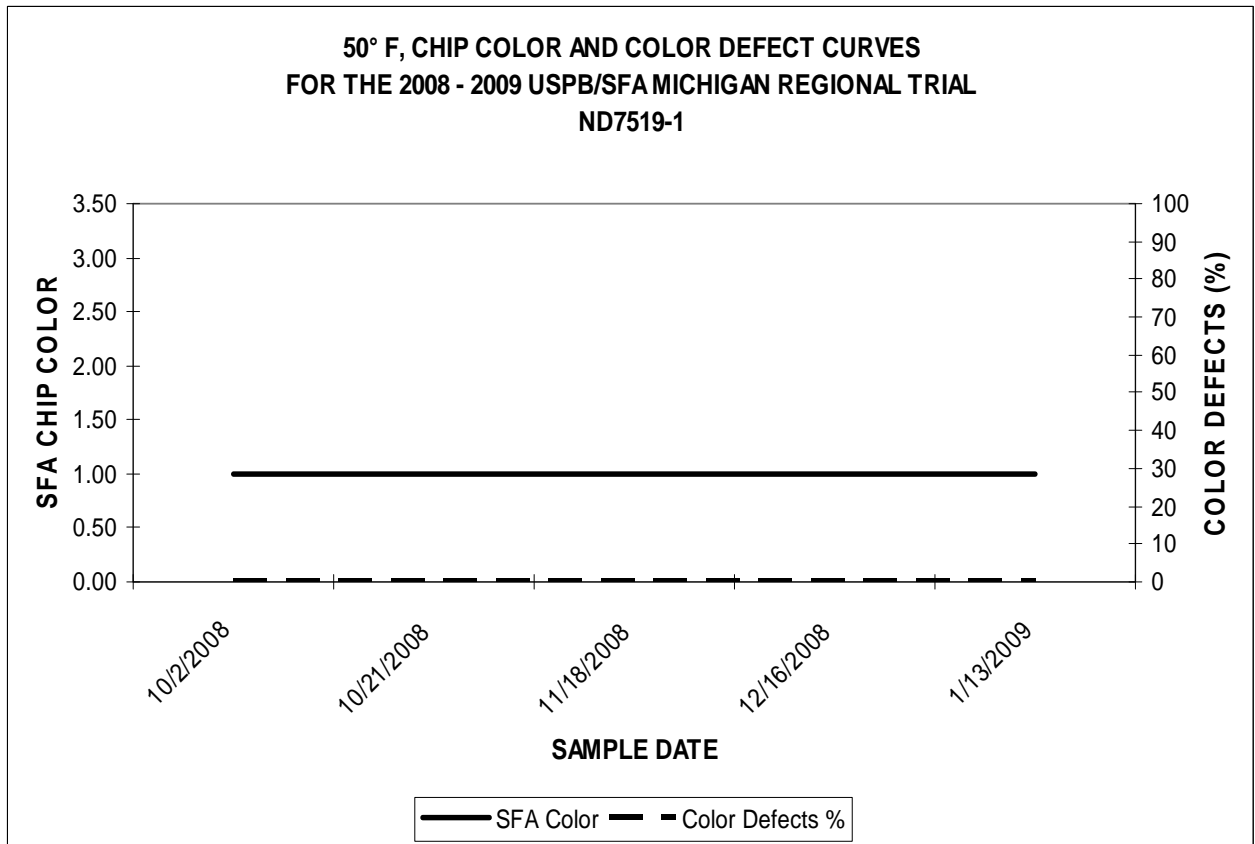


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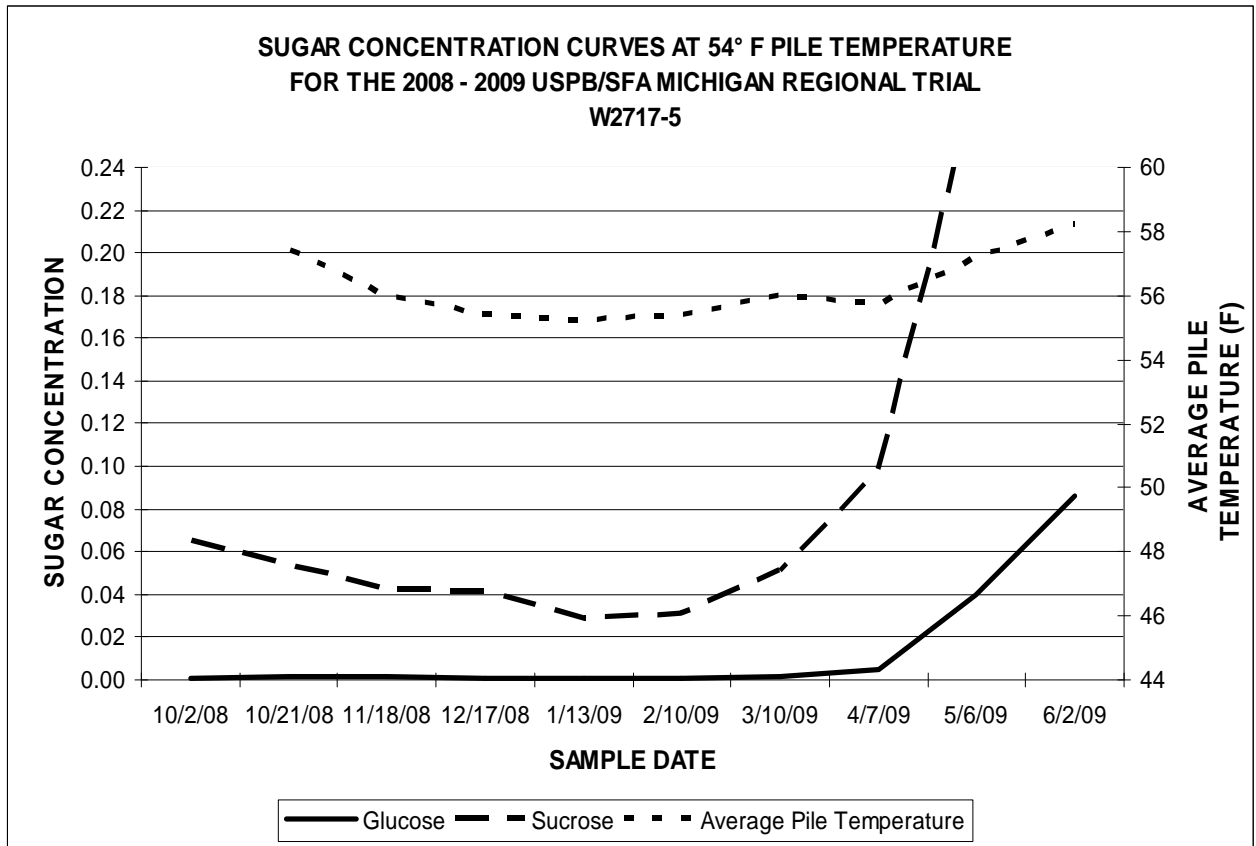


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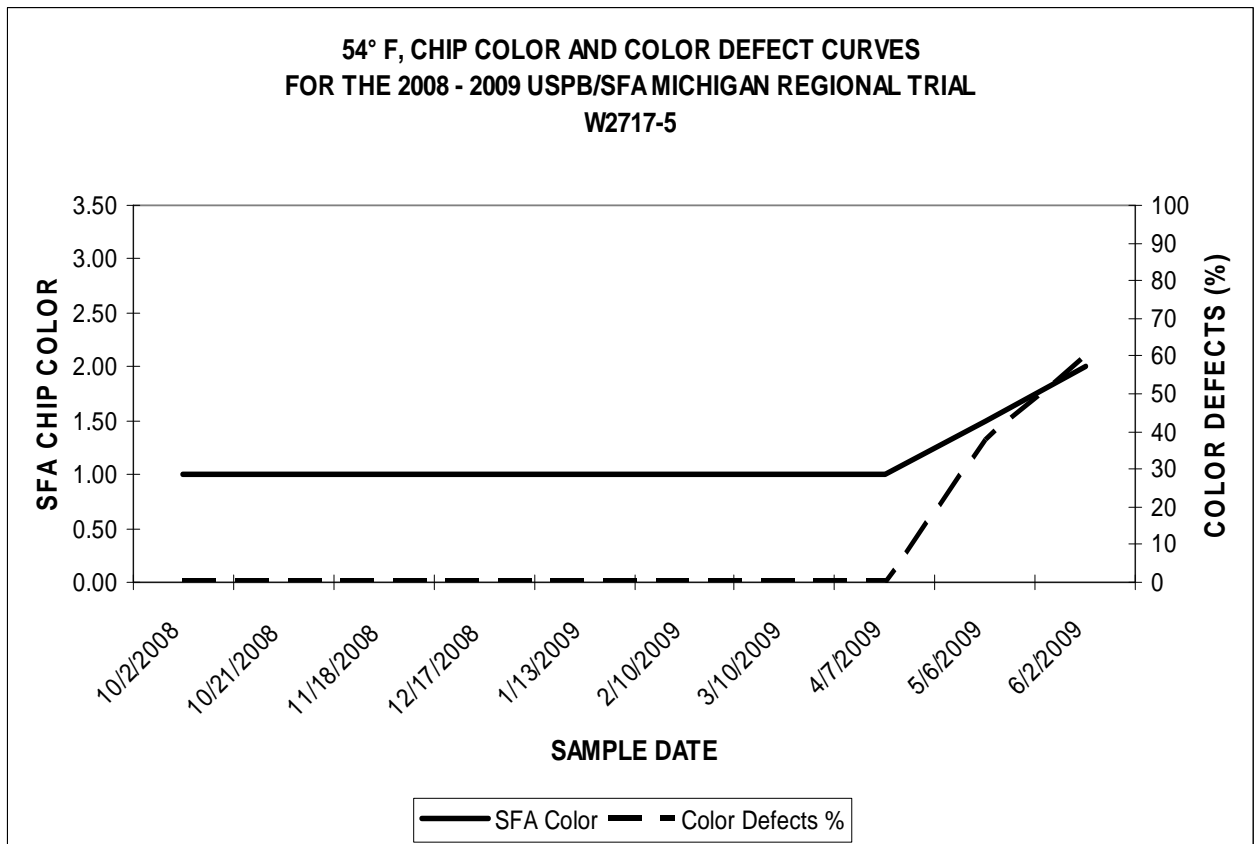


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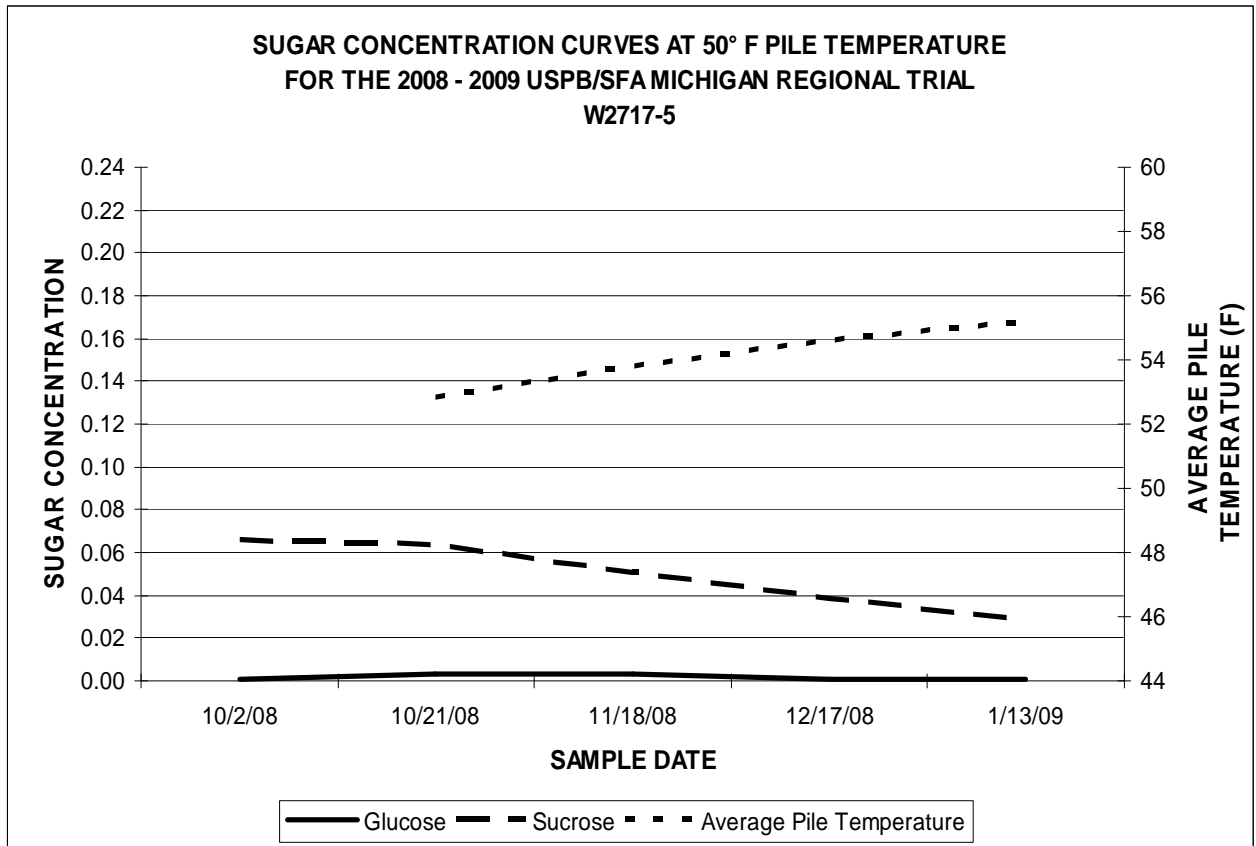


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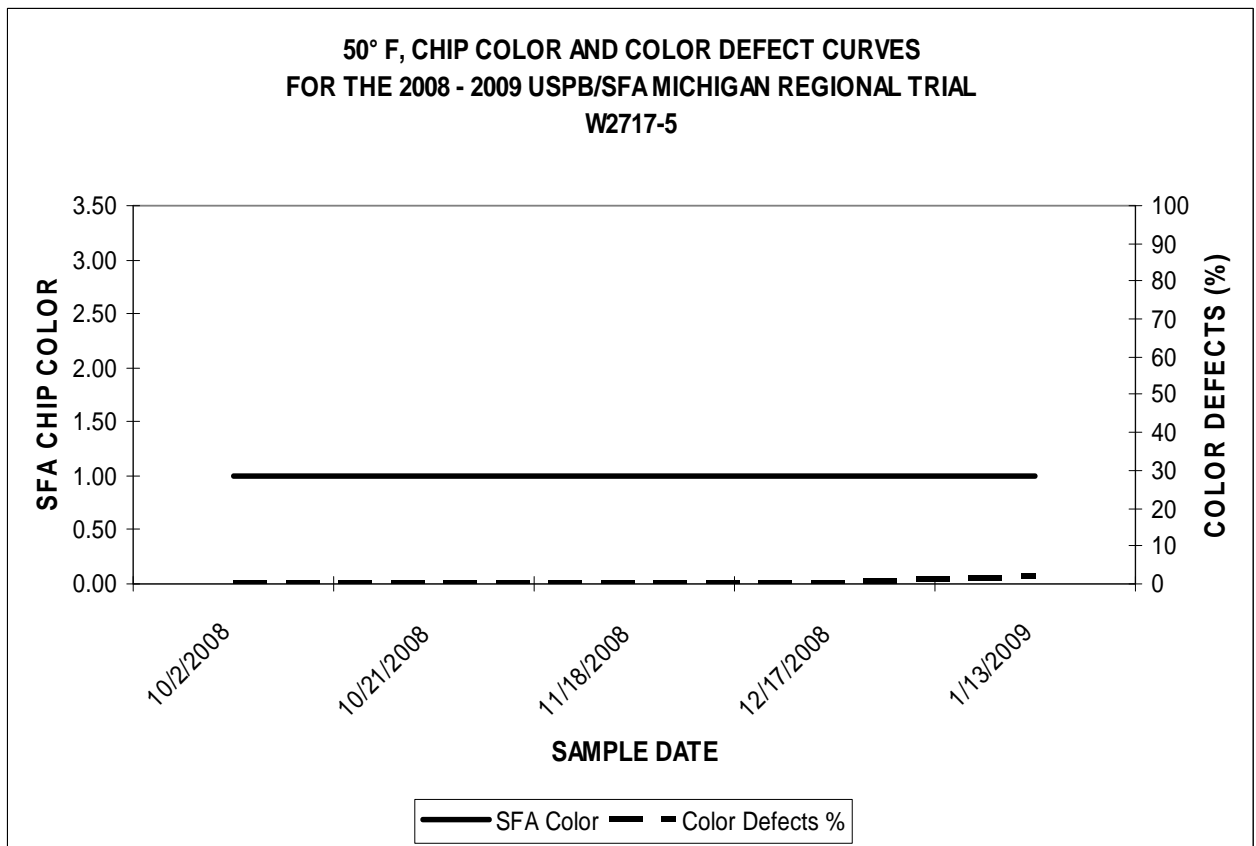


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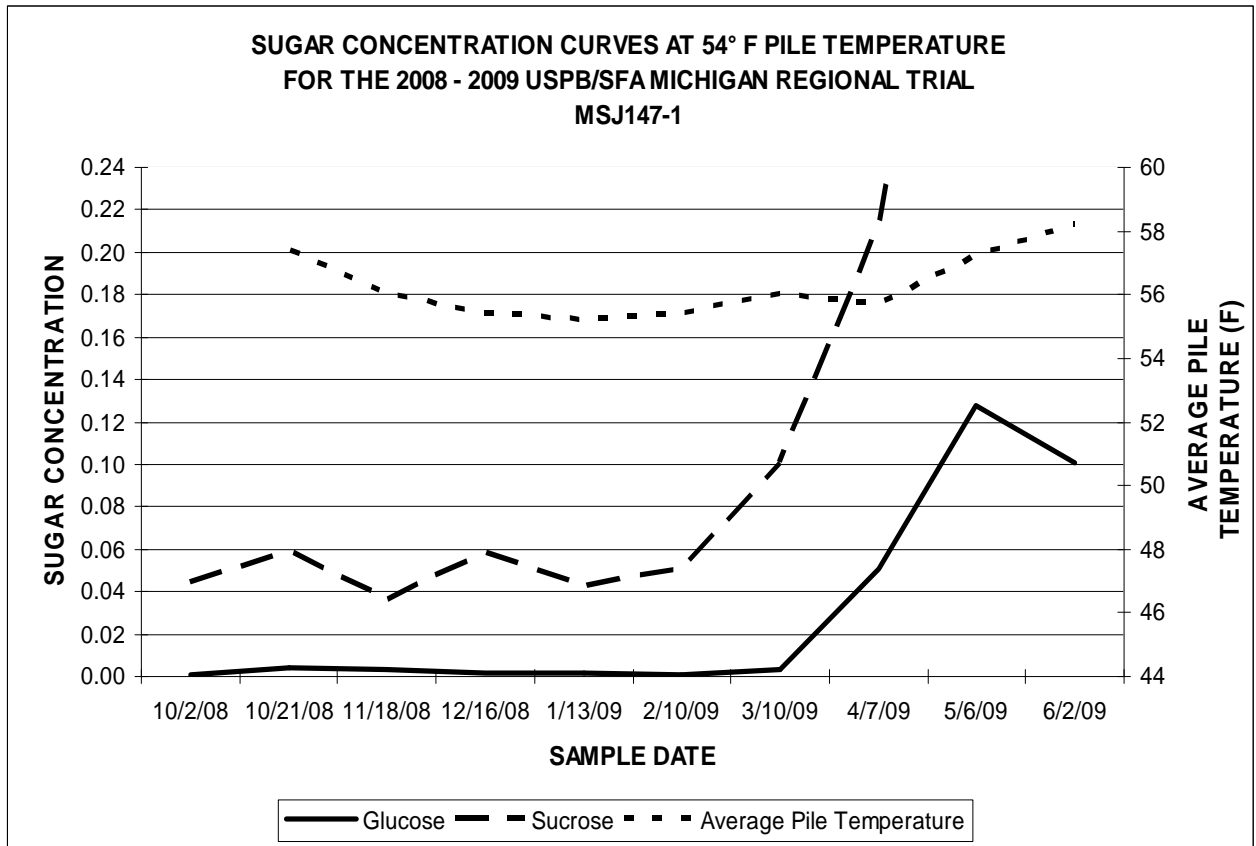


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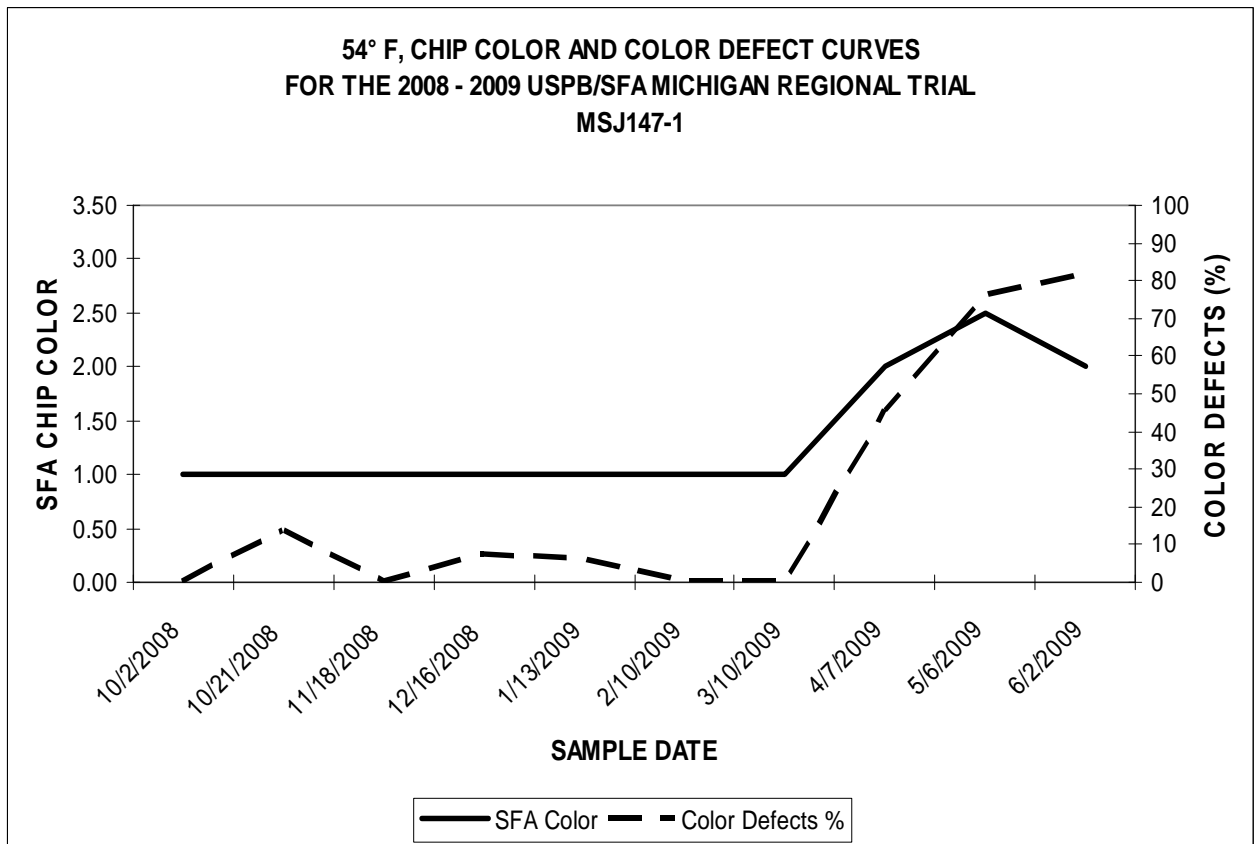


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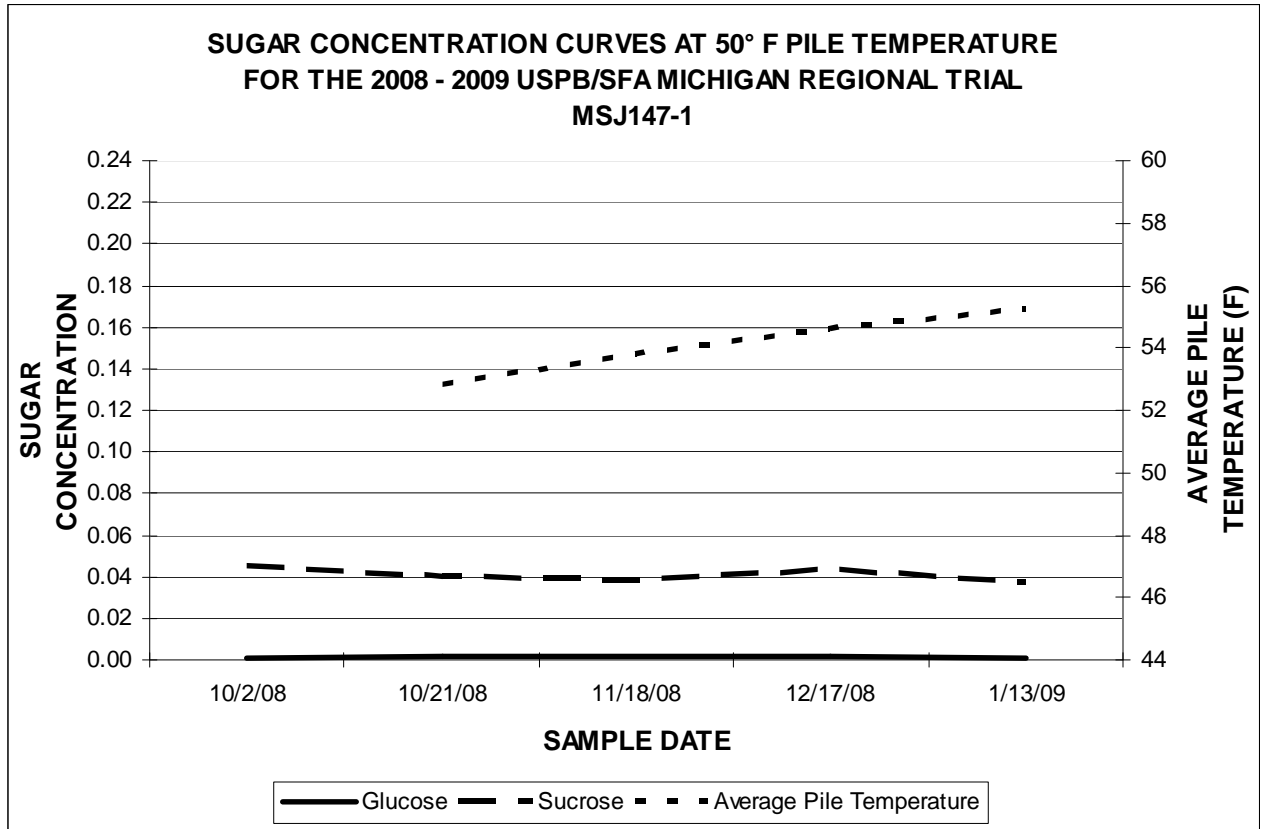


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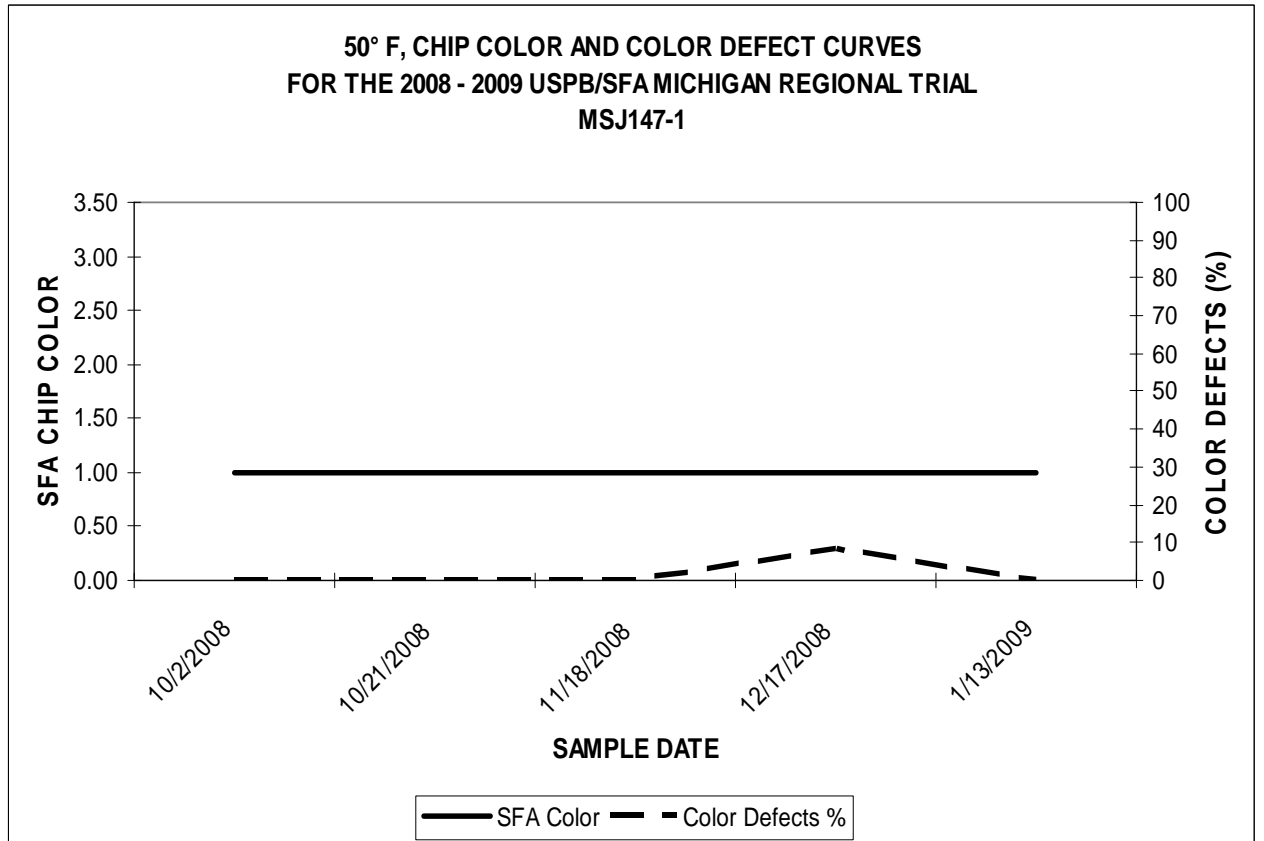


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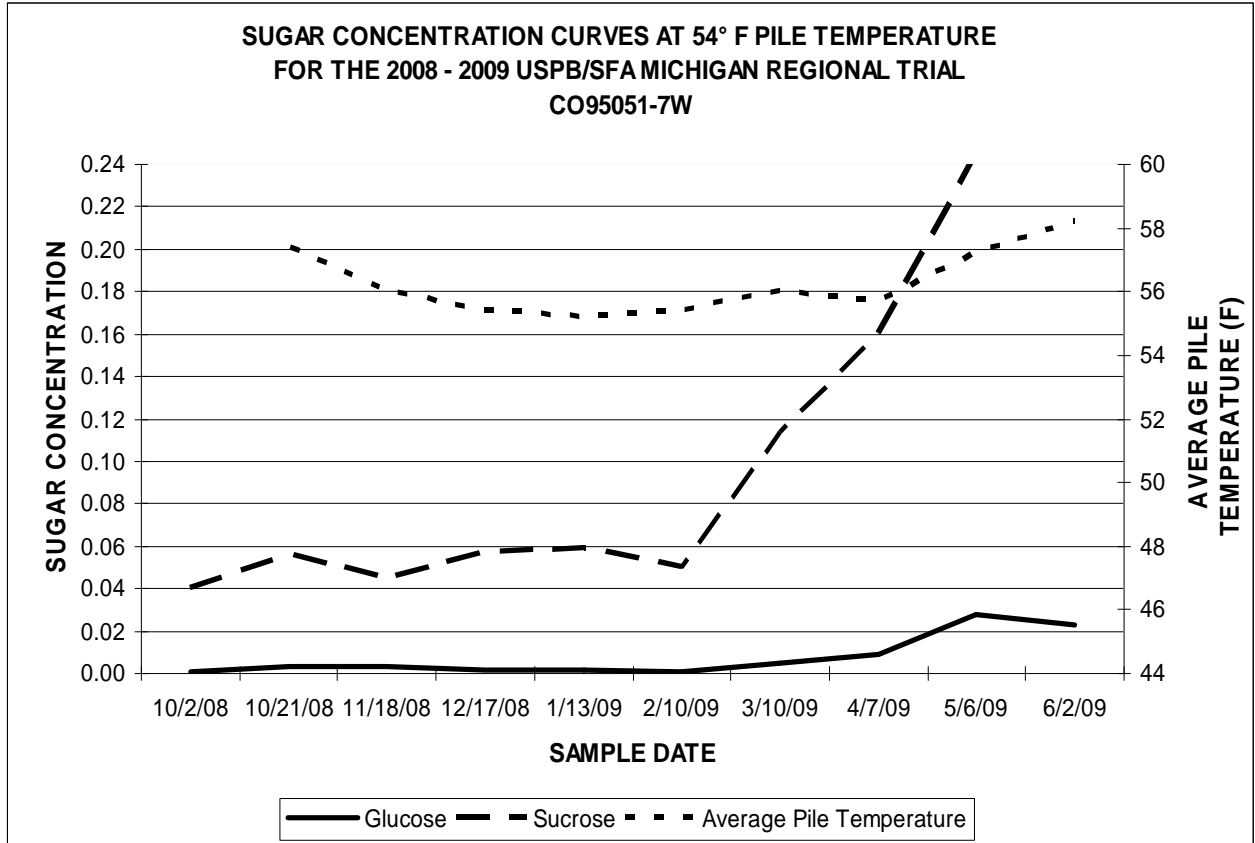


Table 36.

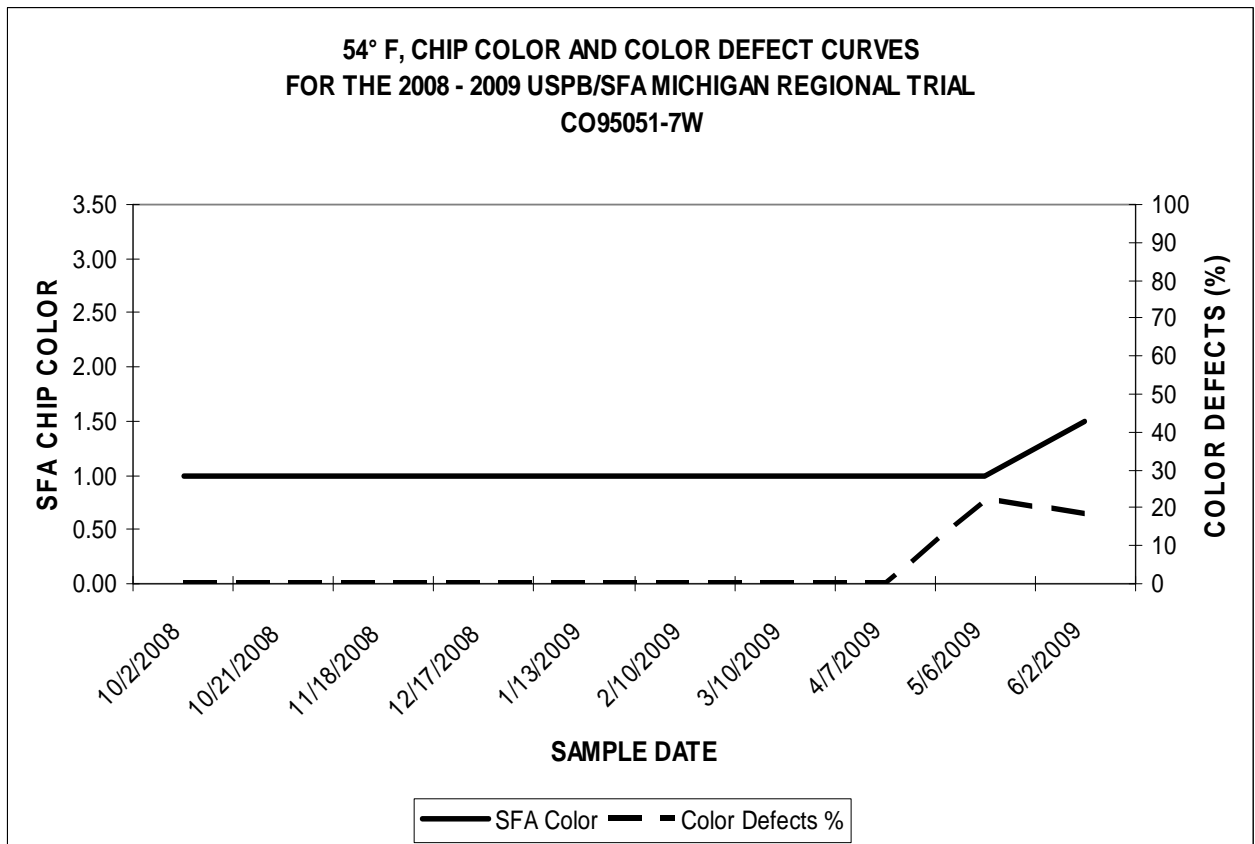


Table 37.

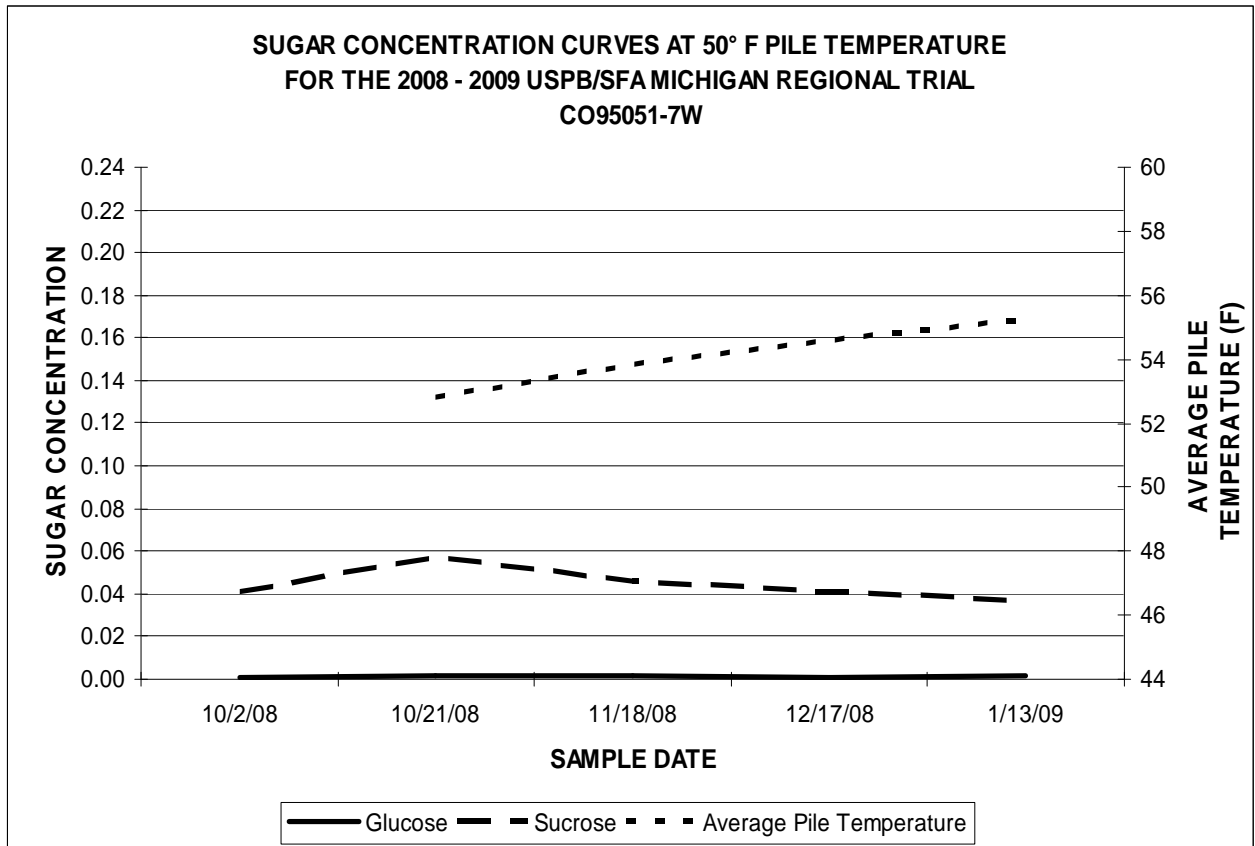
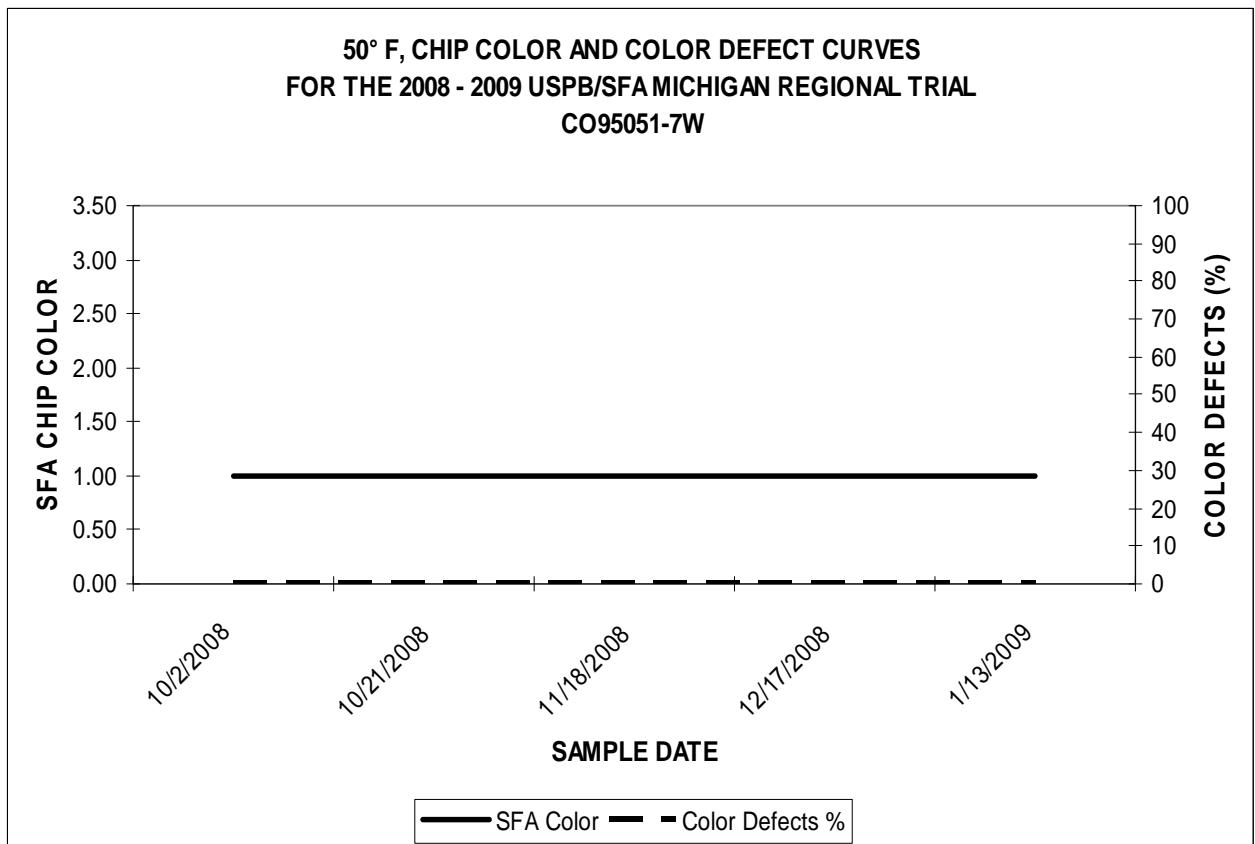


Table 38.



Pennsylvania Regional Trial

Table 1. 2008 USBP-SFA chip trial storage information on fourteen entries and two standards.

Entry	Average sprout length in inches.										Storage Chips*			
	13-Jan		12-Feb				23-Mar				Agtron	Specific Gravity		
	45°F	notes	55°F	notes	45°F	notes	55°F	notes	45°F	notes			55°F	notes
CO97065-7W	0.0		0.3		0.0		1.3		1.4		2.2	c	53	1.089
NY138	0.0		0.0		0.0		1.4	b	0.4		7.5	c	56	1.079
CO96141-4W	0.4		3.7		1.3		2.5	b	2.7	b	3.2	c	58	1.089
MSJ147-1	0.5		1.4		0.8		2.1	b	1.2		4.6	c	59	1.092
CO97043-14W	0.0		1.7		0.2		2.5	b	2.8	b	6.7	c	61	1.090
W2310-3	0.0		0.7		0.0		3.0	b	1.0	b	11.7	c	55	1.098
Snowden	0.0		1.7		0.7		3.3	c	4.0	b	14.0	c	53	1.093
CO95051-7W	0.0		1.0		0.0		1.3	c	1.1	b	2.3	c	52	1.089
W2717-5	0.0		0.5		0.7		0.8		0.8		4.8	b	49	1.097
Beacon Chipper	0.0		0.8		0.7		1.8	b	1.5		11.3	c	56	1.085
MSJ036-A	0.0		0.9		0.2		0.8		1.0		2.7	c	54	1.086
AF2291-10	0.0		0.2		0.2		0.5		0.9		0.5	b	55	1.097
W2324-1	0.8		9.3		2.2		11.8	c	3.0	b	18.7	c	54	1.096
ND7519-1	1.1		0.8		1.2		1.0	b	1.0	b	1.0	c	53	1.094
Atlantic	0.0		1.2		0.5		2.6	b	1.2	b	6.8	c	52	1.092
NY139	0.0		2.2		0.2		7.5	b	1.1		13.2	c	56	1.095

a = samples less than 0.5" were reported as 0.5"

b = minor tuber shrinkage

c = major tuber shrinkage

* Out - Of - Storage Chips processed February 25, 2009

2008-09 Red River Valley USPB-SFA Storage Trial
 Agron ratings from 45F and 50F Storage for October 2008 through April 2009

Variety	Oct 08 50F	Nov 08 50F	Dec 08 50F	Jan 09 50F	Feb 09 50F	Mar 09 50F	Apr 09 50F
ATLANTIC	45	46	52	52	53	63	57
SNOWDEN	55	61	63	61	59	69	62
AF2291-10	53	50	54	55	58	62	63
CO96141-4W	64	63	65	63	62	69	62
CO97043-14W	67	67	70	68	64	72	66
CO97065-7W	66	59	65	66	62	70	61
NY138	63	63	68	64	62	70	68
NY139	64	63	66	66	60	68	61
W2324-1	57	54	59	59	56	66	63
W2717-5	62	67	67	65	59	72	64

Variety	Oct 08 45F	Nov 08 45F	Dec 08 45F	Jan 09 45F	Feb 09 45F	Mar 09 45F	Apr 09 45F
ATLANTIC	45	41	47	46	48	50	50
SNOWDEN	48	41	47	50	54	59	60
AF2291-10	47	44	46	47	47	49	56
CO96141-4W	58	54	60	56	54	58	57
CO97043-14W	65	52	60	53	55	53	57
CO97065-7W	57	43	53	50	55	56	57
NY138	57	49	57	57	58	65	63
NY139	52	46	62	58	62	60	62
W2324-1	43	40	44	46	50	49	56
W2717-5	64	61	64	61	61	64	60

USPB-SFA 2008-2009 CHIP STORAGE DATA - WISCONSIN

Table 1. Processing scores by date and storage temperature, 2008 - 2009.

Variety	11/4/08	1/15/09			3/4/09			6/16/09		
	52°F	42°F	45°F	48°F	42°F	45°F	48°F	42°F	45°F	48°F
AF2291-10	3.2	7.2	6.9	6.6	8.0	6.9	5.0	10.0	8.7	7.6
CO96141-4W	3.3	6.8	6.4	5.3	7.9	7.3	4.8	10.0	10.0	8.6
W2310-3	2.5	4.1	3.1	2.9	4.6	2.9	2.6	8.1	6.2	5.8
SNOWDEN	3.7	5.4	4.8	3.2	4.6	3.7	2.8	7.5	6.9	6.2
CO97043-14W	2.7	7.0	5.3	5.0	7.5	6.2	4.9	10.0	8.3	7.2
NY139	2.8	6.0	5.0	3.1	5.9	3.5	2.4	8.6	6.2	5.3
MSJ147-1	2.6	3.4	2.9	3.1	3.7	3.1	2.8	7.6	5.8	5.2
BEACON CHIPPER	3.8	7.3	4.9	4.6	7.0	6.5	3.7	10.0	7.6	6.8
CO95051-7W	2.5	3.8	4.3	3.2	5.6	3.3	2.8	6.2	5.8	4.3
W2324-1	3.1	6.0	5.9	4.5	7.0	4.5	3.8	10.0	7.8	7.2
W2717-5	2.0	3.3	2.9	2.3	3.6	3.0	1.9	7.2	5.4	4.6
ND7519-1	2.3	4.1	3.5	2.6	2.7	2.1	2.8	6.4	6.2	5.0
MSJ036-A	2.7	6.1	5.6	4.4	6.1	5.3	4.0	10.0	8.2	7.2
ATLANTIC	3.9	7.5	5.9	5.5	7.2	6.4	5.2	10.0	8.2	8.0
NY138	2.4	5.0	2.9	2.9	4.6	2.8	2.7	8.6	5.3	5.4
CO97065-7W	3.3	7.3	7.0	6.2	7.7	7.0	6.6	10.0	10.0	8.9

Chip color rating: a score of 1 represents the lightest color and 10 the darkest color.
 Chip scores of 4 or less are considered acceptable color.

Table 7. USPB-SFA Chip Trial Entry Summary: 1985 - 2009

Atlantic (1985-2009) and Snowden (1988-2009) as Standards

WNC672-2, 1985-1987	NY102 (Monticello), 1994-1995
WNC521-12, 1985-1986	NY103 (Eva), 1995-1997
W879, 1985-1986	BCO894-2, 1995-1997
W833, 1985	ATX85404-8, 1996-1998
TXA17-1, 1985-1986	AF1433-4, 1996-1998
A70369-2, 1985-1986	ND2676-10 (Dakota Pearl), 1997-1999
ND860-2, 1985-1986	B0564-8 (Harley Blackwell), 1997-1999
G670-11, 1985	B0564-9, 1997-1999
BR7093-24 (Gemchip), 1986-1988	NY115, 1997-1999
W848 (Niska), 1986-1987	W1313, 1999
NY71 (Kanona), 1986-1988	NY112 (Marcy), 1998-2000
NY81 (Steuben), 1986-1988	AF1668-60, 1998-2000
NY72 (Allegany), 1987-1989	MSNT-1, 1998-2000
AF236-1 (Somerset), 1987-1989	MSA091-1 (Liberator), 1999-2001
MS700-70, 1987-1989	B0766-3, 2000-2002
AC80545-1 (Chipeta), 1987-1989	AF1775-2, 2000-2002
LA01-38 (LaBelle), 1988-1990	W1431, 2000-2002
MS716-15, 1988-1990	NY120, 2000-2002
MS700-83 (Spartan Pearl), 1988-1990	AF1424-7, 2001-2003
W855 (Snowden), 1988-1990	MSG227-2, 2001-2003
Saginaw Gold, 1988-1990	W1355-1 (White Pearl), 2001-2003
AF875-16 (Mainechip), 1989-1991	NDTX4930-5W, 2001-2003
D195-24, 1989	ND2470-27 (Dakota Crisp), 1999, 2003-2004
ND2008-2, 1990	A91790-13, 2002-2004
Coastal Chip, 1990	MSF099-3, 2002-2004
CS7232-4, 1990-1992	B1240-1, 2004
Andover, 1991-1993	W1773-7, 2004
Pike, 1991-1993	ND5822C-7 (Dakota Diamond), 2003-2005
NY87 (Reba), 1991	W1201(Megachip), 2003-2005
W887, 1991-1993	AF2211-9, 2004-2006
W870, 1991-1993	MSJ461-1, 2004-2006
A80559-2, 1991-1993	NY132, 2004-2006
NDA2031-2, 1992-1994	MSJ316-A, 2005-2007
Suncrisp, 1992-1994	W2133-1, 2005-2007
B0178-34, 1992-1994	BEACON CHIPPER, 2006-2008
NDO1496-1 (Ivory Crisp), 1993-1995	CO95051-7W, 2006-2008
NY95, 1993	MSJ147-1, 2006-2008
AF875-15, 1994-1996	W2324-1, 2006-2008 (4 Southern trials 2009)
ND2417-6 (NorValley), 1994-1996	CO96141-4W, 2007-2009
ND2471-8, 1994-1996	MSJ036-A (Kalkaska), 2008-2009