2009-2010 DR. B. F. (BURT) CARGILL POTATO DEMONSTRATION STORAGE ANNUAL REPORT MICHIGAN POTATO INDUSTRY COMMISSION

Chris Long, Coordinator

Introduction and Acknowledgements

Round white potato production leads the potato market in the state of Michigan. Michigan growers continue to look for promising new, round white varieties that will meet necessary production and processing criteria. There are many variety trials underway in Michigan that are evaluating chipping varieties for yield, solids, disease resistance and chipping quality with the hope of exhibiting to growers and processors the positive attributes of these lines. Extended storage chip quality and storability are areas of extreme importance in round white potato production. Due to the importance of these factors, all new varieties that have the potential to become a commercial chip processor will have storage profiles developed. Being able to examine new varieties for long-term storage and processing ability is a way to keep the Michigan chip industry at the leading edge of the snack food industry. This information can position the industry to make informed decisions about the value of adopting these varieties into commercial production.

The Michigan Potato Industry Commission (MPIC) Burt Cargill Potato Demonstration Storage facility currently consists of two structures. The first building, constructed in 1999, provides the Michigan potato industry the opportunity to generate storage and chip quality information on newly identified chip processing clones. This information will help to establish the commercial potential of these new varieties. This demonstration storage facility utilizes six, 550 cwt. bulk bins (Bins 1-6) that have independent ventilation systems. The second structure built in 2008, has three 600 cwt. bulk bins that are independently ventilated. The first of these bulk bins, bin seven, has been converted into box bin storage that holds 36, 10 cwt. box bins to provide storage profiles on early generation potato varieties. The box bin is an entry level point in storage profiling that allows the industry to learn about a varieties' storability before advancing to the bulk bin level. We would typically have 4-6 years' worth of agronomic data on a variety before entering box bin testing. In the variety development process, little information has been collected about a varieties' storability or storage profile prior to being included in the box bin trial. A storage profile consists of bi-weekly sampling of potatoes to obtain; sucrose and glucose levels, chip color and defect values. In addition, each variety is evaluated for weight loss or shrinkage and pressure bruise. With this information, the storage history of a variety can be created, providing the industry with a clearer picture of where a line can or cannot be utilized in the snack food industry. The Michigan potato industry hopes to use these storage profiles to improve in areas such as long-term storage quality, deliverability of product and, ultimately, sustained market share.

The two remaining 600 cwt. bulk bins in the second structure are designed to be used to evaluate the post-harvest physiology of the potato. The facility can be used to evaluate storage pathology or sprout inhibitor products. The Michigan industry recognizes the importance of being able to control disease and sprout development in storage and is committed to doing research in these areas.

This ninth annual Demonstration Storage Report contains the results of the storage work conducted in the facility during the 2009-2010 storage season. Section I, "2009-2010 New Chip Processing Variety Box Bin Report", contains the results and highlights from our 10 cwt. Box Bin study. Section II, "2009-2010 Bulk Bin (500 cwt. Bin) Report", shows bulk bin results including information from commercial processors regarding these new varieties.

The storage facility and the work done within it is directed by the MPIC Storage and Handling Committee and Michigan State University (MSU) faculty. The Chair of the committee is Brian Sackett of Sackett Potatoes. Other members of the committee include: Bruce Sackett, Steve Crooks, Todd Forbush, Chris Long, Troy Sackett, Dennis Iott, Randy Styma, Keith Tinsey, Ben Kudwa and Tim Young. The funding and financial support for this facility, and the research that is conducted within it, is largely derived from the MPIC. The committee occasionally receives support for a given project from private and/or public interests.

We wish to acknowledge all the support and investment we receive to operate and conduct storage research. First, we express our gratitude for the partnership we enjoy between the MPIC and Michigan State University. Thank you to the MPIC Storage & Handling Committee for their investment of time, guiding the decisions and direction of the facility. Brian Sackett, Sackett Potatoes; Larry and Troy Sackett, Sackett Ranch, Inc.; Steve, Norm and John Crooks, Crooks Farms, Inc.; Tim and Todd Young, Sandyland Farms and Kim and Kyle Lennard, Lennard Ag Co.; these are the growers that provided the material to fill the bulk bins this year and without their willingness to be involved, we could not have accomplished our objectives. Equal in importance are the processors who invested in this research. They are; Gene Herr, Herr Foods Inc., Nottingham, PA; Mitch Keeny of UTZ Quality Foods, Inc., Hanover, PA; Al Lee and Paul Geiser of Better Made Snack Foods, Detroit , MI. It has been a great pleasure to work with all of you. Special thanks to Butch and William Riley (Gun Valley Ag. & Industrial Services, Inc.) for their annual investment in the sprout treatment of the storage facility. We would also like to acknowledge a long list of additional contributors who invested much time to help foster a quality storage program: Dr. Dick Chase (MSU Professor Emeritus), Dr. Dave Douches and the MSU potato breeding program, Todd Forbush (Techmark, Inc), Larry Jensen (Chief Wabasis Potato Growers), and Tim Wilkes (Potato Services of Michigan). All played a role in making this facility useful to the Michigan potato industry.

Overview of the production season *

The overall 6-month average maximum temperature during the 2009 growing season was two degrees lower than the 6-month average maximum temperature for the 2008 season and was one degree lower than the 15-year average. There were three recorded temperature readings of 90 °F or above in 2009. This high temperature event was recorded during a period of time from June 23rd to June 25th, prior to tuber bulking. There were no recorded daytime temperatures above 90 °F or night time temperatures above 70 °F in the month of August. There were two days in May that the air temperature was below 32 °F. This occurred on May 11th and 18th. The average maximum temperatures for July, and August 2009 were six and three degrees below the 15-year average, respectively. In October 2009, there were 15 days with measureable rainfall and eight daytime highs below 50 °F. Six of these eight days fell on days with no recorded rainfall, leaving only 10 days in October that had no rain and temperatures above 50 °F.

Rainfall for April through September was 16.82 inches, which was 2.4 inches below the 15-year average. Rainfall recorded during the month of August was the highest recorded for that month since the year 2002. In October 2009, 3.79 inches of rain were recorded. Overall, the 2009 growing season resulted in above average specific gravity with average overall yields. The early part of the season was cool and dry. The harvest season was generally wet and cool.

* Weather data collected at the MSU, Montcalm Research Farm, Entrican, MI.

I. 2009-2010 New Chip Processing Variety Box Bin Report

(Chris Long and Brian Sackett)

Introduction

The purpose of this project is to evaluate new chip processing varieties from national and private breeding programs for their ability to process after being subjected to storage conditions. A variety's response to pile temperature, as reflected in sucrose and glucose levels, is evaluated. Weight loss and pressure bruise susceptibility of each variety is also evaluated. Bin 7 contained 36, 10 cwt. boxes. Thirty-six boxes were placed in six stacks of six. The boxes were designed for air to travel in from a header or plenum wall through the forklift holes of each box, up through the potatoes within it and onto the next box above until the air reaches the top and is drawn off the top of the chamber, reconditioned and forced back through the header wall plenums and up through the boxes again. Each box contains a sample door facing the center aisle from which tubers can be removed to conduct bi-weekly quality evaluations.

Procedure

Sixteen new varieties were evaluated and compared to the check variety Snowden. The 16 varieties were chosen by the MPIC Storage and Handling Committee. Once the varieties were chosen, 1 cwt. of each variety was planted on May 12th at the MSU, Montcalm Research Farm, Entrican, MI. The varieties were planted at a 10" spacing with the Snowden check variety being planted at 12". All varieties received a rate of fertilizer recommended to achieve a 350 to 400 cwt/A yield (270 lb. N/A). The varieties were vine killed after 114 days and allowed to set skins for 20 days before harvest on September 23, 2009; 134 days after planting. Variety maturity is not taken into account in the harvest timing due to storage and handling restrictions.

Approximately ten cwt. of each variety was placed in each box bin, labeled and stacked in Bin 7. The average storage temperature for all the box bins (Bulk Bin 7) was 55 ºF for the 2009-2010 season. At harvest, nine, 20 lb. samples from each variety were collected for weight loss and pressure bruise evaluation. Some additional tuber samples were taken and shipped to regional chip plants for evaluation throughout the storage season. A description of the varieties tested, their pedigree and scab ratings are listed in Table 1. Yield, size distribution, chip quality, and specific gravity were recorded at harvest (Table 2). All 17 varieties were graded to remove all "B" size tubers and pick-outs and entered the storage in good physical condition.

The storage season began September 23, 2009 and ended June 1, 2010. Bin 7 was gassed with CIPC on November 2nd 2009 and again on December 7th 2009. Variety evaluation began October 7th 2009 followed by a bi-weekly sampling schedule until June. Thirty tubers were removed from each box every

two weeks and sent to Techmark, Inc. for sucrose, glucose, chip color and defect evaluation. Nine pressure bruise sample bags were taken for each variety, weighed and placed in one of the bulk bins at the storage facility. Three bags were placed at each of 3', 6' and 9' from the pile floor. When that bin was unloaded, the sample bags were weighed and percent weight loss was calculated. A 25 tuber sample was taken from each of the nine bags and was evaluated for the presence or absence of pressure bruise. The number of tubers and severity of bruise were recorded. All pressure bruises were evaluated for discoloration.

This report is not intended to be an archive of all the data that was generated for the box bin trial, but a summary of the data from the most promising lines. The purpose of this report is to present a summary of information from 2-4 lines from this trial that will be moved along the commercialization process. If more detailed information is desired, please contact Chris Long at Michigan State University in the Crop and Soil Sciences Department for assistance (517) 355-0271 ext. 1193.

Table 1. 2009 MPIC Demonstration Box Bin Variety Descriptions

Entry	Pedigree	2009 Scab Rating*	Characteristics
Snowden (W855)	B5141-6 X Wischip	2.3	High yield, late maturity, late season storage check variety, reconditions well in storage, medium to high specific gravity
A00188-3C	A91790-13 X Dakota Pearl	1.3	High U.S. No. 1 yield, scaly buff skin, high specific gravity
A01143-3C	COA95070-8 X Chipeta	1.3	High yielding, scaly buff chipper; smaller tuber size
CO00188-4W	A90490-1W X BC0894-2W	2.0	Medium-high yield potential, small tuber size, minimal grade defects, medium-early maturity, high specific gravity, some ability to recondition out of 40º F
CO00197-3W	A91790-13W X NDTX4930-5W	3.1	High yield potential, small size profile, minimal grade defects, early maturity, medium-high specific gravity, some ability to recondition out of 40º F
CO00270-7W	BC0894-2W X A91790-13W	2.8	Medium-high yield potential, minimal grade defects, medium-early maturity, medium-high specific gravity, ability to recondition out of 40º F
MSH228-6	MSC127-3 X OP	1.3	Average yield, mid-season maturity, blocky flat tuber type, shallow eyes, medium specific gravity
MSJ126-9Y	Penta X OP	1.3	Medium-high yield, cold chipper from 45º F, uniform A-size tubers, attractive appearance, good internal quality, long term storage potential, medium specific gravity
MSL007-B	MSA105-1 X MSG227-2	1.0	Average yield, early to mid-season maturity, uniform tuber type, medium specific gravity, scab resistant
MSL292-A	Snowden X MSH098-2	2.3	Above average yield, scab susceptible, late blight susceptible, medium-high specific gravity, long storage potential
MSN170-A	MSI055-5 X MSG227-2	1.3	Flattened blocky round type, some early bulking, scab resistant
MSP459-5	Marcy X NY121	1.8	Bright chips, low incidence of defects, medium specific gravity
MSQ070-1	MSK061-4 X Missaukee	1.3	Round tuber type, late maturity, scab and late blight resistant, high specific gravity, strong vine and roots
MSQ279-1	Boulder X Pike	1.4	High yield, large round tubers, good internal qualities
MSR061-1	W1201 X NY121	1.1	Average yield, round tuber type with netted skin, low sugars, PVY resistant, moderate late blight resistance

*Scab rating based on 0-5 scale; 0 = most resistant and 5 = most susceptible

Entry	Pedigree	2009 Scab Rating*	Characteristics
NY 139 (Y28-9)	NY120 X NY115	1.5	High yield, mid-late season maturity, medium specific gravity
W5015-12	Brodick X W1355-1	-	Relative high tuber set and yield, medium-late vine maturity, uniform size tubers, tubers tend toward flat shape, very flat in some environments

*Scab rating based on 0-5 scale; 0 = most resistant and 5 = most susceptible

Table 2. 2009 Michigan Potato Industry Commission Box Bin Processing Potato Variety Trial

2009 MPIC Box Bin Processing Potato Variety Trial
Montcalm Research Farm, Montcalm County, MI

Harvest 23-Sep-09 134 Days

DD, Base 40[6] 2703

	CWT/A		PERCENT OF TOTAL[1]						CHIP	TUBER QUALITY[2]				TOTAL	VINE	VINE		CHIP
LINE	US#1	TOTAL	US#1	Bs	As	OV	PO	SP GR	SCORE[3]	HH	VD	IBS	BC	CUT	VIGOR[4]	MATURITY[5]	COMMENTS	COMMENTS
MSH228-6	297	315	94	6	89	5	0	1.079	1.0	1	2	0	0	10	2.0	4.5	flat oval, tr surface scab	1 SED
NY139	263	296	89	11	89	0	0	1.083	1.0	0	2	0	0	10	3.0	3.5	tr surface scab	
MSQ279-1	238	301	79	20	67	12	1	1.084	2.0	1	0	0	0	10	2.0	4.5	gc in pickouts, tr surface scab, sheep nose	many chips with discoloration
A00188-3C	228	302	76	24	74	2	0	1.082	1.0	2	1	0	5	10	2.5	3.5		
CO00197-3W	226	297	76	20	76	0	4	1.080	1.0	0	3	0	0	10	2.0	3.5	gr and misshapen in pickouts	
A01143-3C	225	297	76	21	74	2	3	1.078	1.0	0	0	0	0	10	2.0	4.5	misshapen in pickouts	
MSN170-A	219	242	91	8	79	12	1	1.084	1.0	0	0	0	0	10	1.5	3.5	misshapen in pickouts, nice size and profile	
MSQ070-1	214	274	77	23	74	3	0	1.090	1.0	2	0	0	0	10	2.0	4.5	round uniform type	4 SED
MSL292-A	207	257	81	19	79	2	0	1.081	1.0	1	1	0	0	10	2.5	3.5	uniform type	
Snowden	**196**	**234**	**84**	**16**	**84**	**0**	**0**	**1.085**	**1.0**	**1**	**2**	**0**	**0**	**10**	**2.0**	**3.5**		
CO00270-7W	183	221	83	16	81	2	1	1.079	1.0	0	2	0	0	10	2.0	2.5	pitted scab	
W5015-12	178	247	72	26	69	3	2	1.086	1.0	0	3	0	0	10	2.0	4.5	russeted skin	
MSL007-B	176	231	76	24	76	0	0	1.080	1.0	0	1	0	0	10	1.5	3.5	nice uniform type	
MSP459-5	170	219	78	21	76	2	1	1.080	1.0	1	0	0	0	10	1.5	2.5	sl sheep nose	
MSR061-1	155	219	71	29	68	3	0	1.082	1.0	2	0	0	0	10	2.0	3.5		
MSJ126-9Y	118	152	78	16	78	0	6	1.077	1.5	0	0	0	0	10	1.0	2.5	misshapen in pickouts, small size	3 SED
CO00188-4W	92	181	51	49	51	0	0	1.083	1.0	0	0	0	0	10	2.5	1.5	small bright appearance	
MEAN	**199**	**252**	**78**					**1.082**										

tr = trace, sl = slight, N/A = not applicable

SED = stem end defect, gc = growth crack

[1]SIZE

Bs: < 1 7/8"

As: 1 7/8" - 3.25"

OV: > 3.25"

PO: Pickouts

[2]TUBER QUALITY (number of tubers per total cut)

HH: Hollow Heart

VD: Vascular Discoloration

IBS: Internal Brown Spot

BC: Brown Center

[3]CHIP COLOR SCORE - Snack Food Association

(Out of the field)

Ratings: 1 - 5

1: Excellent

5: Poor

[4]VINE VIGOR RATING

Date Taken: 15-Jun-09

Ratings: 1 - 5

1: Slow Emergence

5: Early Emergence (vigorous vine, some flowering)

[5]VINE MATURITY RATING

Date Taken: 14-Aug-09

Ratings: 1 - 5

1: Early (vines completely dead)

5: Late (vigorous vine, some flowering)

Planted:	12-May-09
Vines Killed:	3-Sep-09
Days from Planting to Vine Kill:	114
Seed Spacing:	10"
No Fumigation	

[6]MAWN STATION: Entrican

Planting to Vine Kil

Results: 2009-2010 New Chip Processing Box Bin Report

MSH228-6

MSH228-6 is a Michigan State University (MSU) developed common scab resistant, chip processing variety. This variety has a tuber set of six to eight tubers that are round to oval in shape with a strong netted skin. The specific gravity was medium and was the highest recorded yielding variety in the 2009 Box Bin Trial (Table 2). The variety appeared to have a late maturity and a small set suggesting that this variety should be planted at an eight inch in-row seed spacing and managed for a 130 to 140 growing day maturity. This variety has a Snowden-like storage profile, exhibiting the ability to store well into March in most years. During the 2009-2010 storage season, MSH228-6 was placed into storage on September 23rd 2009 having a sucrose value of 0.634 mg/g (X10) and a glucose value of 0.005 mg/g. These values decreased quickly until early March 2010 when the sucrose levels began to increase. A chip picture is included from March 15th 2010 to show the chip quality during this period. Tuber weight loss data that was collected during the storage season showed a 1.86 percent average weight loss in the sample collected with 2.2 percent of the tubers exhibiting pressure bruising and discoloration under the bruises. Overall, this variety performed well enough to warrant further large scale commercial testing in hopes of replacing some Snowden acreage with a variety that has common scab resistance. The storability of MSH228-6 is similar to Snowden but the common scab tolerance of this variety is its big advantage.

MSL292-A

This MSU variety exhibited an average yield of "A" sized tubers with a good processing specific gravity. The 2009 Box Bin Trial recorded this clone yielding 207 cwt./A US#1 (Table 2). The tuber type and size of MSL292-A is uniform and round. The overall Box Bin Trial in 2009 performed below expectations, possibly due to a colder growing season. The long term chip quality of MSL292-A has been excellent. The

vine maturity for MSL292-A is medium-late. A ten inch in-row seed spacing would be recommended for this variety. On September 23rd 2009, this variety was put into storage with a 0.819 mg/g (X10) sucrose rating and a 0.005 mg/g glucose value. Sucrose and glucose levels came down to their lowest points in mid-March at 0.488 and 0.001, respectively. At this point in storage, the sucrose values began to rise to 0.785 in early June 2009. From late March 2010 until June 1st 2010, the glucose level remained at or below 0.005 mg/g. Total defects recorded for this variety on May 24th 2010 were 6.9 percent, resulting largely from free internal glucose present in the tubers which can be observed in the picture above. The percent weight loss recorded for this variety was 2.25 with only 3.1 percent of the tubers evaluated expressing bruise with discoloration under the surface. The only negative aspect to this clone is the lack of strong common scab tolerance. Overall, this variety has great yield potential and excellent long term storability for chip processing. This variety has the potential to store and chip process in early June most seasons.

MSQ279-1

This MSU developed clone is known for good mid-season storage chip quality, as well as common scab tolerance. MSQ279-1 has a large uniform round type, a medium netted skin. The common scab tolerance is similar to Pike. The specific gravity ranges from 1.075 to 1.084. The vine type has tended to be strong and upright. In the 2009 Box Bin Trial, MSQ279-1 was third from the top in yield. It produced 238 cwt./A US#1 (Table 2). The internal tuber quality appeared to be good and the vine maturity of the variety is medium-late. On September 23rd 2009 these tubers were placed into storage. The sucrose level appeared to be elevated at 1.208 mg/g (X10). The sucrose level did come down steadily into early February 2010. The glucose and sugar related defects remained low into early March. During early March 2010, the sucrose rating began to increase. MSQ279-1 is pictured above on March 1st 2010 with a 0.604 sucrose rating and 0.002 glucose value. The percent weight loss recorded was moderate at 3.58 percent, with 14.2 percent of the tubers exhibiting pressure bruise with discoloration under the skin. This number was quite high and the pressure bruise susceptibility of this line needs to be monitored closely as we move forward. Overall, this variety yielded well and the common scab tolerance is good. This variety, although exhibiting a few reasons for concern, has shown good yield, mid-season chip quality and common scab tolerance thus warranting further testing.

NY139

This Cornell University developed clone can have a slightly elongated and pear shaped type, but has great yield potential, excellent chip quality and some moderate common scab tolerance. In the 2009 Box Bin Trial, this variety yielded above the trial average at 263 cwt./A US#1 (Table 2). NY139 expresses better common scab tolerance and longer term chip quality than the check variety Snowden. The vine maturity for NY139 is medium-late. A ten inch in-row seed spacing would be recommended for this variety because it can oversize. NY139 was placed into storage on September 23rd 2009 with a 1.322 mg/g (X10) sucrose rating and a 0.006 mg/g glucose value. The sucrose and glucose levels were at their lowest in early January and by mid-April chip defects began to appear. The picture above shows NY139 in mid-April prior to an increase in chip color related defects. The tuber percent weight loss was the lowest of these four lines reported at 1.84 percent with 4 percent of the tubers having bruise and discoloration under the skin. Overall, this variety has great commercial potential. Its yield and chip quality provide the industry with some potential opportunities.

W5015-12

This University of Wisconsin developed clone has a nice uniform type, great yield potential and good chip quality. In the 2009 Box Bin Trial, this variety yielded below the trial average at 178 cwt./A US#1 (Table 2). This variety did not yield well under the much cooler growing conditions of the 2009 growing season. This variety has exhibited much higher yield potential than it displayed in 2009. W5015-12 has some common scab susceptibility much like the check variety Snowden. The vine maturity for W5015-12 is medium-late. A 10 inch in-row seed spacing would be recommended for this variety. W5015-12 was placed into storage on September 23rd 2009 with a 1.202 mg/g (X10) sucrose rating and a 0.016 mg/g glucose value. The sucrose and glucose levels were at their lowest in late December 2009 and by late February, chip defects cleaned-up and chip quality appeared to be quite good. The picture above shows W5015-12 in early March, prior to an increase in chip color related defects. The tuber percent weight loss was reported at 2.66 percent with 6.2 percent of the tubers having bruise

and discoloration under the skin. Overall, this variety has good commercial potential. Its yield and chip quality provide the industry with some potential opportunities, but caution must be taken with the lines common scab susceptibility.

II. 2009 - 2010 Bulk Bin (500 cwt. Bin) Report

(Brian Sackett and Chris Long)

Introduction

The goal of the MPIC Storage and Handling Committee for the 2009-2010 bulk bin storage season was to develop storage profiles on six promising advanced seedlings and evaluate the effectiveness of Ethylene as a sprout inhibitor, for chip processing potatoes, on the Snowden variety. The first variety tested for storage profiling was Kalkaska, a clone from the potato breeding program at Michigan State University (MSU). This clone has a strong yield potential, early die tolerance and good common scab resistance. Kalkaska was also tested in a bulk bin in the 2008-2009 storage season. The second variety, MSH228-6, is an MSU developed clone that has good common scab tolerance, an oval to oblong type and a storage profile similar to Snowden. MSJ126-9Y, the third variety of interest, is an MSU developed clone with good agronomic quality, common scab resistance and yellow flesh. MSJ147-1 was the fourth MSU line tested in the bulk bins in 2009-2010. The variety is uniform in size, a moderate yielding line, with very good late season storage quality for chip processing. The fifth variety tested in the bulk bin storage was CO95051-7W. This University of Colorado developed clone has some common scab tolerance and good long term chip quality from cold storage. Yield potential is moderate with uniform round tuber type. Bulk bin number 6 contained a new promising russet line from Aberdeen, ID. The name of this variety is Classic Russet (A95109-1). Classic Russet has a uniform blocky type, nice uniform russeted skin and good yield potential.

For each of the varieties listed above a brief description of agronomic and storage performance is provided. In addition, a short description of pressure bruise susceptibility, chip color and color defects, sugar accumulation and overall chip quality are given. With this information, a clearer perspective can be obtained regarding the viability of these varieties in commercial production.

The goal of the Ethylene Sprout Inhibitor Study was to determine the commercial viability of ethylene gas as a sprout inhibitor in chip processing potatoes and to evaluate the feasibility of replacing CIPC as the industry standard sprout inhibitor. Of particular interest in this study is the ability of ethylene gas to control sprouts adequately while maintaining tuber quality, but most importantly, to see if the ethylene gas would have a negative effect on tuber sugar quality. Sucrose and glucose was evaluated bi-weekly throughout the study and a sprout evaluation was performed at the time of bin unloading to establish the differences in sprout control between the two sprout inhibitor products.

Procedure

Each bin was filled under contract with potato producers in the state of Michigan. MPIC paid field contract price for the potatoes to be delivered to the demonstration storage. Pressure bruise samples were taken and designated bulk bins were filled. The varieties and their storage management strategies were established by the MPIC Storage and Handling Committee. For each bulk bin filled, a corresponding box bin containing 10 cwt. was filled and placed into Bin 7. Bin 7 was held at a warmer temperature, in most cases, than the corresponding bulk bin of the same variety. Sugar sampling for the box bin was carried out longer into the storage season, in general, than the bulk bin. This allowed the committee to see if the warmer storage temperature in the box bin would reduce storage life and provided information as to how the bulk bin might physiologically age.

In the 2009-2010 storage season; Bin 1 was filled with Kalkaska; Bin 2 was filled with MSH228-6; Bin 3 was filled with MSJ126-9Y; Bin 4 was filled with MSJ147-1; Bin 5 with CO95051-7W and Bin 6 was filled with Classic Russet (A95109-1). The Snowden's in Bin 8 were treated with the industry standard CIPC sprout treatment while Bin 9 was exposed to ethylene gas under controlled conditions.

Kalkaska was grown by Sackett Potatoes and was loaded into Bin 1 on September 18, 2009. It was planted April 18, 2009, and vine killed on August 19, 2009 (124 DAP, GDD_{40} 2660). The variety was harvested September 18, 2009; 154 days after planting. The pulp temperature for Kalkaska at bin loading was 68.0 ºF. A blackspot bruise sample was taken on this variety at the time of bin loading. The results indicated that the tubers were 87% bruise free.

MSH228-6 was grown by Lennard Ag. Co. and was loaded into Bin 2 on September 28, 2009. It was planted May 22, 2009, vine killed September 15, 2009 (117 DAP, GDD_{40} 2832) and harvested September 27, 2009; 129 days after planting. MSH228-6 pulp temperature at bin loading was 56.0 ºF. A blackspot bruise sample was taken on this variety at the time of bin loading and indicated that the tubers were 68% bruise free.

MSJ126-9Y was grown by Thorlund Brothers and was loaded into Bin 3 on October 21, 2009. It was planted May 23, 2009, and vine killed on September 18, 2009 (119 DAP, GDD_{40} 2883). The variety was harvested October 21, 2009; 152 days after planting. The pulp temperature for MSJ126-9Y at bin loading was 63.0 ºF. A blackspot bruise sample was taken on this variety at the time of bin loading. The results indicated that the tubers were 81% bruise free.

MSJ147-1, in Bin 4, was grown by Sandyland Farms and was loaded into storage on October 20, 2009 with a pulp temperature of 50.0 ºF. It was planted May 30, 2009, vine killed September 16, 2009 (110 DAP, GDD_{40}

2714) and harvested October 20, 2009; 144 days after planting. A blackspot bruise sample was taken on this variety at the time of bin loading and indicated that the tubers where 75% bruise free.

CO95051-7W was grown by Sackett Ranch and was loaded into Bin 5 on October 22, 2009. It was planted May 20, 2009, vine killed September 4, 2009 (108 DAP, GDD_{40} 2618) and harvested October 22, 2009; 156 days after planting. The pulp temperature of CO95051-7W at bin loading was 54.0 ºF. A blackspot bruise sample was taken on this variety at the time of bin loading and indicated that the tubers were 78% bruise free.

Classic Russet was grown by Sandyland Farms and was loaded into Bin 6 on October 21, 2009. It was planted May 18, 2009, and vine killed on September 2, 2009 (108 DAP, GDD_{40} 2608). The variety was harvested October 21, 2009; 157 days after planting. The pulp temperature for Classic Russet at bin loading was 54.0 ºF. A blackspot bruise sample was taken on this variety at the time of bin loading. The results indicated that the tubers were 67% bruise free.

The potatoes placed in Bins 8 and 9 were grown by Johnson Farms, Howard City, MI. Bin 8, Snowden, (Standard CIPC Sprout Treatment) was planted May 20, 2009 and vine killed on September 12, 2009 (116 DAP, GDD_{40} 2822). Harvest took place on October 8, 2009; 142 days after planting. The potatoes were loaded into the bin on October 8, 2009 with a pulp temperature of 54.2 ºF. A blackspot bruise sample was taken on this variety at the time of bin loading and indicated that the tubers where 70% bruise free. The potatoes in Bin 9, Snowden (Ethylene Treated), were identical to the potatoes in Bin 8, thus planting, vine kill, harvest and bin loading dates are identical. A blackspot bruise sample was taken on these Snowdens as they went into Bin 9 and indicated that the tubers were 73% bruise free. The pulp temperature, at filling, remained the same for both Bins 8 and 9 at 54.2 ºF.

Bulk Bin 8 was the control bin for the ethylene versus CIPC study. The Snowden potatoes in this bin were managed in a manner consistent with commercial grower storage practices. Bin 9 was the treatment bin. The ethylene concentration in this bin was regulated by an “Ethylene Management Unit” (EMU) developed by the BioFresh Co., United Kingdom. The EMU measured baseline ethylene levels of the inlet air, as well as, the ethylene concentration in the return air of the treatment bin. The EMU had a 200 liter cylinder of commercial grade ethylene gas connected to it. The EMU regulated the injection of this gas into the supply air of the storage to maintain an ethylene set point concentration measured in parts per million (ppm). The tubers were loaded into both Bins 8 and 9 the same day (October 8, 2009) and allowed to wound heal at 54.0 ºF for two weeks. The relative humidity was maintained at 98 percent in both bins. The ethylene injection began on October 20, 2009 and was maintained at 0.1 ppm continually for 7 days (7 Days After First Treatment (DAFT)). At the conclusion of this time period the concentration of ethylene was increased to 0.3 for 7 days (14 DAFT). The ethylene concentration was increased every 7 days from October 20, 2009 until November 24, 2009. This time period represents 5 increases in ethylene concentration. The ethylene concentration in ppm was increased based on the following ranges; 0.1, 0.3, 0.6, 1.0 and 2.0 ppm. Bin 9 remained at each of these ethylene levels for 7 days. On November 24, 2009, the ethylene concentration was increased again to 4.0 ppm and remained at this level for 14 days (49 DAFT). On December 8, 2009, the ethylene level was increased to 8.0 ppm and

remained at this level until December 22, 2009 (63 DAFT). Finally, on the 63rd day after the first treatment, the ethylene level was increased for the last time to 10.0 ppm and remained there for the duration of the study.

Sucrose and glucose values were evaluated and compared across treatments for both Bins 8 and 9 throughout the sprout inhibitor study. A comparison of sprout suppression was made between treatments by evaluating 3 replicates of 10 tubers from five locations in the potato bulk pile for each treatment. These locations were identified as the following; the sample door, 3 feet above the pile floor, 6-8 feet above the pile floor, 12-14 feet above the pile floor and the top of the pile. At bin loading, three, 25 pound tuber samples were placed in the pile, for sprout evaluation, at each of these locations. At the time of sprout evaluation on January 18, 2010, each of the 10 tuber replicate samples were weighed (150 tubers total per treatment), the number of eyes present were recorded, the number of eyes that were sprouted and 2-5 mm in length were recorded, the number of eyes sprouted greater than 5mm were recorded and the length of the longest sprout was recorded. The sprouts that were recorded as 2 mm and greater in length were removed by hand and the 10 tuber samples were weighed again. The mean was established for; the mass of sprouts, the number of eyes, the number of eyes sprouting 2-5 mm, the number of eyes sprouting greater than 5 mm and the length of the longest sprout in mm. The means of the two treatments were compared to establish effectiveness of sprout control for the two products.

Bins 1,2 and 8 were gassed with CIPC on November 2, 2009. On November 25, 2009 Bins 3, 4, 5 and 6 were gassed with CIPC. Bin monitoring began the day the tubers were placed into storage and were evaluated on a two week sampling schedule thereafter. Forty tubers were removed from the sample door in each bin every two weeks and sent to Techmark, Inc. for sucrose, glucose, chip color and defect evaluation. The sample door is located in the center back side of each storage bin and is an access door that allows samples to be taken from the pile three feet above the bottom of the pile. Pressure bruise evaluation began by collecting nine 20 to 25 lb. tuber samples as each bin was being filled. Three samples were placed at each of three different levels within the bulk bin pile at 3, 6, and 9 feet from the storage floor.

The pressure bruise samples were evaluated 3 to 5 days after the bin was unloaded. A set of 25 tubers were randomly selected from each bag and visually inspected for pressure bruise. Each bruise was evaluated for discoloration by removing the tuber skin with a knife. A visual rating was given to the bruise for the presence or absence of flesh color (blackening of flesh). Percent weight loss in each tuber sample was calculated as it was removed from the storage.

Objective

The Storage and Handling committee's objective in testing the varieties in Bins 1-6 was to determine what the optimal storage temperature was for each variety, while maintaining acceptable storage and chip quality. Also of interest was the level of pressure bruise damage that may be incurred by each variety at a given storage temperature. The goal for the Kalkaska variety was to evaluate longevity at a given storage temperature while maintaining chip quality. Based on blackspot bruise numbers, sugar accumulation and stem end defect, this

variety was left warm and slated for a November, December shipping window. MSH228-6 was evaluated for duration of storability. As the chip quality improved in this variety, the pile would be cooled to extend storage life in hopes of reaching a March to April shipping window. Bin 3, MSJ126-9Y, was tested to evaluate the storability of this line. The variety appeared to have vascular and stem end related defects. Sugar accumulation was watched closely around the defect areas before cooling the potatoes to a longer-term storage profile temperature. MSJ147-1 in Bin 4 has long term storage potential into May and June. The sugar and chip quality was good early and the variety was slated for long-term storage. The CO95051-7W, much like the MSJ147-1, has excellent long-term chip quality. The variety was slated for long-term storage quality testing and storage. The Classic Russet in Bin 6 was evaluated for tuber quality and storability for the freshpack market. Resistance to weight loss and Silver Scurf tolerance are important qualities to evaluate throughout the storage season.

The goal of the Ethylene Sprout Inhibitor Study in Bins 8 and 9 was to determine the commercial viability of ethylene gas as a sprout inhibitor in chip processing potatoes and to evaluate the feasibility of replacing CIPC as the industry standard sprout inhibitor. Of particular interest in this study is the ability of ethylene gas to control sprouts adequately while maintaining tuber quality, but most importantly, to see if the ethylene gas would have a negative effect on tuber sugar quality.

Bulk Bin 1, Kalkaska

Kalkaska is a common scab resistant, round shaped chip processing variety from the Michigan State University (MSU). This variety is much like that of Snowden in regards to its shape and skin type. In the 2008 on-farm variety trials this line yielded 400 cwt/A US#1. It has a three year average from 2006-2008 of 337 cwt/A US#1. The specific gravity of this variety averages between at 1.078 – 1.085. The variety has been observed to have good Early Die tolerance.

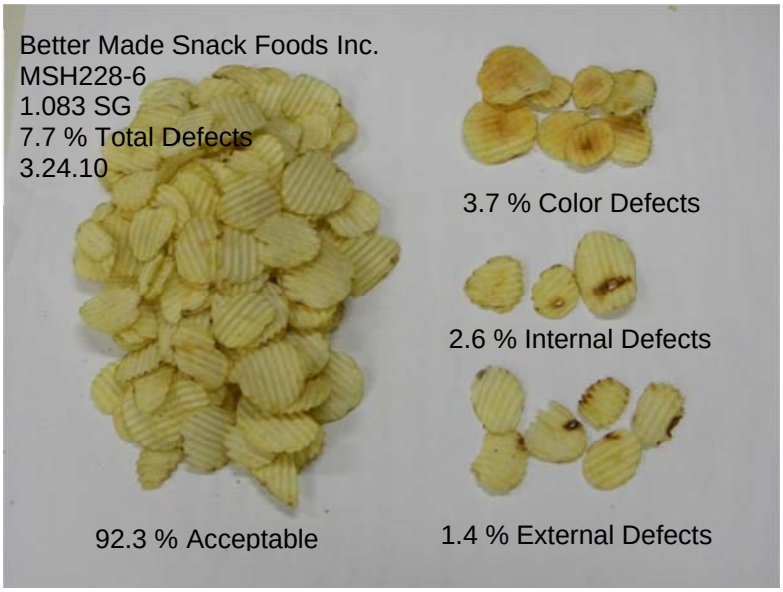
For the 2009-2010 storage season, this variety was grown by Sackett Potatoes Mecosta, MI, which is located in Mecosta county. The tuber temperature upon arrival at the storage was 68.0 ºF. The variety was tested and found to be 87 percent black spot bruise free.

SFA chip color and color related defects were acceptable October through December. Sucrose levels were acceptable, but glucose values were elevated and somewhat variable during this storage period. Glucose levels varied from 0.003 to 0.009. This glucose variability is a concern to overall chip quality. These results reflect similar experiences in past storage seasons with Kalkaska. Most of the internal defects recorded in 2009-2010 were stem end defects (SED), see picture in the upper right corner of this page. After 2 months in the storage at 58.0 ºF, it was evident that this bin of potatoes contained a significant amount of stem end vascular discoloration and we would have to maintain the pile temperature at this level to encourage tuber respiration in order to remove the free sugar. At this warm bin pile temperature, over an extended period from October through December, we were unable to cause enough positive change to the amount of chip defects that were present. The sugar related color associated with these defects was not burning off. That prompted the Storage Committee to cut losses in this storage bin and the variety was shipped on December 21, 2009, as an open market load of chip processing potatoes and that ended our evaluations in Bin 1. Tuber weight loss numbers were excellent at 3.44 percent and only 0.4 percent of the tubers that expressed pressure bruise had discoloration under the skin.

Kalkaska has exhibited great agronomic quality, high yield potential, common scab resistance, Early Die tolerance, but the chip quality has been too variable for commercialization to occur. Any available seed of Kalkaska was flushed out of the seed increase system in the Spring of 2010. Kalkaska is now a source of common scab resistance, Early Die tolerance and yield in the MSU breeding program.

Bulk Bin 2, MSH228-6

MSH228-6 is a common scab resistant, round to oval shaped chip processing variety from MSU. This variety is much like that of Snowden in regards to its chip quality from mid-season storage. In the 2009 on-farm variety trials this line yielded 407 cwt/A US#1. It has a three year average, from the 2007-2009 growing seasons, of 348 cwt/A US#1. The specific gravity of this variety averages between at 1.078 – 1.085.

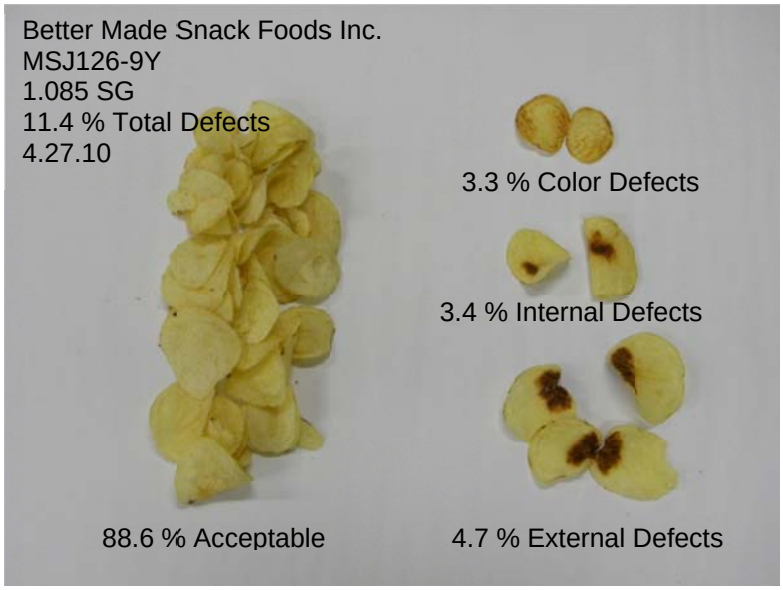


For the 2009-2010 storage season, this variety was grown by Lennard Ag. Co. Samaria, MI, which is located in Monroe county. The tuber temperature upon arrival at the storage was 56.0 ºF. The variety was tested and found to be 68 percent black spot bruise free.

SFA chip color and color related defects were acceptable October through January. Pile sucrose and glucose in early December were 0.348 and 0.001, respectively, with a pile temperature of 52.4 ºF. At this time, the pile temperature was further cooled to 50.0 ºF. This resulted in an increase in sucrose and glucose two weeks later to 0.712 and 0.003, respectively. Sucrose and glucose remained elevated through late February. The pile temperature was raised in early March to help clean-up the free glucose in order to improve chip quality. It appears that this variety would be best held at 52.0 ºF or warmer to prevent cold induced sugars from forming. It is unclear, but probable, that this higher storage temperature would reduce longevity in storage. The pile cooling rate in December was 0.2 ºF a day from 52.0 to 50.0 ºF. It does not appear that this variety has the ability to metabolize sugar as quickly as the Snowden variety. In mid-March the sucrose and glucose were 0.542 and 0.005, respectively, with the sugar related defects being at their lowest points since the beginning of the storage season at 1.4 percent. The decision was made to sell the bin based on this marked improvement. Thought was given as to whether two more weeks would have led to even greater improvement. Possibly this can be evaluated in a future storage season. Weight loss numbers at bin unloading were excellent at 3.97 percent while 2.2 percent of the tubers expressed pressure bruise and discoloration under the skin.

Overall, the MSH228-6 processed acceptably at Better Made Snack Foods on March 24, 2010. The picture in the upper right provides a visual of the varieties chip performance. Because the variety exhibited some lateness, we are suggesting that the variety get 130-140 growing days from planting to harvest. The variety appears to only set 6-10 tubers per plant and in order to increase US#1 yield per acre we are suggesting that this variety be planted at an 8-9 inch in-row seed spacing on 34 inch rows. Further testing is needed to verify the commercial potential of this line.

Bulk Bin 3, MSJ126-9Y

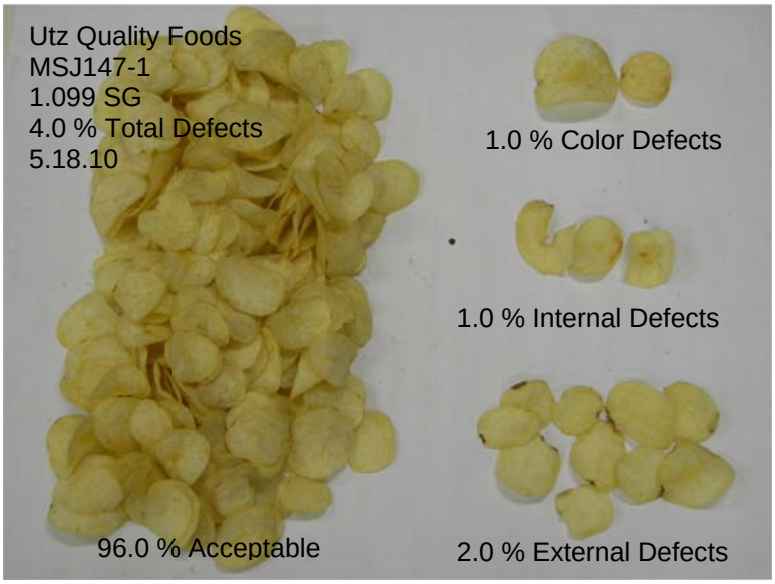


MSJ126-9Y is an MSU variety from the Potato Breeding and Genetics program. This variety has moderate tuber size with a generally round appearance. The common scab tolerance is strong. The US#1 yield for this variety is 350 cwt/A over three years from 2007 -2009. The specific gravity is average, ranging from 1.076 to 1.085 in Michigan. MSJ126-9Y was grown by Thorlund Brothers, Inc. in Greenville, MI, on fumigated ground. 550 cwt. was harvested and loaded into the storage during the fall of 2009. The variety has a good set of medium size tubers that average 2.0 to 3.25 inches in diameter. The storage was filled on October 21st with a pulp temperature of 53.0 ºF. The variety was evaluated to be 81 percent bruise free.

In late December, Bin 3 had a 0.974 sucrose level and a 0.005 glucose level which led the Storage and Handling Committee to believe that this variety was slightly chemically immature at harvest. This was not apparent from pre-harvest sucrose values. The varieties' sucrose values decreased steadily from harvest until mid- March. From harvest until early February, the glucose level in the tubers varied between 0.003 and 0.005 mg/g fresh weight. Most concerning was the dark stem end discoloration (SED) that was visible in the finished chips. The amount of SED that was present was so severe that we wondered if we were ever going to be able to process the bin. Pile temperature was maintained at 52.0 ºF until mid-February. At this time, it was decided to raise the pile temperature to 54.0 ºF in hopes of improving the overall chip quality. By early March, the pile temperature was 54.0 ºF and by mid-March the sucrose and glucose fell to their lowest levels of 0.359 and 0.001, respectively. Chip related defects deceased as well. From mid-March, the sucrose and glucose began to rise, as well as, the chip defect scores. Tuber weight loss numbers at bin unloading were higher than desired at 6.14 percent and 3.6 percent of the tubers expressed pressure bruise and discoloration under the skin.

On April 27, 2010, the bin was sent to Better Made for processing. The picture in the upper right shows a snap-shot of the chip quality from this bin. The total defects are higher than desired at 11.4 percent. These defects appear to be comprised of mostly stem end defects. The Storage and Handling Committee would like to continue further testing of MSJ126-9Y in the 2010-2011 storage season. Agronomically, the variety performed well exhibiting strong common scab tolerance. 2009 was a cold growing season and the crop experienced 200-400 fewer GDD40 heat units than on an average year. This may help to explain the stem end defects and chemical immaturity.

Bulk Bin 4, MSJ147-1



MSJ147-1 is an MSU breeding line with a medium-late maturity, slight small size profile, high specific gravity and long-term chip quality. In the 2007 to 2009 field trials, this clone exhibited an average yield of 307 cwt/A US#1 and a high specific gravity of 1.090.

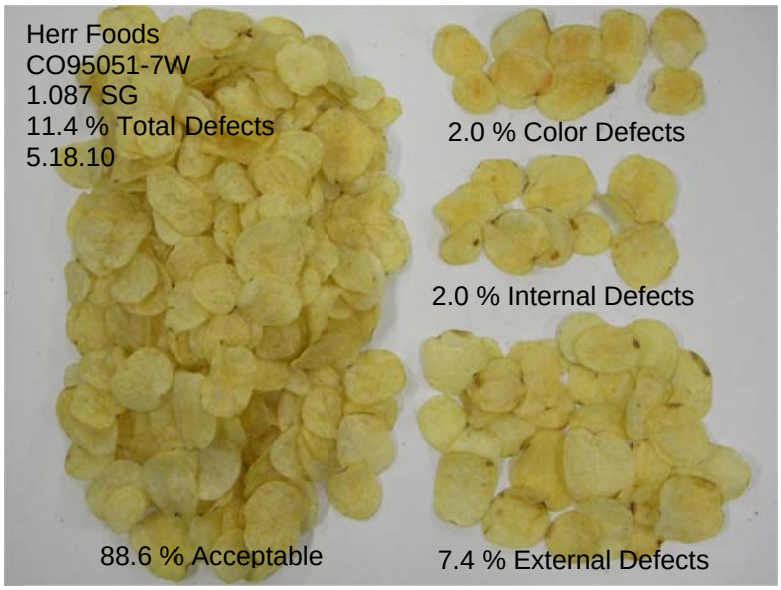
MSJ147-1 was grown by Sandyland Farms and was delivered on October 20th with a pulp temperature of 51.0 ºF. The goal for this bin was to establish the long-term storage potential of this variety. MSJ147-1 arrived at the storage with a 75% bruise free rating. The variety was slated for long-term storage and scheduled to go to 50 ºF for holding. At this time, the sugar profile would be reevaluated and the variety possibly cooled further if chip quality remained. In early December, the pile temperature was 50.6 ºF and the sucrose and glucose values were 0.631 and 0.003, respectively. The pile chip quality was acceptable, so the decision was made to cool the pile further to 48.0 ºF by early January 2010. In January, we experienced a rise in tuber sucrose values indicating the induction of sugars as a result of cooling. The pile was warmed to 50.0 ºF in early February and remained there for the duration of the storage season. The sucrose and glucose values stabilized in March and the chip quality continued to improve. The chip quality of MSJ147-1 was good in early May and the committee felt they had reached their goal of storing this variety beyond that of a Snowden.

Bulk Bin 4 was shipped May 17th and processed at Utz Quality Foods on May 18th 2010. The picture to the upper right depicts the excellent chip color at the time of processing. Total tuber weight loss numbers at bin unloading were higher than desired at 6.10 percent. 7.6 percent of the tubers expressed pressure bruise and discoloration under the skin. This high level of tuber moisture loss resulted in an elevated amount of pressure bruise being observed at the time of processing.

Overall, the variety processed very well. Tuber weight loss must be managed better to reduce the appearance of this level of pressure bruising. The agronomic performance of this line remains a concern as well. It becomes hard to remain profitable with a variety that does not yield better than 307 cwt/A. We need to continue to look for varieties that chip process like this line, but have better agronomic quality.

Bulk Bin 5, CO95051-7W

CO95051-7W is a Colorado State University developed variety. In 2009, this variety yielded 331 cwt/A US#1. It has a three year US#1 yield average of 303 cwt/A from 2007-2009. This variety is small and uniform round in type. It exhibits some moderate common scab tolerance. A small amount of vine rot has been observed to occur in this variety. A fungicide application at blossom drop for White Mold prevention is recommended. In-row seed spacing should be 10.5 to 11.5 inches. The tuber set per plant is 10-18 tubers.



The potatoes in Bin 5 were grown by Sackett Ranch, Stanton, MI., and were harvested and loaded into storage on October 22nd with a pulp temperature of 54.0 ºF. Upon arrival, the tubers were held for two weeks to suberize and then were cooled at 0.2 ºF per day until the potatoes reached a pulp temperature of 52.0 ºF. At this time the status of the potatoes was reevaluated and then cooled to 50.0 ºF for holding. The tubers were determined to be 78% bruise free at bin loading. In early January 2010, the pile temperature was cooled to 50.0 ºF. On March 15th, 2010, the tubers reached their most stable sugar levels of the storage season with a 0.327 sucrose value and a 0.001 glucose value on recorded. From this point, the sucrose value rose steadily until the potatoes were shipped in mid-May. The pile temperature was 49.6 ºF on the date of shipping.

The picture at the upper right depicts the overall chip quality of this load after processing at Herr Food, Inc. on May 18, 2010. White knot and black spot bruise was evident in the internal chip defects, as well as, some pressure bruise in the external defect score. The overall weight loss in this bin was good at 2.55 percent, but 8.4 percent of the tubers had pressure bruise and discoloration under the skin. The bin processed acceptably at Herr's.

Overall, this variety has excellent chip quality and processing potential. Of concern is the varieties weak yield performance and some potential for vine rot susceptibility.

Bulk Bin 6, Classic Russet (A95109-1)

Classic Russet has looked promising in on-farm variety trials since 2007. In 2009, this variety yielded 348 cwt/A US#1 with a 1.073 specific gravity. The three year yield average for this variety is 367 cwt/A US#1. Vine maturity is medium to late. The tuber type is uniform and blocky with a Russet Norkotah type russet skin. The variety produces a nice percentage of marketable potatoes. The common scab tolerance is strong, but tuber susceptibility to Pink Eye and Pythium Leak is concerning. In row seed spacing should be kept at 9-10 inches to prevent oversized potatoes. This variety had roughly 8 percent hollow heart observed across nine trial locations in 2009.

The MPIC stored about 550 cwt. of Classic Russet in 2009. The potatoes were grown at Sandyland Farms in Howard City, MI. They stored 2500 cwt. as well in their commercial storage. In the 2009 growing season, Ariel Black Leg was noted in this variety which expressed itself as stem end rot and Black Leg in the harvested tubers. At harvest, the tubers were evaluated for black spot bruise and determined to be only 67 percent bruise free. The Classic Russet was loaded into Bin 6 on October 21st, 2009, with a 54.0 ºF pulp temperature. At bin load, a large amount of Black Leg was noted in the tubers. The potatoes were held at 54.0 ºF to suberize and then the pile was cooled to 40.0 ºF as outside air was available. Shortly after bin loading, tuber quality was declining as was evident by visible wet breakdown. As the pile was cooled, the breakdown slowed and reached a manageable level. The grower was experiencing similar quality issues and shipped their potatoes shortly after storing. We managed to hold Bin 6 until December 15th, 2009, when we chose to ship them to Fresh Solutions for packaging. At load-out, the pile was reported to have lost 7.19 percent of its initial weight to dehydration. But, over 91 percent of the tubers were bruise free and less than 1 percent of the tubers with bruise had discoloration under the skin.

In 2009, many reports of bacterial rot in this variety were made throughout the country, not only in commercial production, but in seed producing regions as well. This variety looked as though, initially, it would bring some good agronomic quality and tuber type to our russet industry in Michigan, but the tuber rot from Black Leg and Pythium Leak brought an end to the commercial potential of this line in Michigan.

Ethylene Study, Bulk Bins 8 and 9

This section is intended to provide a brief summary of the Ethylene versus CIPC study that the MPIC Storage and Handling Committee conducted over two storage seasons from 2008-2009 and 2009-2010. The general protocol was described earlier in this report. Two, 575 cwt bulk bins of Snowden potatoes were treated either with CIPC (Bin 8) or ethylene (Bin 9). The CIPC applications were described earlier. The ethylene levels and their timings were described early. Figure 1 shows the EMU and the ethylene tank configuration in the storage facility.

In comparing these two sprout inhibitor products we will discuss; storage management, chip quality and sprout suppression. In both years, 2008 and 2009, the Snowden tubers arrived at the MPIC storage with elevated glucose values. Neither in 2008 nor 2009 did the control chip quality look as good as expected. There was always some background vascular discoloration and color shading in the control chips each year at the beginning of the experiment. The reduced chip quality, in both years, warranted elevated storage pile temperatures and increased fresh air inlet to facilitate the respiration of the simple sugars present in the tubers. This was feasible in the control bin, but in the treatment bin which contained ethylene gas, it was very difficult to maintain the desired amount of fresh air inlet and maintain ethylene levels at 10.0 ppm to control sprouting. Thus, the amount of fresh air was limited. Limited fresh air inlet into Bin 9 caused reduced respiration of free sugars. Also, because the inlet had to be open periodically, this made it difficult to maintain the necessary ethylene concentration to control tuber sprouting. There is a difficult trade off imposed by the ethylene product and its protocol. The ethylene system may work better in a storage environment where the inlet door is rarely opened if ever and the pile temperature is maintained between 36.0 and 42.0 ºF. It would also be ideal if the tuber sugar quality was not a factor. Both years the reduction in fresh air inlet resulted in the treatment bins having higher glucose and sucrose values when compared to the control bins. For example, in the 2009-2010 storage season, Bulk Bin 8 had sucrose and glucose values of 0.417 and 0.003, respectively, and a 34.5 percent total chip defect score on January 18th, 2010. Bin 9 had a sucrose value of 0.477 and glucose value of 0.006 with 57.2 percent of the chips with defects on this same date. It was not clear during the two storage seasons if the ethylene level in the storage was causing the elevated sugars observed or the fact that the fresh air inlet had been reduced that was causing this reduction in chip quality. Figures 3 and 5 show the chip quality, in both Bins 8 and 9 at the time of bin unloading in 2010.

Table 1 shows sprout data from the 2008-2009 storage season. Sprouting in each pile was evaluated from 5 locations described earlier in the report. The table also shows the sprout results from tuber control samples taken from both bins prior to sprout treatment which were stored at 50.0 ºF. In both years, the mass of sprouts removed from the CIPC treated tubers, the amount of sprouting in both sprout length categories and the length of the longest sprouts were much smaller with the CIPC treatment than with the ethylene treatment (Tables 1-2). Figures 2 and 4 depict these results. Under these storage conditions and during both storage seasons, the CIPC sprout treatment provided the best sprout control for the tubers and the CIPC treatment resulted in the best quality chips being produced at the end of the storage seasons.

Table 1.

2008-2009
MPIC Demonstration Storage Bins 8 & 9
Snowden: CIPC and Ethylene Sprout Evaluation

	Mass of sprouts > 2mm in grams	# of eyes	# of eyes sprouting 2-5 mm	# of eyes sprouting > 5 mm	longest sprout length in mm
CIPC Door MEAN	2.00	6.93	0.03	0.03	0.33
Ethylene Door MEAN	5.67	6.73	1.33	0.43	3.98
CIPC 10s MEAN	5.00	7.33	0.13	0.40	6.20
Ethylene 10s MEAN	6.33	7.23	1.53	0.90	6.98
CIPC 20s MEAN	2.00	7.20	0.40	0.30	4.72
Ethylene 20s MEAN	7.00	7.30	1.97	0.20	4.90
CIPC 30s MEAN	2.67	7.57	0.07	0.23	3.23
Ethylene 30s MEAN	6.67	7.10	2.50	0.43	5.37
CIPC Top of Pile MEAN	6.33	6.80	0.33	0.40	5.03
Ethylene Top of Pile MEAN	14.00	6.87	3.30	1.70	7.73
Non-Treated Snowden Bin 8 MEAN	50.67	8.10	0.67	1.77	105.95
Non-Treated Snowden Bin 9 MEAN	44.67	7.57	0.70	1.60	104.43

Table 2.

2009-2010
MPIC Demonstration Storage Bins 8 & 9
Snowden: CIPC and Ethylene Sprout Evaluation

	Mass of sprouts > 2mm in grams	# of eyes	# of eyes sprouting 2-5 mm	# of eyes sprouting > 5 mm	longest sprout length in mm
CIPC Door MEAN	0.00	7.93	0.00	0.00	0.07
Ethylene Door MEAN	8.29	8.60	6.77	0.83	5.03
CIPC 10s MEAN	1.79	8.83	0.17	0.03	1.30
Ethylene 10s MEAN	7.07	7.30	3.37	0.37	4.03
CIPC 20s MEAN	0.20	9.10	0.03	0.00	1.03
Ethylene 20s MEAN	8.88	7.30	2.83	0.27	4.03
CIPC 30s MEAN	0.70	9.17	0.13	0.07	1.50
Ethylene 30s MEAN	6.21	8.13	6.20	0.43	4.10
CIPC Top of Pile MEAN	7.60	9.07	0.57	0.27	4.07
Ethylene Top of Pile MEAN	17.21	7.60	5.83	0.63	5.90
Non-Treated Snowden Bin 8 MEAN	NA	NA	NA	NA	NA
Non-Treated Snowden Bin 9 MEAN	NA	NA	NA	NA	NA

Figure 1. Ethylene Management Unit and Ethylene Tank

Figure 2. Snowden tubers from Bin 8 (CIPC Treated) 1.28.10

Figure 3. Chip quality picture Bin 8, 1.18.10

Figure 4. Snowden tubers from Bin 9 (Ethylene Treated) 1.28.10

Figure 5. Chip quality picture Bin 9, 1.18.10