2021-2022 Michigan Regional Trial
Potatoes USA / SNAC International Storage Chip Quality

Michigan State University Montcalm Research Center
MPIC Demonstration Storage

Investigators: Chris Long, Potato Extension Specialist, longch@msu.edu
Trina VanAtta, Research Assistant, tvanatta@msu.edu
Damen Kurzer, Research Technician, kurzerda@msu.edu

Objective: To assess the storability of seven 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 17, 2021 at 10" within row spacing and 34" between row spacing. Vine kill occurred on September 8, 2021. We harvested the potatoes on October 13, 2021 (3274 GDD_{40} 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 25 and April 4, 2022. The pile temperature before processing was 49ºF in January and 51ºF April.

Demonstration Storage and Monthly Evaluations
Nine samples of 30 tubers per variety were stored at the Michigan Potato Industry Commission's (MPIC) Cargill Potato Demonstrations Storage Facility in Bulk Bin 4. The sample bags from each of the nine varieties were stored at approximately 48ºF for monthly evaluations from October 2021 through June 2022. Techmark, Inc. processed these MPIC samples for sucrose and glucose values (percent of fresh weight), SNAC color score, and undesirable chip color rating. Undesirable chip color rating is scored as a percentage by weight of the total chips evaluated.

Results:

Commercial Storage and Processing
Herr Foods, Inc. evaluated varieties on January 25th and April 4th, 2022 (Table 1 and 2). On the first processing date, the top four varieties for chip quality were W12078-76, Lamoka, MSZ242-13, and NY163. (Table 1). On the second processing date, the top four varieties were Snowden, W12078-67, Lamoka, and NY165 (Table 2). MSZ242-13 had the highest specific gravity at both dates with 1.100 and 1.098 in January and April, respectively. W12078-76 had the fewest chip defects in January while Snowden had the fewest defects in April (Table 1 and 2).

Table 1. 2022 SNAC Variety Trial January 25, 2022[1]

Merit[2]	Variety	Specific Gravity	SNAC Color[3]	Percent Chip Defects[4]			Comments
				Internal	External	Total	
1	W12078-76	1.087	2.0	3.4%	1.0%	4.4%	Scab, greening, 1 ¾ to 3 ½ inches in size
2	Lamoka	1.080	2.0	9.1%	2.8%	11.9%	1 ¾ to 4 ½ inches in size
3	MSZ242-13	1.100	2.0	9.9%	12.9%	22.8%	Greening and bruising, 2 to 3 ½ inches in size
4	NY163	1.090	2.5	6.1%	8.9%	15.0%	Bruising, 2 to 3 ½ inches in size
5	MSAFB605-4	1.076	2.5	12.6%	7.5%	20.1%	Bruising, 1 ½ to 3 ¼ inches in size
6	MSW474-1	1.086	2.5	13.0%	12.6%	25.6%	Bruising, 1 ⅞ to 3 inches in size
7	Snowden	1.085	2.0	4.4%	5.4%	9.8%	Minor greening, scab, 1 ¾ to 3 ¾ inches in size
8	NY165	1.081	3.0	29.1%	8.5%	37.6%	Brusing, scab, stem end defect, 2 ¼ to 5 ½ inches in size
9	NYOR14Q9-9	1.074	4.0	49.3%	4.7%	54.0%	A lot of internal color, mechanical damage, scab, 3 to 5 ½ inches in size

[1]Samples collected on January 22, 2022 and processed by Herr Foods, Inc., Nottingham, PA on January 25, 2022.

[2]Merit: ranked by Herr Foods, Inc. 1 = highest chip quality, 9= lowest chip quality

[3]SNAC Color: 1=lightest, 5=darkest

[4]Percent Chip Defects: percentage based on weight of the total sample; comprised of undesirable color, greening, internal and external defects

Table 2. 2022 SNAC Variety Trial April 4, 2022[1]							
Merit[2]	Variety	Specific Gravity	SNAC Color[3]	Percent Chip Defects[4]			Comments
				Internal	External	Total	
1	Snowden	1.078	2.0	0.0%	4.7%	4.7%	Scab, 1 ⅞ to 4 ¼ inches in size
2	W12078-76	1.084	2.0	0.0%	13.3%	13.3%	Minor scab, 2 to 3 ¾ inches in size
3	Lamoka	1.076	2.0	5.8%	2.2%	8.0%	Minor internal defects, minor greening, 2 ½ to 4 ½ inches in size
4	NY165	1.078	3.0	2.2%	3.4%	5.6%	Slight bruising, 2 to 5 inches in size
5	MSZ242-13	1.098	3.0	7.8%	1.8%	9.6%	Slight bruising, 2 to 4 ½ inches in size
6	NY163	1.089	2.0	1.2%	6.1%	7.3%	1 ⅞ to 3 inches in size
7	MSW474-1	1.080	3.0	14.9%	9.5%	24.4%	Minor internal color, bruising, 2 to 4 inches in size
8	NYOR14Q9-9	1.085	3.0	19.3%	6.8%	26.1%	Internal color, bruising, 2 ½ to 4 ¾ inches in size
9	MSAFB605-4	1.078	3.0	27.2%	6.5%	33.7%	Internal color, bruising, 2 ½ to 3 ¾ inches in size

[1]Samples collected from storage on April 2, 2022 and processed by Herr Foods, Inc., Nottingham, PA on April 4, 2022.

[2]Merit: ranked by Herr Foods, Inc. 1 = highest chip quality, 9 = lowest chip quality

[3]SNAC Color: 1 = lightest, 5 = darkest

[4]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 48ºF in the MPIC Demonstration Storage facility and evaluated monthly from October 2021 to June 2022. The varieties are listed alphabetically with the check varieties last. For yield and raw tuber quality data at harvest, please see the 2021 field trial results.

Conclusions:

Based on the processing results from both commercial and demonstration storage, W12078-76, MSZ242-13, and NY163 appear to be the most promising lines for commercialization and full season storage. Herr's ranked W12078-76 1st in January with a specific gravity of 1.087 and some scab and greening on the chips (Table 1). This variety moved into 2nd place in April with a specific gravity of 1.084, with minor scab noted (Table 2). Internal browning was observed in June (Table 9). Glucose and sucrose concentrations were consistent with those of Snowden, especially mirroring the check variety with a steep increase in both from the May to June samples (Figures 25 and 26). Chip defects were lower than those of Lamoka and Snowden in all but the last sample (Figure 27). W12078-67 has storage potential through May in Michigan (Table 9). MSZ242-13 was ranked 3rd by Herr's in January with a very high specific gravity of 1.100 and 22.8% total defects (Table 1). In April it was ranked 5th, with a specific gravity of 1.098 and 9.6% total defects. Bruising was observed in both samples (Tables 1 and 2). MSZ242-13 displayed glucose and sucrose concentrations consistent with those of Lamoka during storage (Figures 9 and 10). Total defects were generally low, with defect incidence below at least one of the check varieties through June (Figure 11). NY163 was ranked 4th in January with a high specific gravity of 1.090 and 15.0% chip defects (Table 1). In April it was ranked 6th with a specific gravity of 1.089 and 7.3% chip defects (Table 2). Bruising was noted at the first sample date (Table 1). Sucrose and glucose concentrations were consistent with those of the checks, and chip quality was good through June with chip defects below 35.0% during storage (Figures 13, 14, and 15).

Other varieties have good chip quality during part of the storage season but did not demonstrate full season storage potential in 2021-2022. MSW474-1 had acceptable chip quality though February, but then displayed stem end defects and internal browning (Table 4). NY165 and NYOR14Q9-9 had full season storage potential though June, but required cleanup during storage and had marginal chip quality before May (Tables 7 and 8). MSAFB605-4 appeared susceptible to senescence sweetening (Table 3).

MSAFB605-4: This variety had a slightly elevated glucose profile compared to both Lamoka and Snowden, with glucose concentrations especially high between December and March (Figure 1). Conversely, sucrose concentration were lower than those of the checks during storage, although concentrations rose slightly beginning in April (Figure 2). MSAFB605-4 had defect incidence above 25% from the beginning of storage though March. Chip quality improved from April to the end of storage with defect incidence below 15% in these samples (Figure 3). Techmark Inc. noted bruise, hollow heart, and slight stem color as the cause of chip defects. The SNAC Color Score was 1.0 for all chip samples (Figure 4). MSAFB605-4 appears to recondition during storage, but chip quality was not acceptable in the middle of storage, especially from January to March (Table 3).

Table 3. MSAFB605-4 monthly chip quality pictures from Techmark Inc.

Month		Month	
October		February	
November		March	
December		April	
January		May	

June	

Figure 1. MSAFB605-4 glucose concentrations for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

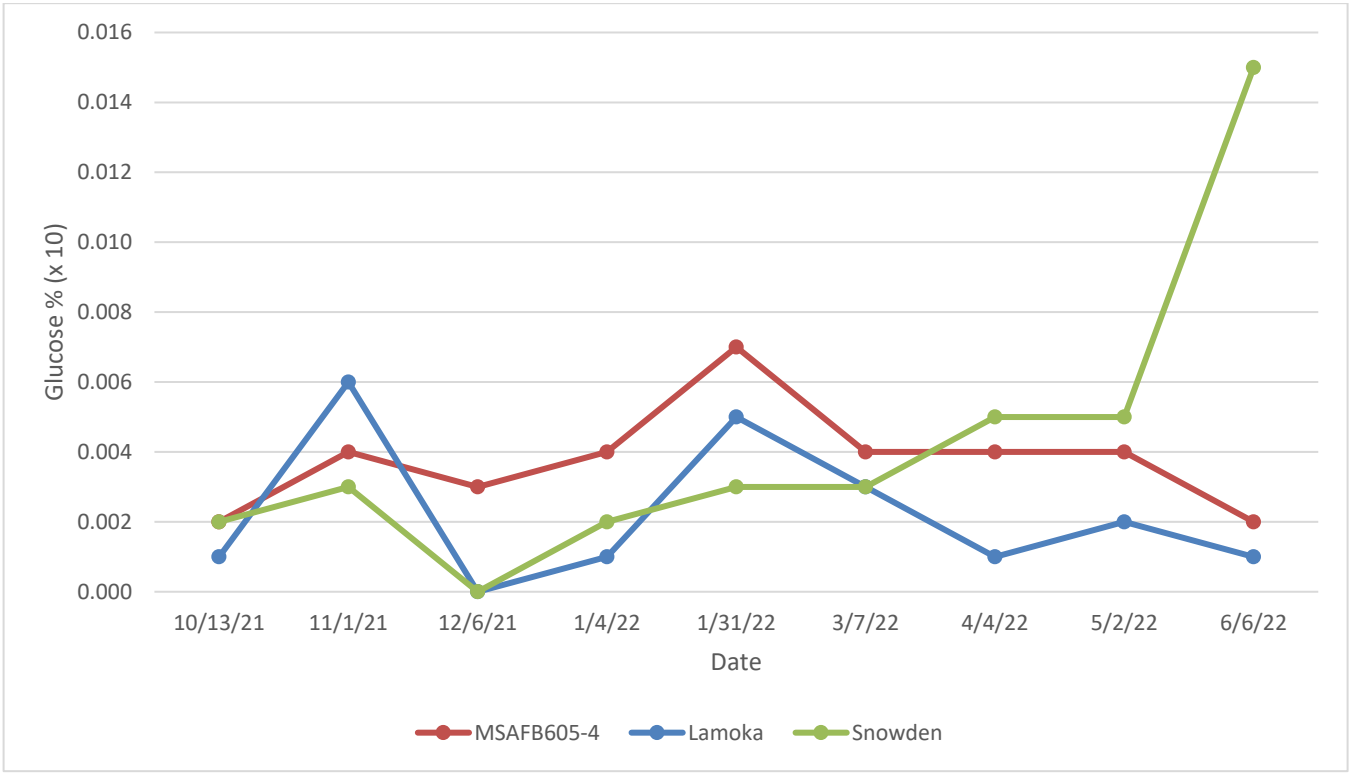


Figure 2. MSAFB605-4 sucrose concentrations for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

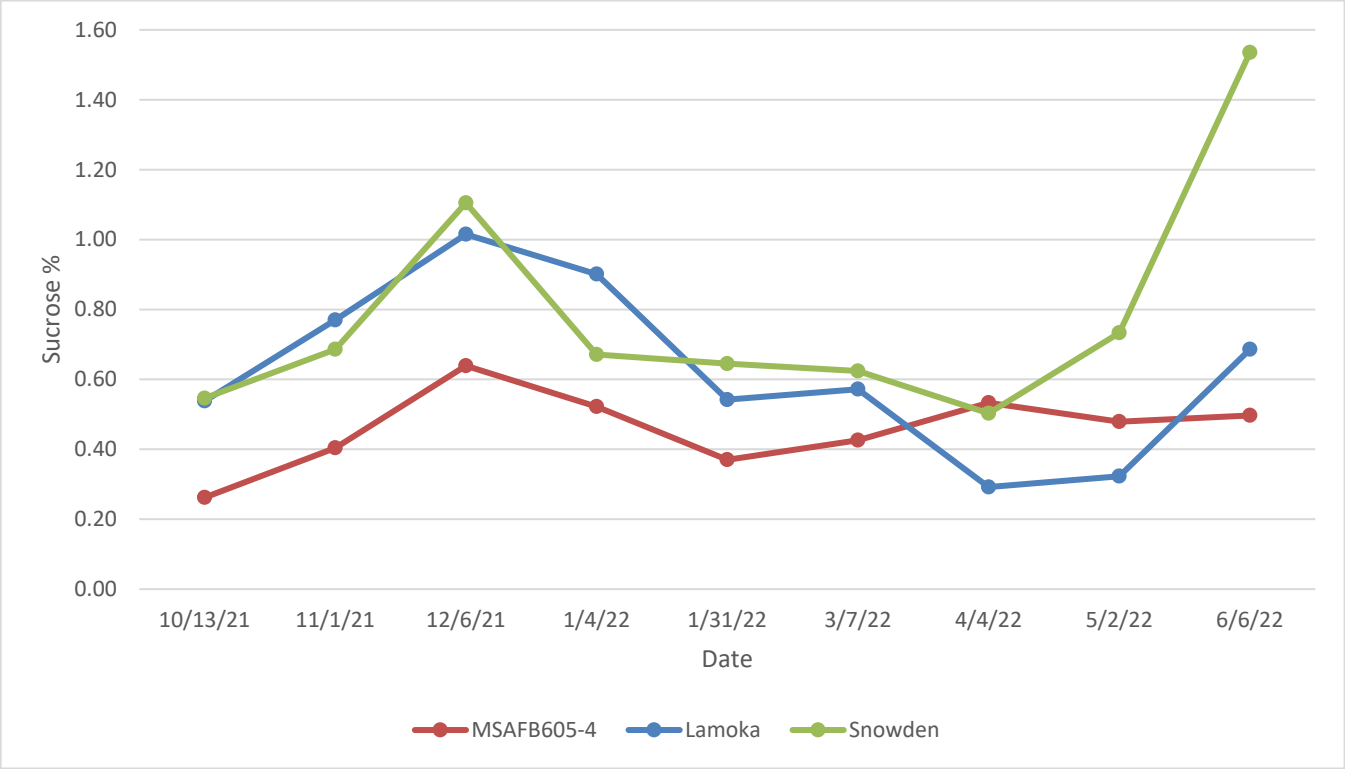


Figure 3. MSAFB605-4 percent defects for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

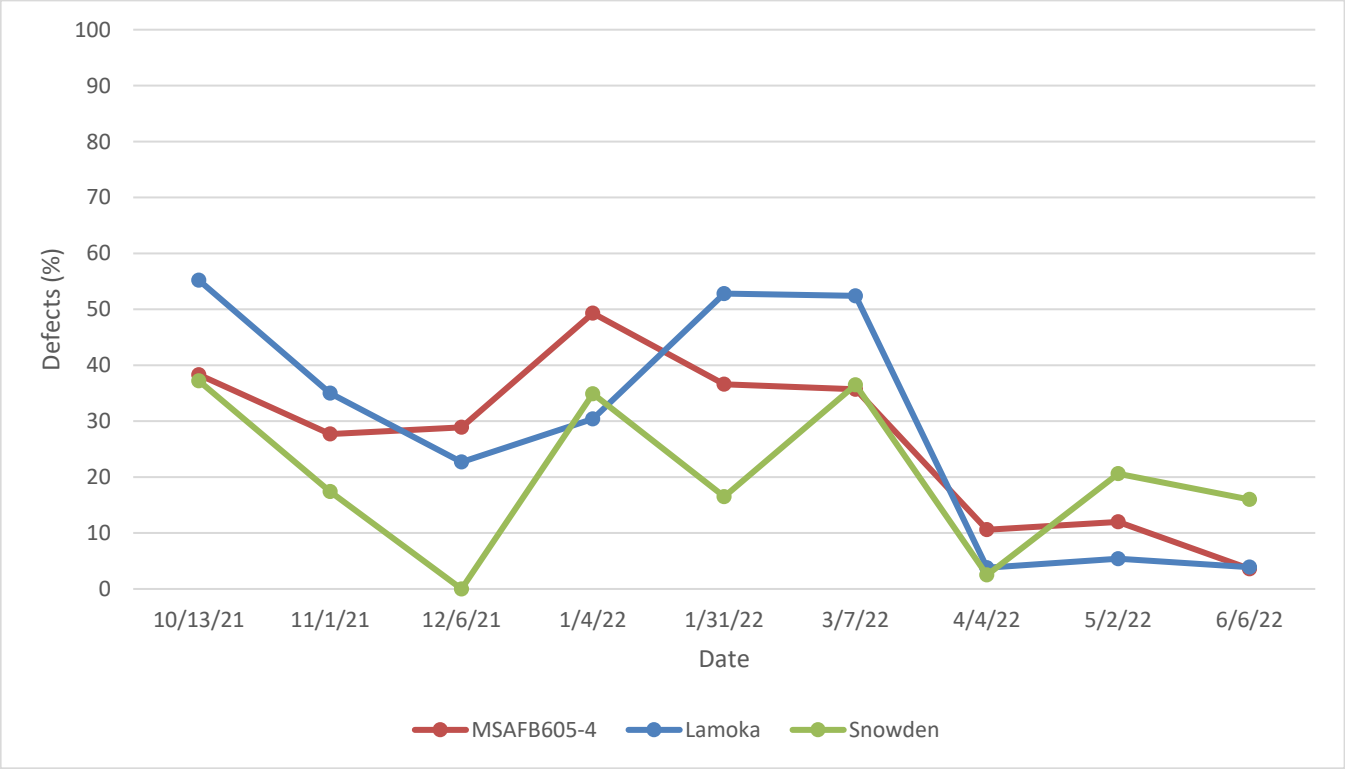
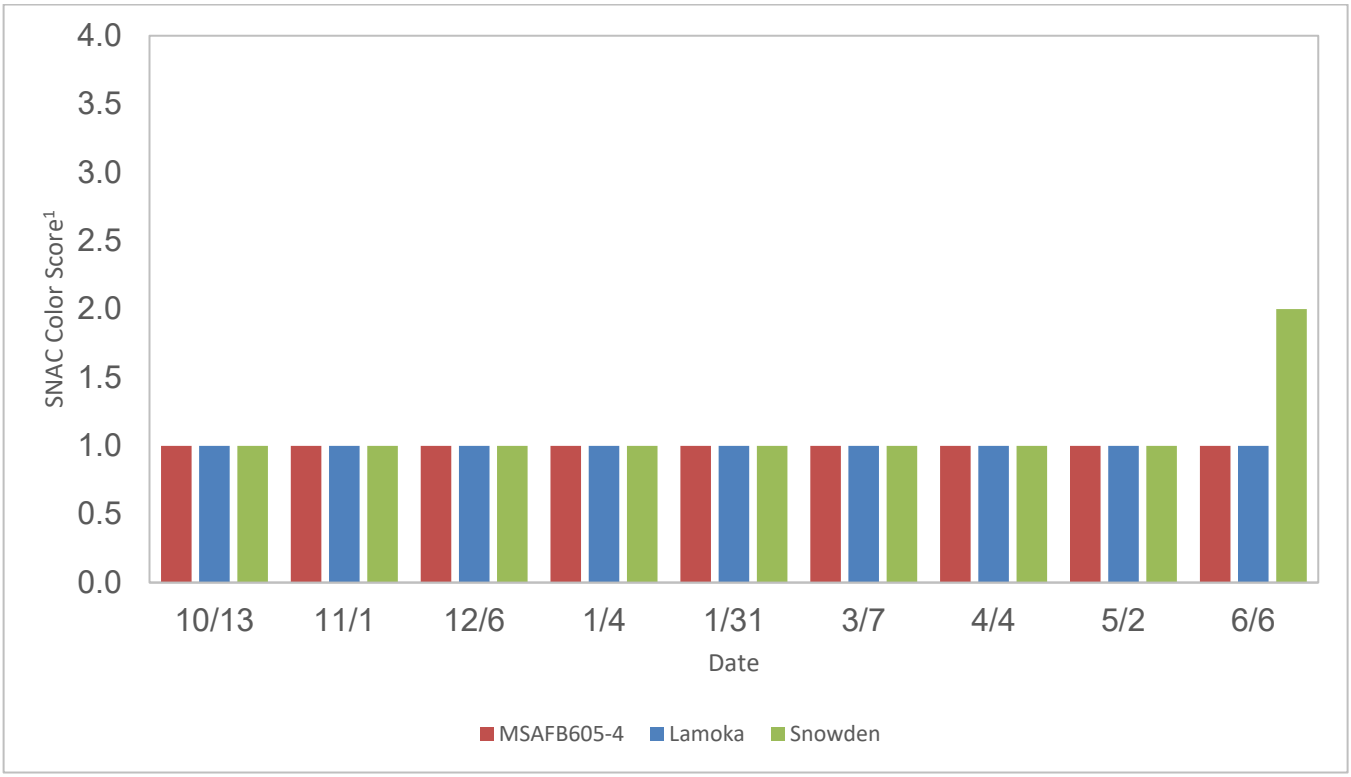


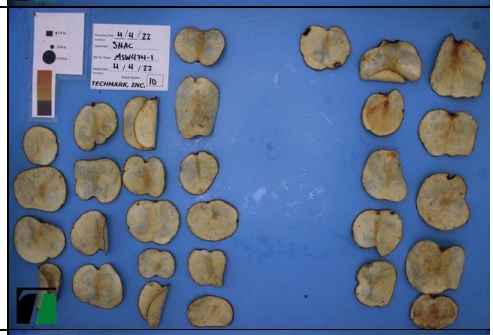
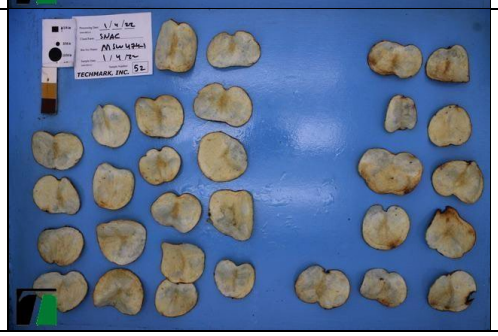
Figure 4. MSAFB605-4 SNAC Color Score (1 = lightest, 5 = darkest) the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.



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

MSW474-1: This Michigan State University variety had elevated glucose levels for most of storage, especially in February, March, and April. Glucose concentrations decreased in May, but then rose in June, ending almost identically to that of Snowden (Figure 5). The sucrose concentrations were slightly lower than those of Lamoka and Snowden until February, after which they rose gradually and ended at 1.144% (x 10), between the two checks (Figure 6). MSW474-1 had chip defects between 20% and 64% at all samples. The most chip defects were observed in the March sample, which were moderate stem end defect and bruising (Figure 7). Chip color was consistently rated 1.0 during storage, excluding the last sample where it rose to 1.5 (Figure 8).

Table 4. MSW474-1 monthly chip quality pictures from Techmark Inc.

Month		Month	
October		February	
November		March	
December		April	
January		May	

June	

Figure 5. MSW474-1 glucose concentrations for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

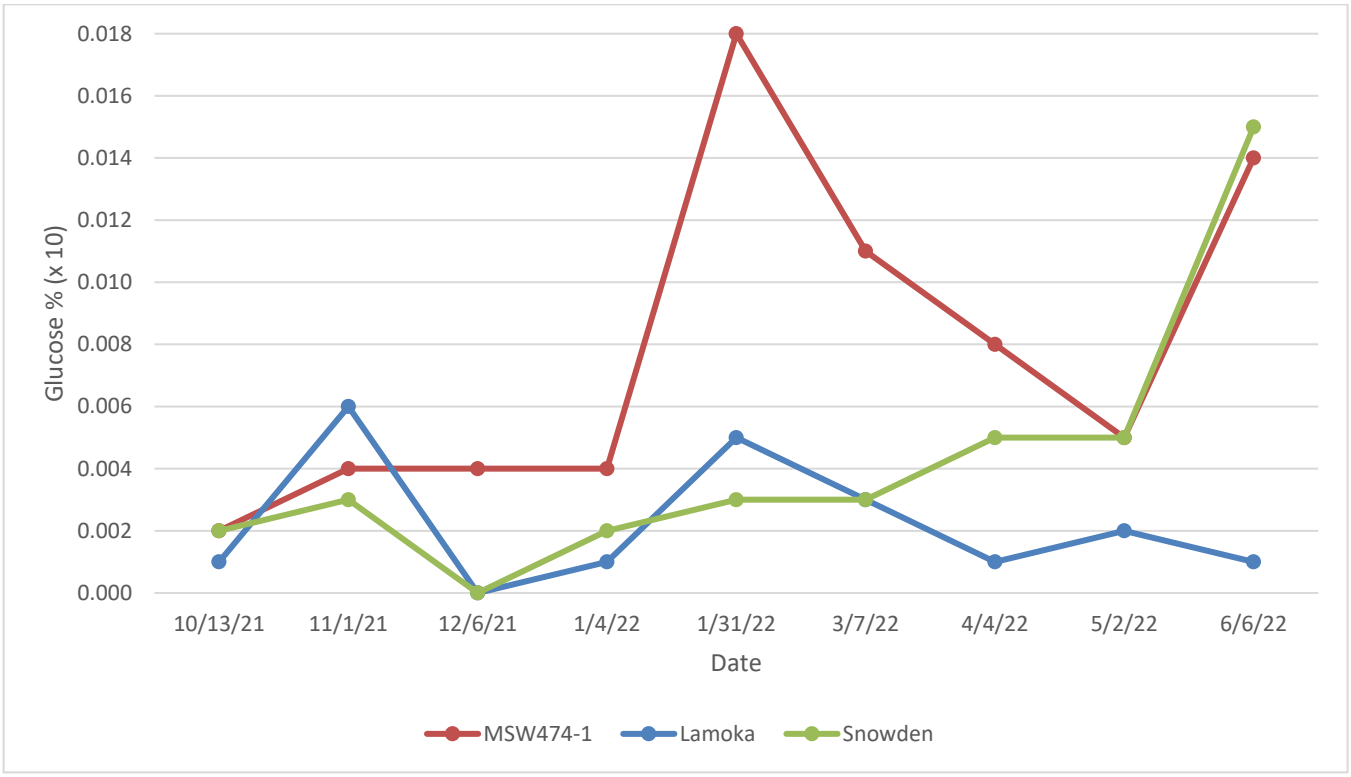


Figure 6. MSW474-1 sucrose concentrations for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

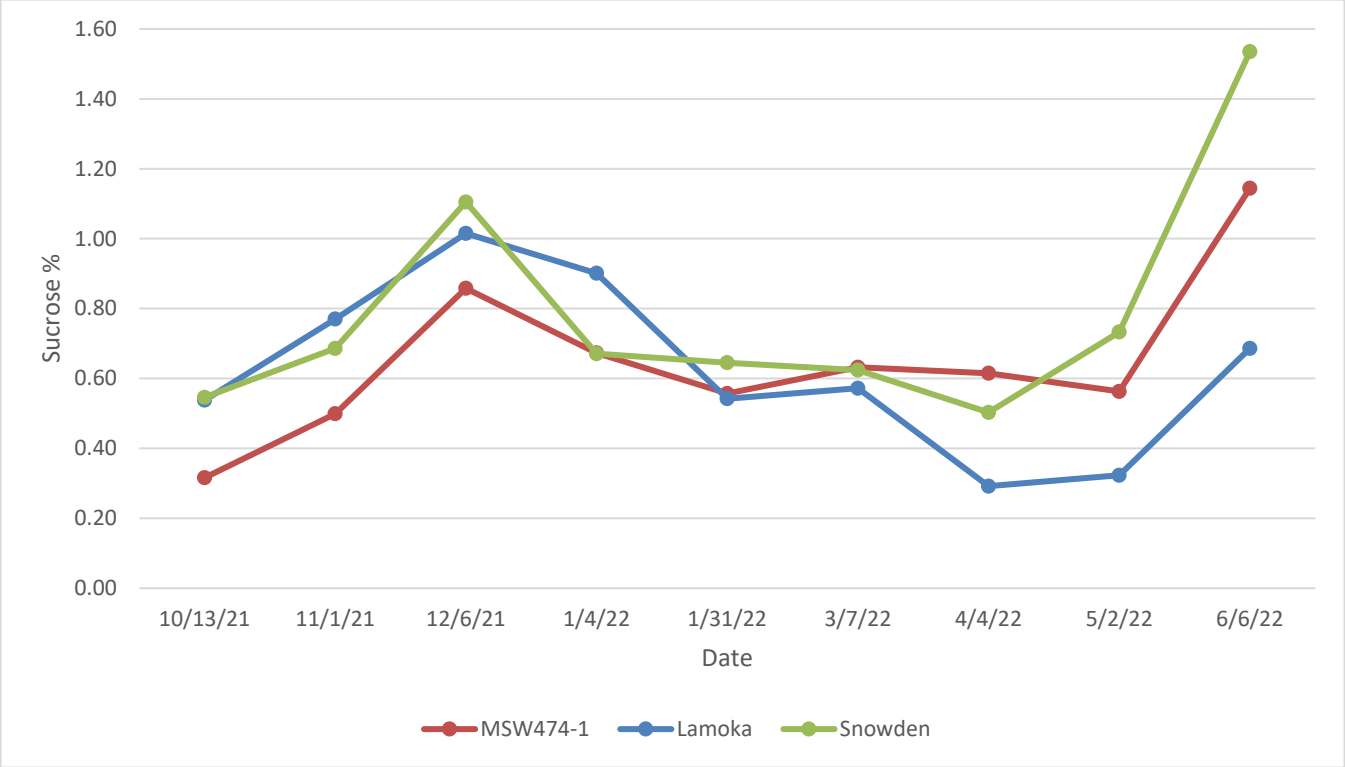


Figure 7. MSW474-1 percent defects for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

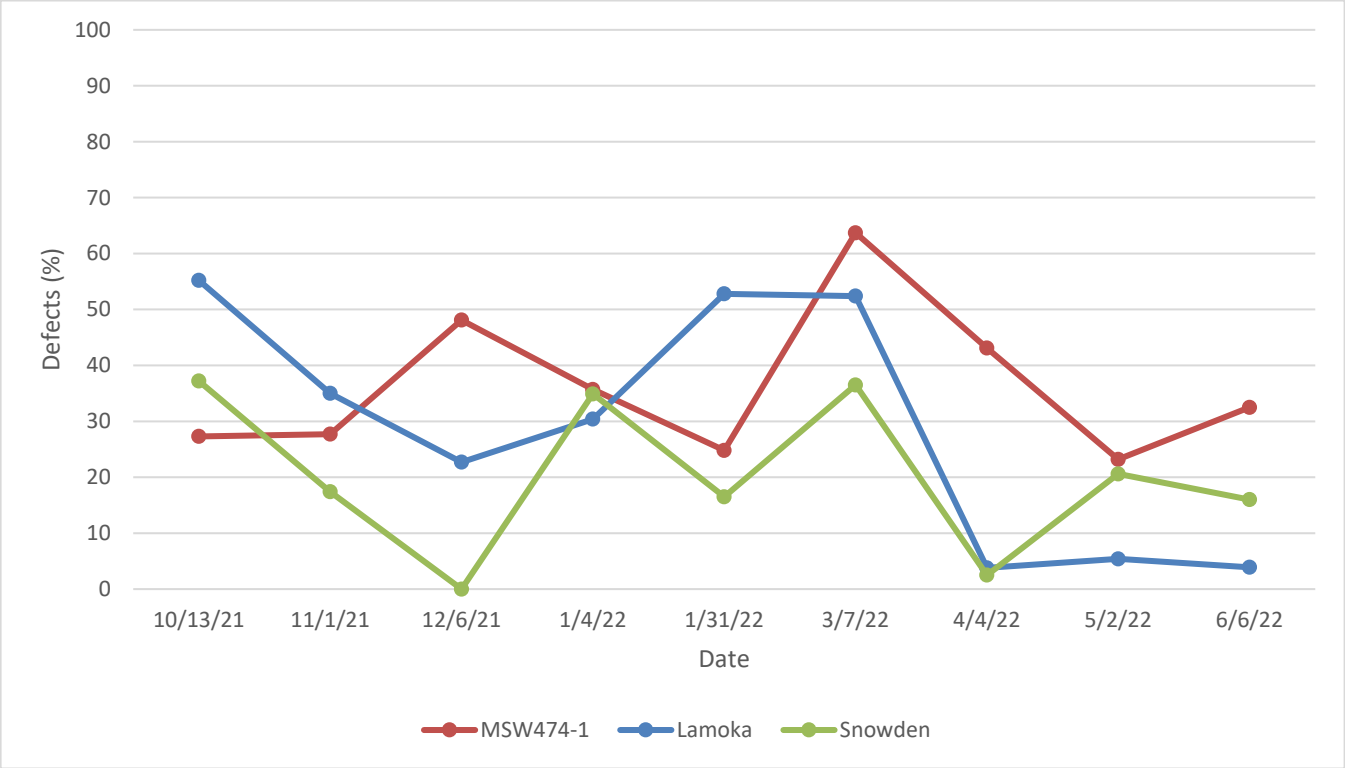
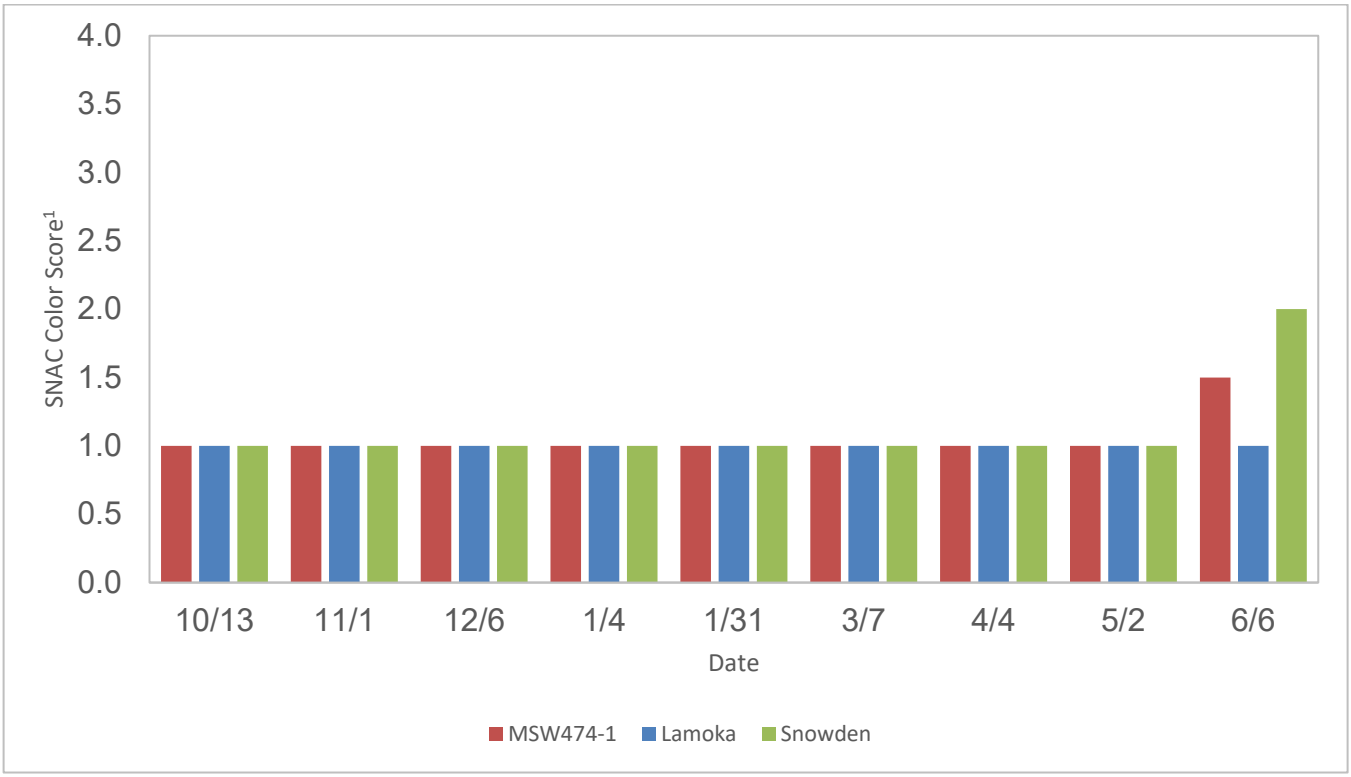


Figure 8. MSW474-1 SNAC Color Score (1 = lightest, 5 = darkest) the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.



MSZ242-13: This variety had glucose concentrations that rose to 0.006% in February and March, and then decreased to 0.002% in April though the end of storage (Figure 9). The sucrose concentrations were consistent with those of Lamoka and Snowden, ending at 1.12% (x 10), between the two checks (Figure 10). Chip defects were initially high at 35.4%, decreased through December, and then rose again by February to 29.7%. After this sample, defects decreased through the end of storage, ending at 4.1% (Figure 11). The chip color was 1.0 for the duration of storage (Figure 12). Bruising and stem end color were observed in most chip samples (Table 5). MSZ242-13 has acceptable chip quality during storage and will be further evaluated for commercialization potential in Michigan.

Table 5. MSZ242-13 monthly chip quality pictures from Techmark Inc.

Month		Month	
October		February	
November		March	
December		April	
January		May	

June	

Figure 9. MSZ242-13 glucose concentrations for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

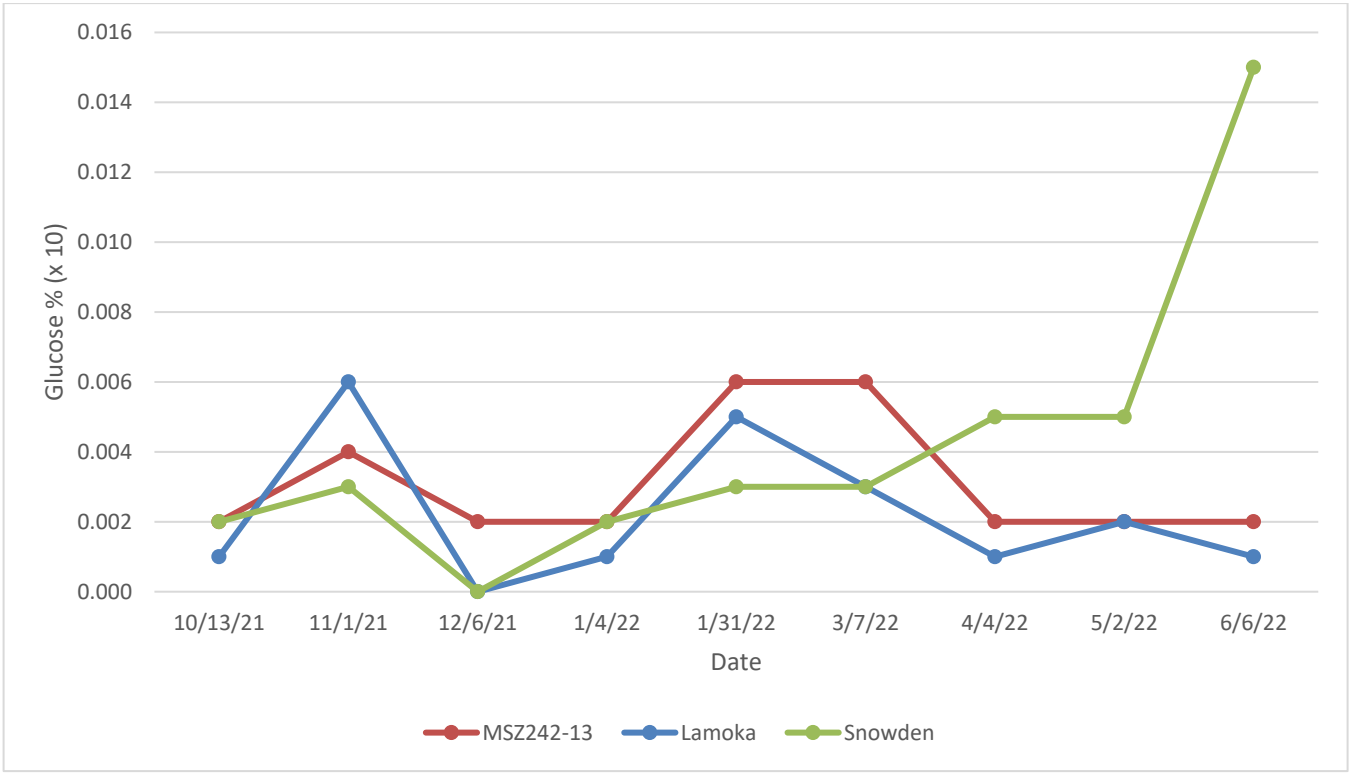


Figure 10. MSZ242-13 sucrose concentrations for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

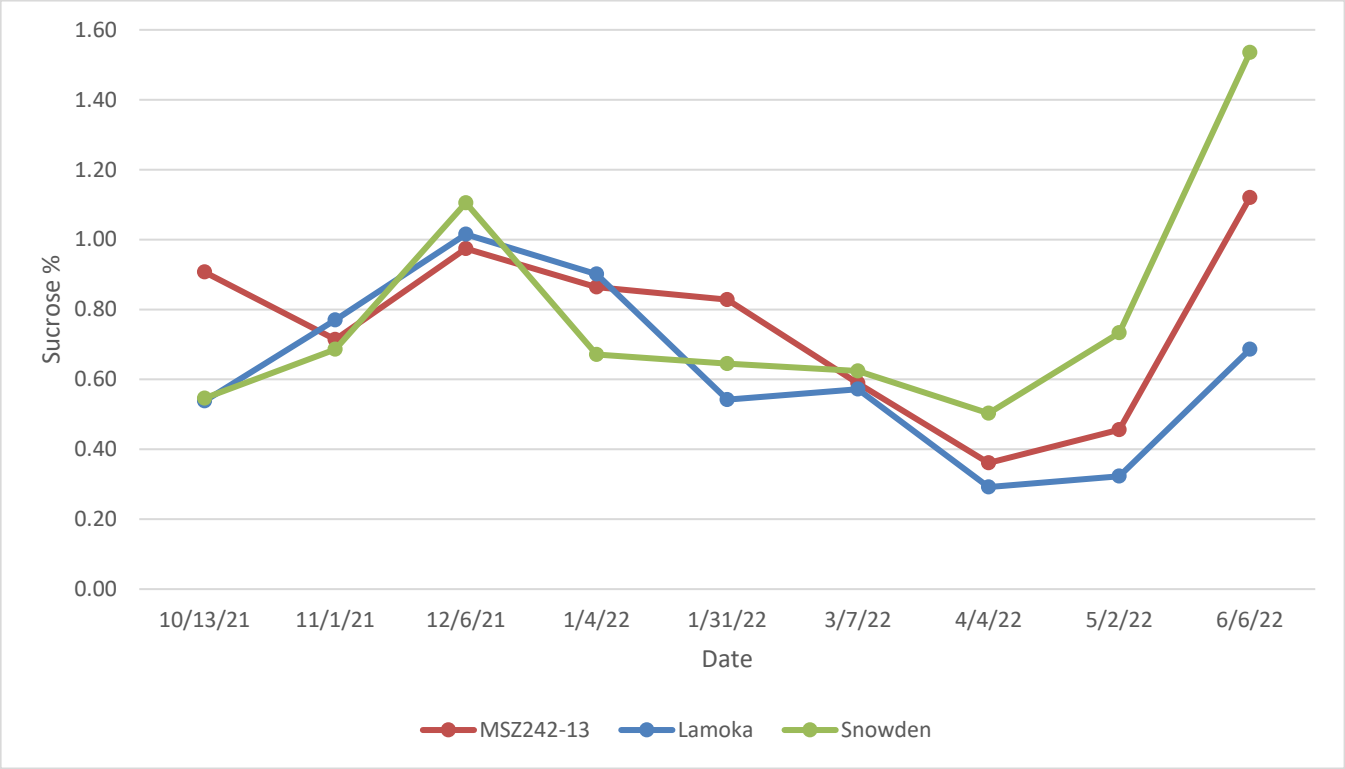


Figure 11. MSZ242-13 percent defects for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

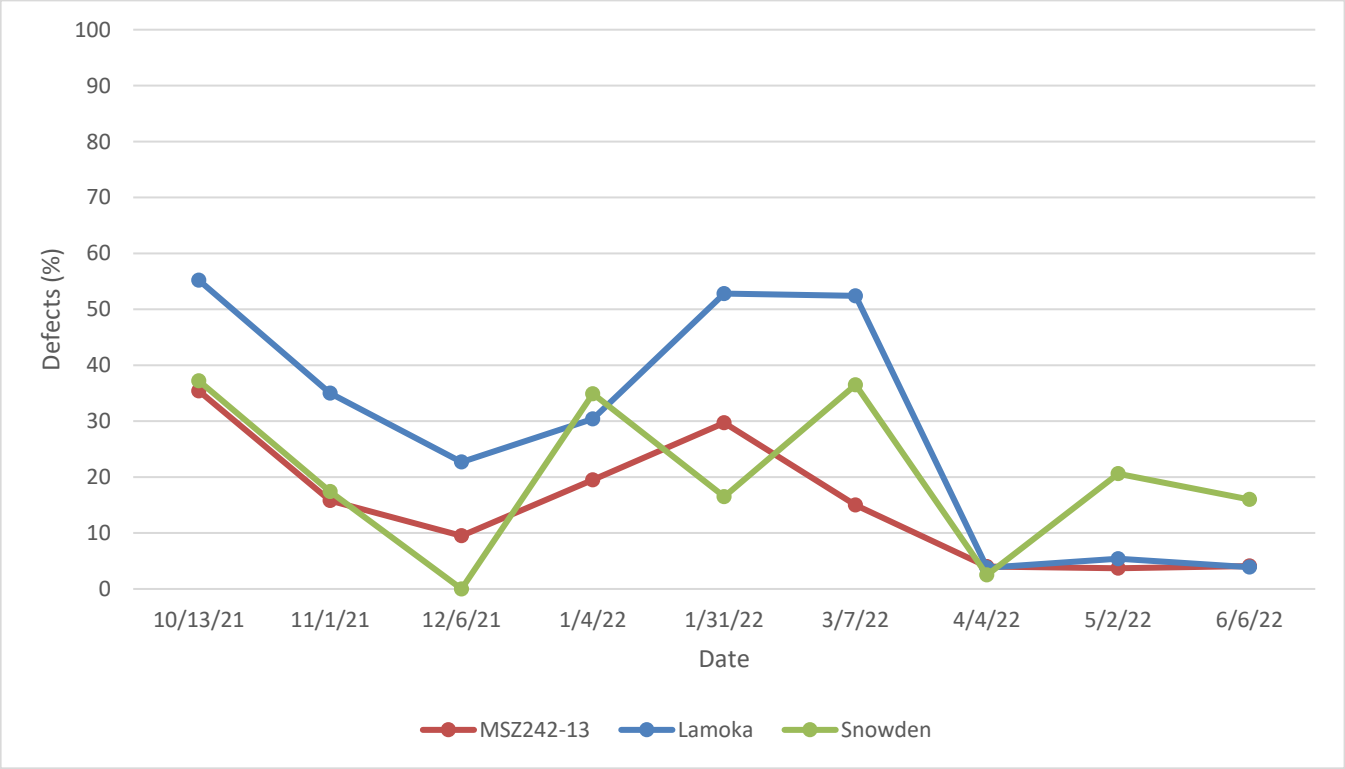
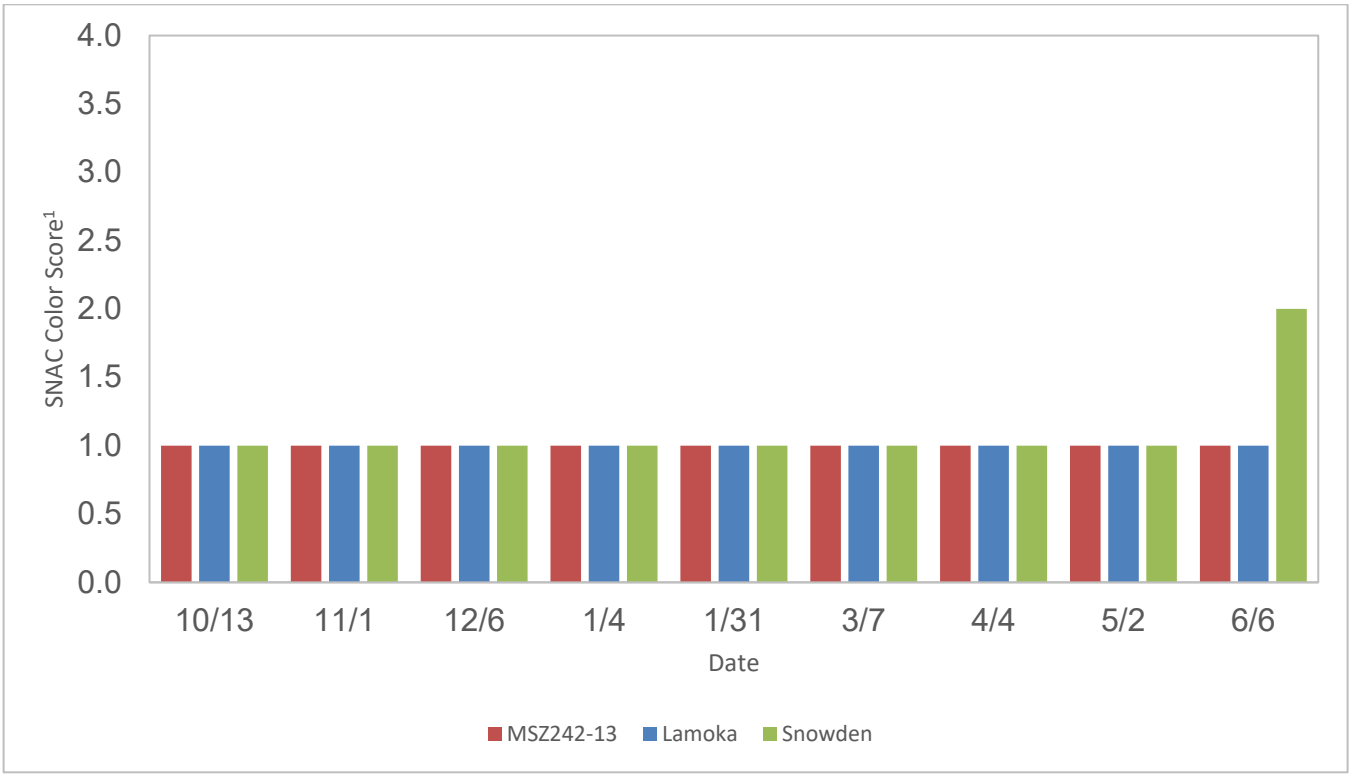
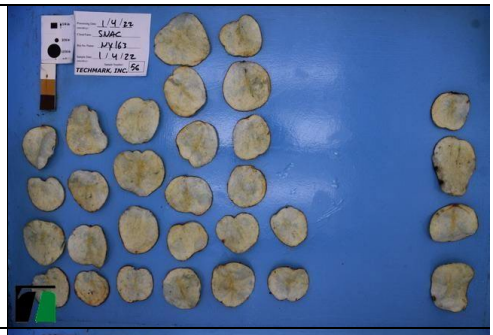


Figure 12. MSZ242-13 SNAC Color Score (1 = lightest, 5 = darkest) the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.



NY163: This Cornell University variety had a relatively stable glucose concentration from October to June. Concentrations were between 0.001% and 0.003% in all samples (Figure 13). The sucrose concentrations mirrored those of Lamoka, increasing through January and decreasing in April and May before rising slightly in June (Figure 14). NY163 had the highest incidence of chip defects at the first sample, with 34.1% defects, mainly slight stem end color. All other samples had defects below 20%, with the final sample containing only acceptable chips (Figure 15). SNAC color was rated at 1.0 for the duration of storage (Figure 16). This variety has a size profile suitable for chipping, with Herr's observing tubers between 1 ⅞ and 3 ½ inches in size (Tables 1 and 2). NY163 has long term storage potential in Michigan and will be further evaluated (Table 6).

Table 6. NY163 monthly chip quality pictures from Techmark Inc.

Month		Month	
October		January	
November		February	
December		March	

April		June	
May			

Figure 13. NY163 glucose concentrations for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

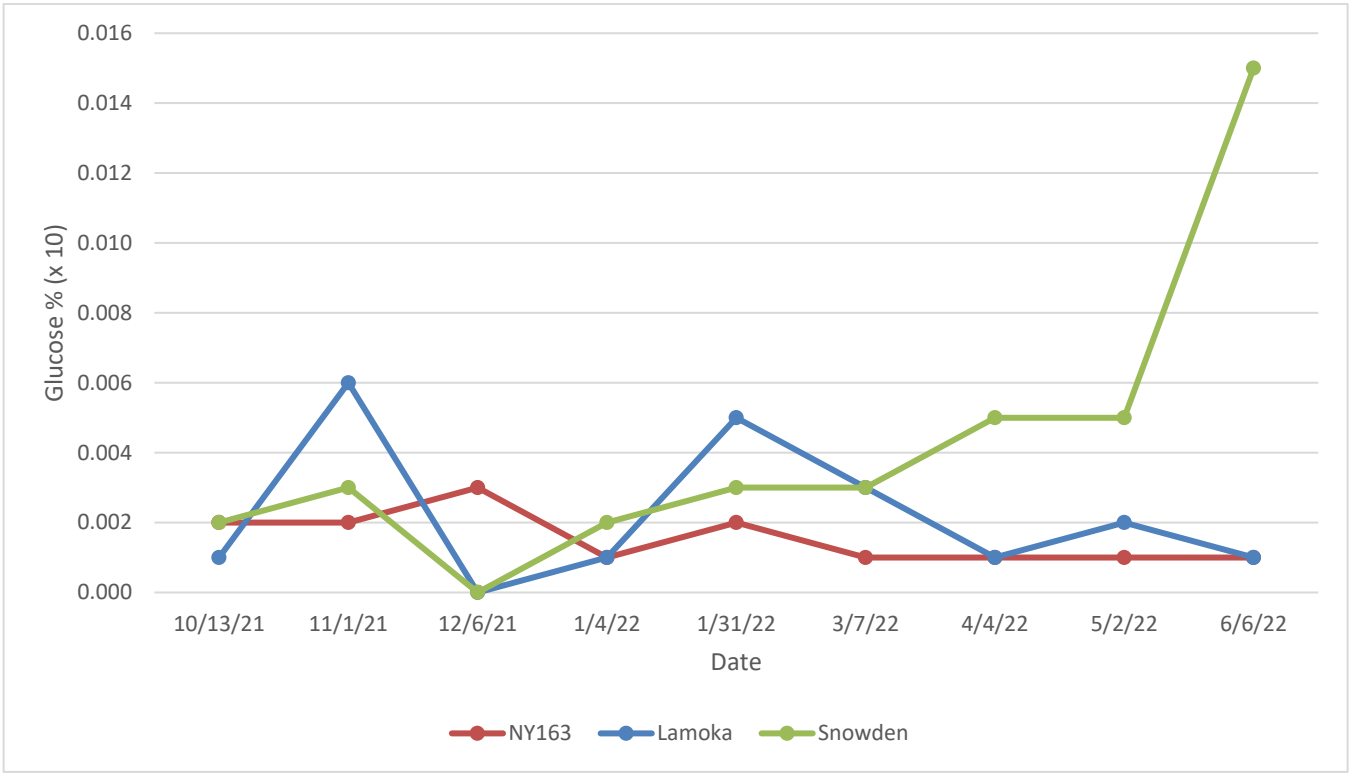


Figure 14. NY163 sucrose concentrations for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

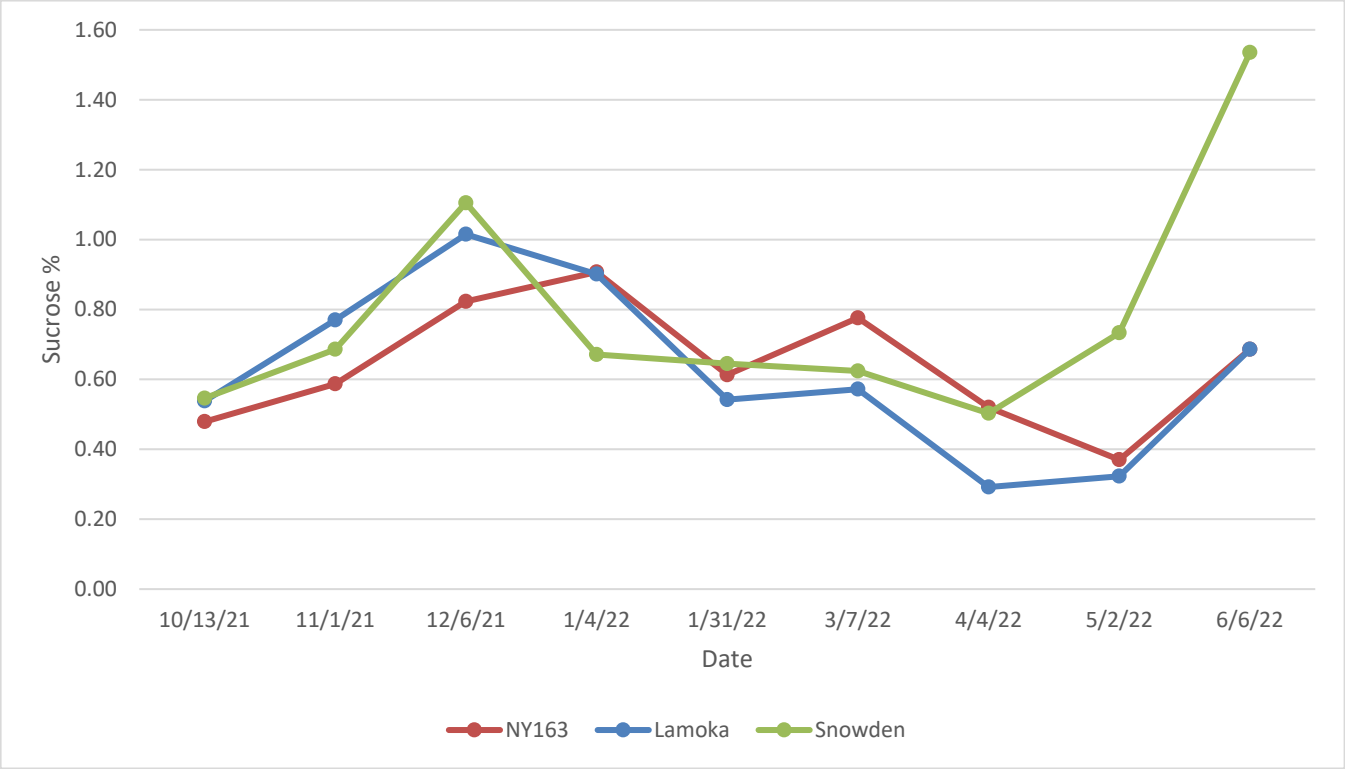


Figure 15. NY163 percent defects for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

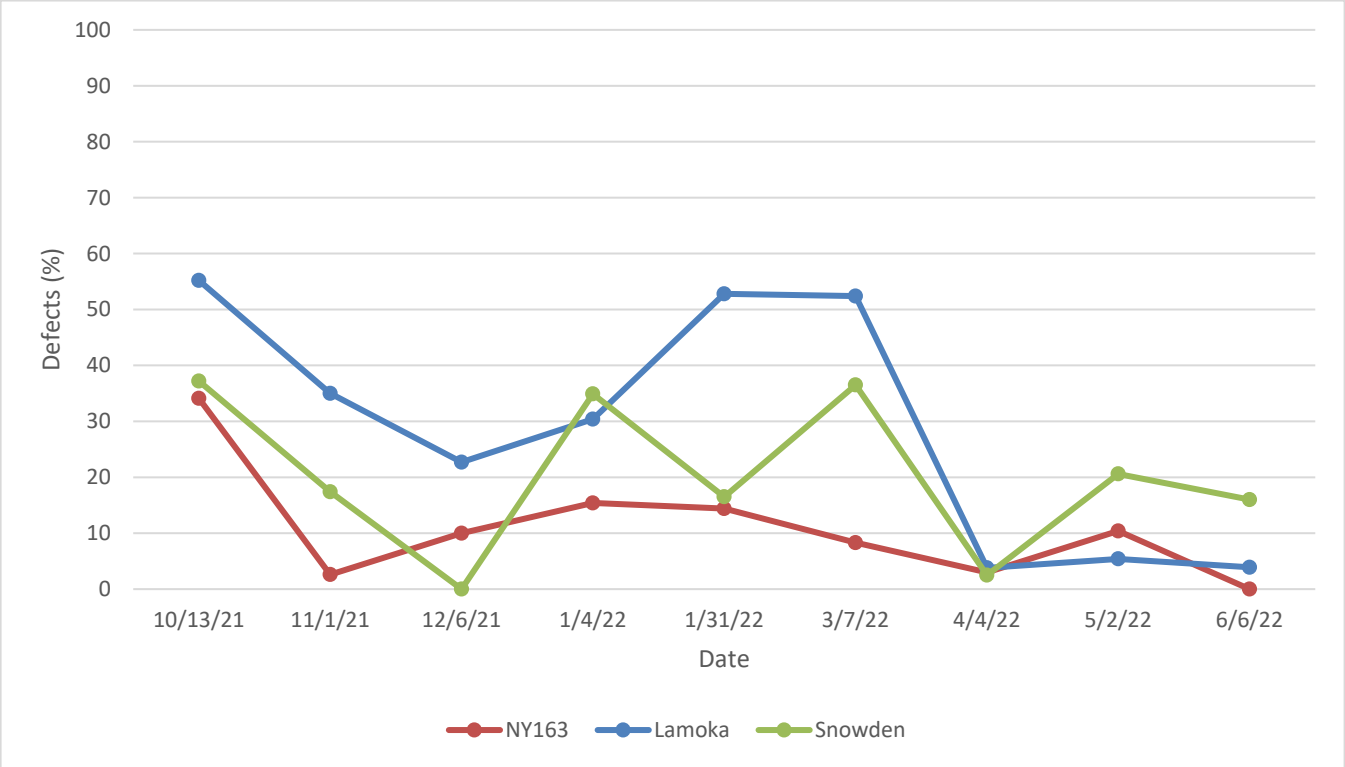
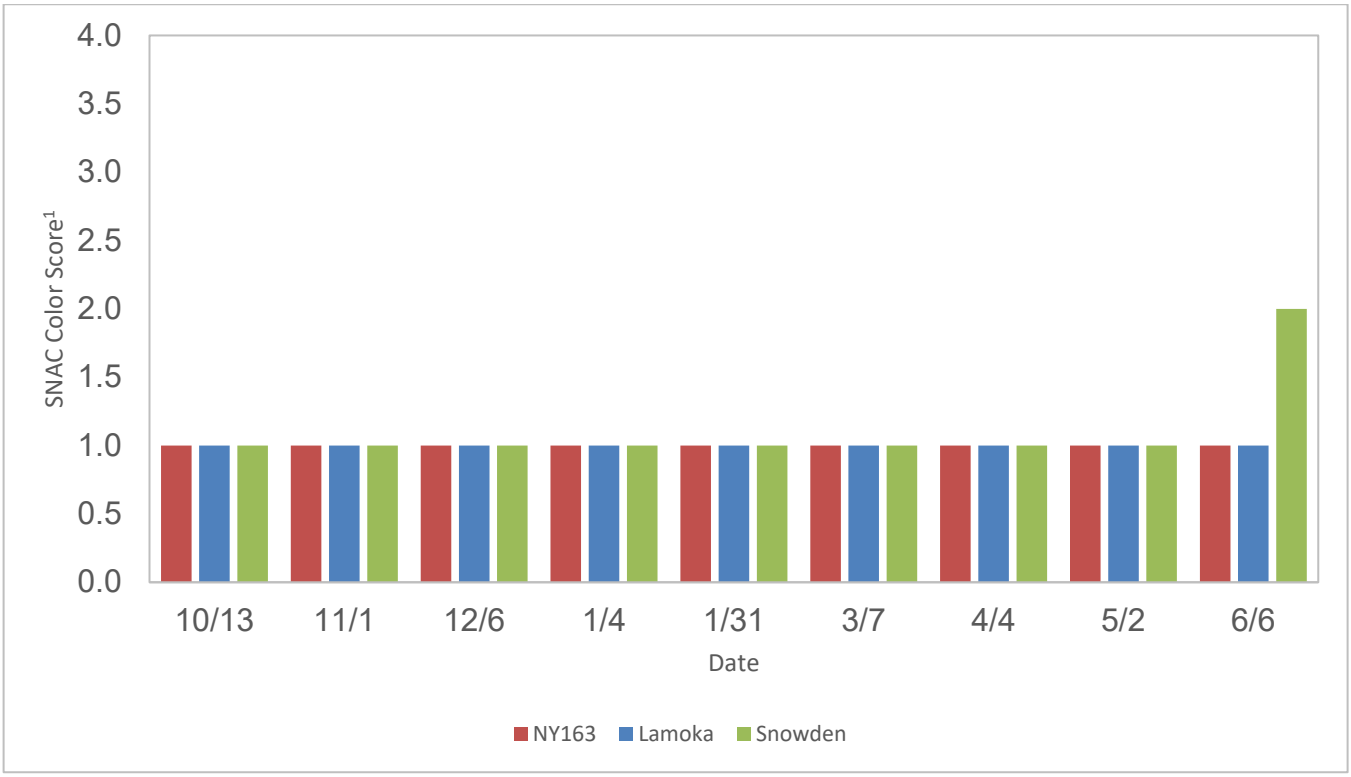


Figure 16. NY163 SNAC Color Score (1 = lightest, 5 = darkest) the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.



NY165: This Cornell University variety had stable glucose concentrations between 0.002% and 0.005% during storage (Figure 17). Conversely, sucrose concentrations were lower than those of the checks through January, and then rose sharply through May to 1.374% (x 10), the highest of any sample in May (Figure 18). Chip defects observed in NY165 were all over 25% from October to May, with most chip samples displaying slight stem end color or bruising. However, the last sample had only acceptable chips with no defects observed. (Figure 19). The SNAC chip color was 1.0 during storage, excluding January when it was 1.5 (Figure 20).

Table 7. NY165 monthly chip quality pictures from Techmark Inc.

Month		Month	
October		February	
November		March	
December		April	
January		May	

June	

Figure 17. NY165 glucose concentrations for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

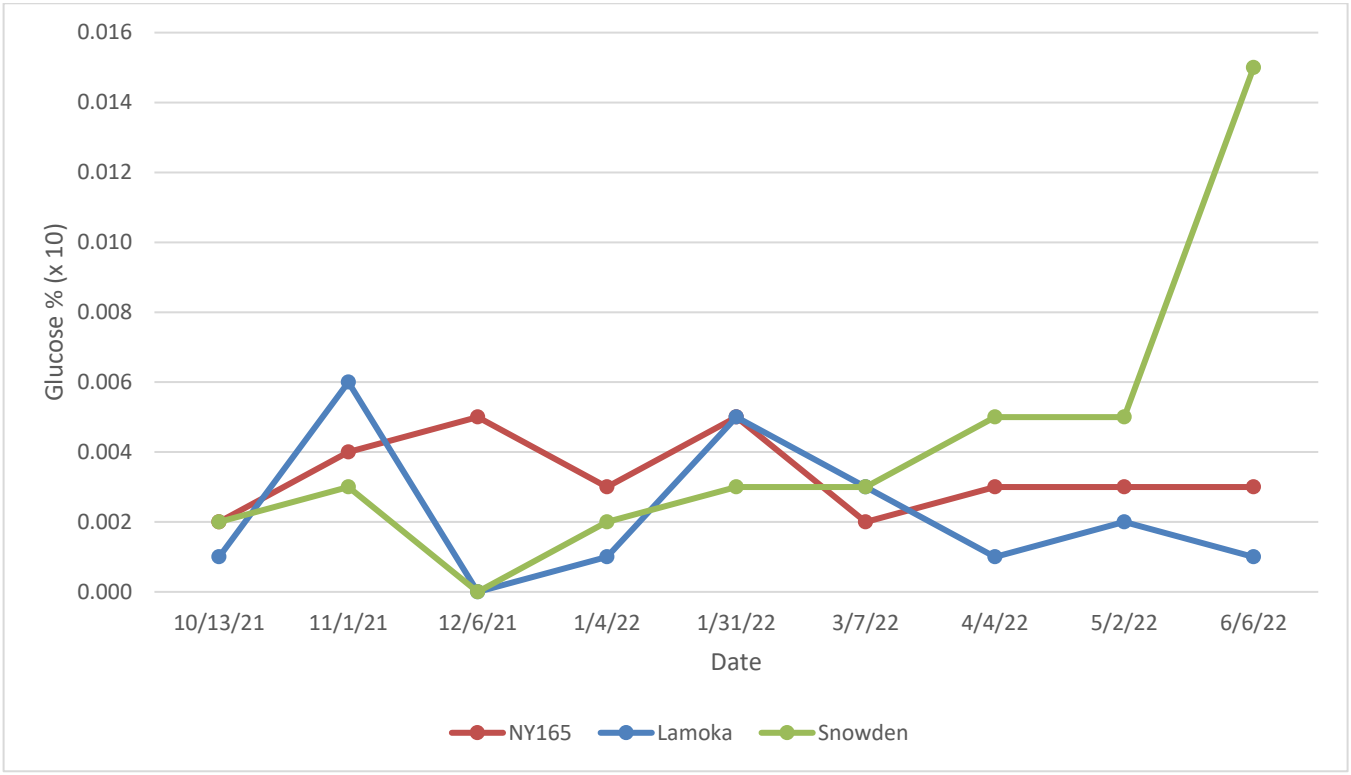


Figure 18. NY165 sucrose concentrations for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

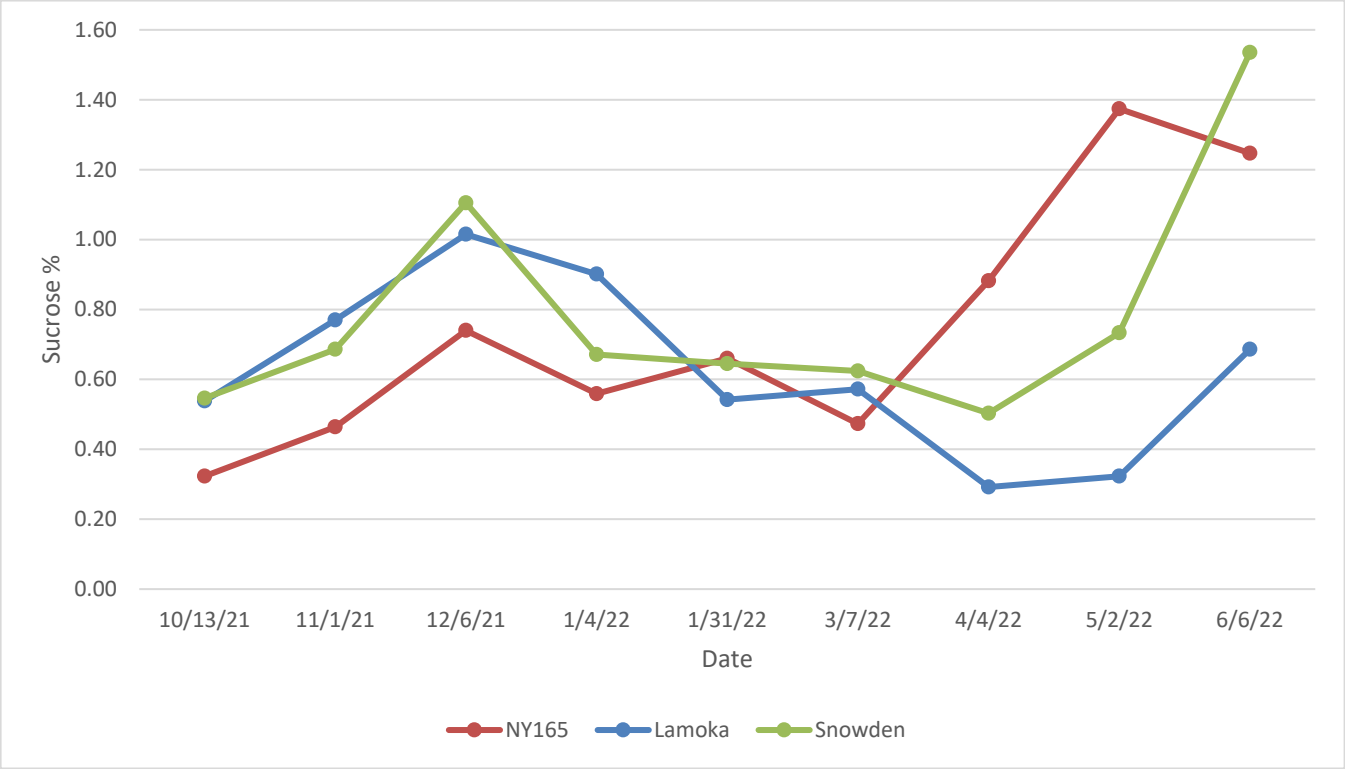


Figure 19. NY165 percent defects for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

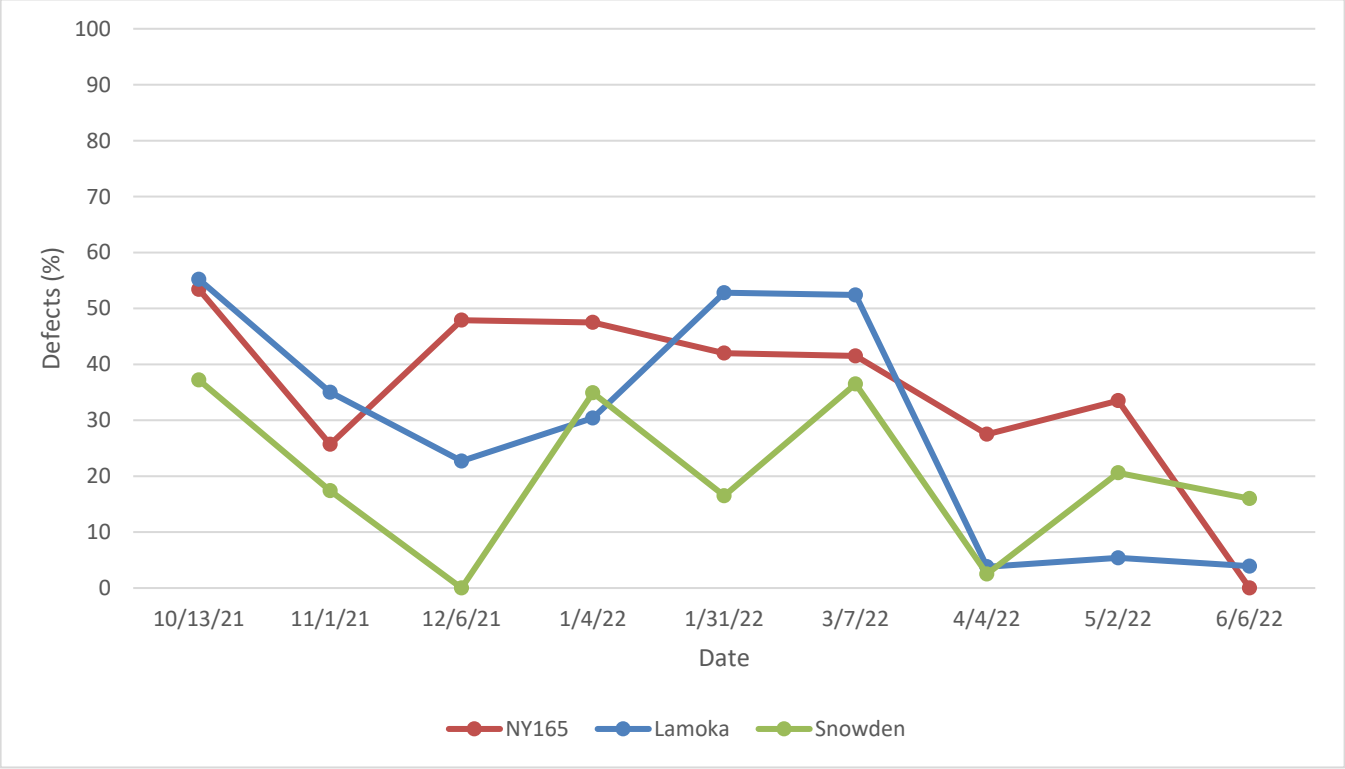
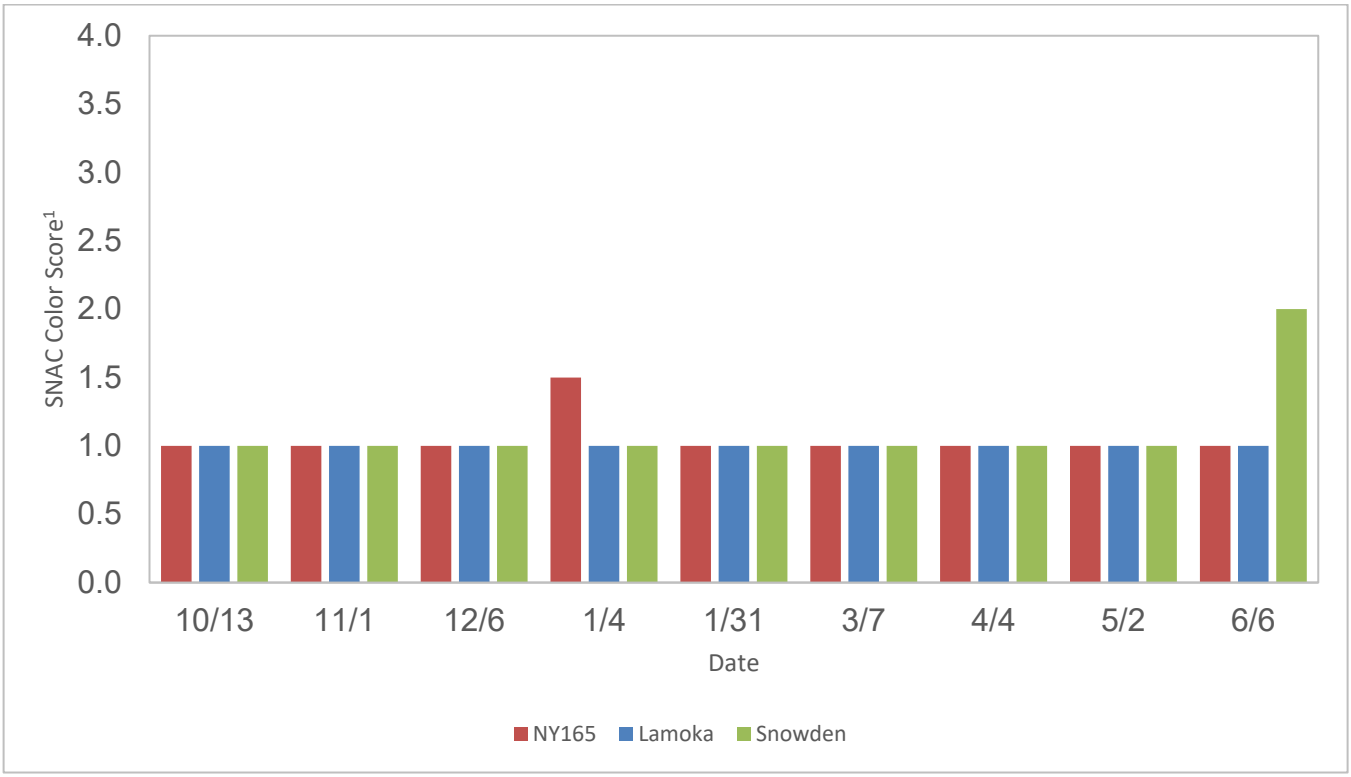
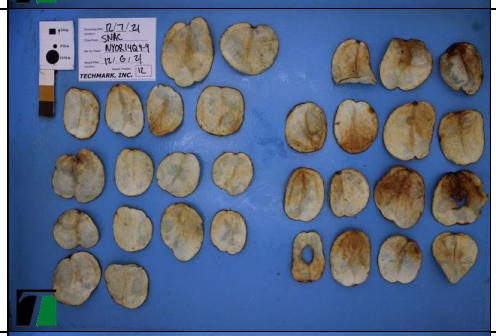


Figure 20. NY165 SNAC Color Score (1 = lightest, 5 = darkest) the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.



NYOR14Q9-9: While the initial glucose levels were like those of the checks, they rose sharply and stayed much higher for all but the last two samples. Glucose was highest on January 31st at 0.036% (Figure 21). The sucrose concentrations of NYOR14Q9-9 had a similar trend, rising through January and then decreasing through June (Figure 22). Chip defects observed in NYOR14Q9-9 were variable, with the highest percentage of defects, each over 85%, observed from January to March. Chip quality improved from April to the end of storage, ending with only 2.6% defects in June (Figure 23). This variety had the poorest chip color, with one rating of 1.5 and two ratings of 2.0 (Figure 24). While NYOR14Q9-9 displays good chip quality in late storage, the sugar and stem end defects from November to April make this variety less suitable for Michigan (Table 8).

Table 8. NYOR14Q9-9 monthly chip quality pictures from Techmark Inc.

Month		Month	
October		February	
November		March	
December		April	
January		May	

June	

Figure 21. NYOR14Q9-9 glucose concentrations for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

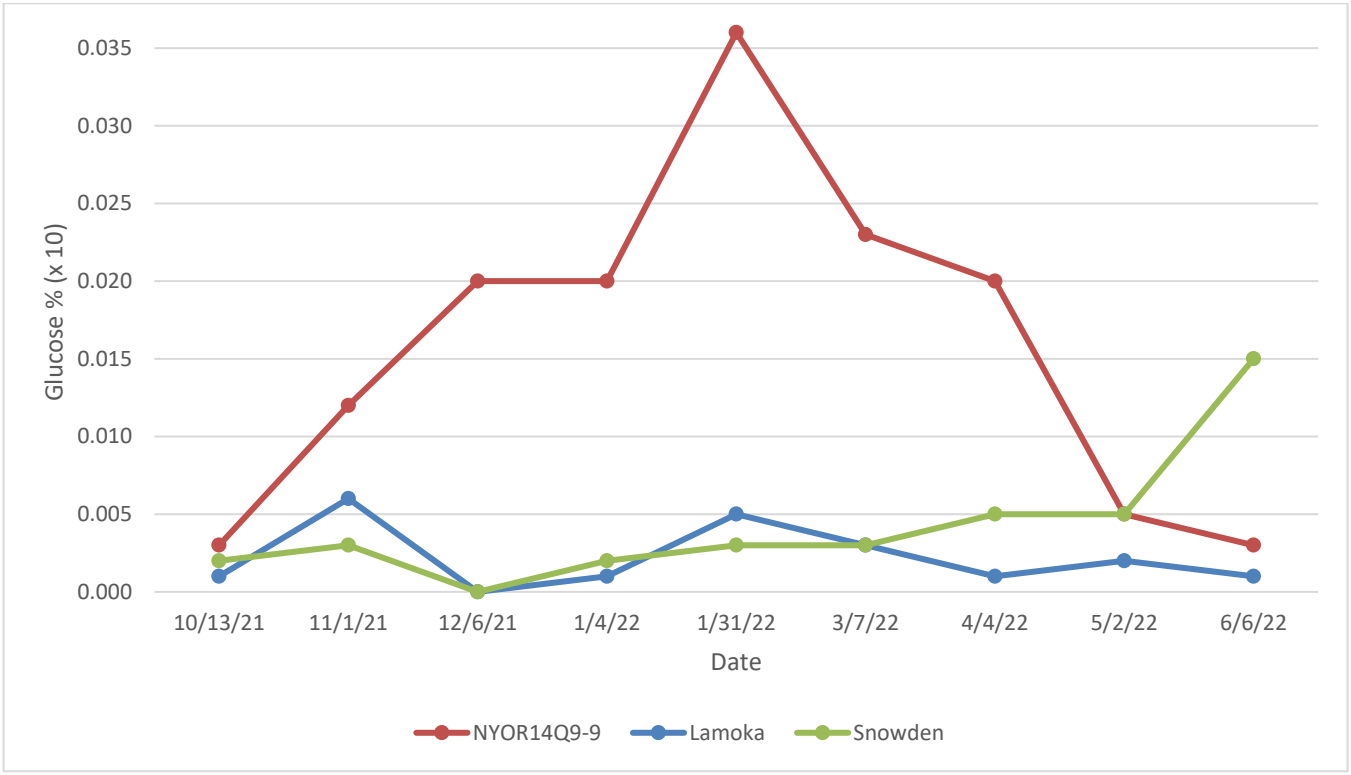


Figure 22. NYOR14Q9-9 sucrose concentrations for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

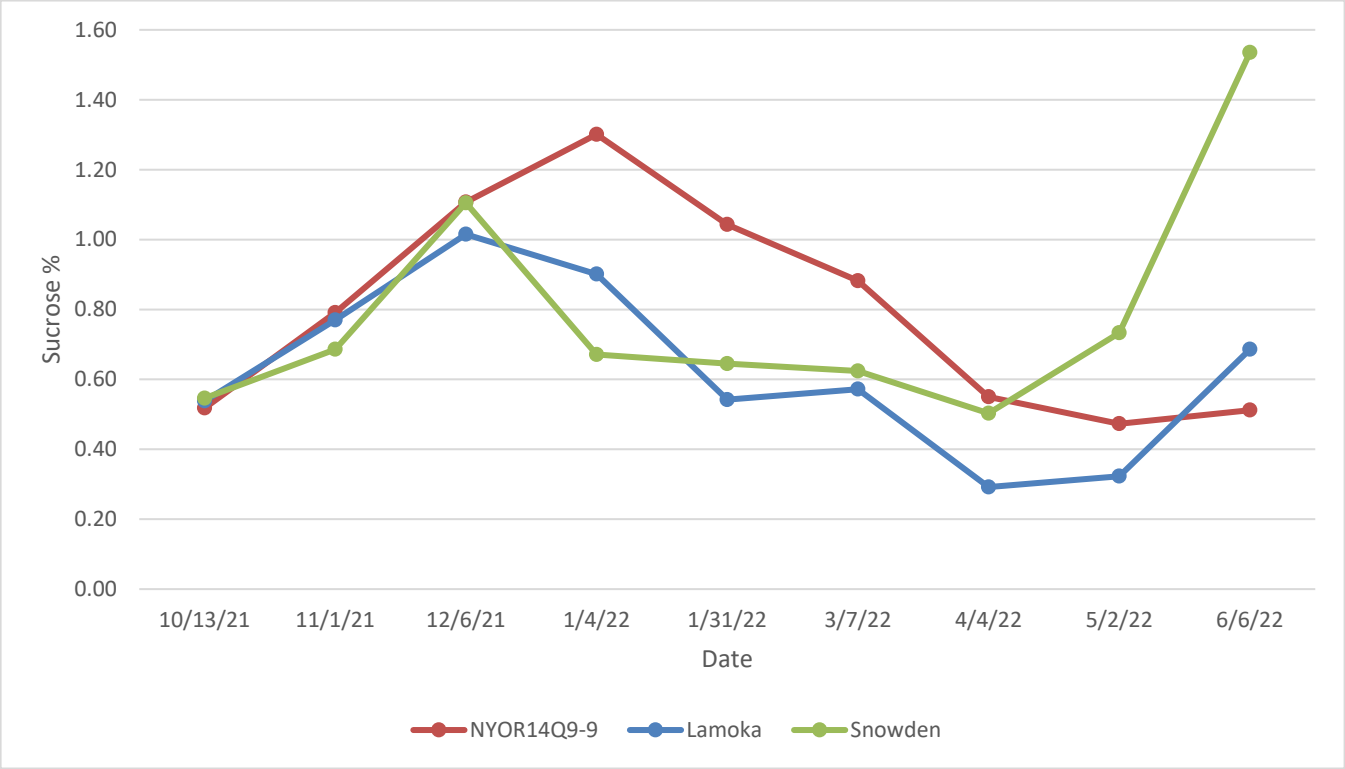


Figure 23. NYOR14Q9-9 percent defects for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

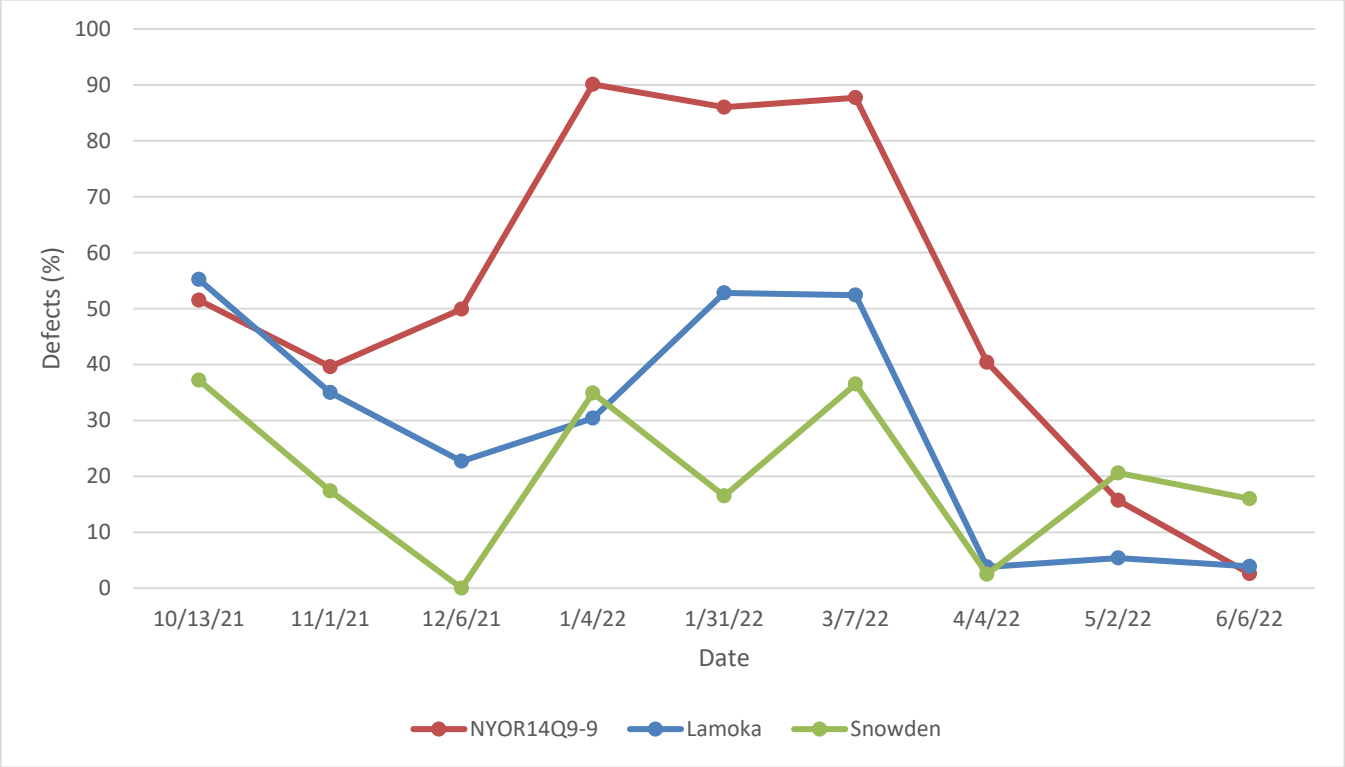
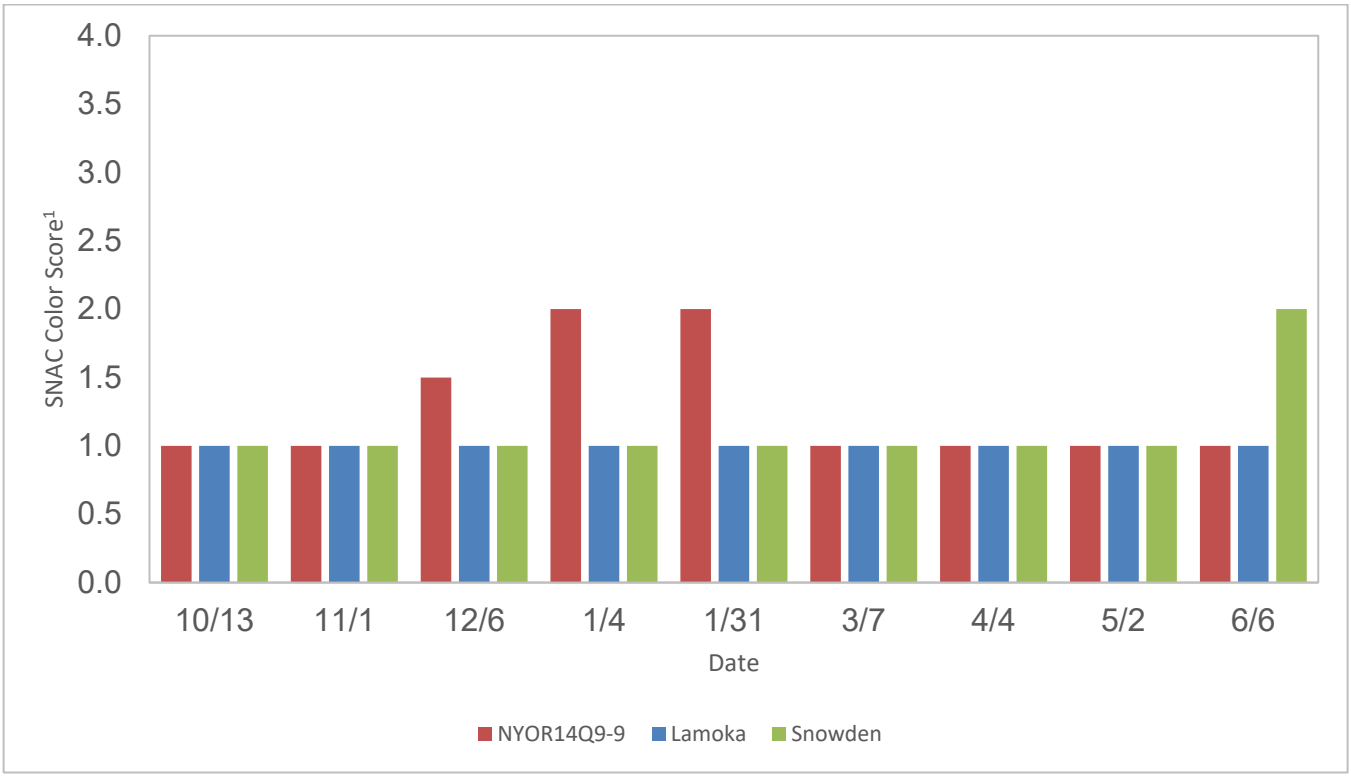


Figure 24. NYOR14Q9-9 SNAC Color Score (1 = lightest, 5 = darkest) the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.



W12078-76: Glucose concentrations were generally similar to those of Lamoka and Snowden, excluding the December and June samples, which were moderately, elevated (Figure 25). The sucrose concentrations more closely mirrored the checks, consistent from October to January, decreasing though May, then rising sharply to end at 1.301% in June (Figure 26). Chip quality in W12078-76 was excellent though most of storage, with all samples excluding the last with less than 25% defects. Unacceptable chips were mainly due to hollow heart (Figure 27, Table 9). Chip color was rated at 1.0 through May and 1.5 in June (Figure 28). This variety has storage potential though May in Michigan if growing season management can decrease hollow heart incidence (Table 9).

Table 9. W12078-76 monthly chip quality pictures from Techmark Inc.

Month			
October		February	
November		March	
December		April	
January		May	

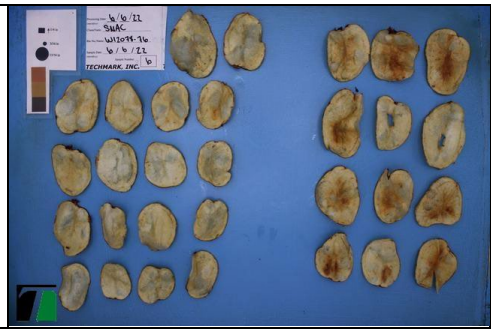
June	

Figure 25. W12078-76 glucose concentrations for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

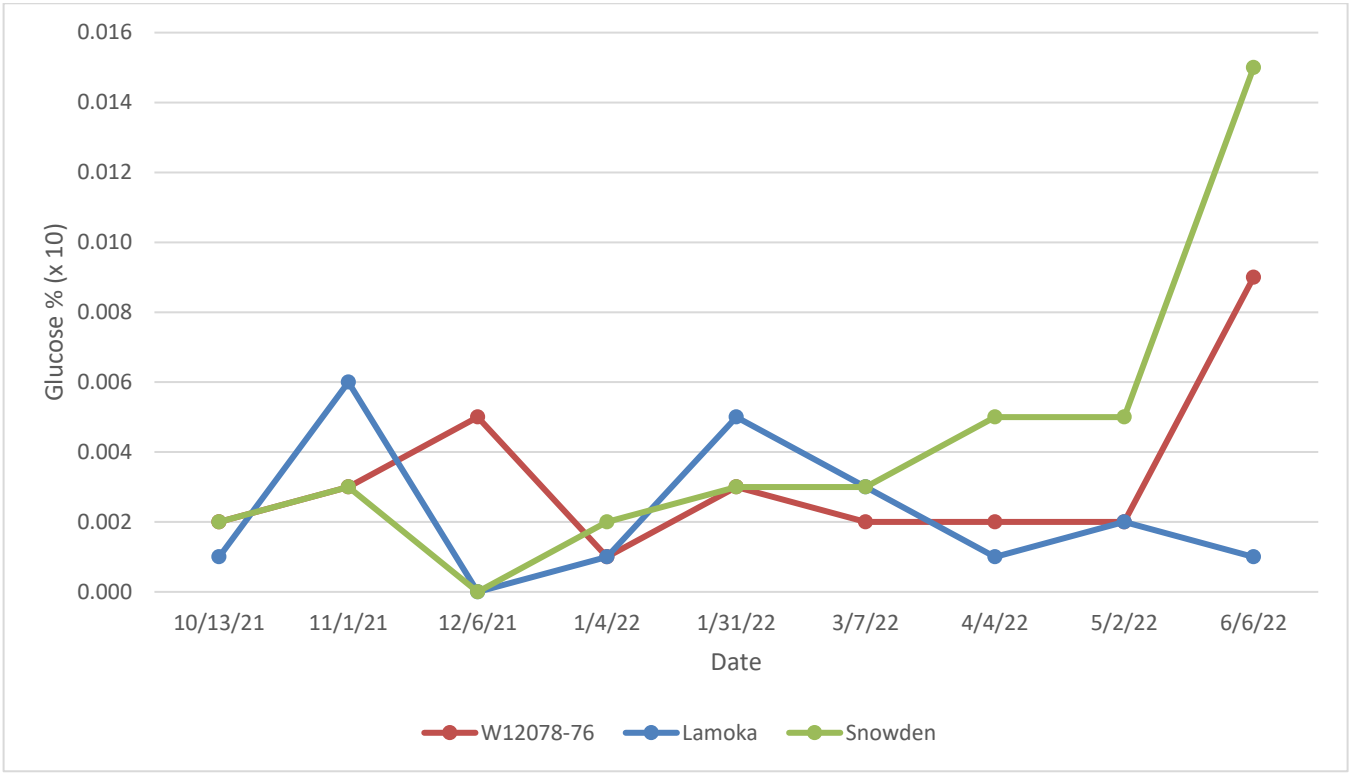


Figure 26. W12078-76 sucrose concentrations for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

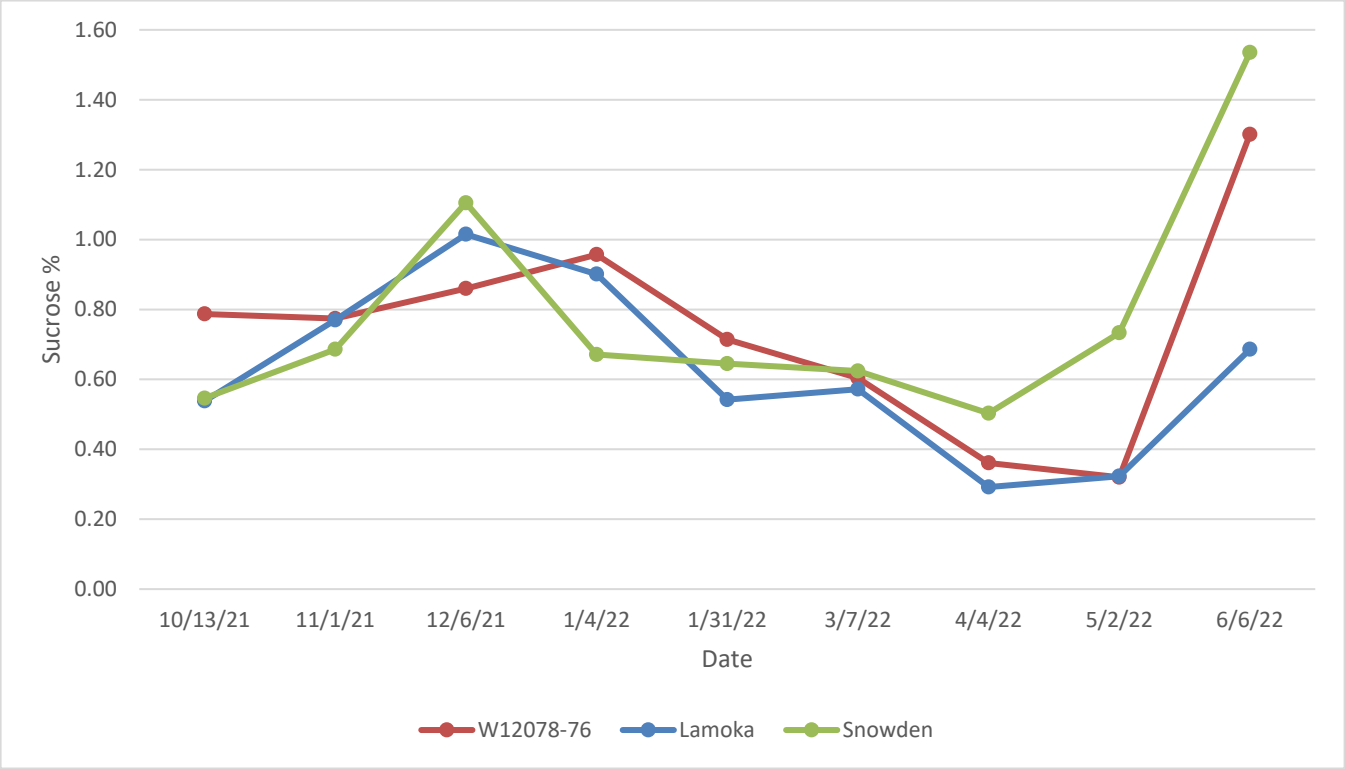


Figure 27. W12078-76 percent defects for the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.

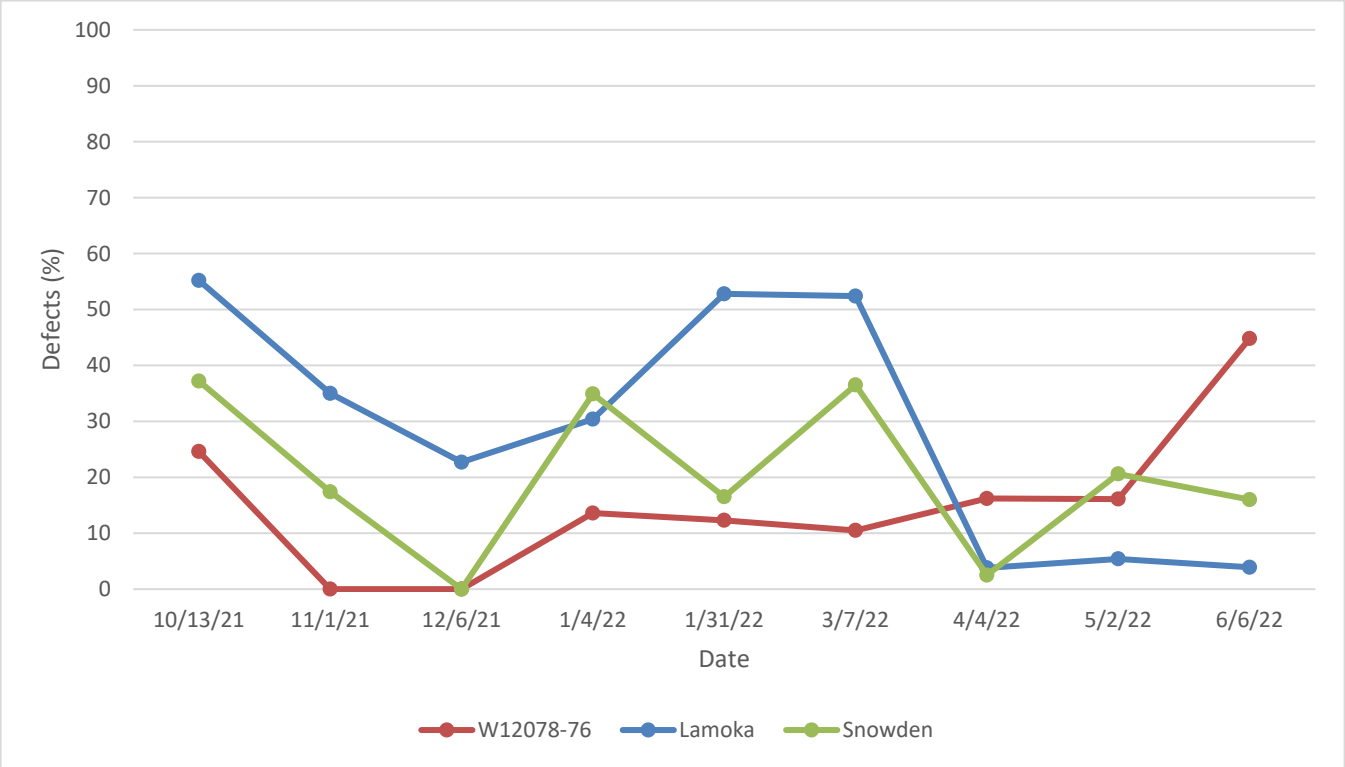
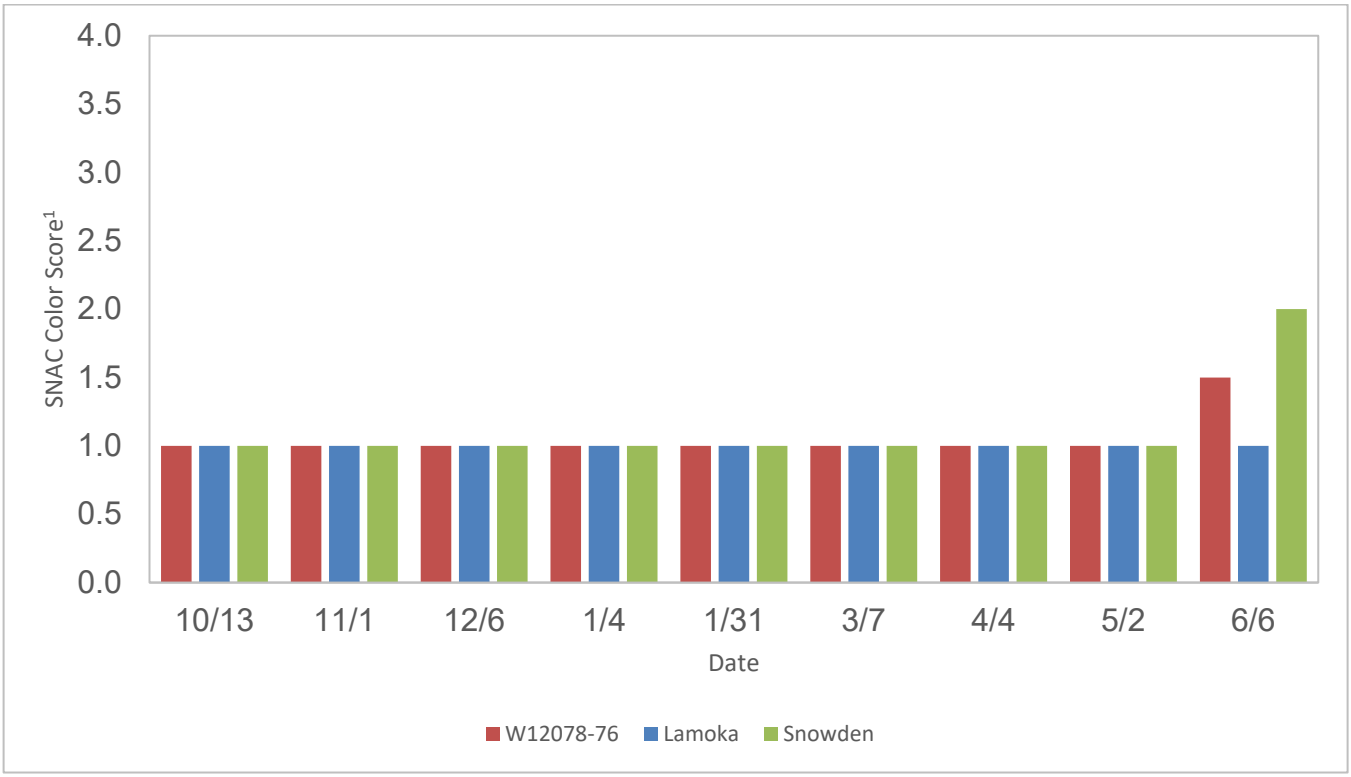
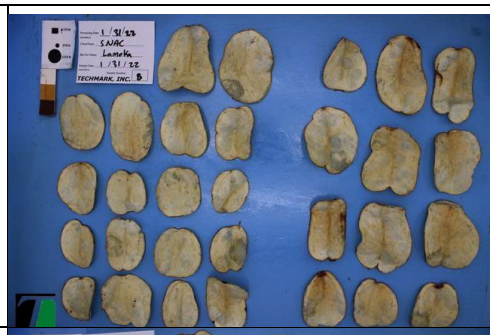


Figure 28. W12078-76 SNAC Color Score (1 = lightest, 5 = darkest) the 2021-2022 storage season at 48°F compared to Lamoka and Snowden.



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.

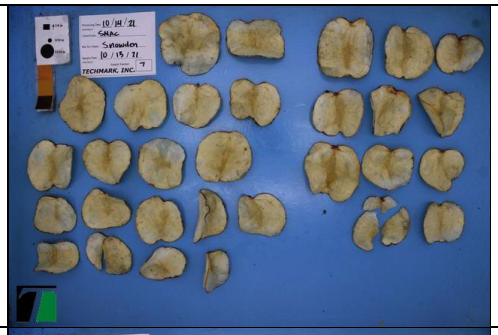
Table 12. Lamoka monthly chip quality pictures from Techmark Inc.

Month		Month	
October		February	
November		March	
December		April	
January		May	

June	

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 13. Snowden monthly chip quality pictures from Techmark Inc.

Month		Month	
October		February	
November		March	
December		April	
January		May	

June