2017-2018 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
John Calogero, Research Technician

Objective: To assess the storability of 12 chipping varieties by evaluating sugar concentrations, chip color, and visual defects during storage.

Materials and Methods:
Sandyland Farms, LLC, in Howard City, MI planted seed on May 26, 2017 at 10" within row spacing and 34" between row spacing. Vine kill occurred on September 12, 2017. We harvested the potatoes on October 17, 2017 (2840 GDD_{40} from planting to vine kill) and collected storage samples.

Commercial Storage and Processing
Two, 40-pound samples of each variety were stored at Sandyland Farms, LCC commercial storage and evaluated at Herr Foods, Nottingham, PA on January 23 and April 30, 2018. The pile temperature before processing was 47ºF in January and 45.8ºF in April. CIPC was applied to control sprouting in December 2017 and March 2018.

Demonstration Storage and Monthly Evaluations
Eighteen samples of 30 tubers per variety were stored at the Michigan Potato Industry Commission's (MPIC) Cargill Potato Demonstrations Storage Facility in two separate bulk bin storages. One sample bag from each of the twelve varieties was stored at approximately 48ºF and 54ºF for monthly evaluations from October 2017 through June 2018. 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 23rd and April 30th, 2017 (Table 1 and 2). On the first processing date, the top three varieties for chip quality were NY152, Lamoka, and MSX540-4 (Table 1). On the second processing date, the top three varieties were Lamoka, NY152, and B2727-2 (Table 2). MSW485-2 had the highest specific gravity at 1.085 in January, while AF5040-8 had the highest specific gravity in April, also 1.085 (Table 1 and 2). MSX540-4 had the highest Agtron color score of 60.5 (Table 1). Agtron color scores were not available in April.

Table 1. 2017 SNAC Variety Trial January 23, 2018[1]

Merit[2]	Variety	Agtron Color[3]	SNAC Color[4]	Specific Gravity	Percent Chip Defects[5]			Comments
					Internal	External	Total	
O/G	NY152	53.5	2	1.076	7.1%	2.7%	9.8%	Minor scab, good round shape, 2.75 to 4.5 inches
G	Lamoka	55.8	2	1.084	4.5%	1.8%	6.3%	Bruise, some oblong, 2.5 to 3.5 inches
G/M	MSX540-4	60.5	2	1.080	14.2%	2.5%	16.7%	Pressure bruise, scab, some oblong, 1.5 to 4.5 inches
M	NDA081453CAB-2C	58.2	3	1.074	9.9%	6.8%	16.7%	Scab, minor vascular browning, 1.75 to 4.5 inches
M	Snowden	55.5	2	1.079	19.8%	8.5%	28.3%	Scab, bruise, good size, 2.5 to 3.5 inches
M/D	AF5040-8	54.2	3	1.078	21.3%	9.3%	30.6%	Some scab, too many externals, 2 to 3.5 inches
M/D	B2727-2	57.1	2	1.075	21.4%	7.1%	28.5%	A lot of scab, bruise, greening, some hollow heart, oblong, 1.5 to 4 inches
D	AC01144-1W	56.4	3	1.083	4.8%	7.6%	12.4%	Scab, greening, stem end defect, many undersize potatoes
D	MSR127-2	56.7	3	1.085	17.1%	7.6%	24.7%	Bruise, scab, growth crack, internal color, stem end, large tubers, 3 to 4.5 inches
D	MSV358-3	58.3	2	1.067	8.3%	1.2%	9.5%	Scab, bruise, gravity is too low, variable size, 1.5 to 4 inches
D	MSW485-2	56.0	3	1.085	8.2%	20.5%	28.7%	Some greening and scab, stem end defect, vascular browning, 1.5 to 4 inches
D	NDA081648CB-13W	56.8	4	1.079	2.2%	44.4%	46.6%	Scab, a lot of internal color

[1]Samples collected at harvest on October 17, 2017 and processed by Herr Foods, Inc., Nottingham, PA on January 23, 2018.
[2]Merit: ranked by Herr Foods, Inc. O= outstanding, G= good, M= marginal, D=drop
[3]Agtron Color: using Agtron M Series II
[4]SNAC Color: 1 = lightest, 5 = darkest
[5]Percent Chip Defects: percentage based on weight of the total sample; comprised of undesirable color, greening, internal and external defects

Table 2. 2017 SNAC Variety Trial April 30, 2018[1]

Rank[2]	Variety	Agtron Color[3]	SNAC Color[4]	Specific Gravity	Percent Chip Defects[5]			Comments
					Internal	External	Total	
1	Lamoka	Not available	2	1.081	3.1%	7.4%	10.5%	Minor hollow heart, 1.5 to 5.3 inches, oblong
2	NY152		2	1.071	2.1%	2.1%	4.2%	Minor scab and minor greening
3	B2727-2		3	1.078	13.4%	5.4%	18.8%	Some internal defects, a lot of scab, 2 to 4 inches, oblong
4	Snowden		3	1.080	12.7%	15.9%	28.6%	Minor internals, a lot of scab, perfect size profile, 2 to 3.5 inches
5	MSX540-4		4	1.080	30.8%	5.7%	36.5%	A lot of internal color, scab
6	MSV358-3		3	1.068	7.8%	19.0%	26.8%	Some scab and color in vascular ring, 2.5 to 3.5 inches
7	MSW485-2		4	1.082	13.5%	15.7%	29.2%	A lot of internal color, 1.75 to 3.5 inches
8	AC01144-1W		3	1.065	8.0%	13.0%	21.0%	A lot of internal color, some scab, 1.5 to 4 inches
9	AF5040-8		4	1.085	46.8%	5.1%	51.9%	Too much internal color, scab, 1.38 to 3.75 inches
10	NDTX0981648CB-13W		4	1.084	28.2%	6.0%	34.2%	A lot of internal color, some scab, a lot of potatoes under 1.5 inches, up to 4 inches in size
11	MSR127-2		5	1.080	72.5%	3.9%	76.4%	Too much internal color, minor rot, 1.5 to 4 inches
12	NDA081453CAB-2C		4	1.080	43.1%	4.9%	48.0%	Too much internal color, minor scab, 2 to 3.75 inches

[1]Samples collected at harvest on October 17, 2017 and processed by Herr Foods, Inc., Nottingham, PA on April 30, 2018
[2]Rank: ranked by Herr Foods, Inc. 1 = highest chip quality, 12 = lowest chip quality
[3]Agtron Color: not avaiable
[4]SNAC Color: 1 = lightest, 5 = darkest
[5]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 and 54ºF in the MPIC Demonstration Storage facility and evaluated monthly from November 2017 to June 2018. The varieties are listed alphabetically. For yield and raw tuber quality data at harvest, please see the 2017 field trial results.

Conclusions:

Based on the processing results from both commercial and demonstration storage, NY152 and MSX540-4 appear to be the most promising lines for commercialization and full season storage. B2727-2 also has commercialization potential but maintains only chip quality through April. These varieties were ranked highly by Herr Foods, Inc. (Tables 1 and 2). Compared to Lamoka, NY152 and MSX540-4 had similar or lower sugar concentrations and defects (Figures 13 and 5; Tables 37-39 and 9-11). Both varieties had excellent chip quality throughout storage (Figures 13 and 5; Table 40 and 12). Several other varieties have good chip quality during part of the storage season, but are unacceptable for full season storage, including AF5040-8 and MSV358-3. NDA081453CAB-2C has good out of the field chip quality, but is unsuitable for storage.

AC01144-1W: When stored at 48ºF, AC01144-1W had higher glucose levels than Lamoka for the whole storage season and higher levels than Snowden for four out of the nine months. At 54ºF it had glucose levels almost identical to Snowden, between .001% and .005% until a sharp increase in June to .028% (Figure 1). AC01144-1W had sucrose levels similar to the check varieties at both 48ºF and 54ºF (Figure 2). This variety had a higher percentage of defects than the check varieties between April and June (Figure 3). Correspondingly, AC01144-1W had acceptable chip color with a SNAC score of 1.0 until May and June, when samples held at both 48ºF and 54ºF increased to 1.5 and 2.5 at the last sample date, respectively (Figure 4).

Table 3. AC01144-1W monthly chip quality pictures from Techmark Inc.

Month	48°F	54°F
October		
November		
December		
January		

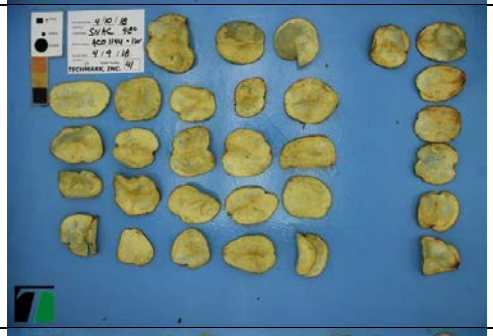
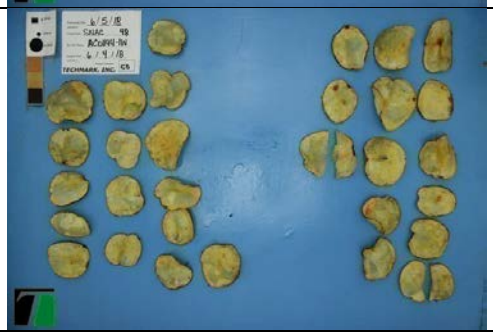
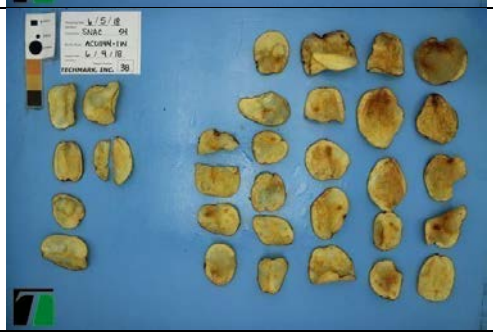
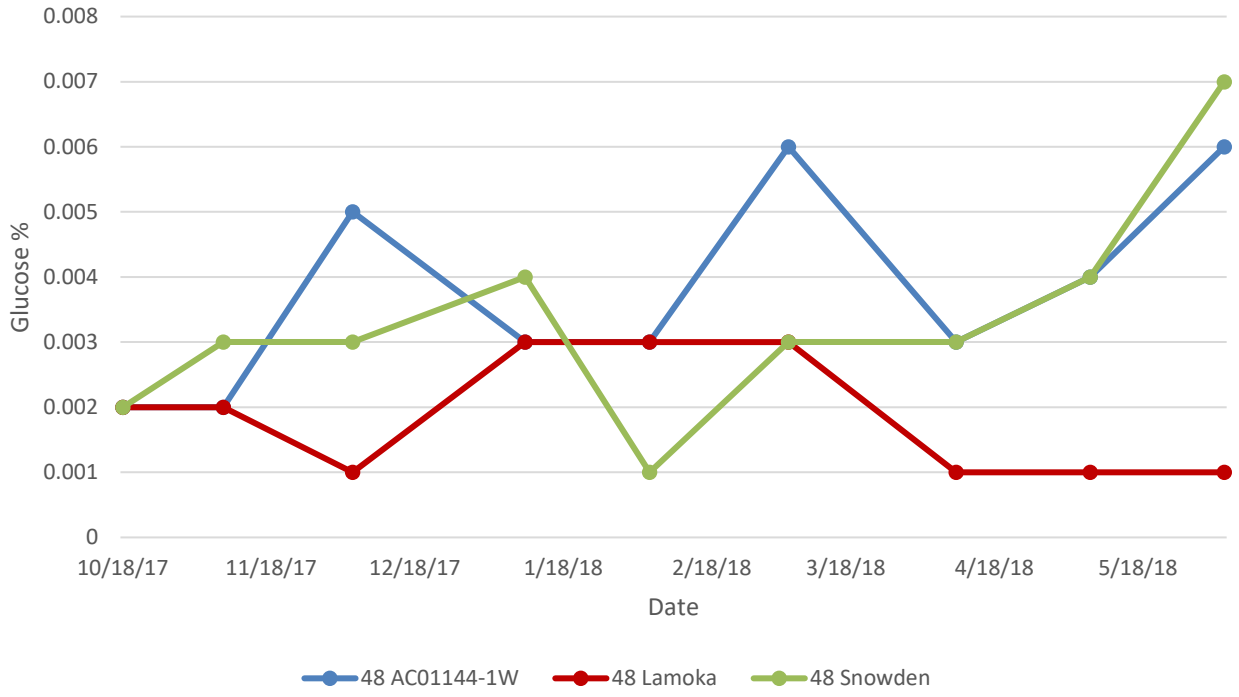
February		
March		
April		
May		
June		

Figure 1. AC01144-1W glucose concentrations for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



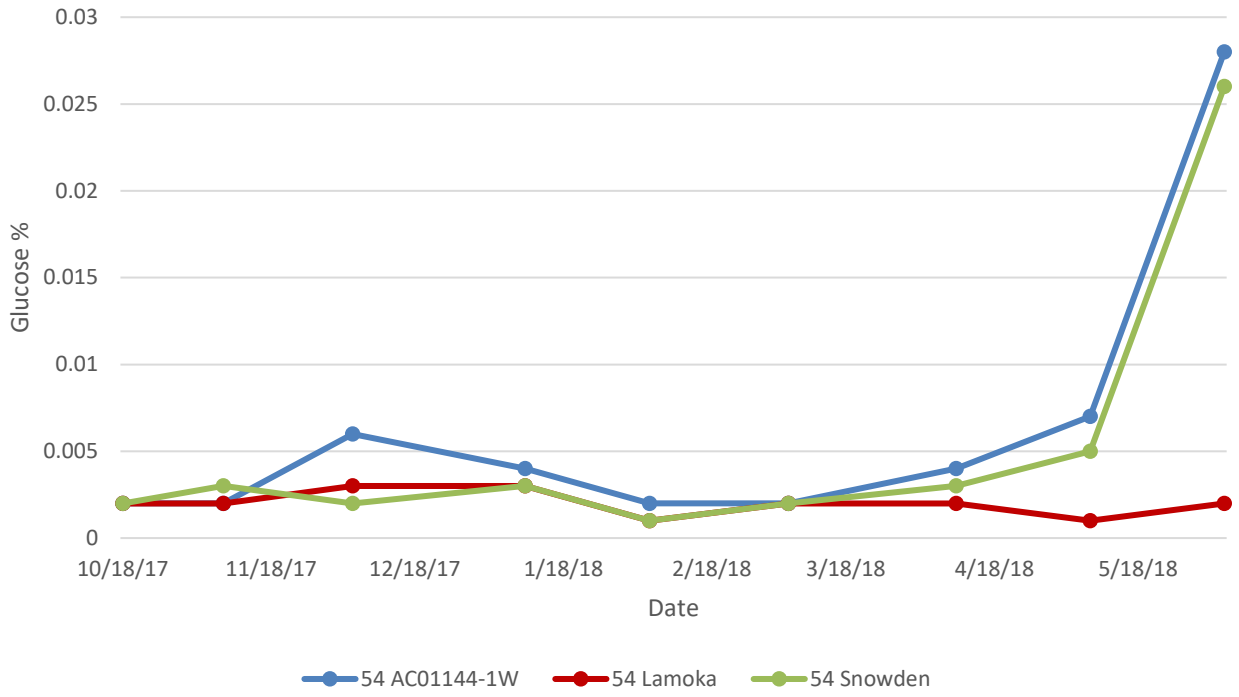
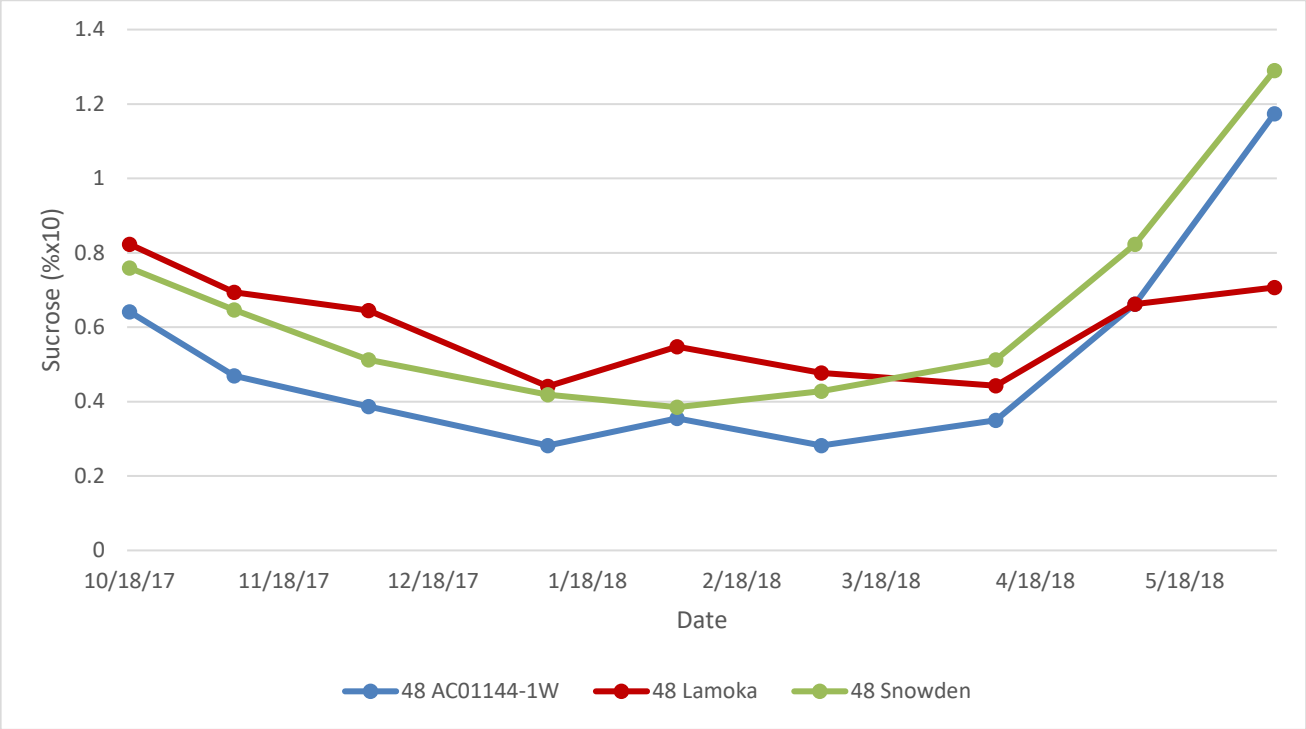


Figure 2. AC01144-1W sucrose concentrations for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



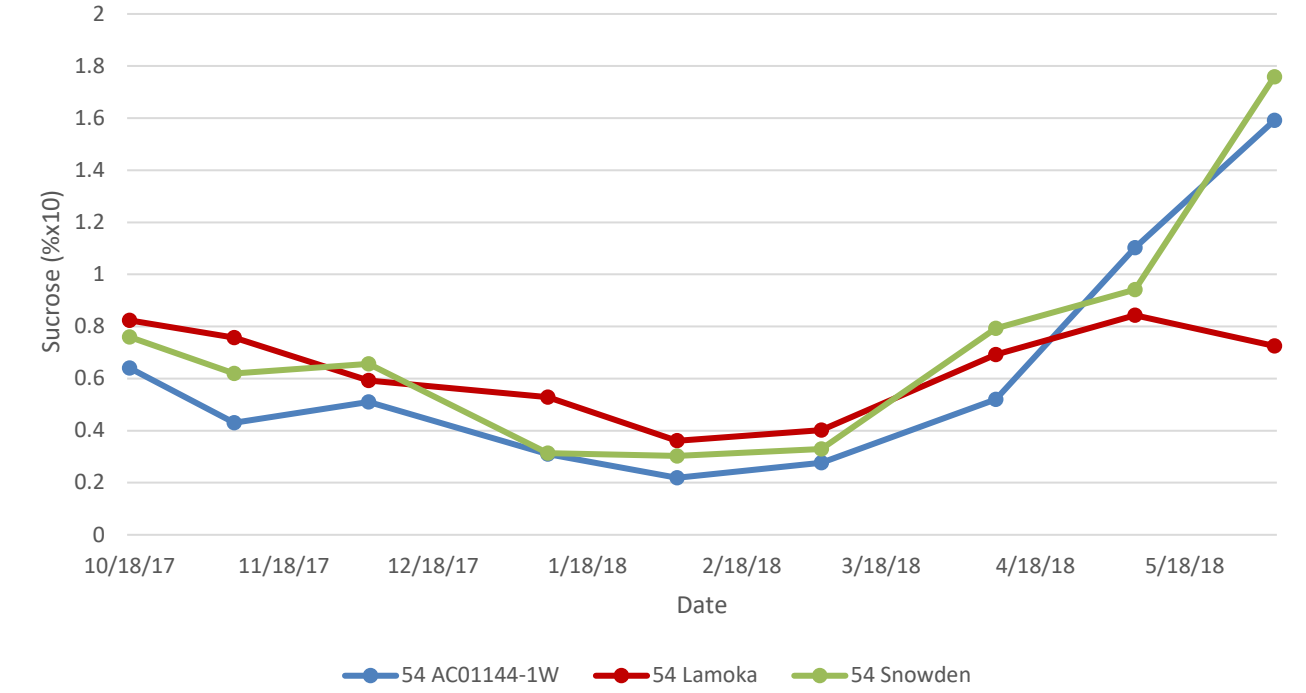
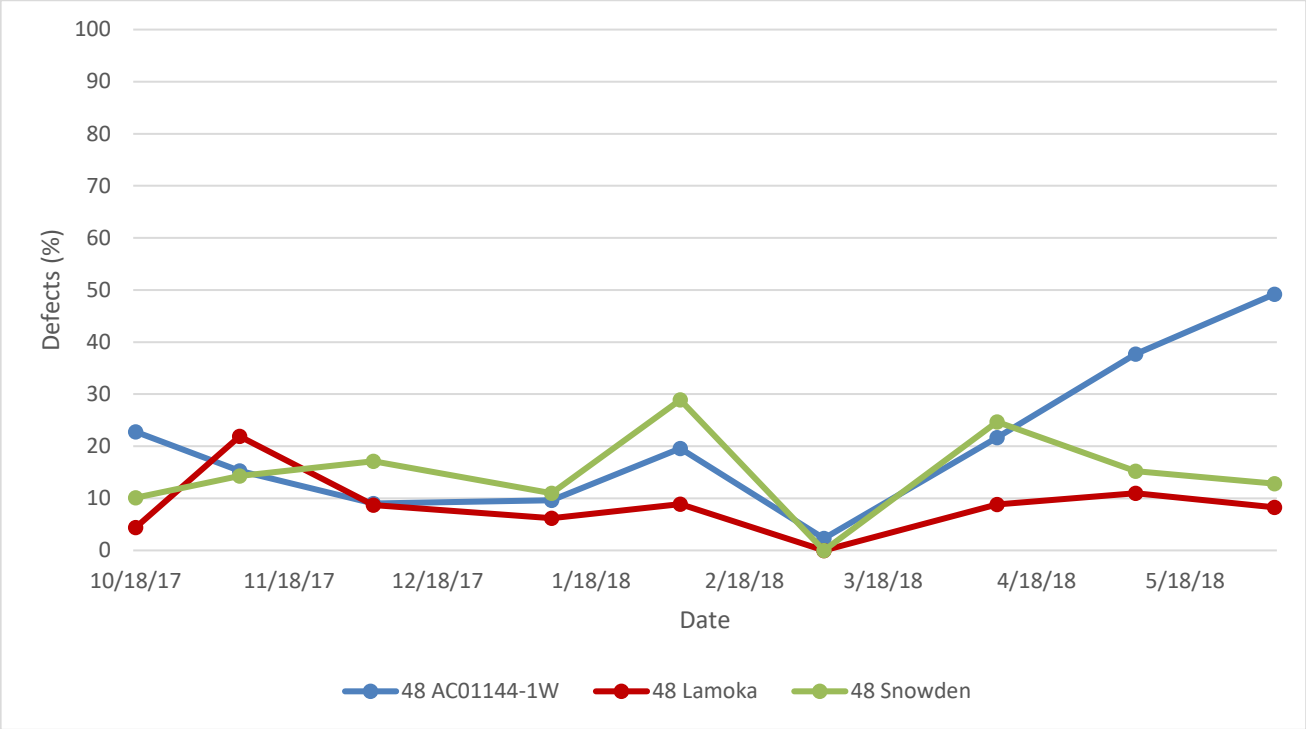


Figure 3. AC01144-1W percent defects for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



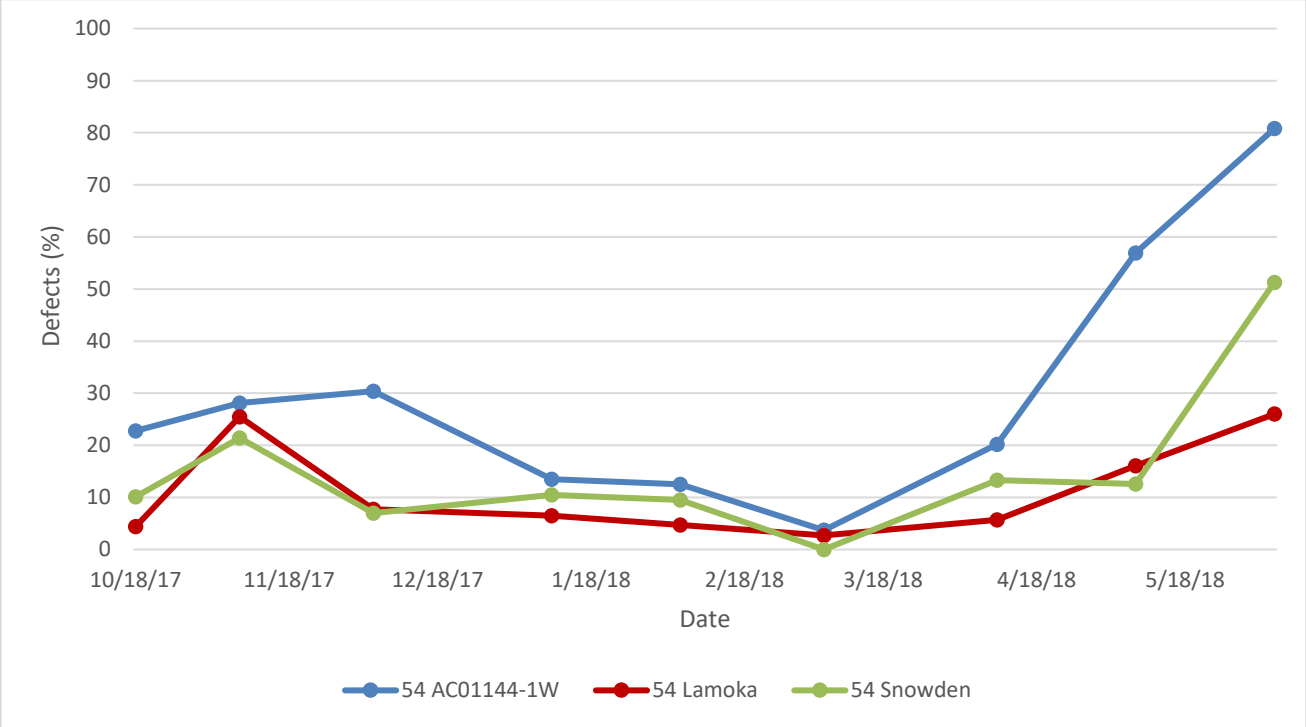
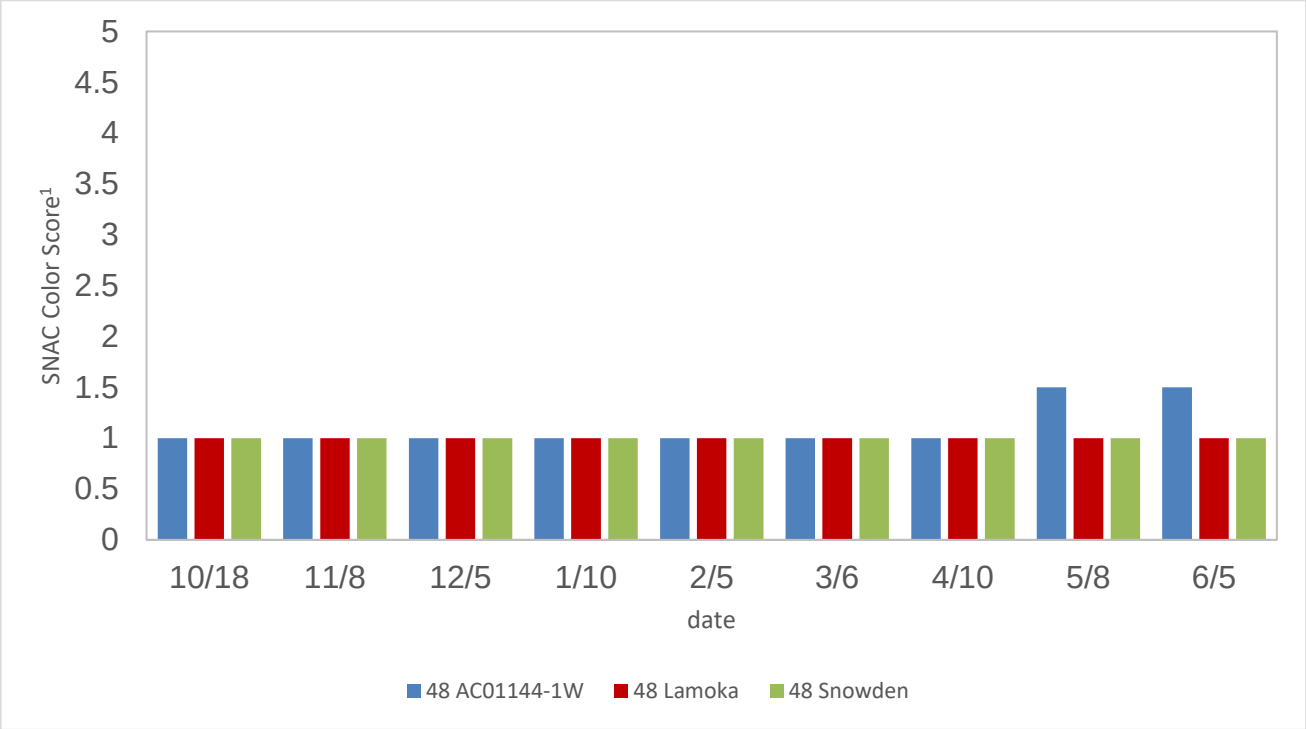
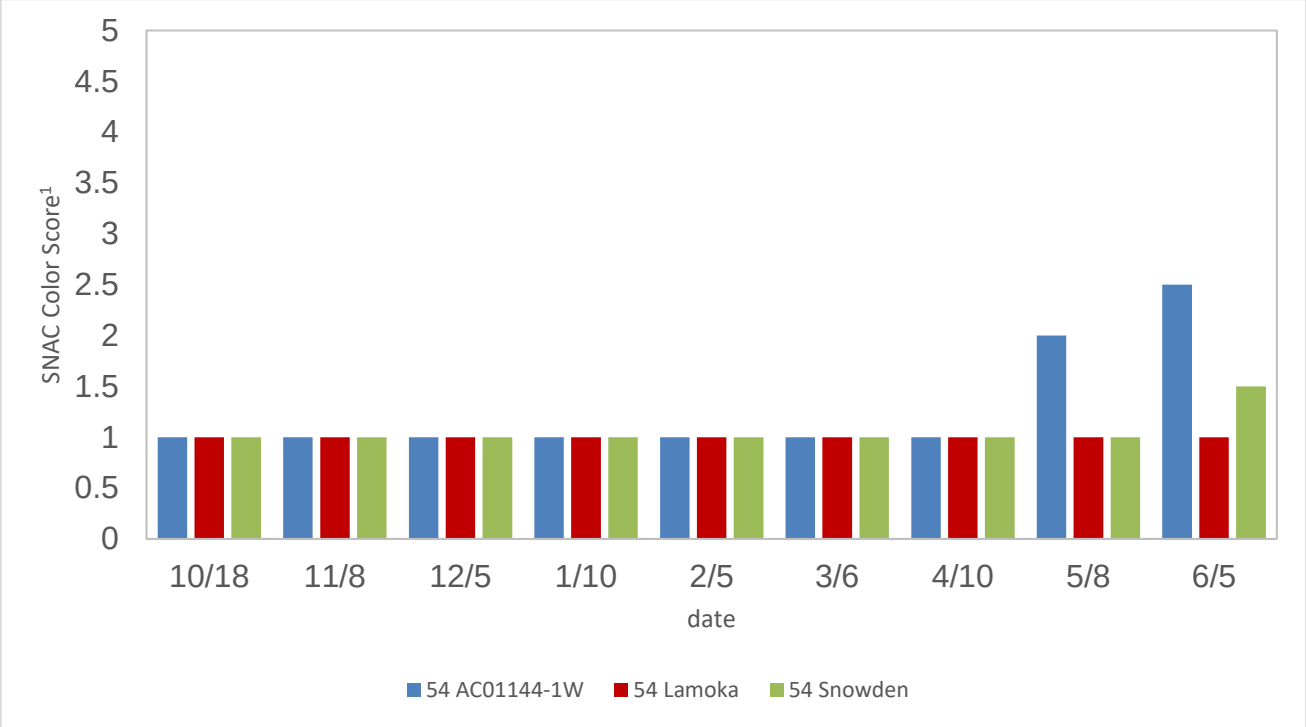


Figure 4. AC01144-1W SNAC Color Score (1 = lightest, 5 = darkest) the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.





AF5040-8: At 48ºF, this variety had higher glucose levels than both check varieties for all but the last three samples. Conversely, the sample held at 54ºF had glucose levels similar to the check varieties until April, after which the glucose concentration increased (Figure 5). The sucrose concentrations followed a similar trend, with levels comparable to the check varieties until April, after which sucrose concentrations exceeded those of the checks (Figure 6). At 48ºF, this variety had a similar percentage of defects as the check varieties with a high of 32% in April. At 54ºF, defects rose sharply beginning in April, ending with a high of 88% in June (Figure 7). The sample held at 54º had a final SNAC score of 3.0 in June, and should be processed before April (Figure 8).

Table 4. AF5040-8 monthly chip quality pictures from Techmark Inc.

Month	48°F	54°F
October		
November		
December		
January		

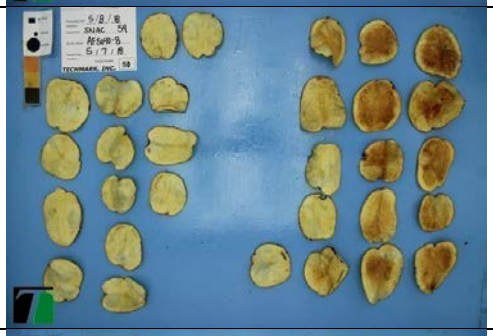
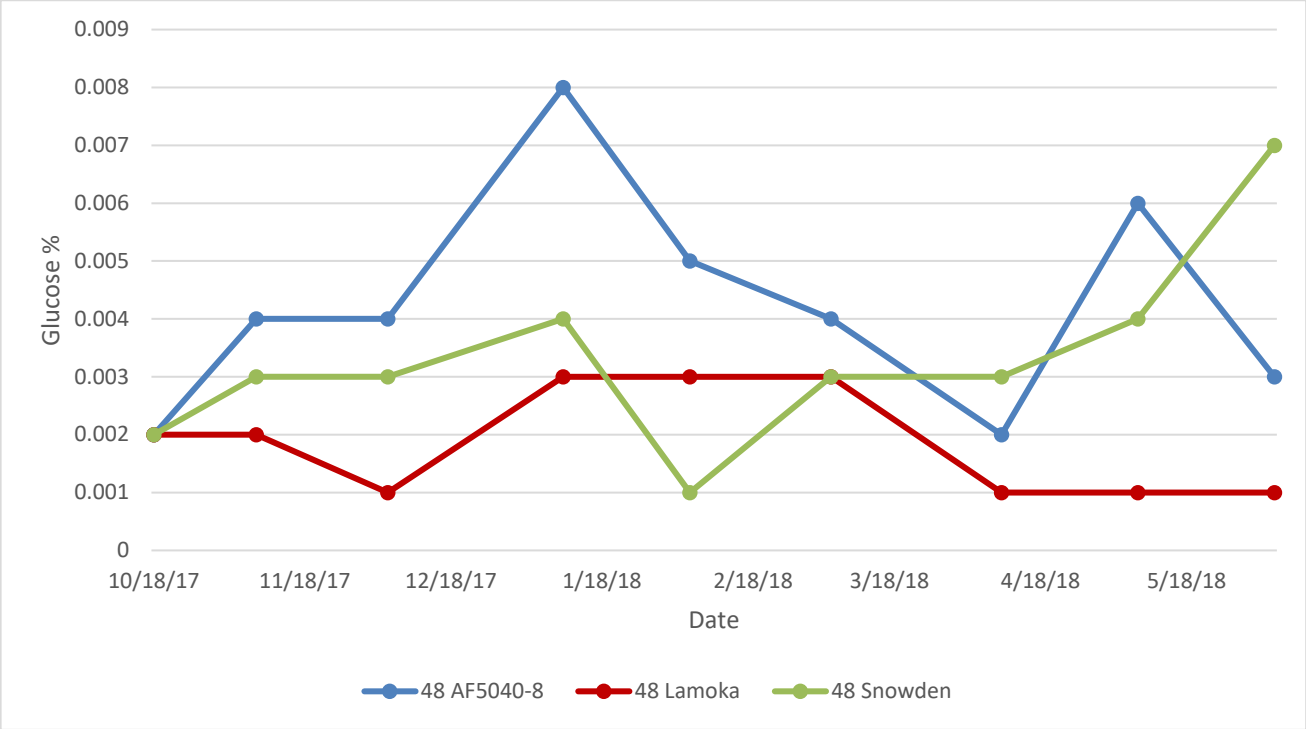
February		
March		
April		
May		
June		

Figure 5. AF5040-8 glucose concentrations for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



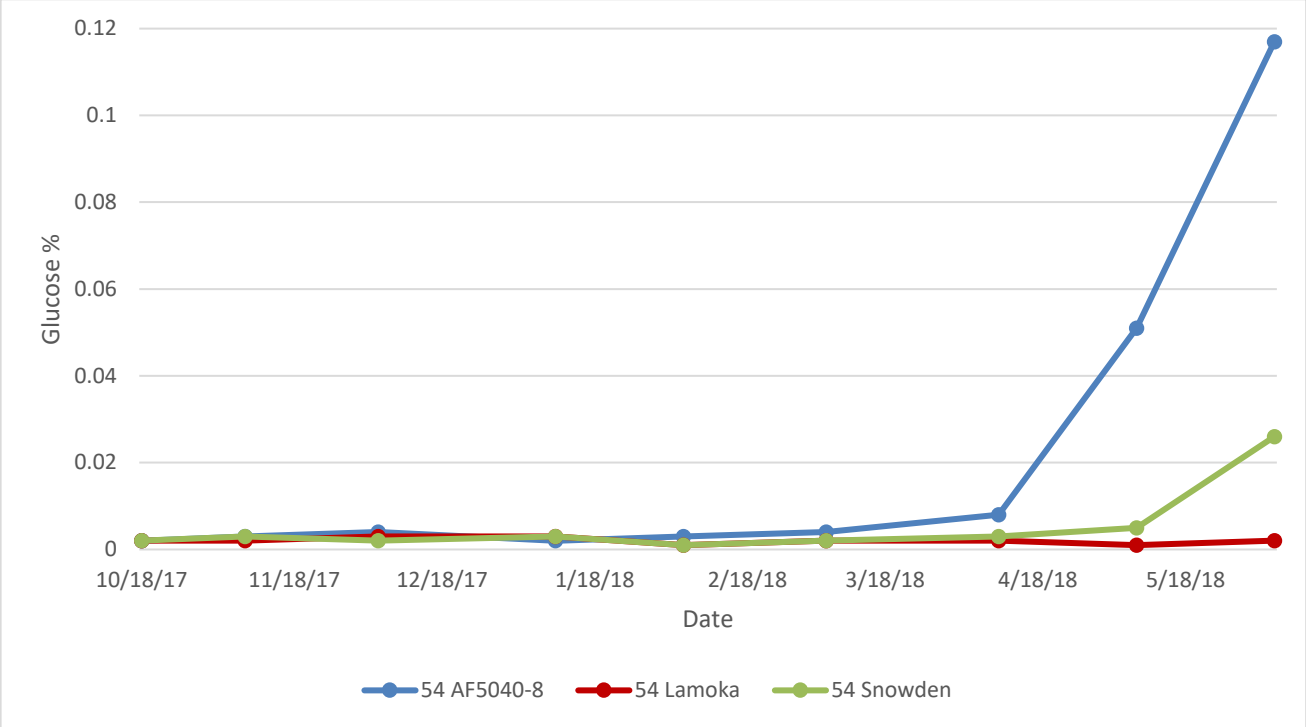
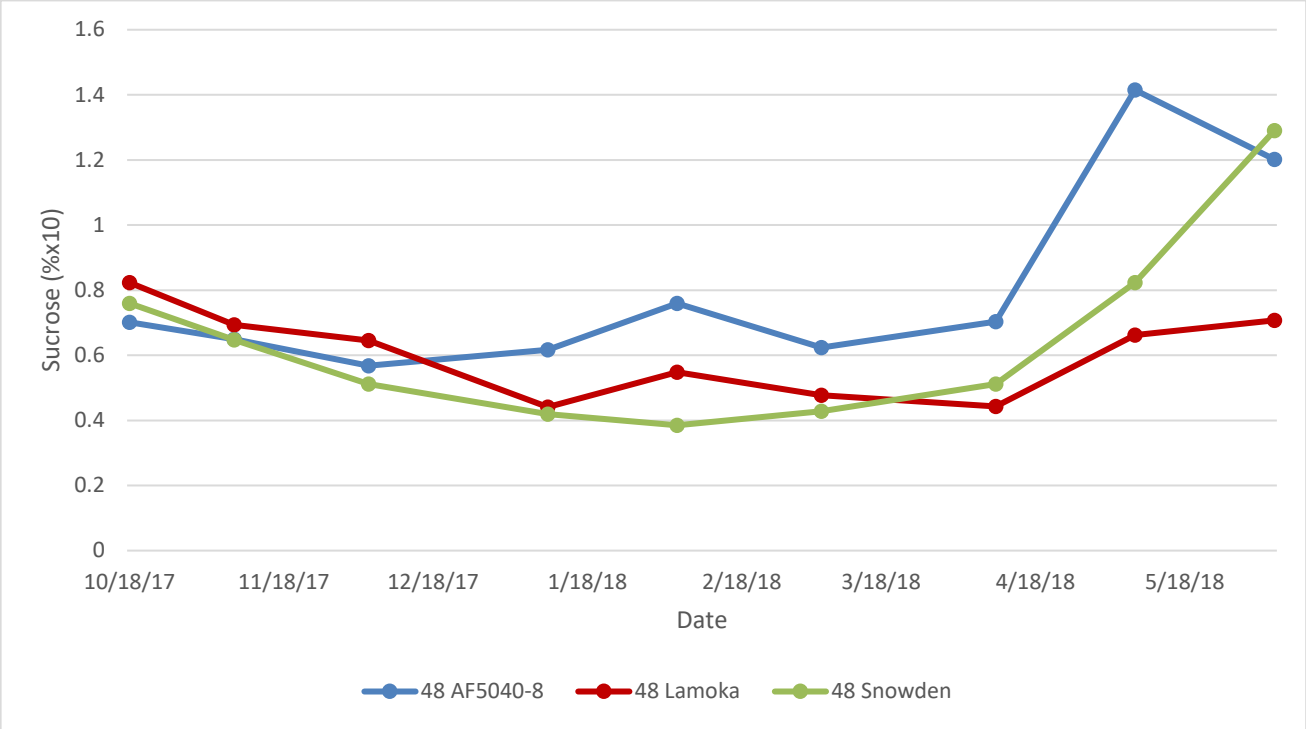


Figure 6. AF5040-8 sucrose concentrations for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



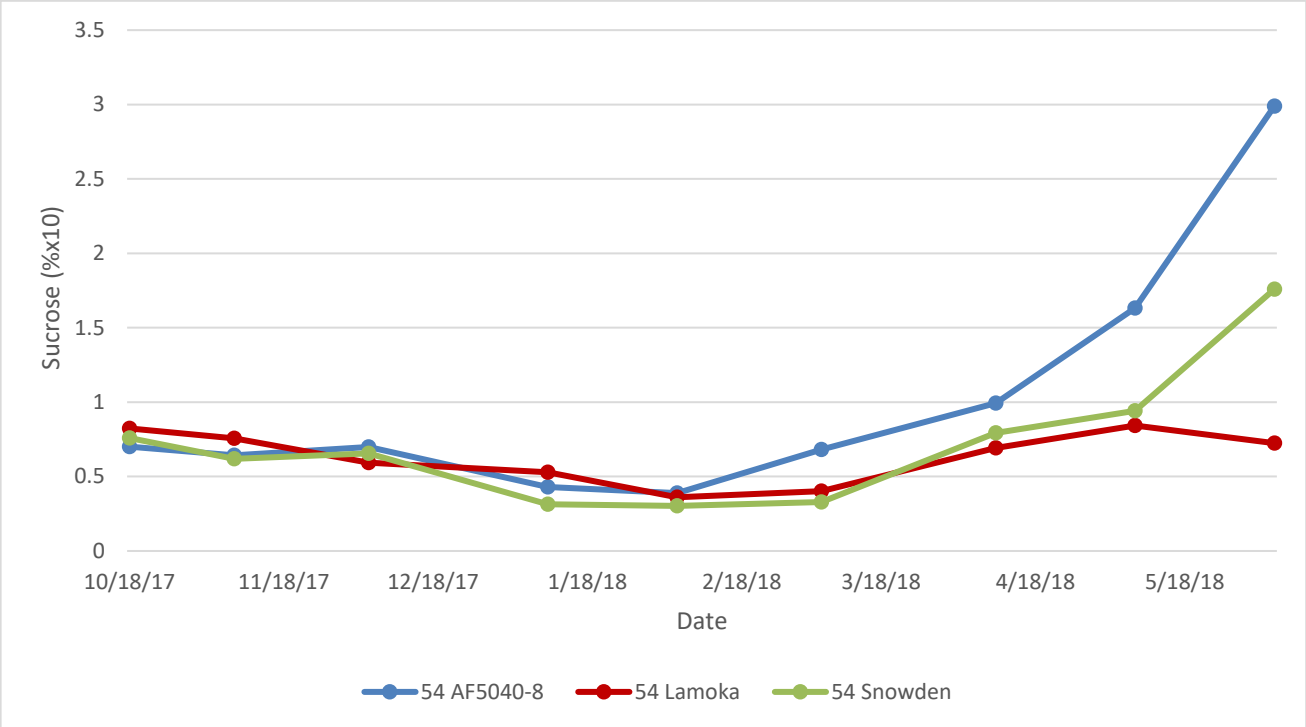
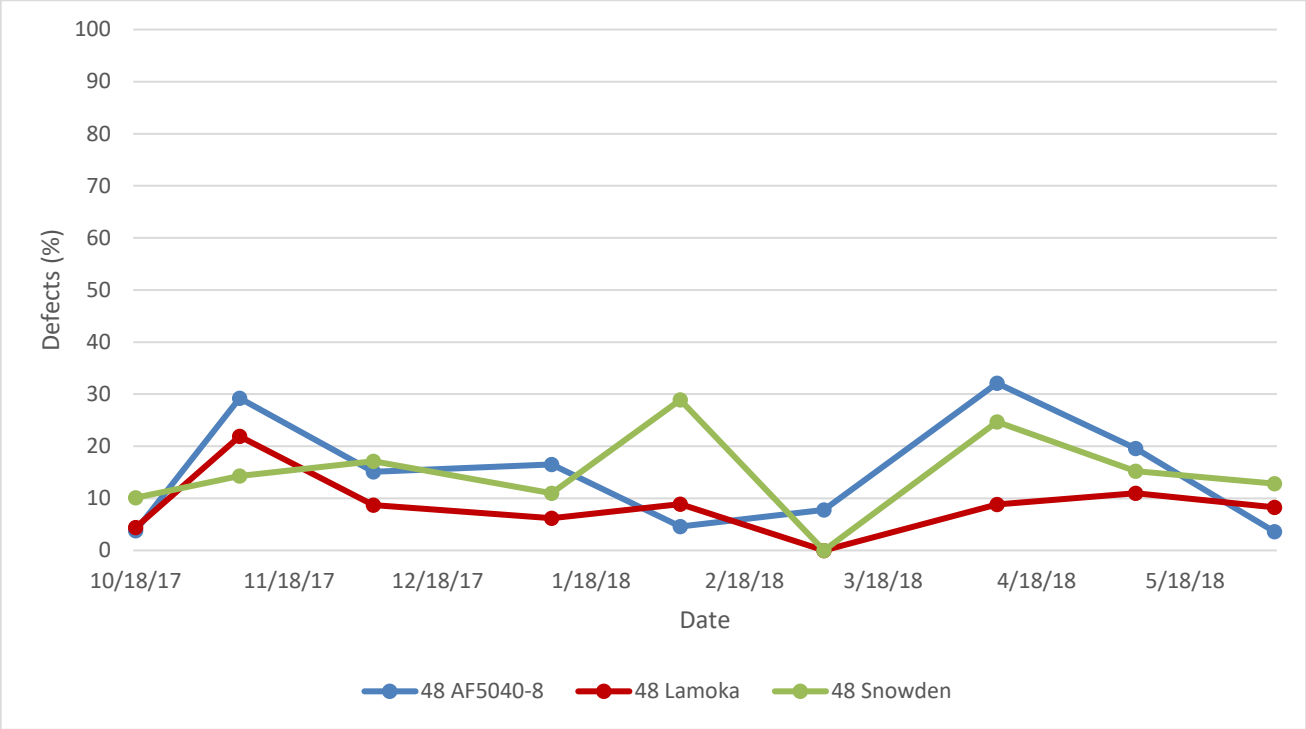


Figure 7. AF5040-8 percent defects for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



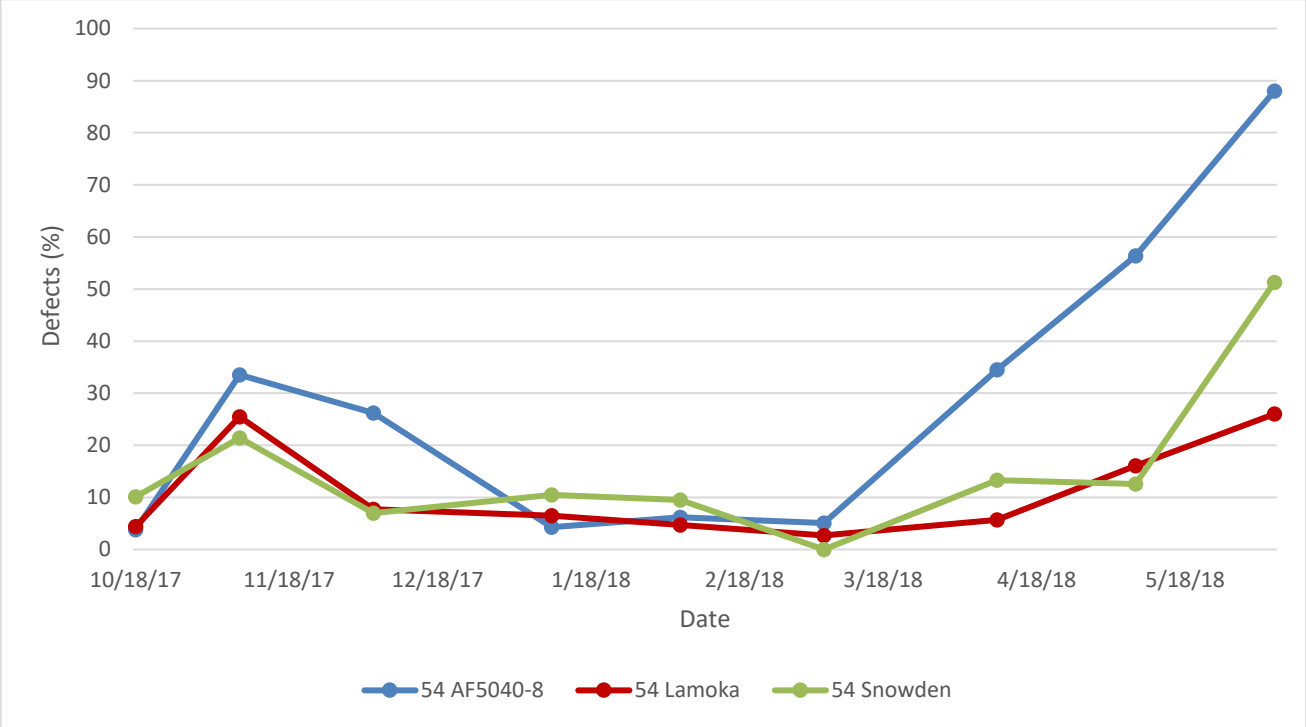
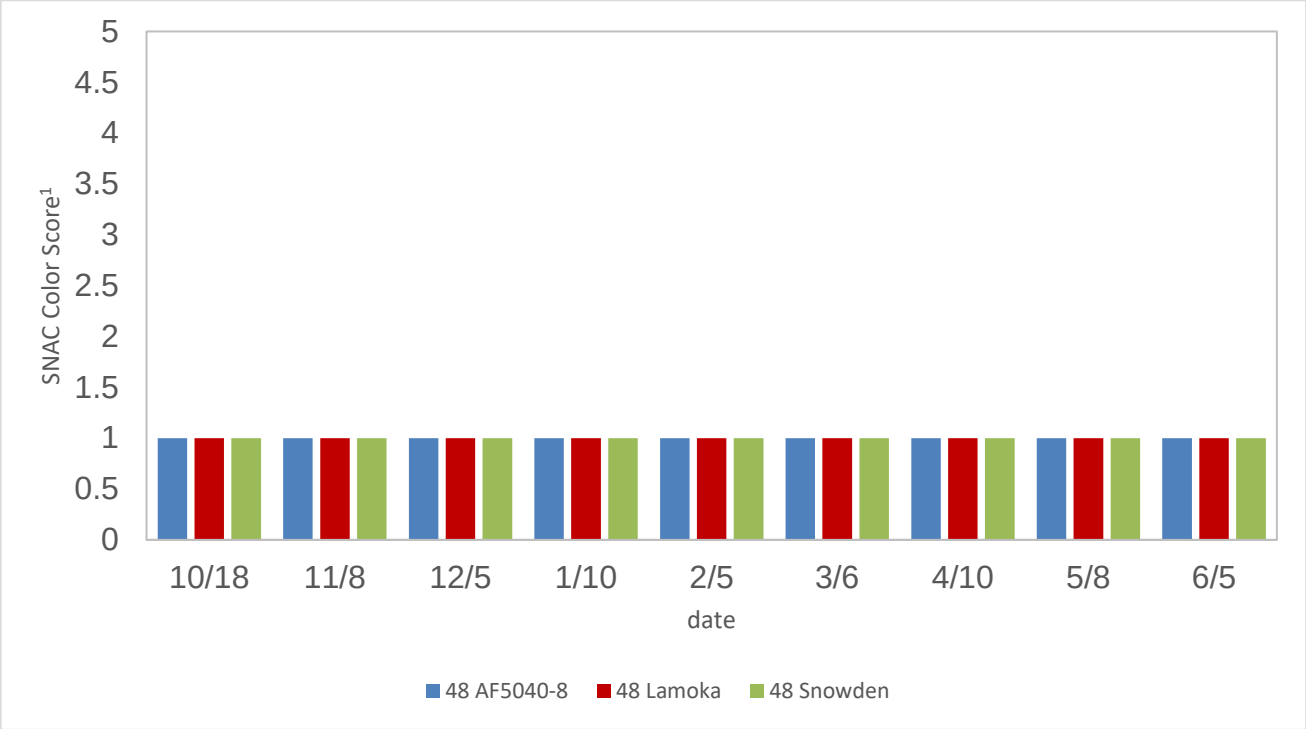
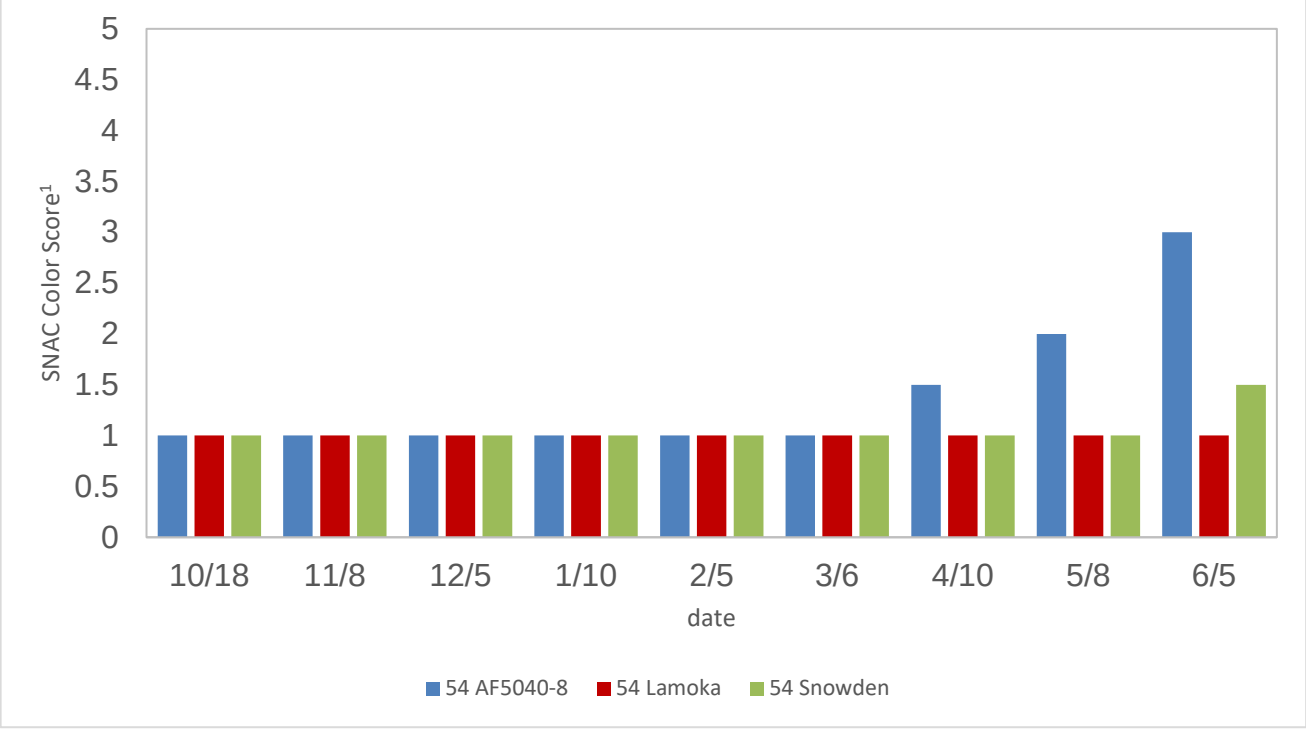


Figure 8. AF45040-8 SNAC Color Score (1 = lightest, 5 = darkest) the 2016-2017 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.





B2727-2: With the exception of the 48°F treatment in May-June, B2727-2 had similar glucose and sucrose levels compared to Snowden throughout storage (Figures 9-10). Despite slightly higher defects compared to the check varieties (Figure 11), B2727-2 maintained a 1-1.5 SNAC color score through June (Figure 12). Chip quality for this variety appeared to be similar at both 48° and 54°F through April, but late storage samples had better quality at 48°F. When stored at 54ºF, this variety should be processed before May (Table 5 and Figures 11-12).

Table 5. B2727-2 monthly chip quality pictures from Techmark Inc.

Month	48°F	54°F
October		
November		
December		
January		

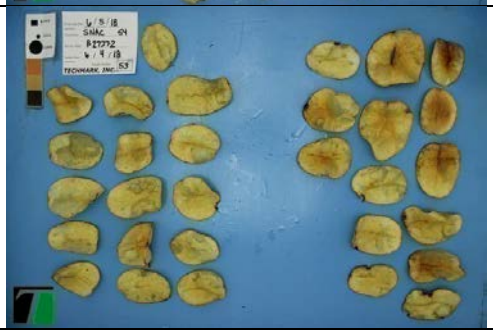
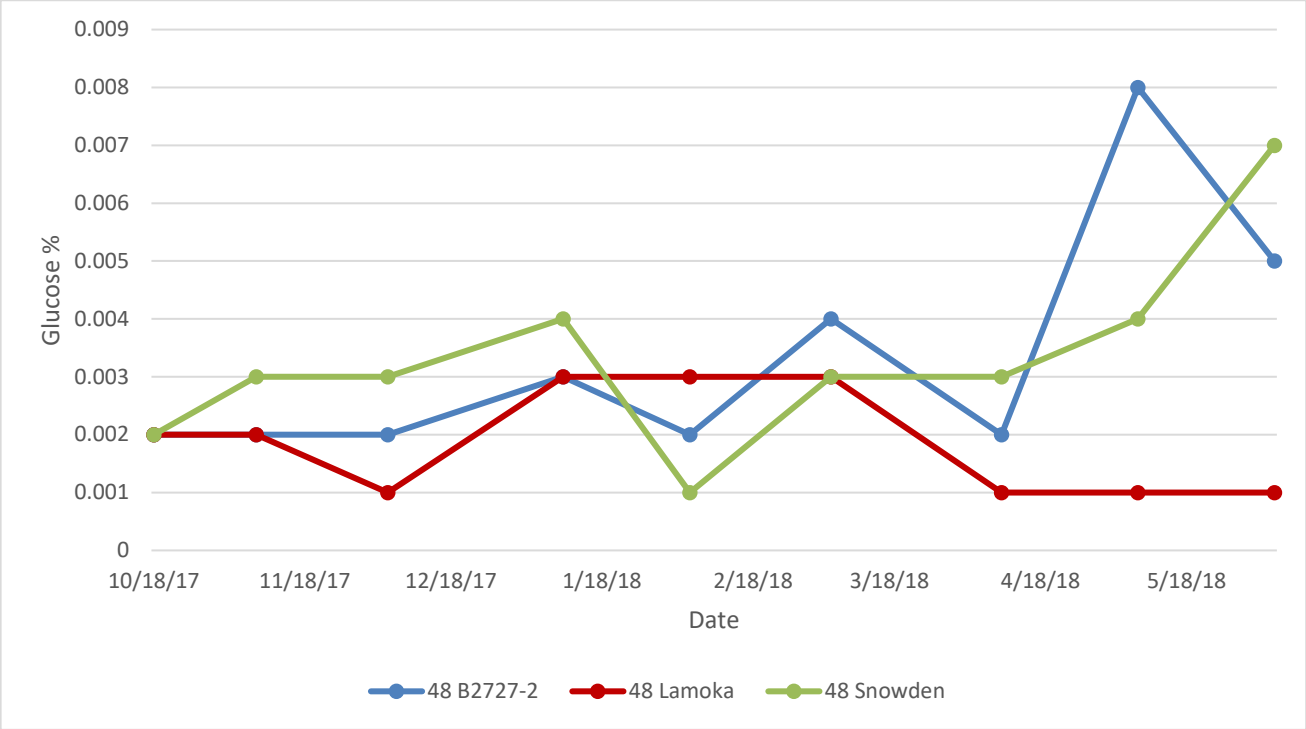
February		
March		
April		
May		
June		

Figure 9. B2727-2 glucose concentrations for the 2016-2017 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



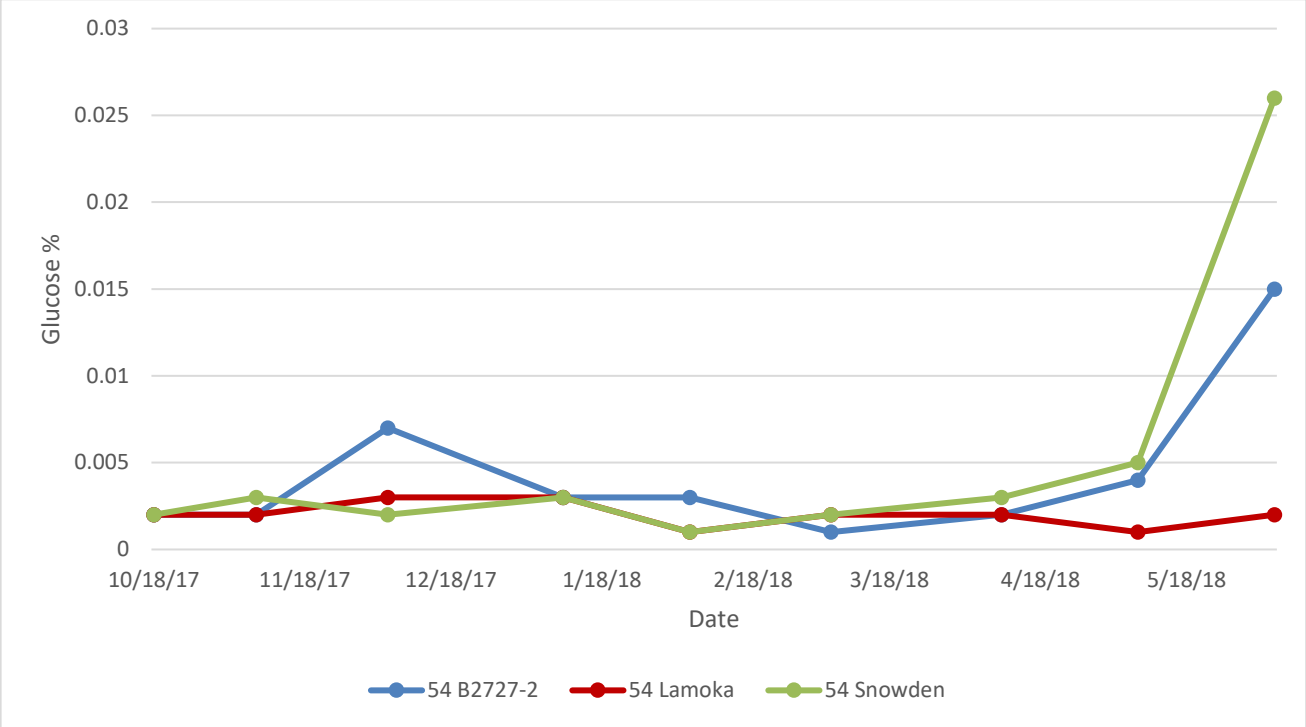
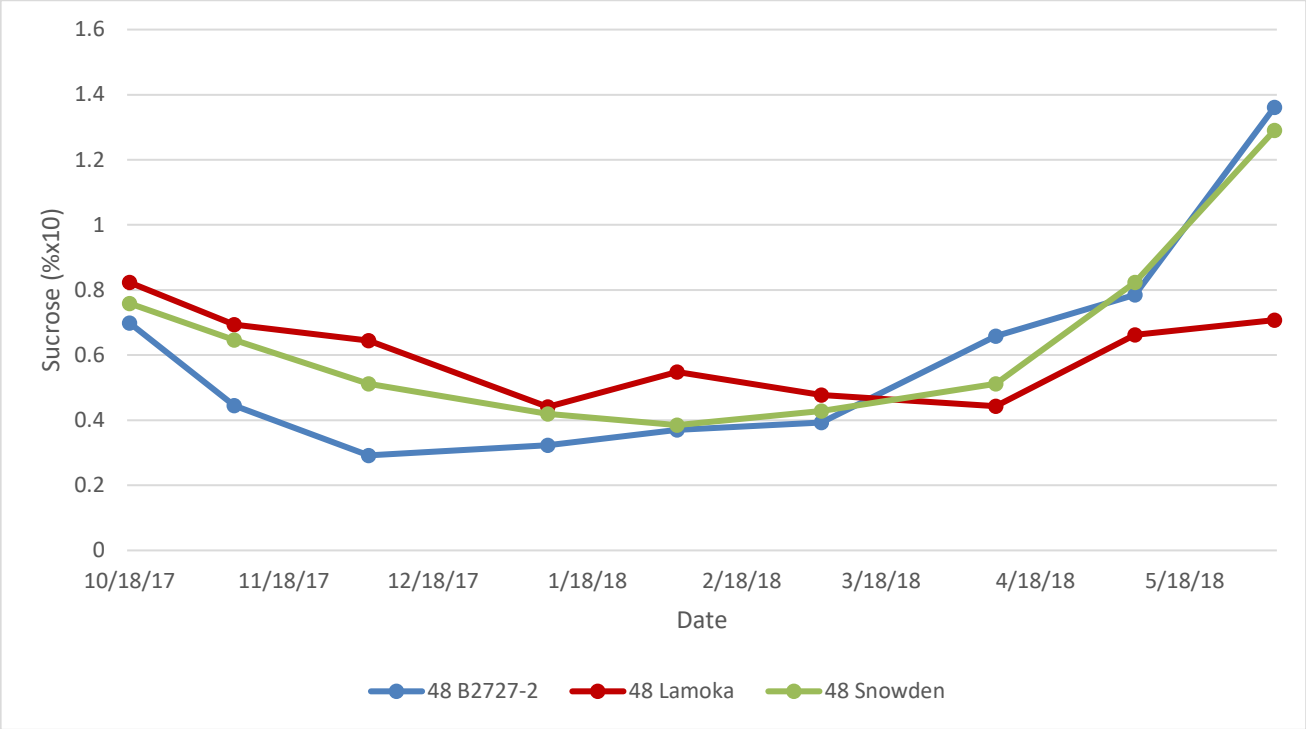


Figure 10. B2727-2 sucrose concentrations for the 2016-2017 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



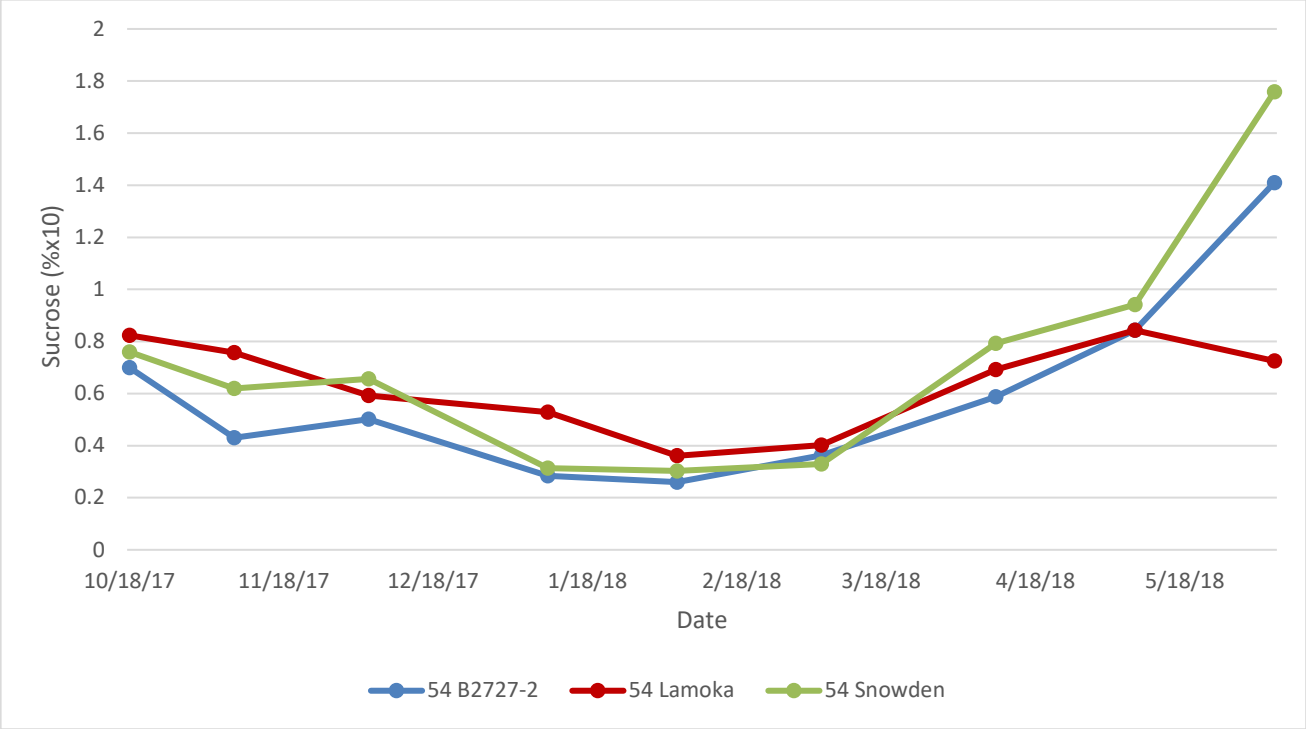
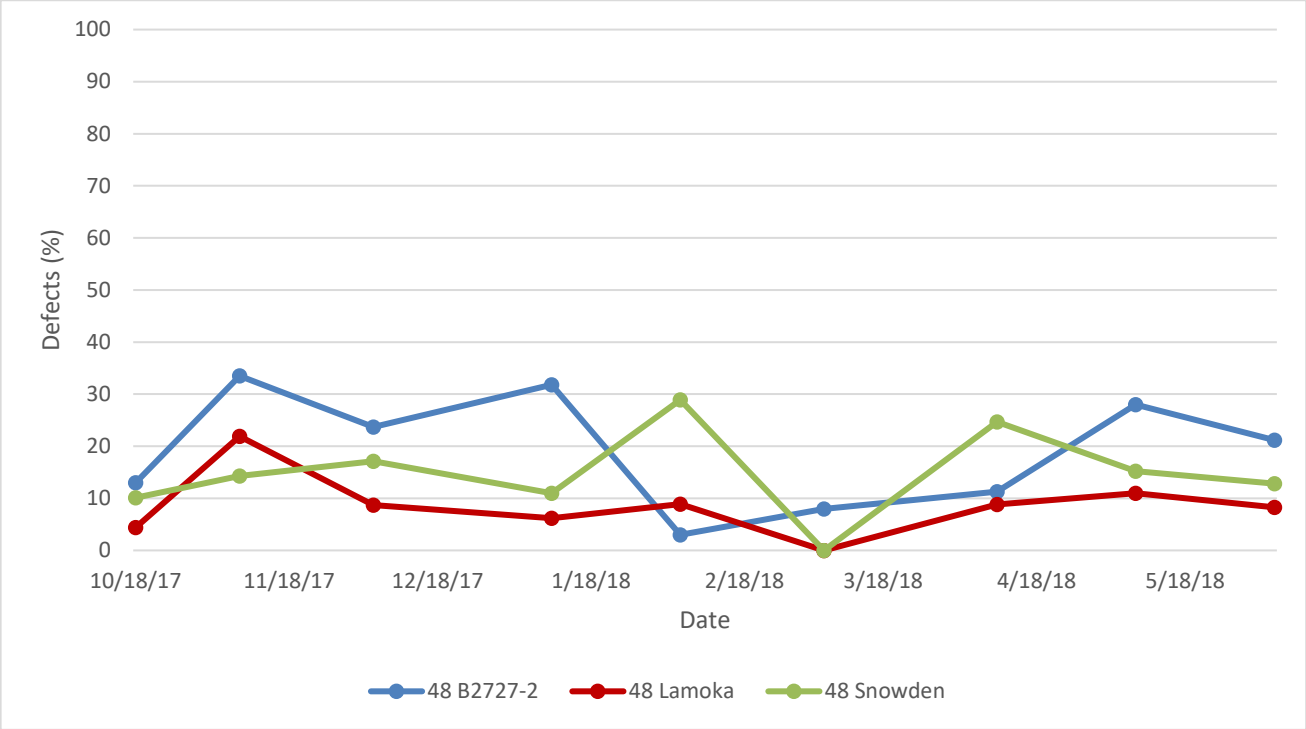


Figure 11. B2727-2 percent defects for the 2016-2017 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



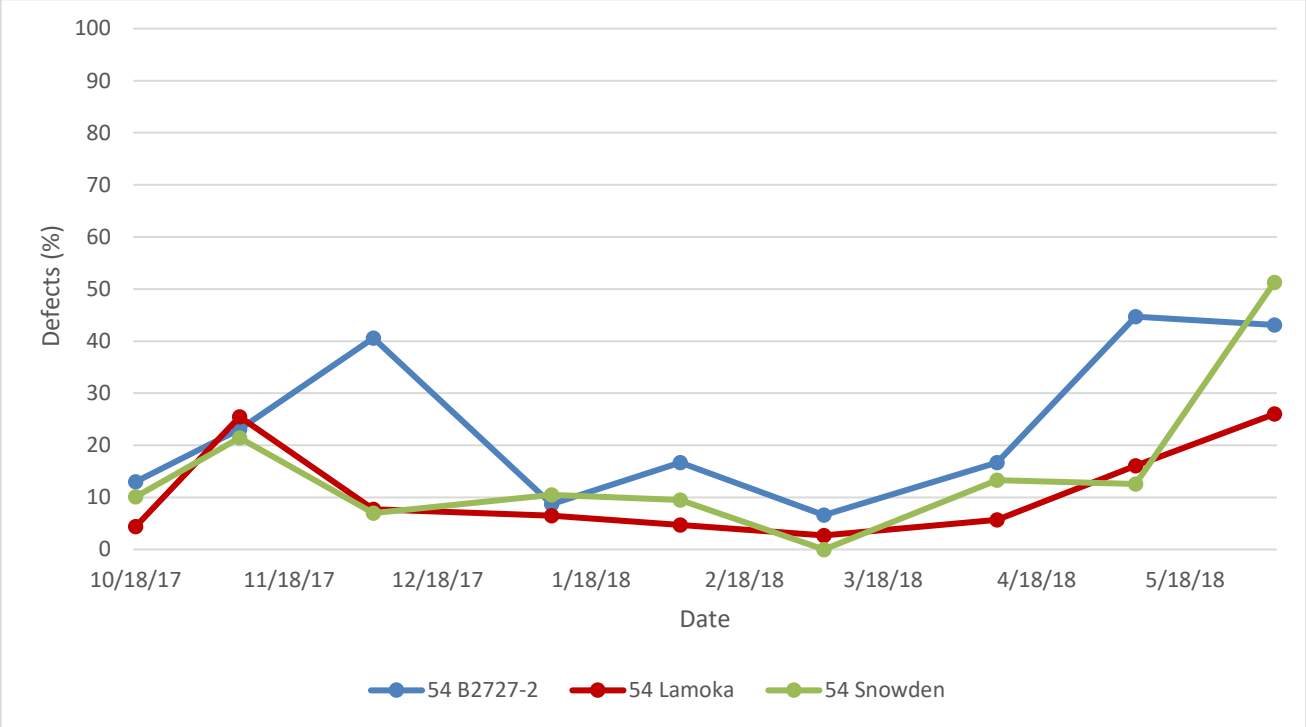
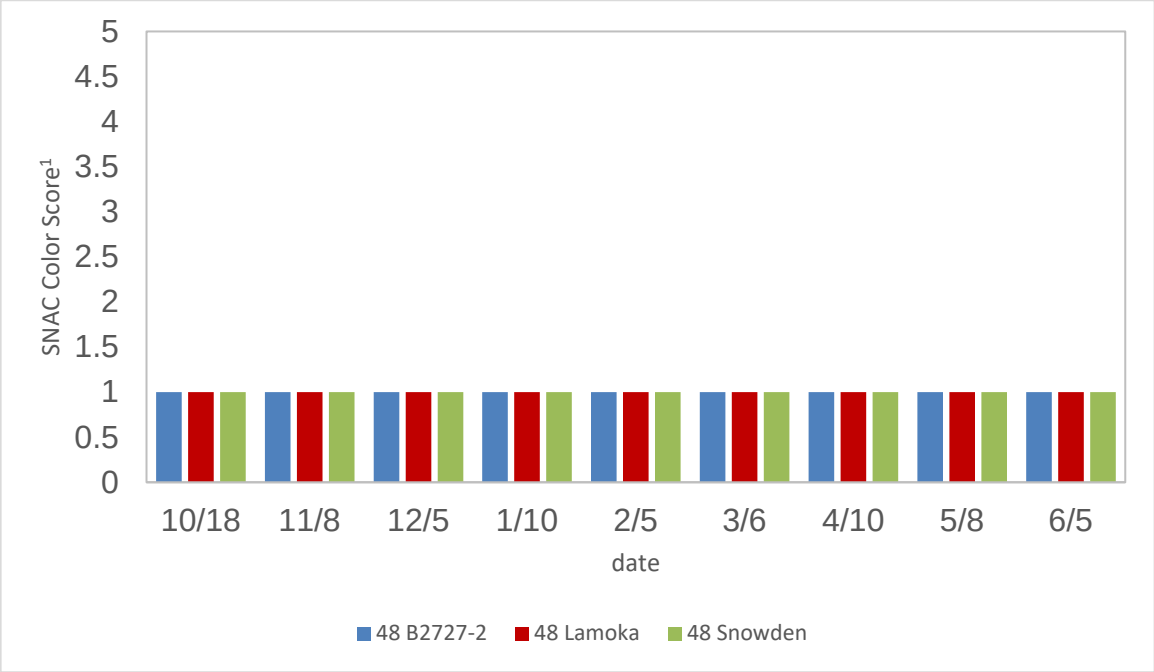
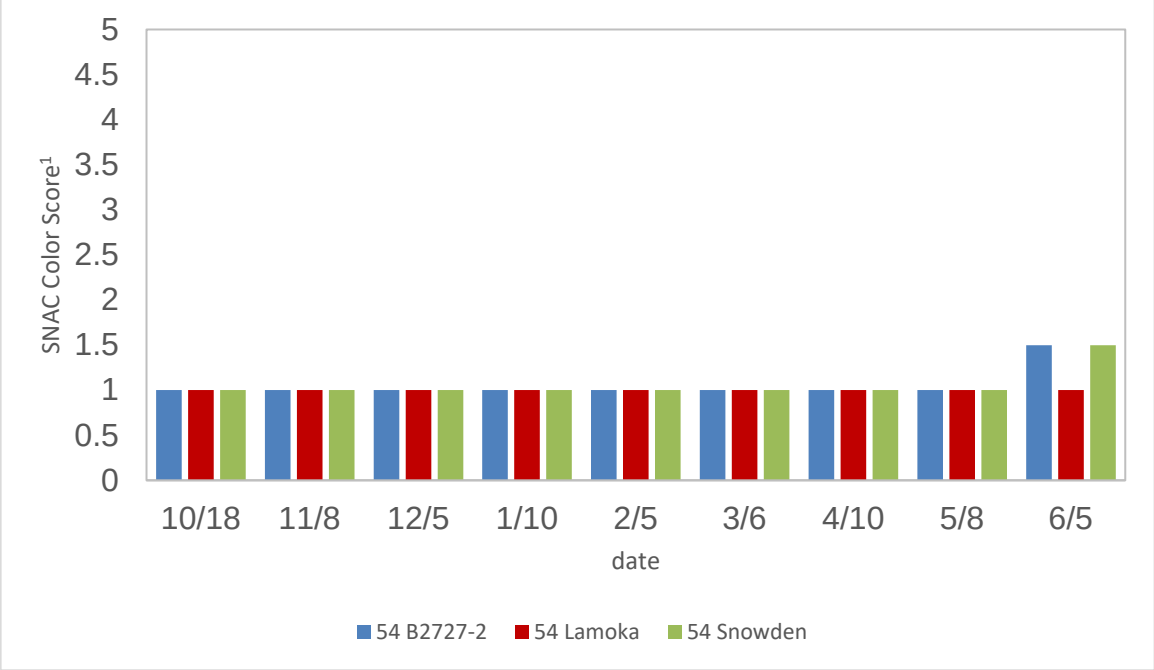


Figure 12. B2727-2 SNAC Color Score (1 = lightest, 5 = darkest) the 2016-2017 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.





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

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

Month	48°F	54°F
October		
November		
December		
January		

February		
March		
April		
May		
June		

MSR127-2: At 48ºF, this variety had higher glucose concentrations than both check varieties beginning in March, while the sample stored at 54ºF maintained a glucose concentration similar to Lamoka during storage (Table 13). The sucrose concentrations for both samples was similar to Lamoka (Table 14). While MSR127-2 had a higher percentage of defects than the check varieties during some months, more notably at 54ºF (Table 15), it maintained a SNAC score of 1.0 during storage, excluding the June sample at 48ºF and the November sample at 54ºF.

Table 7. MSR127-2 monthly chip quality pictures from Techmark Inc.

Month	48°F	54°F
October		
November		
December		
January		

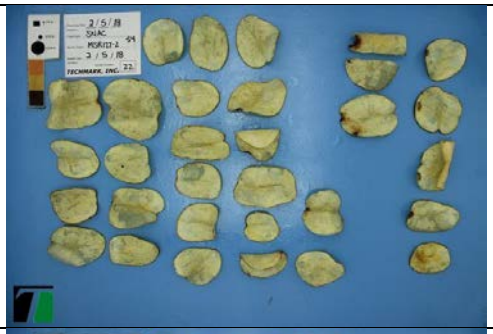
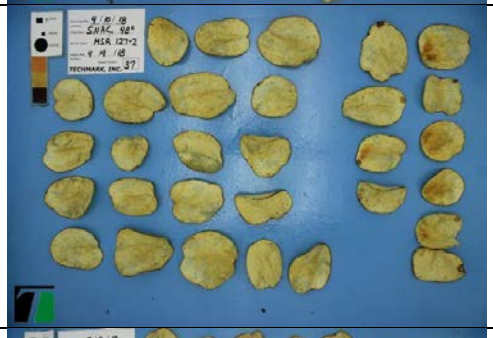
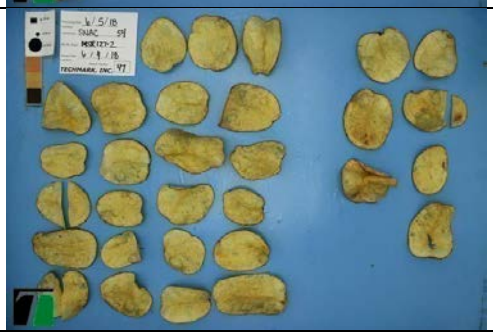
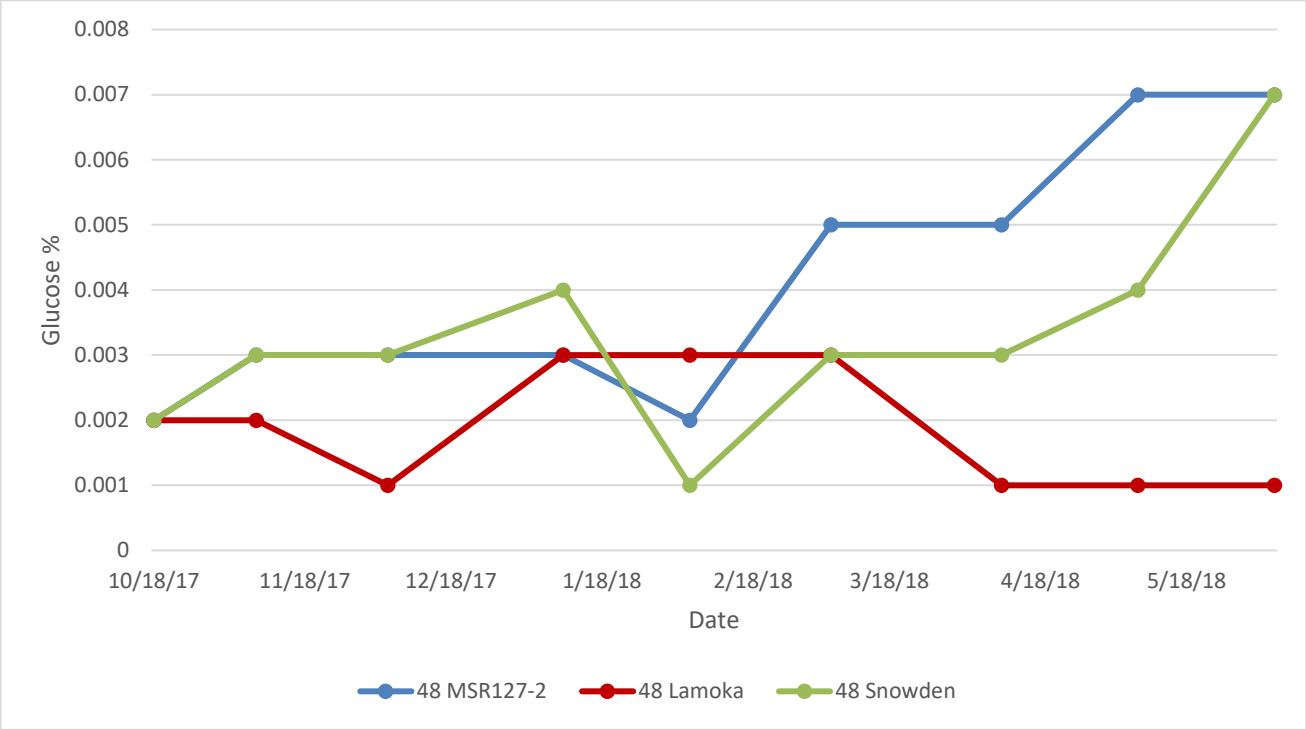
February		
March		
April		
May		
June		

Figure 13. MSR127-2 glucose concentrations for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



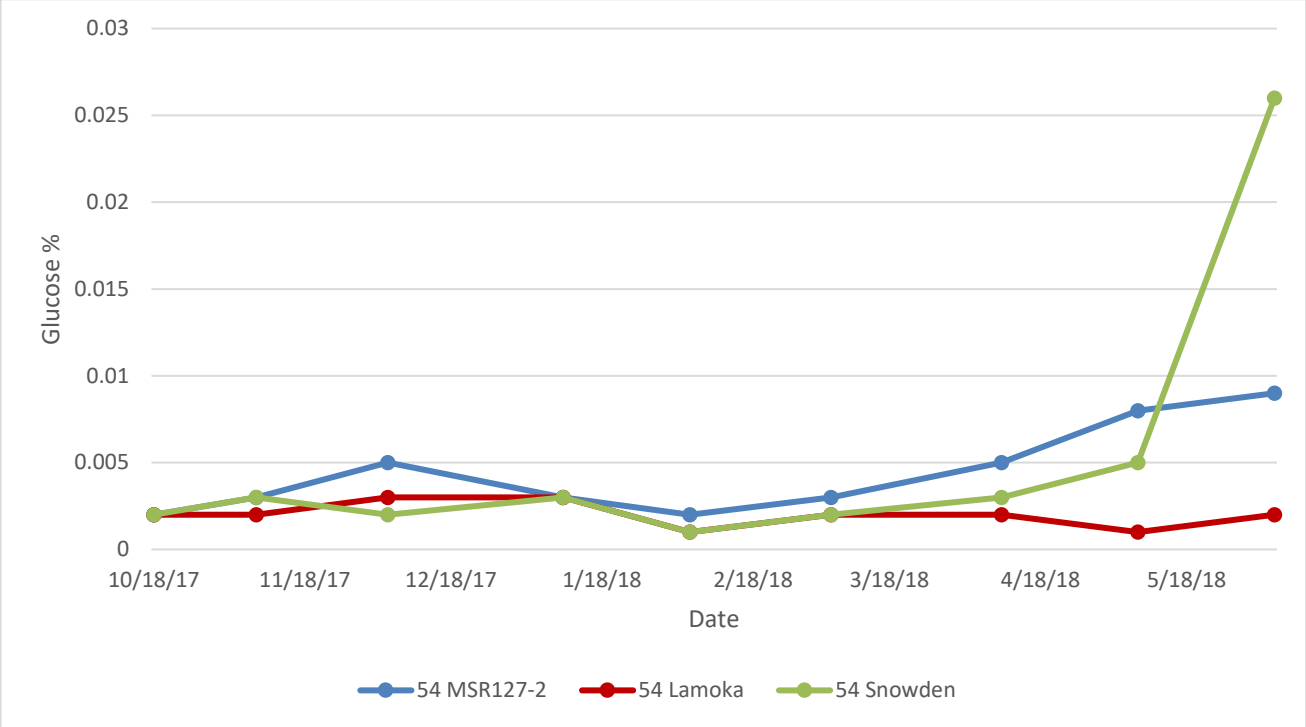
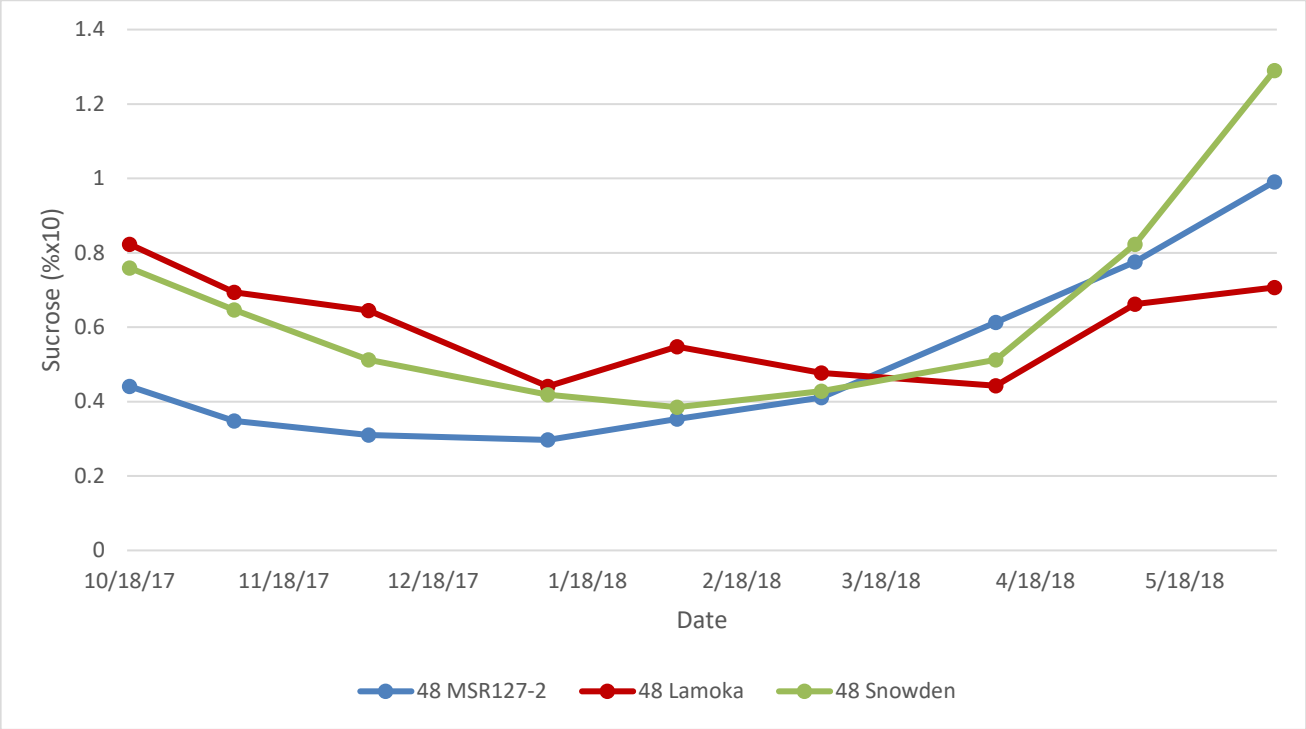


Figure 14. MSR127-2 sucrose concentrations for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



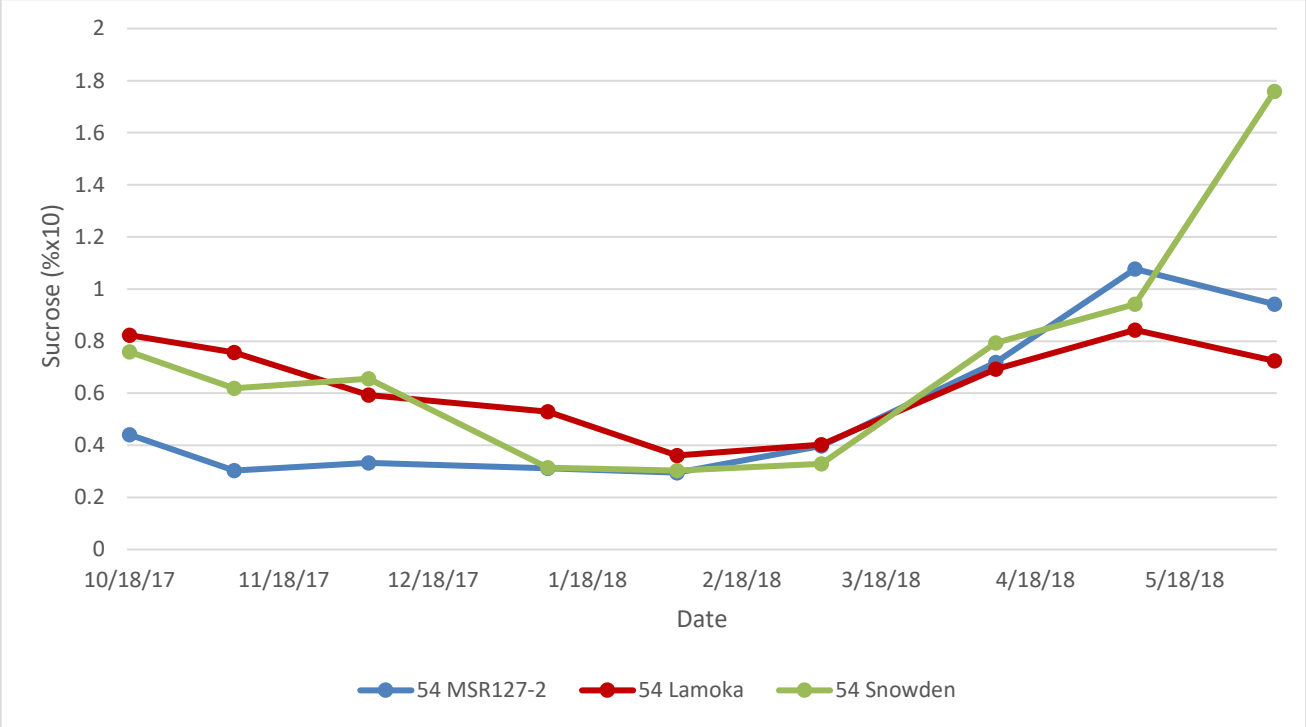
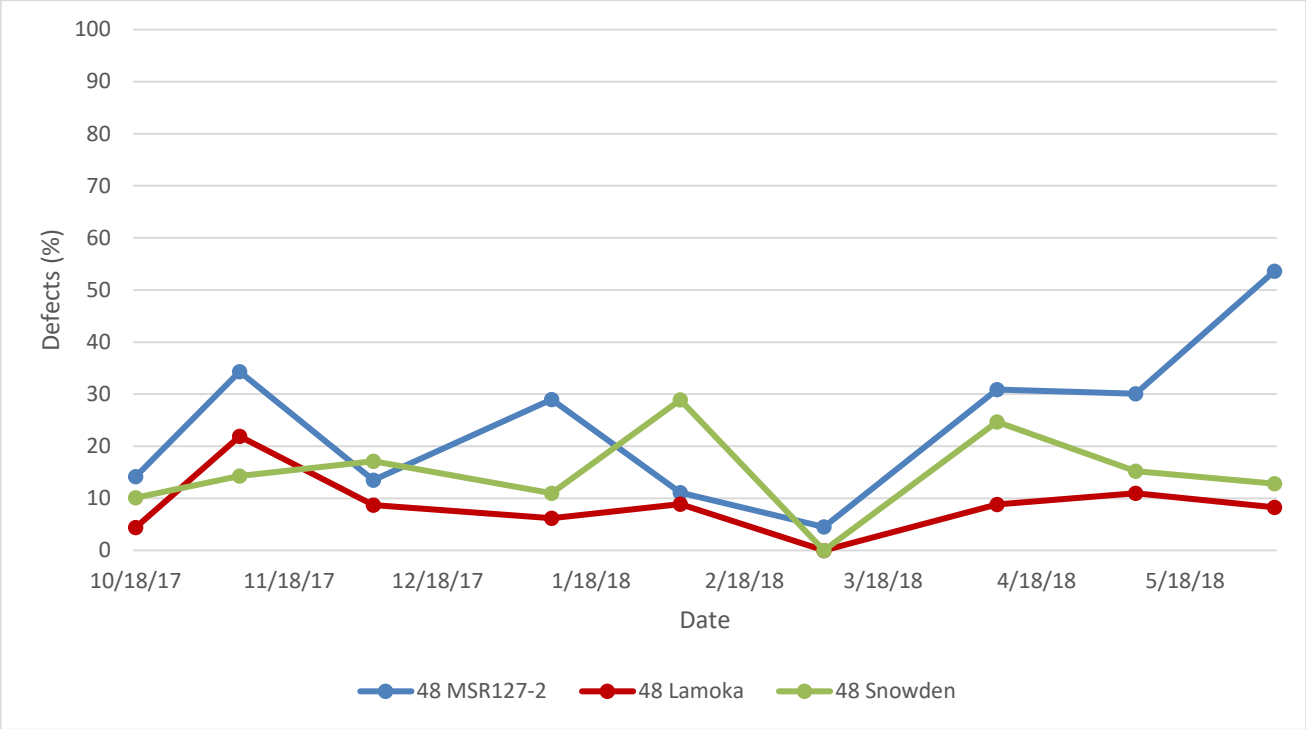


Figure 15. MSR127-2 percent defects for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



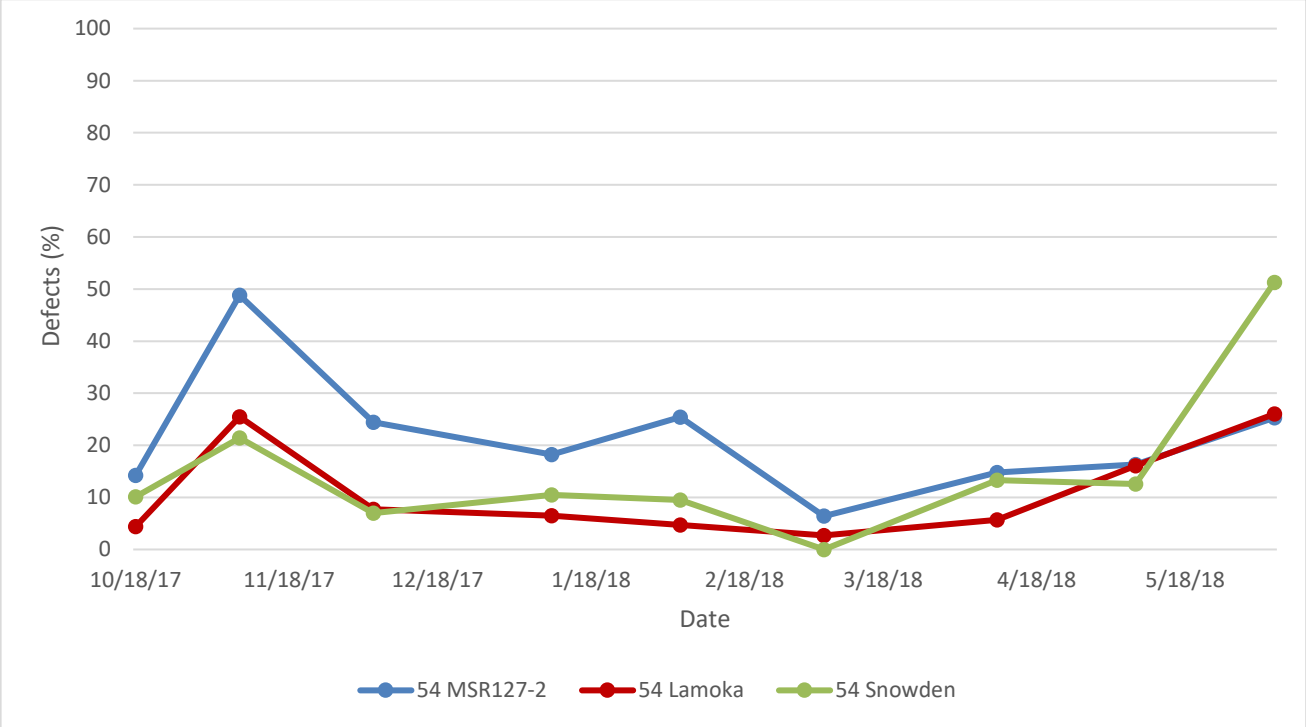
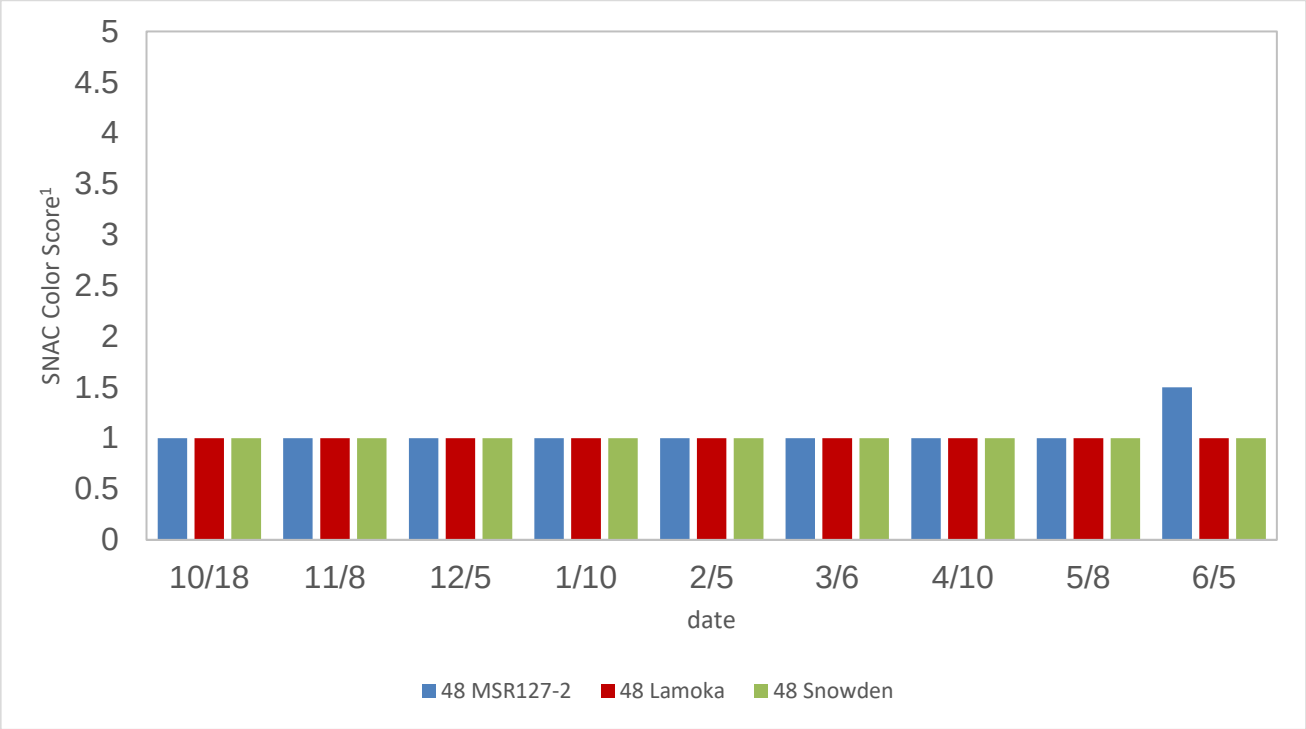
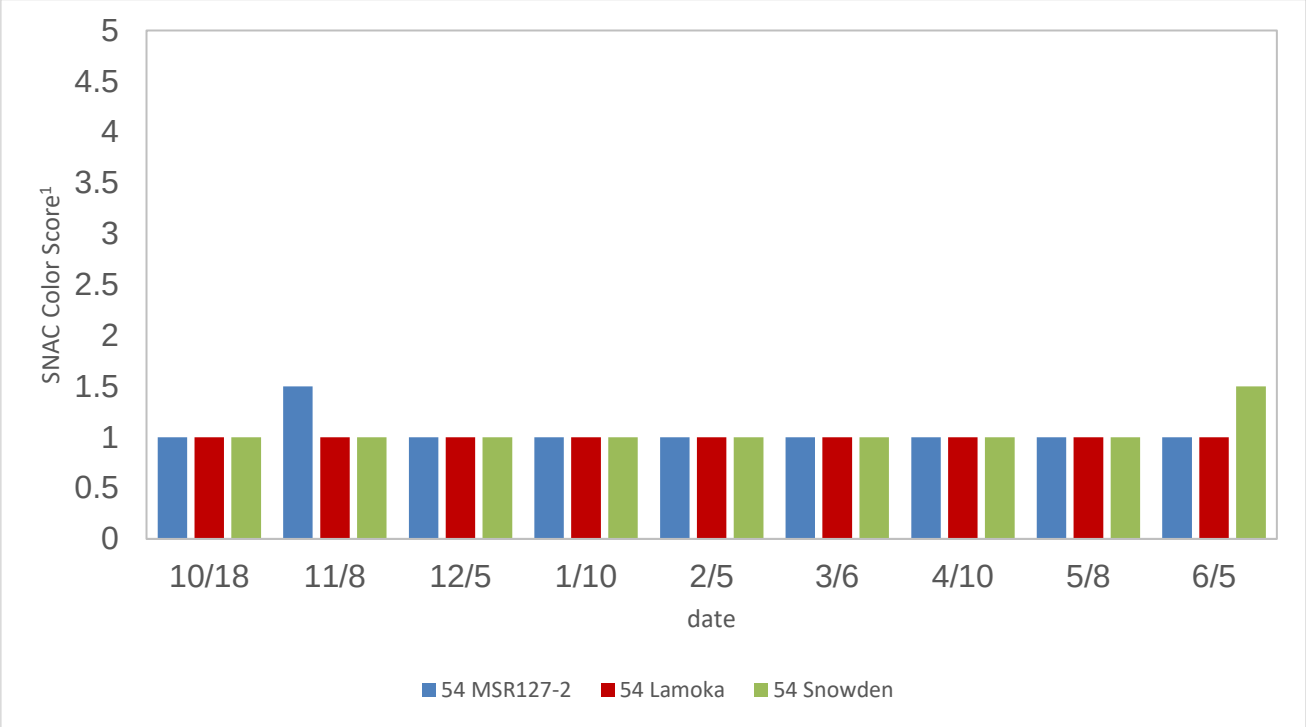


Figure 16. MSR127-2 SNAC Color Score (1 = lightest, 5 = darkest) the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.





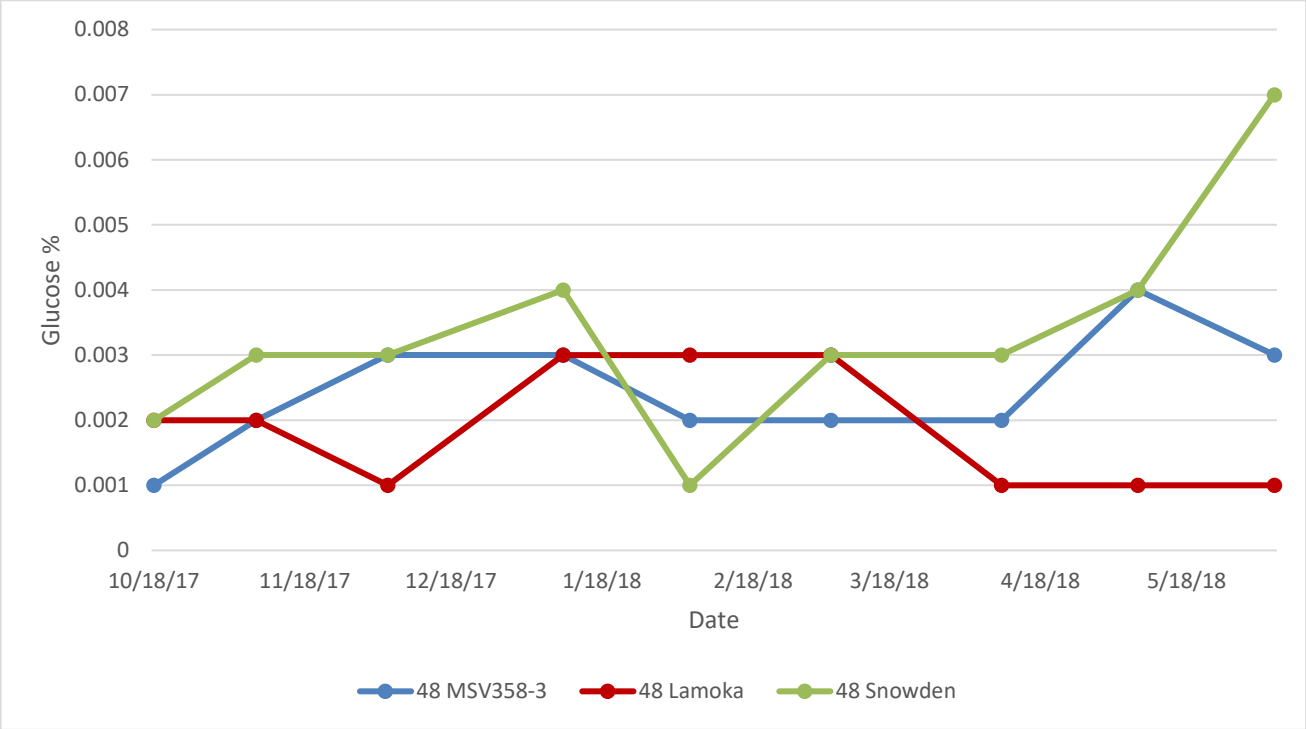
MSV358-3: At 48ºF, this variety had glucose and sucrose concentrations between the two check varieties (Figure 17 and 18). At 54ºF, MSV358-3 had glucose and sucrose concentrations almost identical to those of Lamoka (Figure 17 and 18). Percent defects were comparable to the two check varieties, with a high of 29% and 34% at 48ºF and 54ºF, respectively, both in June (Table 19). MSV358-3 maintained a SNAC score of 1.0 during storage at 48ºF, while at 54ºF the score rose to 1.5 in the last sample (Table 20). Chip quality and color was consistently good through the early May sample.

Table 8. MSV358-3 monthly chip quality pictures from Techmark Inc.

Month	48°F	54°F
October		
November		
December		
January		

February		
March		
April		
May		
June		

Figure 17. MSV358-3 glucose concentrations for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



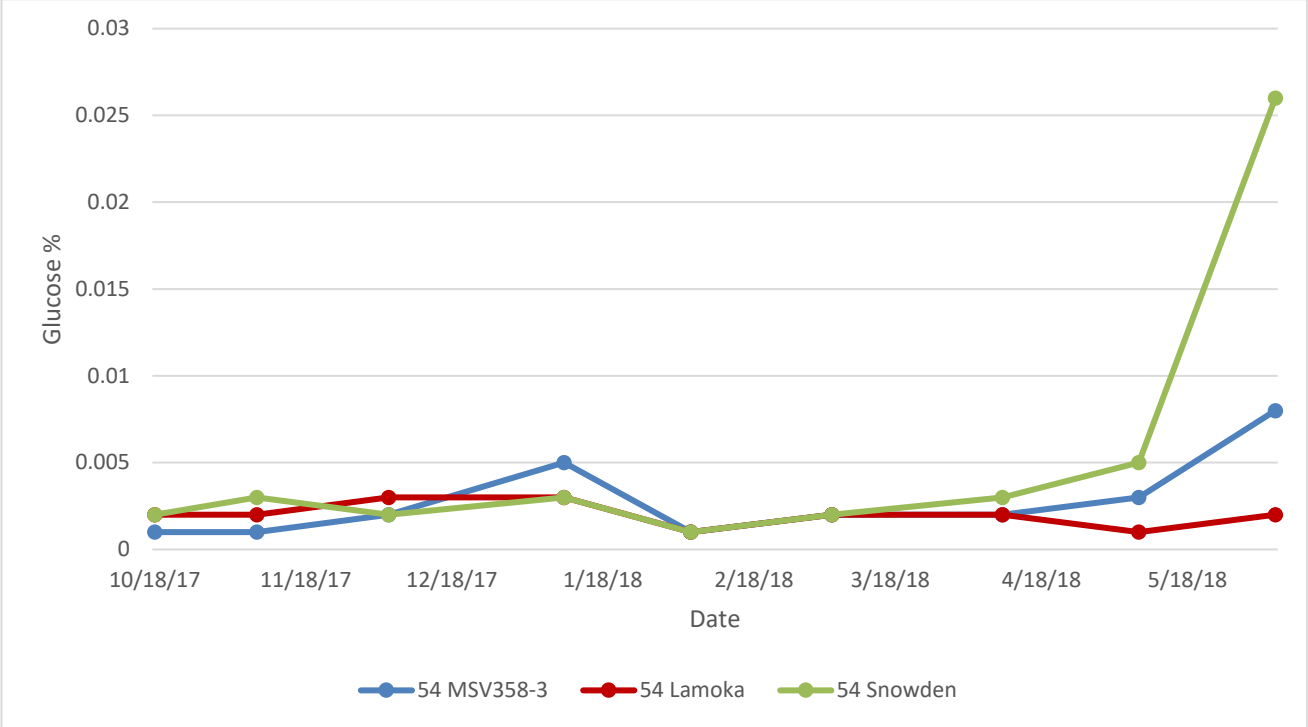
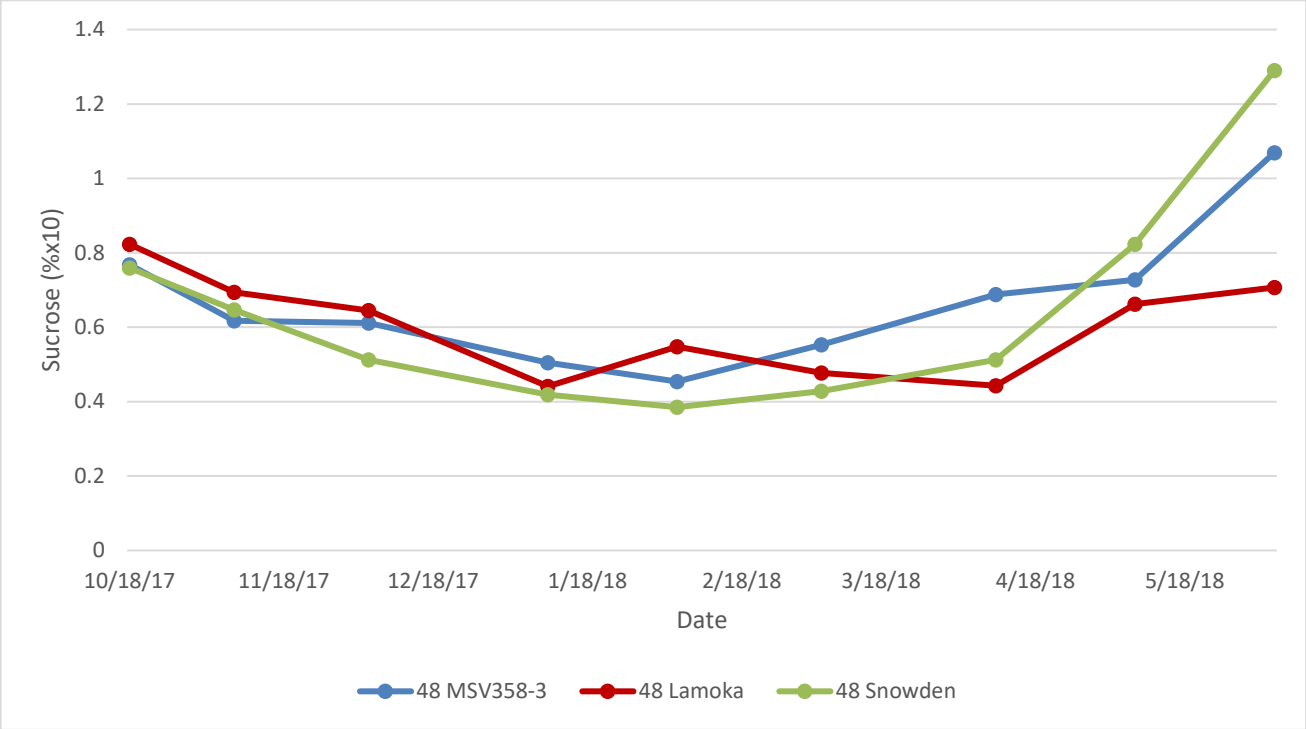


Figure 18. MSV358-3 sucrose concentrations for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



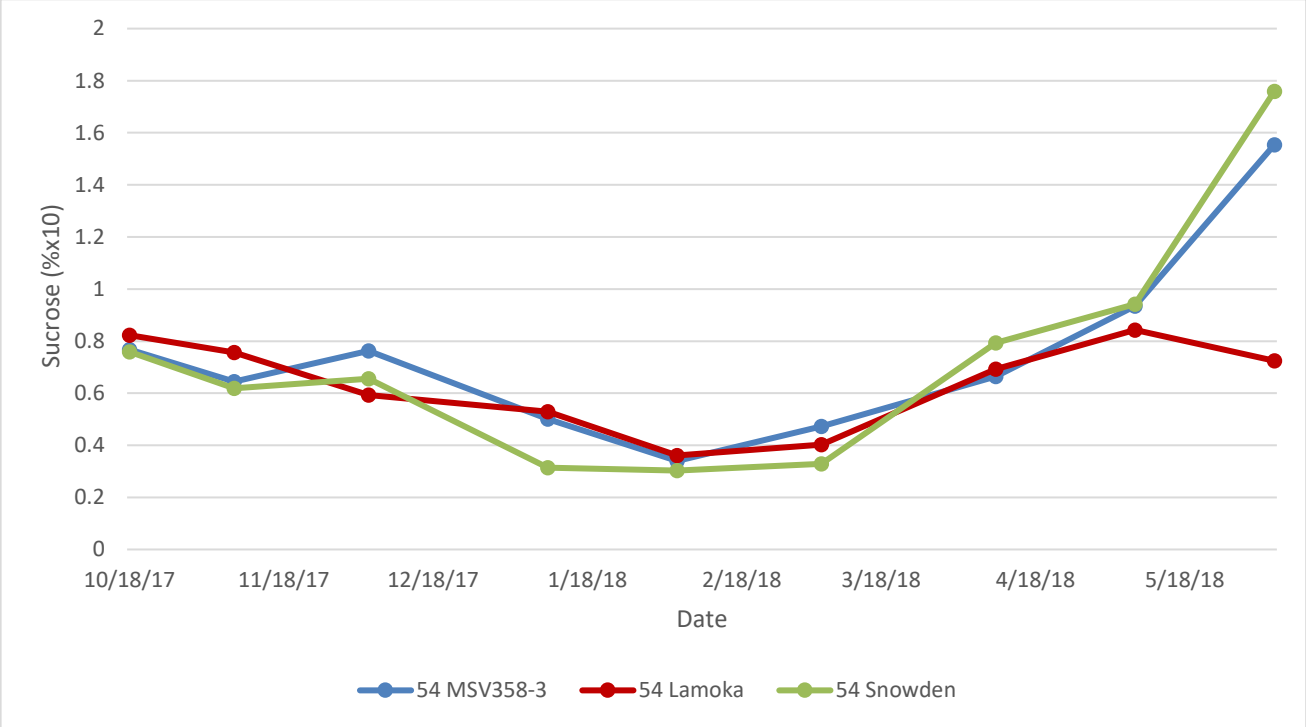
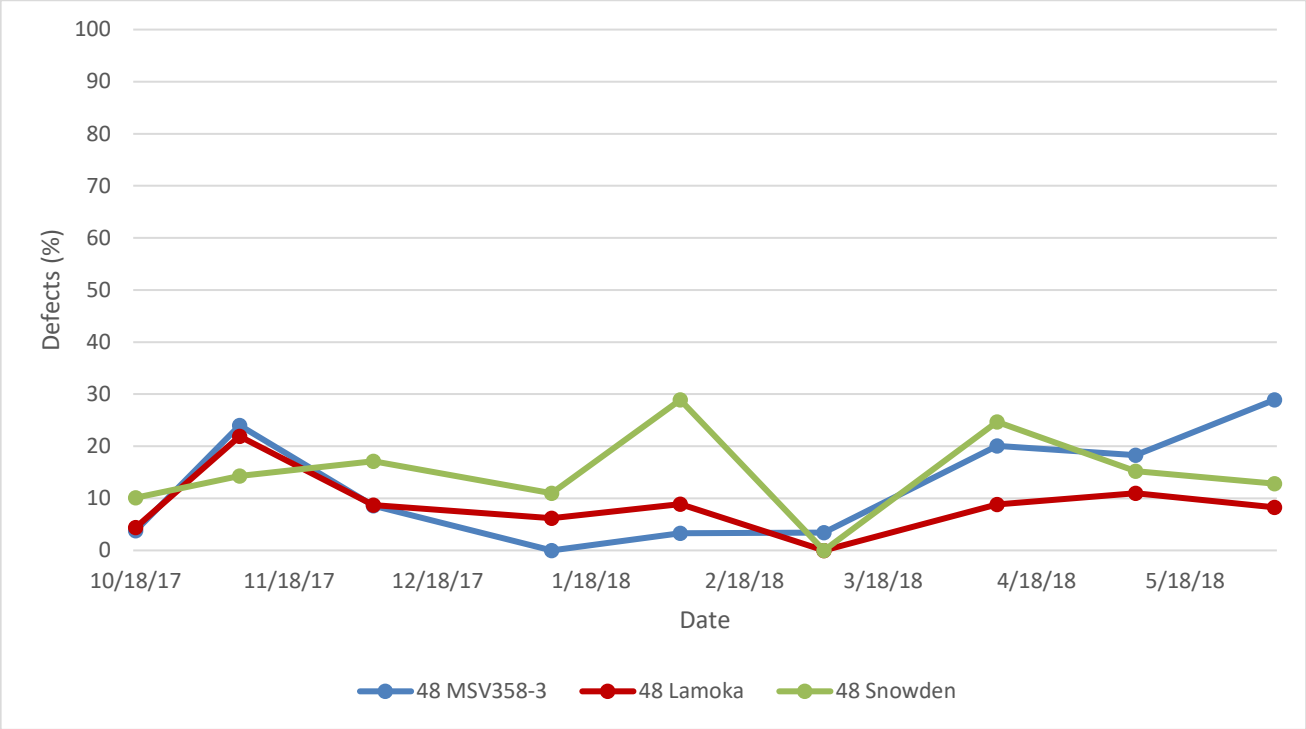


Figure 19. MSV358-3 percent defects for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



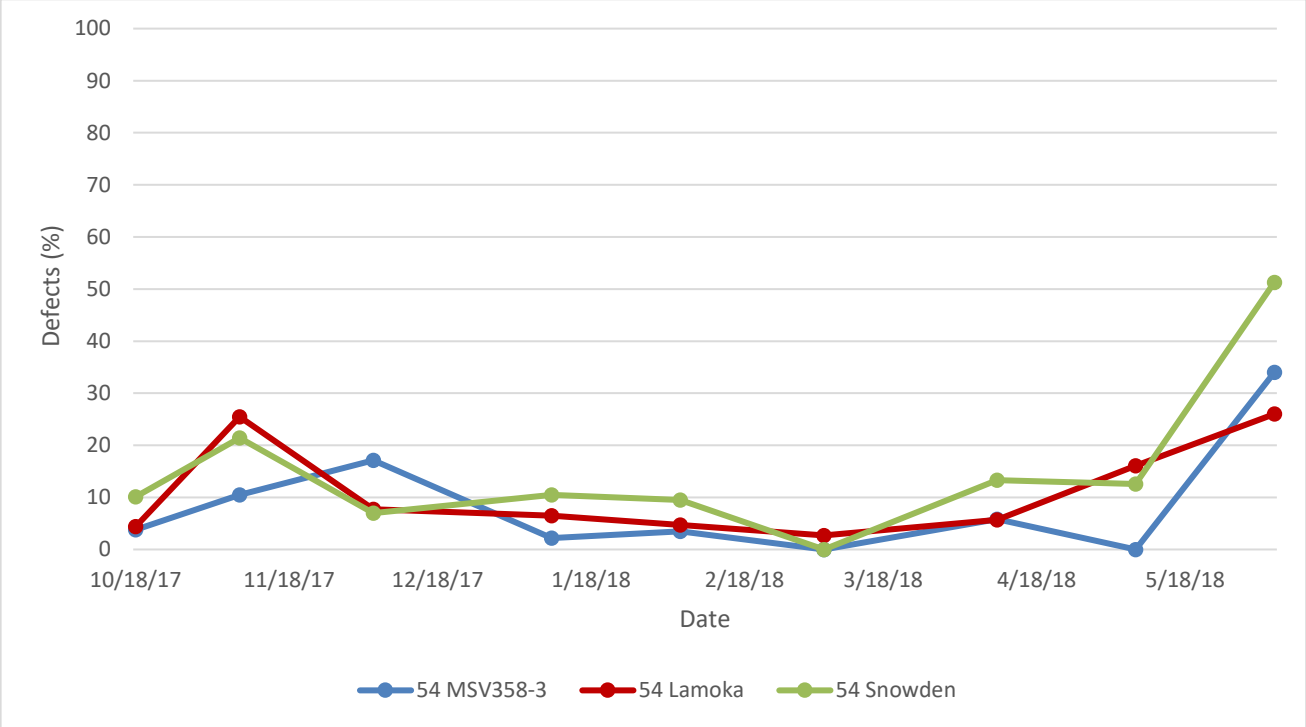
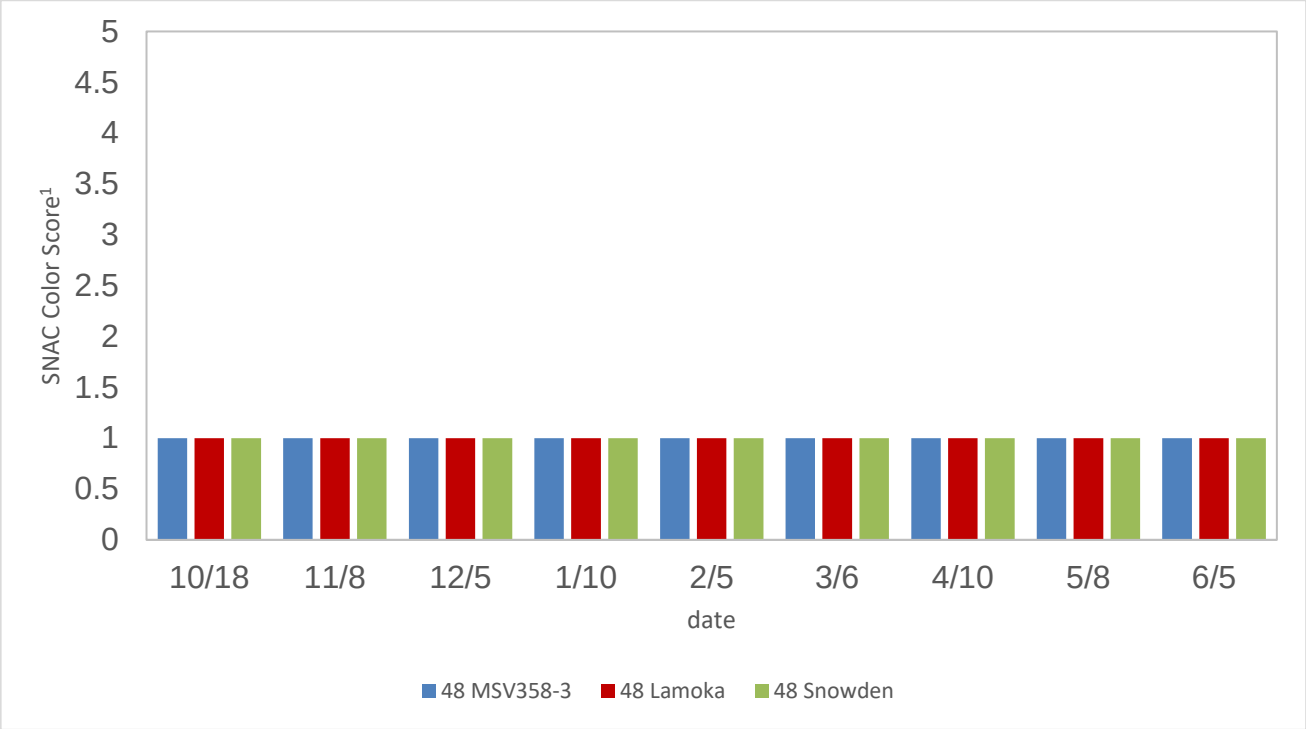
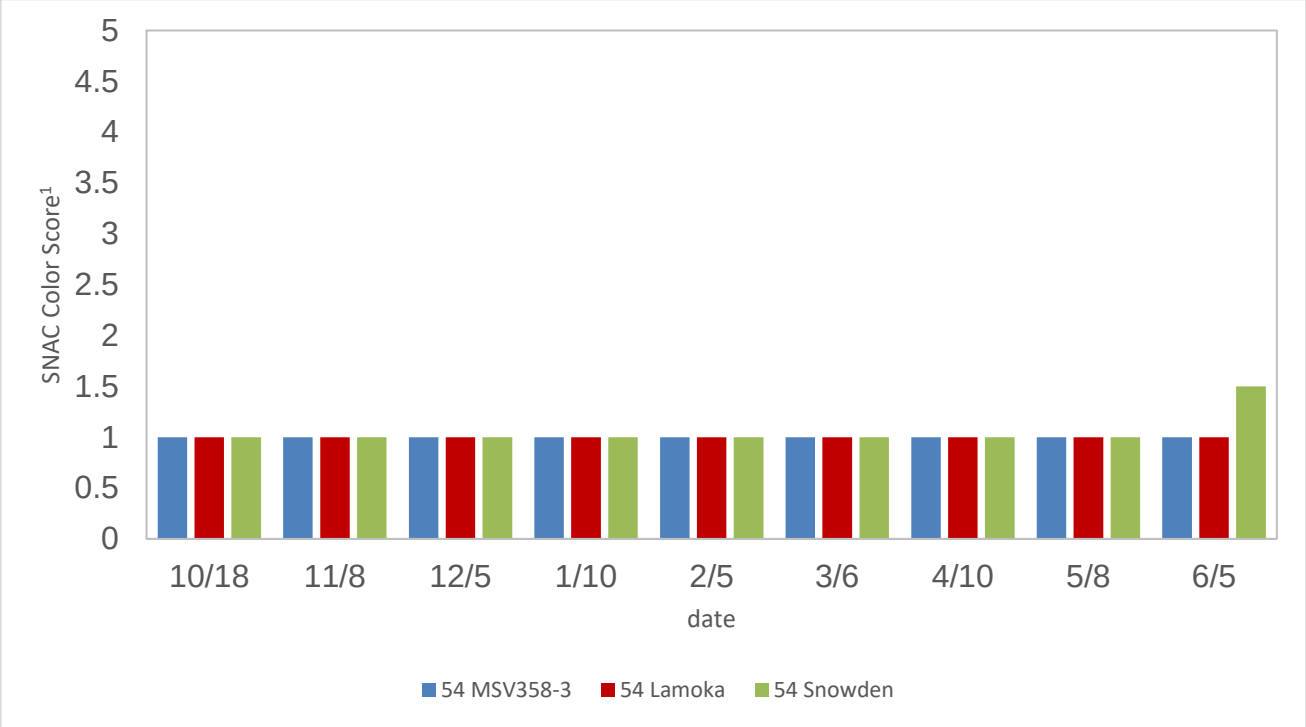


Figure 20. MSV358-3 SNAC Color Score (1 = lightest, 5 = darkest) the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.





MSW485-2: Compared to Snowden, MSW485-2 had similar glucose and sucrose concentrations through April, but glucose concentrations increased at both storage temperatures in May to 0.023% and 0.124% at 48ºF and 54ºF (Figures 21-22). This variety had similar chip defects compared with both check varieties, with highs of 29% and 34%, both in June, at 48ºF and 54ºF, respectively (Figure 23). Chip color was generally acceptable, excluding the last two samples, which had many dark colored chips, corresponding to higher sucrose and glucose concentrations (Figure 24). The best chip quality was observed between January and March (Figure 23).

Table 9. MSW485-2 monthly chip quality pictures from Techmark Inc.

Month	48°F	54°F
October		
November		
December		
January		

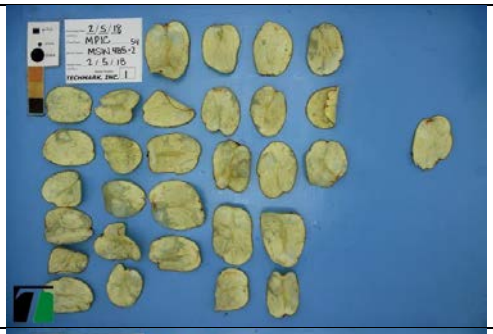
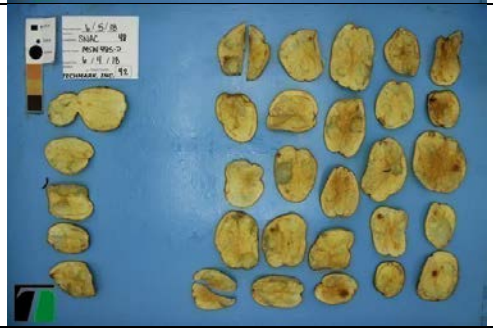
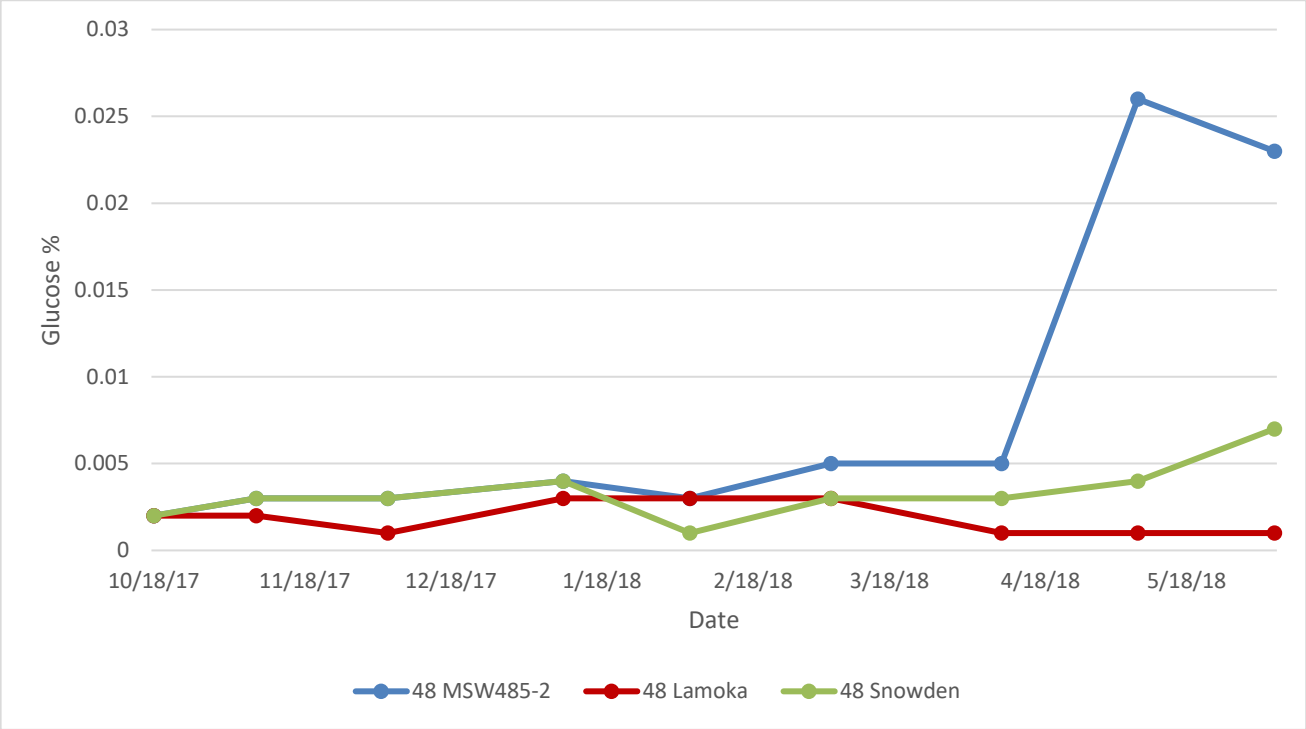
February		
March		
April		
May		
June		

Figure 21. MSW485-2 glucose concentrations for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



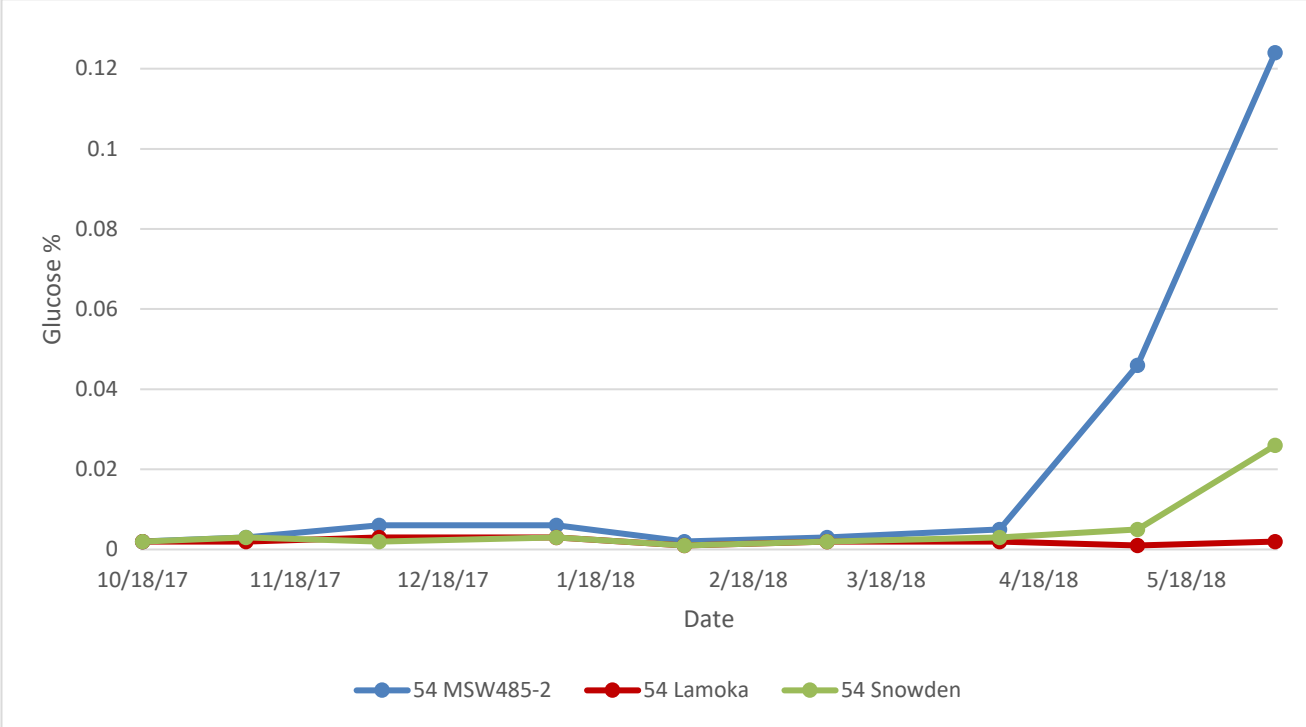
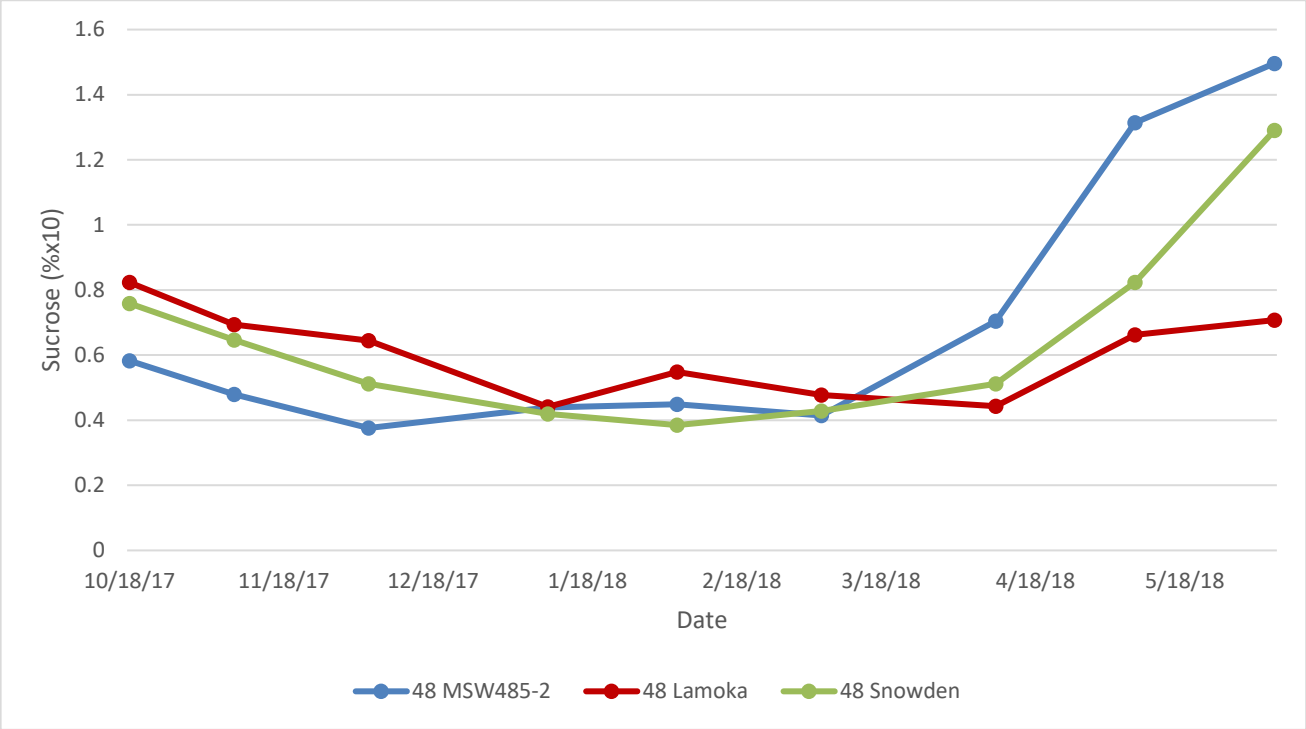


Figure 22. MW485-2 sucrose concentrations for the 2016-2017 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



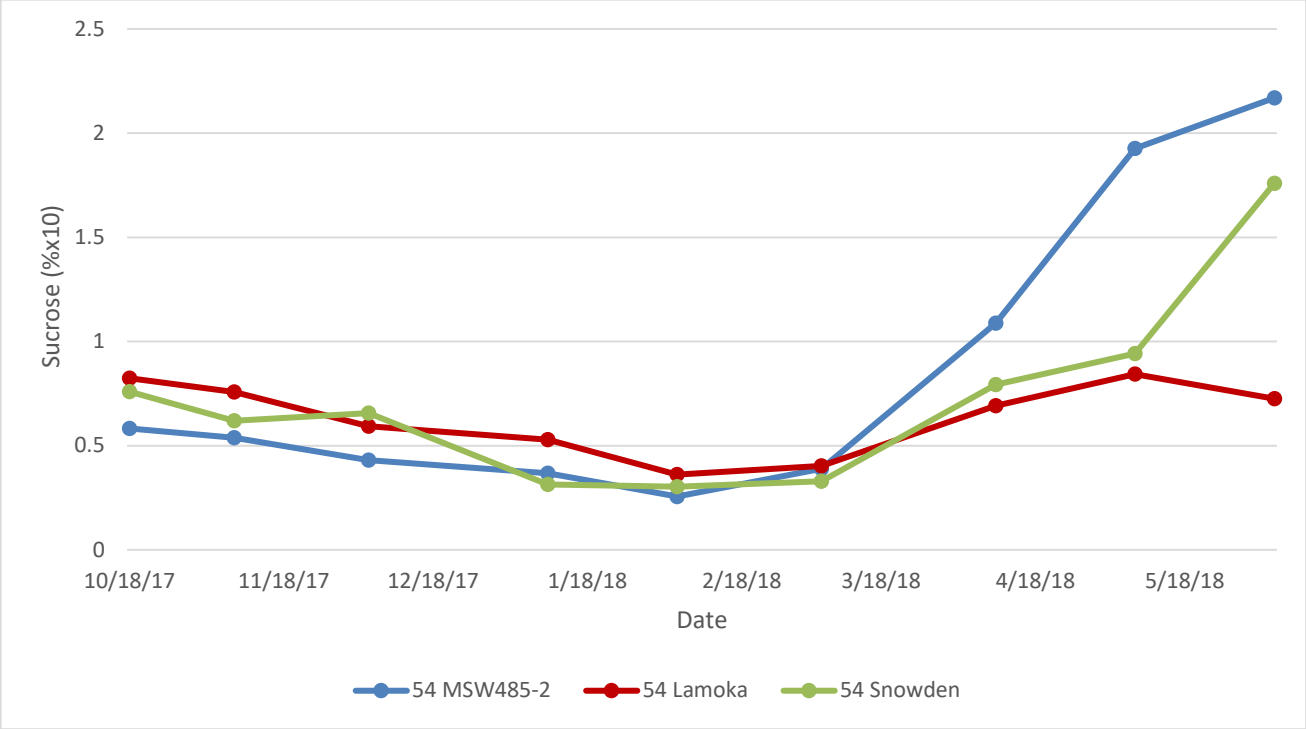
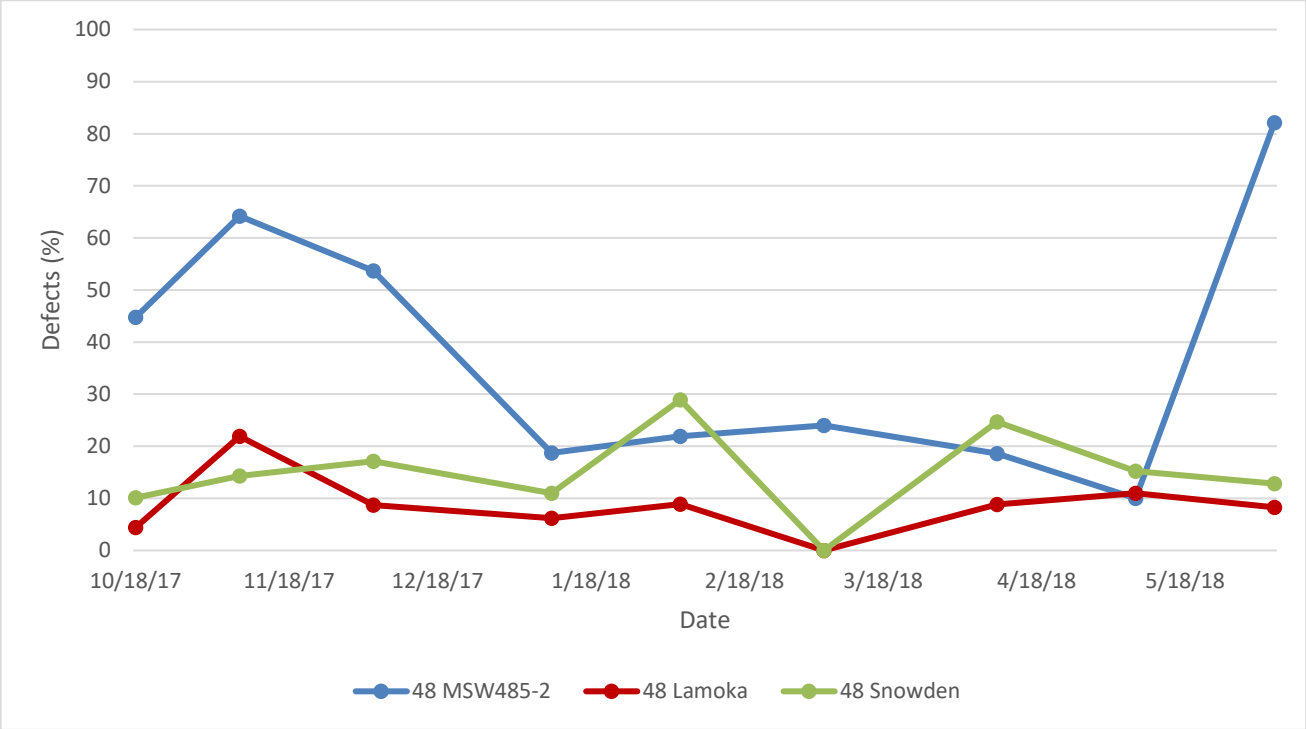


Figure 23. MSW485-2 percent defects for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



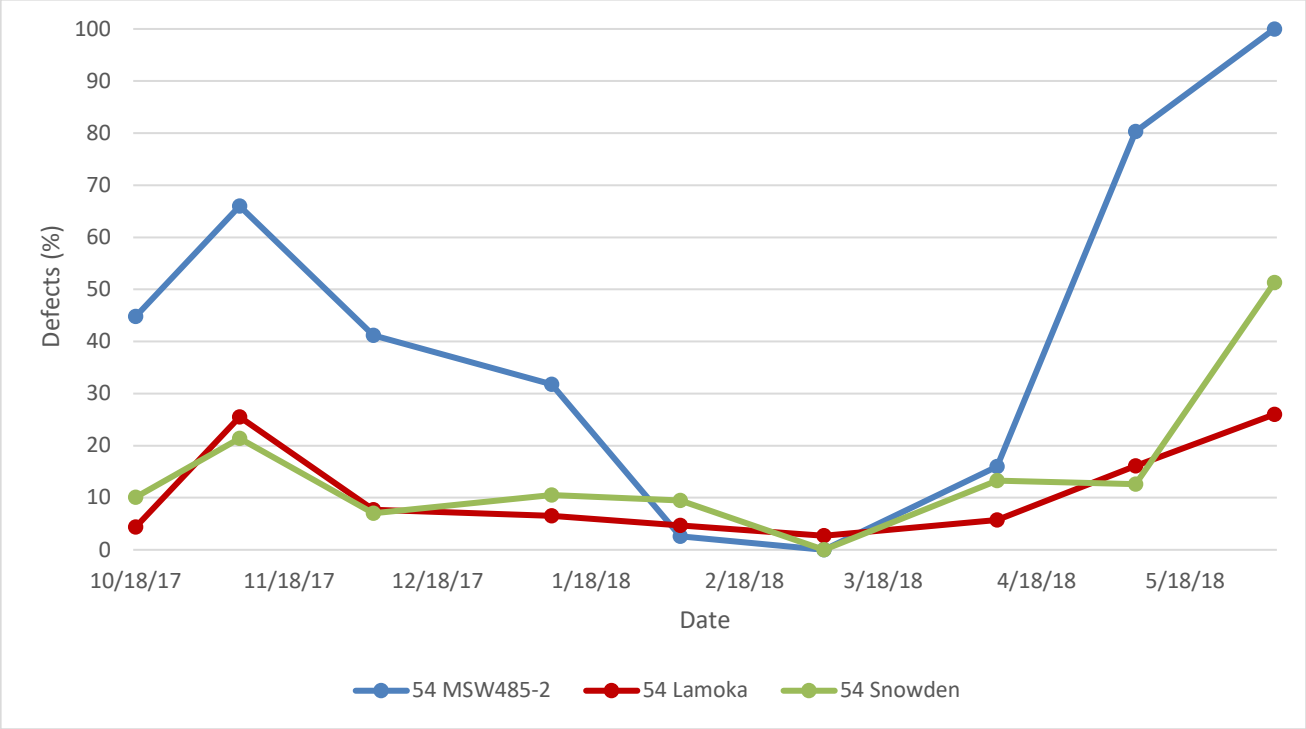
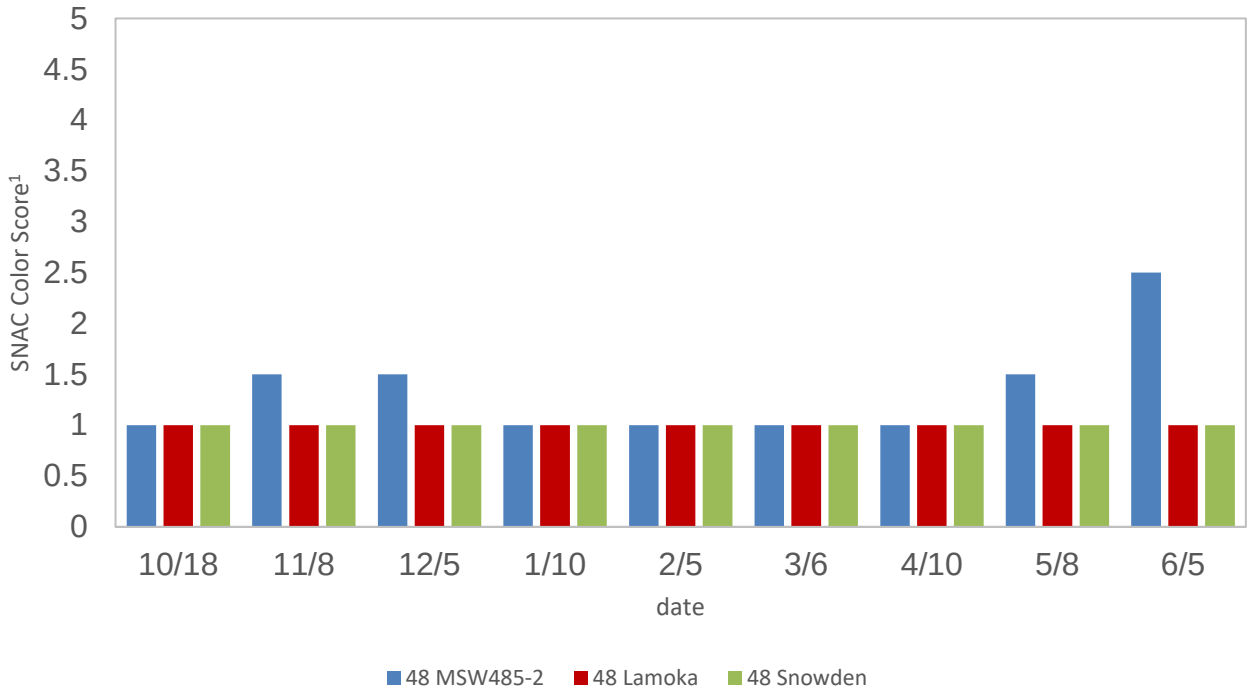
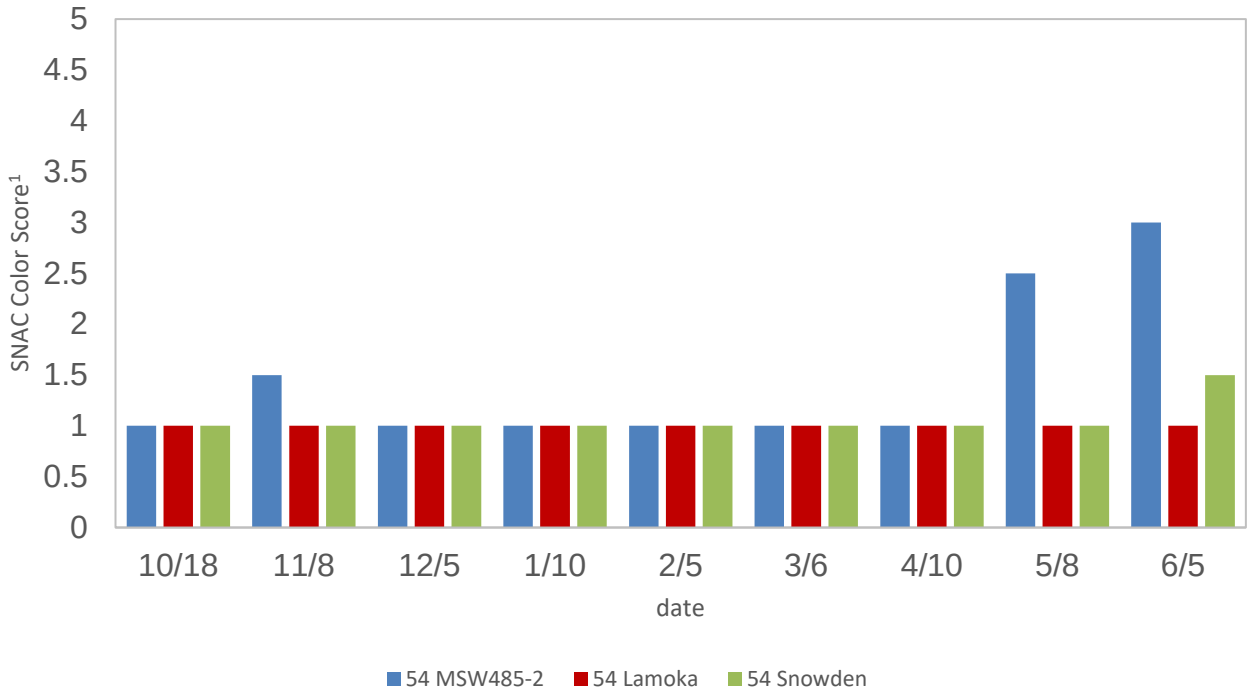


Figure 24. MSW485-2 SNAC Color Score (1 = lightest, 5 = darkest) the 2016-2017 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.





MSX540-4: This variety is comparable to both Lamoka and Snowden for sucrose concentration, percent defects, and SNAC chip color (Tables 26 to 28). The glucose concentrations were similar to, but occasionally higher than those of the check varieties at both temperatures (Table 25). MSX540-4 displays good chip quality through May with full season storage potential.

Table 10. MSX540-4 monthly chip quality pictures from Techmark Inc.

Month	48°F	54°F
October		
November		
December		
January		

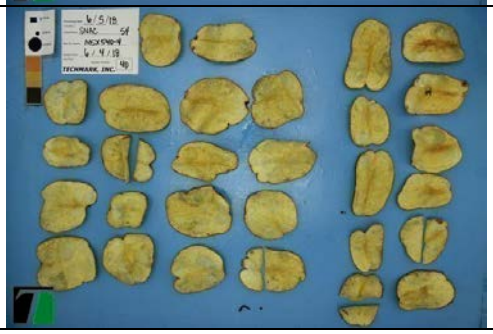
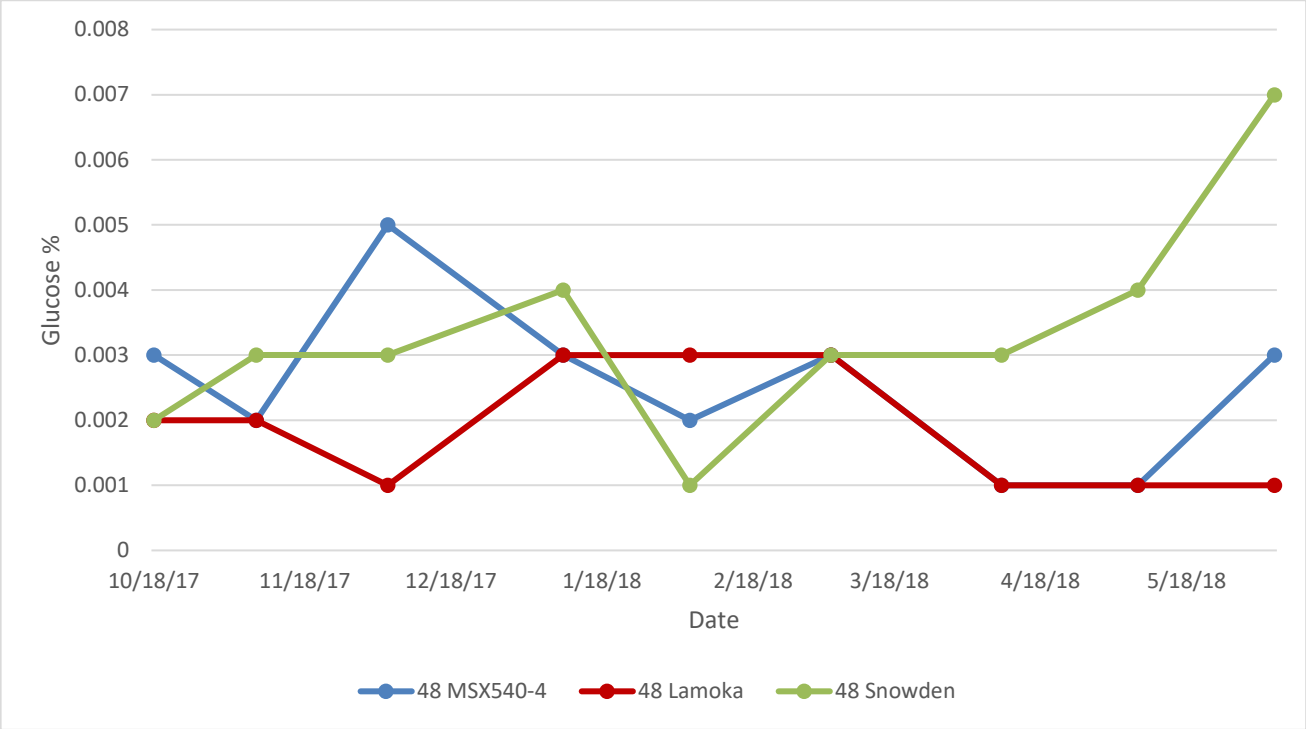
February		
March		
April		
May		
June		

Figure 25. MSX540-4 glucose concentrations for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



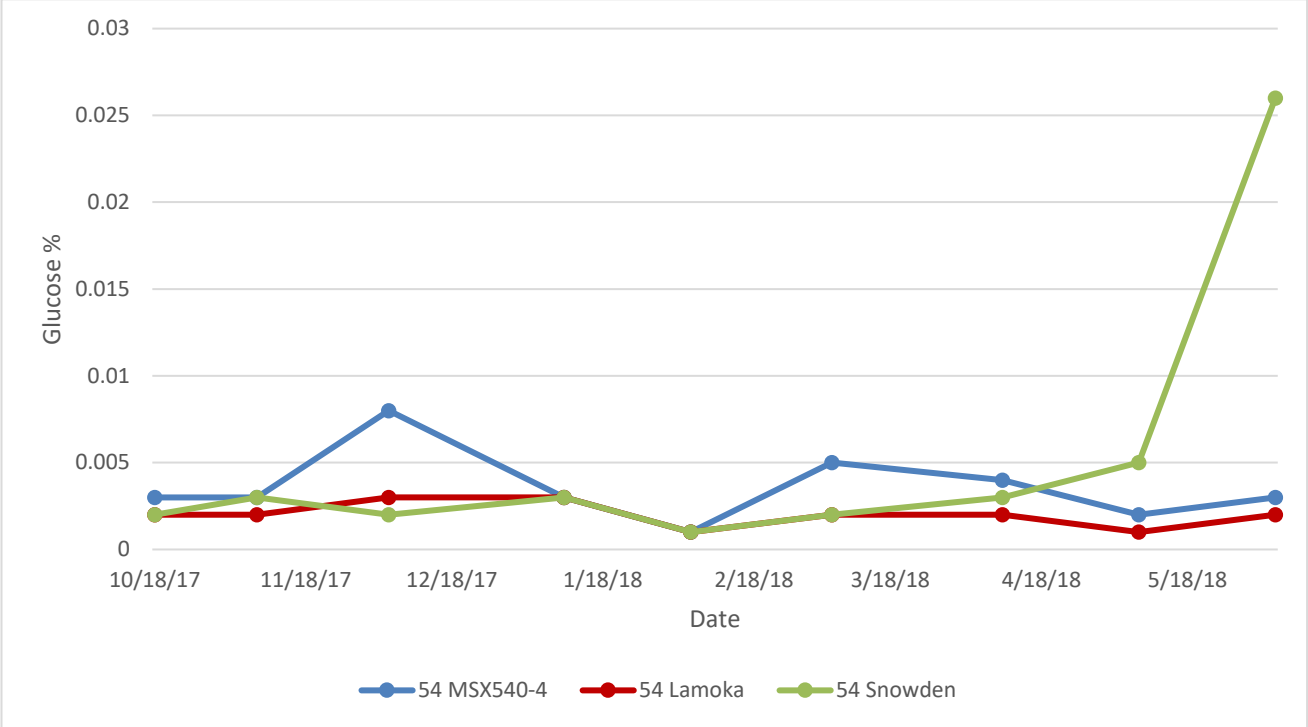
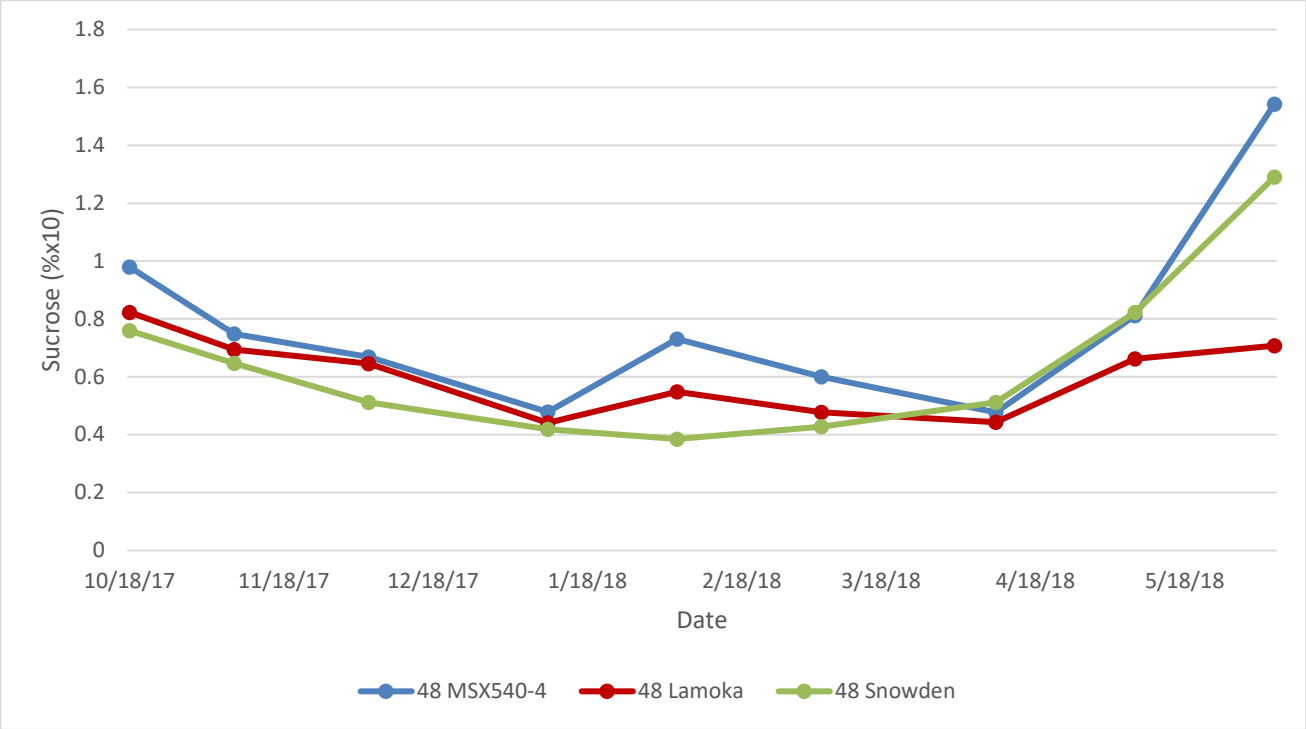


Figure 26. MSX540-4 sucrose concentrations for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



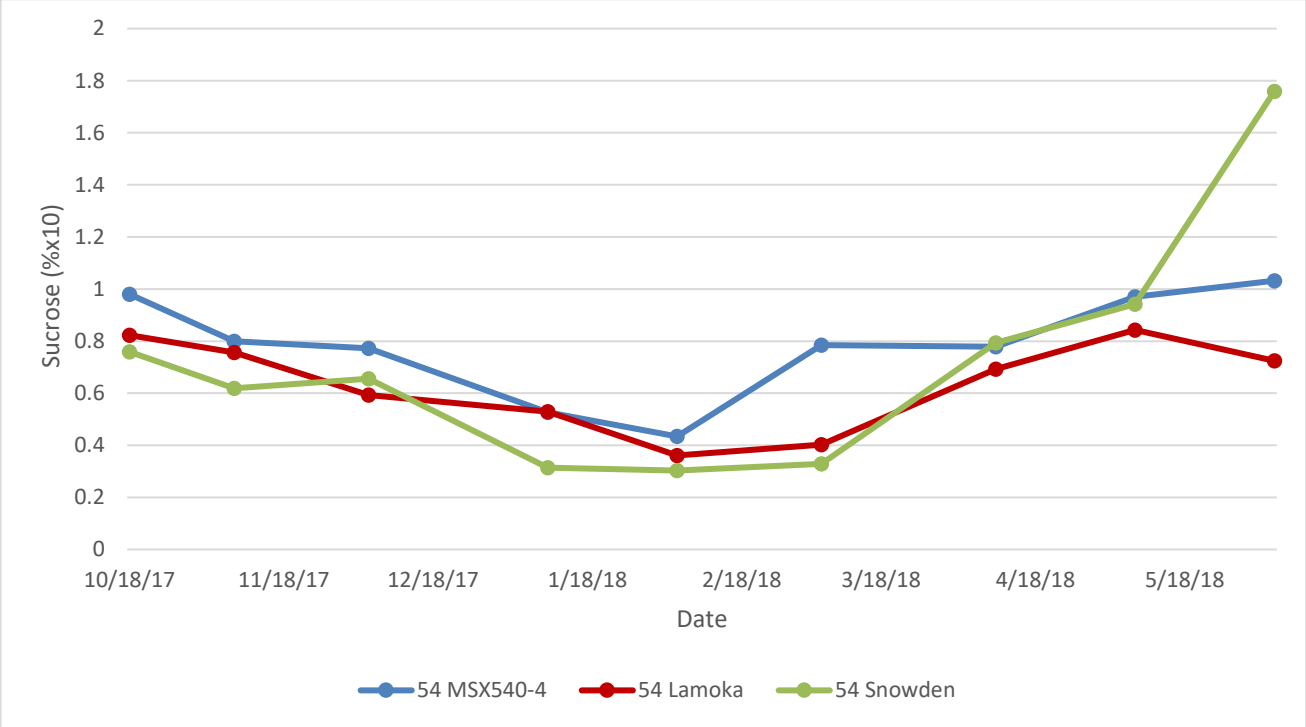
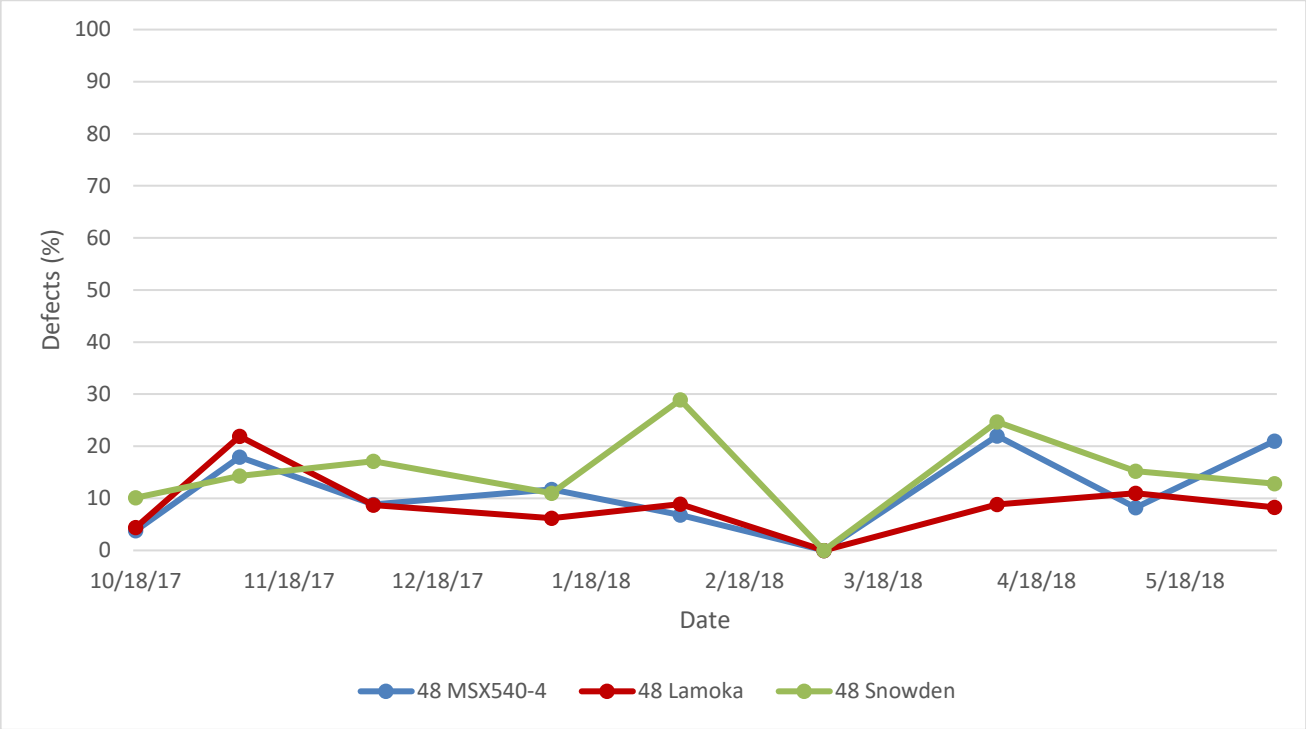


Figure 27. MSX540-4 percent defects for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



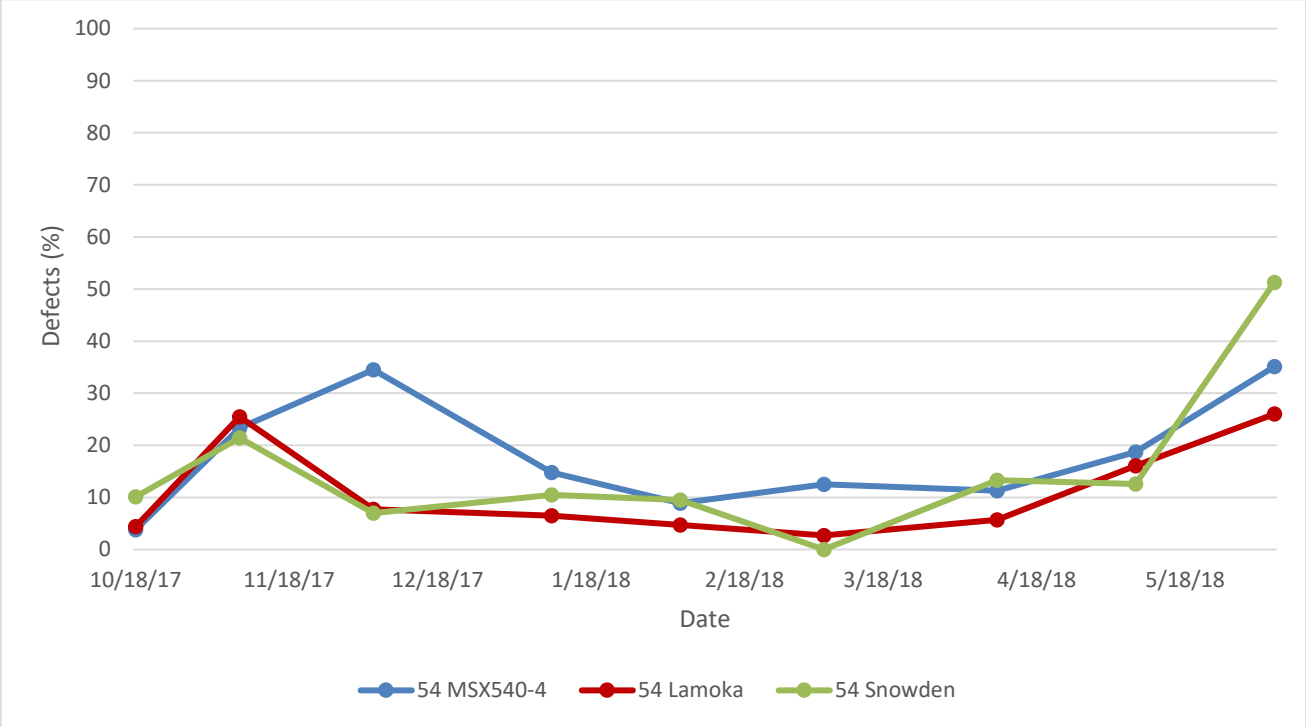
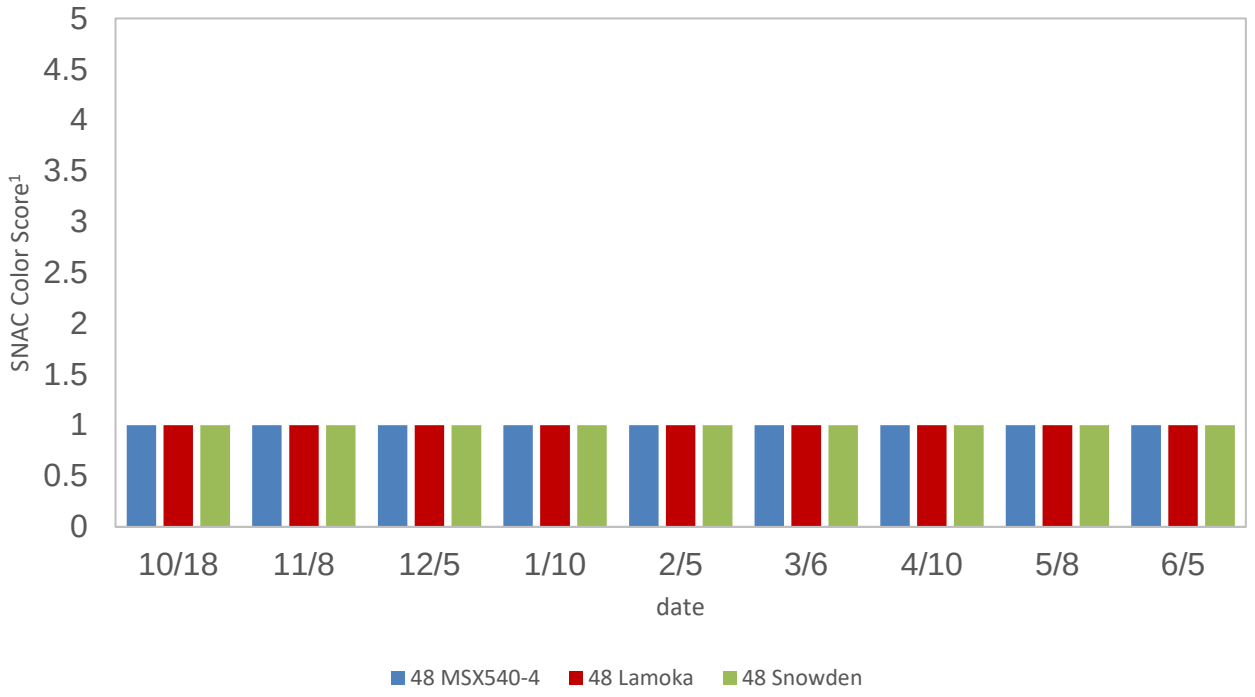
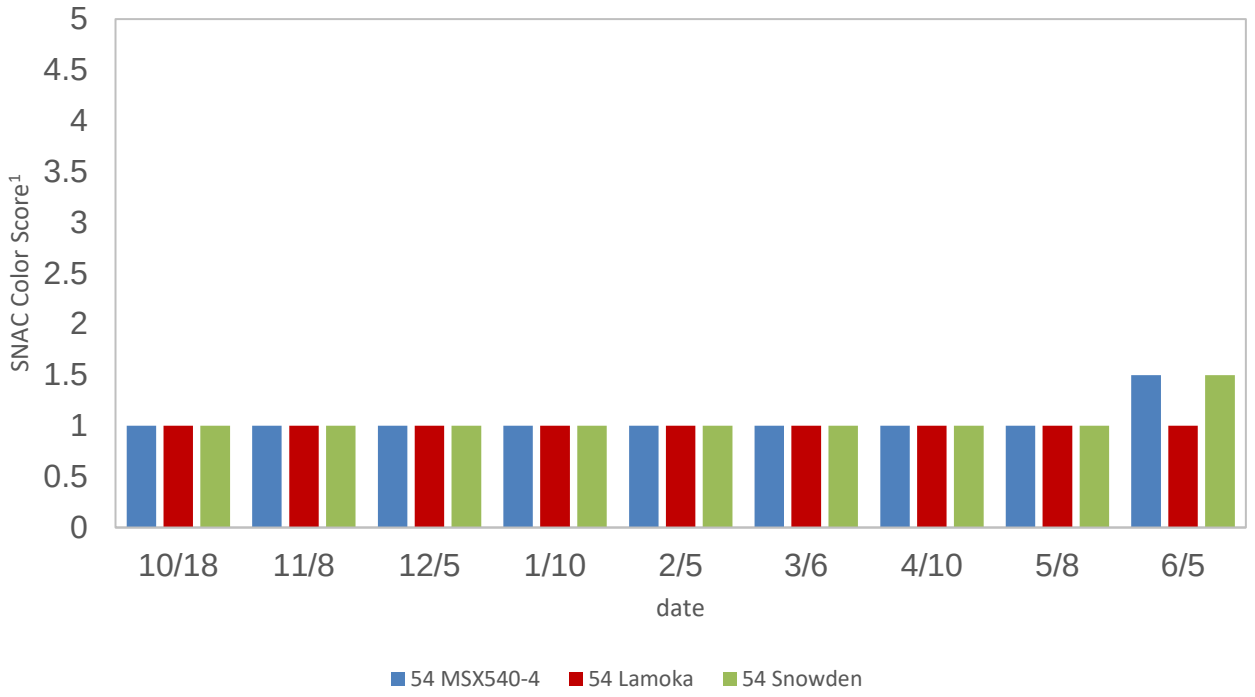


Figure 28. MSX540-4 SNAC Color Score (1 = lightest, 5 = darkest) the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.





NDA081453CAB-2C: This variety had glucose levels comparable to the check varieties until March when stored at 48ºF and April at 54ºF, after which concentrations increased sharply (Figure 29). Sucrose concentrations also increased at the same time, but to a lesser extent in the 48ºF sample (Figure 30). While percent defects and chip color were acceptable before this time, the increase in sucrose and glucose resulted in undesirable chip color beginning in April (Figure 31 and 32). This variety should be processed by March.

Table 11. NDA081453CAB-2C monthly chip quality pictures from Techmark Inc.

Month	48°F	54°F
October		
November		
December		
January		

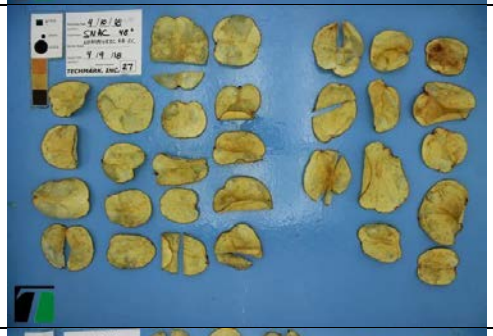
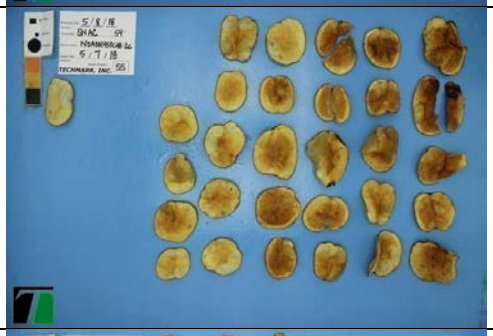
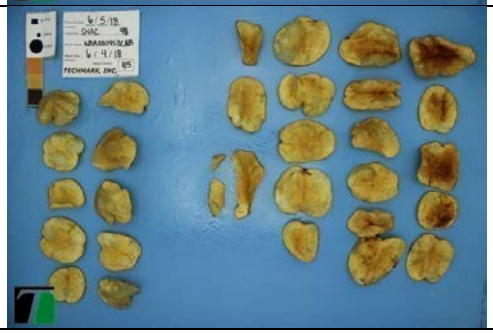
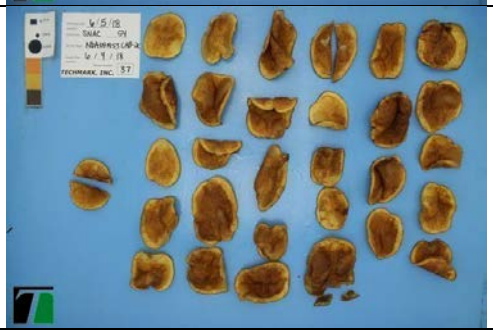
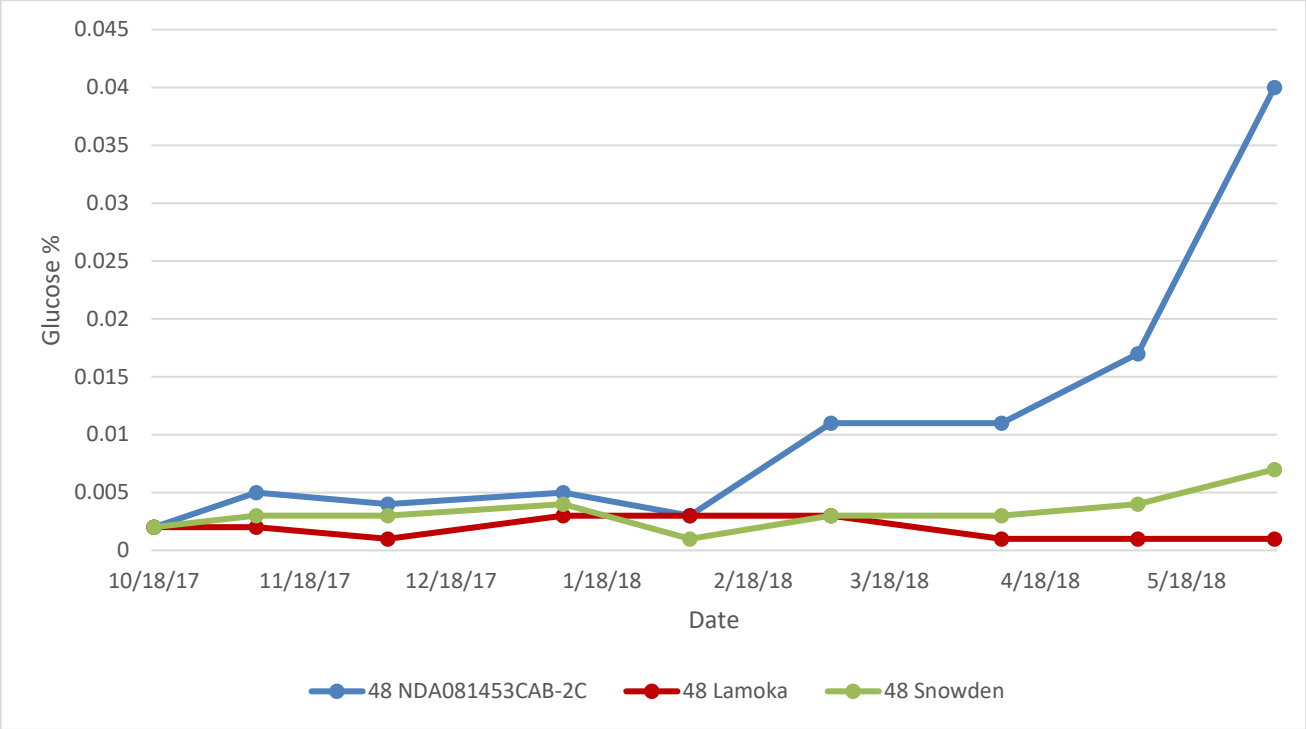
February		
March		
April		
May		
June		

Figure 29. NDA081453CAB-2C glucose concentrations for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



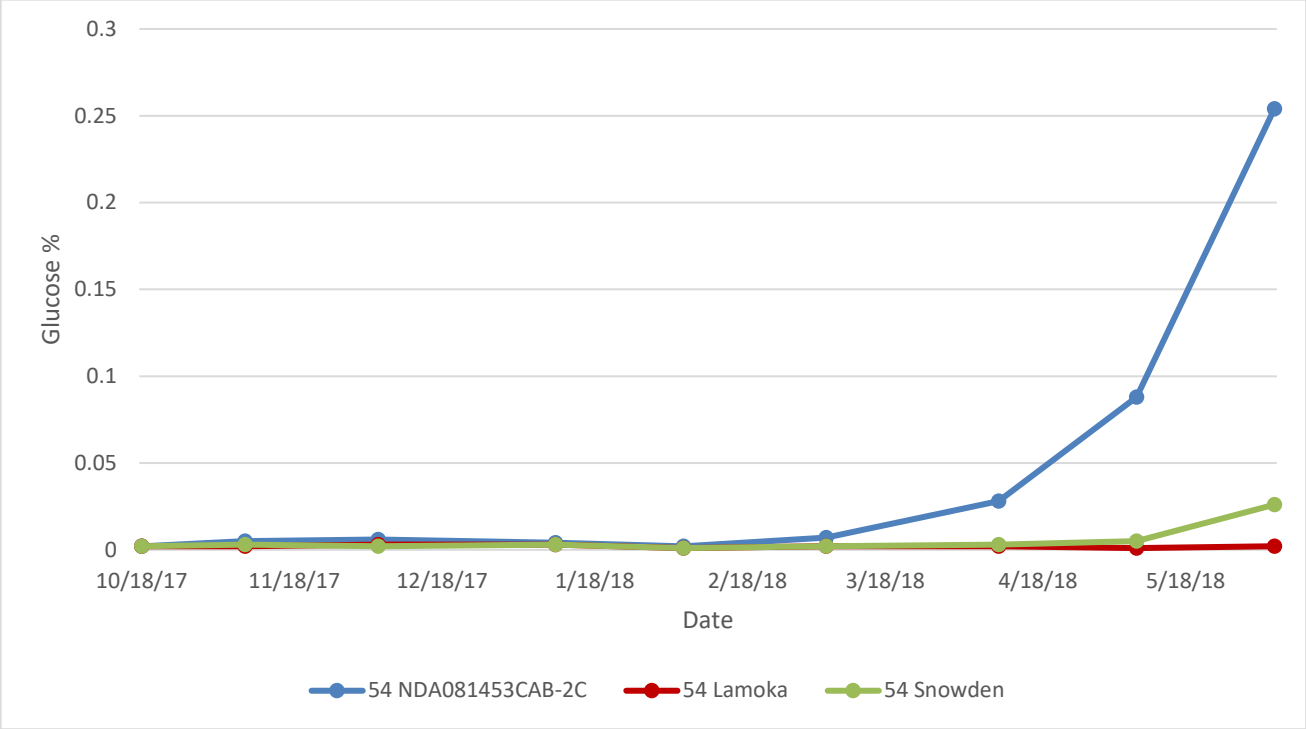
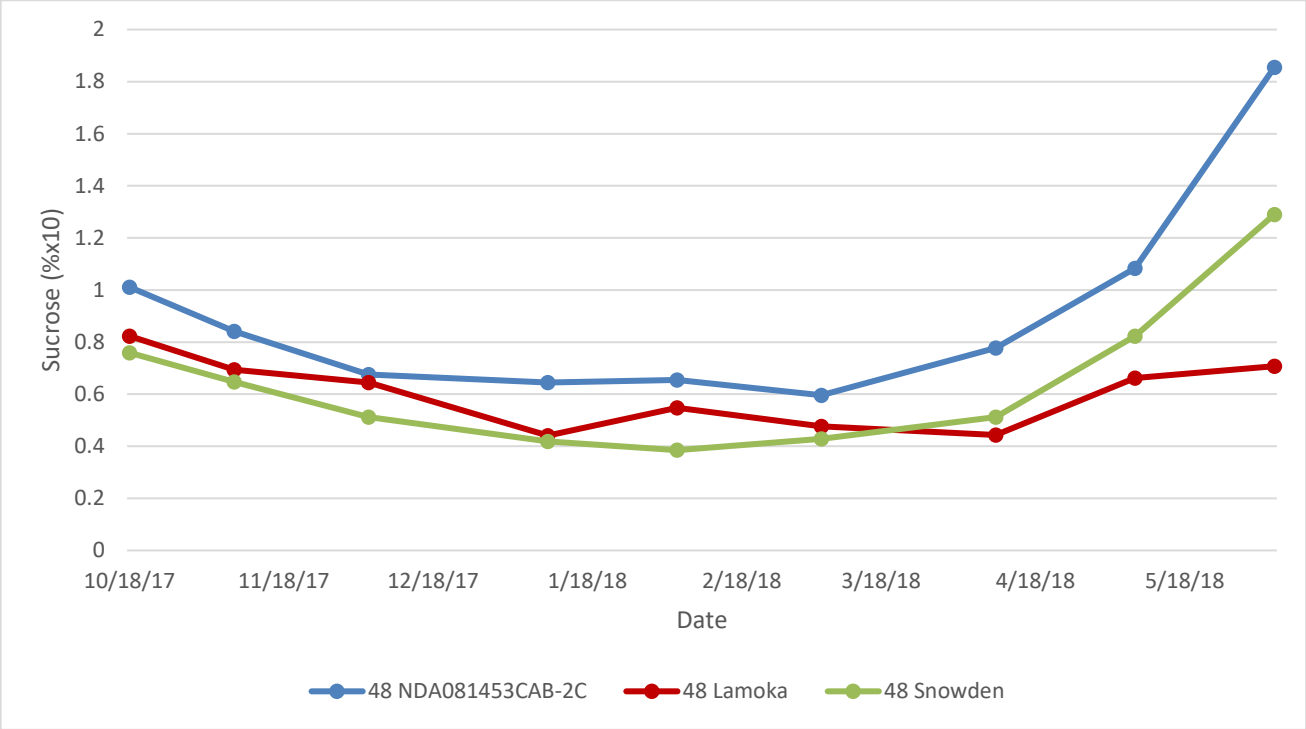


Figure 30. NDA081453CAB-2C sucrose concentrations for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



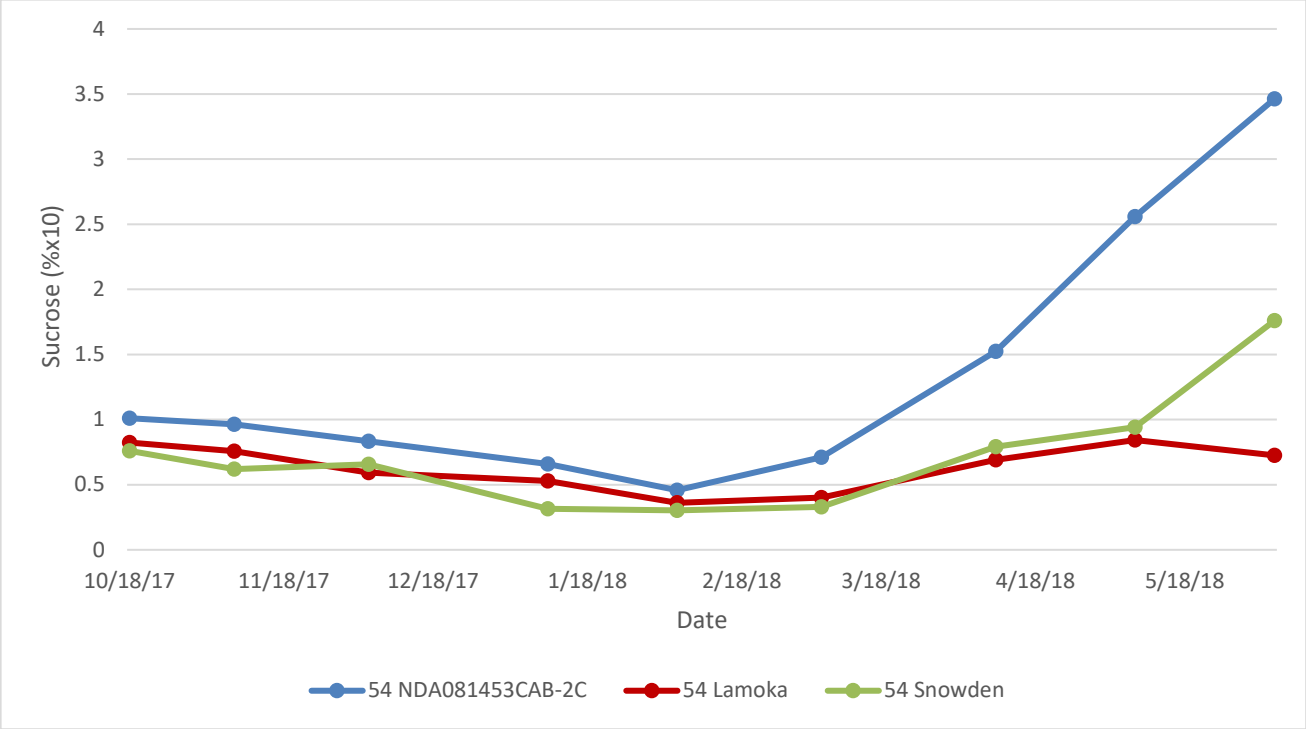
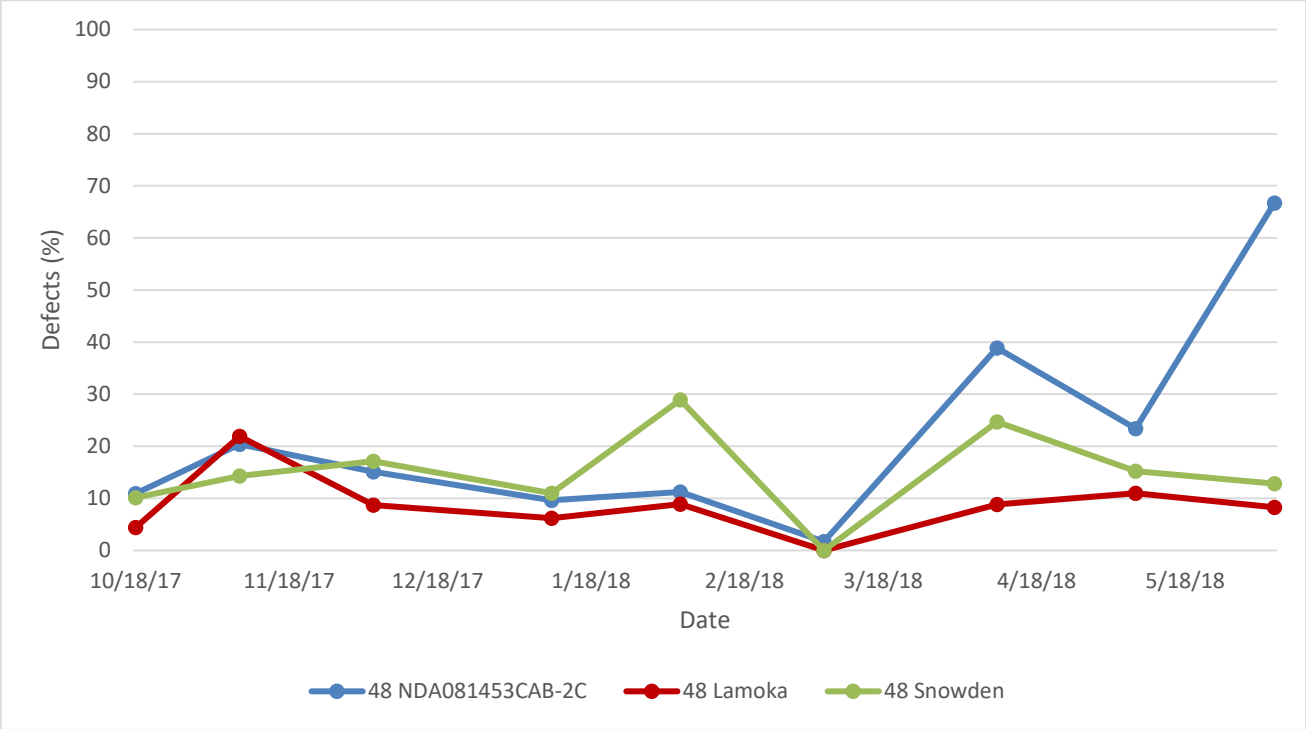


Figure 31. NDA081453CAB-2C percent defects for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



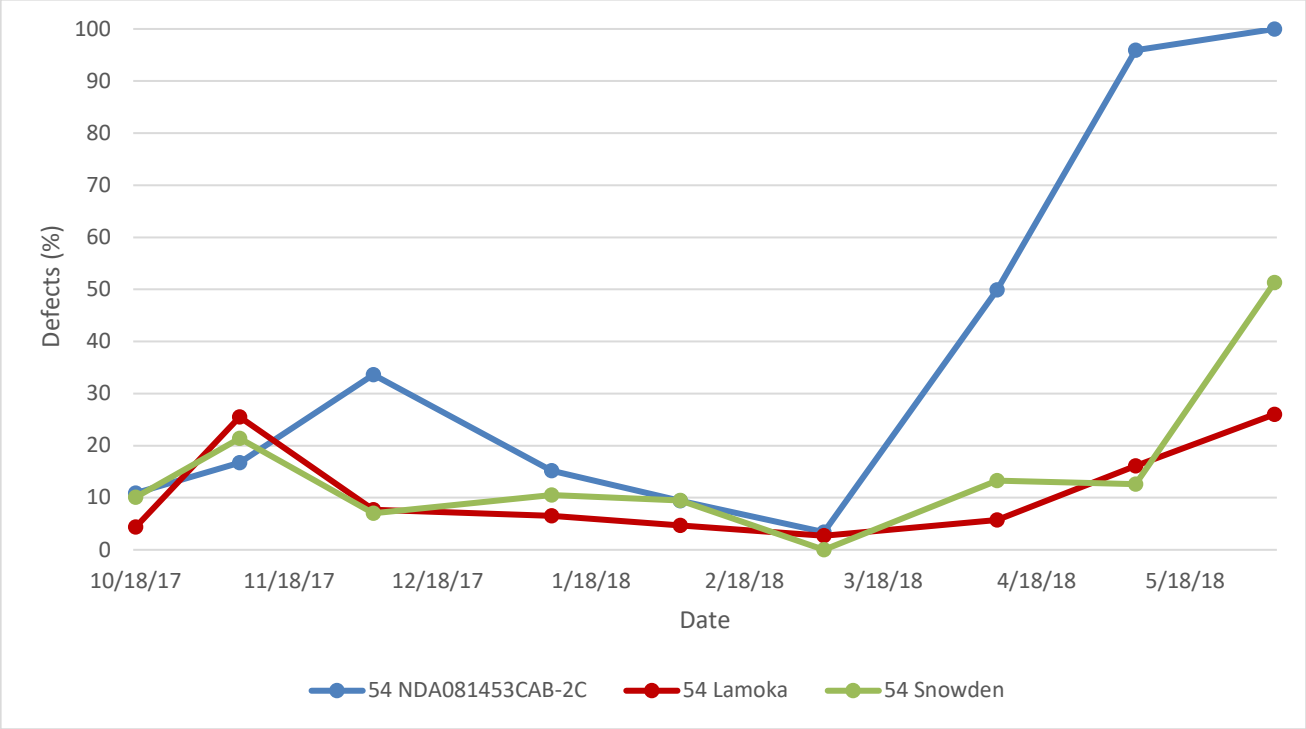
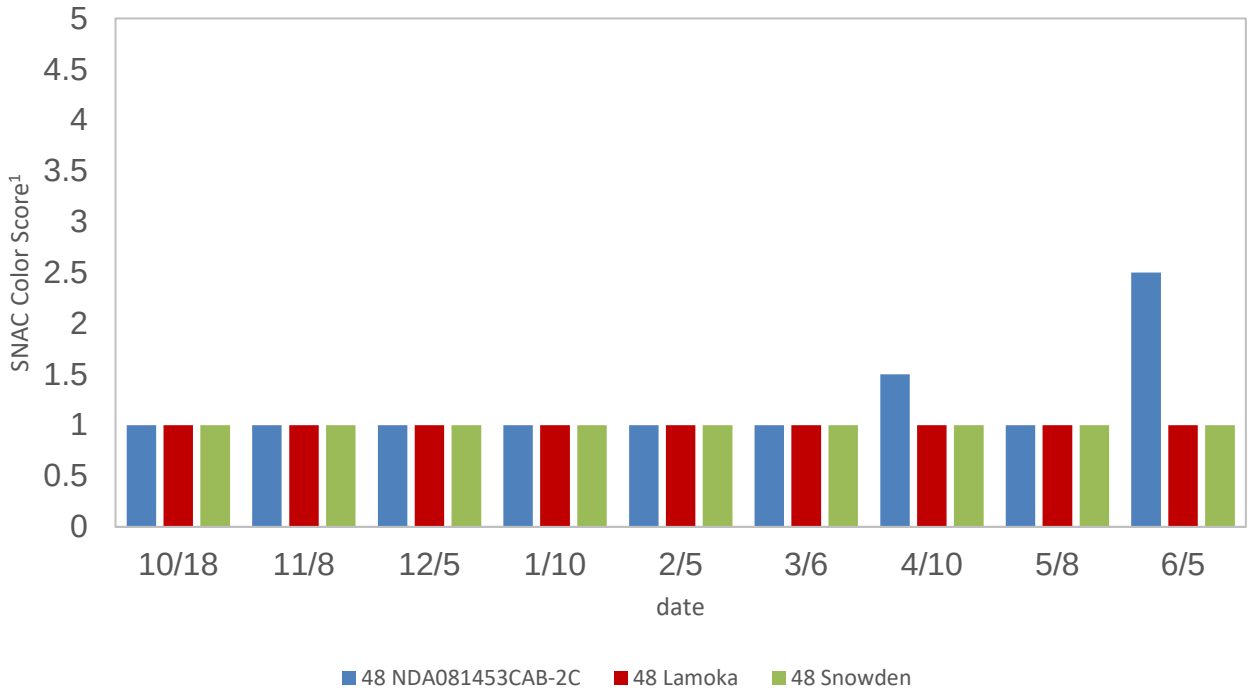
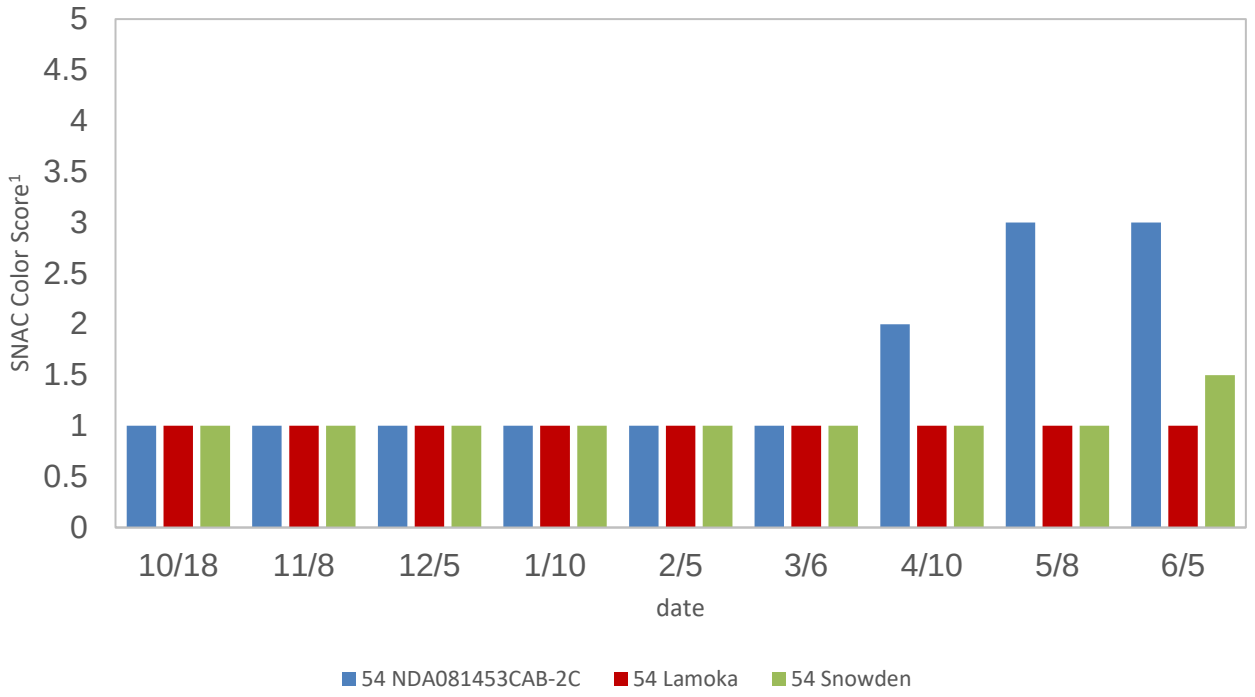


Figure 32. NDA081453CAB-2C SNAC Color Score (1 = lightest, 5 = darkest) the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.





NDTX081648CB-13W: When stored at 48ºF, this variety had consistently higher glucose levels during the season, while the sample held at 54ºF had similar glucose levels compared to the check varieties until an increase in May (Figure 33). At both temperatures, NDTX081648CB-13W had an increase in sucrose concentration in May and June (Figure 34). Despite this, defect levels remained similar to the checks at 48ºF, but exceeded check defects in May and June at 54ºF (Figure 35). Chip color was acceptable through March and marginal in April, with sugar defects observed in later samples (Figure 35).

Table 12. NDTX081648CB-13W monthly chip quality pictures from Techmark Inc.

Month	48°F	54°F
October		
November		
December		
January		

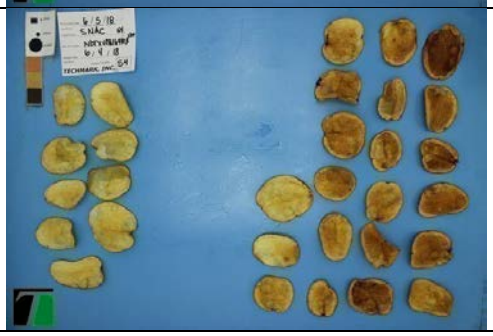
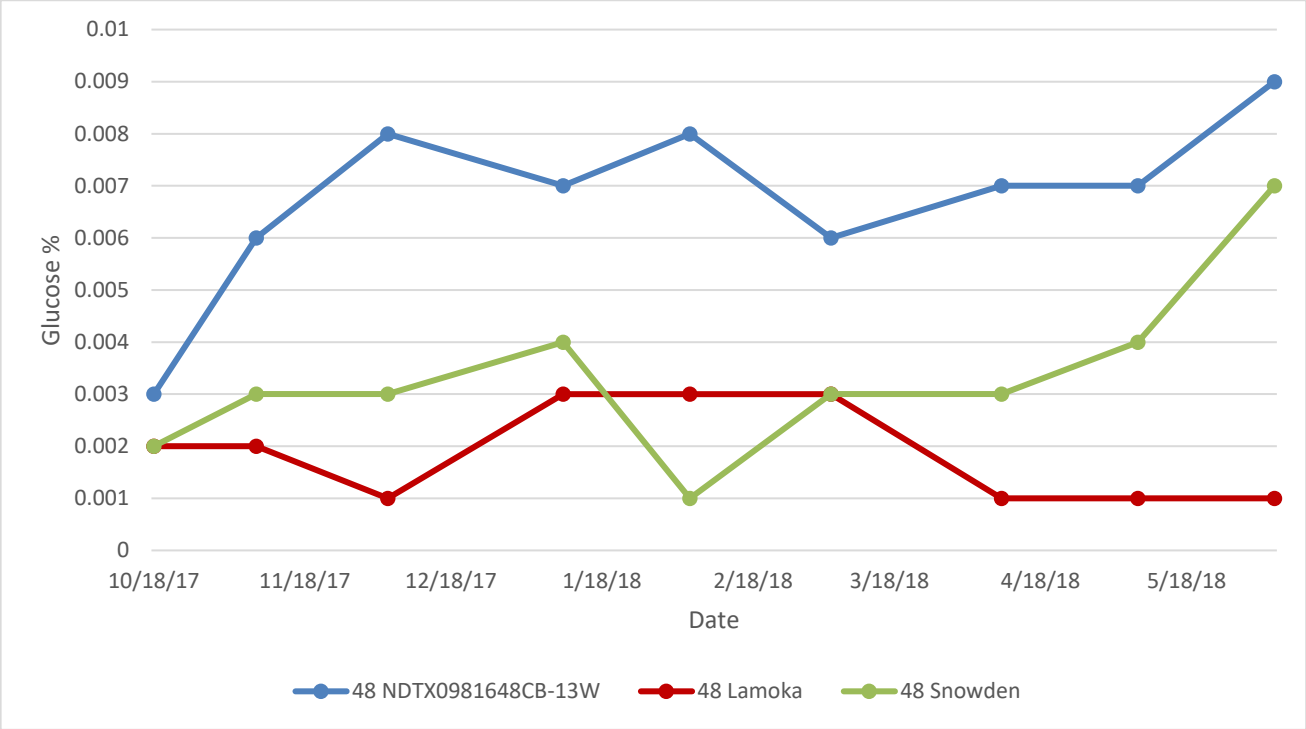
February		
March		
April		
May		
June		

Figure 33. NDTX081648CB-13W glucose concentrations for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



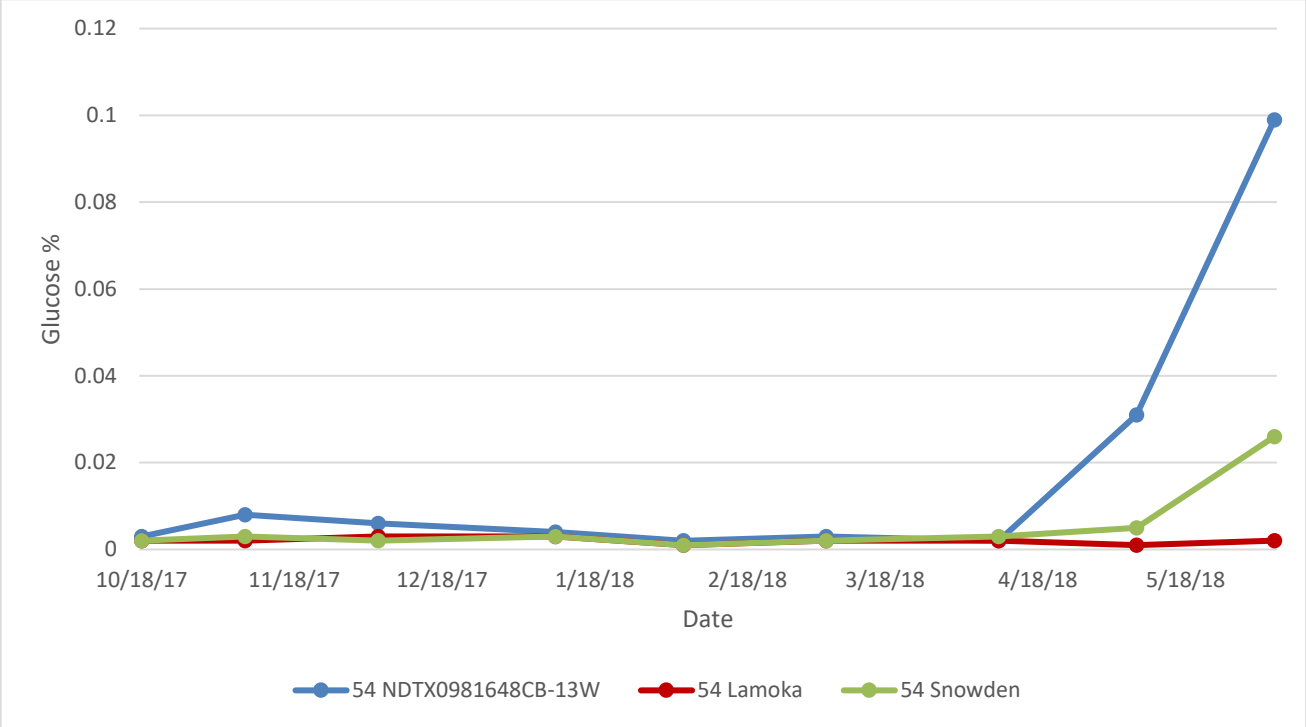
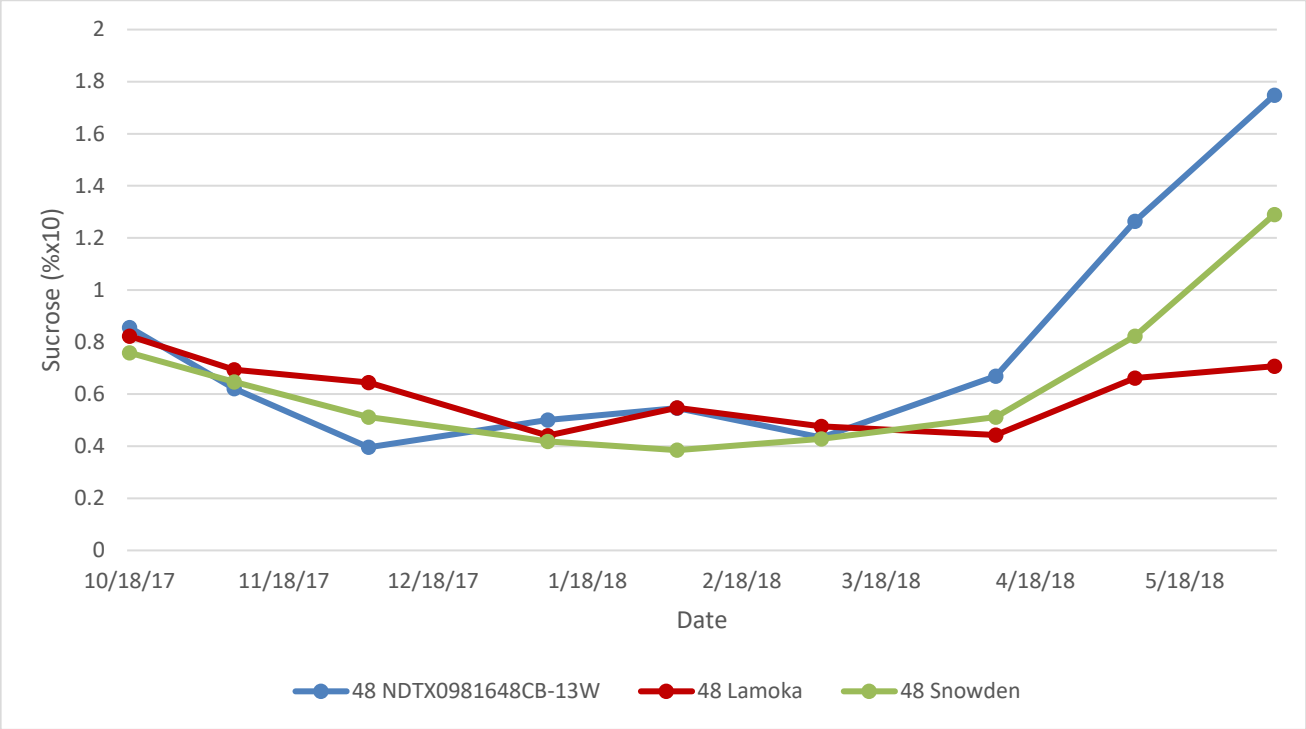


Figure 34. NDTX081648CB-13W sucrose concentrations for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



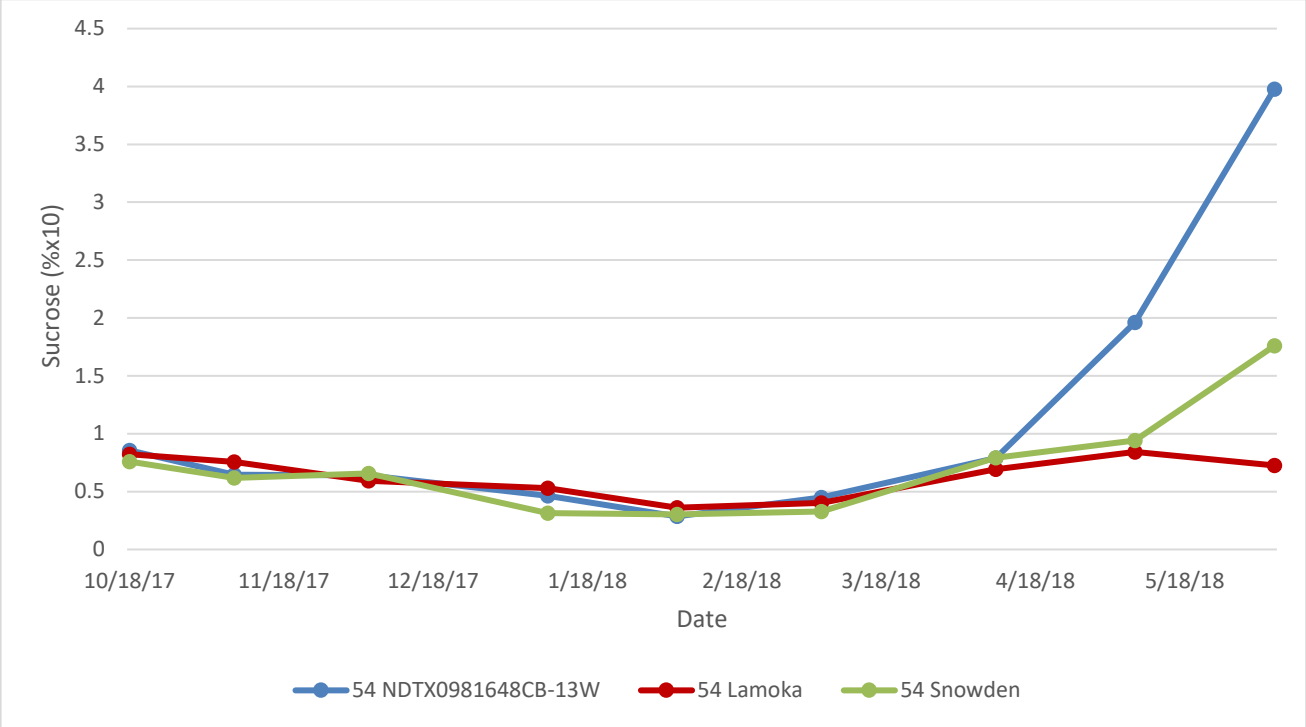
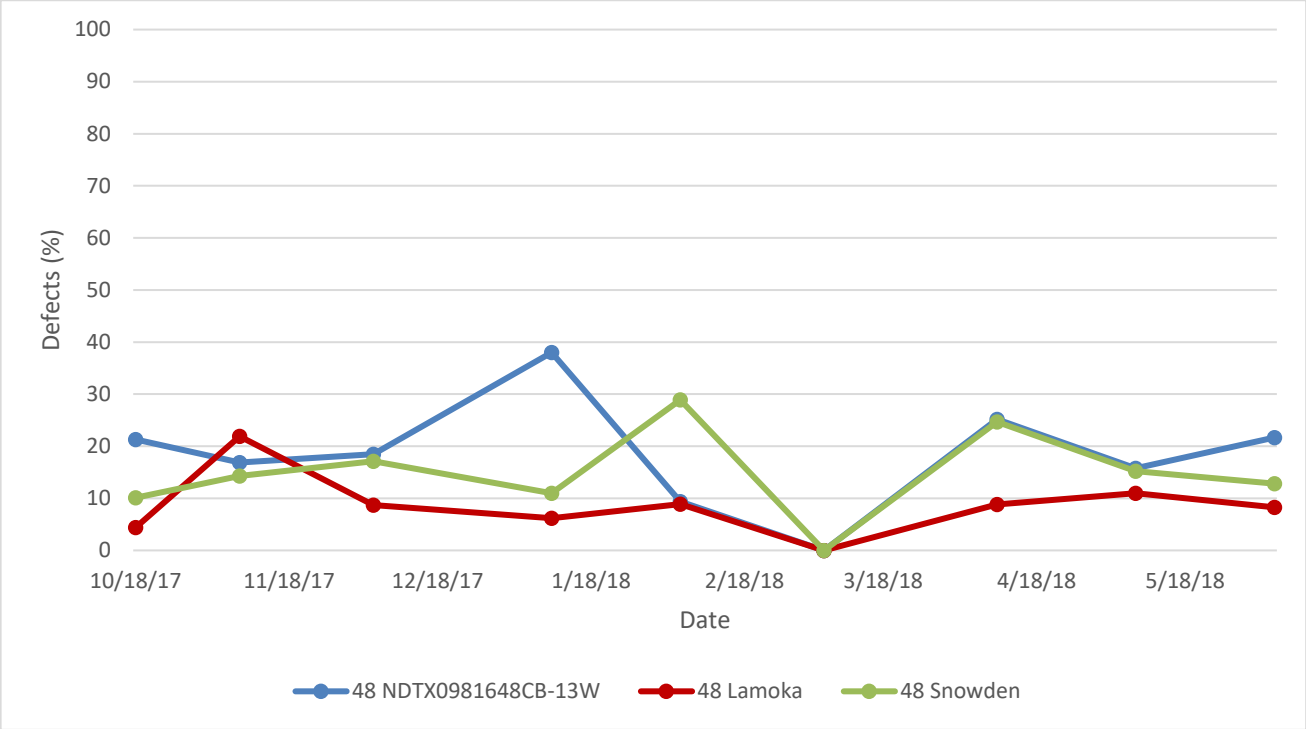


Figure 35. NDTX081648CB-13W percent defects for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



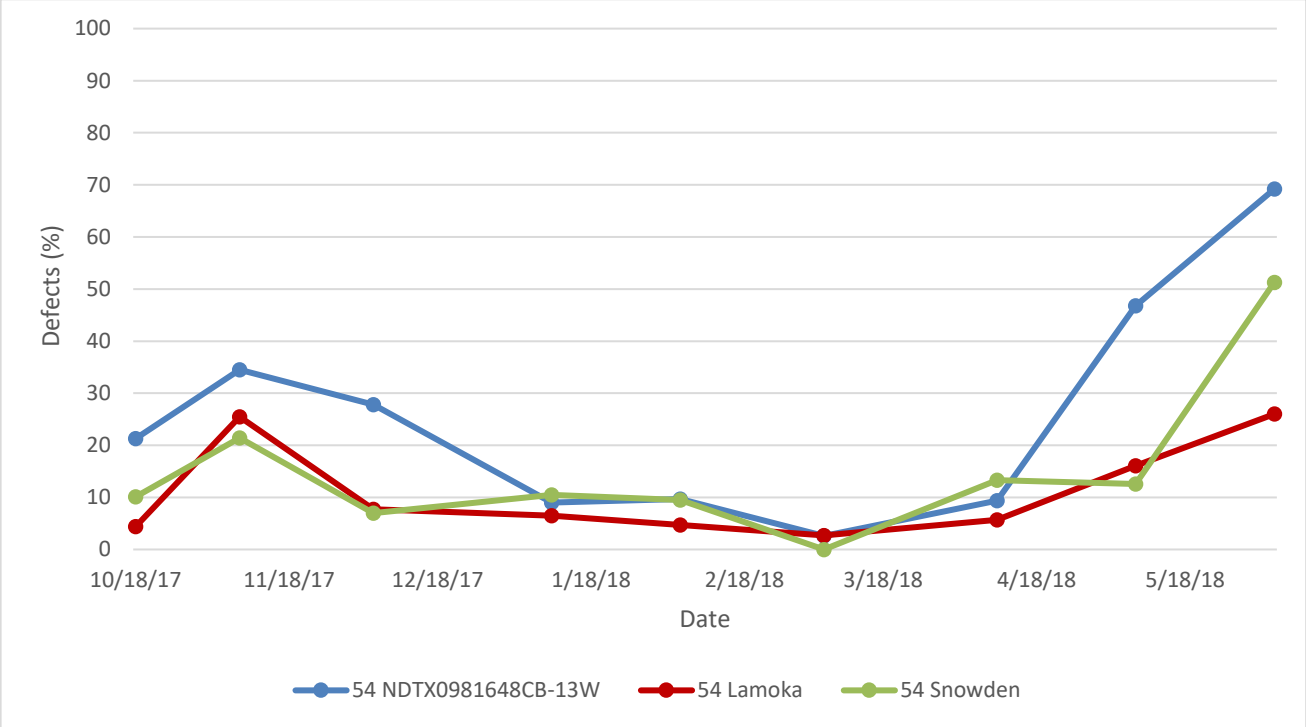
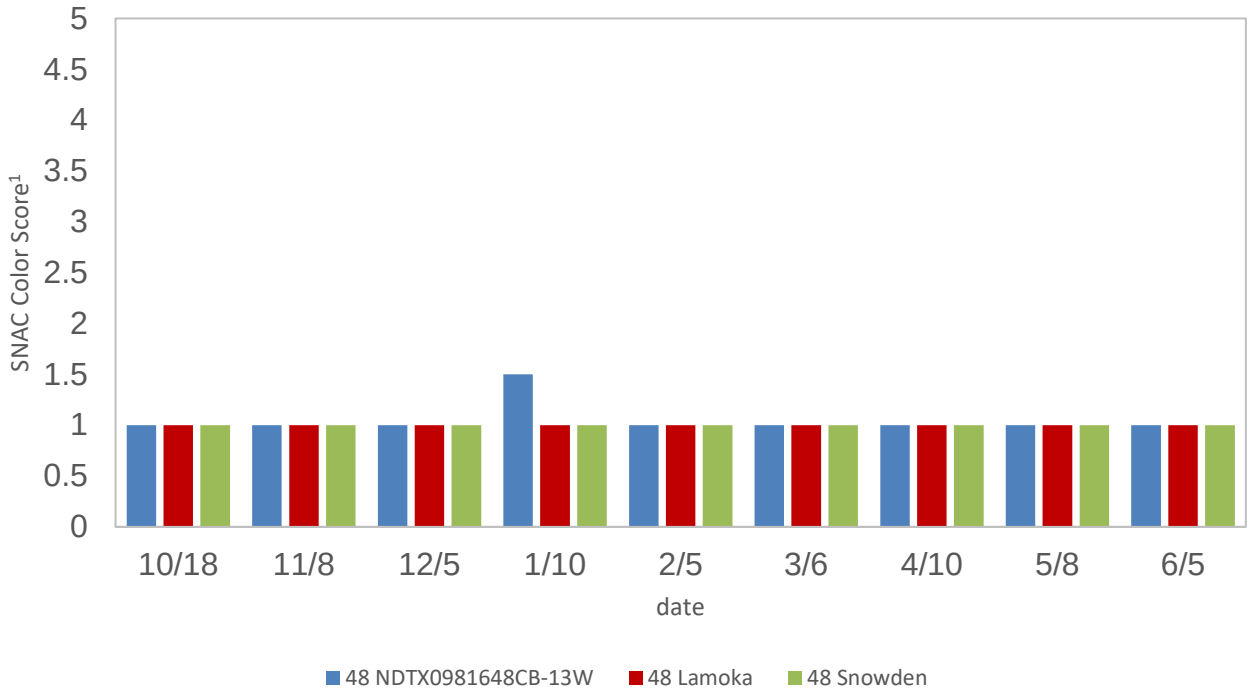
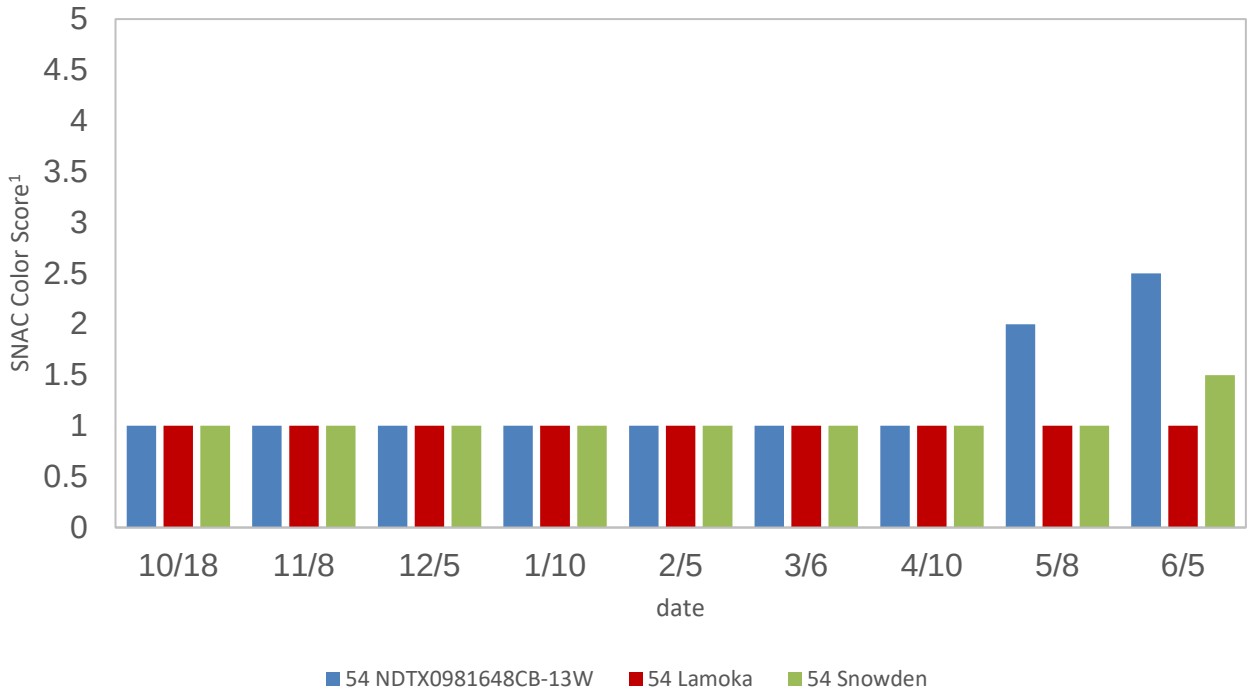


Figure 36. NDTX081648CB-13W SNAC Color Score (1 = lightest, 5 = darkest) the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.





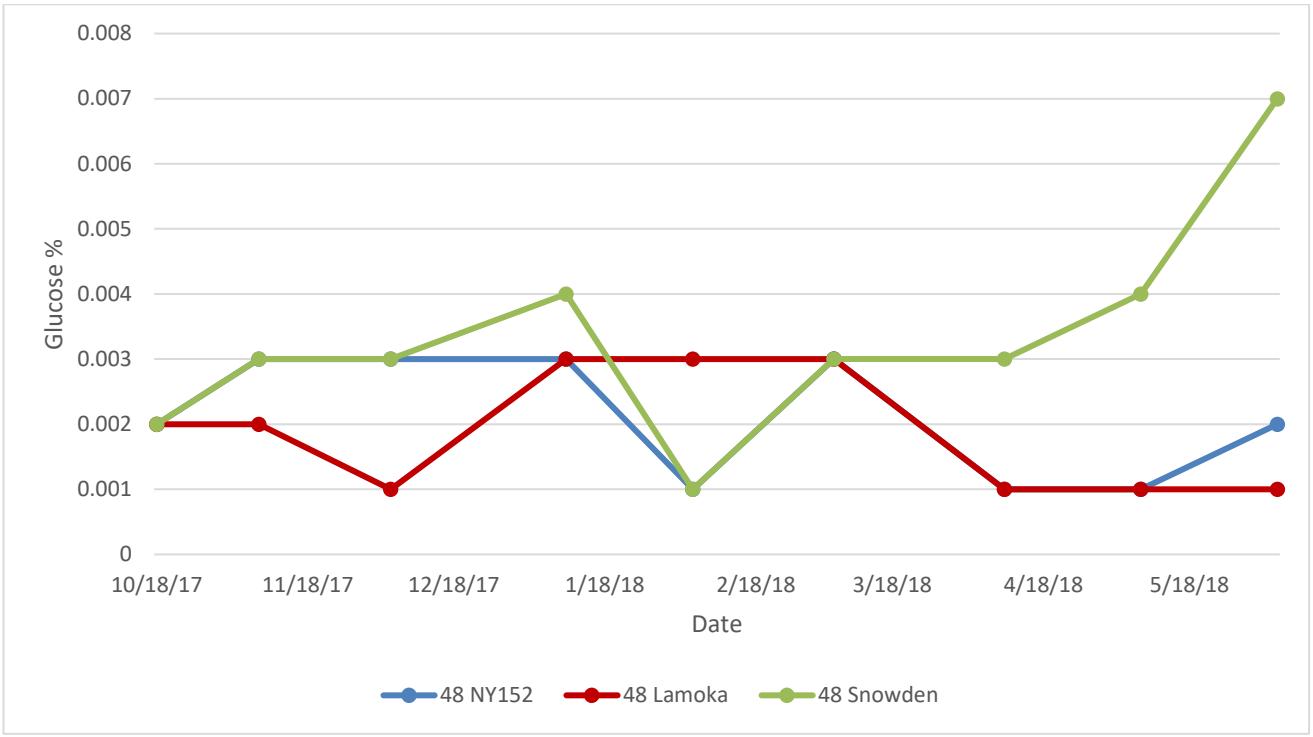
NY152: Compared to both check varieties, NY152 had similar or lower sugar concentrations (Figures 37-38). NY152 also had similar percent defects compared to Lamoka and Snowden throughout storage (Figure 39). SNAC color scores were consistently rated a 1.0 and matched the check varieties for the duration of storage (Figure 40). NY152 stored slightly better at 48°F compared to 54°F towards the end of the storage season (Table 13 and Figures 37-40). NY152 continues to be a promising line for long-term storability and chip quality.

Table 13. NY152 monthly chip quality pictures from Techmark Inc.

Month	48°F	54°F
October		
November		
December		
January		

February		
March		
April		
May		
June		

Figure 37. NY152 glucose concentrations for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



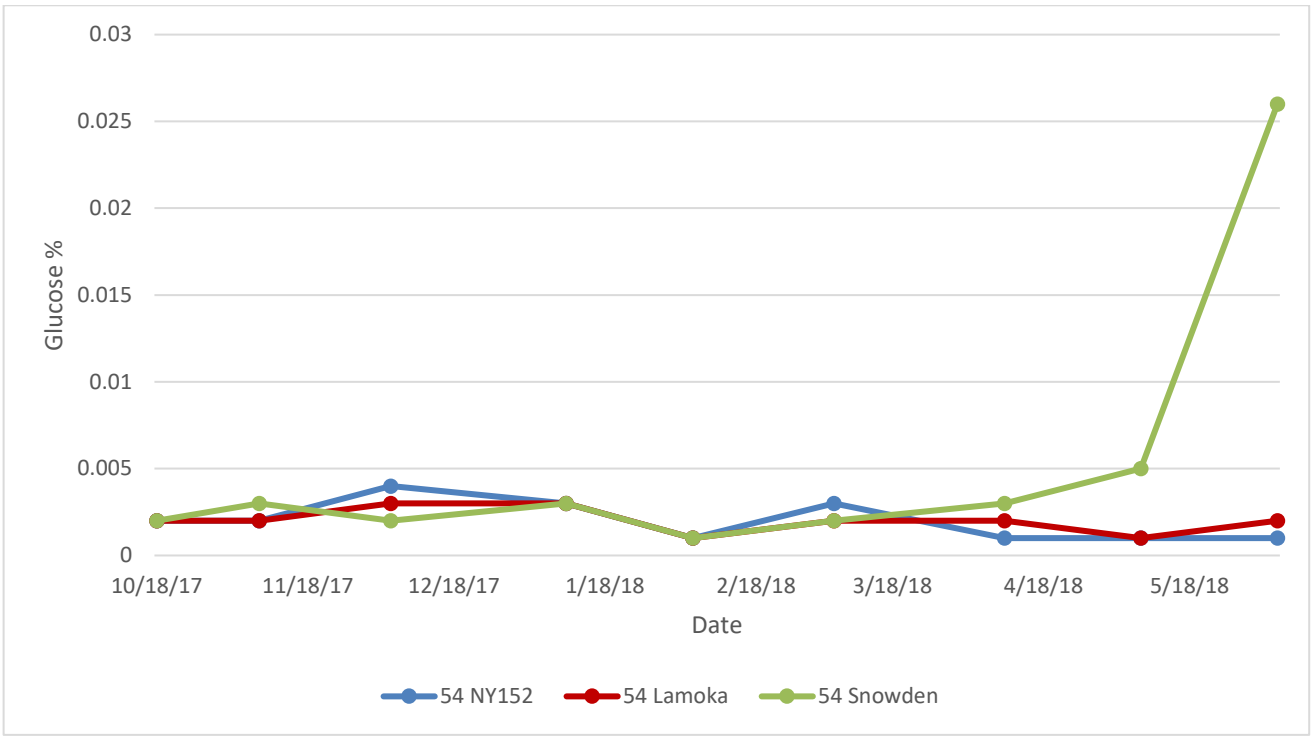
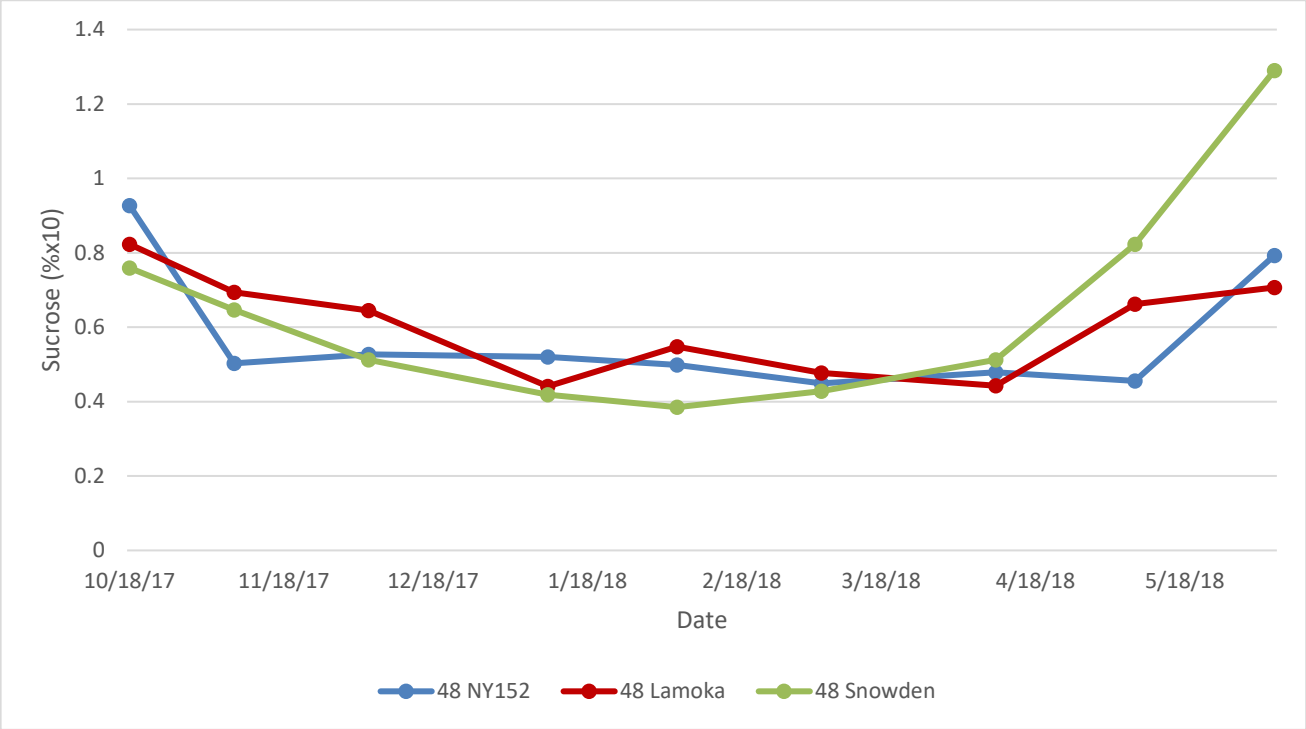


Figure 38. NY152 sucrose concentrations for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



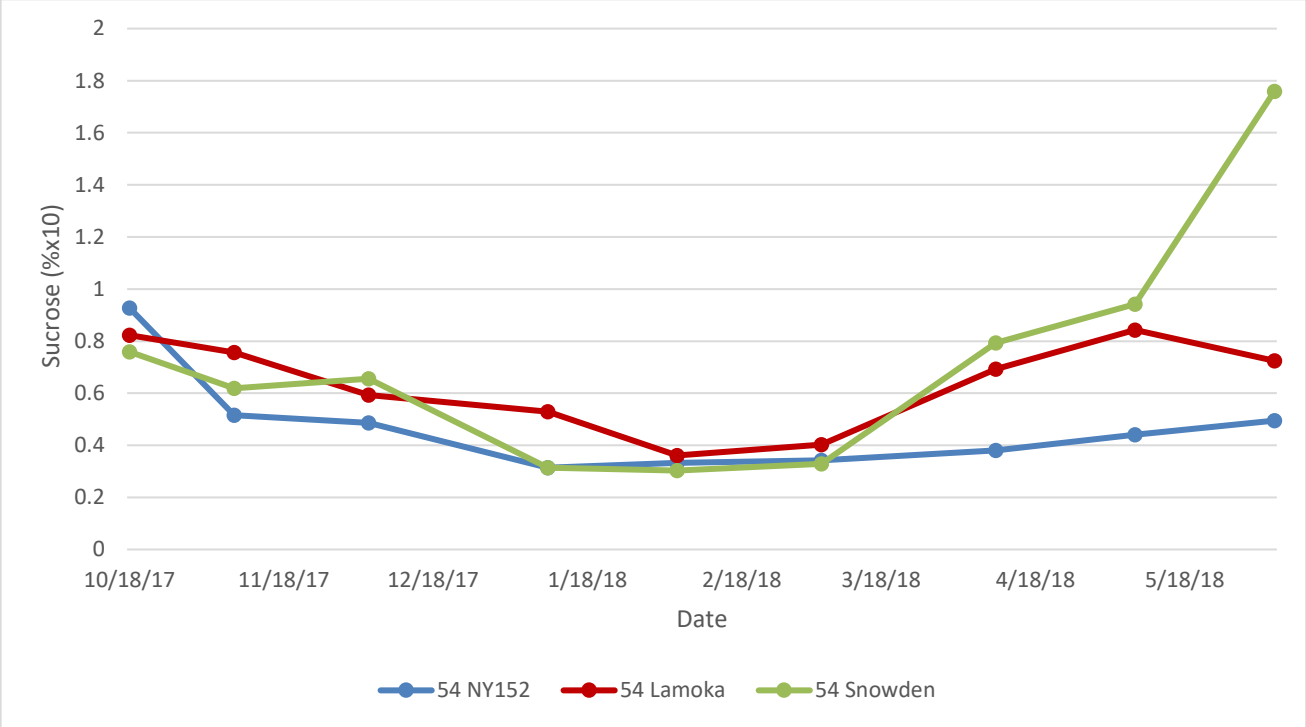
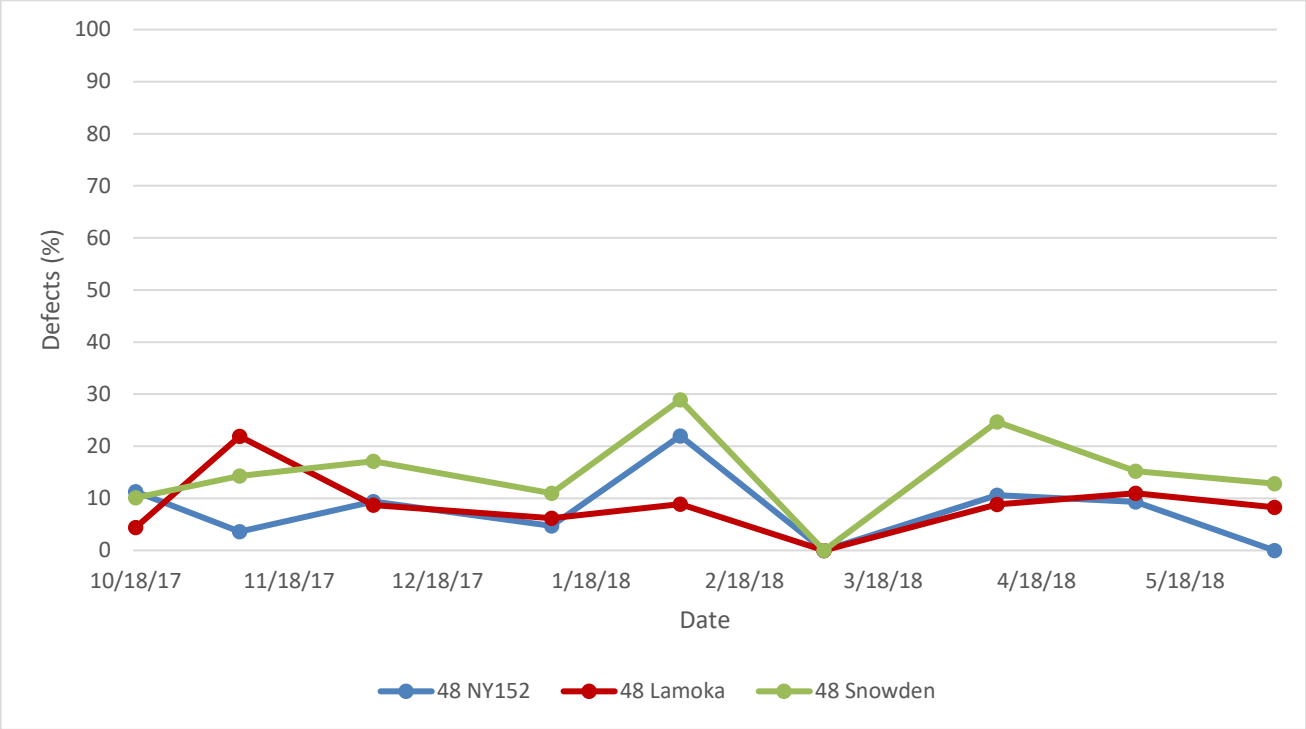


Figure 39. NY152 percent defects for the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.



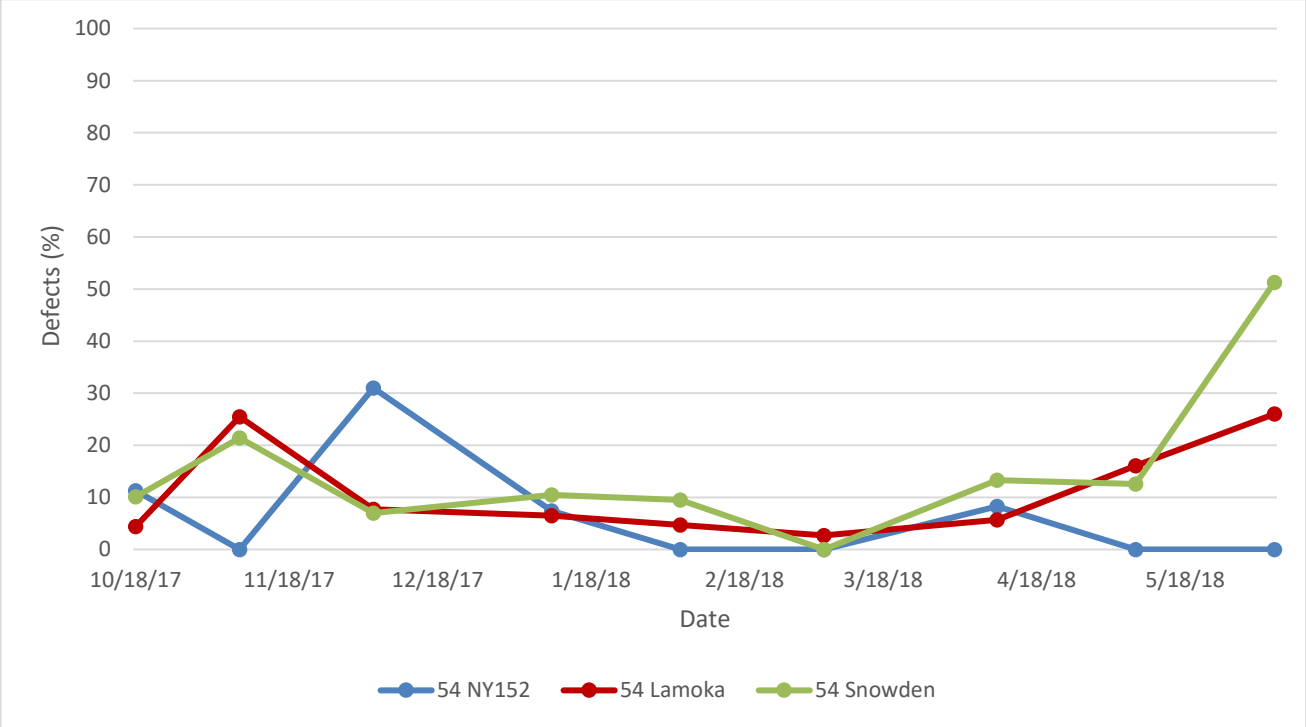
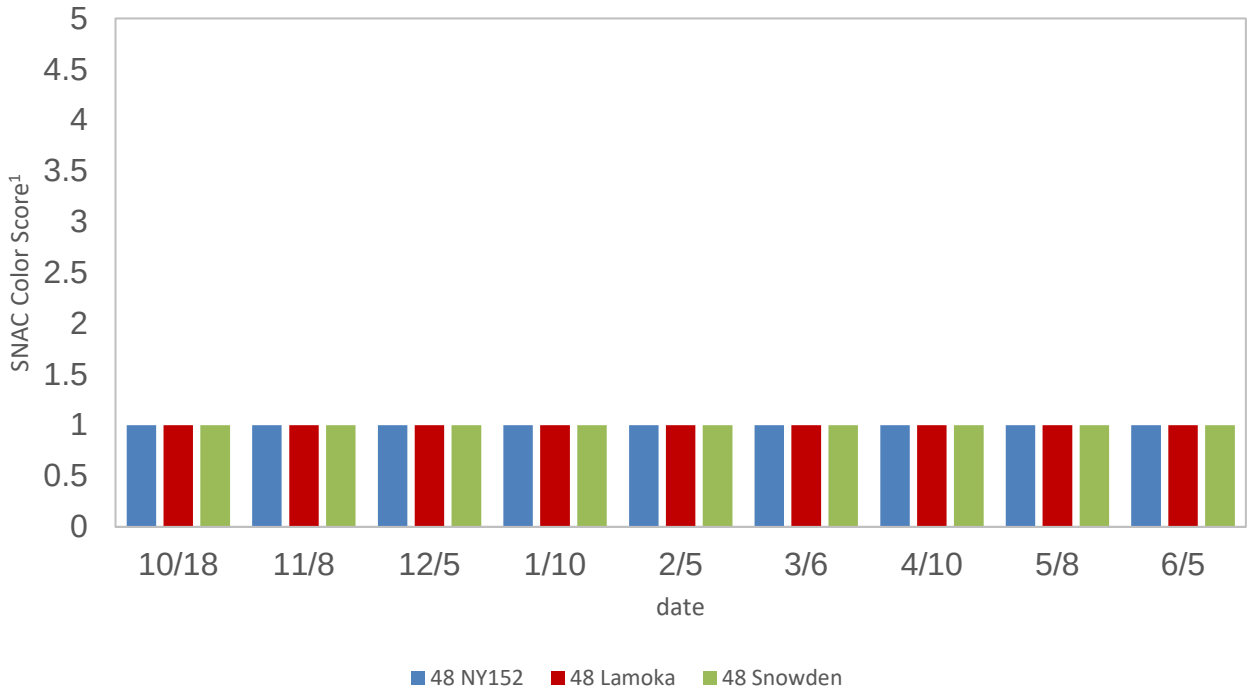
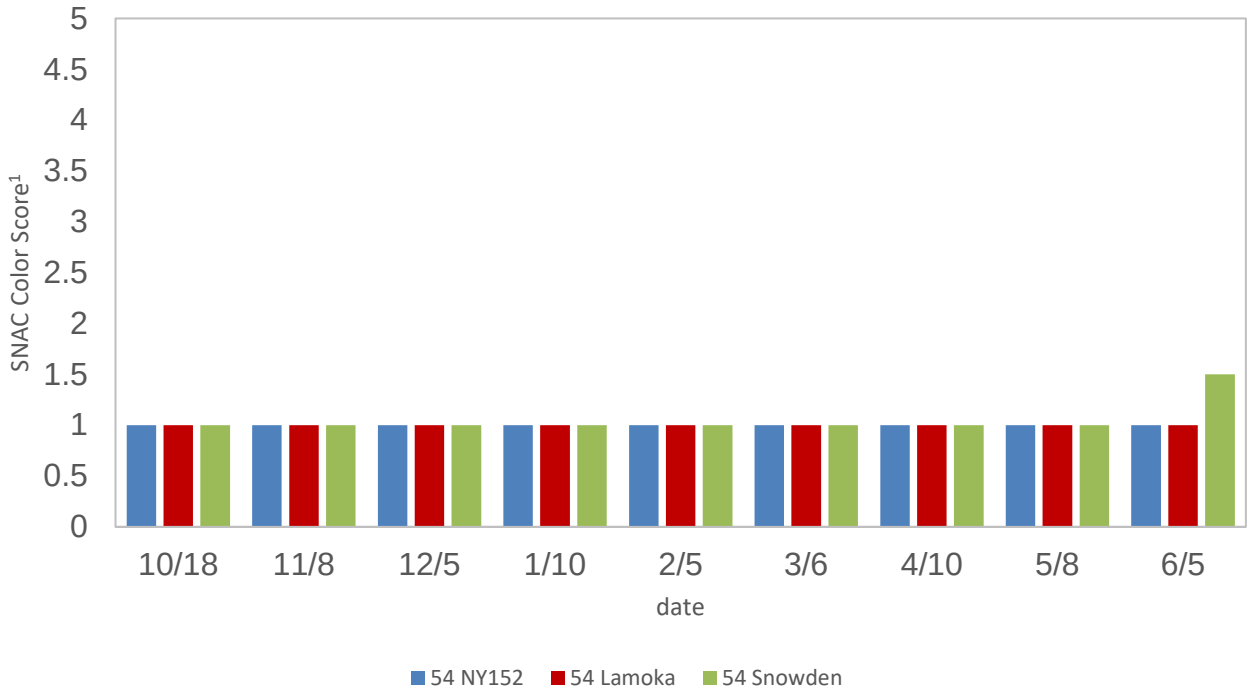


Figure 40. NY152 SNAC Color Score (1 = lightest, 5 = darkest) the 2017-2018 storage duration at 48°F (top) and 54°F (bottom) compared to Lamoka and Snowden.





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

Table 14. Snowden monthly chip quality pictures from Techmark Inc.

Month	48°F	54°F
October		
November		
December		
January		

February		
March		
April		
May		
June