## 2022-2023 Michigan Regional Trial Potatoes USA / SNAC International Storage Chip Quality

# Michigan State University Montcalm Research Center MPIC Demonstration Storage

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**Objective:** To assess the storability of eight chipping varieties by evaluating sugar concentrations, chip color, and visual defects during storage.

#### **Materials and Methods:**

The MSU Potato Outreach Program planted seed at Sandyland Farms, LLC, in Howard City, MI on May 22, 2022 at 10" within row spacing and 34" between row spacing. Vine kill occurred on September 1, 2022. We harvested the potatoes on October 20, 2022 (2842 GDD<sub>40</sub> from planting to vine kill) and collected storage samples.

## **Commercial Storage and Processing**

A 40-pound sample of each variety was stored at Sandyland Farms, LCC commercial storage and evaluated at Herr Foods, Nottingham, PA on January 9 and March 20, 2023. The pile temperature before processing was 48°F in January and 50°F in March.

### **Demonstration Storage and Monthly Evaluations**

Nine samples of 30 tubers per variety were initially stored at the Michigan Potato Industry Commission's (MPIC) Cargill Potato Demonstrations Storage Facility in Bulk Bin 2. After this bin was unloaded in April 2023 the remaining sample bags were moved to Bulk Bin 5. The sample bags from each of the nine varieties were stored at approximately 48°F for monthly evaluations from October 2022 through June 2023. Techmark, Inc. processed these MPIC samples for sucrose and glucose values (percent of fresh weight), SNAC color score, and chip defect rating. Chip defect color rating is scored as a percentage by weight of unacceptable chips due to color, bruise, or stem end defect.

#### Results:

#### **Commercial Storage and Processing**

Herr Foods, Inc. evaluated varieties on January 9<sup>th</sup> and March 20<sup>th</sup>, 2023 (Table 1 and 2). On the first processing date, the top four varieties for chip quality were Lamoka, Monroe, Bliss, and Snowden (Table 1). On the second processing date the top four varieties were the same four varieties in a different order: Monroe, Snowden, Bliss, and Lamoka (Table 2). Monroe had the highest specific gravity of 1.090 in January and MSAFB635-15 had the highest specific gravity of 1.095 in March. Bliss had the fewest total chip defects at both dates (Table 1 and 2).

Merit <sup>2</sup> Variety		Specific	SNAC	Perce	Percent Chip Defects <sup>4</sup>		<b>6</b>
wierit-	Variety	Gravity	Color <sup>3</sup>	Internal	External	Total	Comments
1	Lamoka	1.081	2	6.1%	16.3%	22.4%	Slight stem end, minor scab, 2 ¼ to 5 ¼ inches in size, larger tubers have oblong shape
2	Monroe	1.090	2	6.1%	18.9%	25.0%	Good internal color, nice skin, 2 ¼ to 4 inches in size
3	Bliss	1.079	1	2.8%	12.0%	14.8%	Minor scab and bruise, 2 to 3 inches in size
4	Snowden	1.084	1	6.4%	24.0%	30.4%	Good internal color, scab, 2 to 4 inches in size
5	MSW474-1	1.078	2	11.1%	9.1%	20.2%	Nice internal color, nice skin with minor bruising, good size of 1 7/8 to 3 ¼ inches
6	NY168	1.084	3	14.3%	41.8%	56.1%	Stem end defect, minor bruising, scab, and greening, 2 to 3 ¼ inches in size
7	MSAFB635-15	1.084	2	27.0%	20.2%	47.2%	Minor stem end, minor bruise and scab, 2 to 3 ½ inches in size
8	MSAFB609-12	1.080	3	15.5%	16.9%	32.4%	Minor bruise and scab, nice size of 1 ¾ to 3 ¼ inches
9	W15NYR11-13	1.072	2	7.7%	25.1%	32.8%	Minor color in vascular ring, fair amount of scab with minor greening, 2 to 3 ¾ inches in size
10	W15125-4	1.080	5	39.8%	40.3%	80.1%	Very severe internal color, drop from the program, severe scab, 2 ¼ to 4 ½ inches in size

<sup>&</sup>lt;sup>1</sup>Samples collected on January 7, 2023 and processed by Herr Foods, Inc., Nottingham, PA on January 9, 2023.

<sup>&</sup>lt;sup>2</sup>Merit: ranked by Herr Foods, Inc. 1 = highest chip quality, 10= lowest chip quality

<sup>&</sup>lt;sup>3</sup>SNAC Color: 1=lightest, 5=darkest

<sup>&</sup>lt;sup>4</sup>Percent Chip Defects: percentage based on weight of the total sample; comprised of undesirable color, greening, internal and external defects

Table 2	Table 2. 2022-2023 SNAC Variety Trial March 20, 2023 <sup>1</sup>						
Merit <sup>2</sup>	Variety	Specific	SNAC Color <sup>3</sup>	Perce	nt Chip Def		Comments
		Gravity	T	Internal	External	Total	33
1	Monroe	1.088	2.0	2.5%	8.9%	11.4%	Minor scab and greening, slight bruising, 2 to 4 inches in size
2	Snowden	1.088	3.0	3.3%	7.8%	11.1%	Scab and slight bruising, 1 ¾ to 3 ¾ inches in size
3	Bliss	1.084	2.0	0.0%	4.4%	4.4%	Very slight scab, 1 ½ to 3 inches in size
4	Lamoka	1.083	3.0	2.9%	14.6%	17.5%	Slight bruising and stem end defect, 2 to 3 ½ inches in size
5	MSAFB609-12	1.085	3.0	4.7%	12.5%	17.2%	Moderate vascular color, slight scab and stem end defect, 1 ½ to 3 inches in size
6	MSW474-1	1.083	3.0	11.2%	8.4%	19.6%	Moderate scab and bruising, 1 ½ to 4 ¼ inches in size
7	NY168	1.087	3.0	5.0%	25.7%	30.7%	Moderate scab, slight bruising, 1 ½ to 3 ¼ inches in size
8	MSAFB635-15	1.095	3.0	5.6%	7.8%	13.4%	Slight scab, 1 ½ to 3 ¼ inches in size, potatoes feel spongy, especially compared to other entries in this trial
9	W15NYR11-13	1.071	3.0	7.7%	24.4%	32.1%	Moderate internal color, slight greening and severe scab, 1 ½ to 3 ½ inches in size
10	W15125-4	1.087	4.0	35.7%	4.8%	40.5%	Too much internal color, deep scab pits, 2 to 3 ¾ inches in size

<sup>&</sup>lt;sup>1</sup>Samples collected from storage on March 18, 2023 and processed by Herr Foods, Inc., Nottingham, PA on March 20, 2023.

<sup>&</sup>lt;sup>2</sup>Merit: ranked by Herr Foods, Inc. 1 = highest chip quality, 10 = lowest chip quality

<sup>&</sup>lt;sup>3</sup>SNAC Color: 1 = lightest, 5 = darkest

<sup>&</sup>lt;sup>4</sup>Percent Chip Defects: percentage based on weight of the total sample; comprised of undesirable color, greening, internal and external defects

## **Demonstration Storage and Monthly Evaluations**

Below, Lamoka and Snowden are compared in the Techmark, Inc. assessments of each variety. These samples were stored at 48°F in the MPIC Demonstration Storage facility and evaluated monthly from October 2022 to June 2023. Two sample dates occurred in October, the 20<sup>th</sup> and 31<sup>st</sup>. The sample taken on the 31<sup>st</sup> is referred to as the November sample. The varieties are listed alphabetically with the check varieties last. For yield and raw tuber quality data at harvest, please see the 2022 field trial results.

#### **Conclusions:**

Based on the processing results from both commercial and demonstration storage, Monroe and Bliss appear to be the most promising lines for commercialization and full season storage. Herr's ranked Monroe 2<sup>nd</sup> in January with a specific gravity of 1.090, good internal color, and nice skin (Table 1). This variety moved into 1<sup>st</sup> place in March with a specific gravity of 1.088, with minor scab and slight bruising noted (Table 2). Bruise and slight stem end color were observed between November and January (Table 4). Glucose and sucrose concentrations were consistent with those of Lamoka (Figures 5 and 6). Chip defects were initially high like the check varieties, but decreased through February when chip quality was excellent (Figure 7). Monroe has long term, but not early season, storage potential through June in Michigan (Table 4).

Bliss was ranked 3<sup>rd</sup> at both Herr's evaluation. The size profile is slightly smaller than that of Monroe, 1 ½ to 3 inches in size. Slight scab was observed at both samples with a specific gravity of 1.079 in January and 1.084 in March (Tables 1 and 2). The glucose concentrations were lower than those of both checks until April, while the sucrose concentrations became consistent with those of Lamoka (Figures 1 and 2). Chip defects were high in November and December but were very low during the rest of storage (Figure 3). Bliss has long term and possibly mid-season storage potential in Michigan (Table 3).

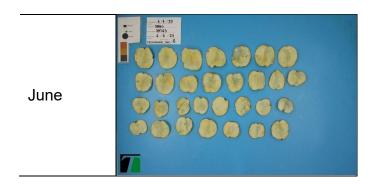
MSAFB609-12 is another promising chip selection that appeared to recondition in storage after unacceptable samples in November and December (Table 5). It was ranked 8<sup>th</sup> by Herr's in January but had a nice size profile and moved to 5<sup>th</sup> place in March (Tables 1 and 2). It appears more susceptible to discoloration due to bruising than Monroe and Bliss (Tables 5, 3, and 4). MSW474-1 displayed similar chemical profiles to MSAFB609-12 and appeared to recondition but had more persistent dark chips (Table 7).

NY168, W15125-4, W15NYR11-13, and MSABF635-15 do not have commercialization value in Michigan based on storage performance in the 2022-2023 season. While chip quality in most of these varieties improved over time, quality was inconsistent with multiple chip defects present (Tables 6,8,9 and 10).

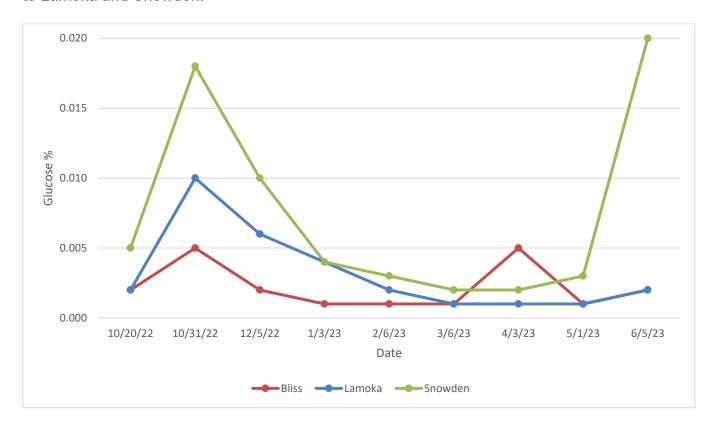
**Bliss:** This Cornell University variety (evaluated as NY163 but recently named) had stable glucose concentrations between 0.001% and 0.005% during storage (Figure 1). The sucrose concentrations were more variable, but roughly followed that of the checks with a U-shaped trend. The highest values occurred at the beginning and end of storage and were lowest in March (Figure 2). Chip defects were also variable, with the highest defect incidence in November of 52.9%. All other samples had 26% defects or less. The final sample in June had all acceptable chips (Figure 3). The SNAC chip color was 1.0 for the duration of storage (Figure 4). Bliss was ranked third in both the November and March Herr's evaluation and continues to display good processing quality (Tables 1 and 2).

**Table 3.** Bliss monthly chip quality pictures from Techmark Inc. Month

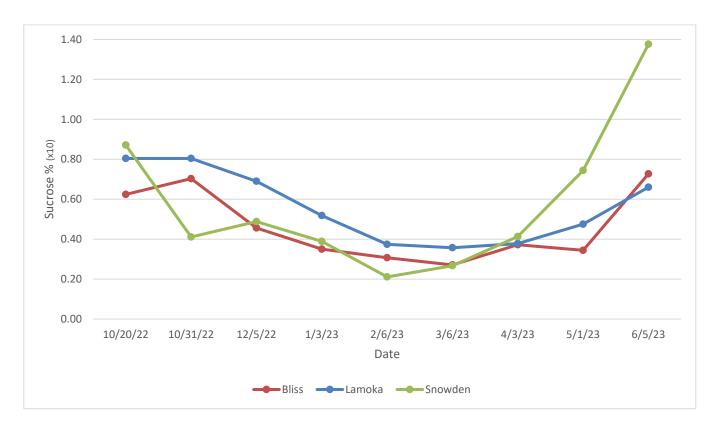
MOHILI			
October		February	
November	11 22 - 11 22 - 11 23 - 11 24 - 11 25	March	2 14 23 24 23 24 24 24 24 24 24 24 24 24 24 24 24 24
December		April	
January	SMC	May	1



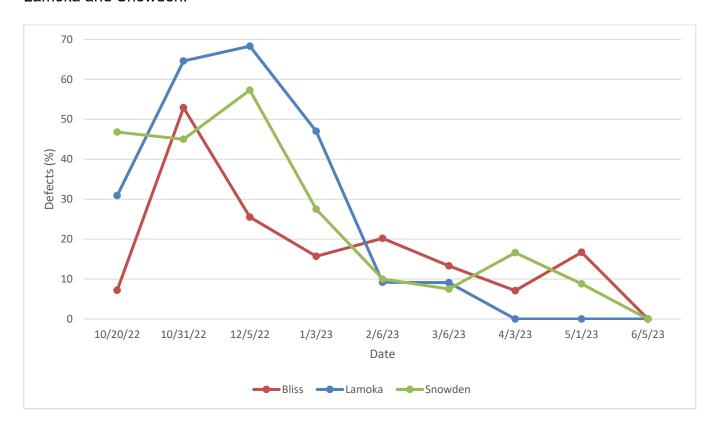
**Figure 1.** Bliss glucose concentrations for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



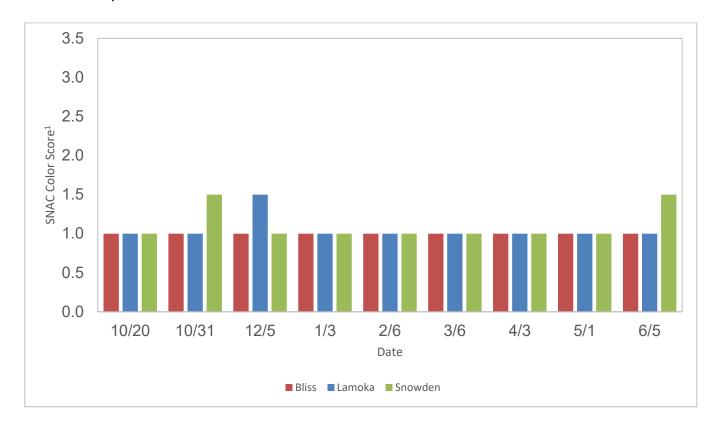
**Figure 2.** Bliss sucrose concentrations for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



**Figure 3.** Bliss percent defects for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



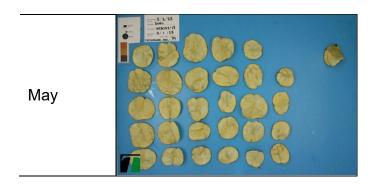
**Figure 4.** Bliss SNAC Color Score (1 = lightest, 5 = darkest) the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



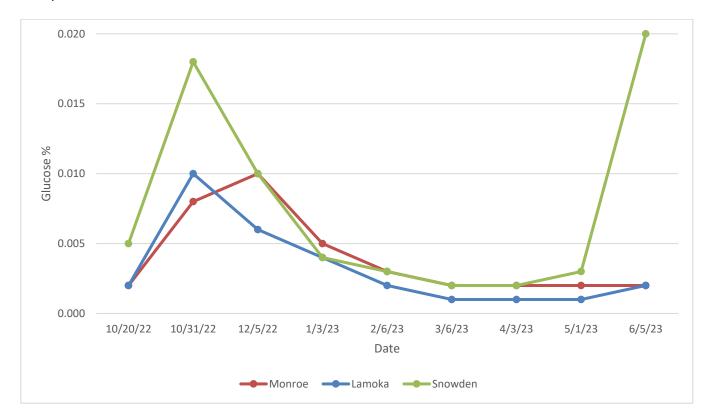
**Monroe:** This Michigan State University variety had rising glucose through December and then decreasing values through June (Figure 5). The sucrose concentrations followed a similar trend to the check varieties, with decreasing concentrations through March, and then a slight increasing trend through June (Figure 6). Monroe had the highest incidence of chip defects from November to January, all over 30%. Chip quality greatly improved beginning in February, with no defects observed excluding the May sample with 4.1% chip defects (Figure 7). SNAC color was rated at 1.0, except for the November sample with a SNAC color of 1.5 (Figure 8). Herr's ranked Monroe second in November and first in March, noting good internal color, low chip defects, and a 2-to-4-inch size profile (Tables 1 and 2).

**Table 4.** Monroe monthly chip quality pictures from Techmark Inc. Month

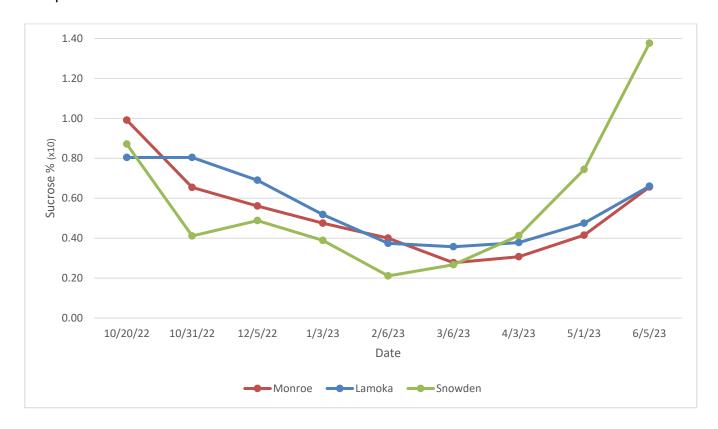
MOHUI			
October	To the state of th	January	1   1   1   2   2   2   2   2   2   2
November	- B.T. 12 - B.T.	February	1 1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/
December	TO STATE OF THE ST	March	- 10 kg - 10 k
April		June	



**Figure 5.** Monroe glucose concentrations for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



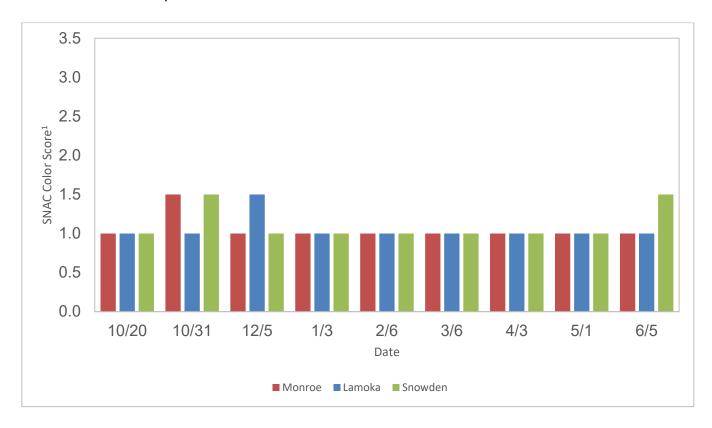
**Figure 6.** Monroe sucrose concentrations for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



**Figure 7.** Monroe percent defects for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



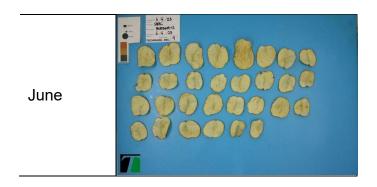
**Figure 8.** Monroe SNAC Color Score (1 = lightest, 5 = darkest) the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



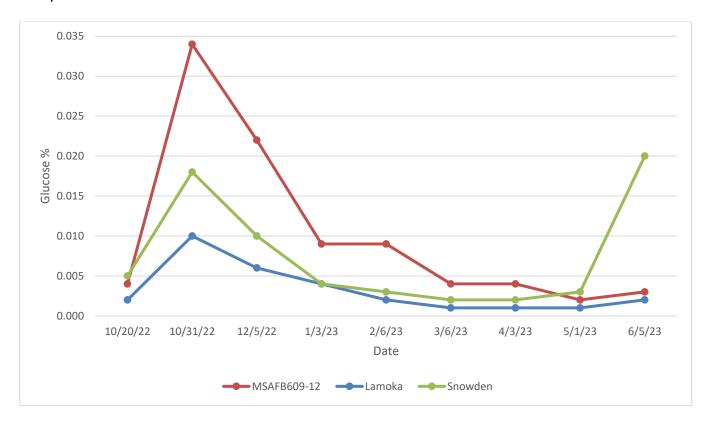
MSAFB609-12: This variety had a very high glucose concentration in November, which then decreased in all subsequent samples (Figure 9). This is reflected in the higher defect incidence in November and December, with many brown chips (Figure 11). Sucrose concentrations were more typical, and were consistent with those of Snowden through April, ending like those of Lamoka in May and June (Figure 10). Chip quality improved during storage, with the final sample containing only acceptable chips (Figure 11). Techmark, Inc. noted bruise, hollow heart, and slight stem color as the cause of chip defects. The SNAC Color Score was 1.5 in the November and December samples but was 1.0 at all other samples (Figure 12). MSAFB609-12 appears to recondition during storage, but chip quality was not acceptable in November and December (Table 5).

**Table 5.** MSAFB609-12 monthly chip quality pictures from Techmark Inc. Month

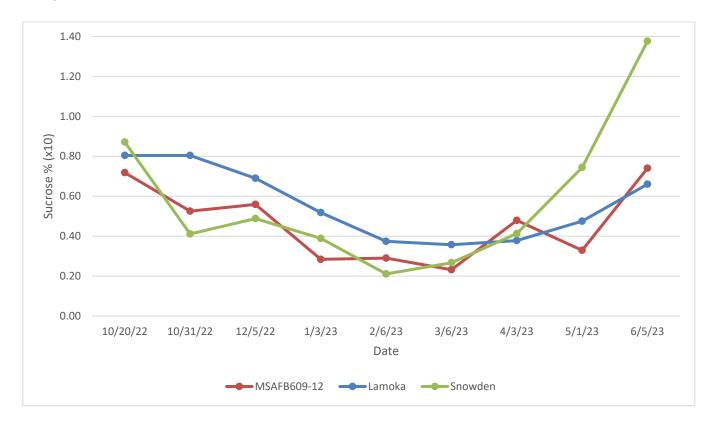
October		February	1
November	1	March	
December		April	10 10 10 10 10 10 10 10 10 10 10 10 10 1
January	-1 ( 2 2 3	May	



**Figure 9.** MSAFB609-12 glucose concentrations for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



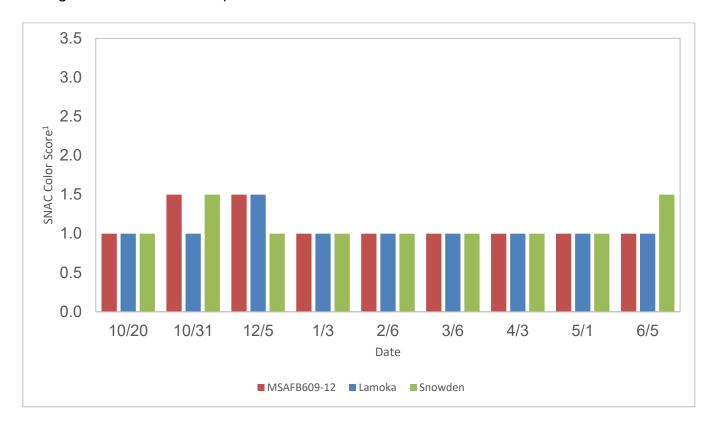
**Figure 10.** MSAFB609-12 sucrose concentrations for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



**Figure 11.** MSAFB609-12 percent defects for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



**Figure 12.** MSAFB609-12 SNAC Color Score (1 = lightest, 5 = darkest) the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.

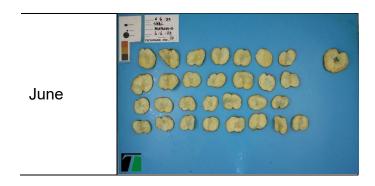


<sup>1</sup>SNAC Color score is rated on a five-point scale with 1 = lightest and 5 = darkest. Scores of two or less are acceptable.

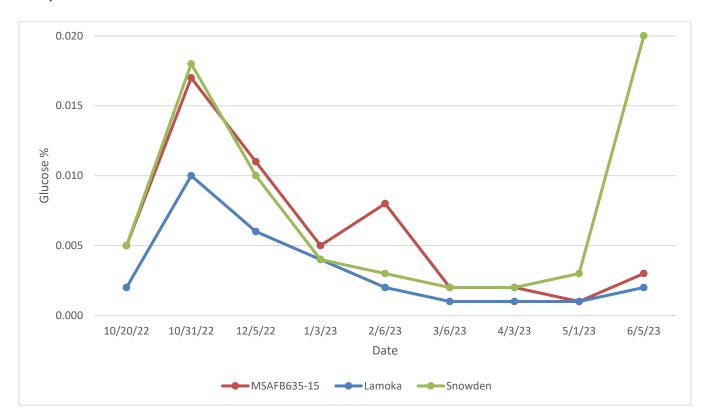
MSAFB635-15: Like Snowden, this University of Maine variety had glucose concentrations that rose sharply in November, but then generally decreased through May. The glucose concentration ended like that of Lamoka at 0.003 % (Figure 13). The sucrose concentrations were more variable but were lowest in February and March and highest at the beginning and end of storage (Figure 14). MSABF635-15 had high chip defects between 40% and 85% from October to February. Chip quality then improved, ending at 6.5% defects in June (Figure 15). Chip color was rated 1.5 in three samples, all before March (Figure 16). While MSAFB615-15 has long term storage potential, variable chip quality in November, December, and February presents a challenge for mid-season shipping (Table 6).

**Table 6.** MSAFB635-15 monthly chip quality pictures from Techmark Inc. Month

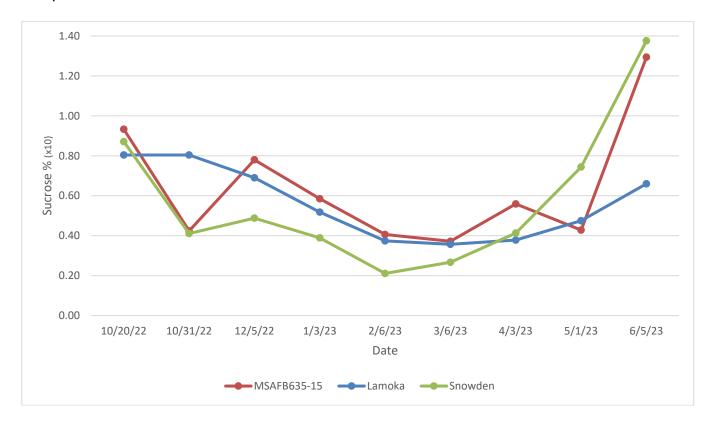
Month			
October		February	SUPPLIES OF THE SUPPLIES OF TH
November	### SAFE	March	100 100 100 100 100 100 100 100 100 100
December	ANAMASIST CONTROL OF C	April	I SHANDA
January	I I I I I I I I I I I I I I I I I I I	Мау	- 5: 1: 23 - 5: 35: 25 - 5: 55: 25 - 5



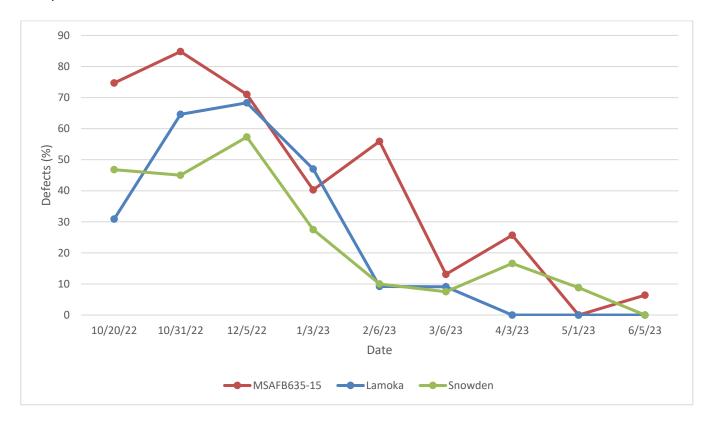
**Figure 13.** MSAFB635-15 glucose concentrations for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



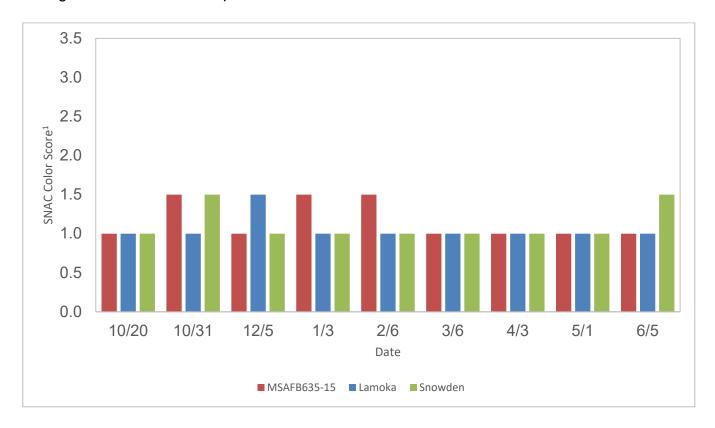
**Figure 14.** MSAFB635-15 sucrose concentrations for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



**Figure 15.** MSAFB635-15 percent defects for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



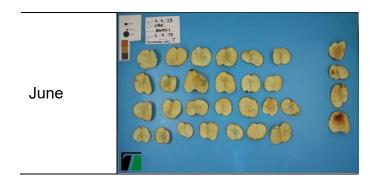
**Figure 16**. MSAFB635-15 SNAC color score (1 = lightest, 5 = darkest) the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



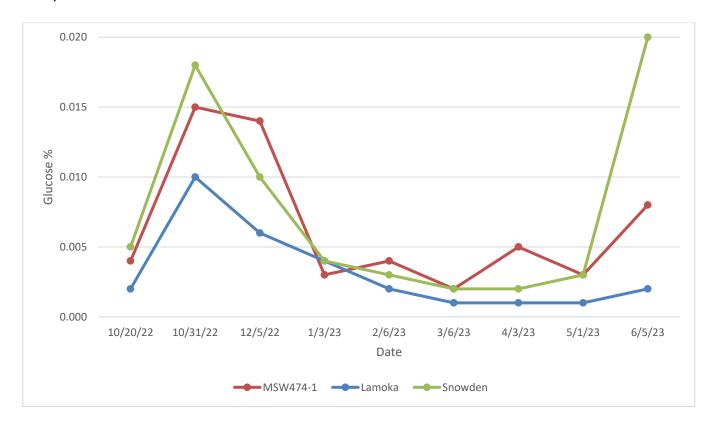
**MSW474-1:** This variety had elevated glucose concentration in November and December, which then decreased through May and rose slightly in June (Figure 17). Despite the elevated glucose, the sucrose concentrations were consistent with those of Lamoka and Snowden, ending at 0.910% (x 10), between the two checks (Figure 18). Chip defects were initially high, especially the November sample with 87.5% defects. However, defects decreased with each sample, ending at a low of 13.6% (Figure 19). The chip color was 1.0 for most of storage, excluding November, December, and June when the color was 1.5 (Figure 20). Techmark, Inc. noted dark chips and stem end color in samples with higher chip defects (Table 7). While chip quality improved, each month, this variety is not suitable for early-season processing.

**Table 7.** MSW474-1 monthly chip quality pictures from Techmark Inc. Month

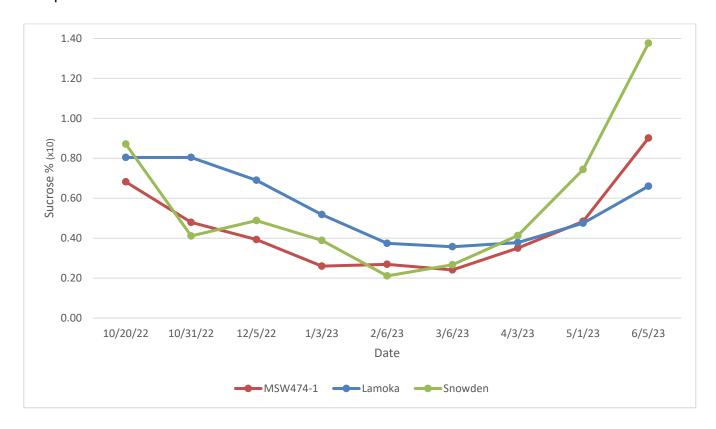
Wichitii			
October	10 10 10 10 10 10 10 10 10 10 10 10 10 1	February	10 10 10 10 10 10 10 10 10 10 10 10 10 1
November		March	5.5 kg. 1
December	### 410 TS	April	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
January	1,1,2,3 	May	### ### ##############################



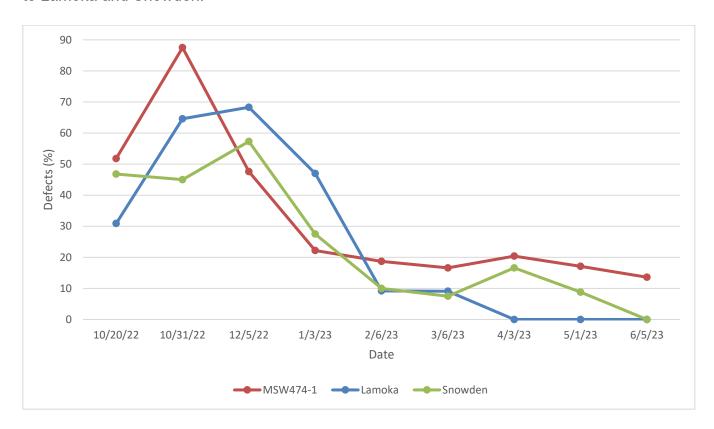
**Figure 17.** MSW474-1 glucose concentrations for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



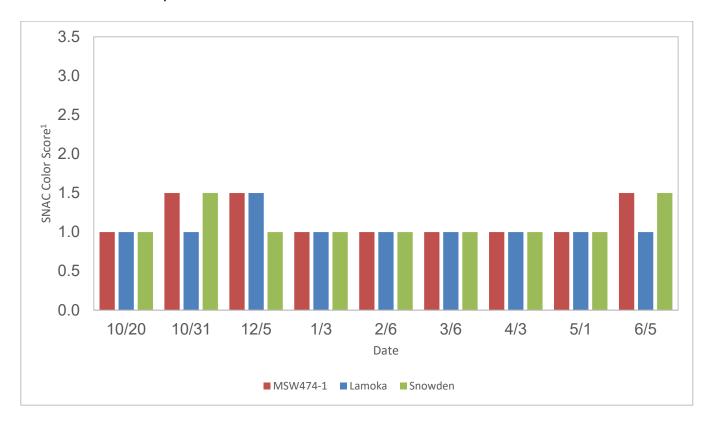
**Figure 18.** MSW474-1 sucrose concentrations for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



**Figure 19.** MSW474-1 percent defects for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



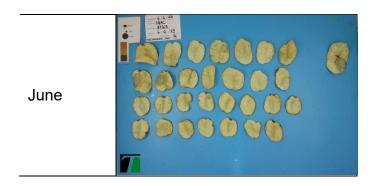
**Figure 20**. MSW474-1 SNAC Color Score (1 = lightest, 5 = darkest) the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



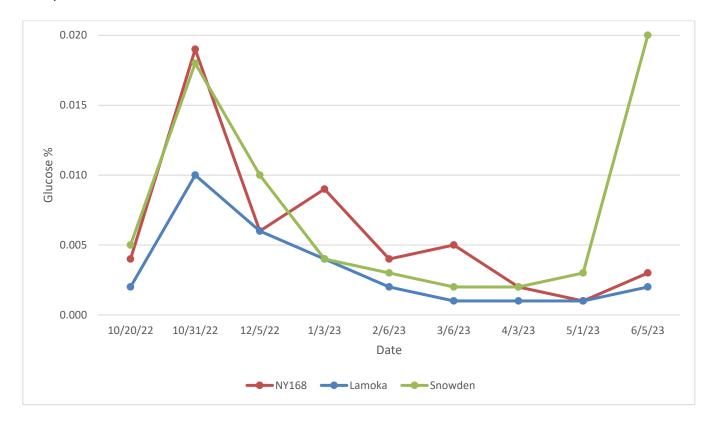
**NY168:** Like Snowden, NY168 had a glucose concentration that rose sharply at the November sample and then decreased during storage. Unlike Snowden, it did not end with an elevated glucose concentration, but mirrored both MSAF lines and MSW474-1(Figure 21). The sucrose concentrations were also like those three lines and followed the typical U-shaped trend (Figure 22). Chip defects were higher than in other lines in the SNAC trial, with all samples containing over 47% defects from October to April. The final two chip samples had defects below 10% (Figure 23). Despite the high defect incidence, only three samples had a SNAC score of 1.5, the rest had a score of 1.0 (Figure 24). Techmark Inc. noted high stem end color in most samples. The high incidence of this defect will likely limit commercialization potential in Michigan (Table 8).

**Table 8.** NY168 monthly chip quality pictures from Techmark Inc. Month

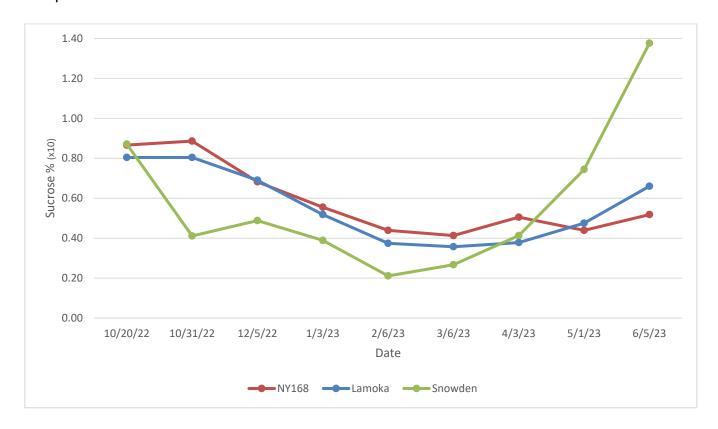
Wioritar			
October		February	
November		March	SMEAN MEAN MARKET MARKE
December	### ##################################	April	
January	-   1   2   2   2   2   2   2   2   2   2	May	



**Figure 21.** NY168 glucose concentrations for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



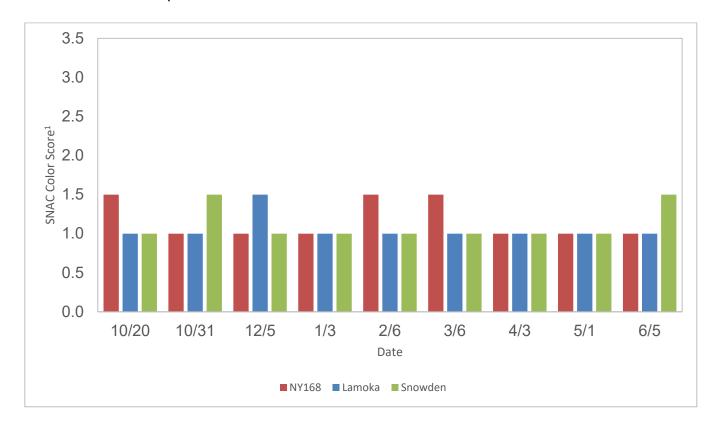
**Figure 22.** NY168 sucrose concentrations for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



**Figure 23.** NY168 percent defects for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



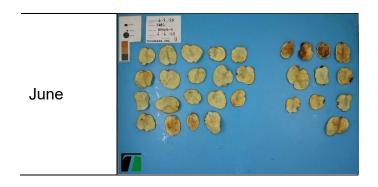
**Figure 24.** NY168 SNAC Color Score (1 = lightest, 5 = darkest) the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



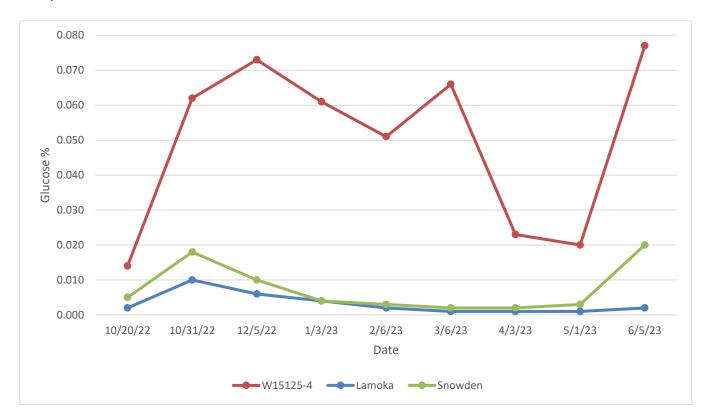
**W15125-4:** Glucose concentrations in this variety were consistently elevated during storage and were always higher than those of the checks (Figure 25). The sucrose concentrations were more typical and mirrored that of the checks. From January to June, sucrose concentrations (x10) were lower than those of the checks but followed a similar trend of increasing slightly (Figure 26). Chip quality in W15125-4 was poor. Six of the nine samples had defects above 70%, and the remaining samples had defects over 30% (Figure 27, Table 9). Chip color was also darker than average, with five samples rated 2.0 or higher (Figure 28). This variety does not have commercialization potential in Michigan for storage chipping (Table 9).

**Table 9.** W15125-4 monthly chip quality pictures from Techmark Inc. Month

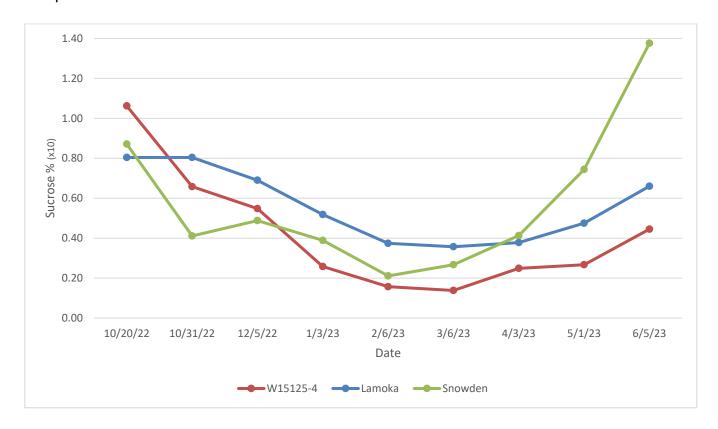
Wioridi			
October	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	February	- 5 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
November		March	1 1 5 2 1 5
December	A CAN CONTROL OF THE PROPERTY	April	
January	L L V 23	May	-9-5/3-3 -9-9/3-3 -9-



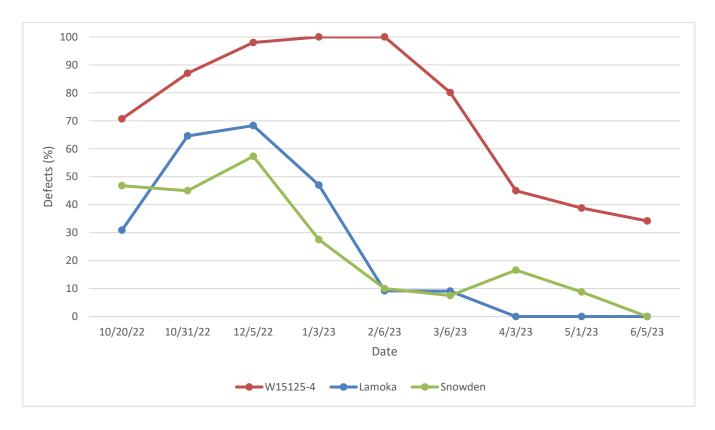
**Figure 25.** W15125-4 glucose concentrations for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



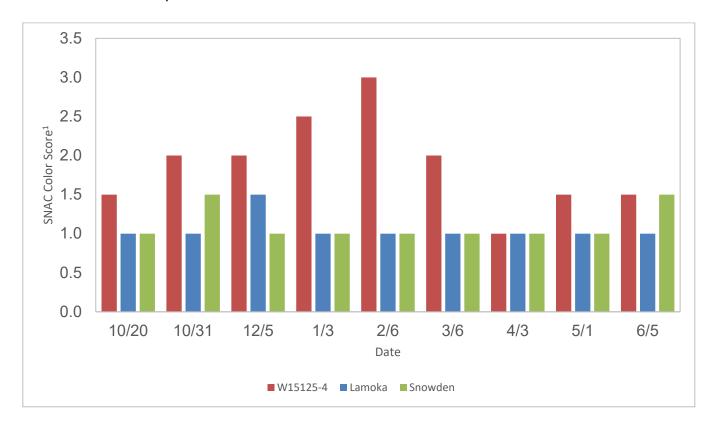
**Figure 26.** W15125-4 sucrose concentrations for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



**Figure 27.** W15125-4 percent defects for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



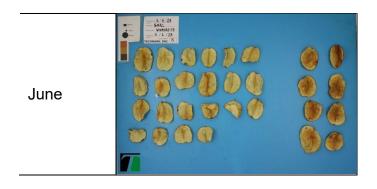
**Figure 28.** W15125-4 SNAC Color Score (1 = lightest, 5 = darkest) the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



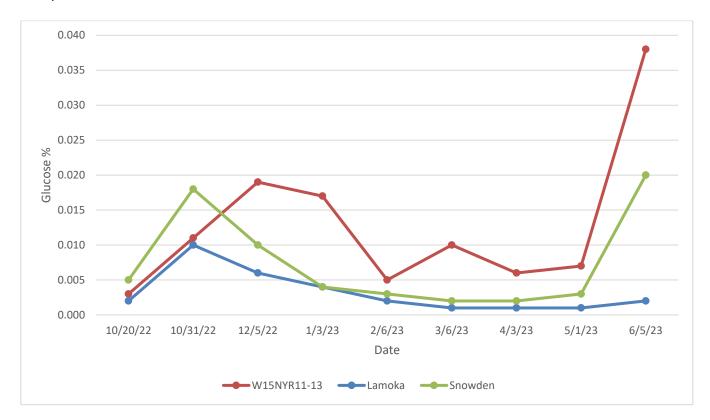
**W15NYR11-13:** Glucose concentrations for this variety were variable during storage. Concentrations were highest at the end of storage (0.038%) and in December (0.019%) (Figure 29). The sucrose concentrations more closely mirrored the checks by decreasing from October to March, then rising through June (Figure 30). Chip quality in W15NYR11-13 was variable but generally poor. Samples in February and May had the lowest defect incidence, 7% and 8.8% respectively. All other samples had defects over 28% (Figure 31, Table 9). Chip color was rated 1.5 between November and January, with the final June rating of 2.0 (Figure 32). W15NYR11-13 displayed stem end defect, dark chips, and bruising. (Table 9).

**Table 10.** W15NYR11-13 monthly chip quality pictures from Techmark Inc. Month

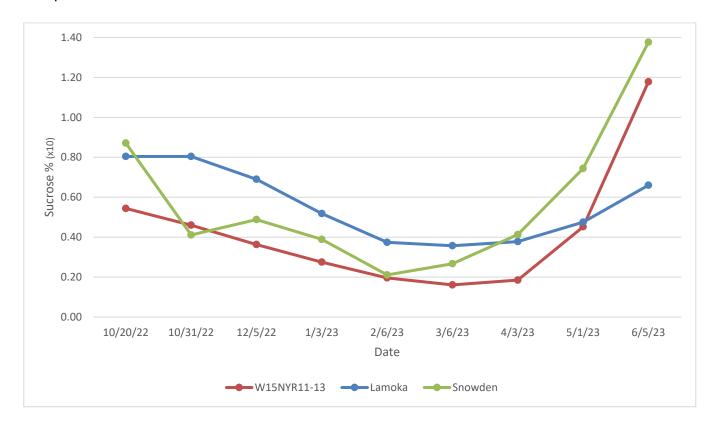
Wioridi			
October		February	- 2 2 - 23 - 23 - 23 - 23 - 23 - 23 - 2
November		March	1 16 17 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
December	TOTAL	April	10 12 12 12 12 12 12 12 12 12 12 12 12 12
January	1 1 1 2 3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	May	



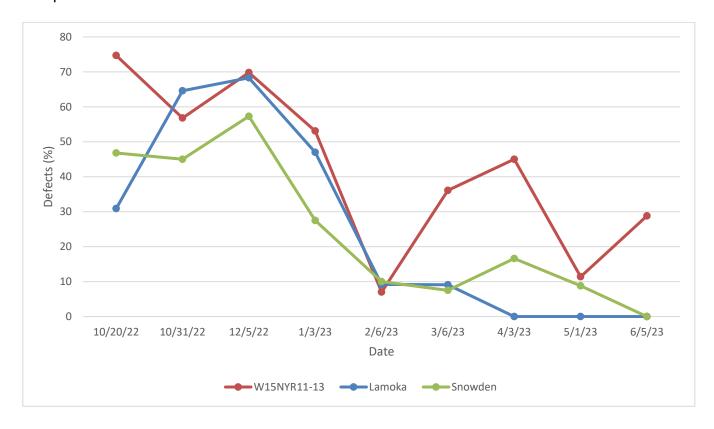
**Figure 29.** W15NYR11-13 glucose concentrations for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



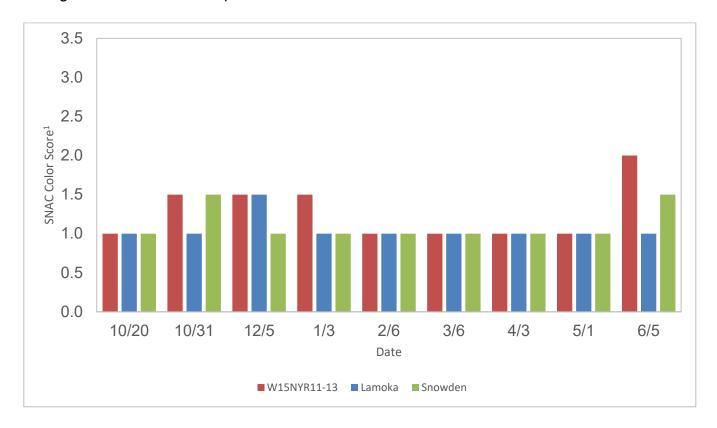
**Figure 30.** W15NYR11-13 sucrose concentrations for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



**Figure 31.** W15NYR11-13 percent defects for the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



**Figure 32.** W15NYR11-13 SNAC Color Score (1 = lightest, 5 = darkest) the 2022-2023 storage season at 48°F compared to Lamoka and Snowden.



**Lamoka:** This check variety can store through May or June with good chip quality. See individual varieties for comparisons on sugar, defects, and SNAC color scores.

**Table 11.** Lamoka monthly chip quality pictures from Techmark Inc. Month

October		February	
November	- 1/1 / 22	March	= 3.4 / 2
December	Section 1 Sectio	April	10 10 10 10 10 10 10 10 10 10 10 10 10 1
January		May	- 5 / 3 / 3 / 3 / 5   5 / 1 /



**Snowden:** This check variety can store through May or June with good chip quality. See individual varieties for comparisons on sugar, defects, and SNAC color scores.

**Table 12.** Snowden monthly chip quality pictures from Techmark Inc. Month

October	### ### #### #########################	February	1
November		March	Solicity Sol
December		April	Service of the servic
January	1/4 2/3 1/4 2/	May	5 (3 (3) (3) (3) (3) (3) (3) (3) (3) (3)

