2020-2021 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 Zavislan, Research Assistant, zavislan@msu.edu
Damen Kurzer, Research Technician, kurzerda@msu.edu

Objective: To assess the storability of eleven 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, 2020 at 10" within row spacing and 34" between row spacing. Vine kill occurred on September 4, 2020. We harvested the potatoes on October 6, 2020 (3606 GDD_{40} from planting to vine kill) and collected storage samples.

Commercial Storage and Processing
A 40-pound samples of each variety were stored at Sandyland Farms, LCC commercial storage and evaluated at Herr Foods, Nottingham, PA on January 25 and April 12, 2021. The pile temperature before processing was 48.0ºF in January and 50.0ºF April. CIPC was applied to control sprouting in February 2021.

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 1. The sample bags from each of the eleven varieties were stored at approximately 48ºF for monthly evaluations from October 2020 through June 2021. 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 rated 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 12th, 2021 (Table 1 and 2). On the first processing date, the top four varieties for chip quality were NY163, Petoskey, Lamoka, and Snowden. The next highest ranked, non-check varieties were MSZ242-13 and CO11023-2W (Table 1). On the second processing date, the top three varieties were Petoskey, Snowden, and NY163 (Table 2). MSZ242-13 had the highest specific gravity at both dates with 1.095 and 1.096. CO11023-2W had the least chip defects in January while Lamoka had the fewest defects in April (Table 1 and 2).

Table 1. 2020 SNAC Variety Trial January 25, 2021[1]

Merit[2]	Variety	Specific Gravity	SNAC Color[3]	Percent Chip Defects[4]			Comments
				Internal	External	Total	
1	NY163	1.083	2	6.9%	6.1%	13.0%	Minor scab, 2 to 4 inches in size
2	Petoskey	1.085	2	6.5%	2.5%	9.0%	Minor internal color and bruise, 2 to 4 inches in size
3	Lamoka	1.072	2	1.9%	1.3%	3.2%	Minor stem end, 2 to 3 ¾ inches in size
4	Snowden	1.078	3	14.1%	9.4%	23.5%	Minor internal color and bruise, a lot of scab, 1 ¾ to 3 ½ inches in size
5	MSZ242-13	1.095	2	8.0%	1.8%	9.8%	Slight stem end and bruise, nice smooth skin set, 1 ½ to 4 inches in size
6	CO11023-2W	1.083	3	3.9%	0.5%	4.4%	1 ¾ to 3 ½ inches in size, a little vascular browning
7	MSW474-1	1.077	2	14.2%	0.9%	15.1%	Minor green with some bruising, nice smooth skin set, 1 ¾ to 3 ½ inches in size
8	MSZ063-2	1.078	3	15.6%	13.2%	28.8%	Some vascular browning and scab, 1 ¾ to 3 inches in size
9	CO11023-9W	1.065	3	5.2%	27.5%	32.7%	Minor bruise, too much scab, 2 ½ to 4 inches in size, drop from trial as the gravity is too low
10	B2869-29	1.076	4	47.5%	17.3%	64.8%	A lot of scab, too much internal color, should be dropped from the trial, 1 ½ to 3 ½ inches in size
	ND7519-1						Data not available

[1]Samples collected on January 23, 2021 and processed by Herr Foods, Inc., Nottingham, PA on January 25, 2021.
[2]Merit: ranked by Herr Foods, Inc. 1 = highest chip quality, 10= 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. 2020 SNAC Variety Trial April 12, 2021[1]							
Merit[2]	Variety	Specific Gravity	SNAC Color[3]	Percent Chip Defects[4]			Comments
				Internal	External	Total	
1	Petoskey	1.077	2	13.5%	3.5%	17%	Minor internal color, 2 to 3 ¼ inches in size, nice skin profile
2	Snowden	1.084	3	6.5%	9.6%	16.1%	A lot of scab, 1 ¾ to 4 inches in size
3	NY163	1.085	2	3.9%	10.8%	14.7%	Minor scab and bruise. 1 5/8 to 3 ¾ inches in size
4	Lamoka	1.077	3	1.2%	6.9%	8.1%	2 to 3 inches in size
5	CO11023-2W	1.082	2	5.2%	4.6%	9.8%	Minor internal color in vascular ring, 1 ¾ to 3 ¼ inches in size
6	MSW474-1	1.082	3	14.5%	9.9%	24.4%	Starch pockets, bruise and minor color in vascular ring, 2 ½ to 3 ¾ inches in size, nice skin profile
7	MSZ063-2	1.084	3	13.2%	5.3%	18.5%	Some internal color, minor scab, 1 ½ to 3 inches in size
8	MSZ242-13	1.096	2	27.7%	1.6%	29.3%	Starch pockets, bruise, 1 ½ to 4 inches in size, nice smooth skin
9	CO11023-9W	1.070	3	17.9%	28.4%	46.3%	Hollow heart, a lot of scab with some edge color, 1 ½ to 3 ¾ inches in size
10	ND7519-1	1.085	4	71.0%	6.9%	77.9%	Too much internal color, minor scab, 1 ¾ to 3 ¼ inches in size
11	B2869-29	1.077	4	51.6%	18.2%	69.8%	Too much internal color, a lot of scab, 1 ¼ to 2 ½ inches in size

[1]Samples collected at harvest on April 11, 2021 and processed by Herr Foods, Inc., Nottingham, PA on April 12, 2021.

[2]Merit: ranked by Herr Foods, Inc. 1 = highest chip quality, 11 = 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 2020 to June 2021. The varieties are listed alphabetically with the check varieties last. For yield and raw tuber quality data at harvest, please see the 2020 field trial results.

Conclusions:

Based on the processing results from both commercial and demonstration storage, Petoskey, NY163, and MSZ242-13 appear to be the most promising lines for commercialization and full season storage. Herr's ranked Petoskey 2nd in January with a specific gravity of 1.085 and observed minor color and bruising (Table 1). This variety moved into 1st place in April with a specific gravity of 1.077, minor internal color, and a nice skin profile (Table 2). Slight bruising and stem end color were observed in the demonstration storage (Figure 11). Glucose, sucrose, and defect incidence were consistent with those of both Lamoka and Snowden (Figure 32, 33, and 34). NY163 was ranked 1st by Herr's in January with a specific gravity of 1.083 and 13% total defects (Table 1). In April it was ranked 3rd, with a specific gravity of 1.085 and 14.7% total defects. Minor bruising was observed in both samples (Tables 1 and 2). NY163 displayed consistently low glucose concentrations during storage, similar to Lamoka. Sucrose concentrations were more variable, but late season increases did not lead to elevated glucose levels (Figures 28 and 29). MSZ242-13 was ranked 5th in January with the very high specific gravity of 1.095 and 9.8% chip defects (Table 1). In April it was ranked 8th with a specific gravity of 1.096 and 29.3% chip defects. Bruising was noted at both sample dates (Tables 1 and 2). Chip quality from the demonstration storage was good from October to June, although the April sample was marginal with over 30% chip defects (Table 8, Figure 23).

The other varieties have good chip quality during part of the storage season but did not demonstrate full season storage potential in 2020-2021. These varieties are listed with the last acceptable chip sample date in parenthesis after the variety name. B2869-28 (December), CO11023-2W (April), CO11023-9W (February), MSW474-1(April), MSZ063-2 (May), and ND7519-1 (April). B2869-29 and ND7519-1 appeared susceptible to senescence sweetening (Tables 3 and 9).

B2869-29: At 48ºF, B2869-29 had higher glucose levels than Lamoka and Snowden at all sample dates. Glucose concentrations increased between January and June, ending at 0.071%, much higher than the glucose concentrations in Lamoka and Snowden, at 0.001% and 0.02%, respectively (Figure 1). This variety had sucrose levels consistently higher than those of Lamoka and Snowden, especially at the last three sample dates (Figure 2). Overall, B2869-29 displayed a high percentage of chip defects during storage. The lowest percentage of defects was observed in December with 11.4% chip defects. Chip defects stayed above 50% at each subsequent sample, ending with a high of 83% defects in June (Figure 3). The SNAC Color Score was 1.0 for the first three chip samples but rose to 1.5 for the remainder of storage (Figure 4). B2869-29 does not have long term storage potential in Michigan due to the high proportion of chip defects in the January to June samples (Table 3).

Table 3. B2869-29 monthly chip quality pictures from Techmark Inc.

Month		Month	
October		January	
November		February	
December		March	

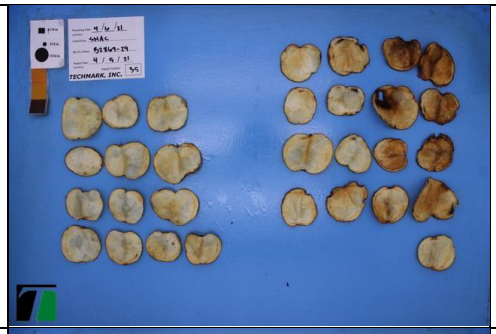
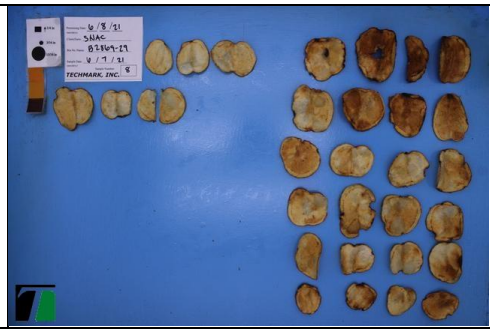
April		June	
May			

Figure 1. B2869-29 glucose concentrations for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

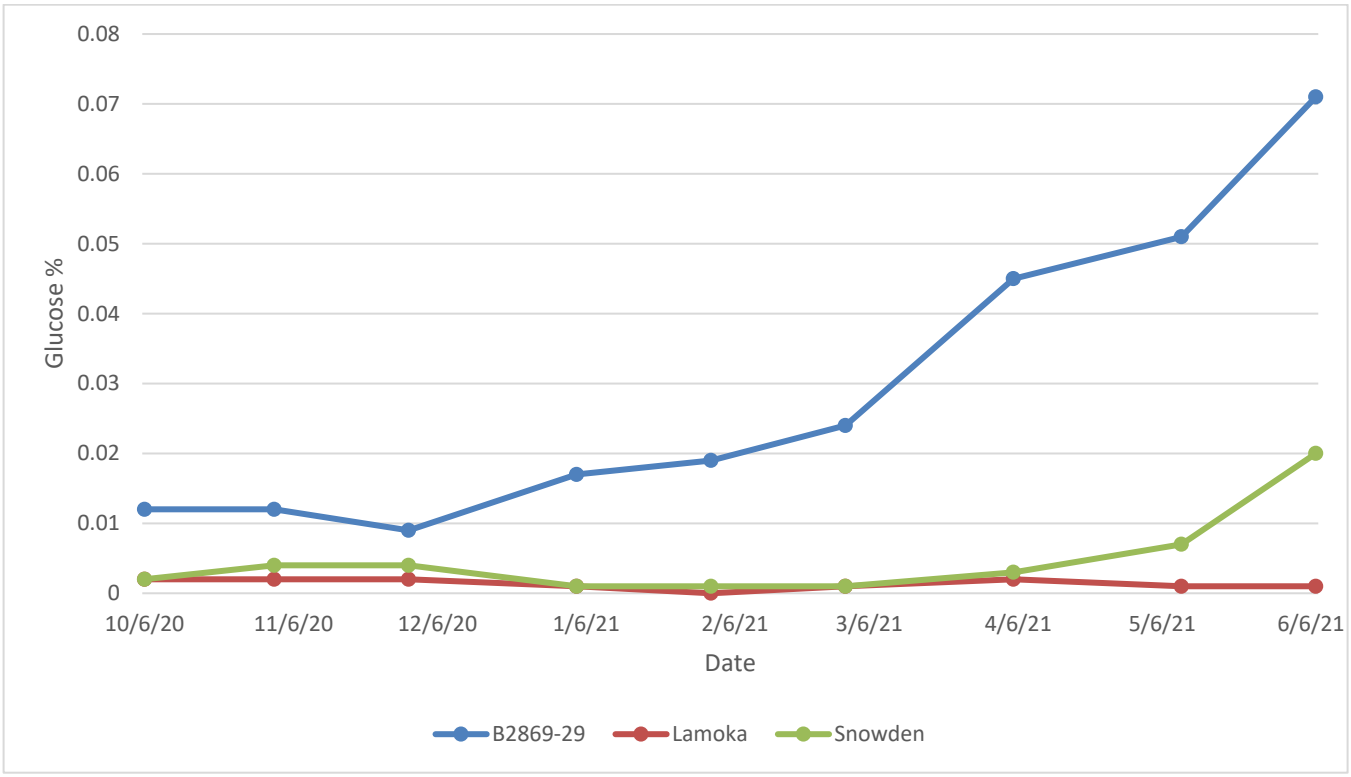


Figure 2. B2869-29 sucrose concentrations for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

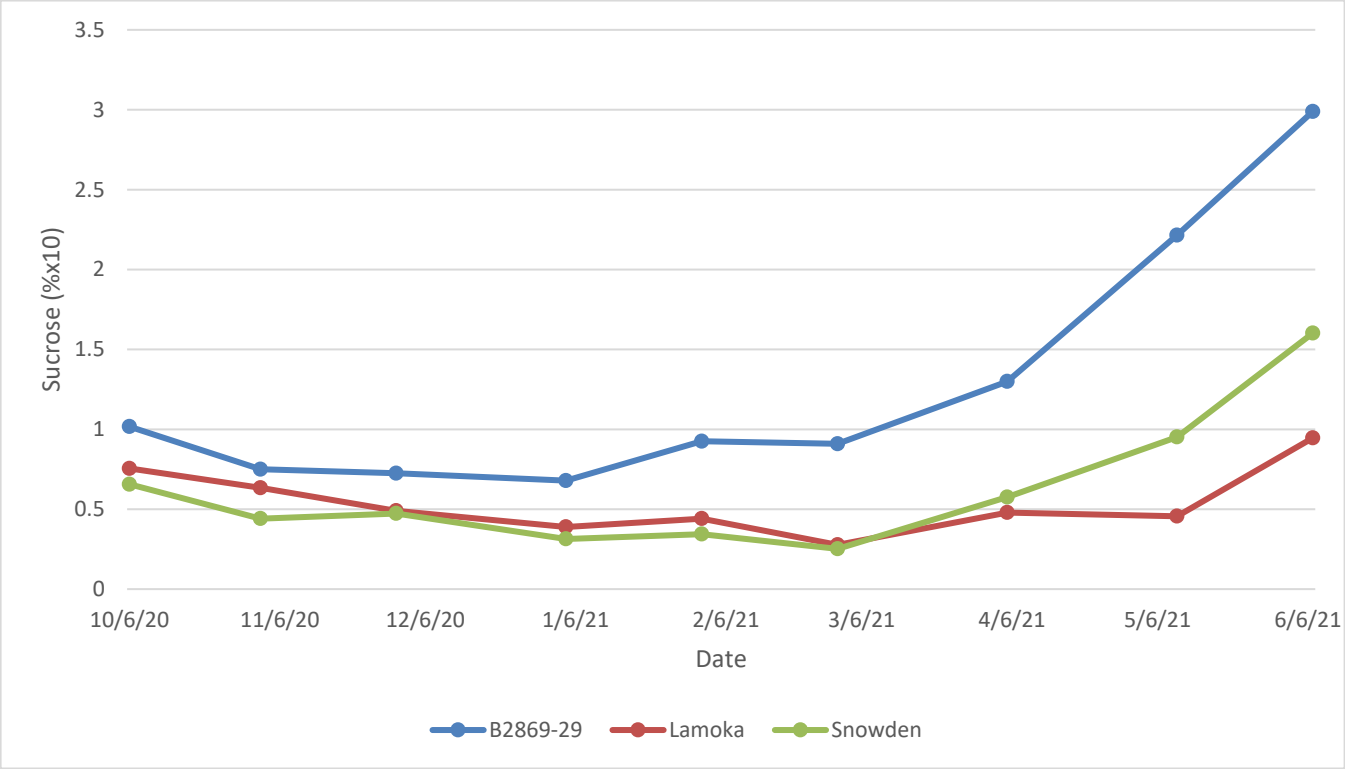


Figure 3. B2869-29 percent defects for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

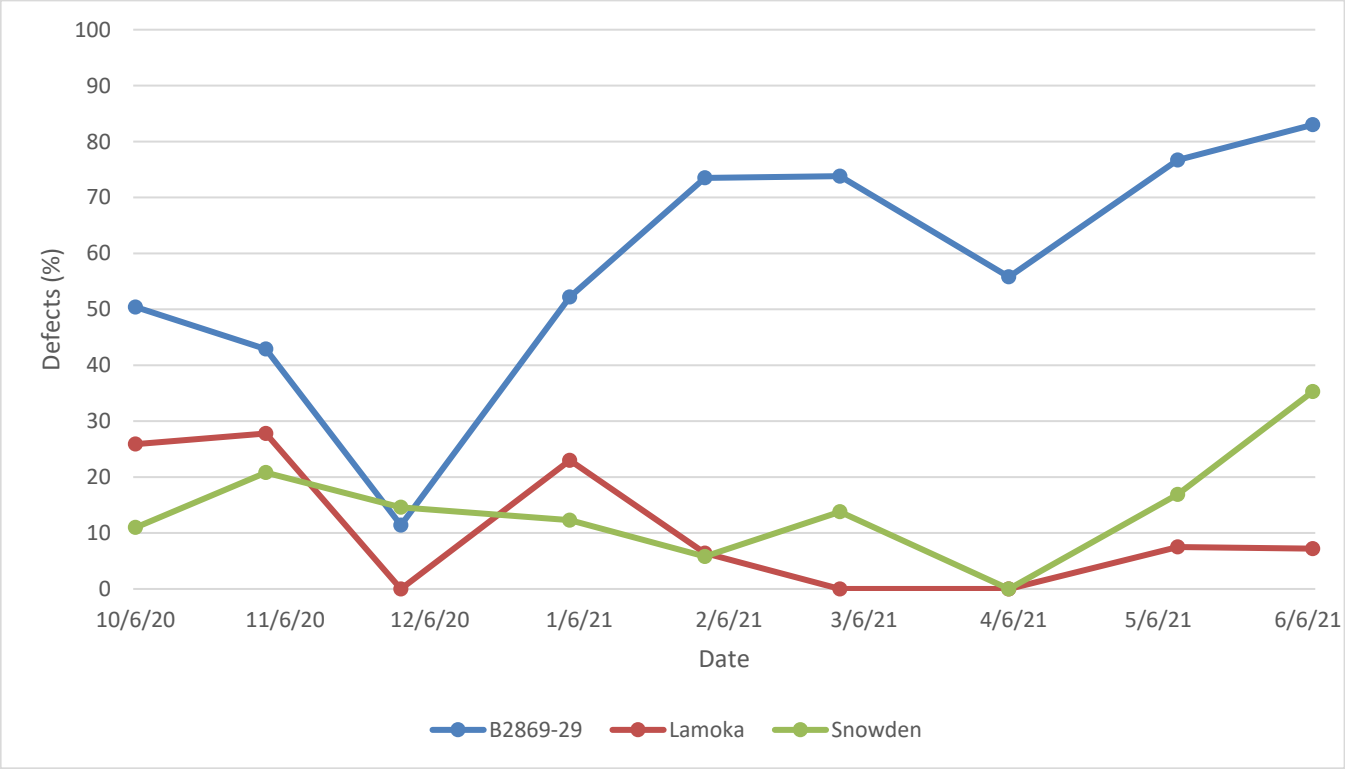
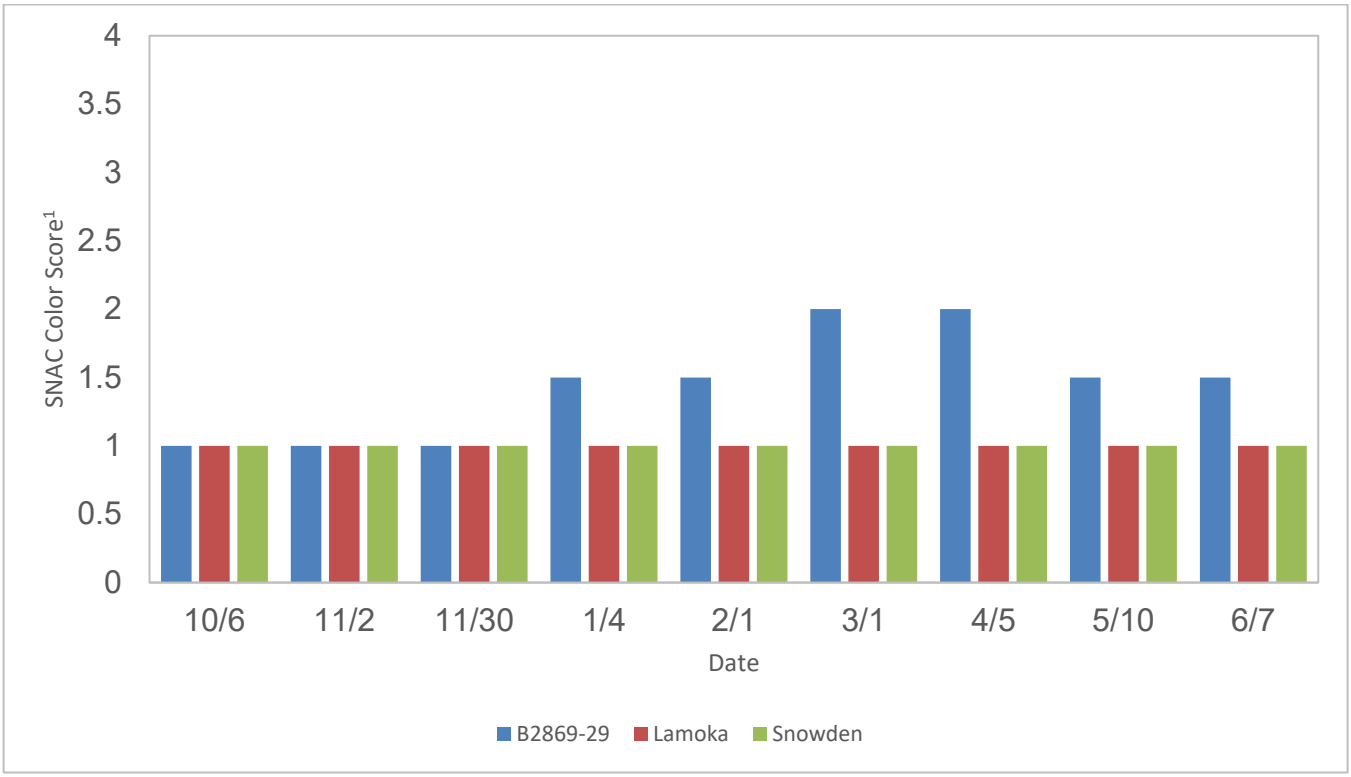


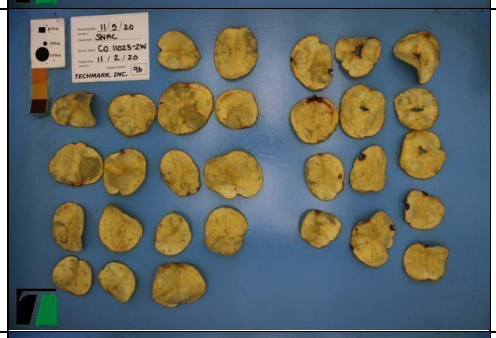
Figure 4. B2869-29 SNAC Color Score (1 = lightest, 5 = darkest) the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.



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

CO11023-2W: At 48ºF, this Colorado State University variety had glucose levels initially consistent with the check varieties. Glucose concentrations were slightly elevated compared to those of Lamoka and Snowden in January and February, and increased from April to June, ending between Snowden and Lamoka (Figure 5). The sucrose concentrations were slightly lower than Snowden from October to February, then rose at each sample, ending higher than Snowden with a 1.896% (x10) sucrose rating (Figure 6). CO11023-2W had the lowest concentration of chip defects in October and April with 11.8% and 3.5%, respectively. All other samples had a higher proportion of chip defects than either check variety. The June sample had the highest percentage of defects, 55.9% (Figure 7). Chip color was consistently rated 1.0 during storage, identical to the Snowden and Lamoka ratings during the 2020 to 2021 storage season (Figure 8).

Table 4. CO11023-2W monthly chip quality pictures from Techmark Inc.

Month			
October		January	
November		February	
December		March	

April		June	
May			

Figure 5. CO11023-2W glucose concentrations for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

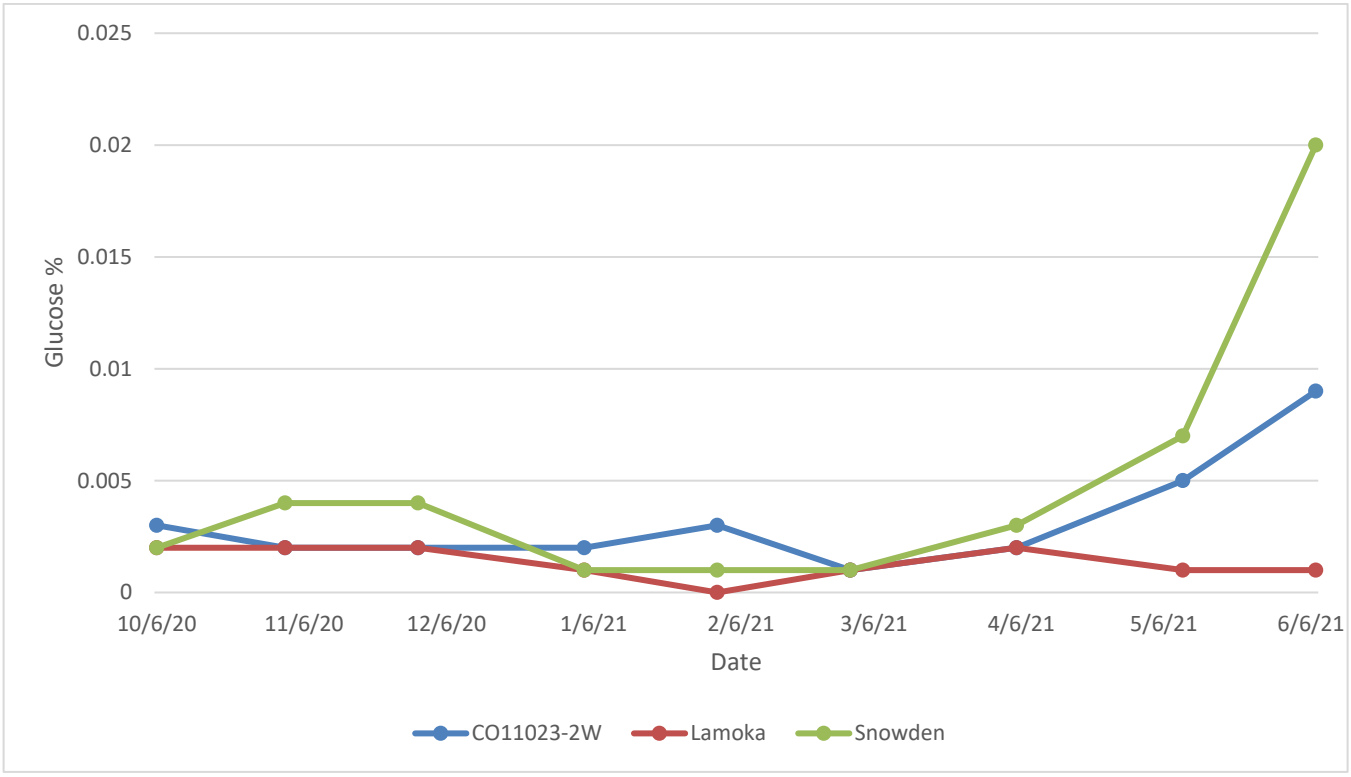


Figure 6. CO11023-2W sucrose concentrations for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

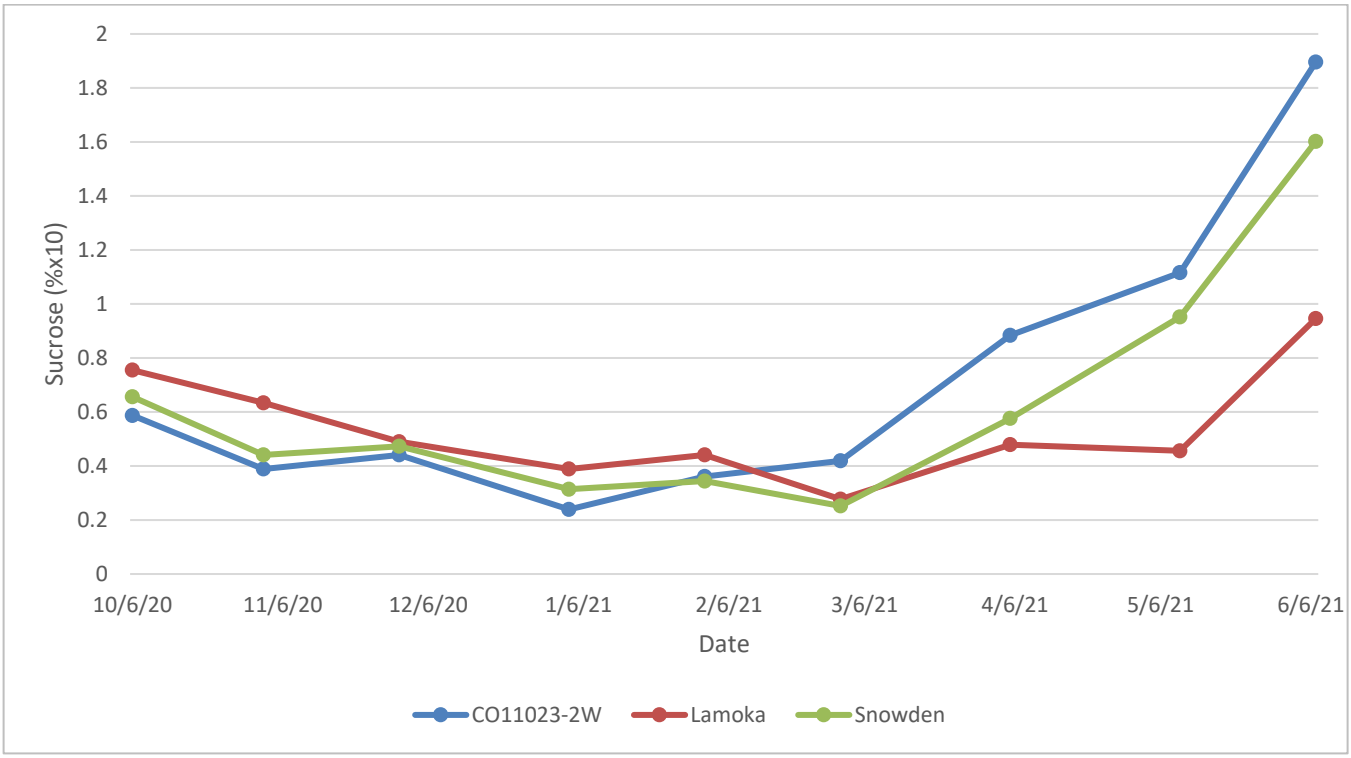


Figure 7. CO11023-2W percent defects for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

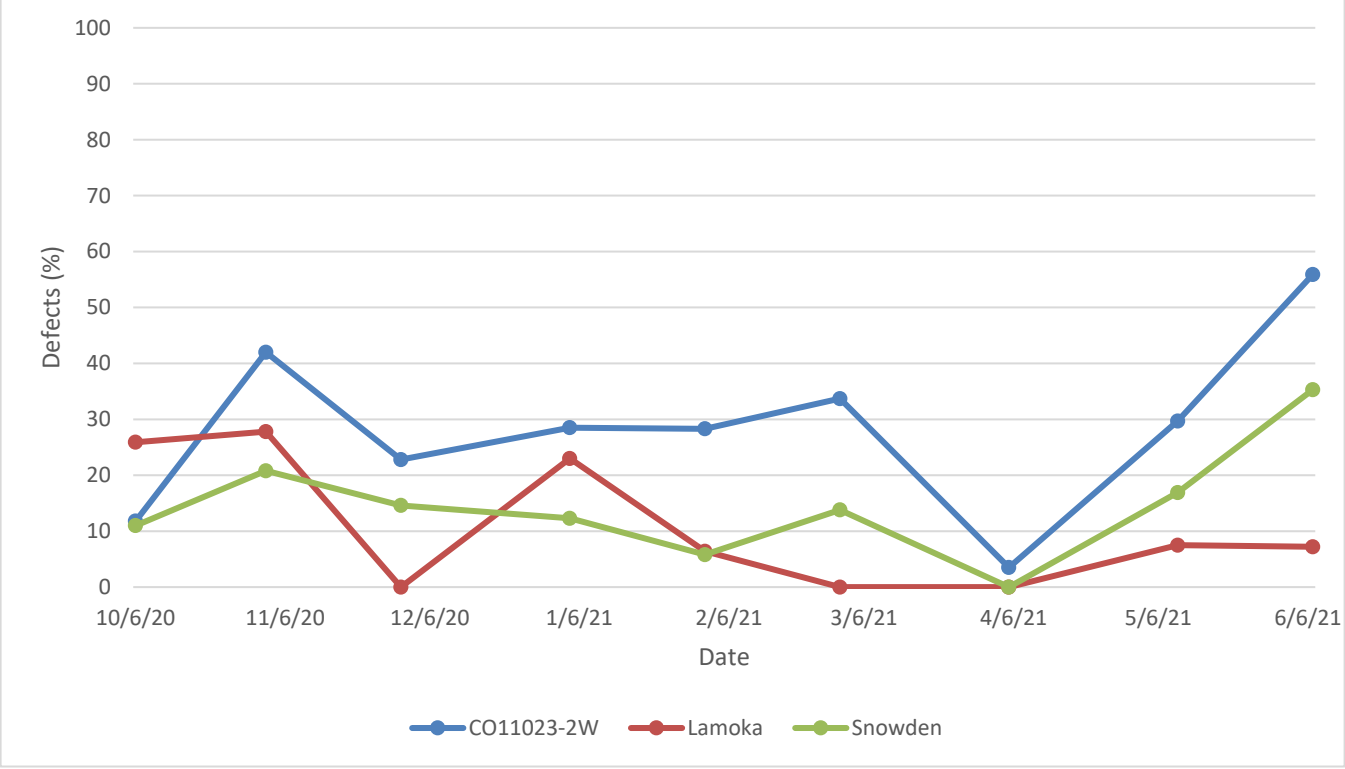
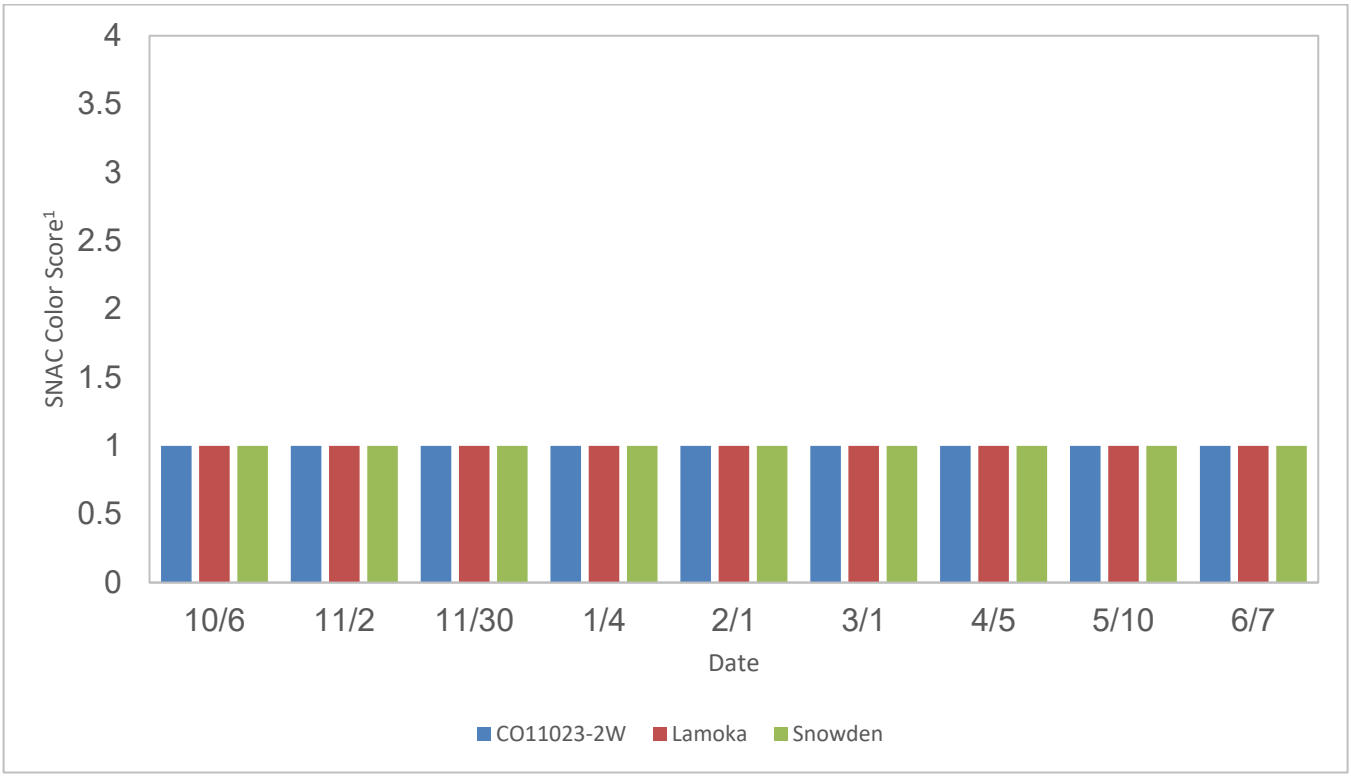


Figure 8. CO11023-2W SNAC Color Score (1 = lightest, 5 = darkest) the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.



CO11023-9W: This variety had glucose concentrations like, but slightly more elevated than those of Lamoka for the duration of storage. Concentrations did not exceed 0.005% (Figure 9). The sucrose concentrations were consistent with those of the checks through February, but increased from March to the end of storage, ending at 1.98% (x10), higher than both check varieties (Figure 10). Excluding the first sample, CO11023-9W had more chip defects at each sample than Lamoka and Snowden, with the most defects observed between March and June. The May sample had the highest defect incidence of 70.6% (Figure 11). The chip color was 1.0 from October to January but rose to 1.5 from February to June (Figure 12). Bruising and vascular color were observed in the chip samples, especially after November (Table 5).

Table 5. CO11023-9W monthly chip quality pictures from Techmark Inc.

Month		Month	
October		February	
November		March	
December		April	
January		May	

June	

Figure 9. CO11023-9W glucose concentrations for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

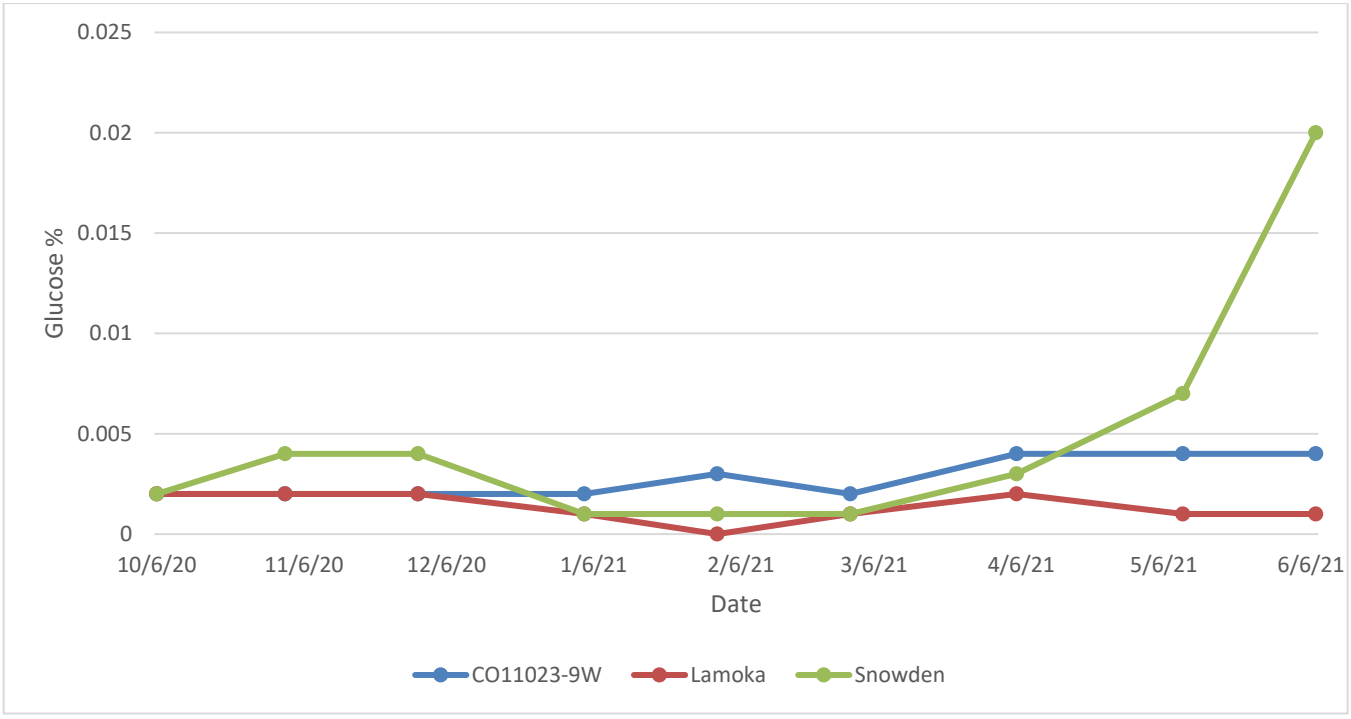


Figure 10. CO11023-9W sucrose concentrations for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

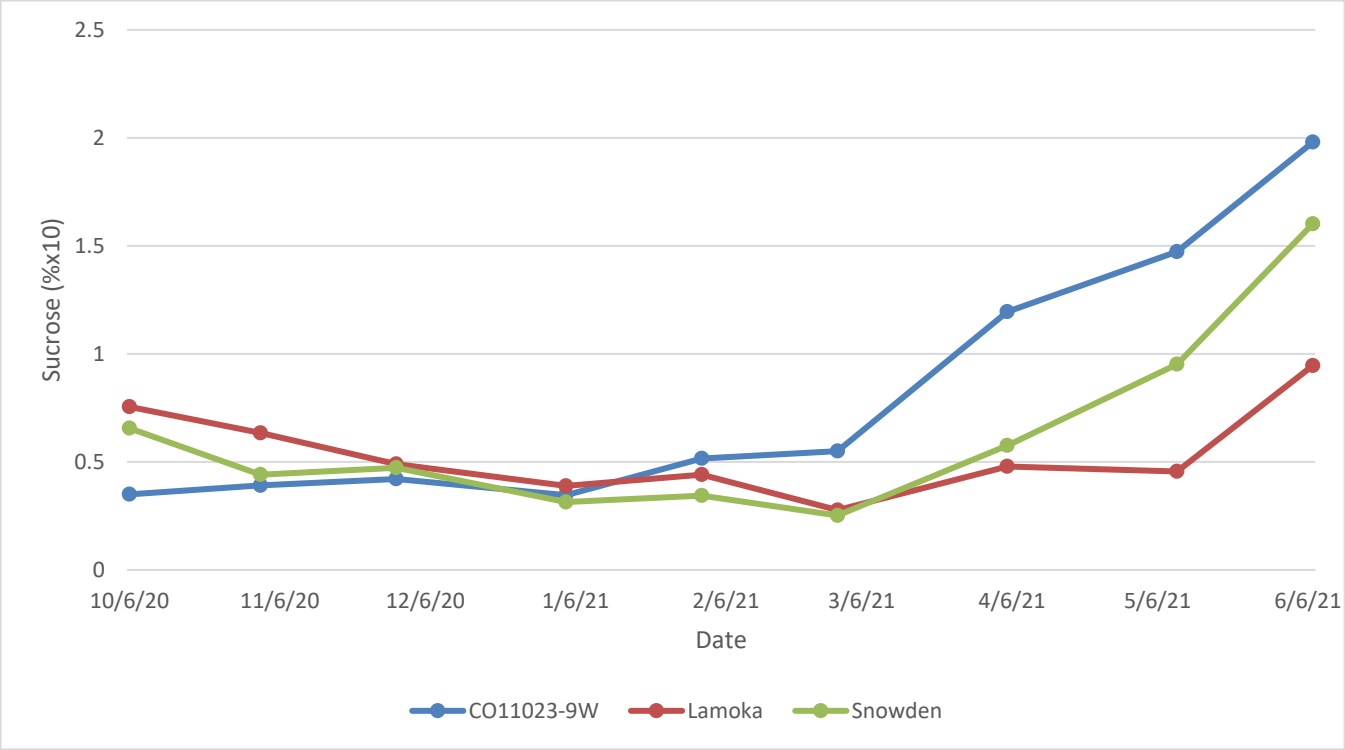


Figure 11. CO11023-9W percent defects for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

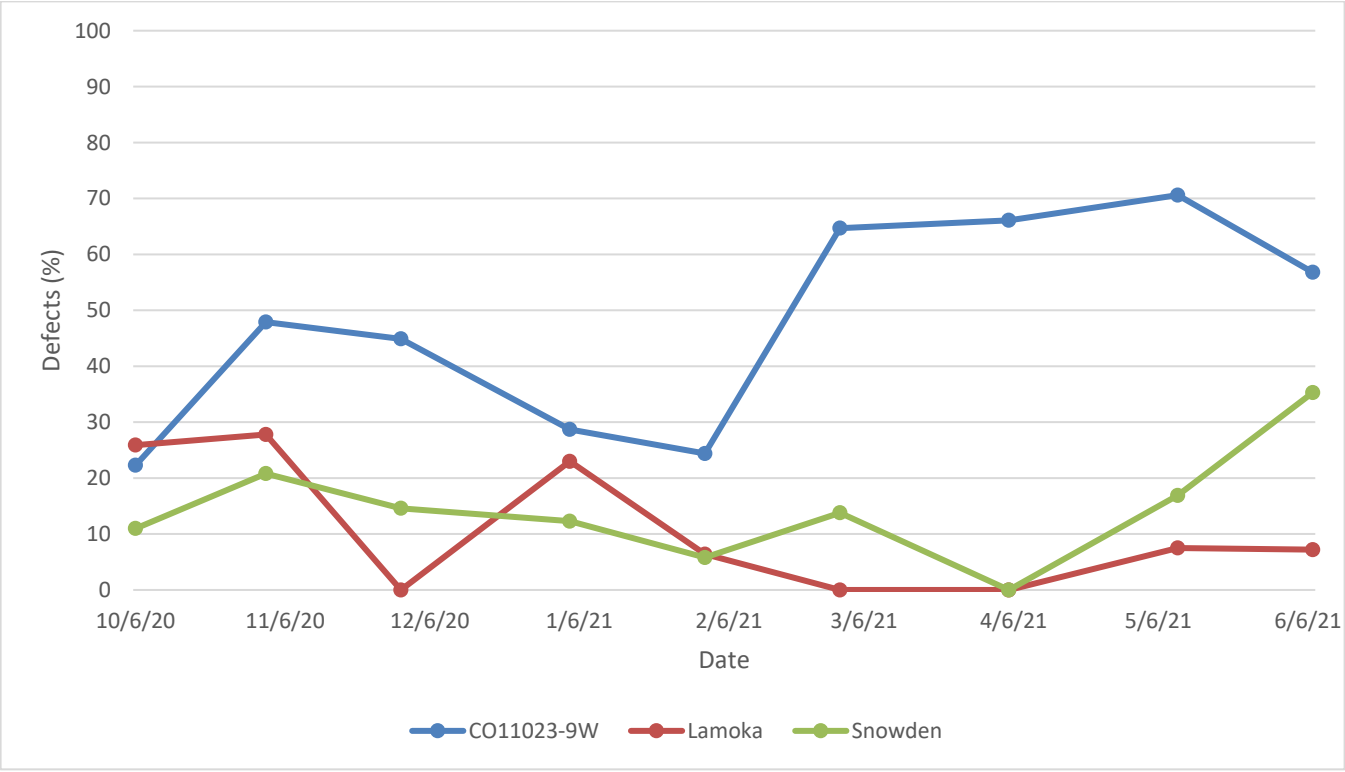
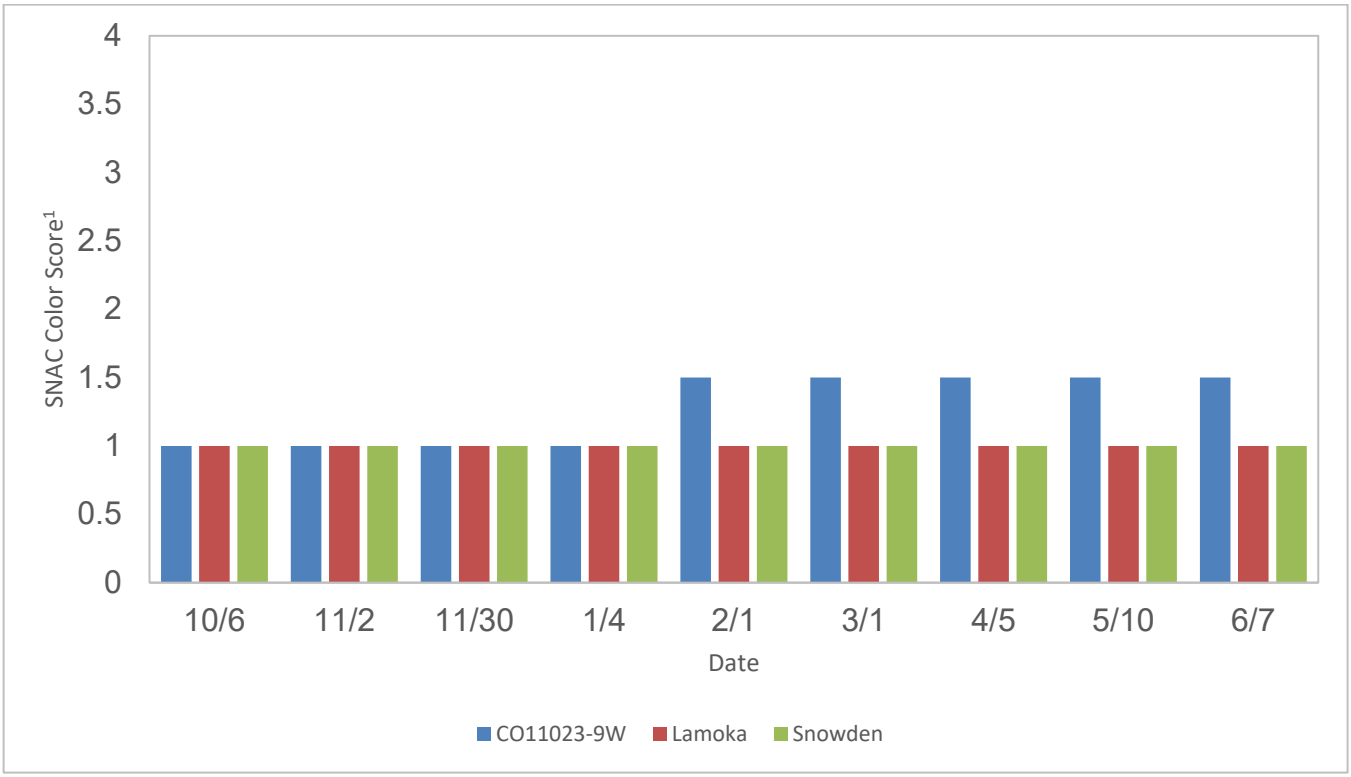


Figure 12. CO11023-9W SNAC Color Score (1 = lightest, 5 = darkest) the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.



MSW474-1: At 48ºF, this variety did not display the decrease in glucose concentration observed in the check varieties had between December and March. Instead, the glucose concentration rose through February, reaching the highest concentration during storage of 0.007%. Glucose concentrations then decreased and remained stable from March to June (Figure 13). MSW474-1 had sucrose concentrations lower than those of the check varieties between October and January, after which the sucrose generally increased through June, ending slightly below that of Lamoka (Figure 14). From November to June, chip defects were consistently higher than the checks. The June sample had the highest incidence of chip defects, 44.5% (Figure 15). SNAC color was rated at 1.0 for the duration of storage (Figure 16). MSW474-1 appears to recondition in storage and will be evaluated further for long term storage potential in Michigan (Table 6).

Table 6. MSW474-1 monthly chip quality pictures from Techmark Inc.

Month		Month	
October		January	
November		February	
December		March	

April		June	
May			

Figure 13. MSW474-1 glucose concentrations for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

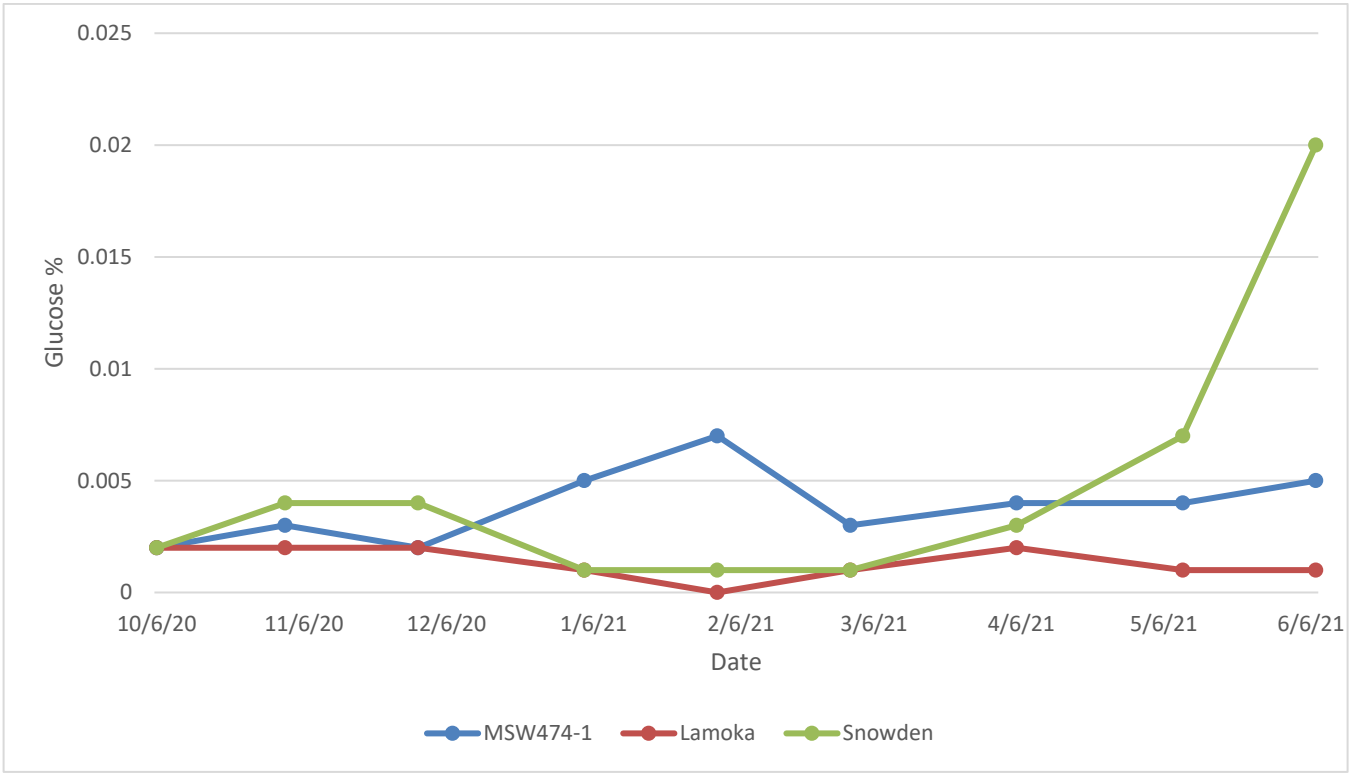


Figure 14. MSW474-1 sucrose concentrations for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

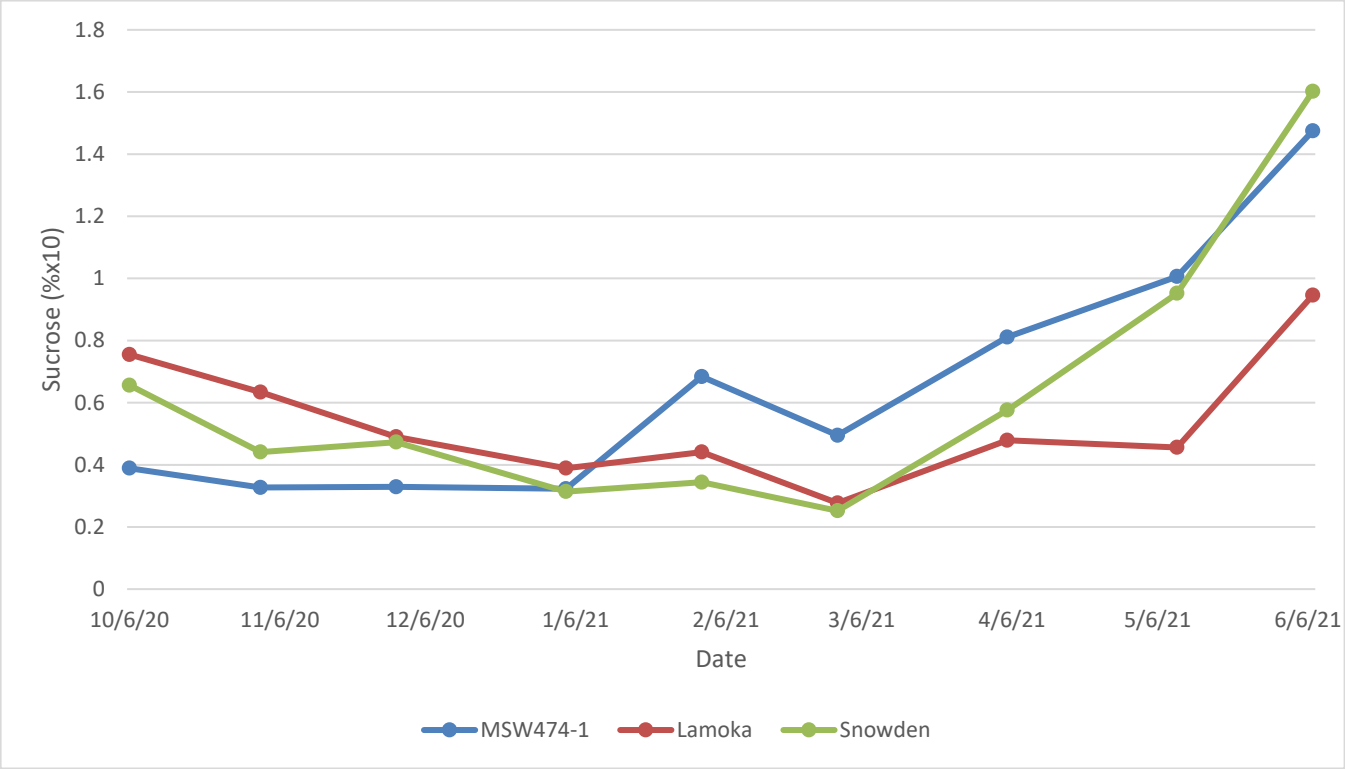


Figure 15. MSW474-1 percent defects for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

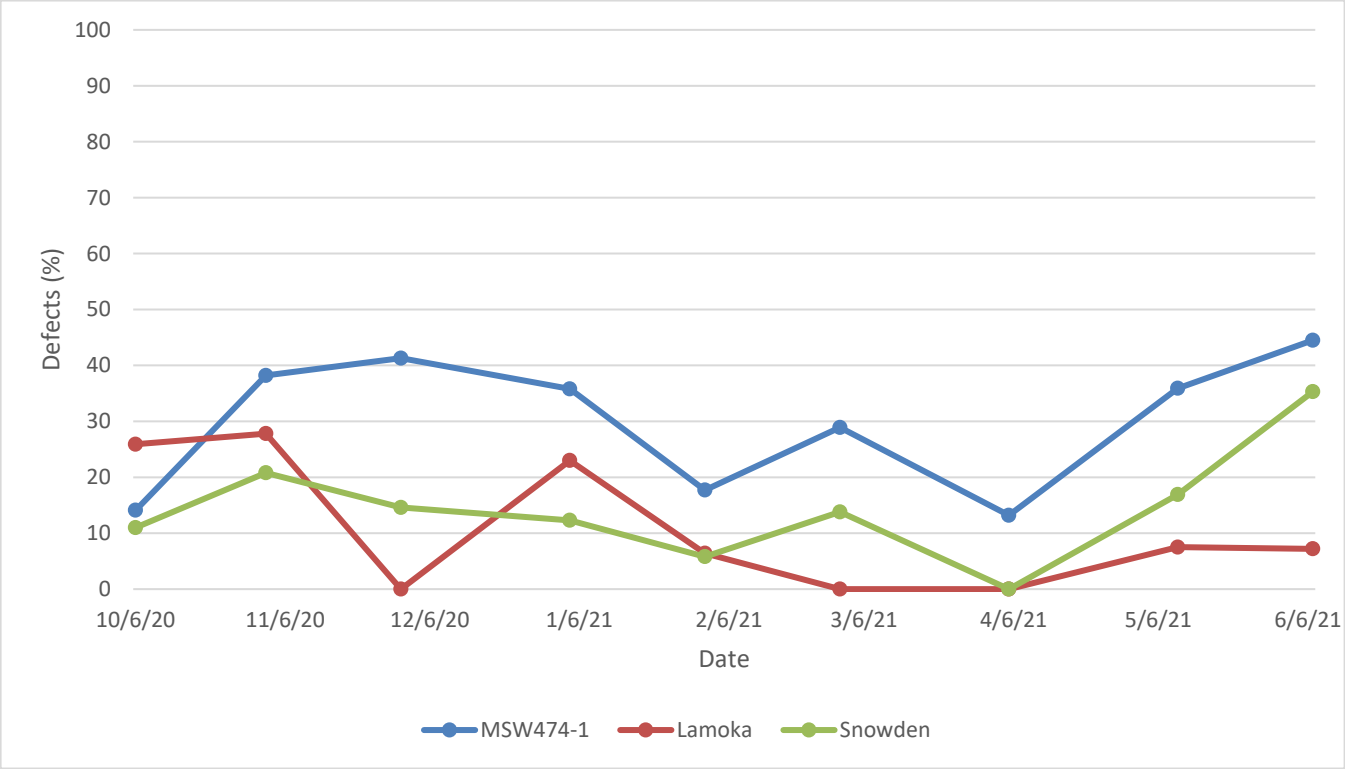
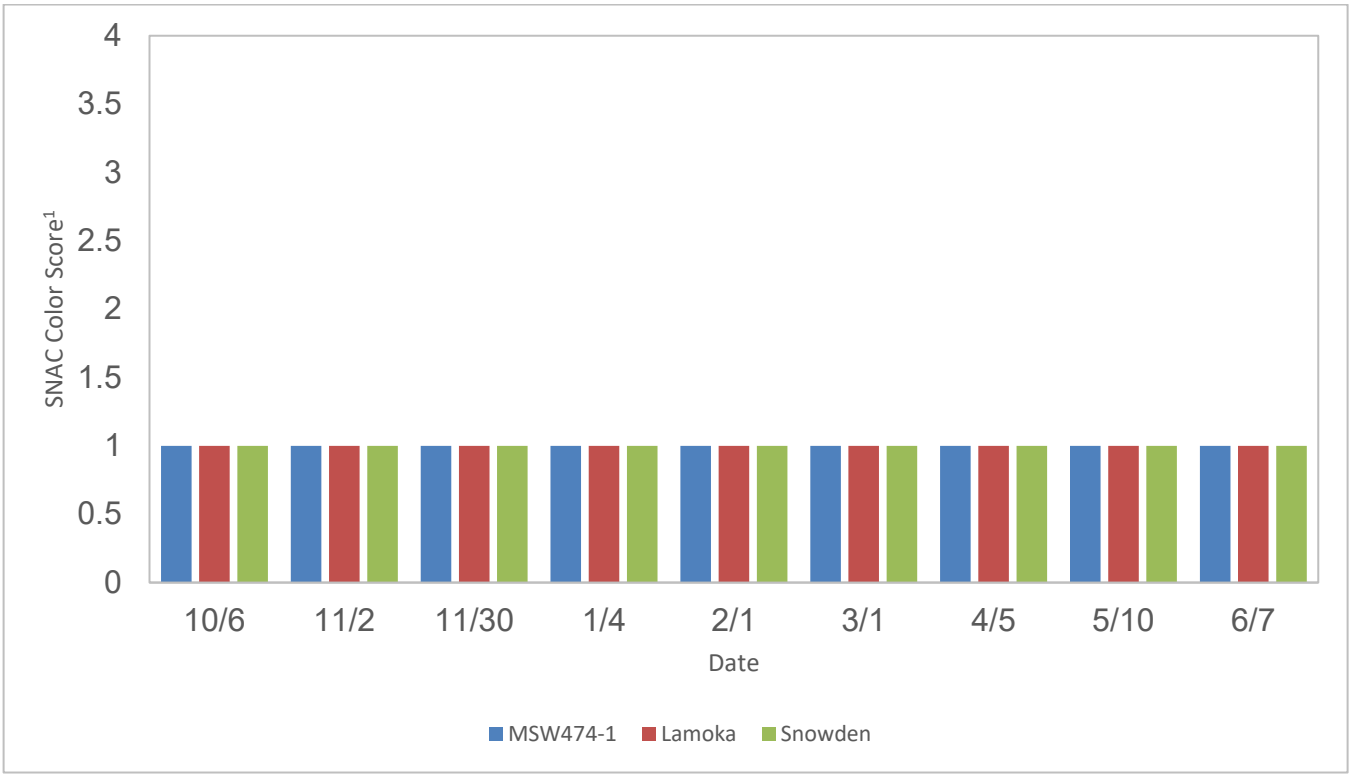


Figure 16. MSW474-1 SNAC Color Score (1 = lightest, 5 = darkest) the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.



MSZ063-2: This Michigan State University variety had stable glucose concentrations between October and April with values below 0.005%. Concentrations rose in May and June, ending at 0.012%, between those of Lamoka and Snowden (Figure 17). Sucrose concentrations followed a trend similar to Lamoka during storage but were higher in all but the first sample (Figure 18). Chip defects observed in MSZ063-2 were variable, with the highest defects observed in January, March, and June, between 31% and 51.5% defects. All other samples had less than 20% defects (Figure 19). SNAC chip color was 1.0 during storage (Figure 20).

Table 7. MSZ063-2 monthly chip quality pictures from Techmark Inc.

Month			
October		February	
November		March	
December		April	
January		May	

June	

Figure 17. MSZ063-2 glucose concentrations for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

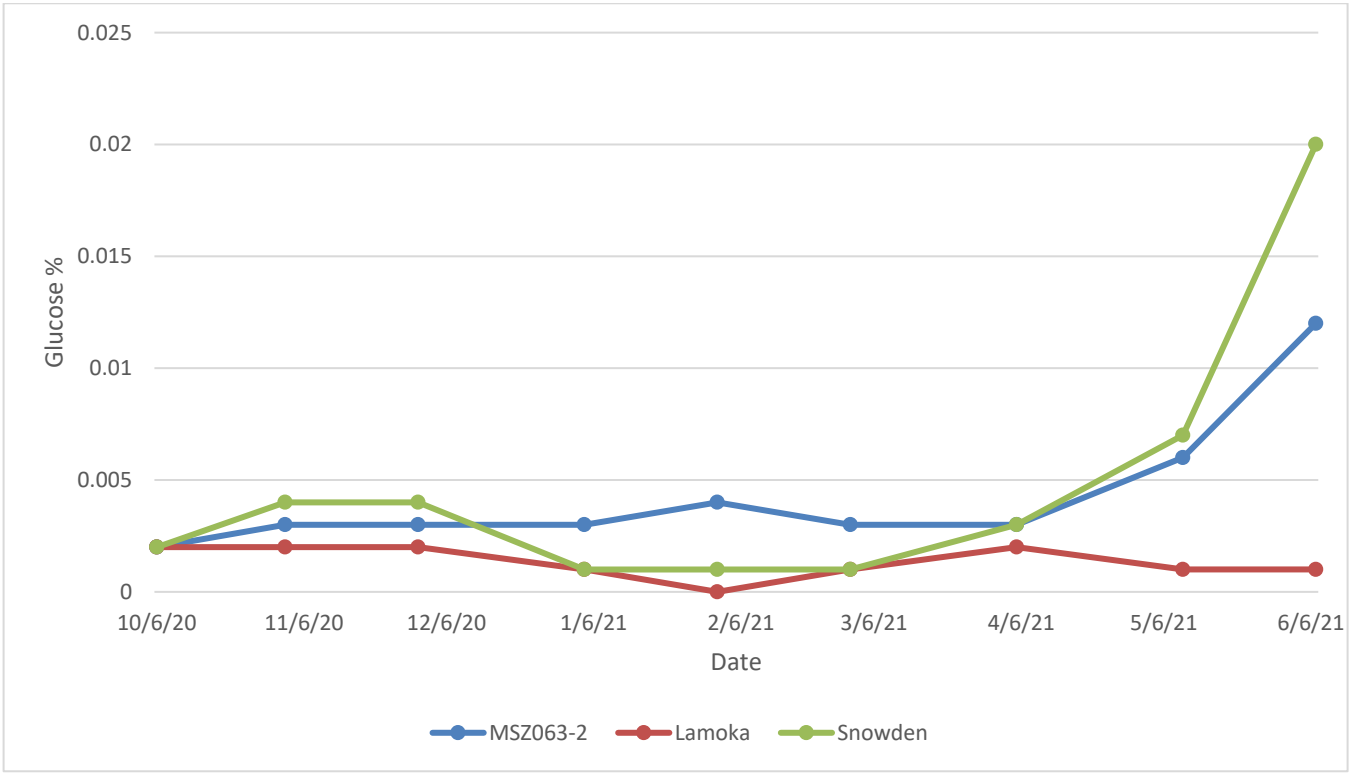


Figure 18. MSZ063-2 sucrose concentrations for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

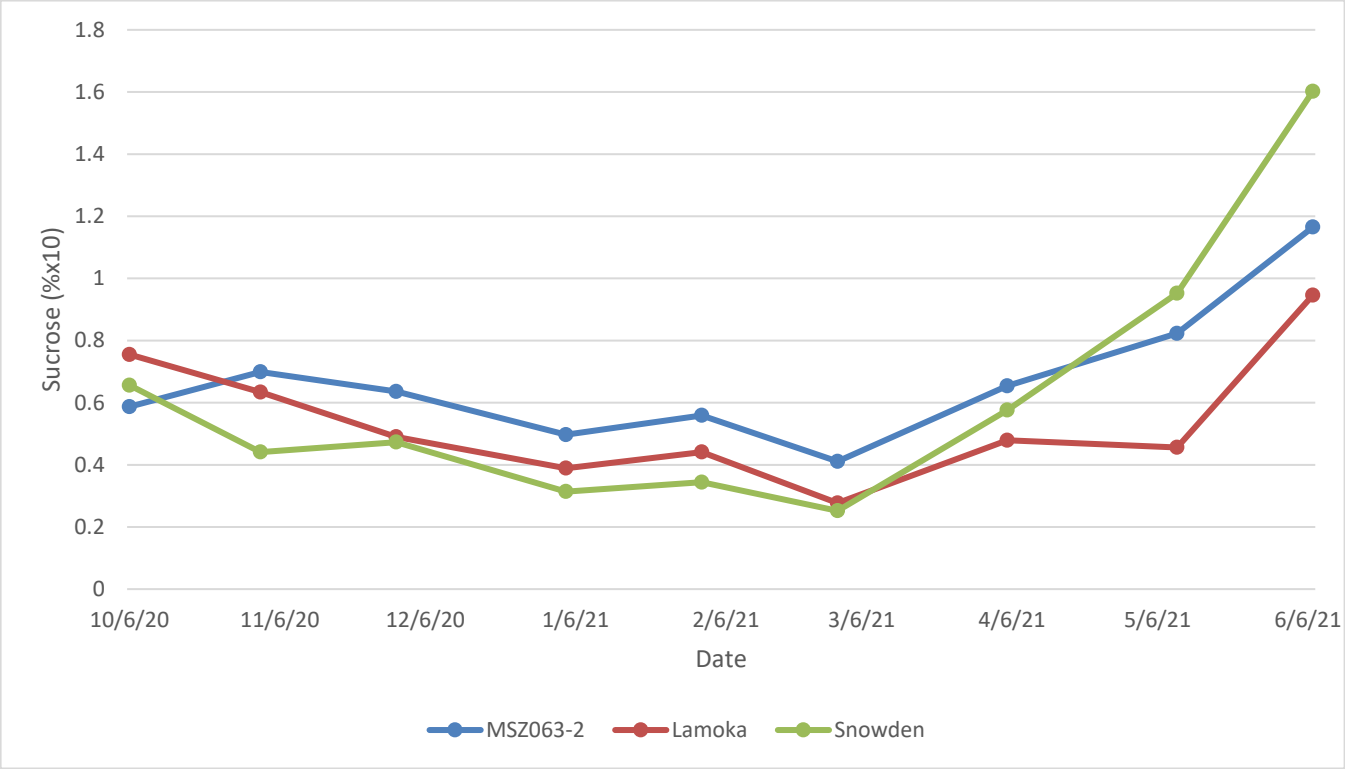


Figure 19. MSZ063-2 percent defects for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

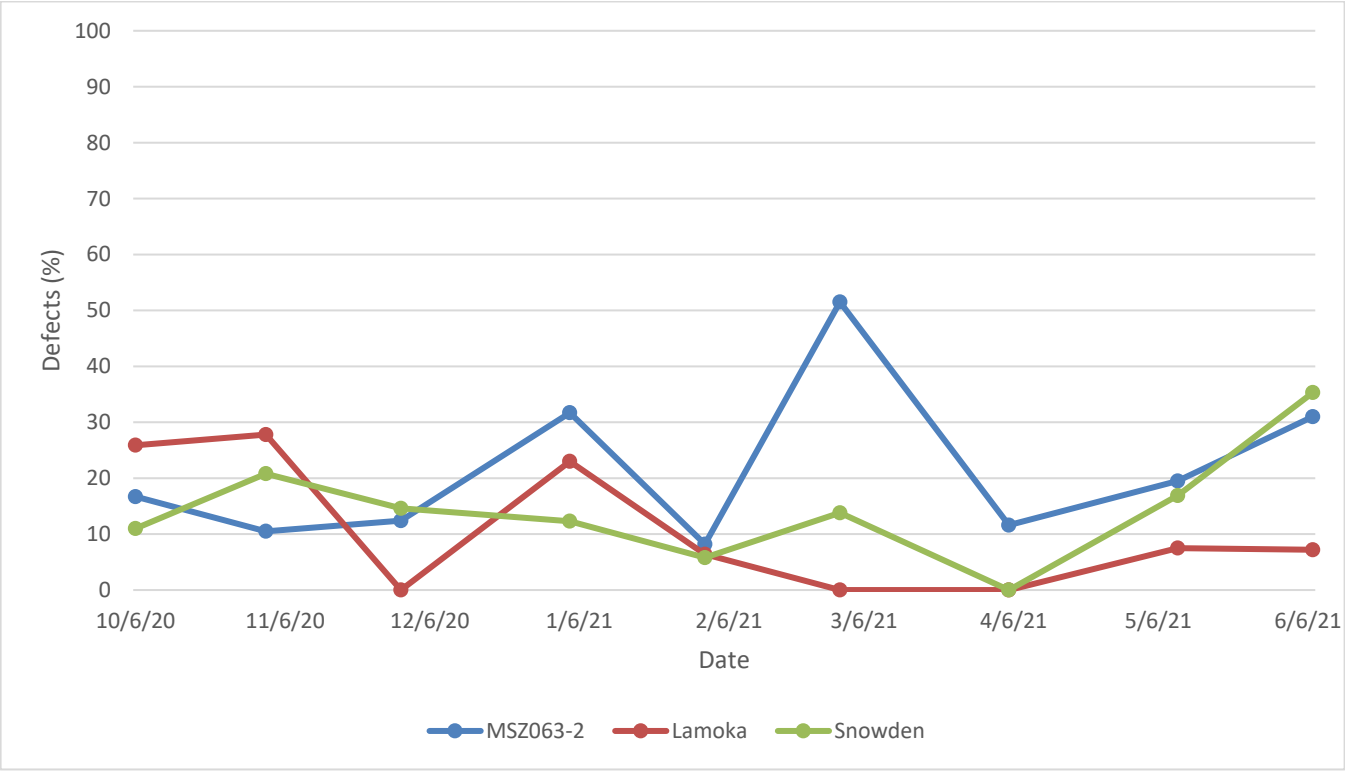
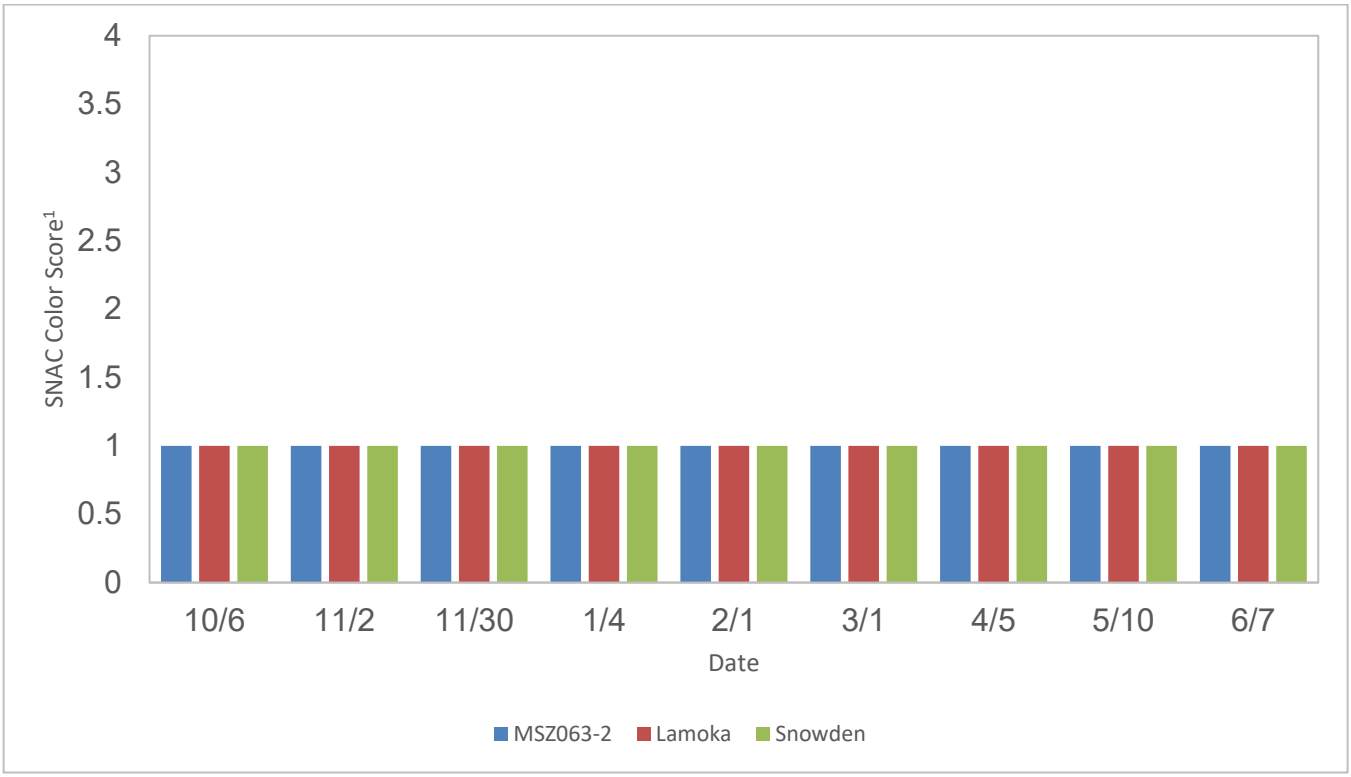


Figure 20. MSZ063-2 SNAC Color Score (1 = lightest, 5 = darkest) the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.



MSZ242-13: While the initial glucose levels of this variety were like those of the checks, the glucose levels increased slightly in January and February before decreasing in March. At all samples, the glucose concentration was at or less than 0.003% (Figure 21). The sucrose concentrations of MSZ242-13 followed the same pattern as the checks, decreasing from October to March, and then increasing though the end of storage (Figure 22). Chip defects observed in MSZ242-13 were variable, with the highest percentage of defects observed in the April sample, 33.8% The first and last samples had very low chip defects, 0% in October and 3% in June (Figure 23). Chip color was a 1.0 at all sample dates (Figure 24). This variety displays good chip quality though June and will be further evaluated for long term storage potential in Michigan (Table 8).

Table 8. MSZ242-13 monthly chip quality pictures from Techmark Inc.

Month		Month	
October		February	
November		March	
December		April	
January		May	

June	

Figure 21. MSZ242-13 glucose concentrations for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

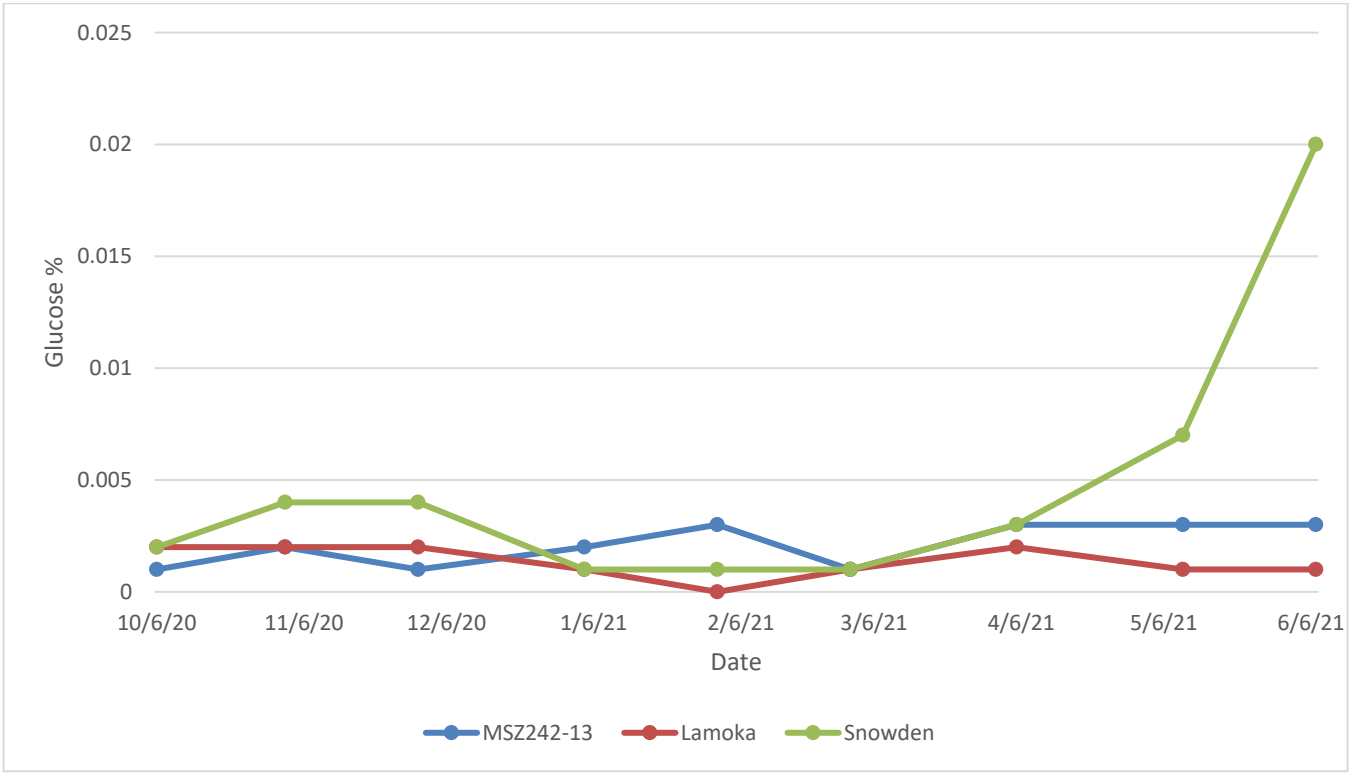


Figure 22. MSZ242-13 sucrose concentrations for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

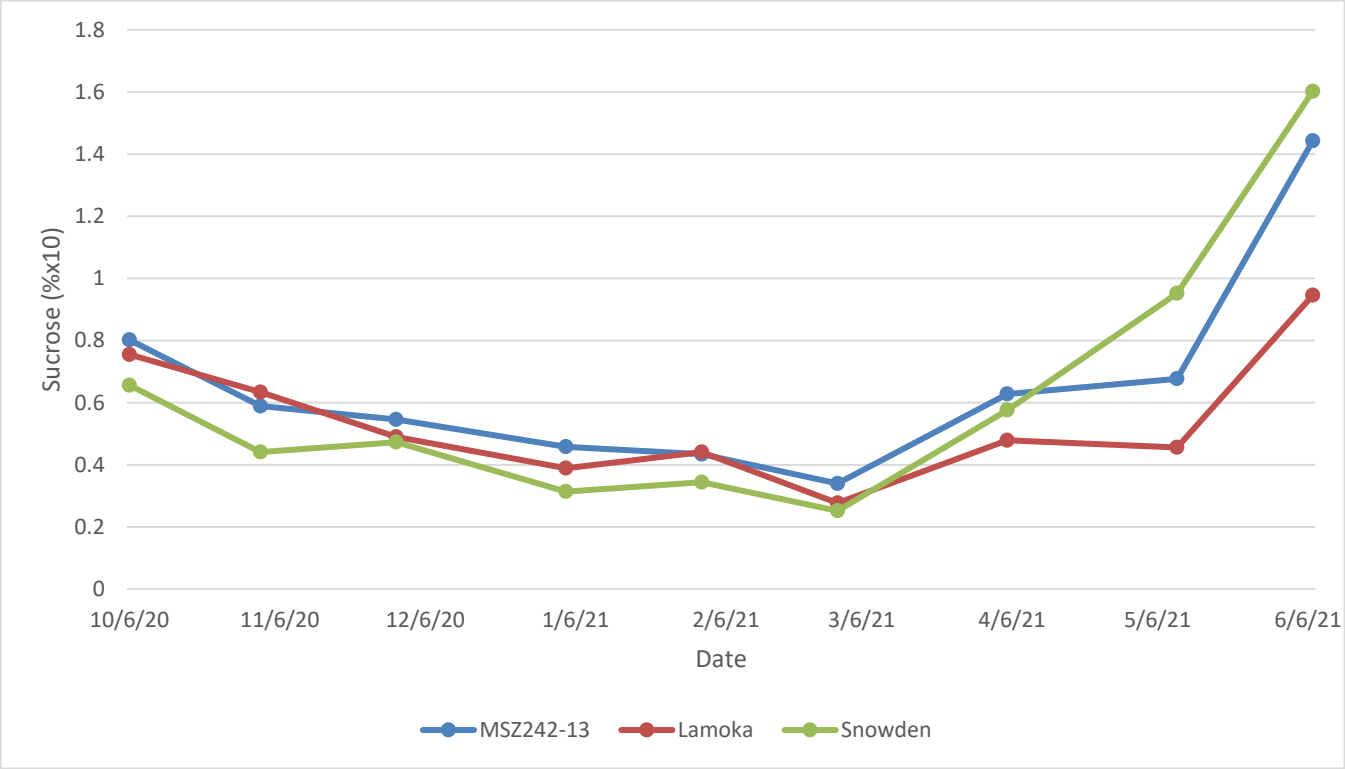


Figure 23. MSZ242-13 percent defects for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

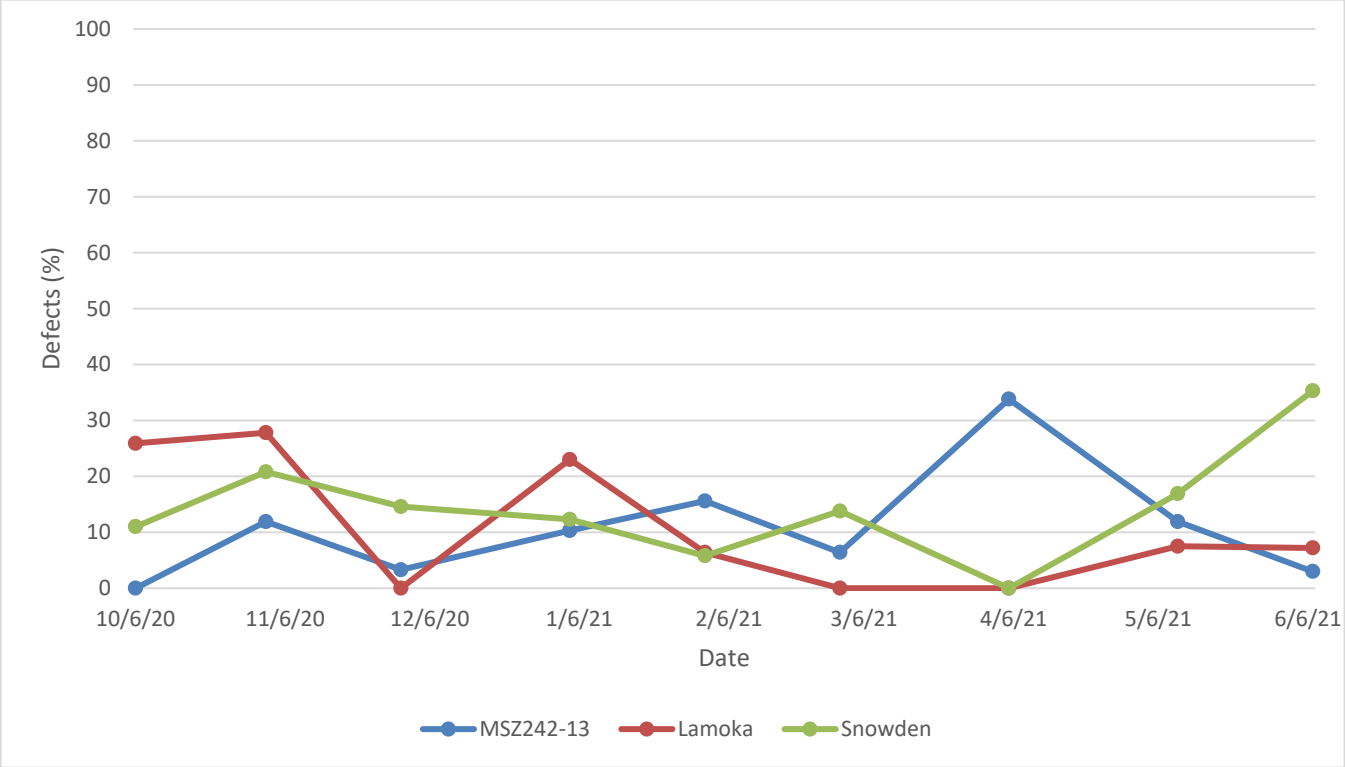
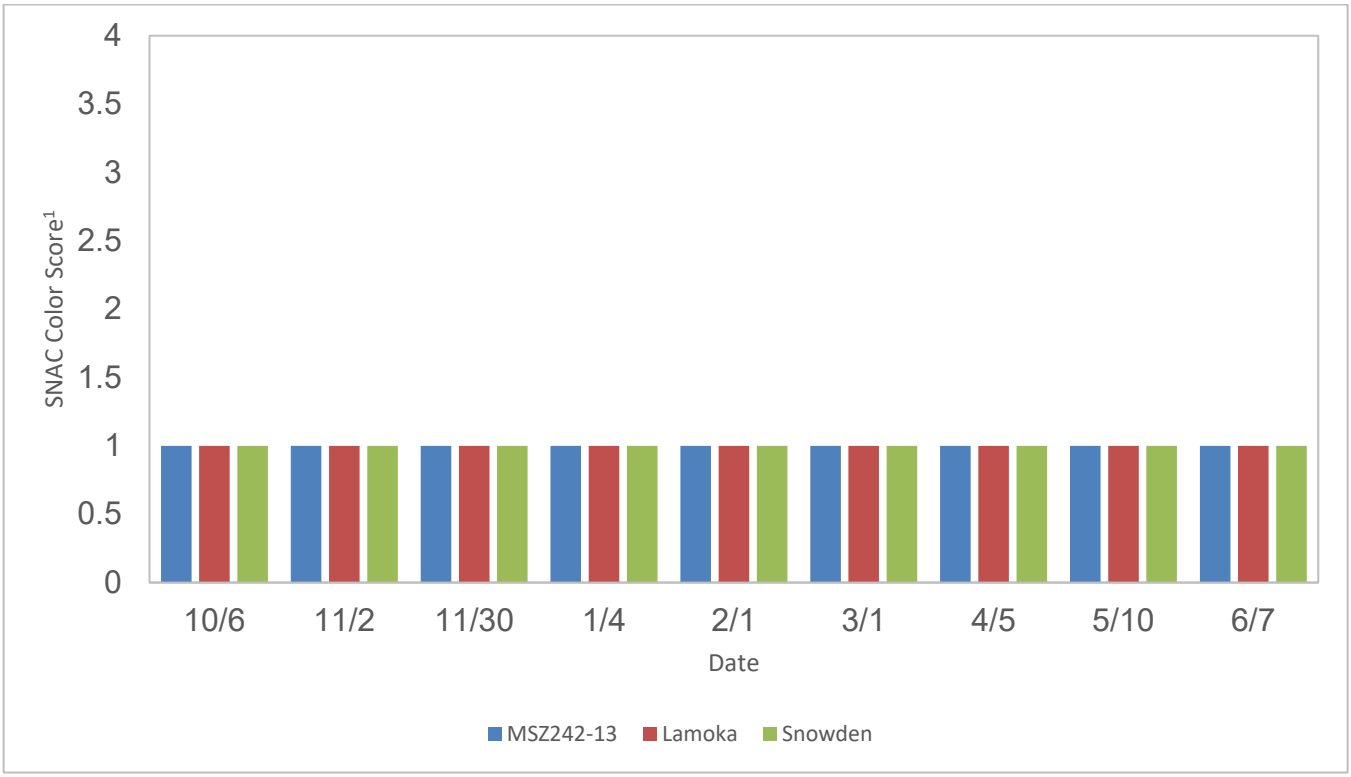


Figure 24. MSZ242-13 SNAC Color Score (1 = lightest, 5 = darkest) the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.



ND7519-1: While the initial glucose levels were like those of the checks, they greatly increased in May and June to 0.039% and 0.064%, respectively. This is much higher than 0.02% in Snowden and 0.001% in Lamoka (Figure 25). The sucrose concentrations were also like those of the checks until March, after which they also steeply increased (Figure 26). Chip quality in ND7519-1 was excellent through January with no chip defects observed. Between February and April more chip defects were observed but were less than 20% in each sample. In May and June, rising sucrose and glucose contributed to darker chips, with over 87% defects in both samples (Figure 27). Chip color was rated at 1.0 though April, and 1.5 though June, which only reflects the color of the acceptable chips (Figure 28). This variety has short term storage potential in Michigan and has good chip quality though April (Table 9).

Table 9. ND7519-1 monthly chip quality pictures from Techmark Inc.

Month		Month	
October		February	
November		March	
December		April	
January		May	

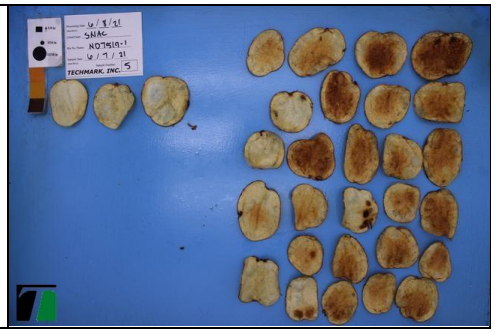
June	

Figure 25. ND7519-1 glucose concentrations for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

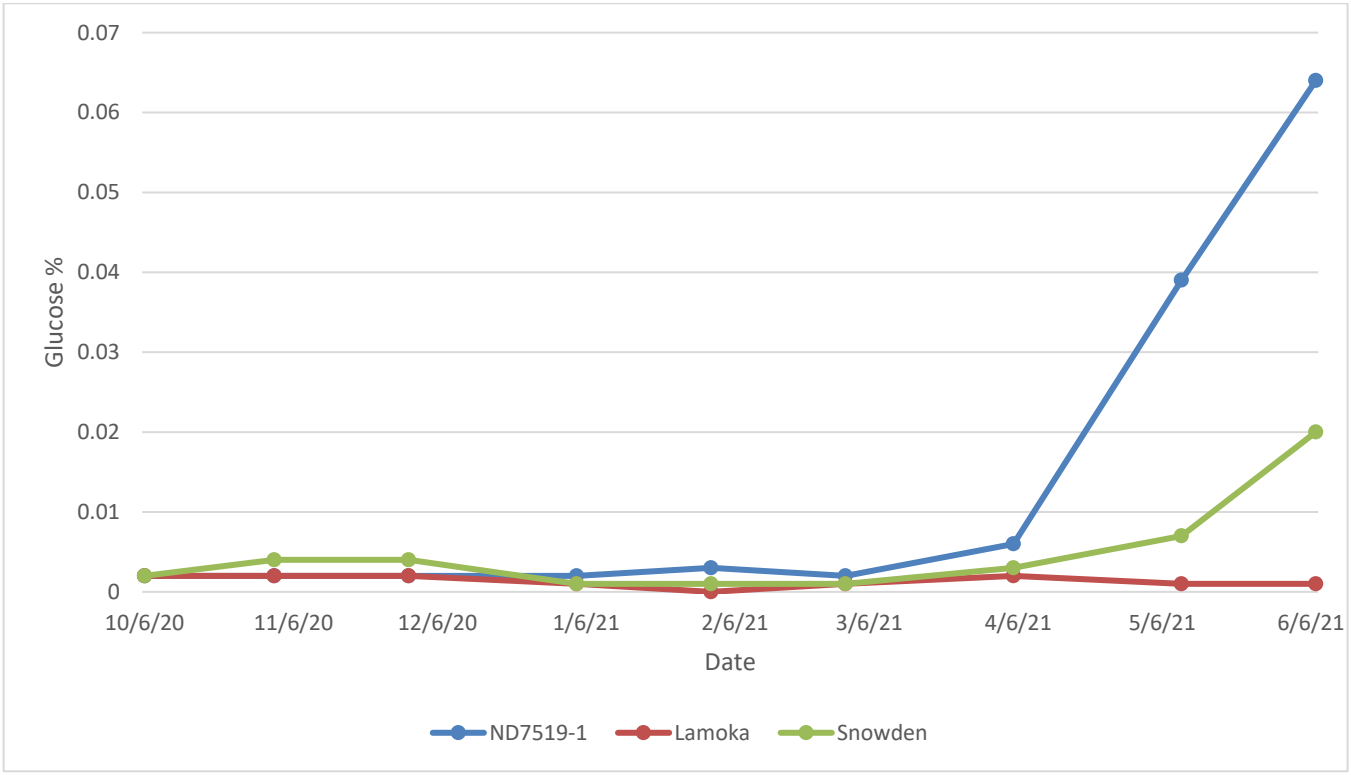


Figure 26. ND7519-1 sucrose concentrations for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

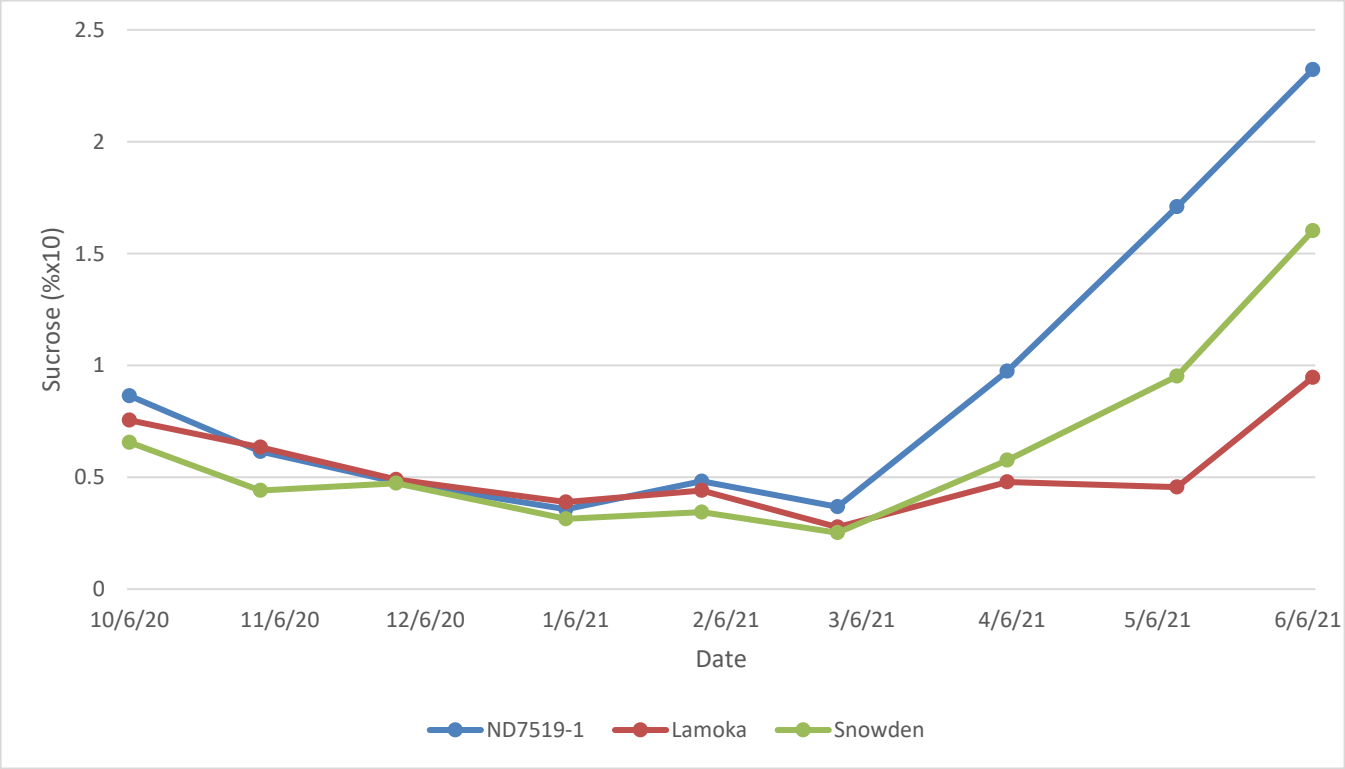


Figure 27. ND7519-1 percent defects for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

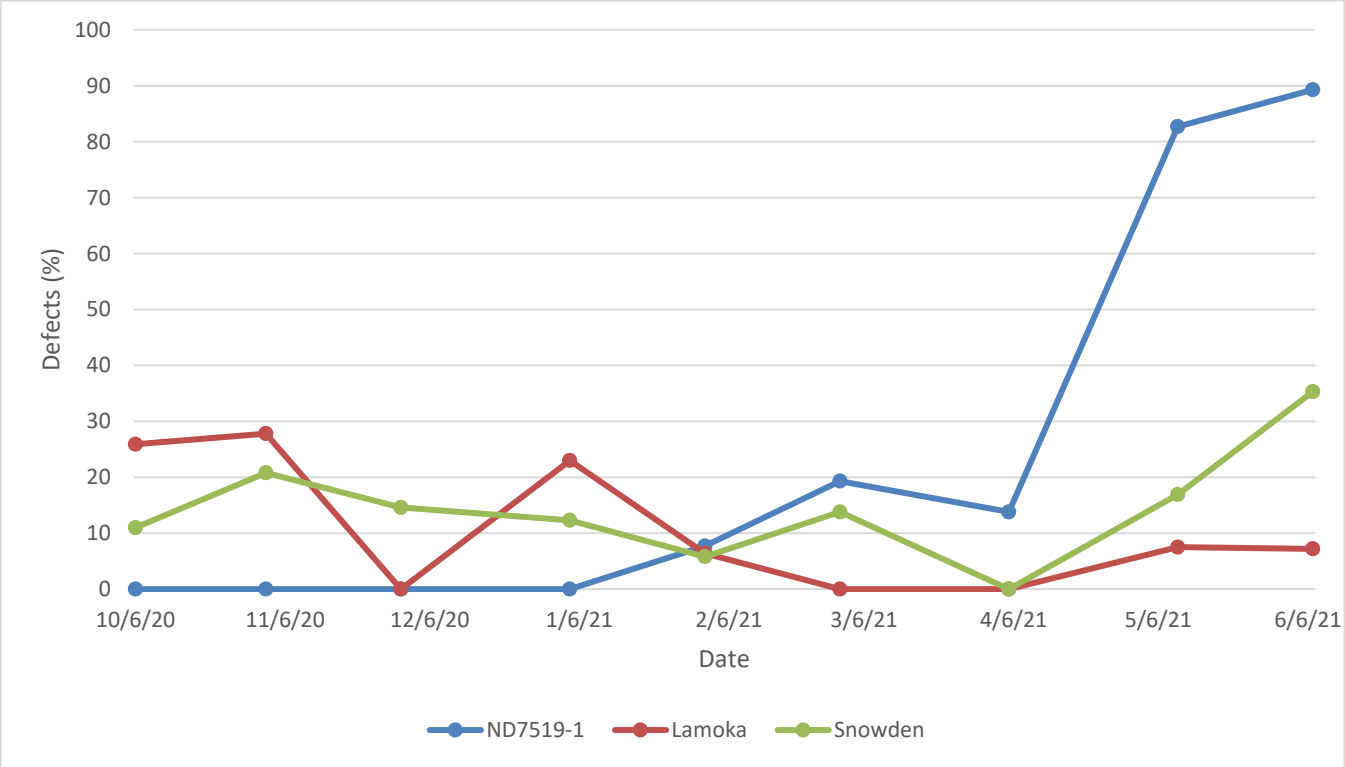
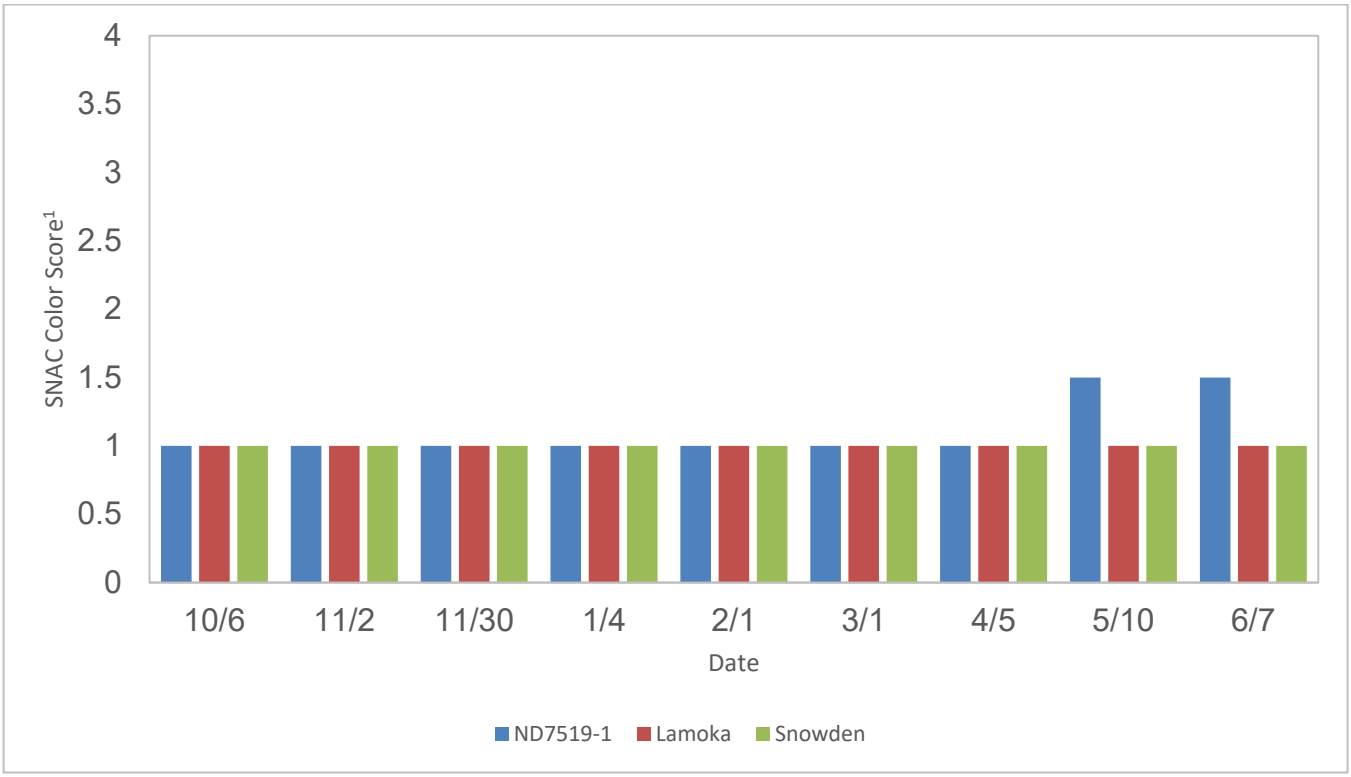


Figure 28. ND7519-1 SNAC Color Score (1 = lightest, 5 = darkest) the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.



NY163: This Cornell variety had relatively stable glucose levels that fluctuated slightly, ending with 0.004% in June, a value slightly higher than that of Lamoka (Figure 28). The sucrose concentrations were consistent between October and March, then generally increased through June, ending between the concentrations of Lamoka and Snowden (Figure 29). NY163 had chip defects below 20% during storage, comparable to both check varieties (Figure 30). Chip color was excellent and was rated 1.0 for the duration of storage (Figure 31). This variety has long term storage potential, with excellent chip color and quality though June (Table 10).

Table 10. NY163 monthly chip quality pictures from Techmark Inc.

Month		Month	
October		February	
November		March	
December		April	
January		May	

June	

Figure 28. NY163 glucose concentrations for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

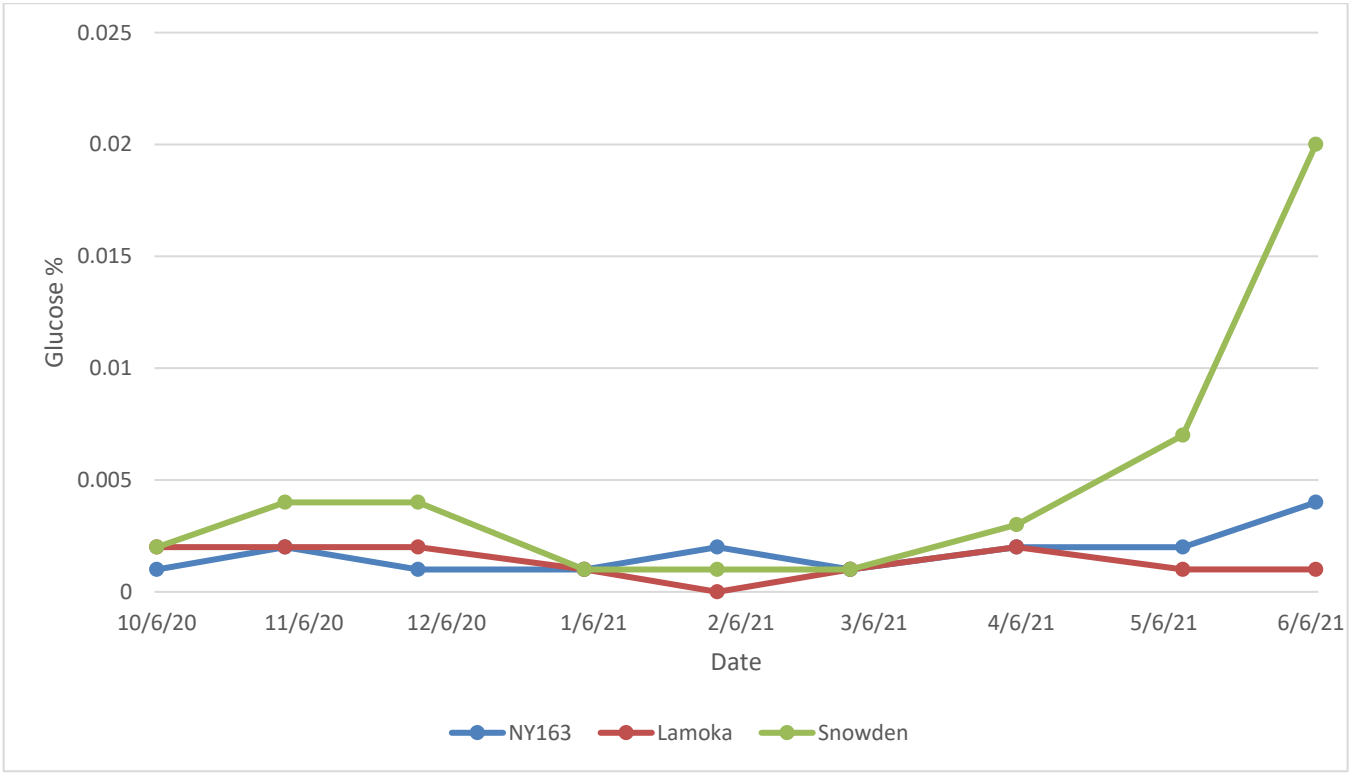


Figure 29. NY163 sucrose concentrations for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

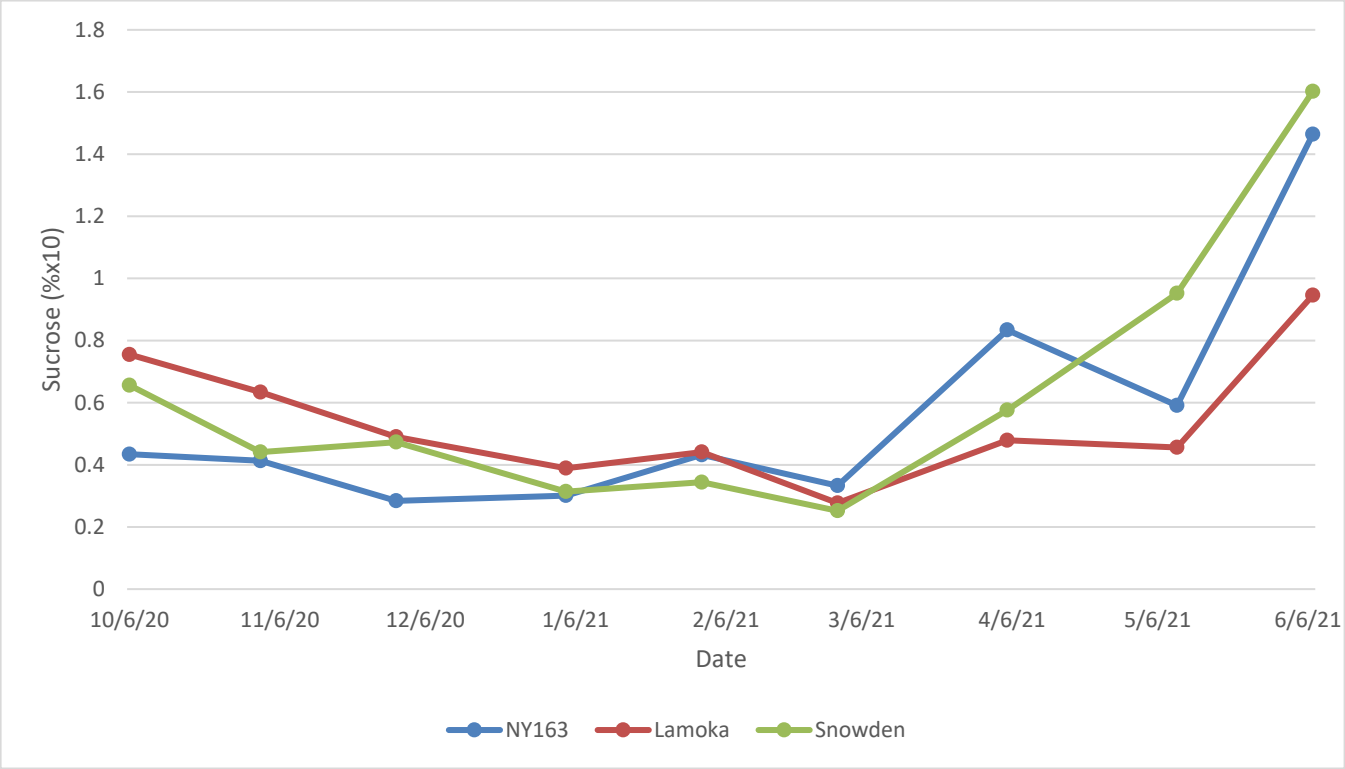


Figure 30. NY163 percent defects for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

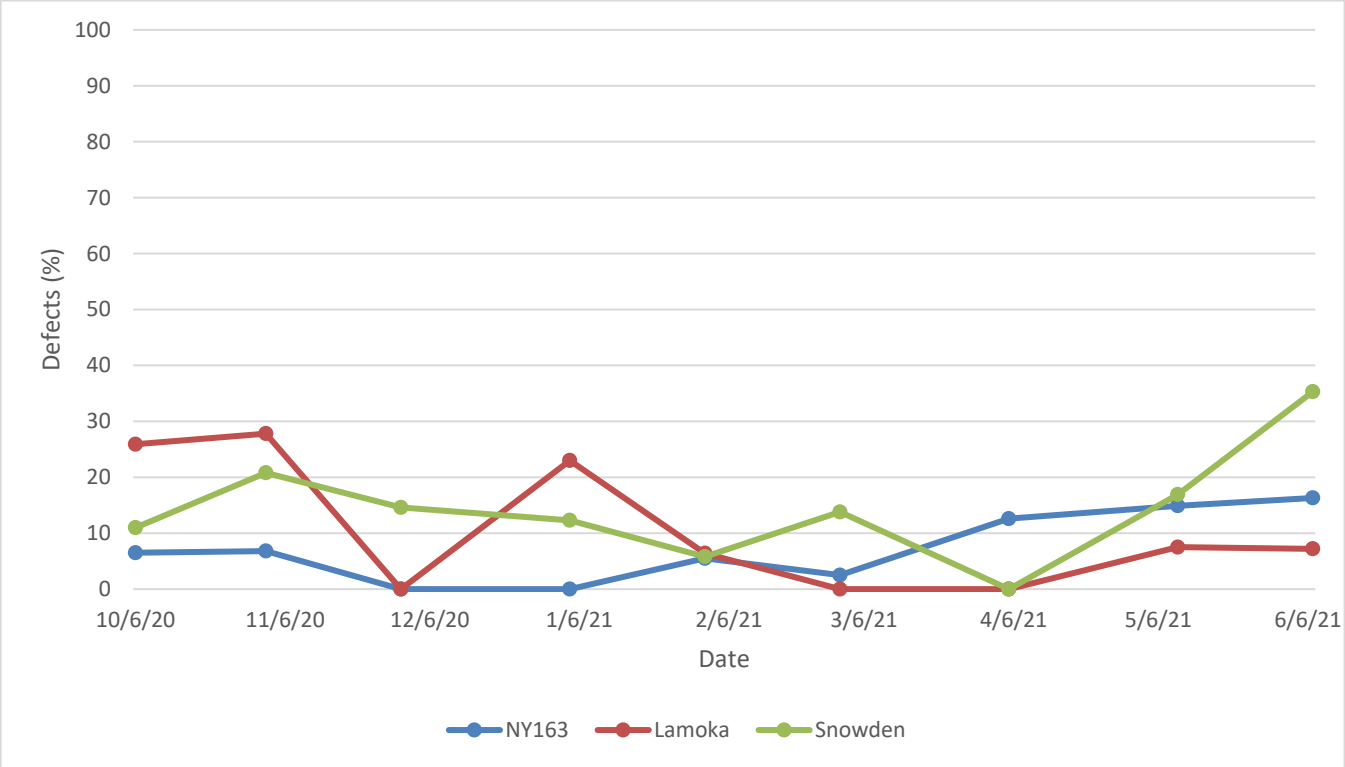
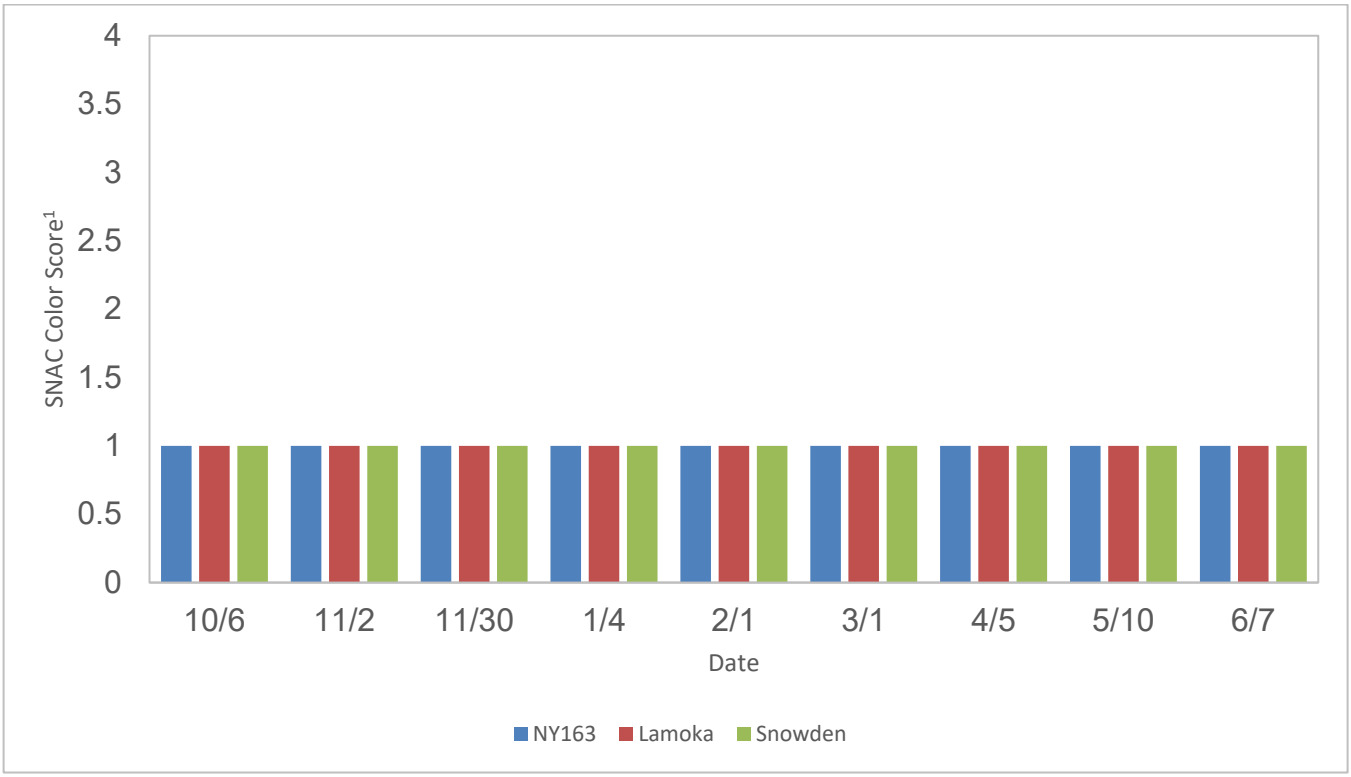


Figure 31. NY163 SNAC Color Score (1 = lightest, 5 = darkest) the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.



Petoskey: This Michigan State University variety had stable glucose concentrations between October and February, then increased slightly through June. The final glucose concentration was 0.008% (Figure 32). Sucrose concentrations followed a U-shaped trend, with an initial concentration of 1.245% (x10) that decreased through March. After March, sucrose concentrations rose, ending at 1.137% (x10) in June (Figure 33). Chip defects were highest in November with 21.6% chip defects. All other samples had less than 10% chip defects, lower than at least one check variety in all but two samples (Figure 34). Chip color was 1.0 from October to June (Figure 35). Petoskey has long term storage potential with good chip quality and color through June (Table 11).

Table 11. Petoskey monthly chip quality pictures from Techmark Inc.

Month		Month	
October		February	
November		March	
December		April	
January		May	

June	

Figure 32. Petoskey glucose concentrations for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

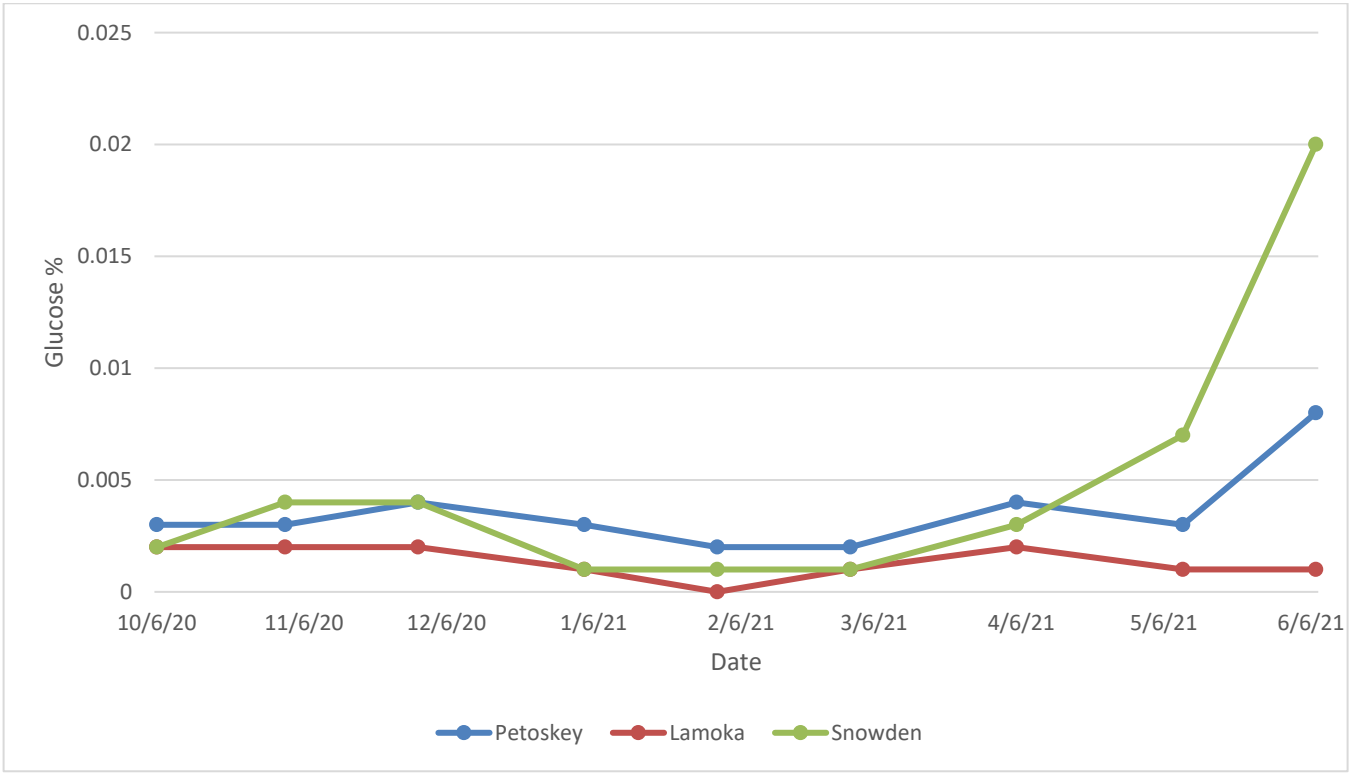


Figure 33. Petoskey sucrose concentrations for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

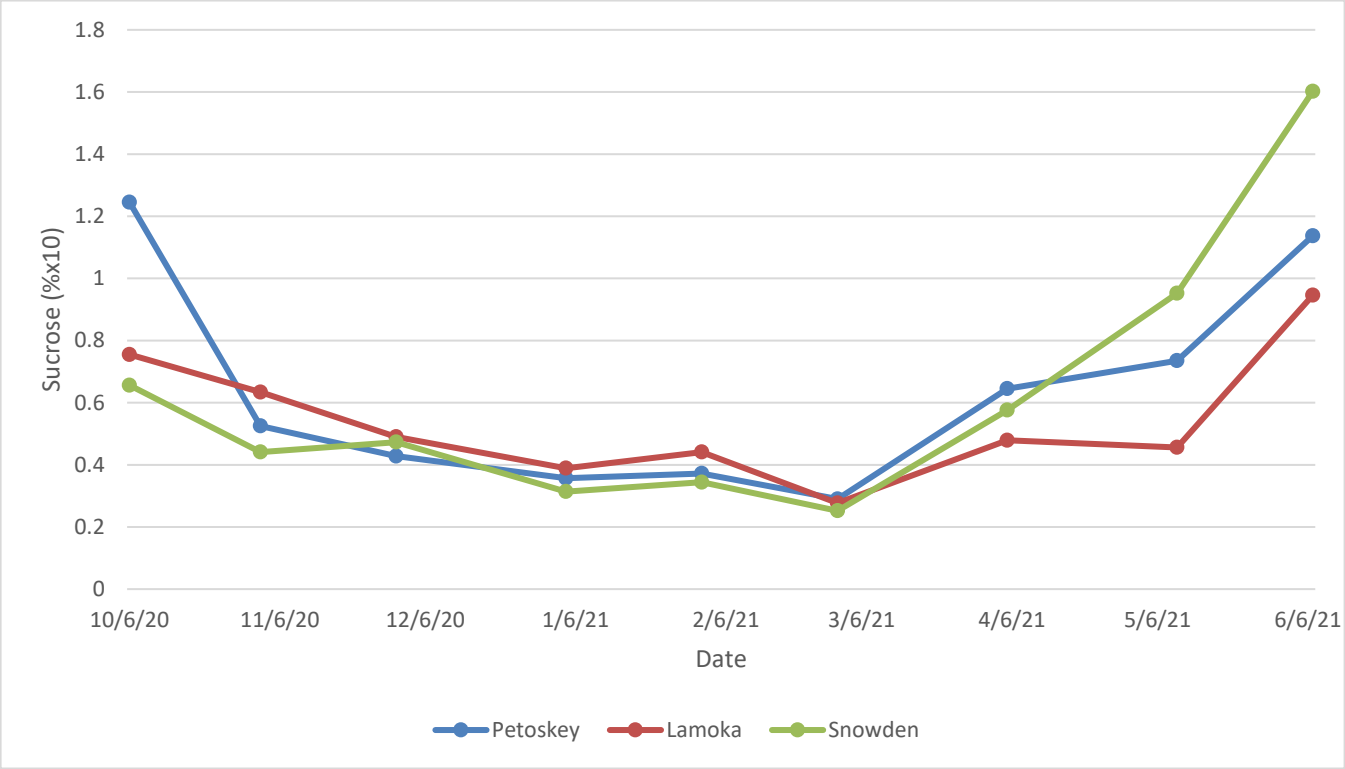


Figure 34. Petoskey percent defects for the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.

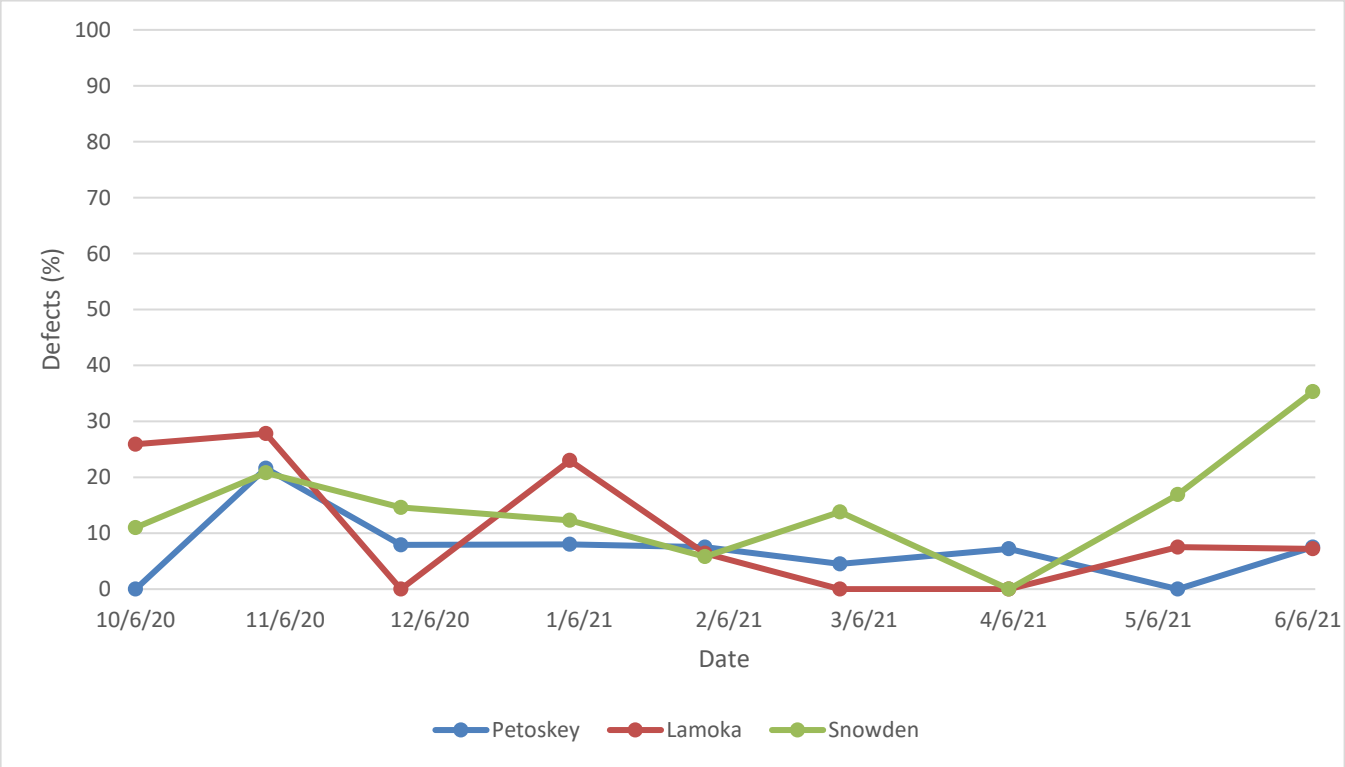
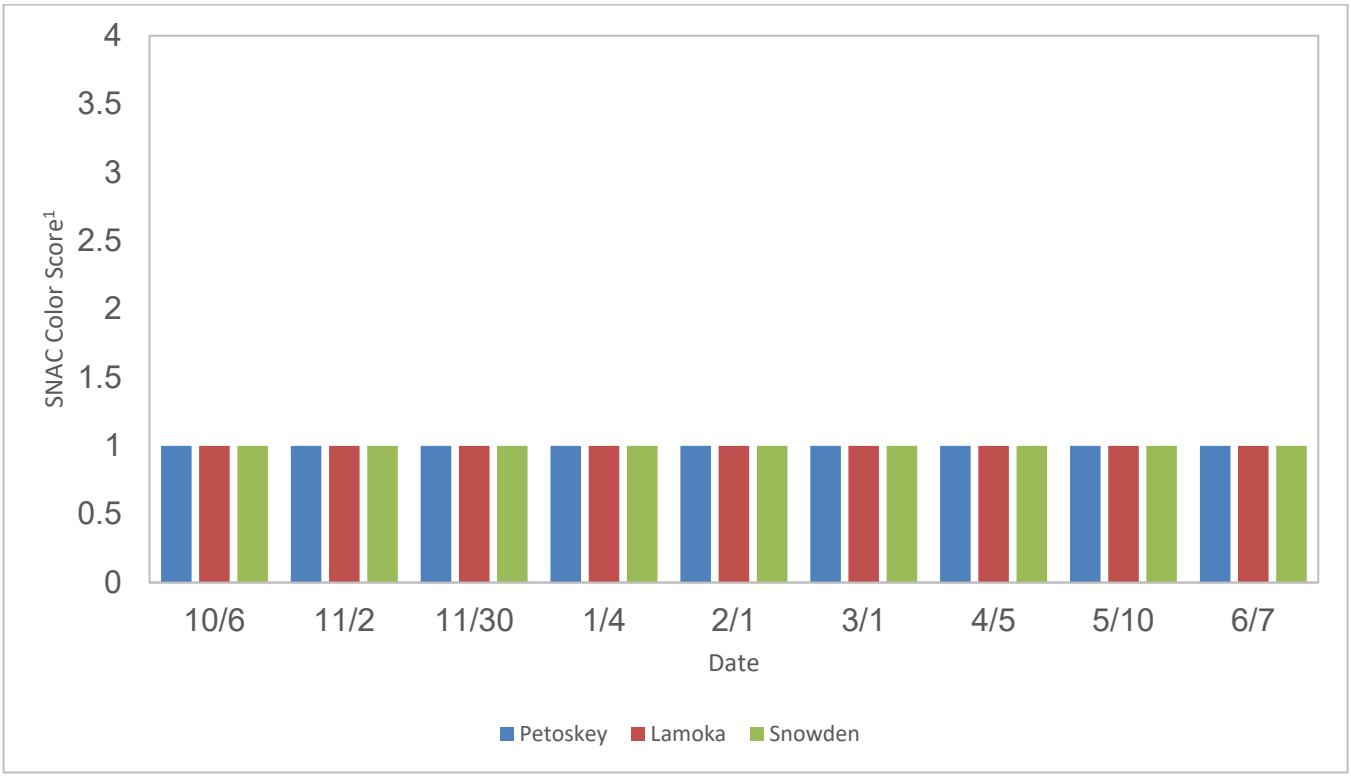


Figure 35. Petoskey SNAC Color Score (1 = lightest, 5 = darkest) the 2020-2021 storage season at 48°F compared to Lamoka and Snowden.



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