USPB / SFA

OUT-OF-STORAGE CHIP QUALITY

2013-2014 MICHIGAN REGIONAL REPORT

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Procedure:

The 2013 USPB / SFA Chip Trial was harvested on October 3, 2013, at Sandyland Farms LLC, Howard City, MI. The crop experienced 2734 GDD, Base 40, from planting to vine kill. At harvest, several chip storage samples were collected from each variety. Two, 40 pound samples were collected from each entry and placed in the cooperating grower's commercial storage to be evaluated in January 2014 and April 2014 at Herr Foods, Nottingham, PA. (Tables 1-2). The 40 pound tuber samples placed in the grower's commercial storage were removed from storage in mid-January 2014 with a pile temperature of 52 ºF and in early April 2014 with a pile temperature of 54 ºF. For sprout control, CIPC was applied to the storages in November 2013.

Eighteen, 30 tuber samples were also collected from each trial entry at harvest and stored in two bulk storages at the Michigan Potato Industry Commission's (MPIC) Cargill Potato Demonstration Storage Facility. One set of nine samples was stored at approximately 54 ºF for monthly evaluation from October 2013 through June 2014. The remaining nine, 30 tuber samples, were stored at approximately 50 ºF and evaluated from October 2013 to June 2014. These samples from the MPIC storage were processed at Techmark, Inc. for sucrose and glucose values (percent of fresh weight), an SFA color score and an undesirable chip color rating. The undesirable chip color rating was reported as a percentage, by weight, of the total chips that were evaluated. See Figures 1 – 68. For sprout control, CIPC was applied in the MPIC storages in November 2013.

Results:

Tables 1 and 2 summarize the chip quality of the 40 pound samples after being processed at Herr Foods, Inc. on January 14th and April 14th, 2014. In Tables 1 and 2, the varieties are listed in chip quality performance order based on Herr Food's observations. As seen in Table 1, MSR061-1, W6483-5, MSL007-B and CO00197-3W exhibited the least amount of total chip defects on this processing date. Overall, Herr Foods ranked W6483-5 as the top performing chip quality variety in the January 14th fry test. W6483-5 was recorded having the lowest specific gravity in the trial on the day of processing. In contrast, Atlantic recorded the highest specific gravity at 1.082.

From Table 2, CO02321-4W was selected by Herrs as being the best overall performer in the April 14th fry test, with 24.9 percent total chip defects recorded. Manistee (MSL292-A) was recorded having the lowest percent of total chip defects at 13.2 percent. Manistee also recorded the highest Agtron score on this date at 62.3.

Figures 1-68 summarize the 30 tuber chip quality samples collected at harvest from each entry and stored at the MPIC Demonstration Storage in the fall of 2013 at two temperatures. Two graphs are provided for each line at each temperature, for a total of four graphs per line. The first graph at each temperature is the sugar concentration and average pile temperature curve, showing the relationship of the bin temperature on physiological age and sugar stability of each variety. The second graph shows the change in SFA chip color and sugar related color defects over time in storage at the given temperature regime. The comments about the varieties below are in yield order, high to low, top to bottom, based on the 2013 field trial results.

NY148: This variety was identified as the top yielding variety in the 2013 Michigan on-farm trial, recording a 542 cwt/A US#1 yield. At both Herr Foods processing dates, this variety performed at or below average for finished chip quality (Tables 1-2). Based on data not presented here, this variety has a high specific gravity resulting in an acute susceptibility to black spot bruise. This variety yields well in Michigan and it appears to have good common scab tolerance, but the storage chip processing quality is questionable. The chip color and sugar related color defects are very low and are very stable all season long from the Michigan small bag samples (Figures 2 and 4). Only at the warmer 54 ºF storage temperature does the sucrose level exceed acceptable levels indicating dormancy break (Figure 3). The sugar concentration of this variety is stable all season long at 48 ºF. This variety appears to have promise when used for chip processing late out-of-the-field with no expectation of chip processing from storage.

A01143-3C: Although this entry was a strong yielder in the 2013 on-farm variety trial, this clone ranked below average at Herr Foods on both processing dates. The sucrose and glucose levels, from the small bag samples that were stored at the cooler storage temperature, remained within an acceptable range until early April 2014 (Figure 5). In mid-April, sucrose levels rose rapidly, resulting in increasing glucose and color related defects in the finished chips (Figure 6). The results from the 54 ºF bag samples show variable sucrose and glucose levels season long resulting in overall poor chip quality for this same period (Figures 7-8).

NY140: NY140 had an above average chip quality performance at Herr Foods on both processing dates (Tables 1-2). The presence of common scab and oblong tuber type was noted at the time of processing. Glucose levels were excellent for this variety at both storage

temperatures. At 50 ºF, the sucrose level remained stable mid-February until early May 2014 (Figure 9). At 54 ºF, the downward decline of sucrose ended in mid-February 2014 followed by a long period of rising sucrose (Figure 11). Chip color and color defect scores were excellent at both storage temperatures (Figures 10, 12). This variety had very good chip processing quality late in storage from both storage temperatures (Figures 9-12). Tuber yield performance was excellent in 2013. NY140 performed slightly below the trial specific gravity average at 1.076. Common scab susceptibility was evident.

CO03243-3W: This variety had a strong agronomic performance in 2013, ranking 4th overall in yield. This variety expressed significant common scab susceptibility in the Michigan field trial. CO03243-3W had an average chip quality performance at Herrs in January 2014, and then was ranked below average at the April 2014 chip quality evaluation (Tables 1-2). When stored at 50 °F, the sucrose levels began to express variability after February while moderately stable glucose levels existed until the first of May 2014 (Figure 13). Tubers of this variety stored at 50 °F chipped acceptably through April 2014 (Figure 14). Similar chip quality was apparent at the 54 °F storage temperature with stable sugar values being exhibited through mid-February. Elevated glucose levels were observed after mid-March 2014 (Figure 15). Chip quality appeared to remain stable until late March, at which time the chip defect levels began to increase (Figure 16).

Manistee (MSL292-A): Manistee was the 5th highest yielding line in the 2013 trial yielding 395 cwt/A US#1. This variety ranked 3rd overall at Herr Foods in January, recording the highest AGTRON score on this date at 63.5 (Table 1). Manistee was also ranked above average on the April 14th evaluation, again recording the highest AGTRON score of the trial at 62.3 (Table 2). This variety had a stable sugar level from 50 °F through early May 2014 with excellent chip quality observed all season long (Figure 17-18). The warmer storage temperature resulted in rising sugars earlier in the season, but chip quality from these tubers remained excellent for the duration of the trial (Figures 19-20). The cooler storage temperature prolonged slightly better tuber quality than did the warmer storage temperature, which is to be expected, but both storage temperatures resulted in good quality chips (Figures 17-20).

Atlantic: This check variety was the sixth highest yielding line in 2013. Atlantic provided a chip quality reference point for the variety trial directly out-of-the-field. No storage sugar data is provided in Figures 1-68 for this variety.

W5955-1: W5955-1 yielded below average in the 2013 on-farm trial, but did express common scab tolerance. On both processing dates, at Herr Foods, this line ranked second highest for chip processing quality (Tables 1-2). The chip quality of W5955-1 on April 14th was recorded as having the second fewest chip defects of the trial. When stored at the cooler storage temperature the sugar levels of this line remained very stable all season long (Figure 21), resulting in good chip quality until early May 2014 (Figure 22). Tubers from this

line, when stored at the warmer (54 ºF) temperature, began losing sugar stability in mid-February and rapidly increased in simple sugar concentration in mid-March (Figure 23). Chip quality also declined quickly in mid-March 2014 resulting in poor chip quality after this period (Figure 24).

A00188-3C: This line yielded below the trial average while expressing a good level of common scab tolerance in the 2013 field trial. A00188-3C was reported to have internal shading in the finished chips on both processing dates by Herr Foods, ranking this variety last overall for chip processing quality (Tables 1-2). The line failed to express stable storage quality at either storage temperature, resulting in poor chip quality being observed throughout the trial period (Figures 25-28).

AF4157-6: This clone was a below average yielding line expressing a severe reaction to common scab in the 2013 on-farm trial. The chip quality at Herr Foods on both processing dates was below average to average (Tables 1-2). Figures 29-30 show variable sucrose values season long with moderately stable glucose levels, resulting in acceptable chip quality through late April 2014. At the 54 ºF storage temperature, the sucrose and glucose levels were much less stable (Figure 31), but acceptable chip quality was observed until early March 2014 (Figure 32). In general, AF4157-6 appears to break dormancy in mid-February no matter what the storage temperature, followed by a decline in chip quality. This variety appears to have better chip quality out-of-the-field than from storage.

MSL007-B: This variety exhibited a below average yield in the 2013 on-farm trial although excellent common scab tolerance was observed. In January 2014, Herrs ranked MSL007-B 7th overall for chip quality performance (Table 1). In April 2014, at Herrs, MSL007-B fell below average due to internal color being present in the finished chips (Table 2). At 50 °F, the sucrose and glucose levels rose steadily from early December 2013 through the remainder of the storage season (Figure 33). Surprisingly, the chip quality at this temperature remained acceptable through April in spite of the steady rising sugar levels (Figures 33-34). The sucrose and glucose increases were similar at 54 °F to the cooler storage temperature (Figures 33, 35). The chip quality performance for this variety was similar at both temperatures (Figures 34, 36).

CO00197-3W: The chip quality performance for this variety was ranked above average to average on both processing dates at Herr Foods (Tables 1-2). On January 14th at Herr Foods, CO00197-3W recorded the second highest AGTRON score of the varieties tested in the trial at 63.2. Sugar stability appeared to be lost in early to mid-February for this clone at the warmer storage temperature (Figure 39). This reaction is delayed by approximately a month at the cooler temperature (Figure 37). The cooler storage temperature appears to have maintained chip quality for a longer period of time (Figure 38). The warm storage temperature resulted in tubers that expressed a greater variability in chip quality (Figure 40).

Snowden: Snowden had an above average chip quality performance at Herr Foods on January 14th, 2014, then was ranked below average on the April 14th, 2014 processing date (Tables 1-2). Herrs recorded Snowden as having one of the highest specific gravity values at the April evaluation date. At both storage temperatures, Snowden appeared to lose sugar stability in mid-February 2014 (Figures 41, 43). Sucrose and glucose levels increased more rapidly at 54 °F, with a much quicker decline in chip quality observed (Figures 43-44). At the cooler storage temperature, Snowden chip processed acceptably into late April 2014 (Figure 42).

MSR061-1: This variety was ranked 3rd for overall processing quality at Herr Foods on April 14th, 2014 (Table 2). At Herrs, the MSR061-1 exhibited a good AGTRON score and a lower percent of internal defects than other varieties. The sugar stability of this line appeared to be good at both storage temperatures until early May (Figures 45, 47). The resulting chip quality was very good all season long for this variety. In addition, the SFA color and color defect scores were good (Figures 46, 48). The variety has a late vine maturity which may be affecting its yield performance in northern climates.

CO02321-4W: The overall chip quality performance for this variety was above average at Herr Foods (Tables 1-2). At the April 14th processing date, this variety was ranked the highest for chipping quality of all the entries. CO02321-4W also recorded one of the highest specific gravity values on this date at 1.079. The sucrose value of this line was stable at 50 °F until mid-April 2014, recording good chip quality season all long at this storage temperature (Figures 49-50). At 54 °F, sucrose levels began to rise in mid-February 2014, with no impact on chip quality being observed through April of 2014 (Figures 51-52).

AC01151-5W: AC01151-5W was a below average performer in the 2013 on-farm variety trial. This variety performed at or below the trial average for both processing dates at Herr Foods (Table 1-2). Sugar stability at the 50 °F storage temperature was acceptable through May 2014. The sucrose level increased steadily from mid-February until the end of the season (Figure 53). The increase in sucrose in February resulted in an increase in the tuber glucose concentration. The increase in the sugar content of the tubers resulted in increased chip color being observed in mid-March 2014 (Figure 54). At 54 °F, the sucrose concentration rose rapidly in mid-March 2014, followed by a sharp increase in the glucose concentration in the tubers (Figure 55). The result of this sugar accumulation was poor chip quality from March to the end of the storage season (Figure 56).

W6483-5: This variety was ranked above average at both processing dates by Herr Foods (Tables 1-2). At the January 14th processing date, W6483-5 was ranked as the top chip quality line, with only 7.9 percent total defects recorded (Table 1). This variety had the lowest specific gravity at Herrs of all the varieties tested in January. The sugar concentration curves

for this variety, at both temperatures, appear very stable (Figures 57, 59). The chip quality on this variety declines at both temperatures in mid-February (Figures 58, 60). W6483-5 appeared to have a short dormancy and would be better chip processed directly out-of-the-field than from storage. There were not enough tubers of this variety at harvest to continue chip processing evaluations later than March 2014. The low recorded specific gravity remains a concern for the future utilization of this line as well.

W4980-1: W4980-1 was an average to below average performing line at Herr Foods on both processing dates (Tables 1-2). This variety responded well in storage at both temperatures until mid-February at which time an increase in sucrose was observed (Figures 63, 65). The glucose level increased at both temperatures through the end of the storage season, but no major impact in chip quality was observed through April 2014 (Figures 62, 64).

W6609-3: W6609-3 was the lowest yielding line in the 2013 on-farm variety trial. W6609-3 had average to above average chip quality at Herr Foods (Tables 1-2). Sugar levels were mostly stable at the colder storage temperature (Figure 65), resulting in good chip quality all season long (Figure 66). The warmer 54 °F storage sample saw sucrose levels increase rapidly in mid-March 2014, followed by a rise in glucose (Figure 67). The increase in simple sugars resulted in a decline in chip quality in mid-March (Figure 68).

Table 1. 2013 SFA Variety Trials January 14, 2014[1]

Entry	Agtron Color	SFA[2] Color	Specific Gravity	Percent Chip Defects[3] Internal	External	Total	Comments
W6483-5	58.9	2	1.064	2.1	5.8	7.9	Very few internal defects. Light skin with minor scab.
W5955-1	58.9	2	1.080	7.8	4.8	12.6	Nice internal color. Good raw grade, almost perfect. Ideal size for chipping.
Manistee(MSL292-A)	63.5	2	1.072	3.0	17.6	20.6	Minor stem end. Some surface scab.
Snowden	60.7	2	1.077	4.1	7.5	11.6	Minor scab. Small to medium in size.
NY 140	61.2	2	1.070	15.5	10.8	26.3	A lot of scab and pitting. Some oblong in shape.
CO00197-3W	63.2	2	1.071	3.0	7.6	10.6	Major scab and deep pitting. Medium to large size.
MSL007-B	56.7	2-3	1.073	0.0	10.4	10.4	Minor scab. Size ideal for chipping
CO03243-3W	57.7	2	1.071	2.0	9.2	11.2	Some deep scab. On the larger size with some rotten potatoes.
NY 148	58.7	2	1.078	10.6	12.1	22.7	Minor edge defects. Ideal size for chipping.
AF4157-6	59.8	2-3	1.078	9.0	6.8	15.8	Deep pitting and scabs. A lot of small tubers.
CO02321-4W	58.7	2-3	1.078	8.2	23.6	31.8	Minor surface scab with minor greening. Very small, almost too small to get a good sample.
Atlantic	57.5	3	1.082	20.9	14.5	35.4	Minor internal shading. Some greening and light scab. Size was average.
MSR061-1	57.2	3	1.067	0.3	4.8	5.1	A few edge defects with minor scab. Small to medium size.
ACO1151-5W	59.4	2-3	1.071	3.3	10.5	13.8	Minor internal defects. Some surface scab with light greening on some potatoes. Nice size profile.
W4980-1	59.4	3	1.078	8.3	10.9	19.2	Minor greening with scab and deep pitting. Medium to large size.
AO1143-3C	54.6	3	1.069	10.5	12.2	22.7	Light shading with some having a bit of necrosis inside. Good raw grade. Large in size.
W6609-3	59.9	2-3	1.075	4.2	14.0	18.2	Deep scab in raw and finished. Really small in size.
A00188-3C	58.4	3-4	1.076	12.9	7.0	19.9	Some internal shading. Minor scab. Nice size with a few rotten potatoes in the sample.

[1] Samples collected at harvest on October 3rd, 2013, and processed by Herr Foods, Inc., Nottingham, PA on January 14, 2014.

Chip defects are included in Agtron and SFA samples.

[2] SFA Color: 1= lightest, 5 = darkest

[3] Percent Chip Defects are a percentage by weight of the total sample; comprised of undesirable color, greening, internal defects and external defects.

Table 2. 2013 SFA Variety Trials April 14, 2014[1]

Entry	Agtron Color	SFA[2] Color	Specific Gravity	Percent Chip Defects[3] Internal	External	Total	Comments
CO02321-4W	56.3	3	1.079	4.7	20.2	24.9	Fair amount of scab. 1 1/2 to 3 inches in size.
W5955-1	57.8	3	1.077	8.1	7.2	15.3	A little hollow heart. Minor edge defects. 1 1/2 to 5 inches in size.
MSR061-1	57.1	3	1.068	7.1	10.4	17.5	Minor internal defects. Big size variance, from some really small to really big.
NY 140	58.2	2	1.073	11.1	13.2	24.3	A little scab. 1 1/2 to 5 1/2 inches in size.
W6483-5	58.7	3	1.062	22.1	4.8	26.9	Minor internals. Odd shaped tubers with a lot of sprouting.
Manistee(MSL292-A)	62.3	3	1.072	8.6	4.6	13.2	Minor internal shading. Some sprouting on raw potatoes. Ideal size.
W6609-3	55.0	3	1.073	31.6	9.0	40.6	Inernal shading. Sample was breaking down and soft when sample was received.
W4980-1	57.0	3	1.070	9.6	21.0	30.6	Minor scab. 2 to 3 inches in size.
ACO1151-5W	56.9	3	1.069	15.4	18.6	34.0	Minor greening with some sprouting. Very small in size.
CO00197-3W	58.9	3	1.073	20.4	17.4	37.8	Minor internal defects. Minor bruising. 1 1/2 to 3 1/2 inches in size.
Snowden	55.6	3	1.079	15.5	14.7	30.2	1 3/8 to 3 inches in size. Some internal color.
MSL007-B	53.5	4	1.073	47.8	4.0	51.8	Fair amount of internal color. Minor scab. 1 1/2 to 4 inches in size.
AF4157-6	60.2	3	1.078	17.4	26.2	43.6	A lot of scab and sprouting. Small in size 1 3/4 to 3 3/4 inches.
AO1143-3C	54.2	4	1.070	22.6	7.4	30.0	Some black rot in the vascular ring. 3 1/2 inches to larger in size.
NY 148	51.4	3	1.073	32.1	21.6	53.7	Minor internal color. Scab present. 1 1/2 to 3 3/4 inches in size.
CO03243-3W	51.2	3	1.073	49.6	9.5	59.1	Black rot on vascular ring. 1 inch to 3 inches in size.
A00188-3C	49.3	5	1.077	47.1	4.7	51.8	A lot of internal color with some necrosis. Ideal size.

[1] Samples collected at harvest on October 3rd, 2013, and processed by Herr Foods, Inc., Nottingham, PA on April 14, 2014.

Chip defects are included in Agtron and SFA samples.

[2] SFA Color: 1= lightest, 5 = darkest

[3] Percent Chip Defects are a percentage by weight of the total sample; comprised of undesirable color, greening, internal defects and external defects.

Figure 1.

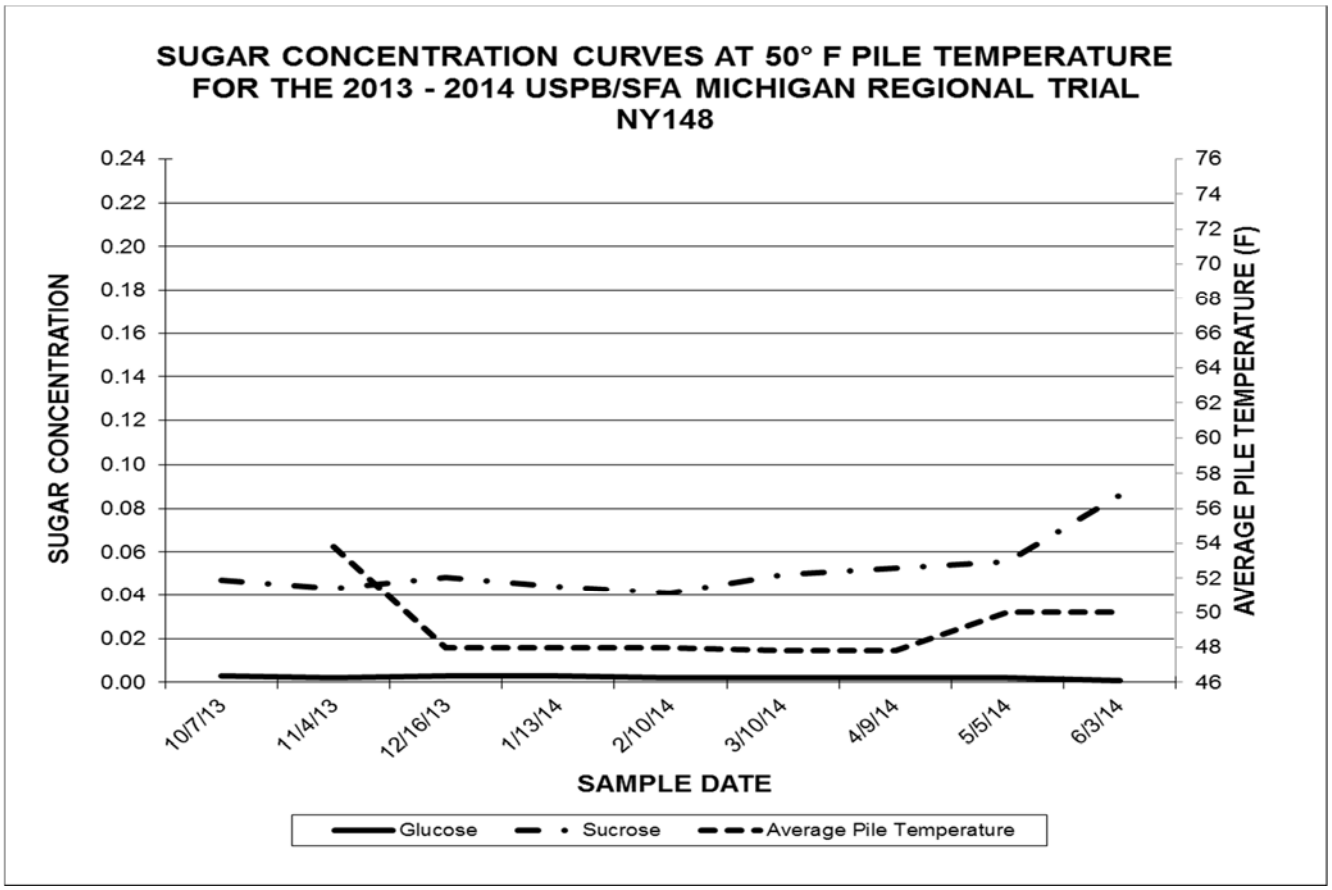
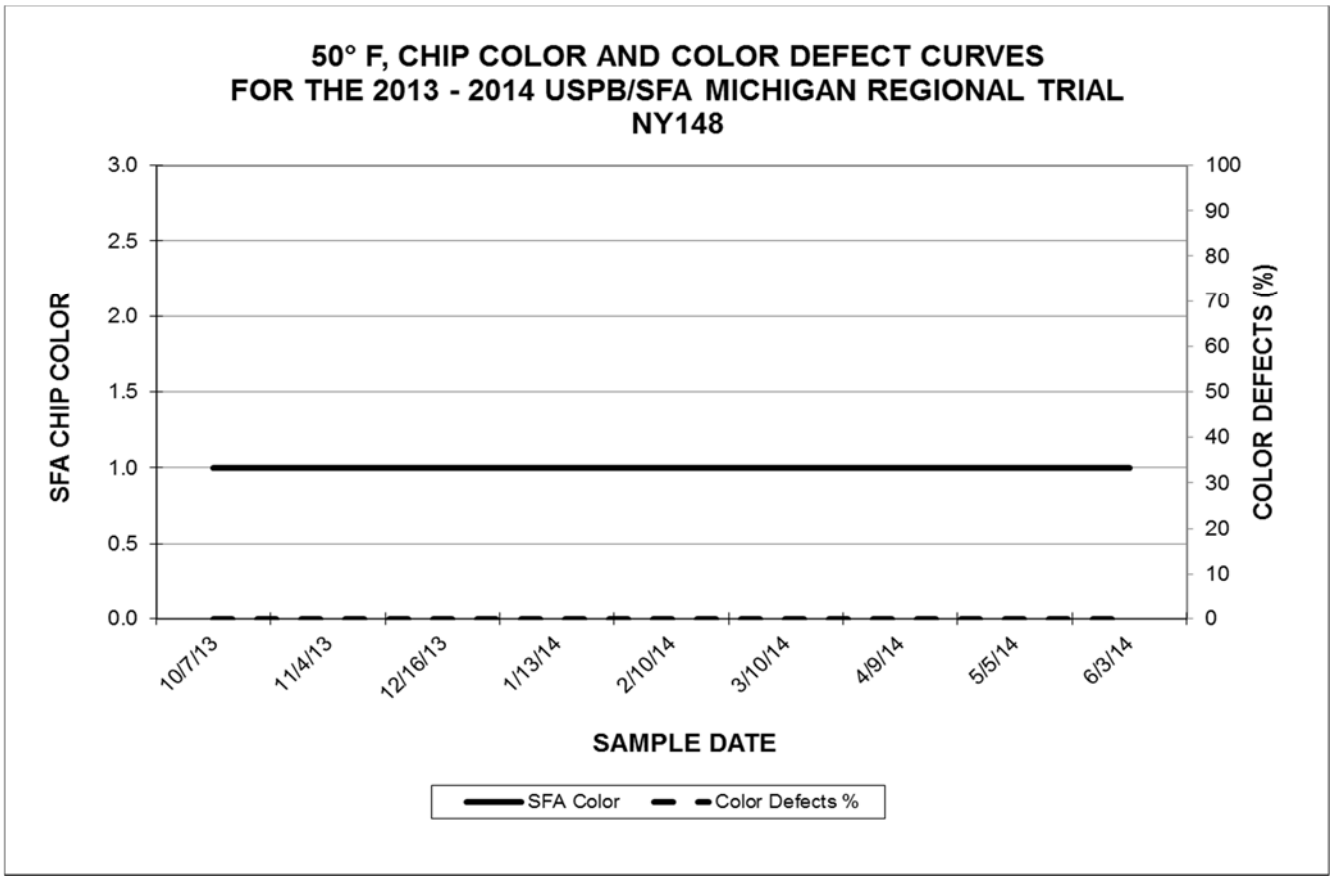


Figure 2.



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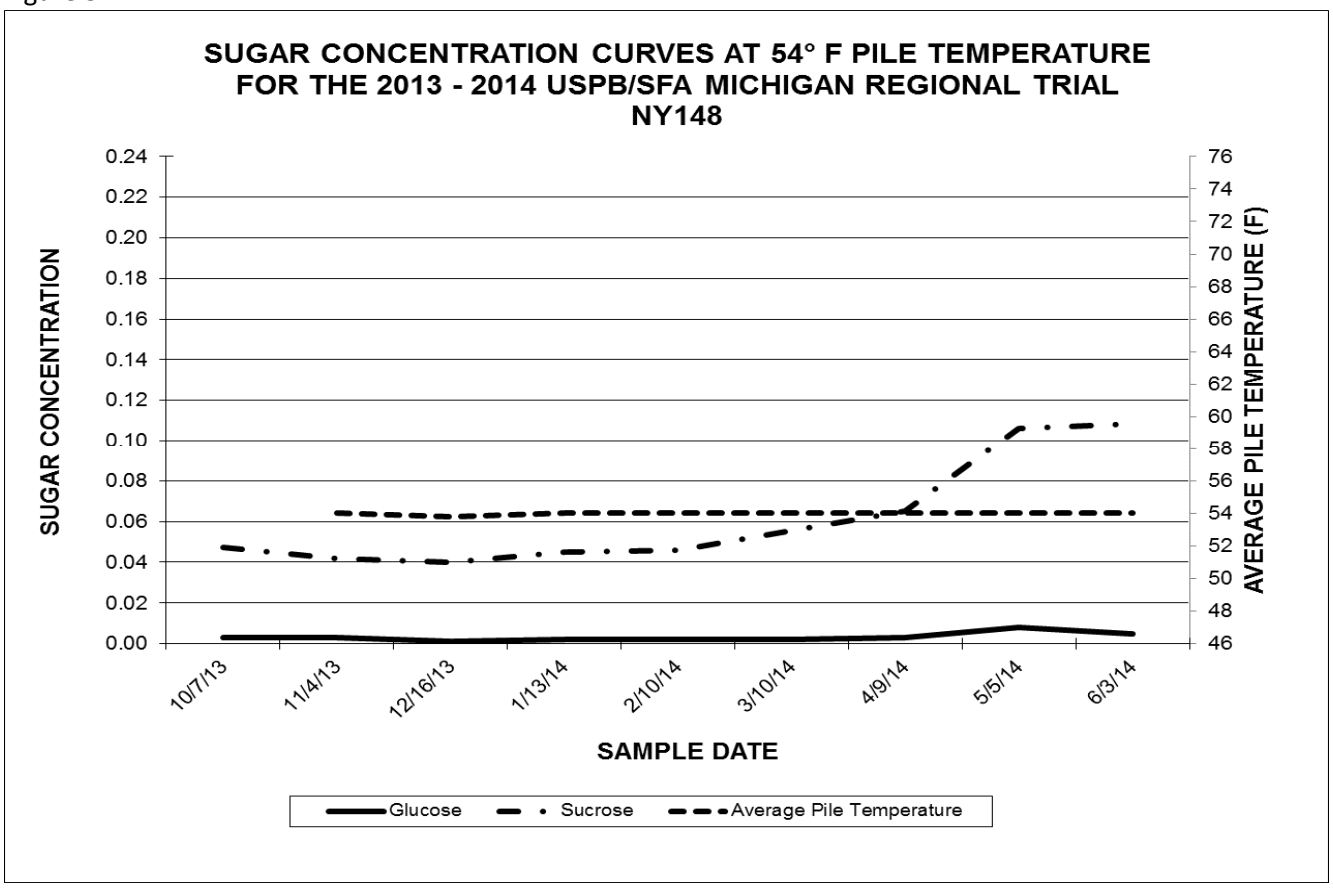

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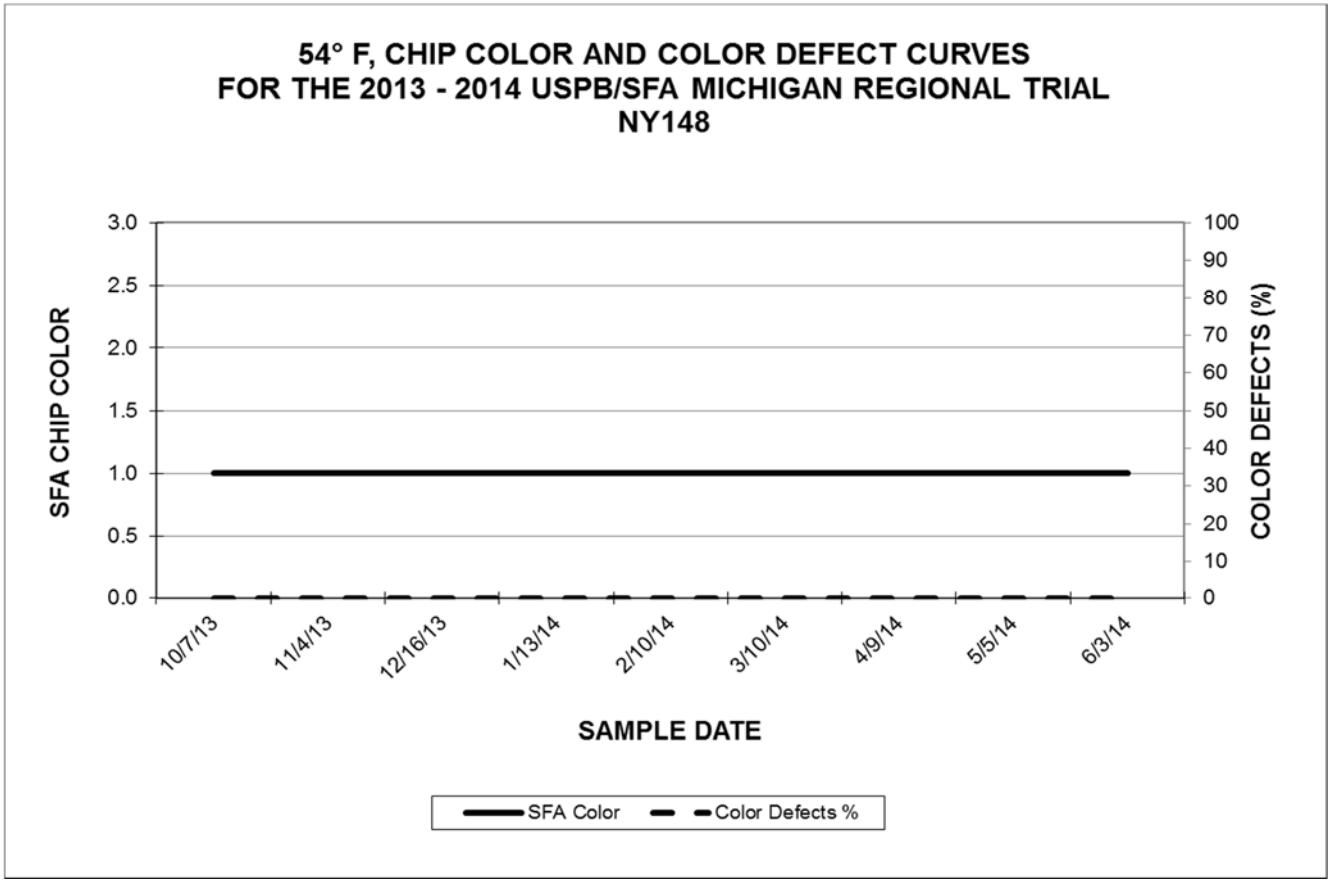

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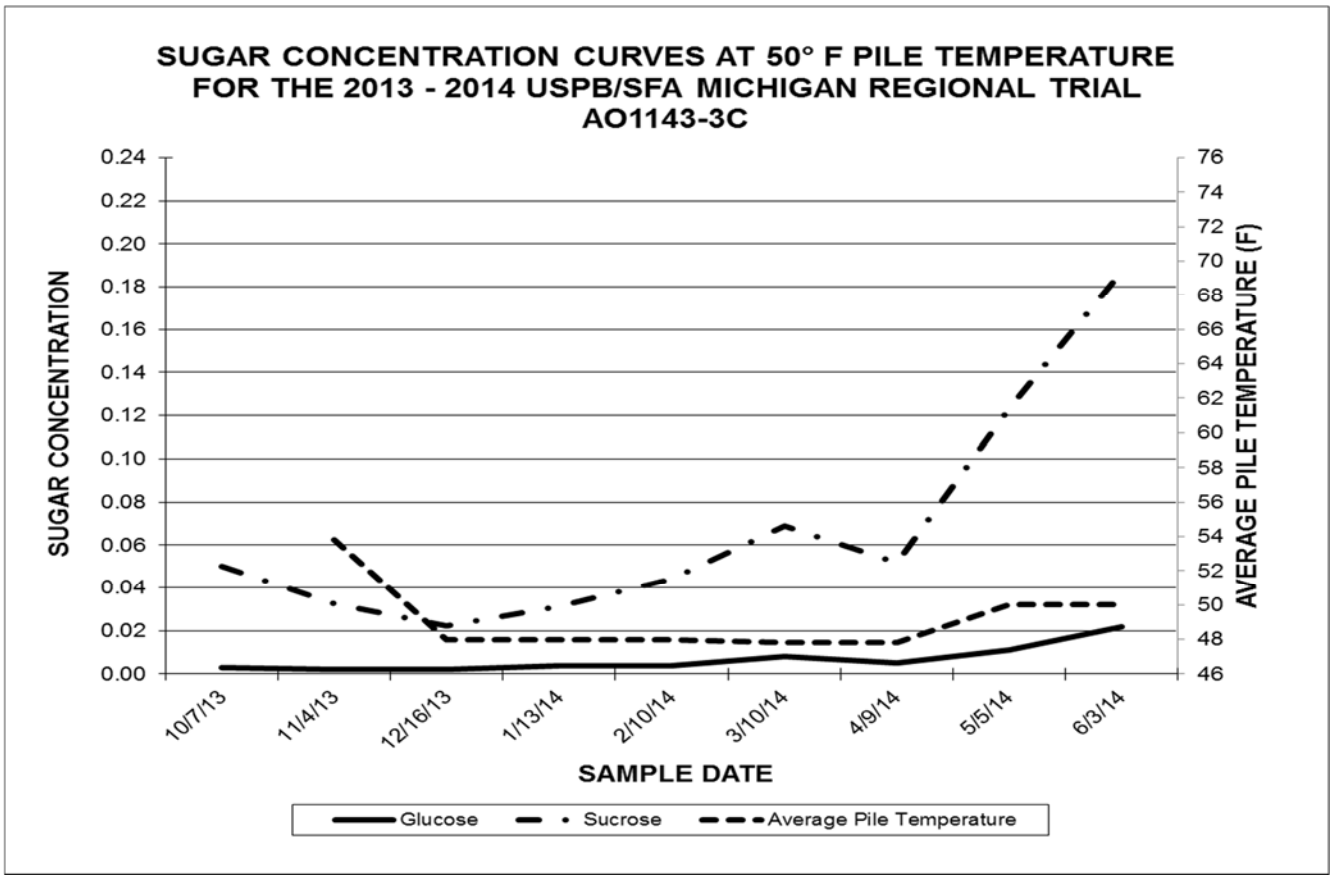

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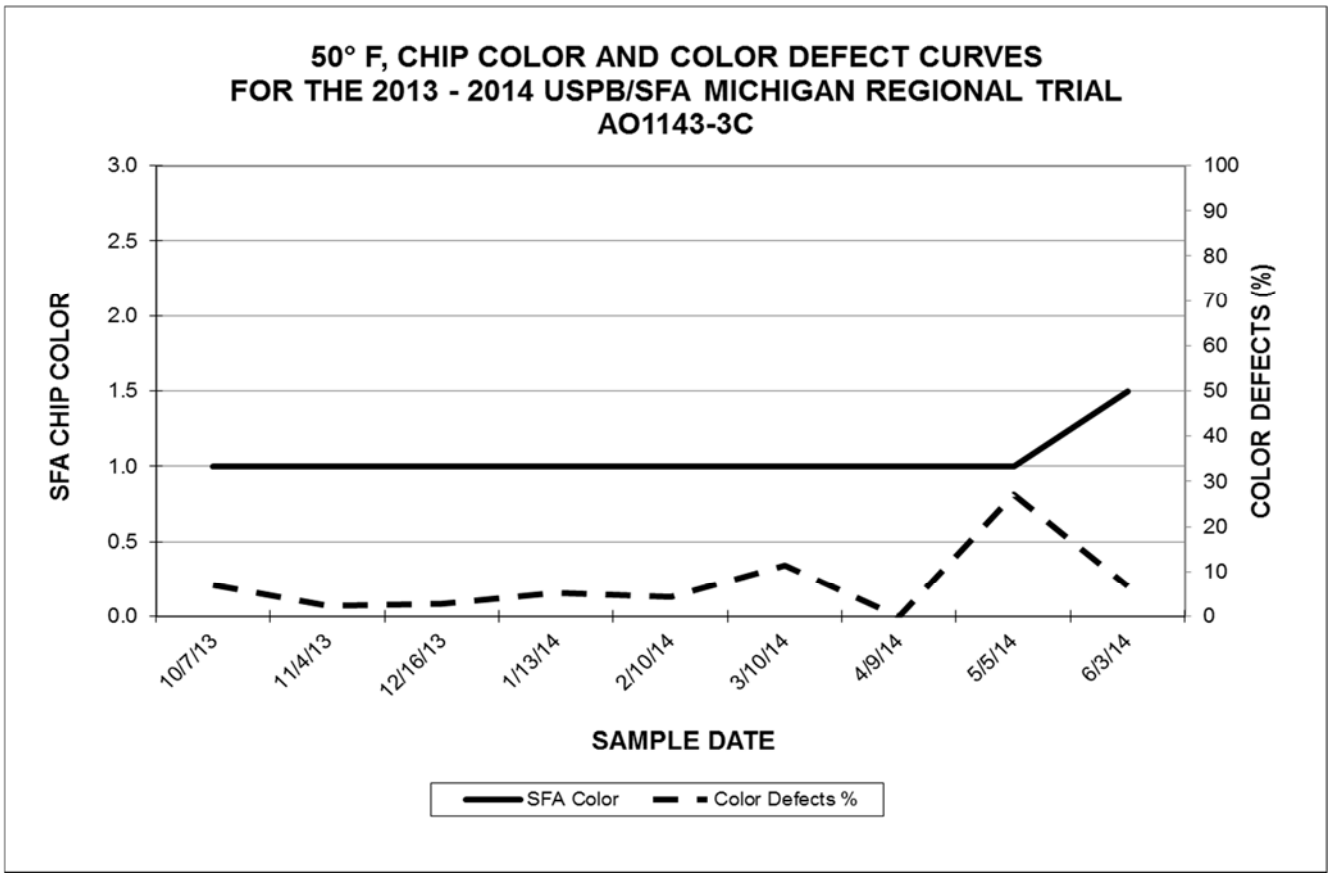

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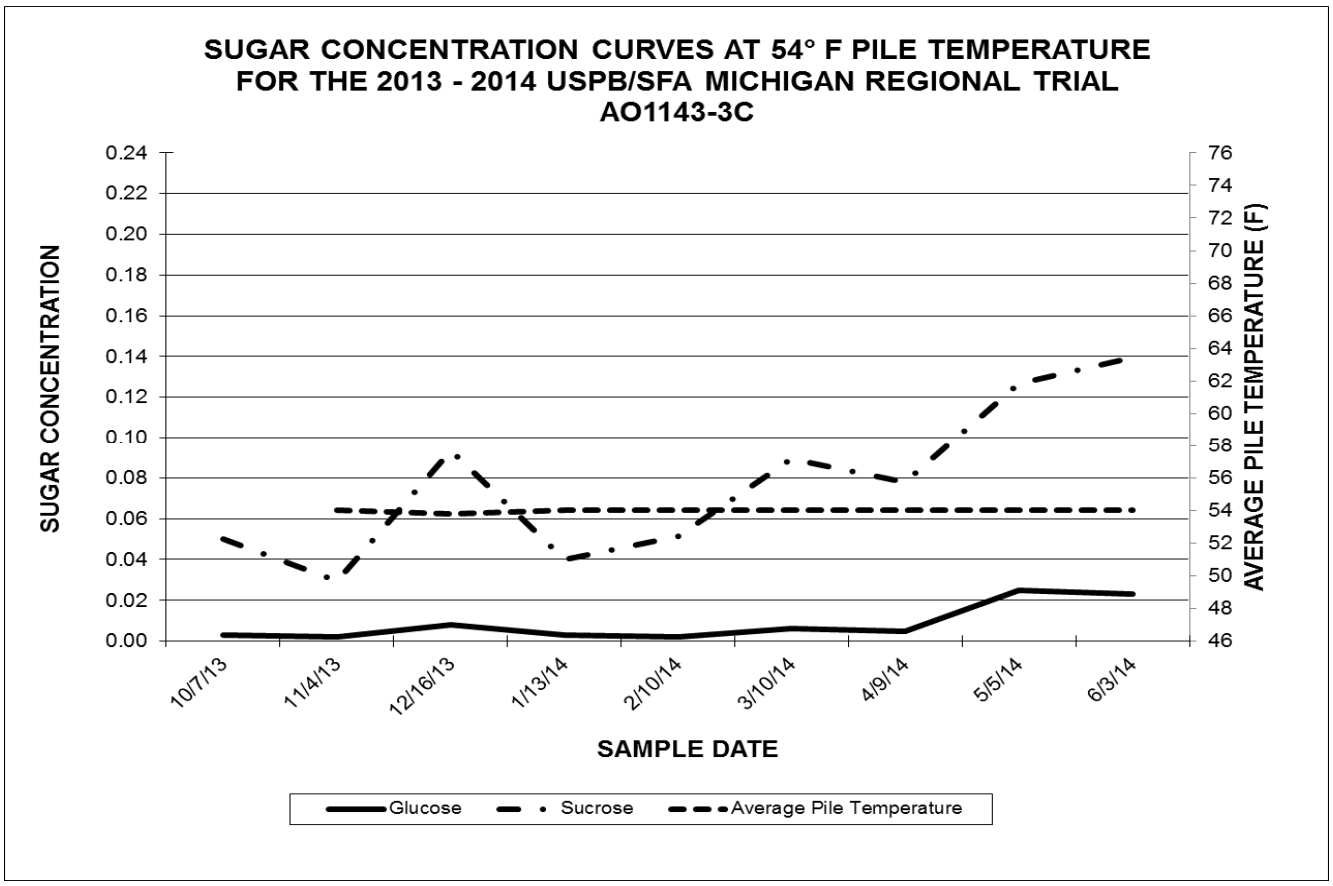

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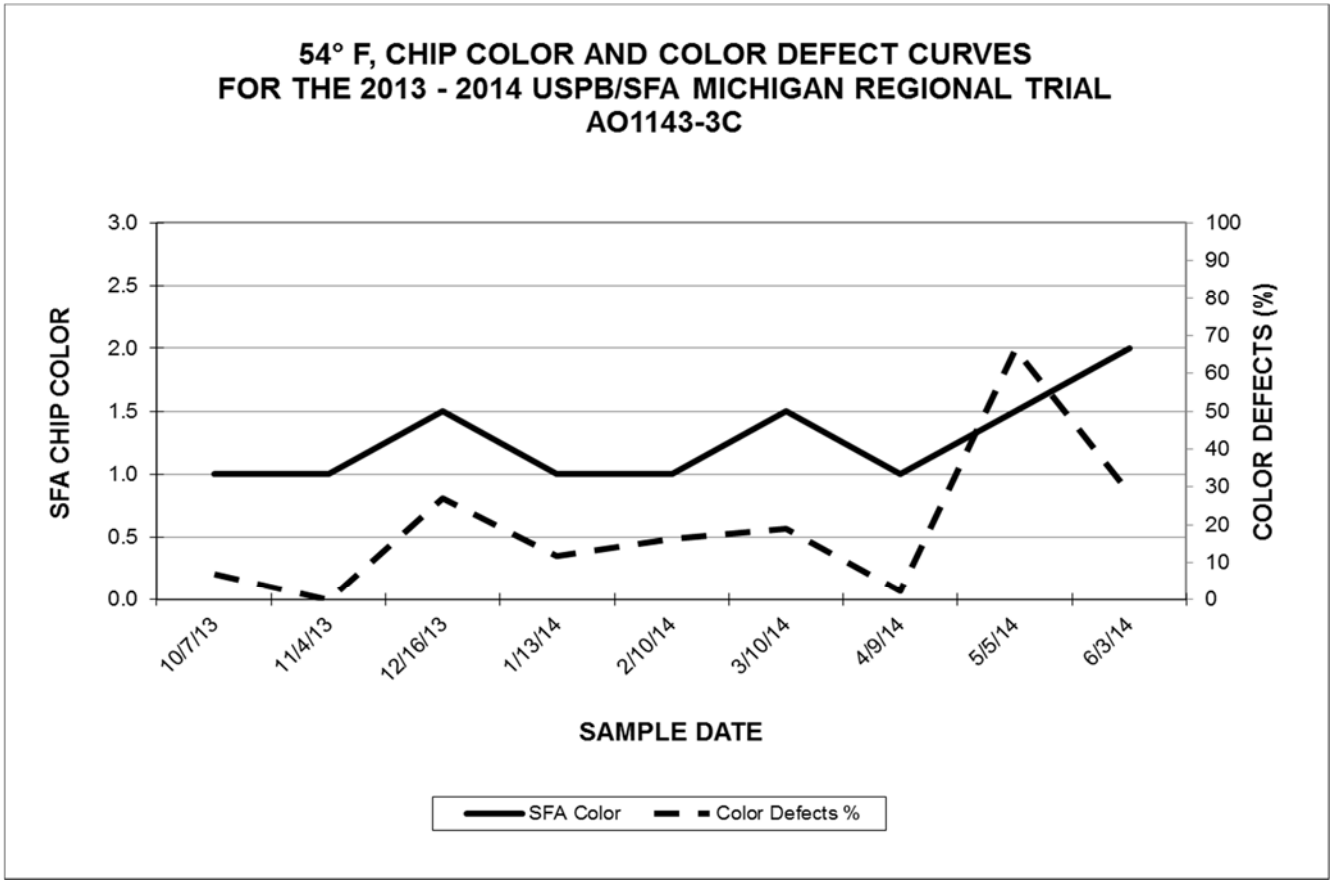

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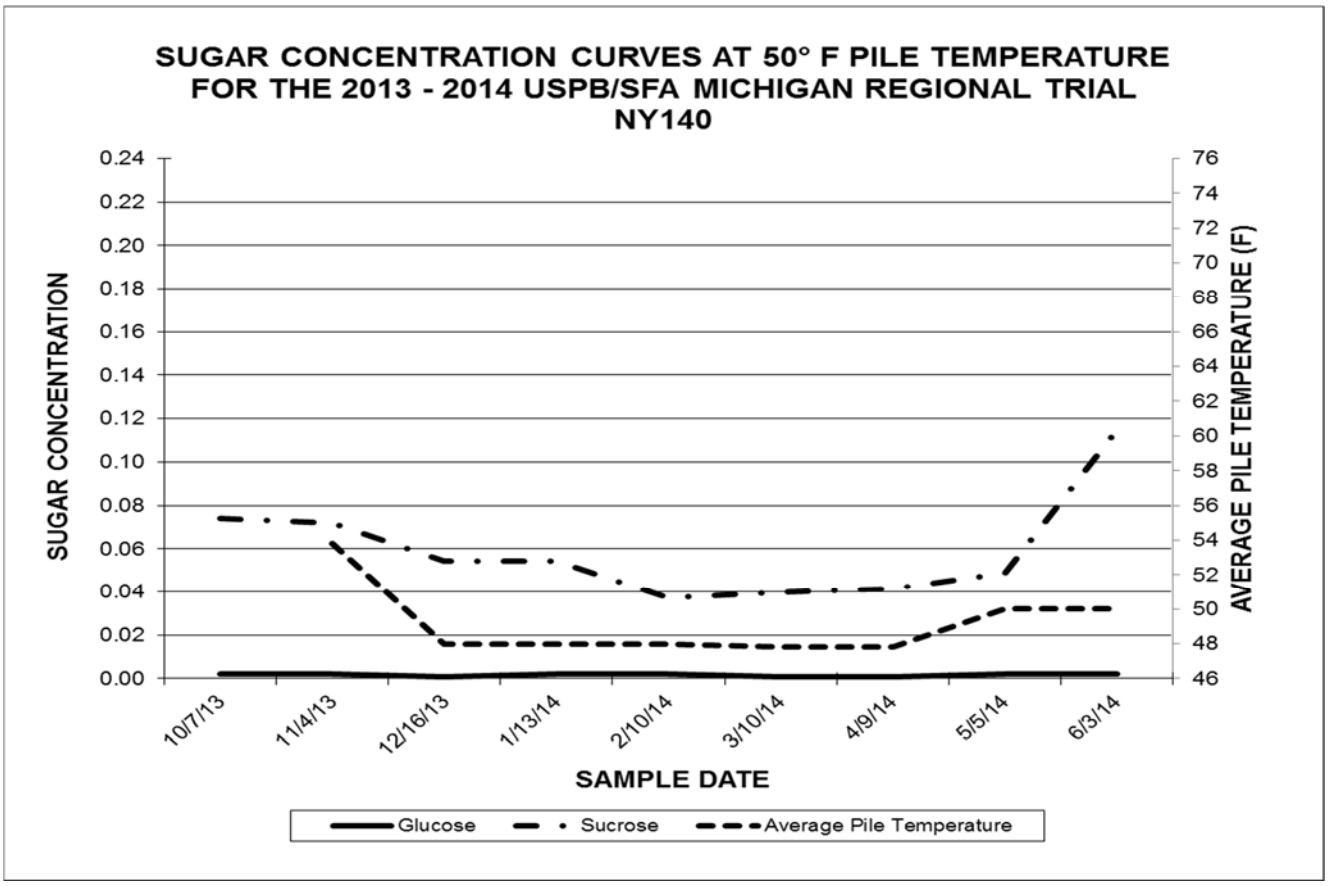

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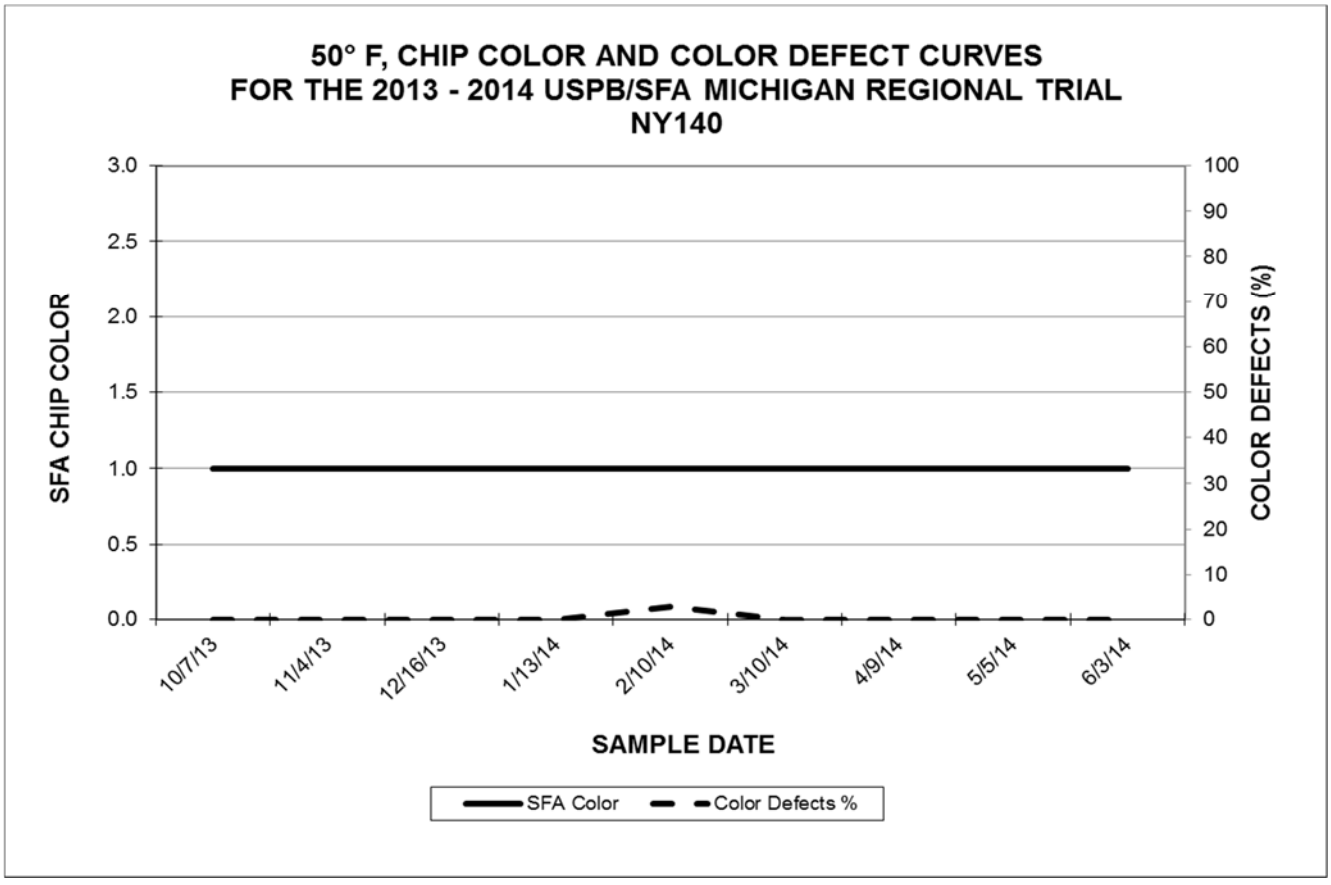

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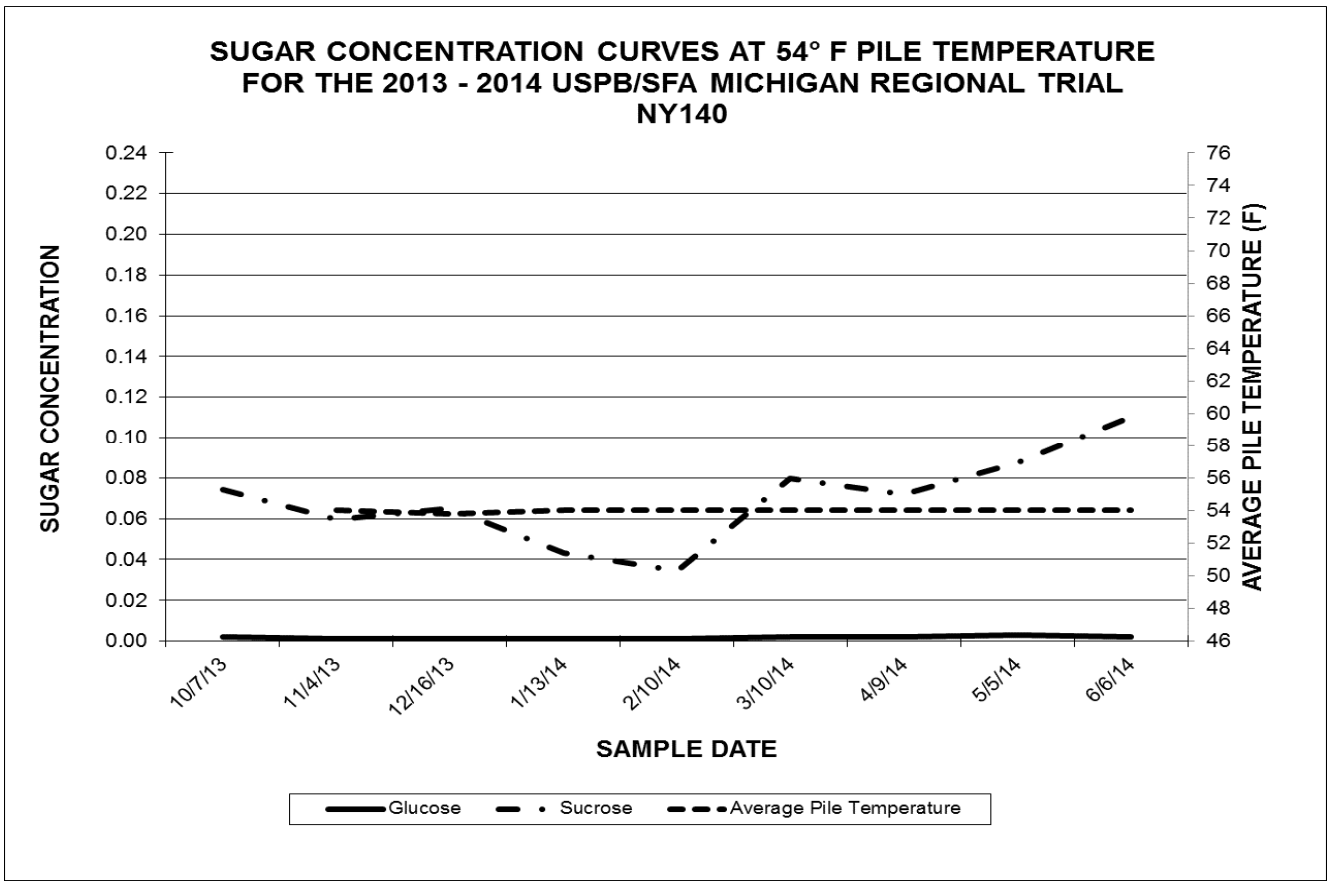

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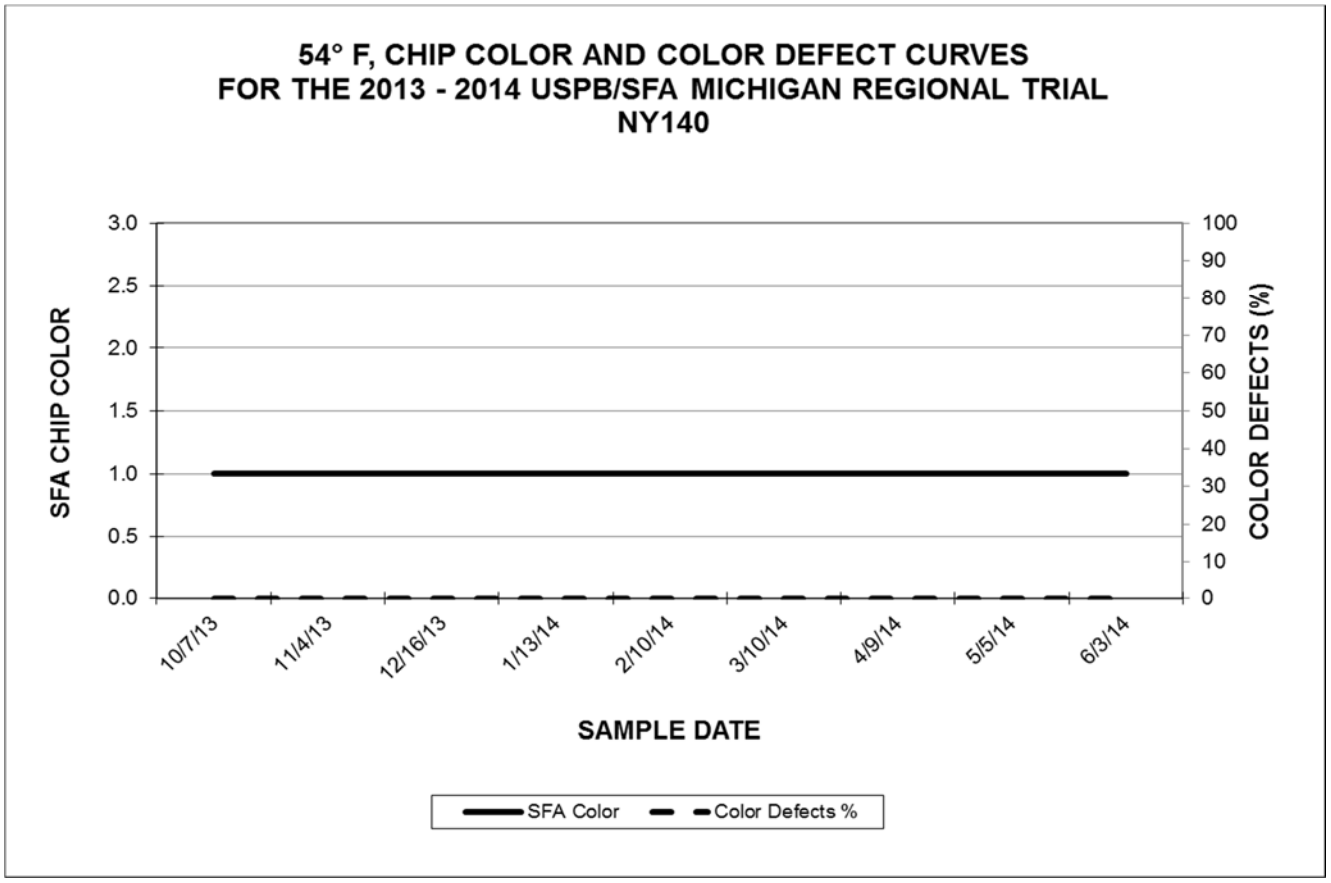

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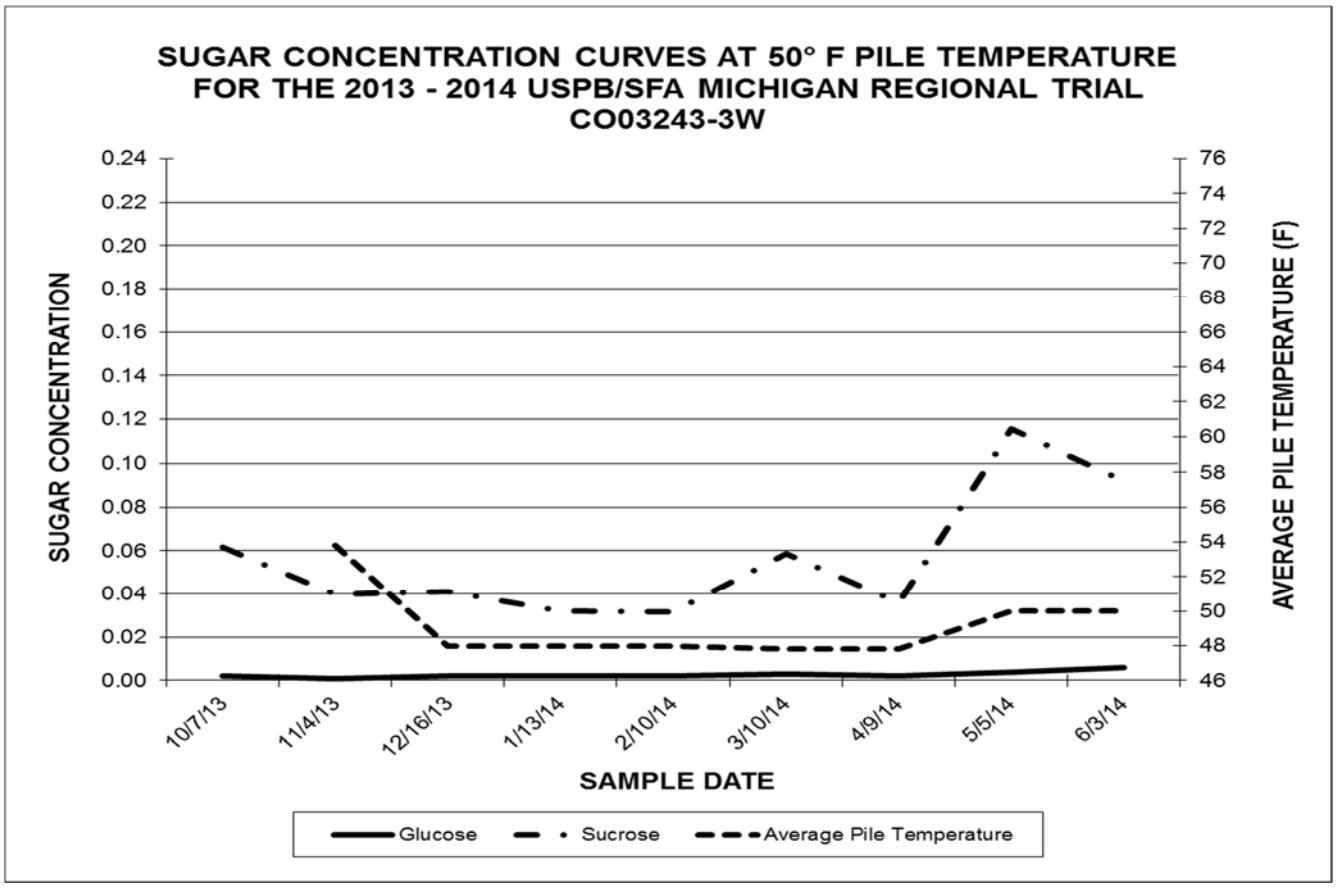

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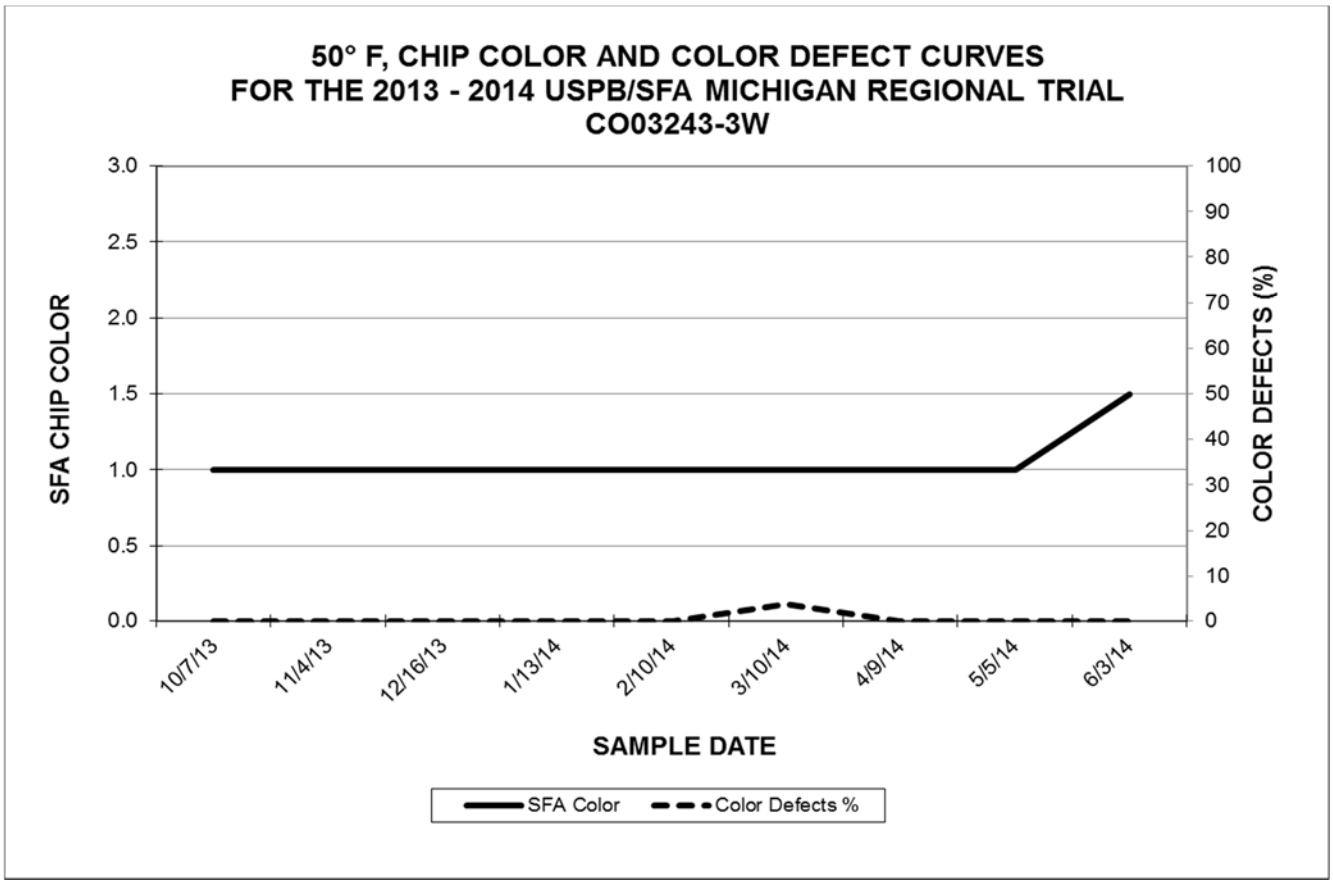

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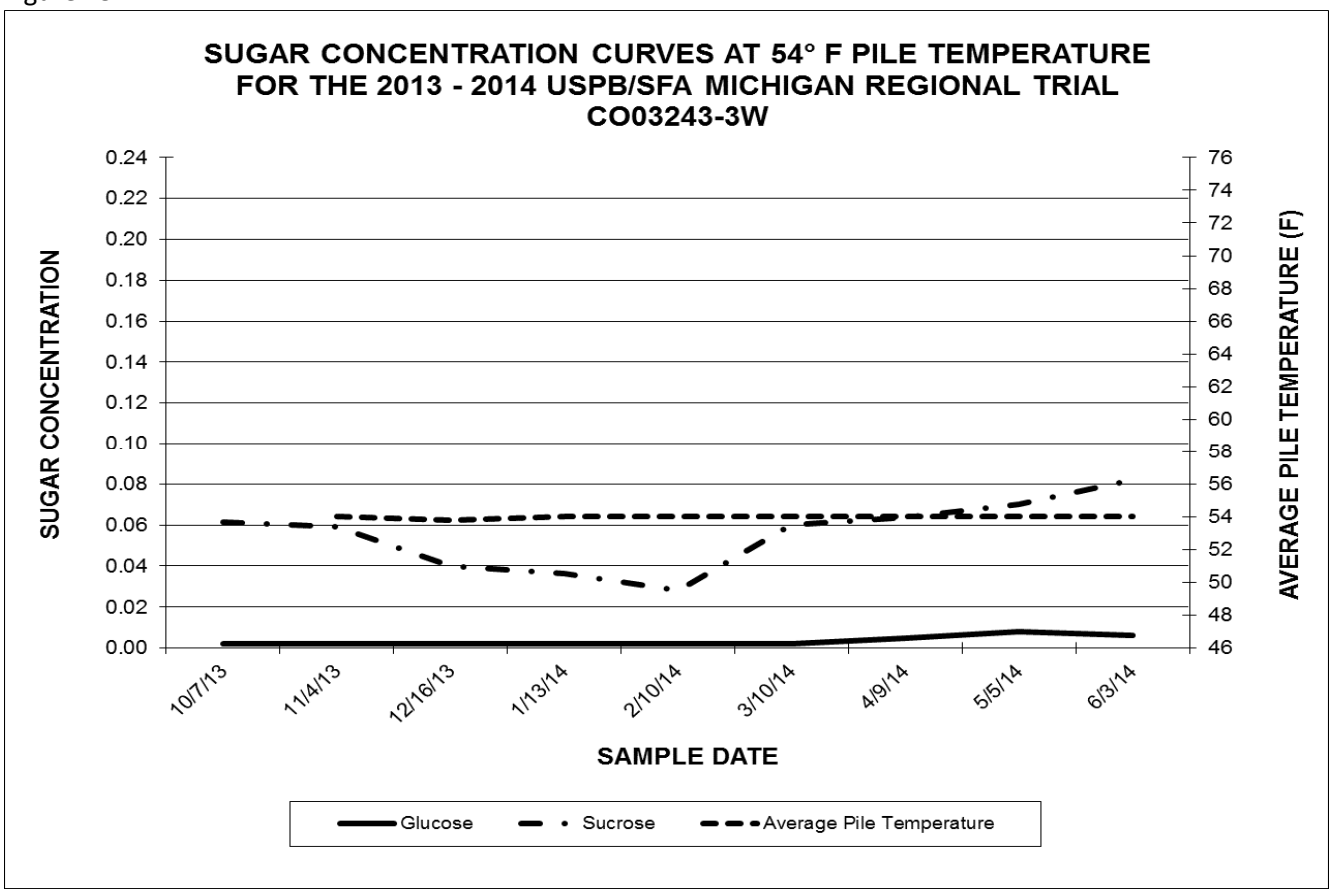

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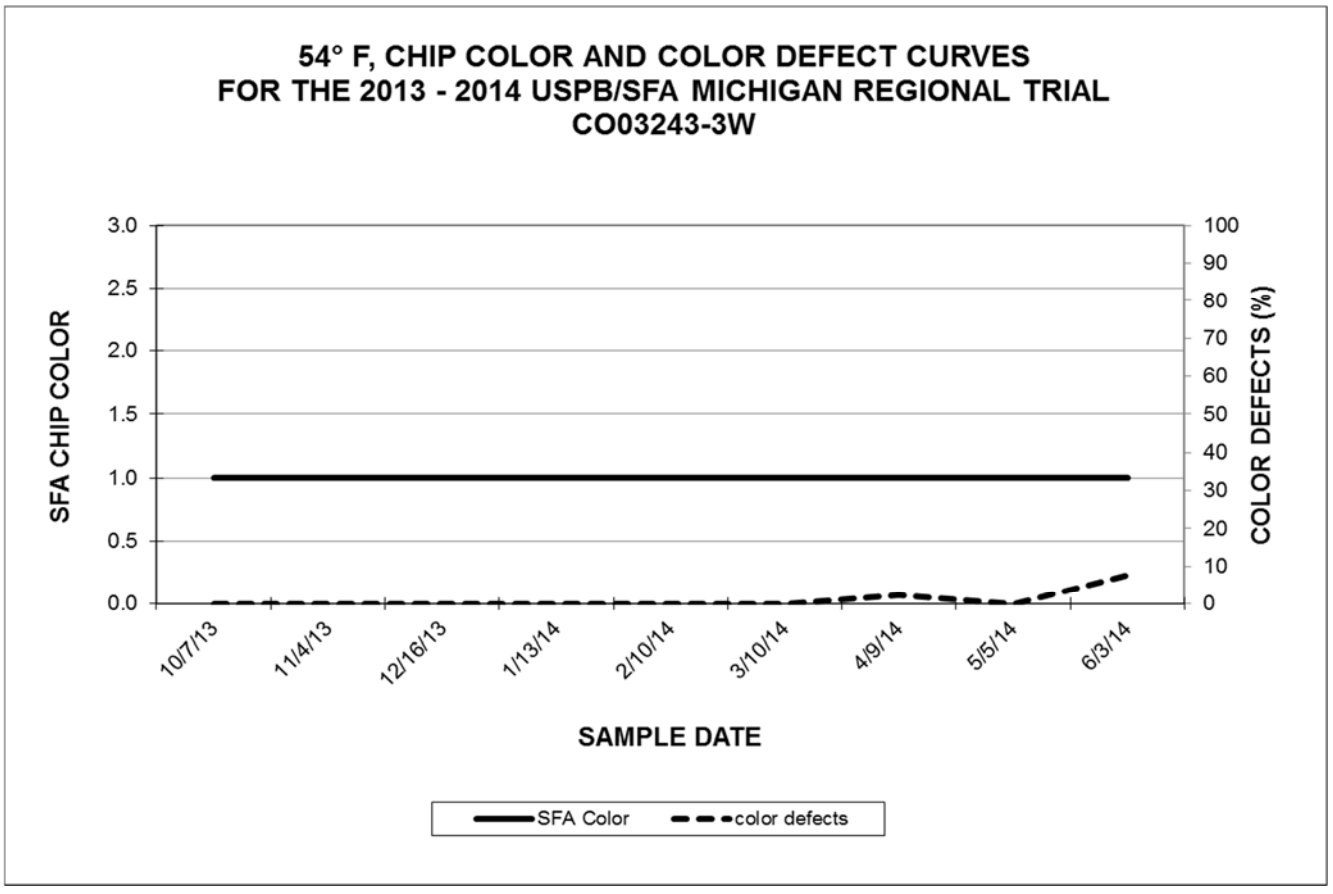

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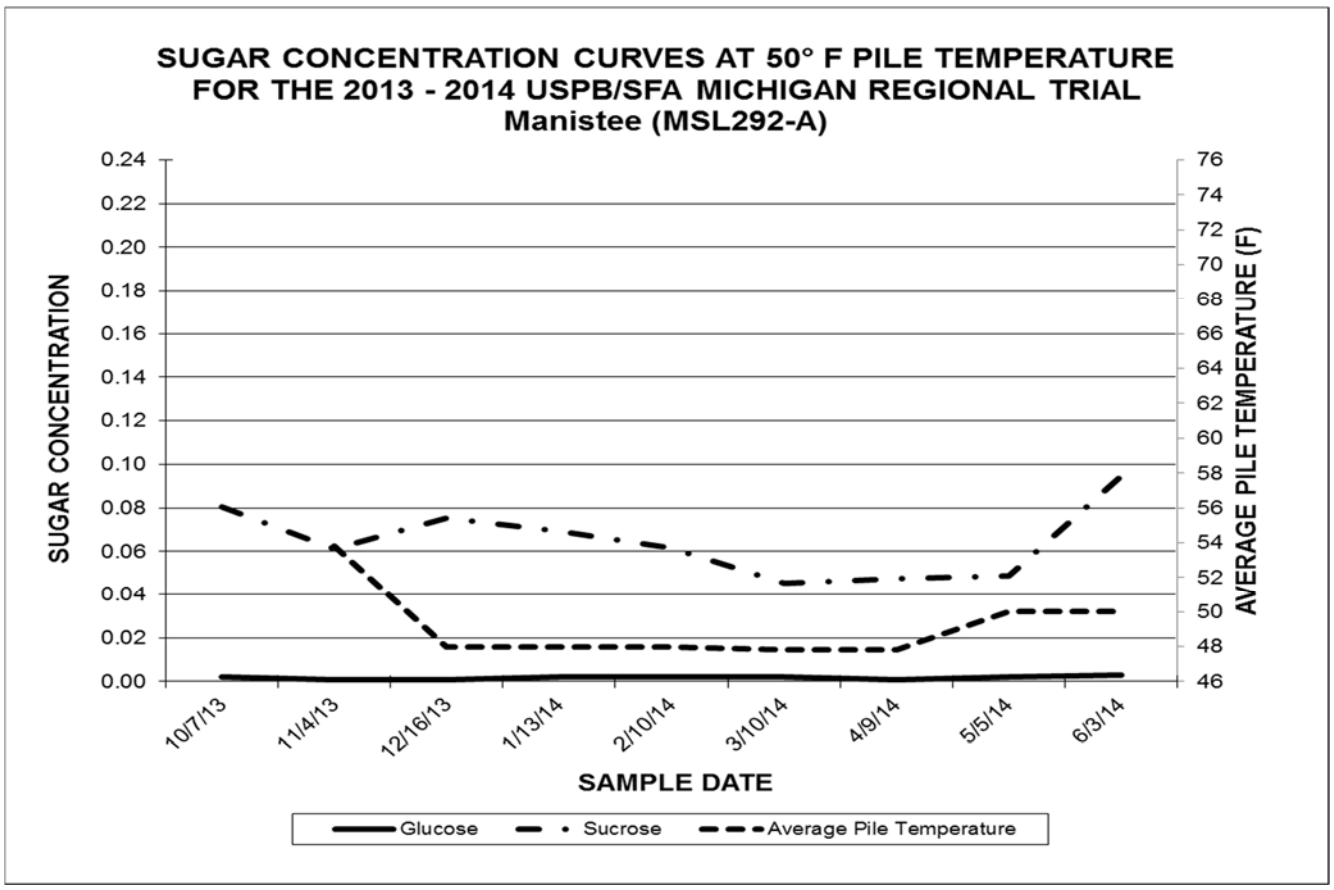

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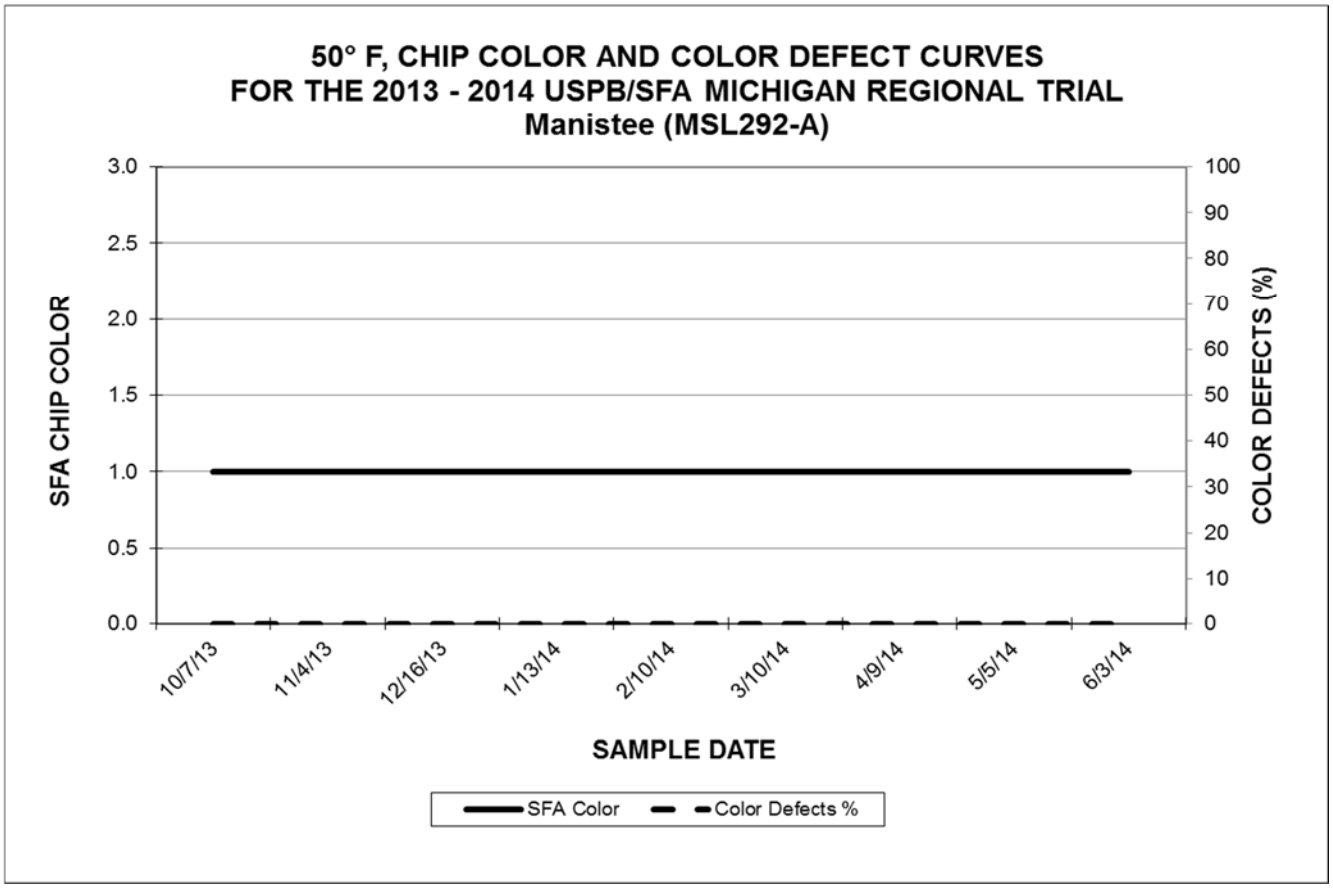

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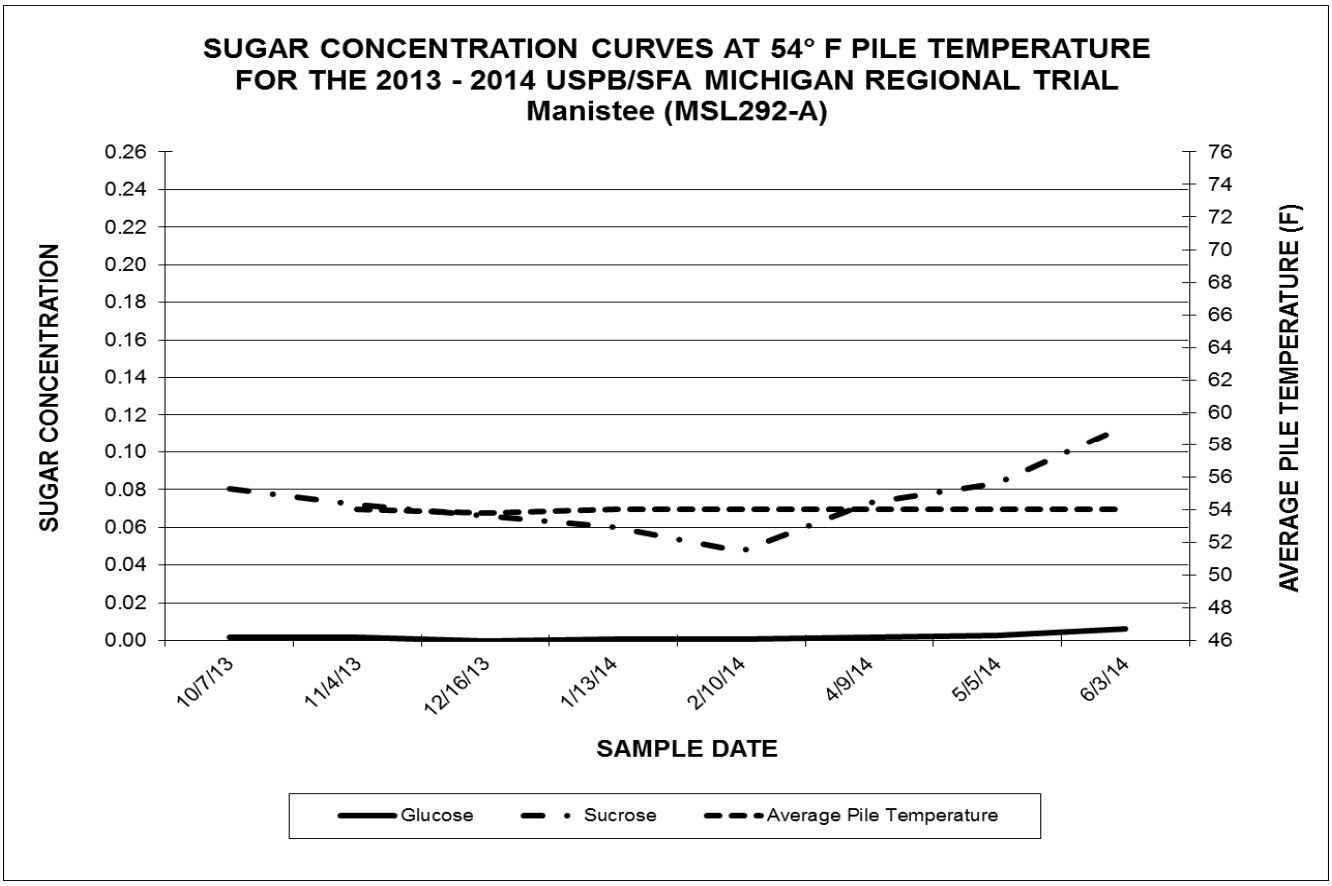

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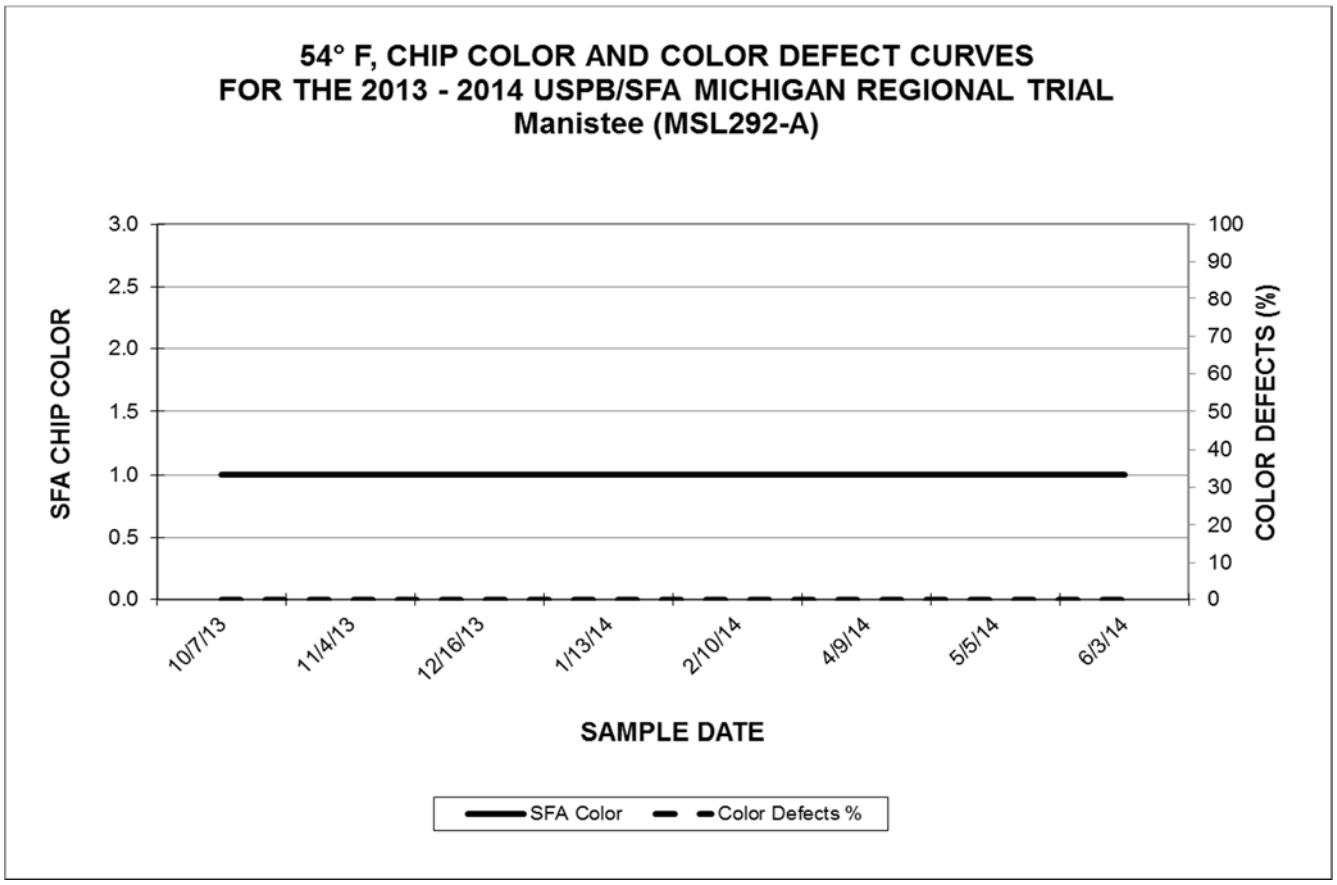
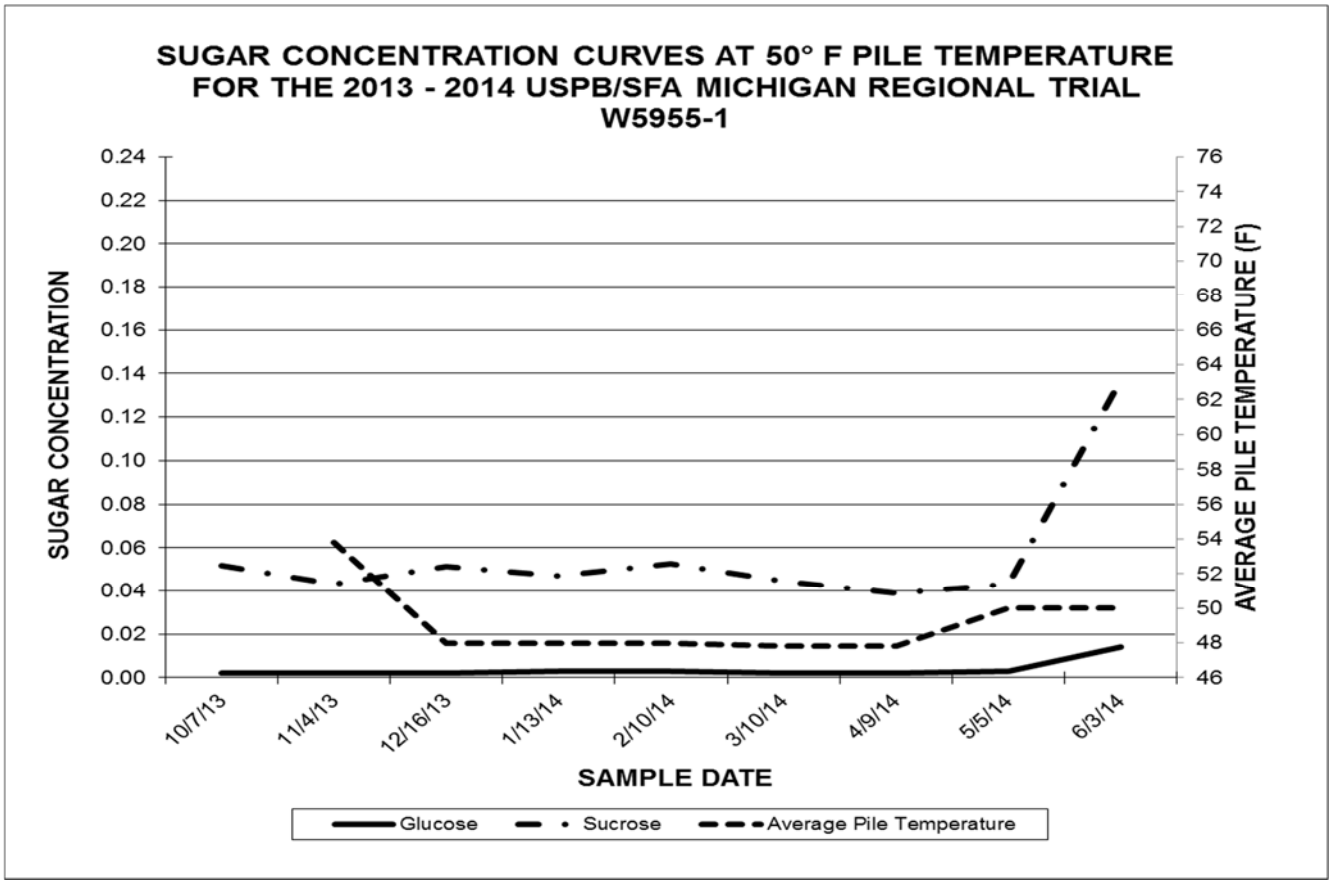


Figure 21.



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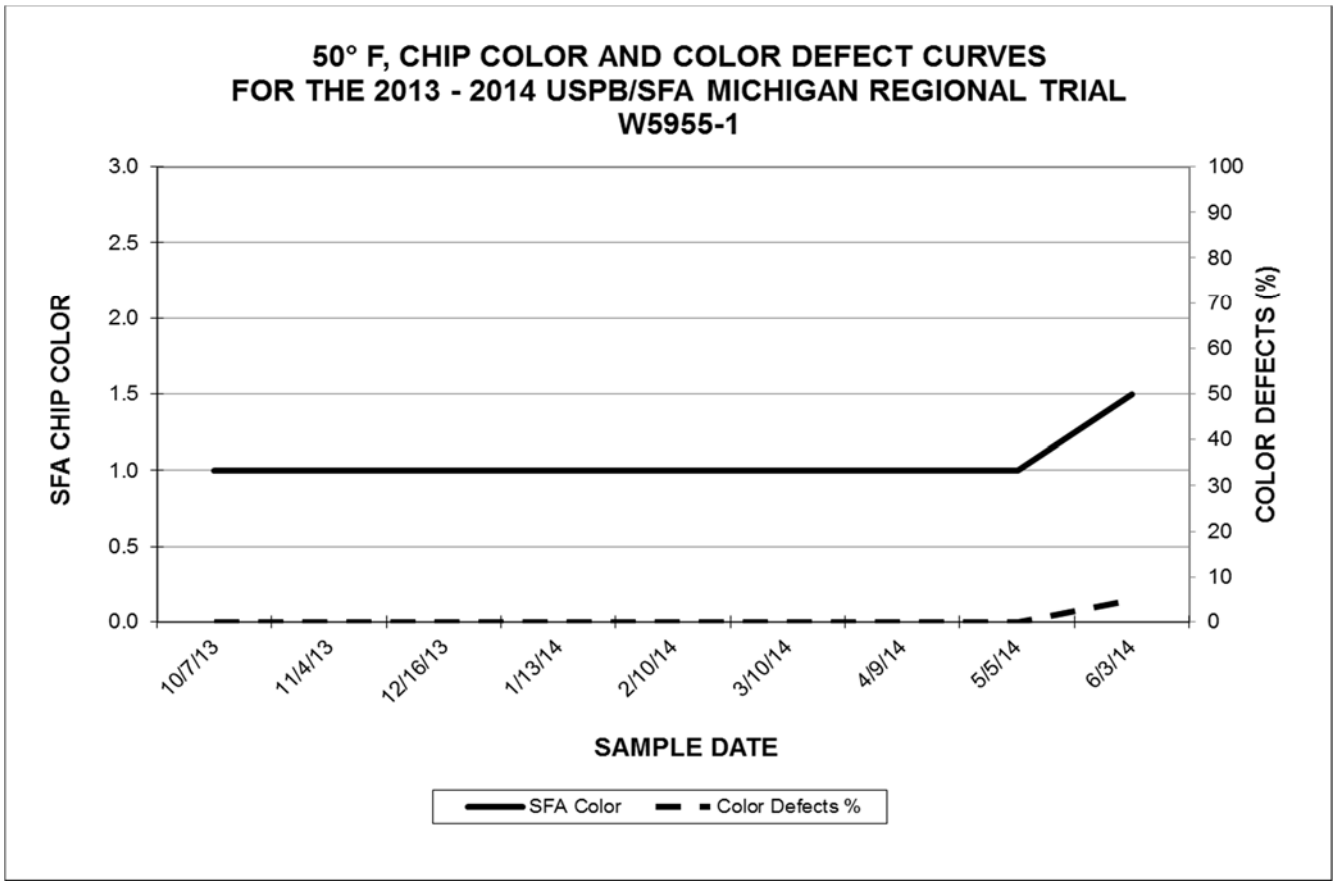

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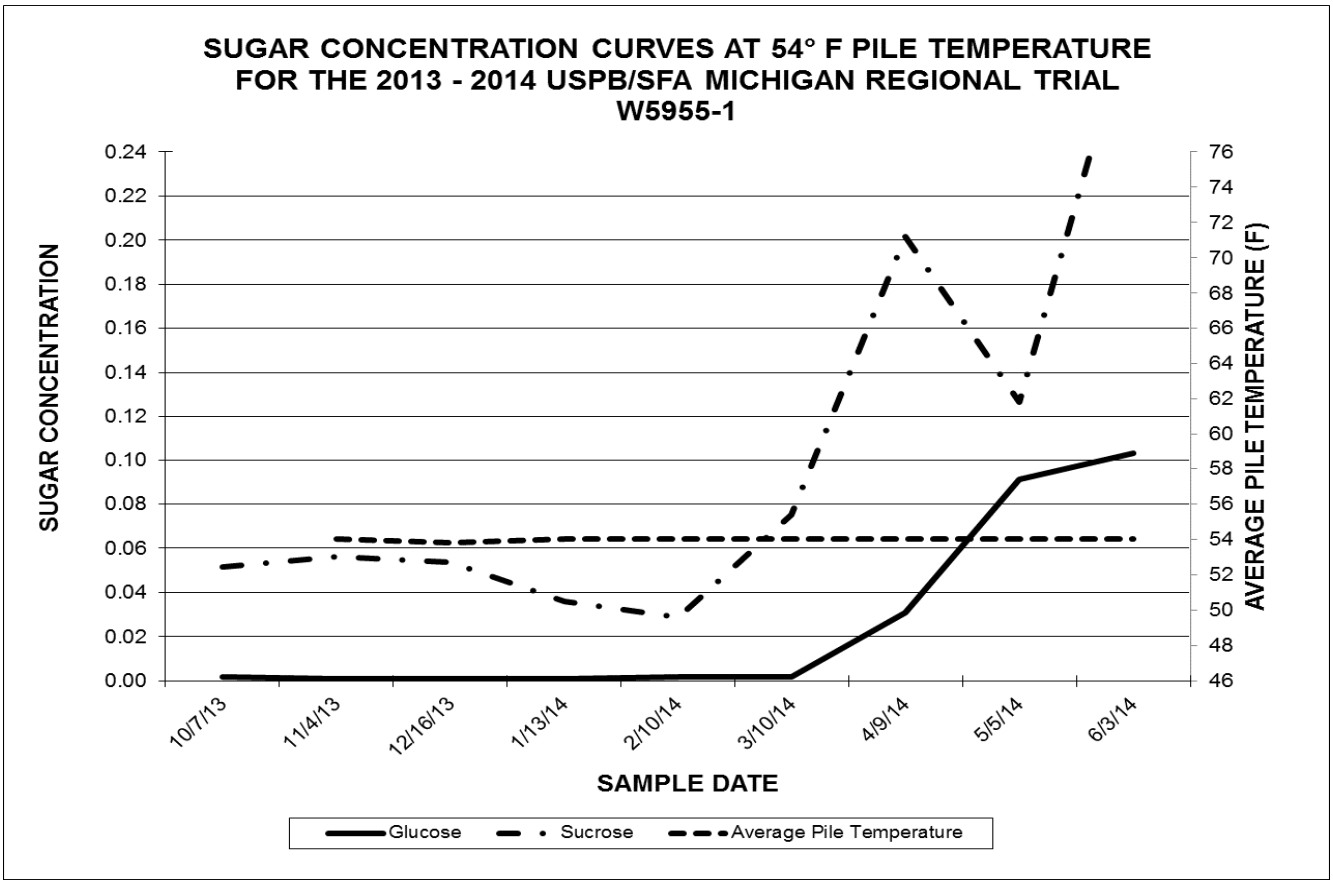

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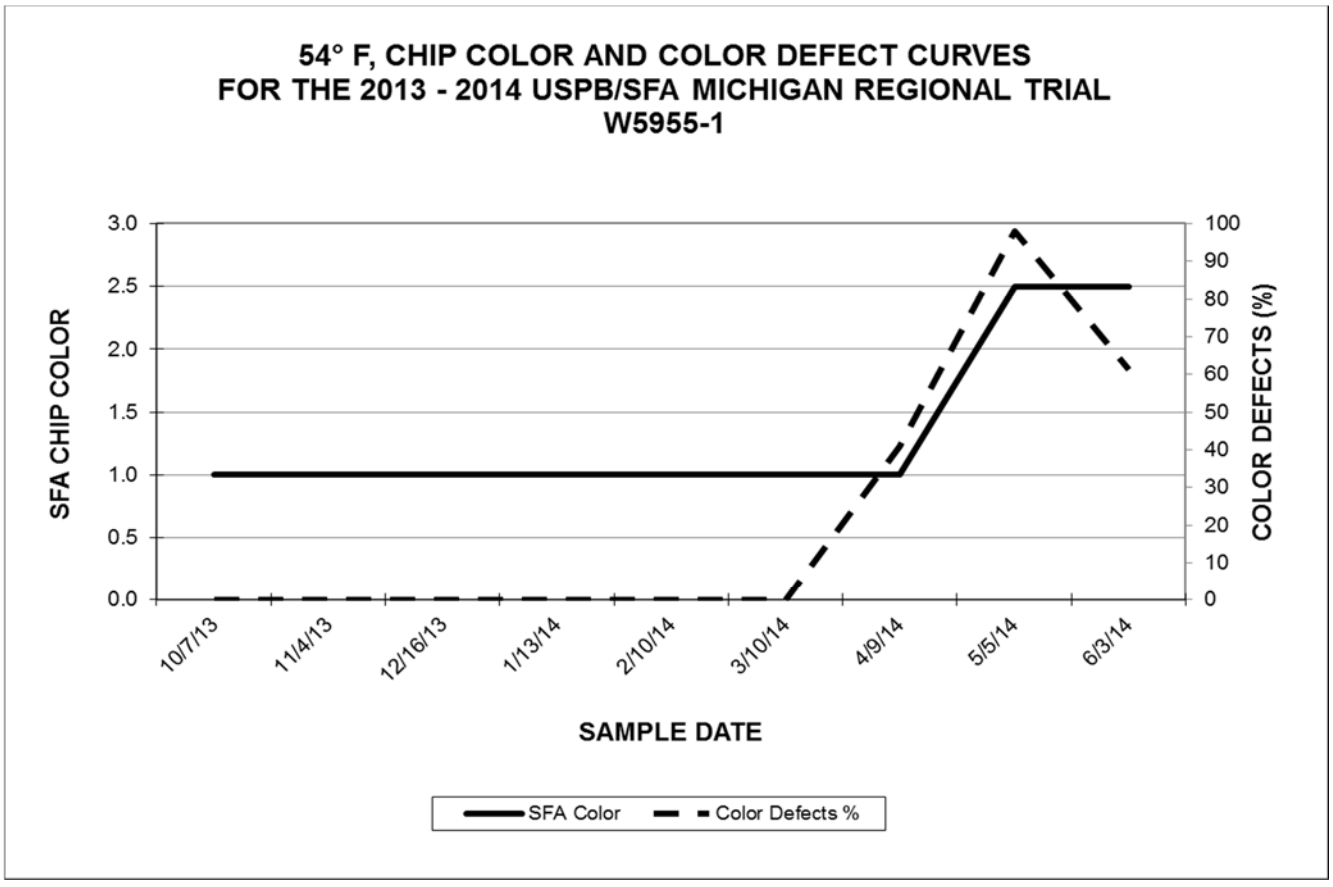

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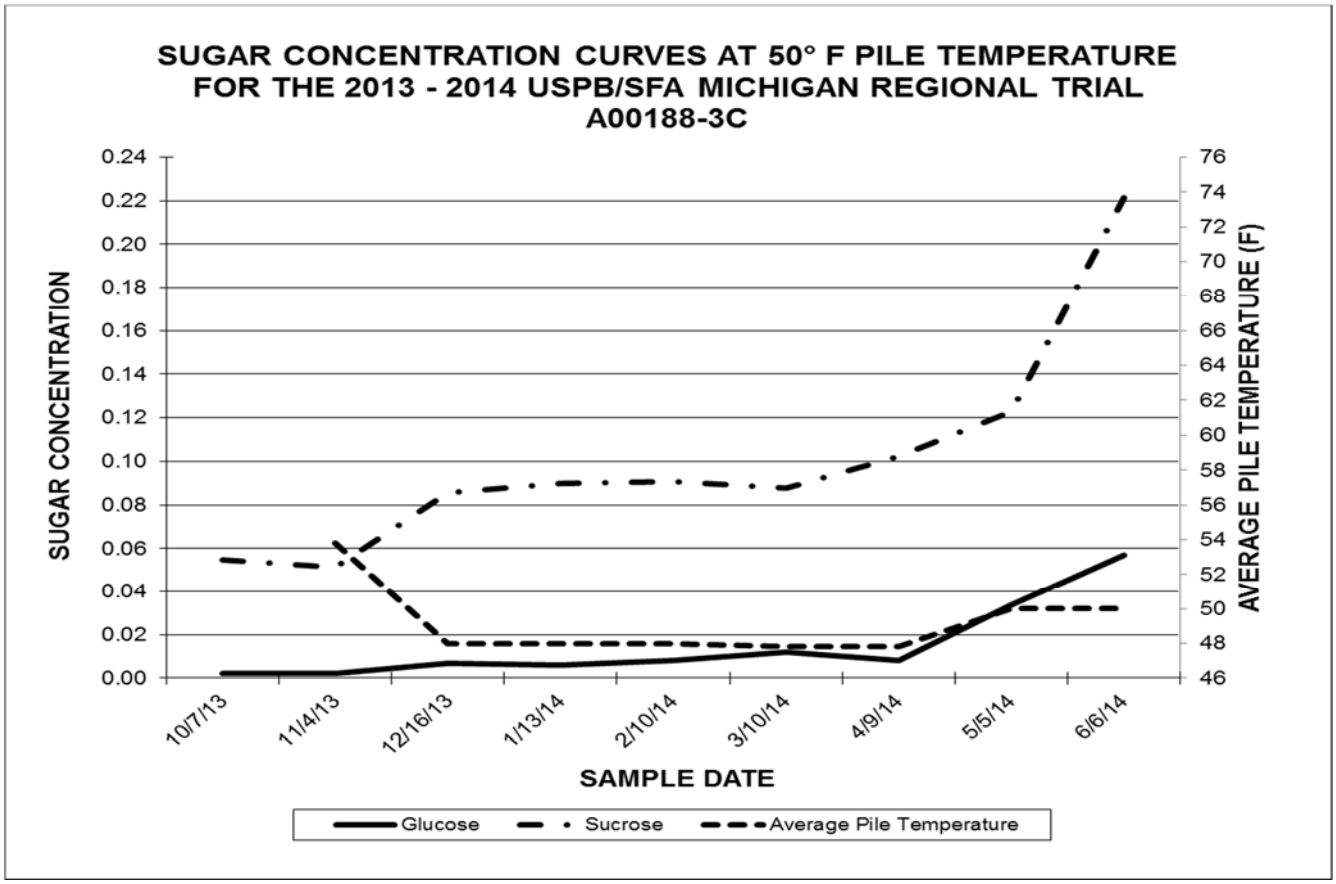

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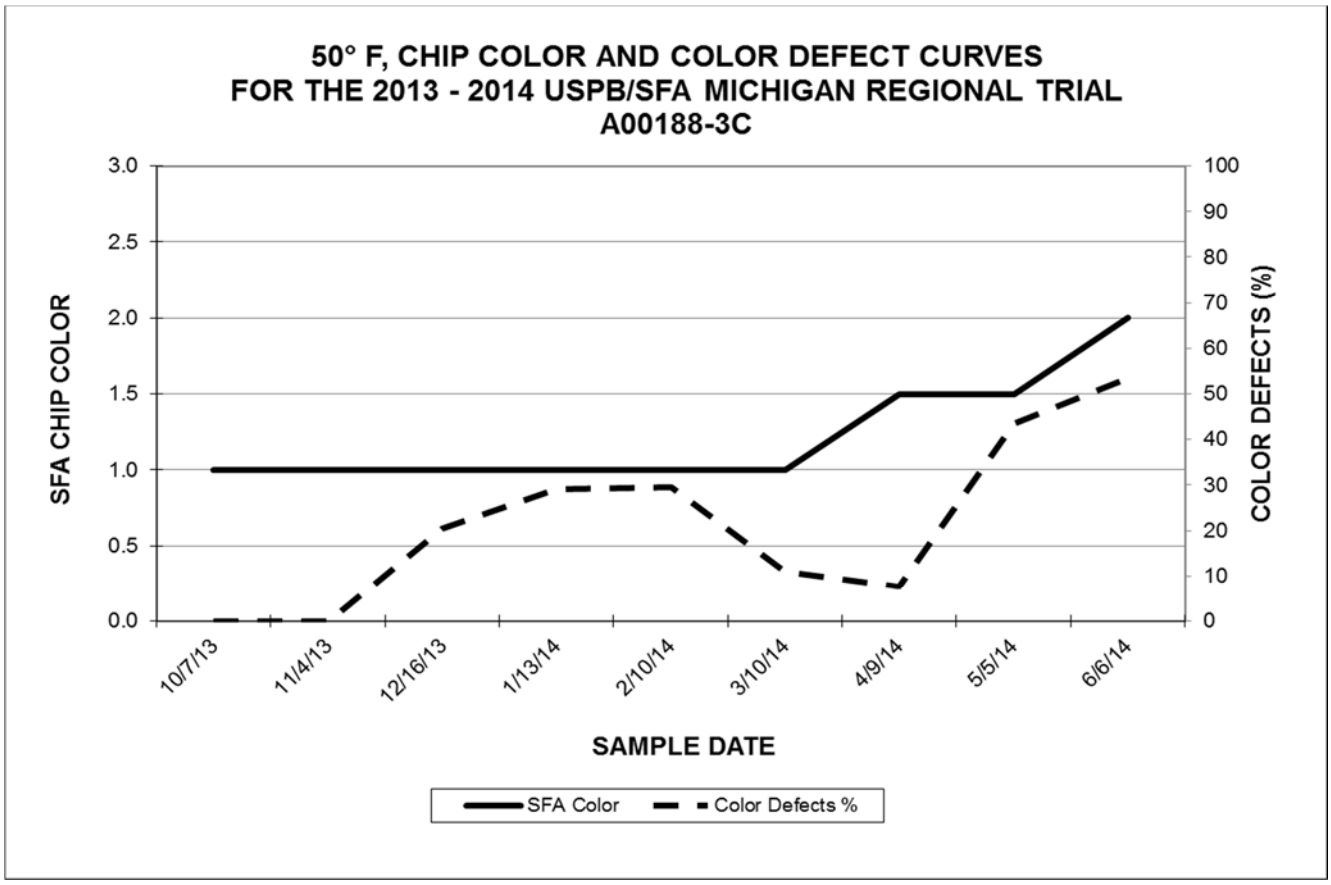

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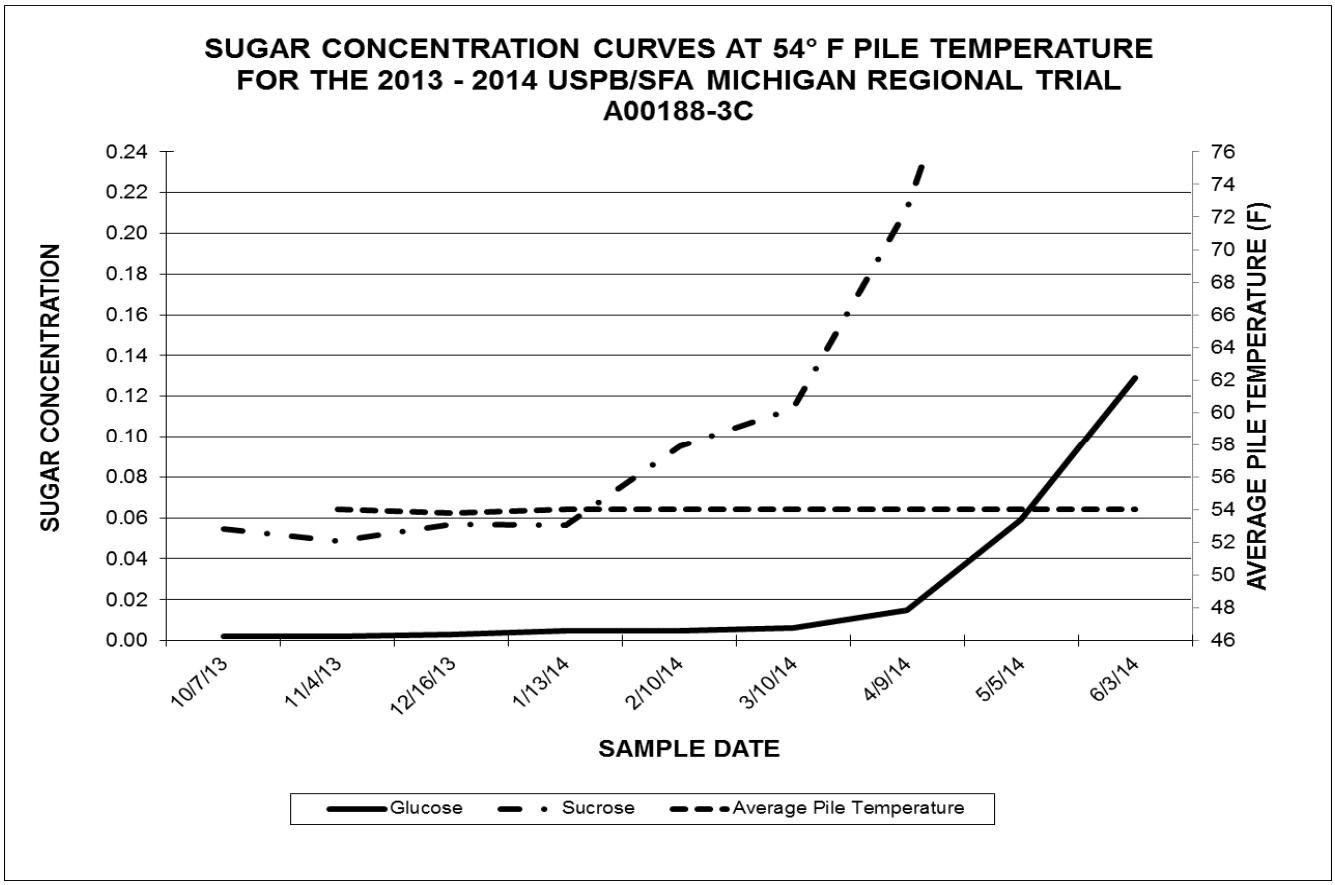

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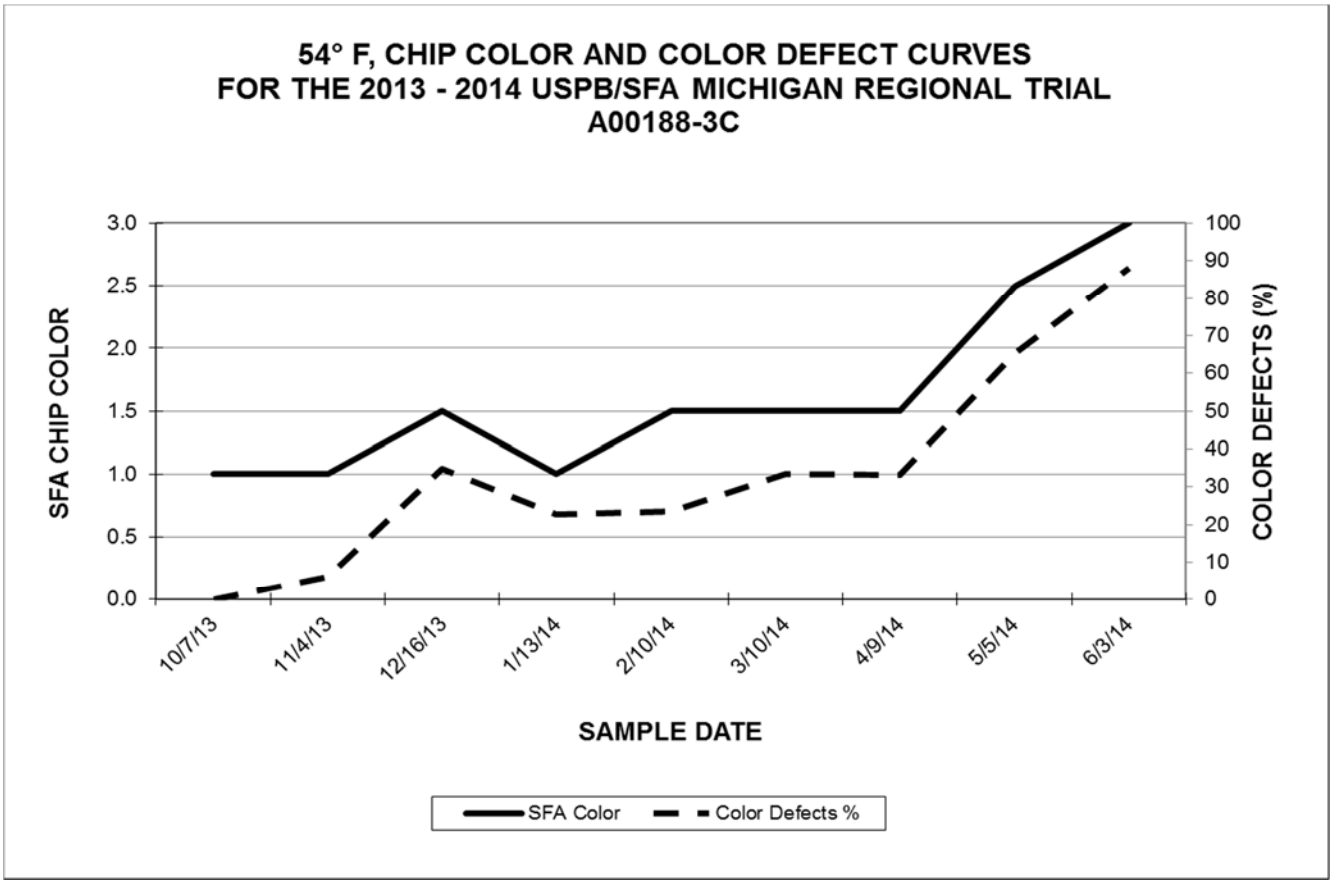

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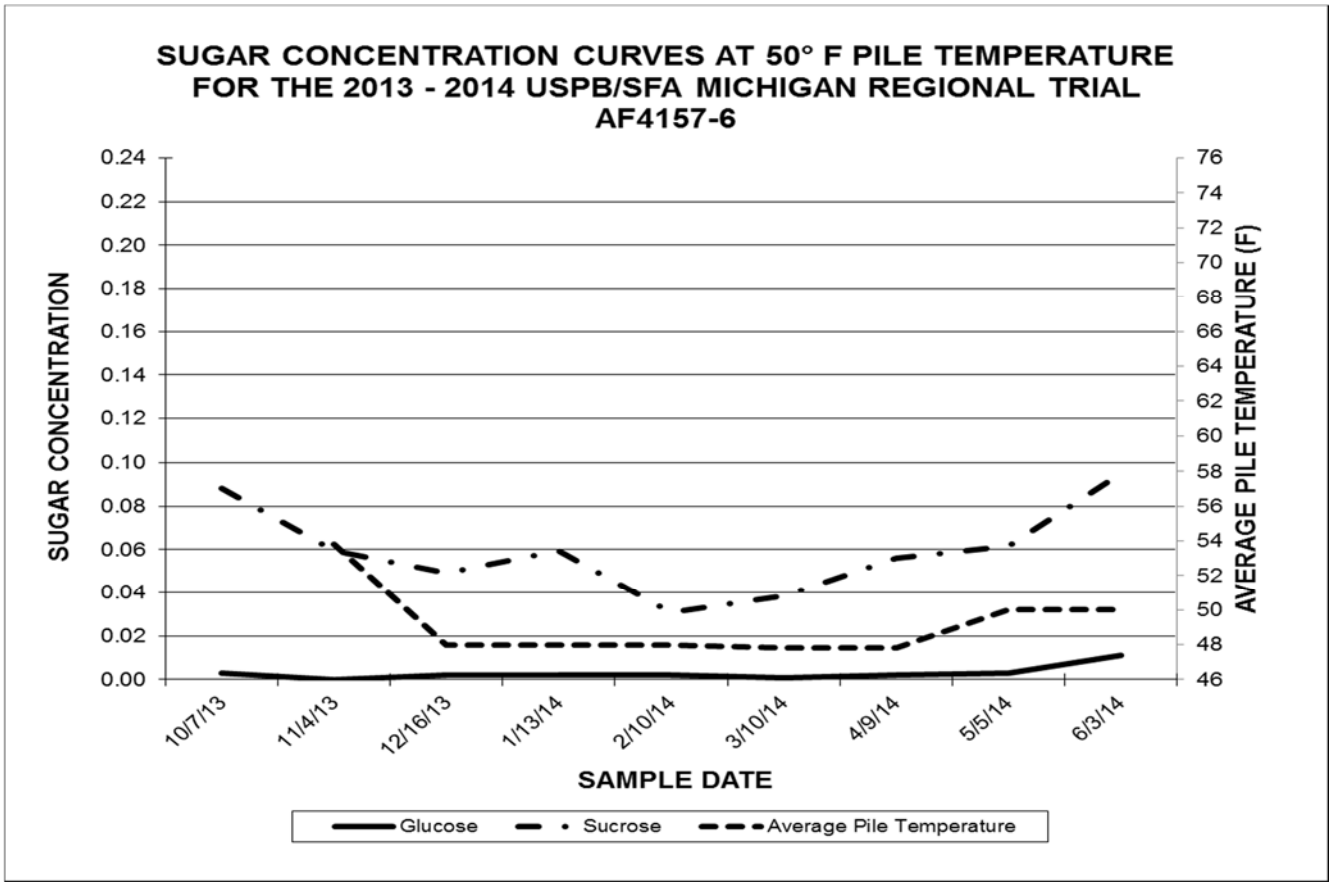

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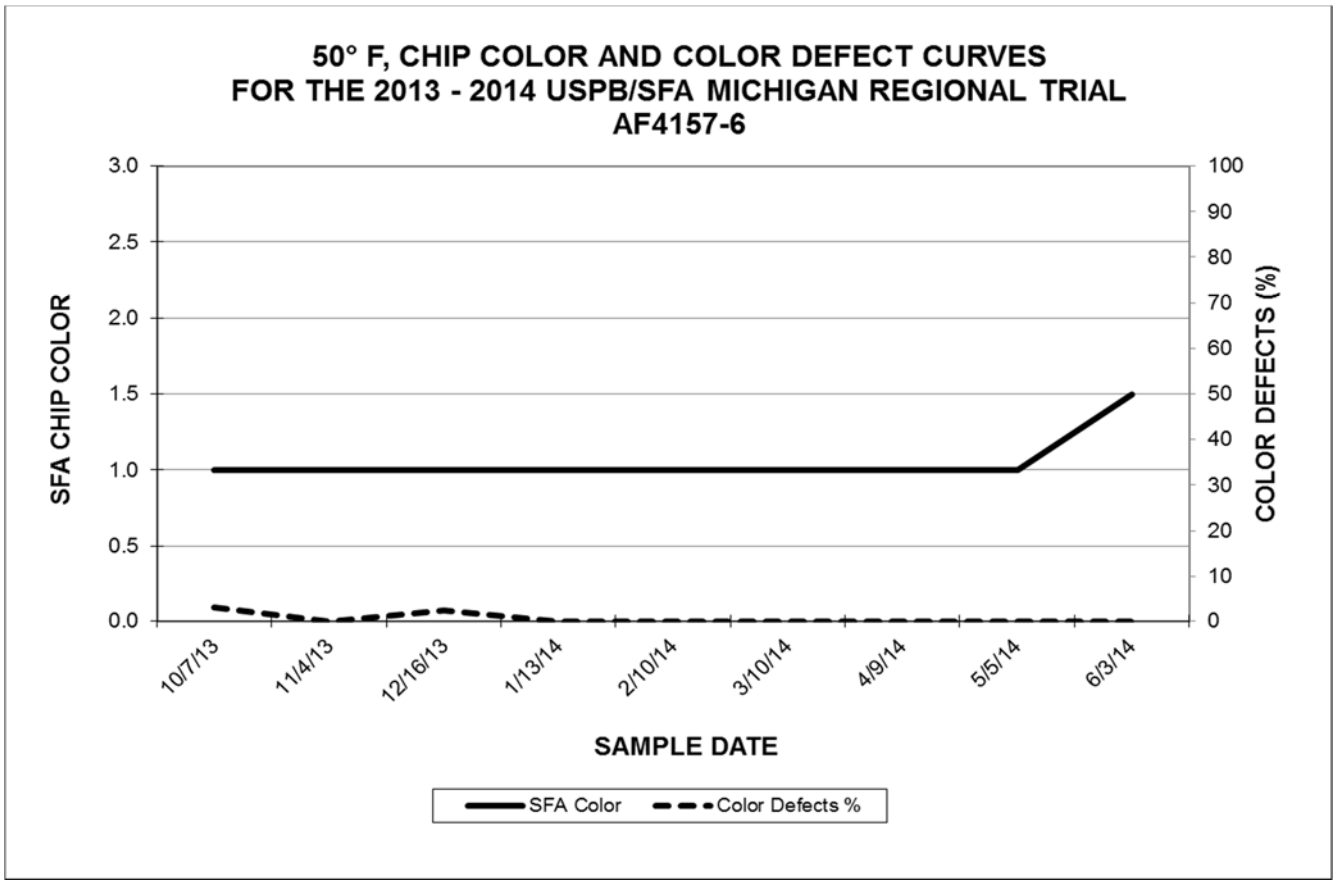

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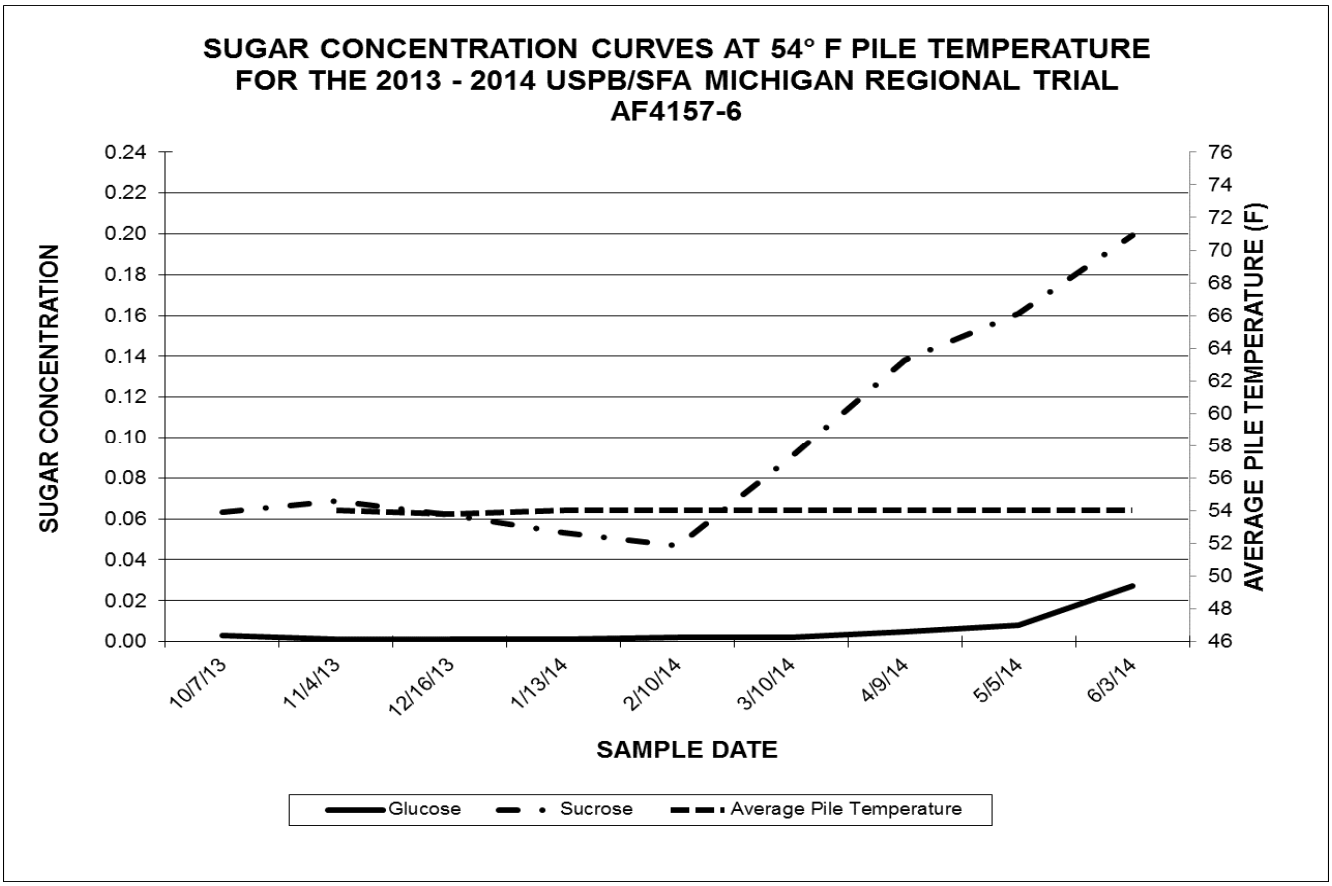

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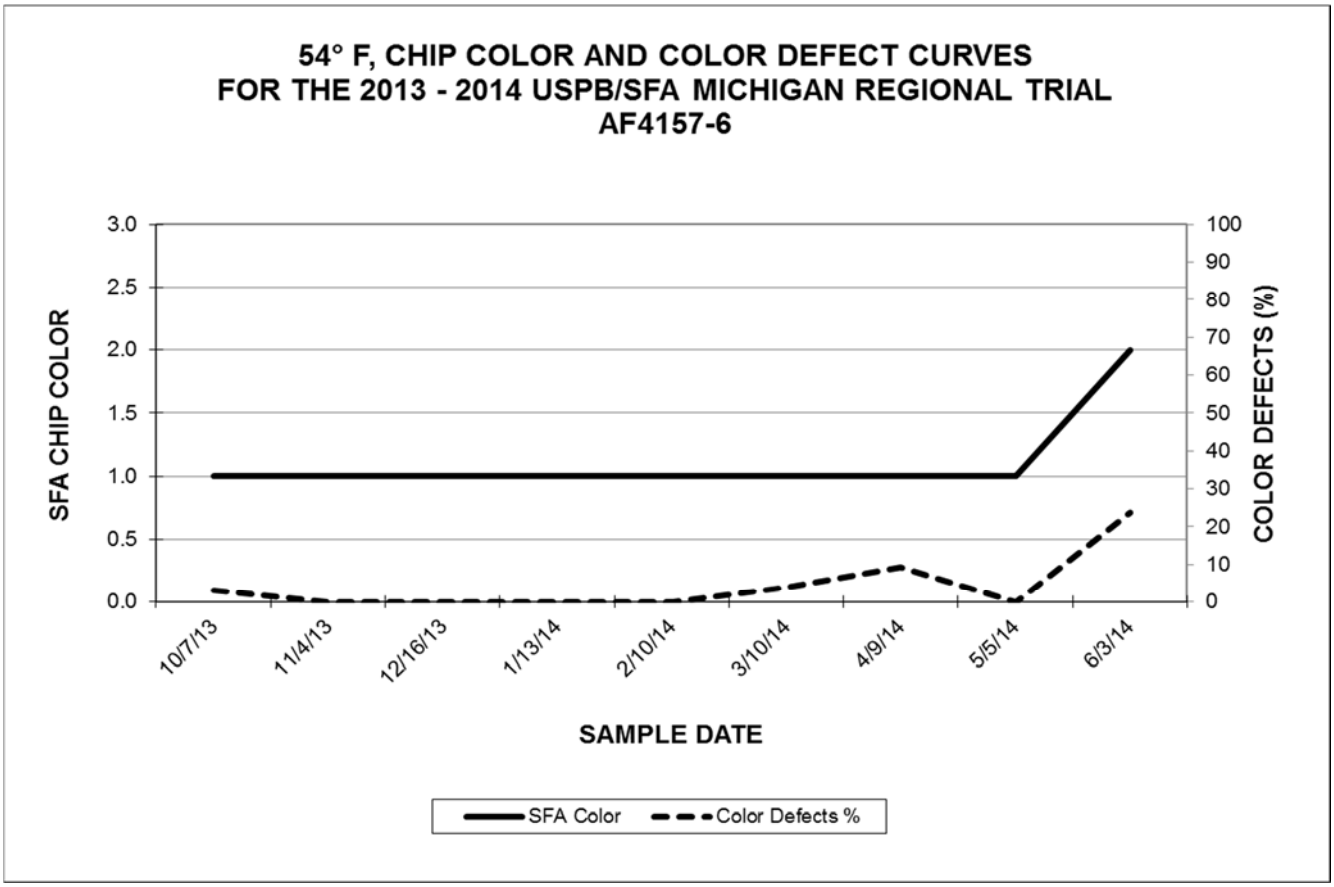

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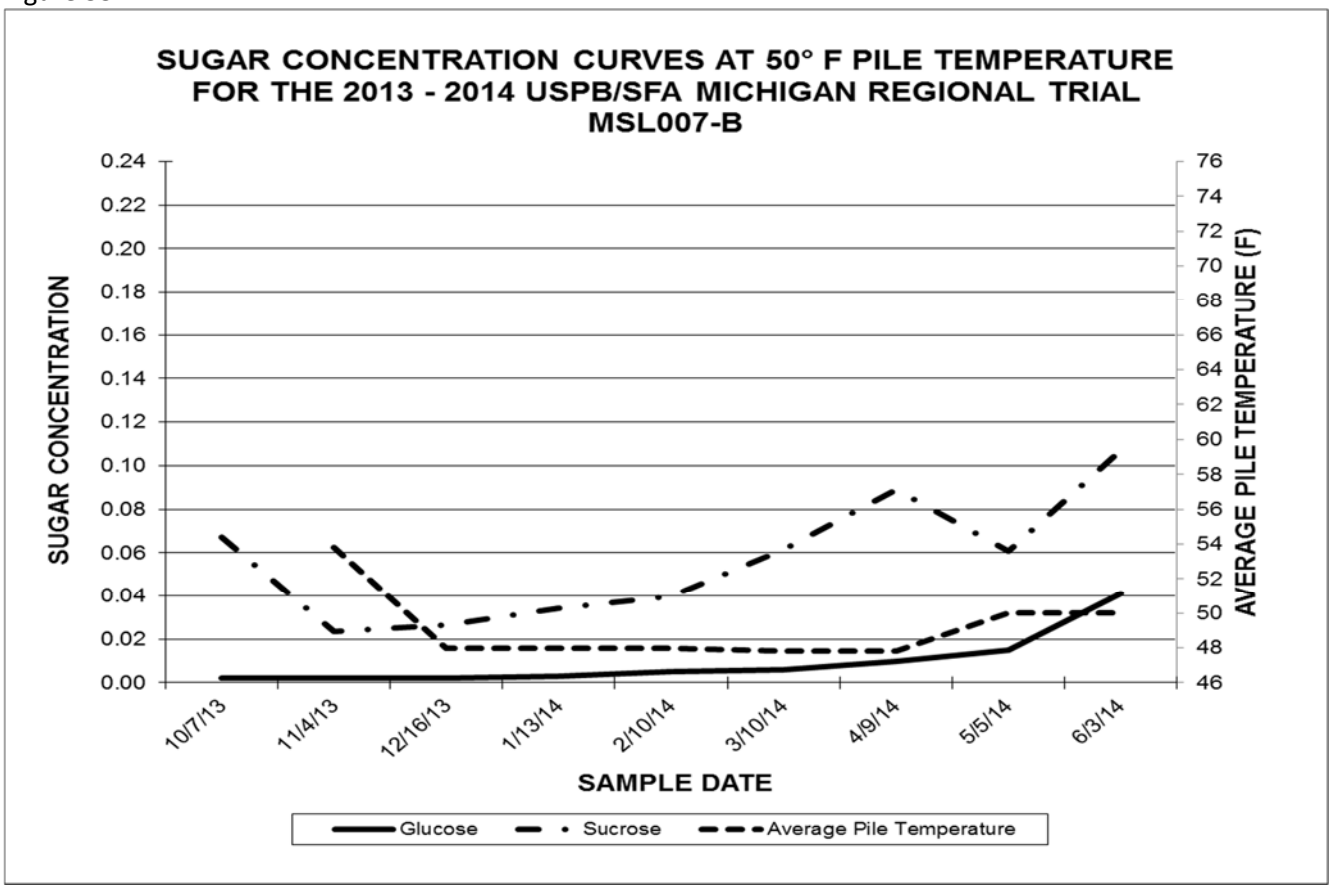

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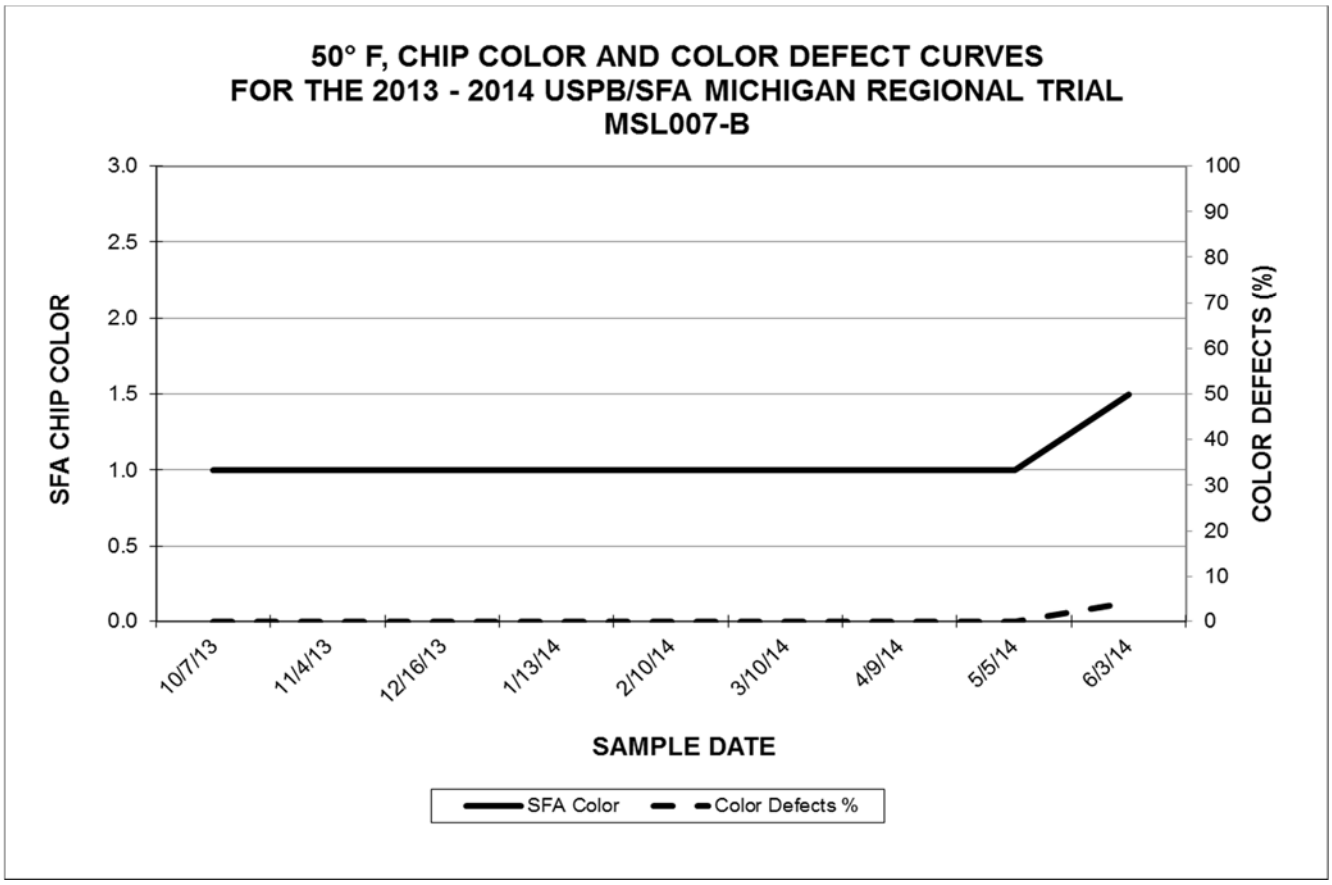

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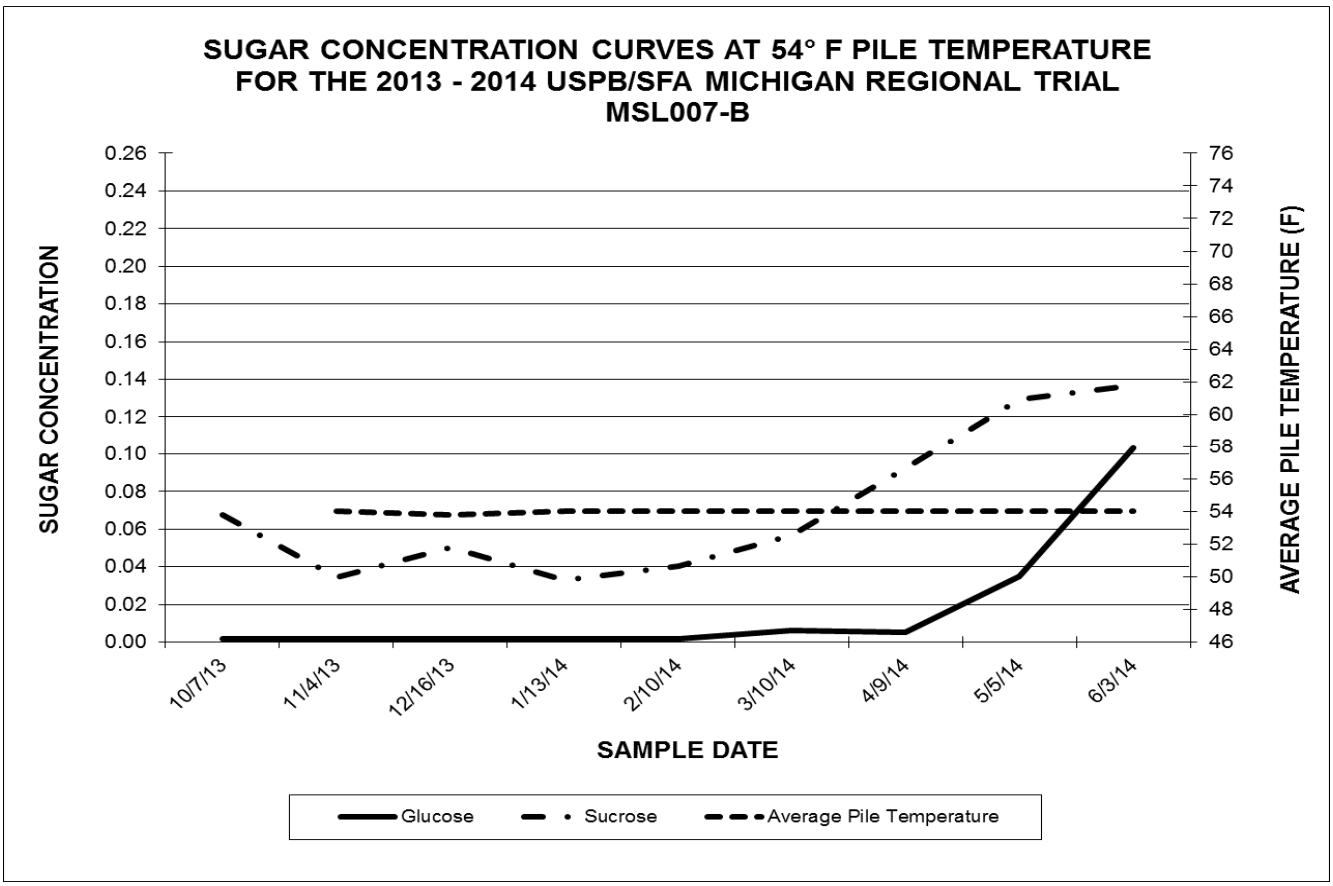

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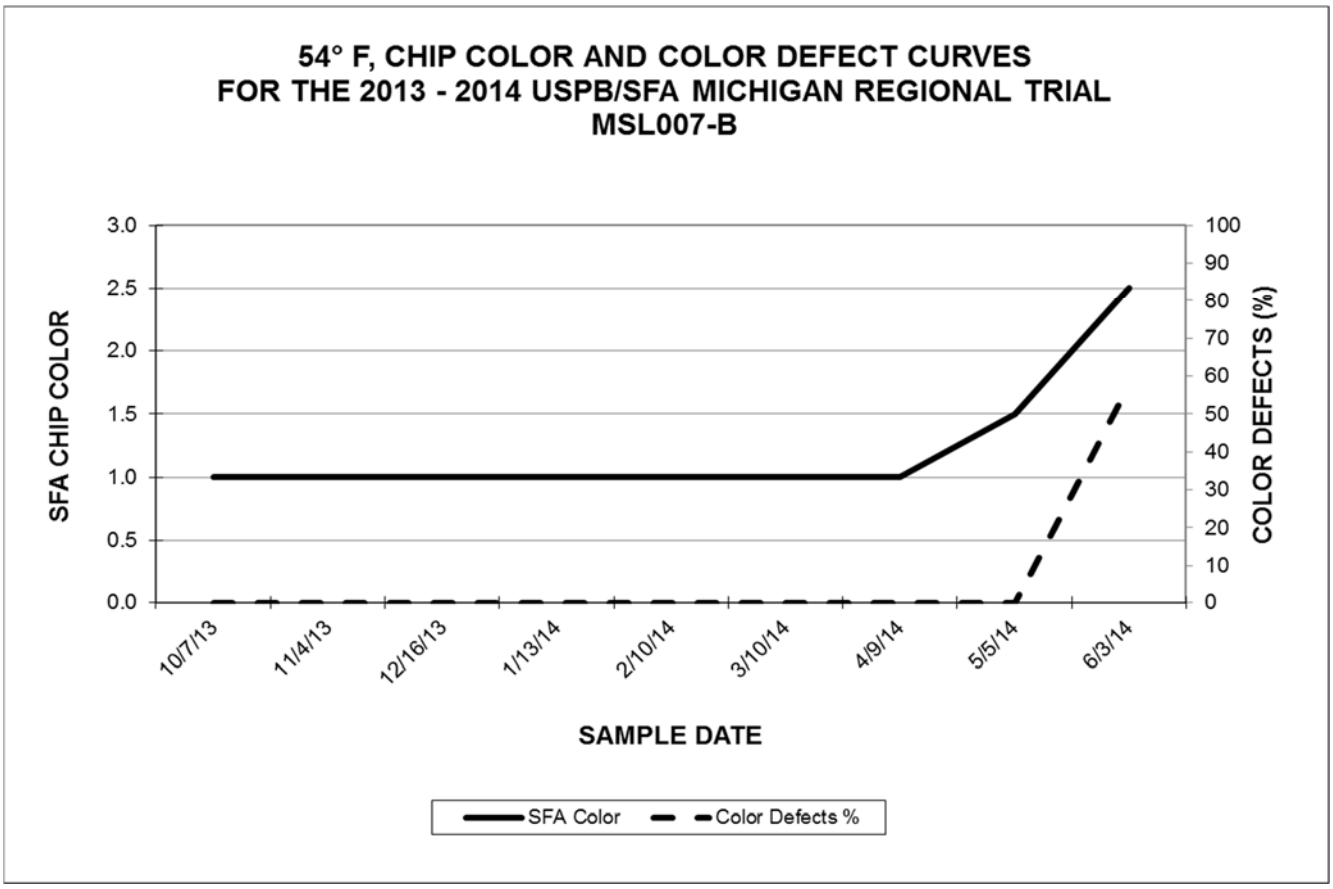

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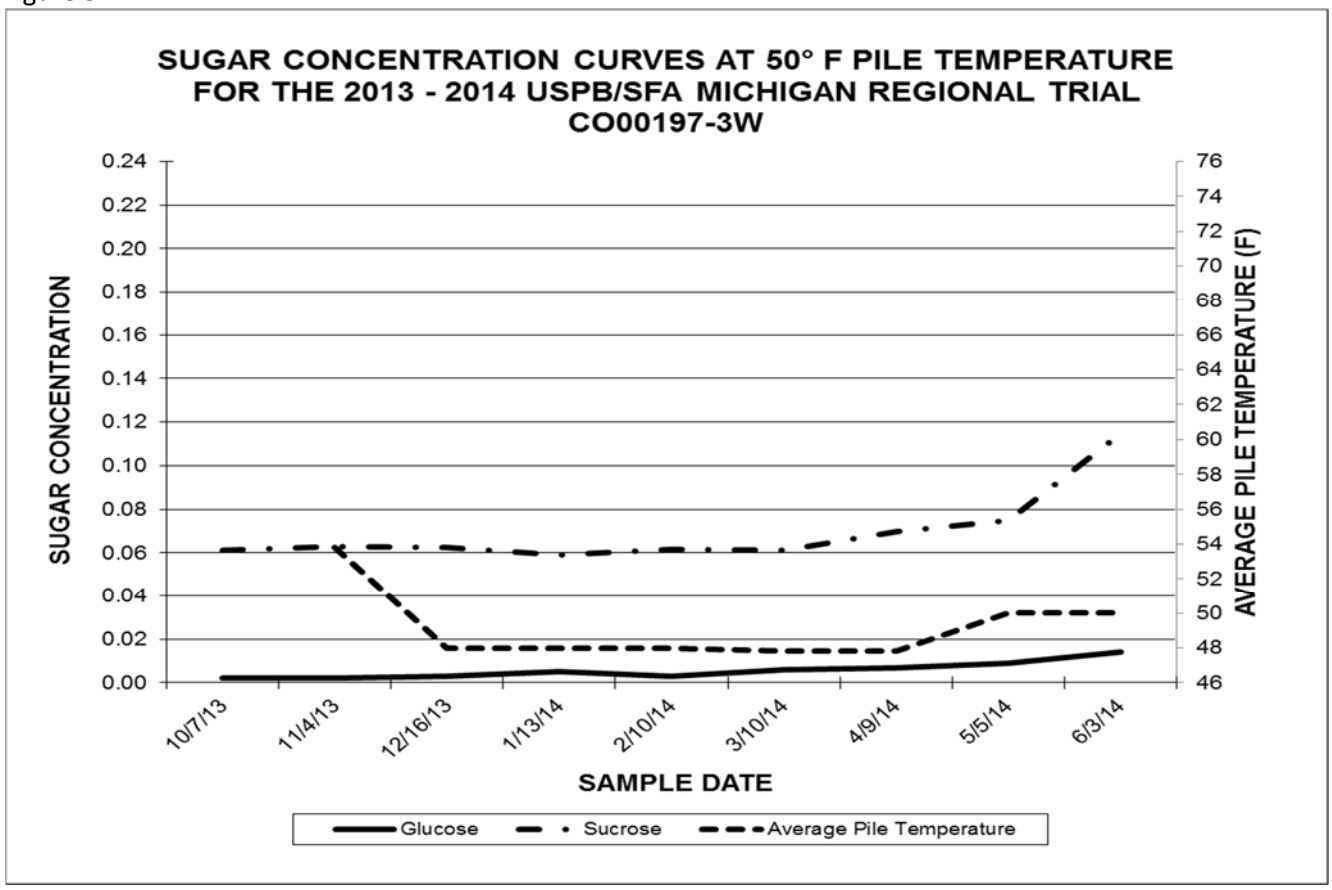

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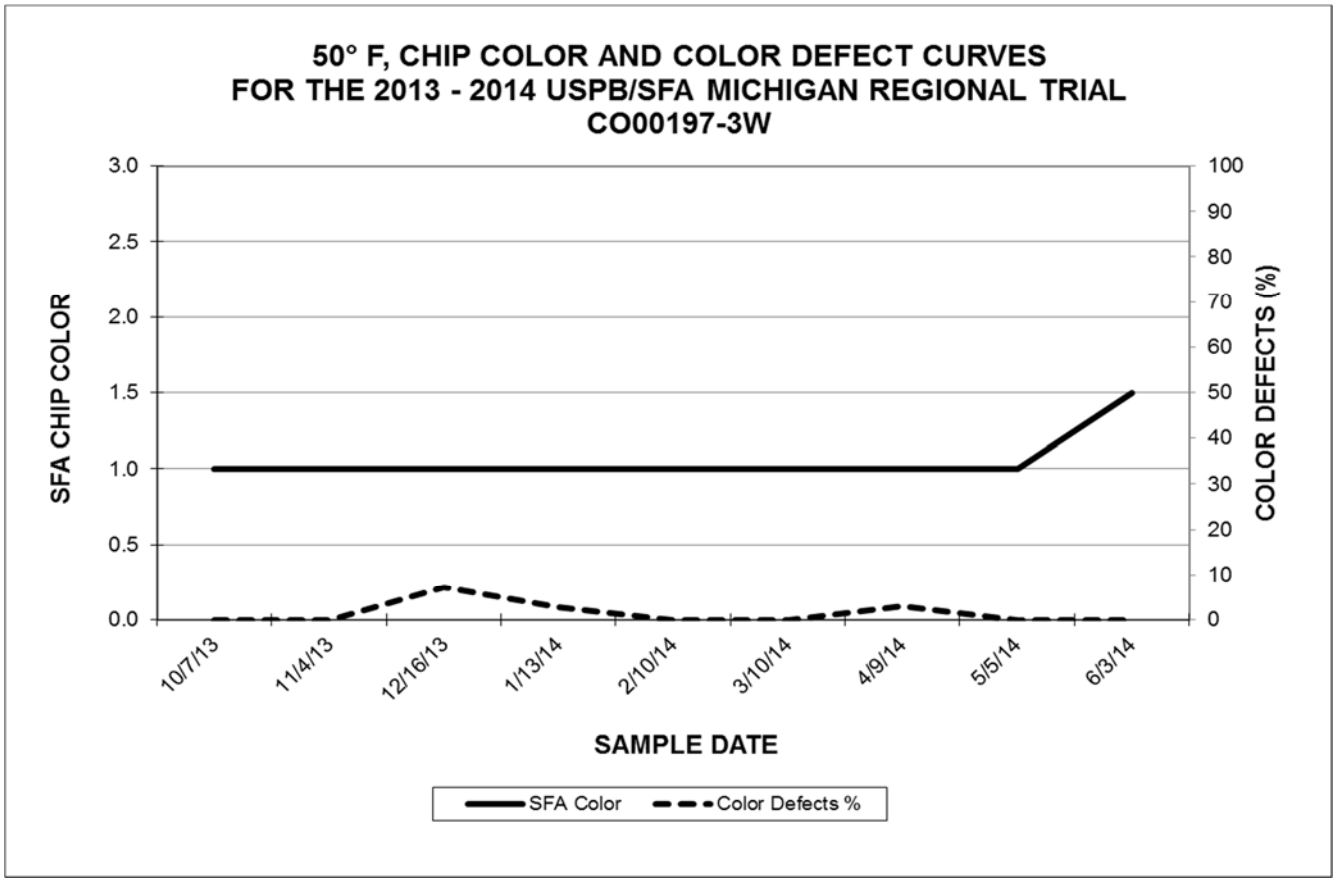

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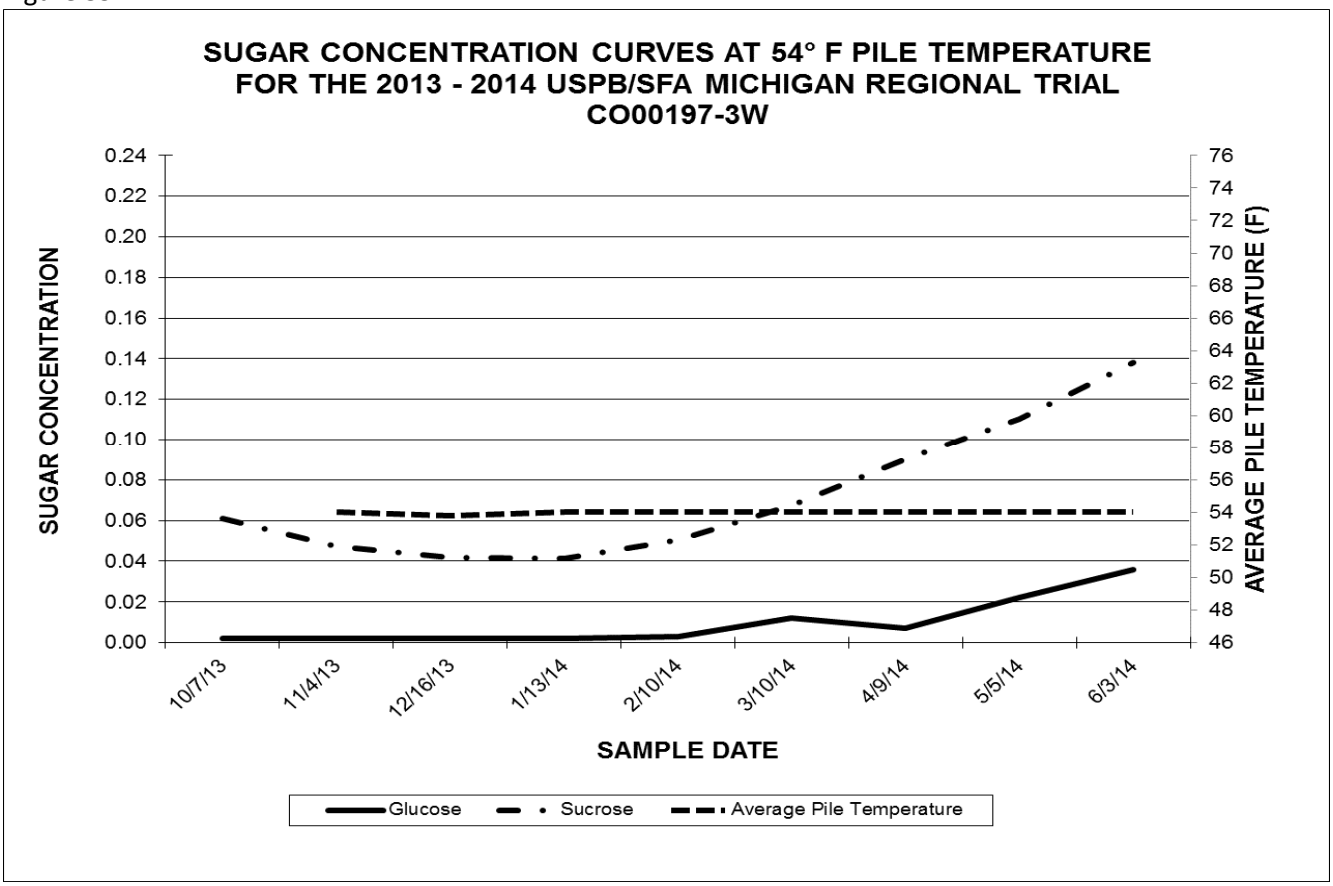

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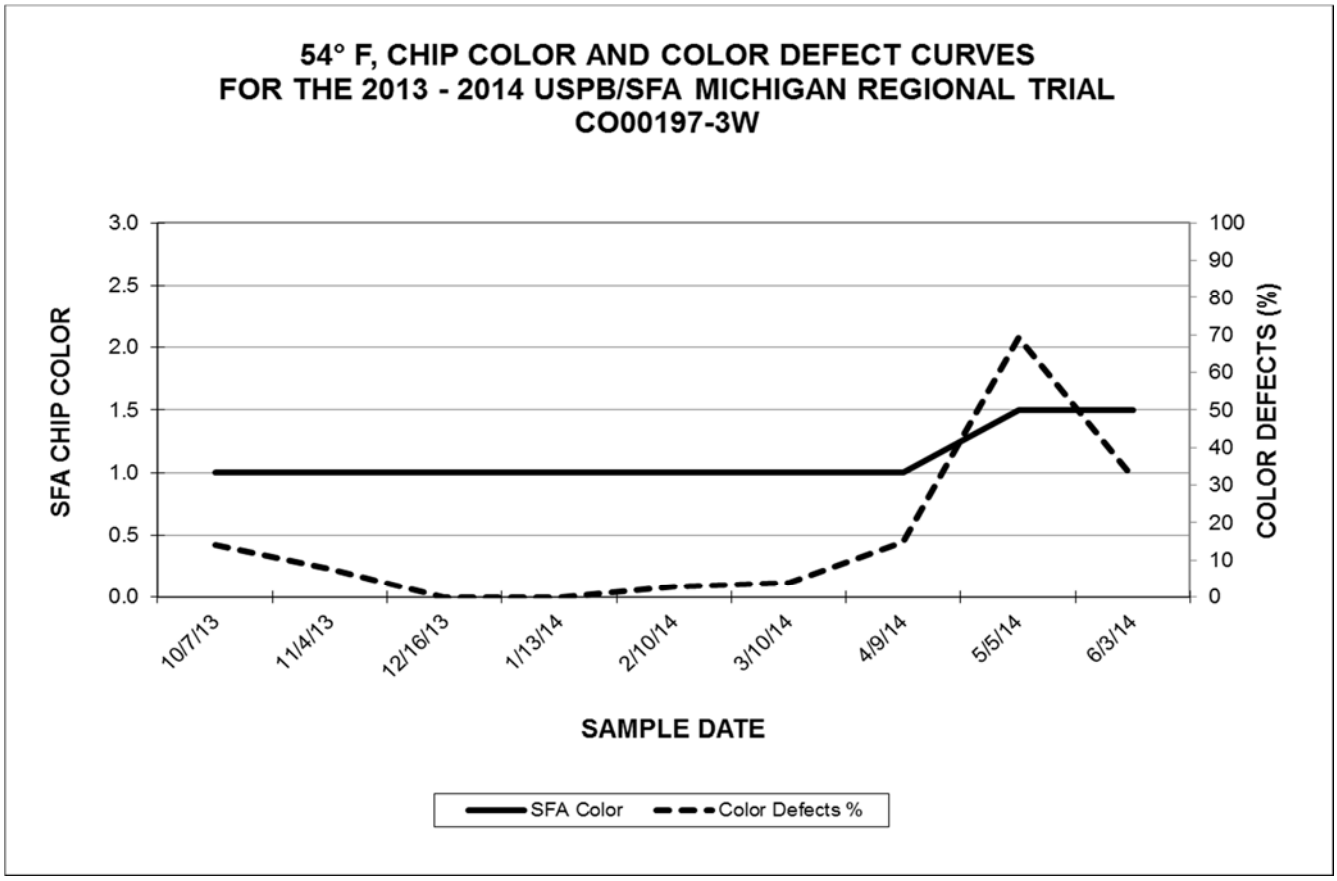

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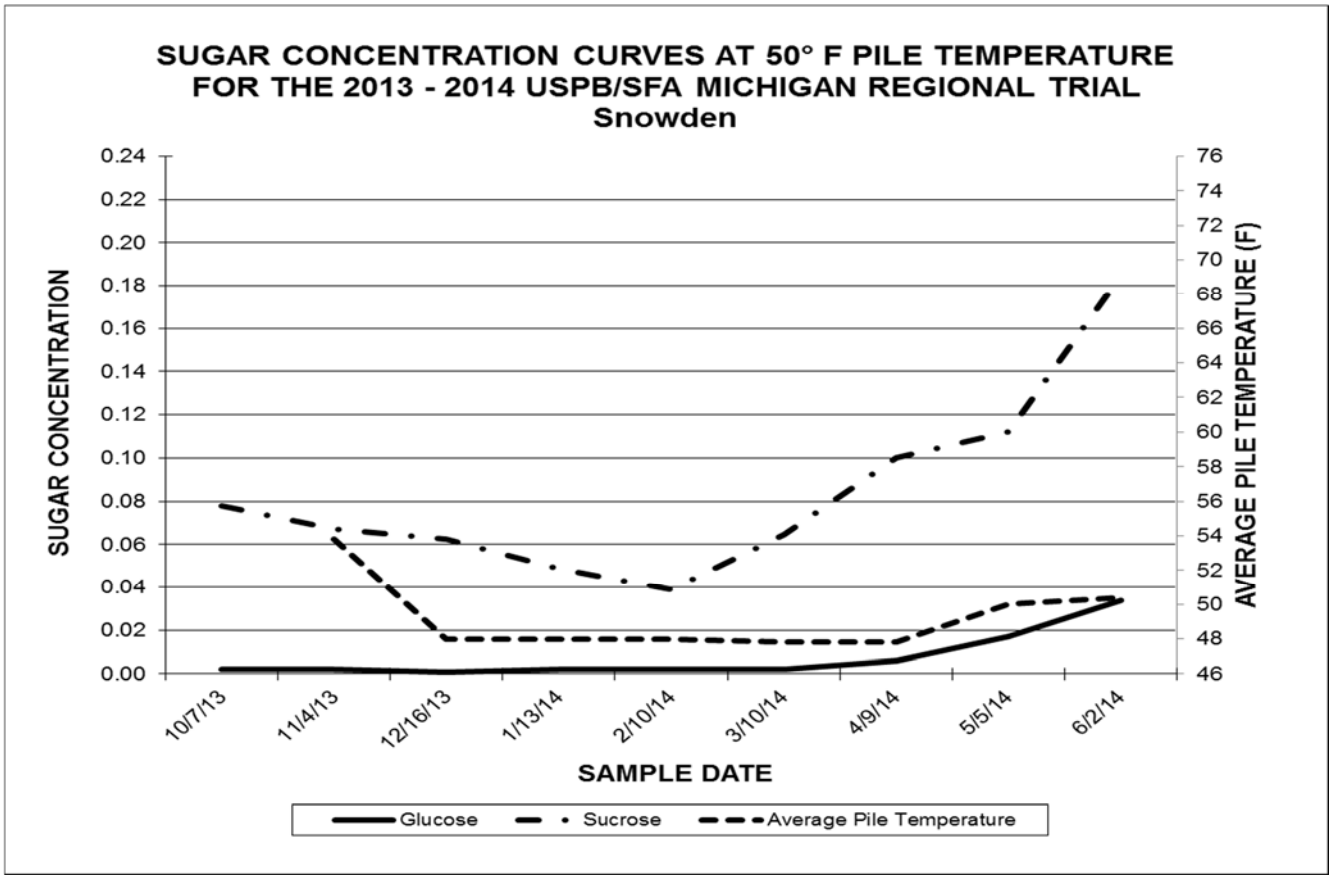

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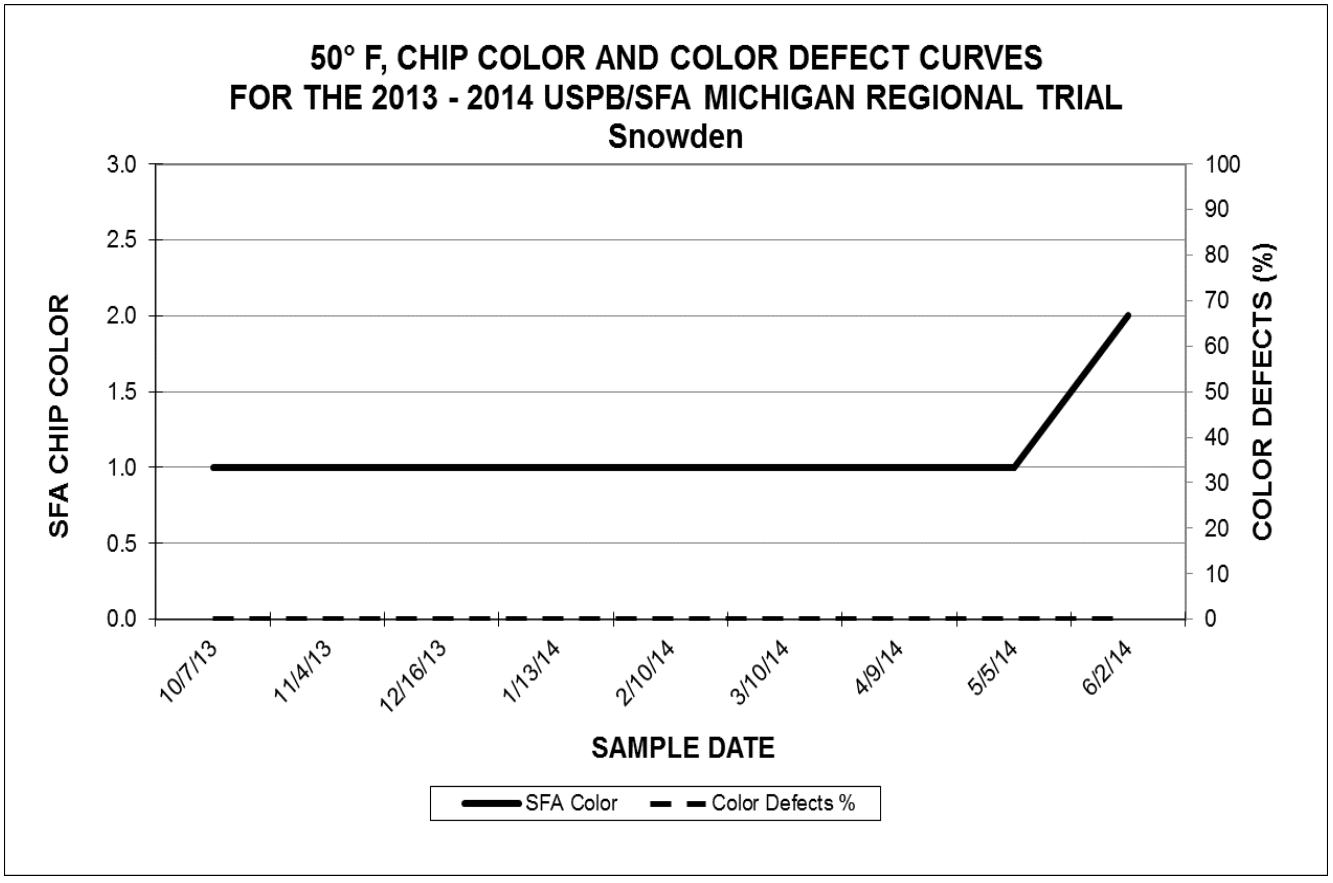

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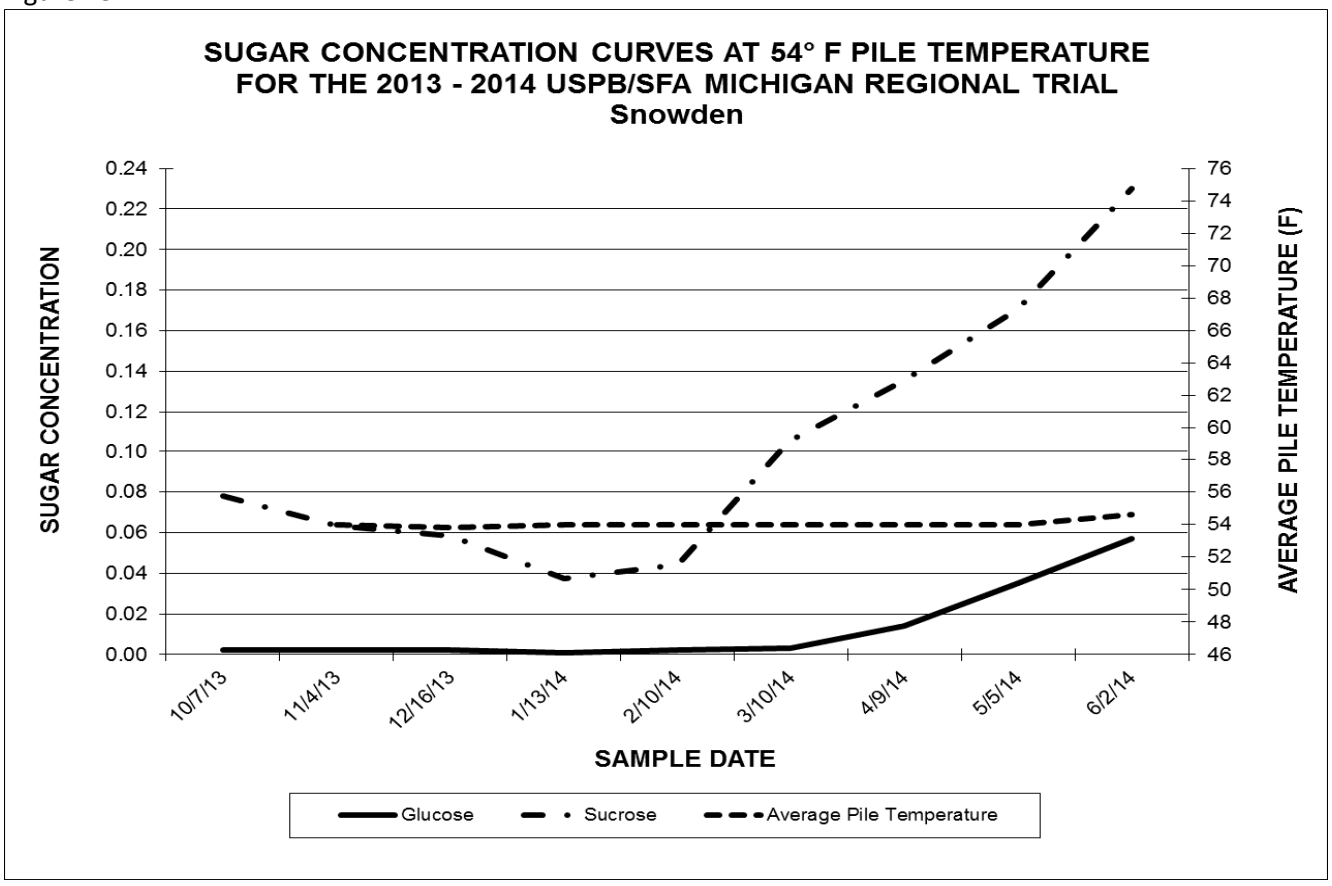

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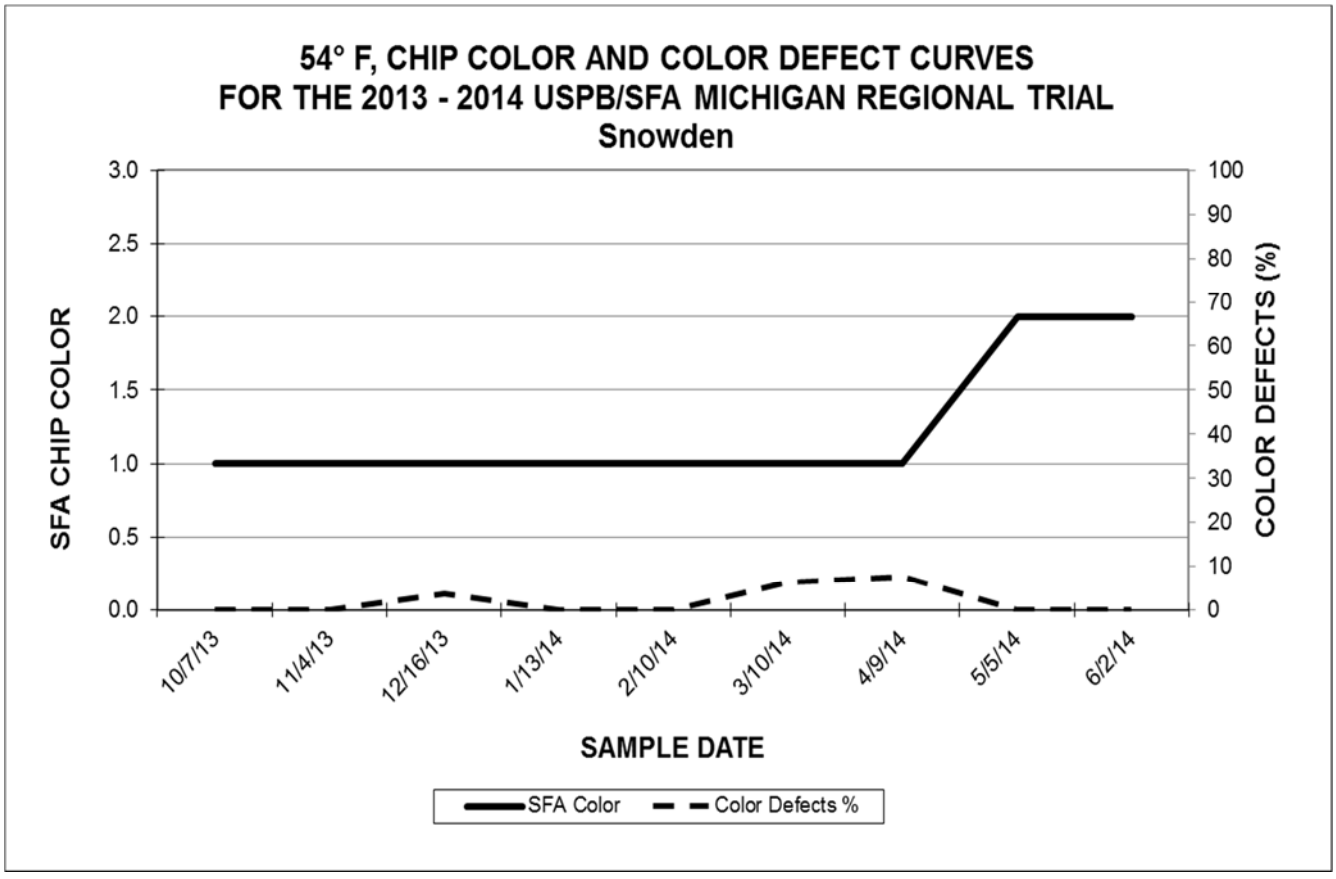

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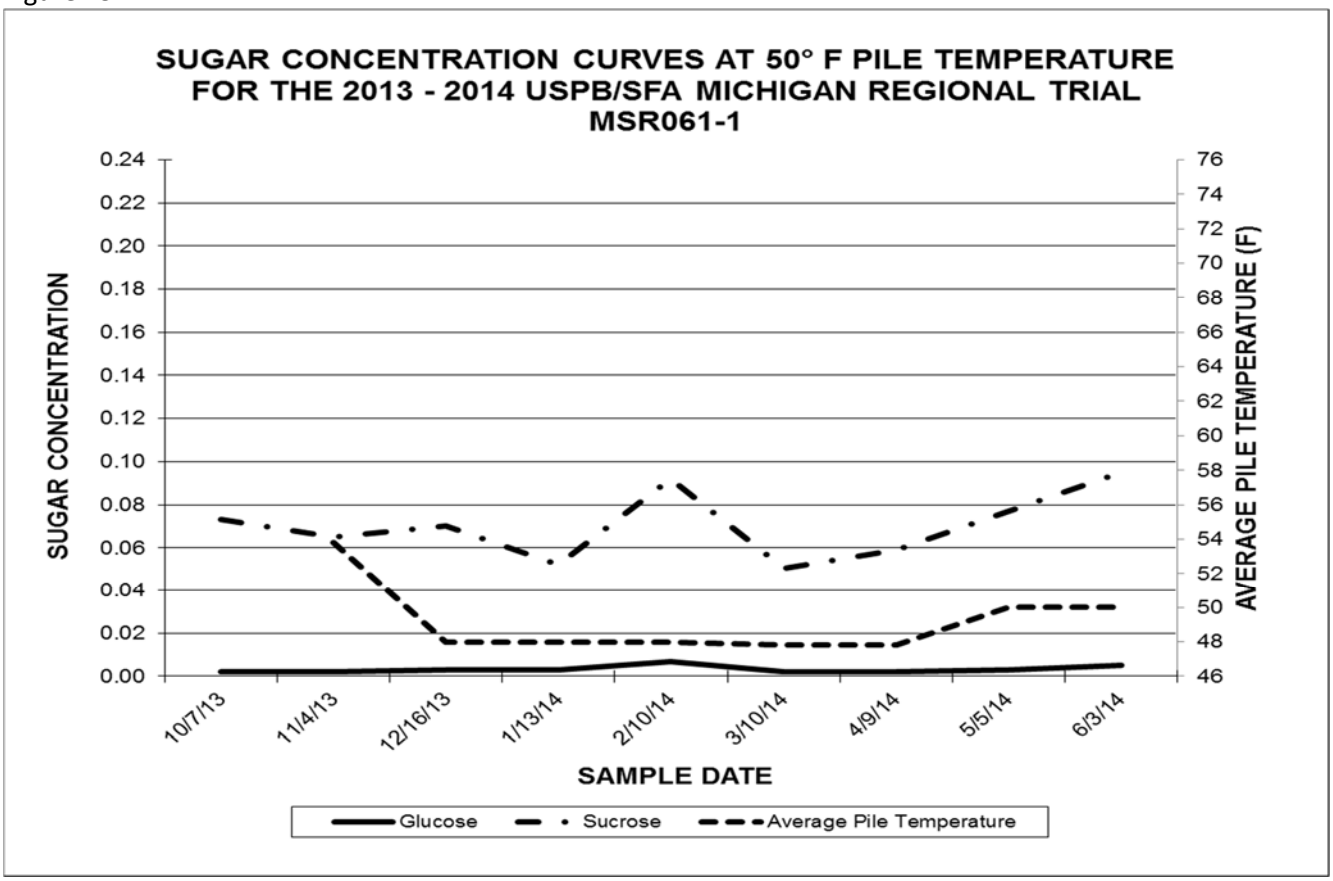

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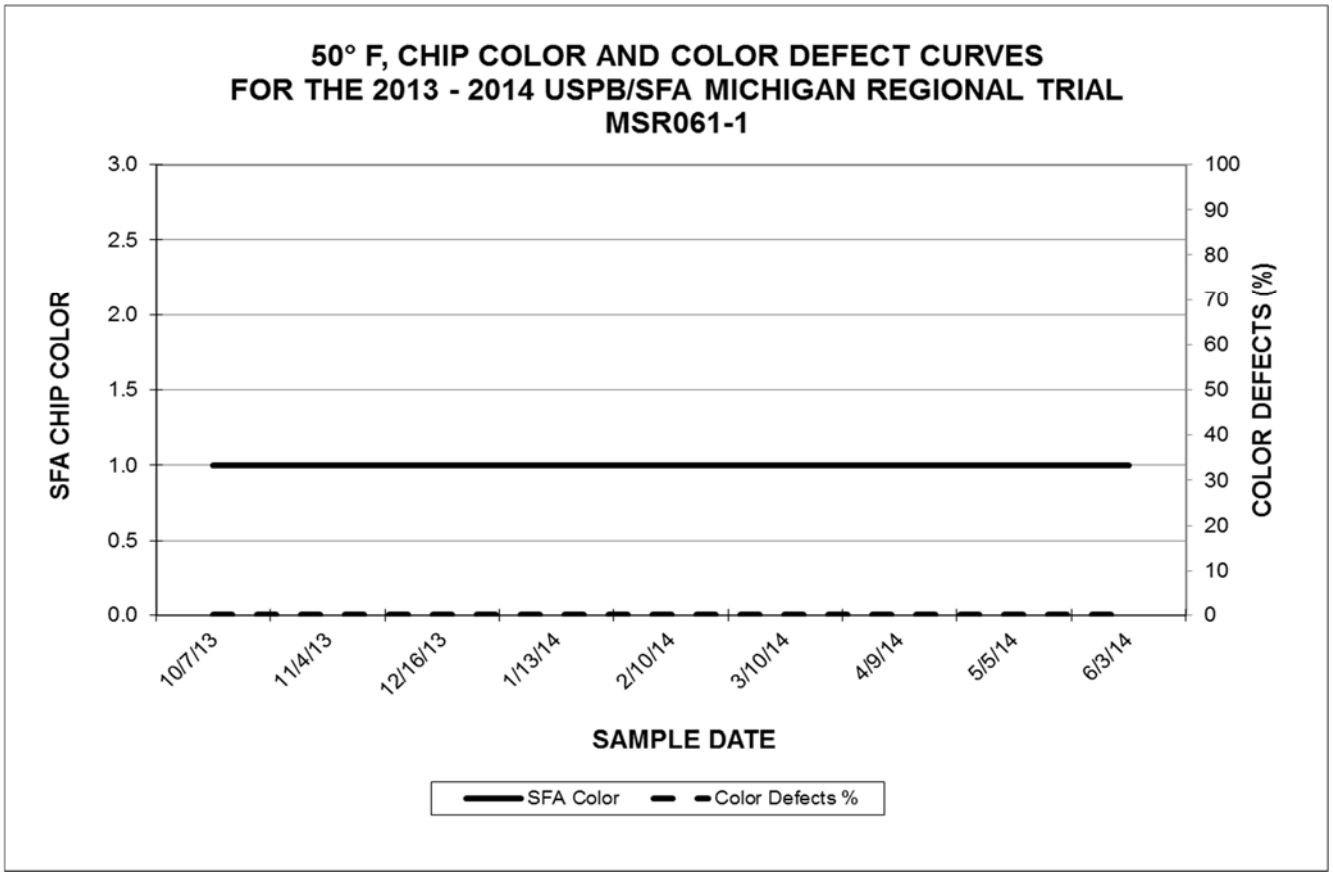

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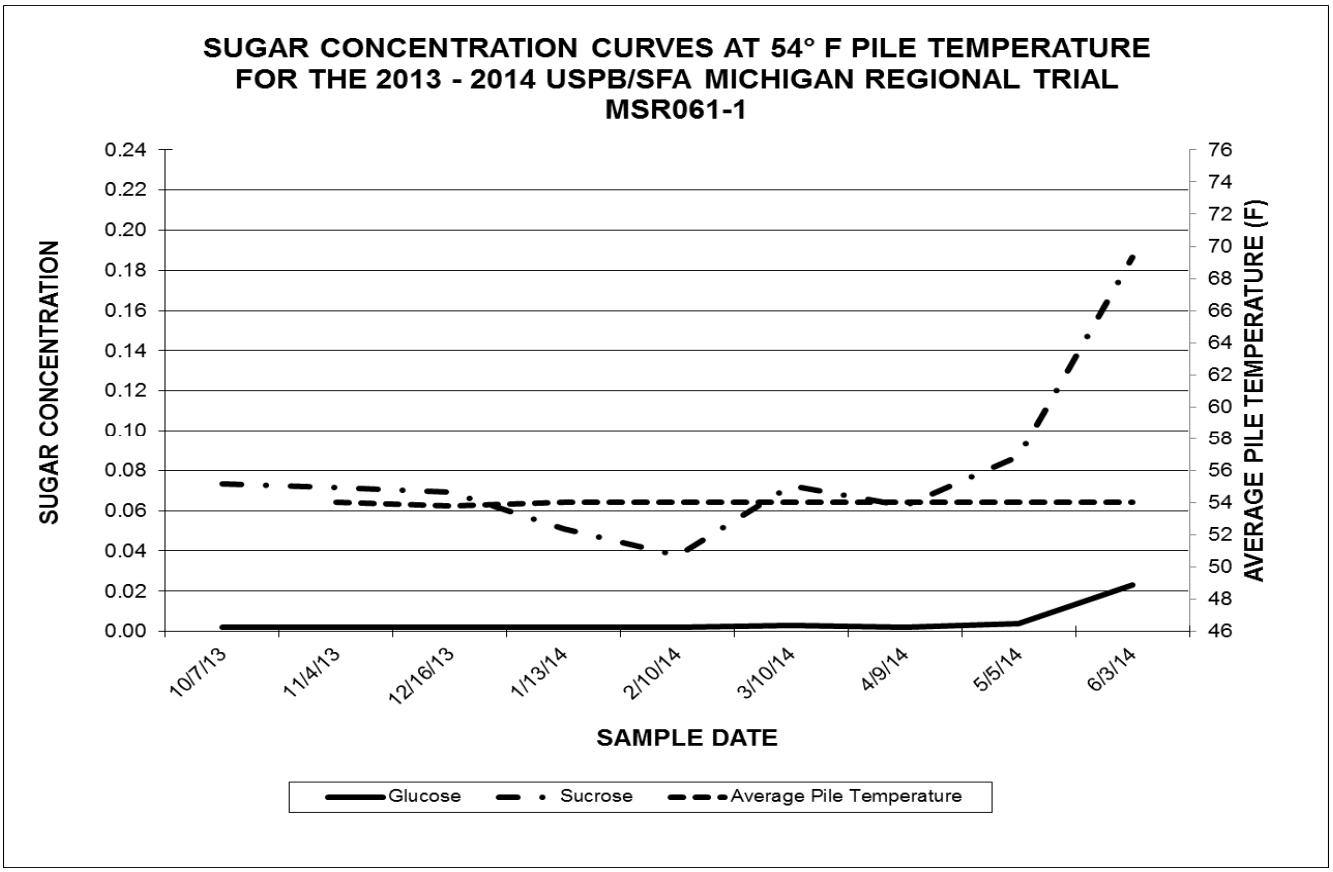

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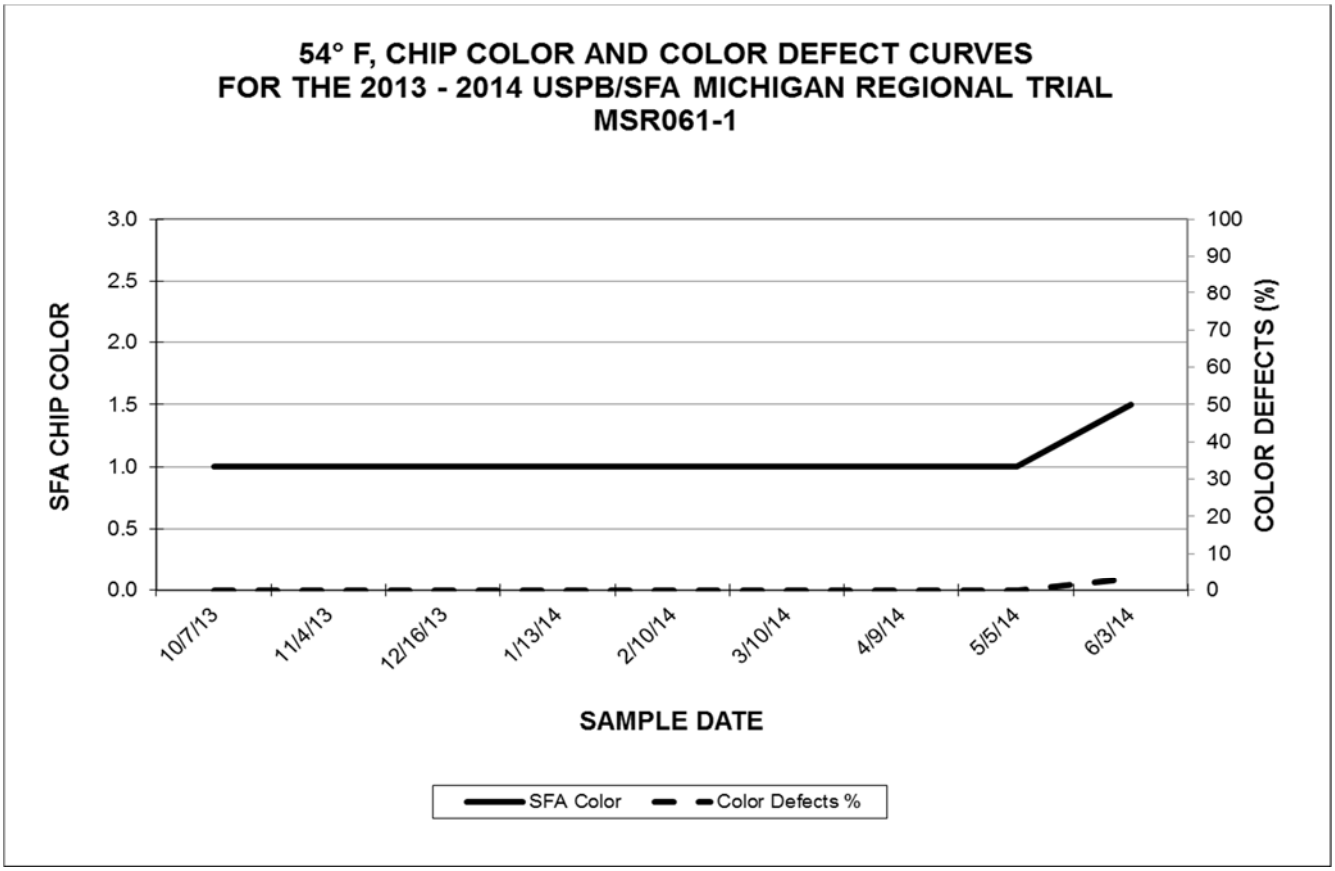

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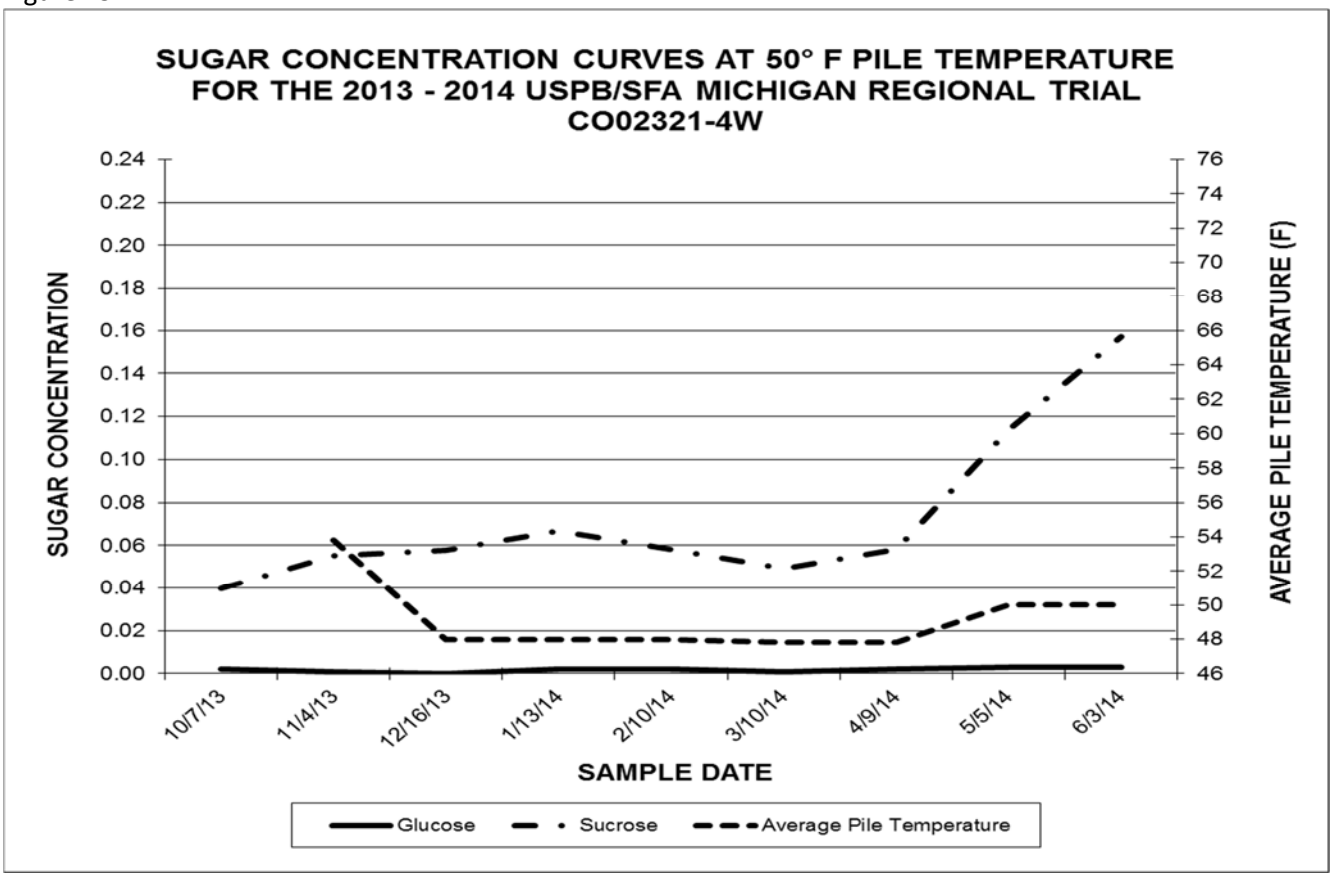

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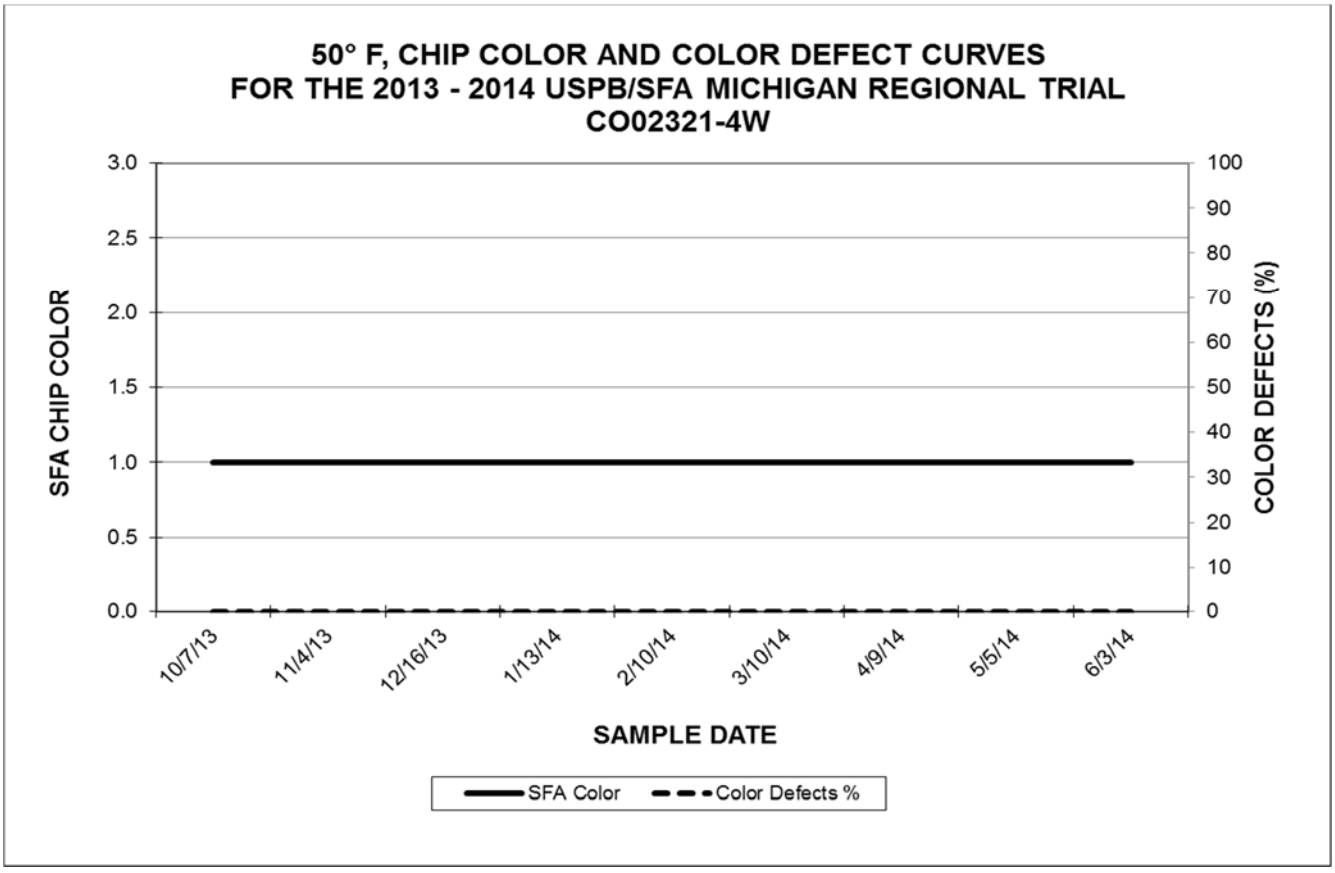

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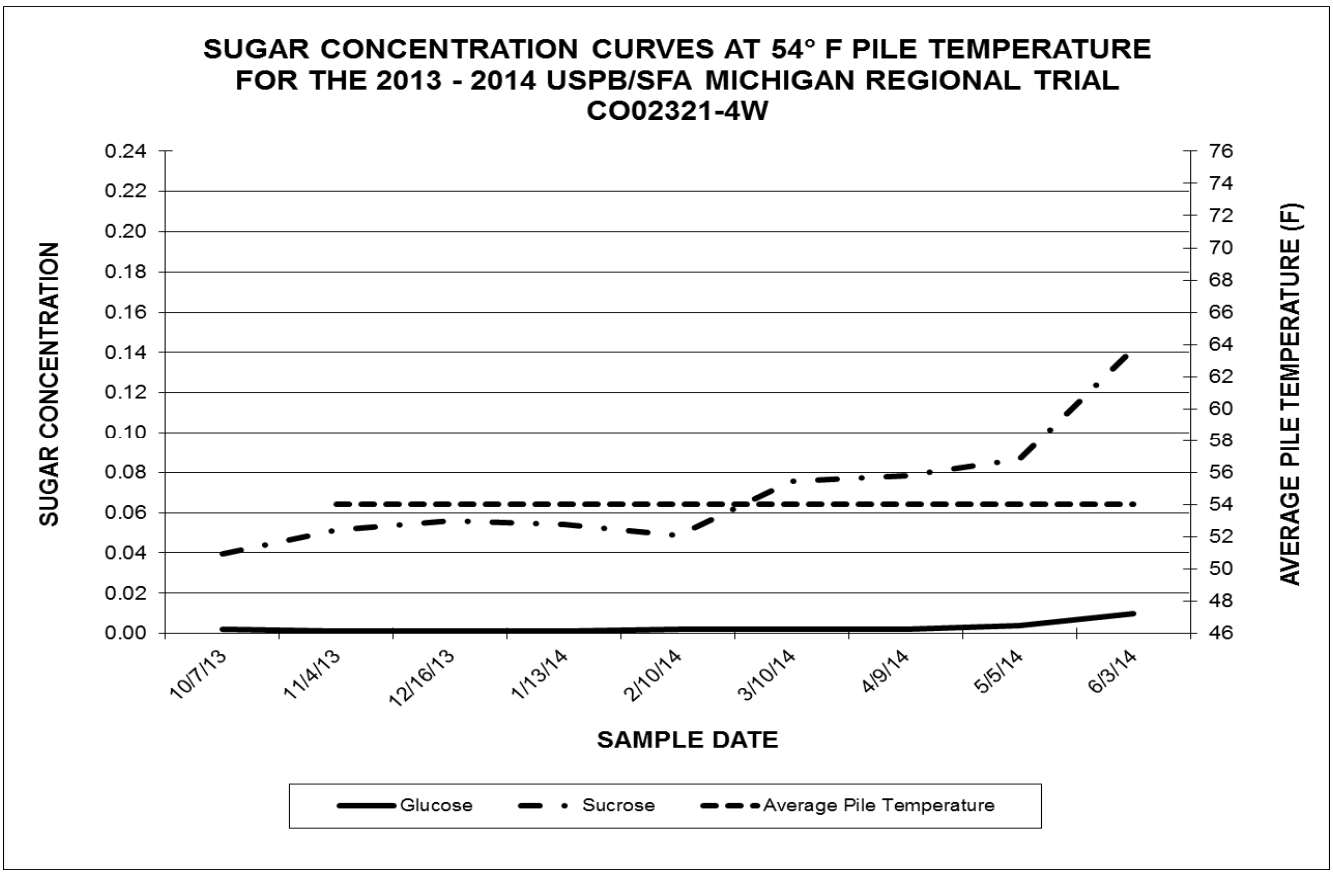

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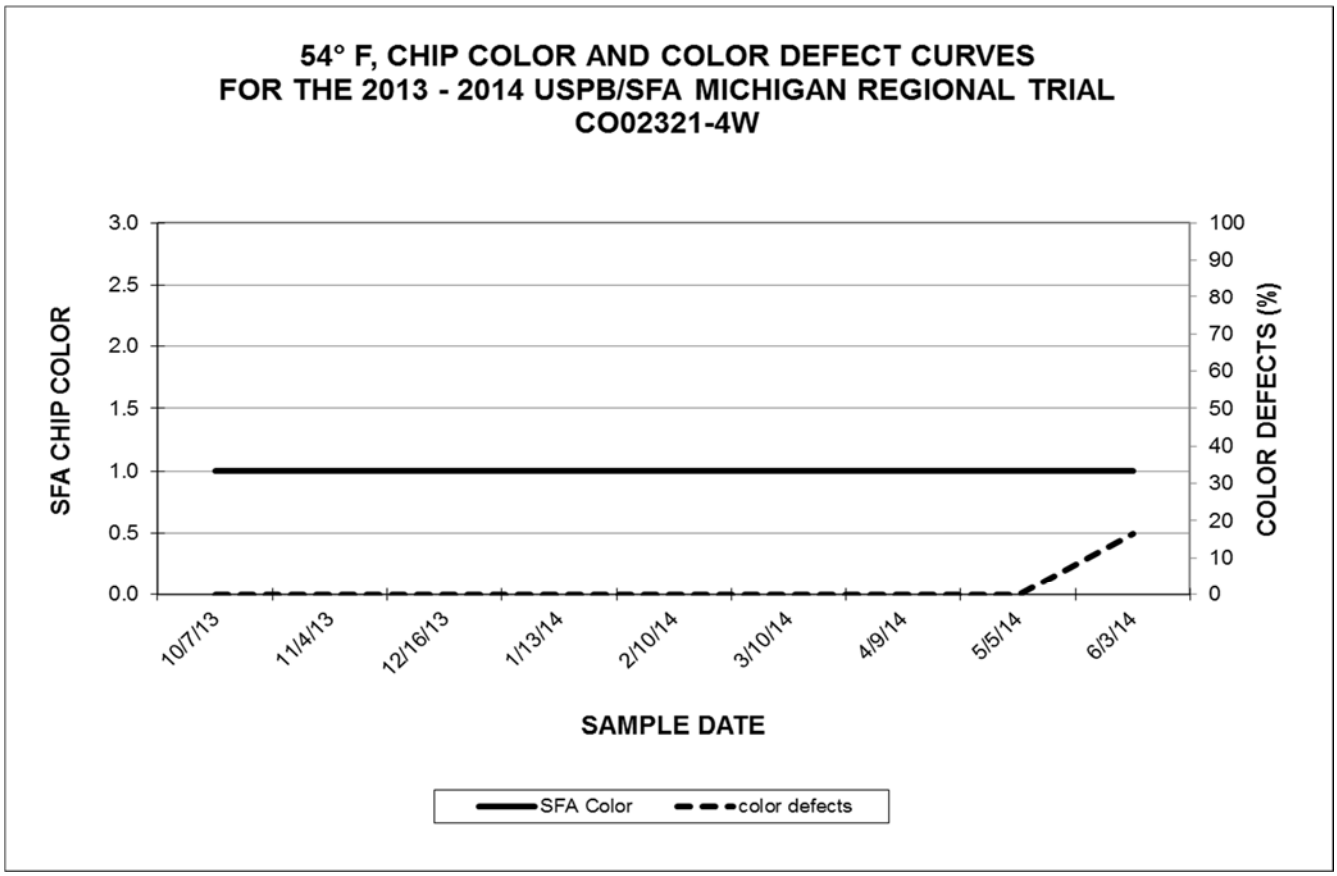

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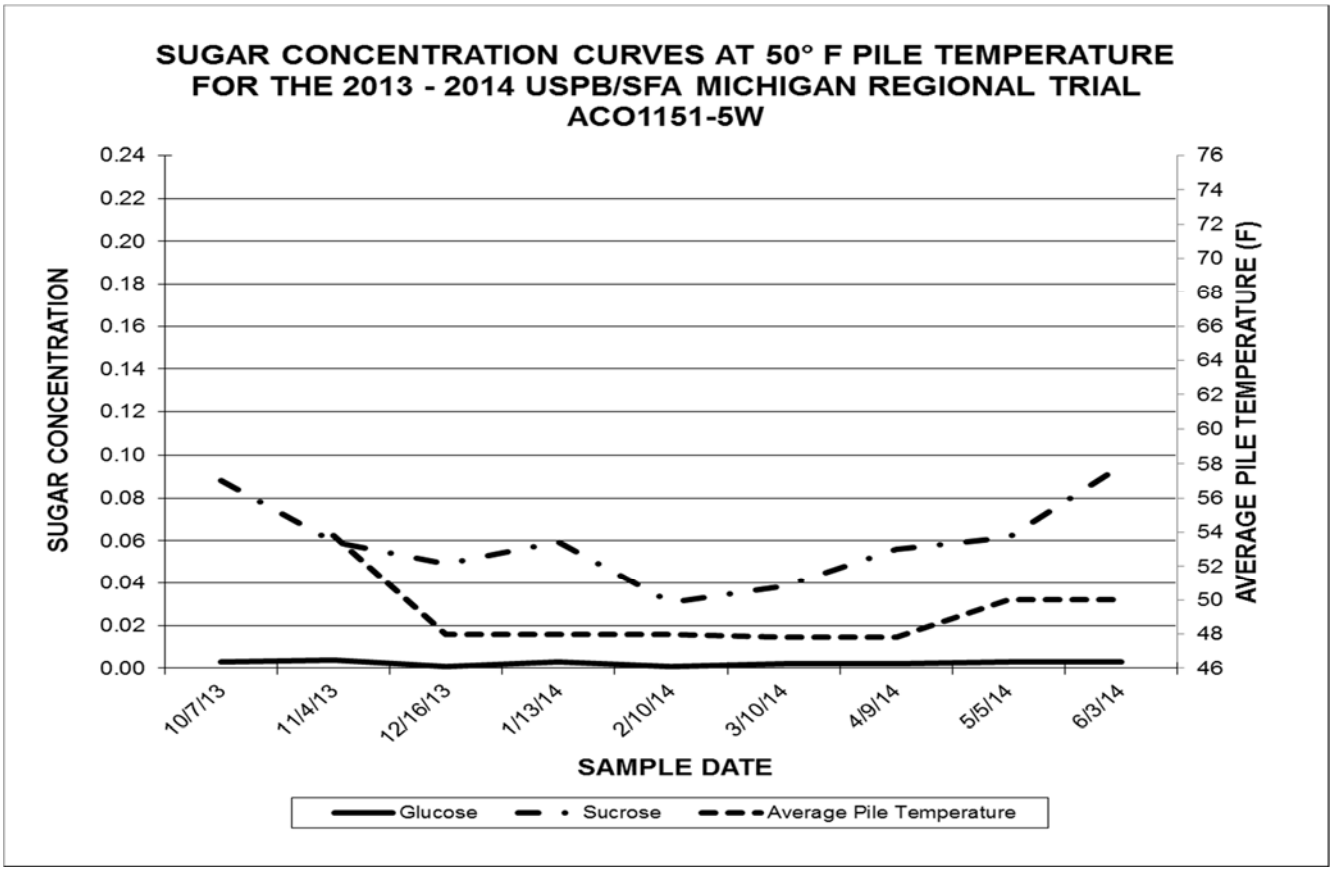

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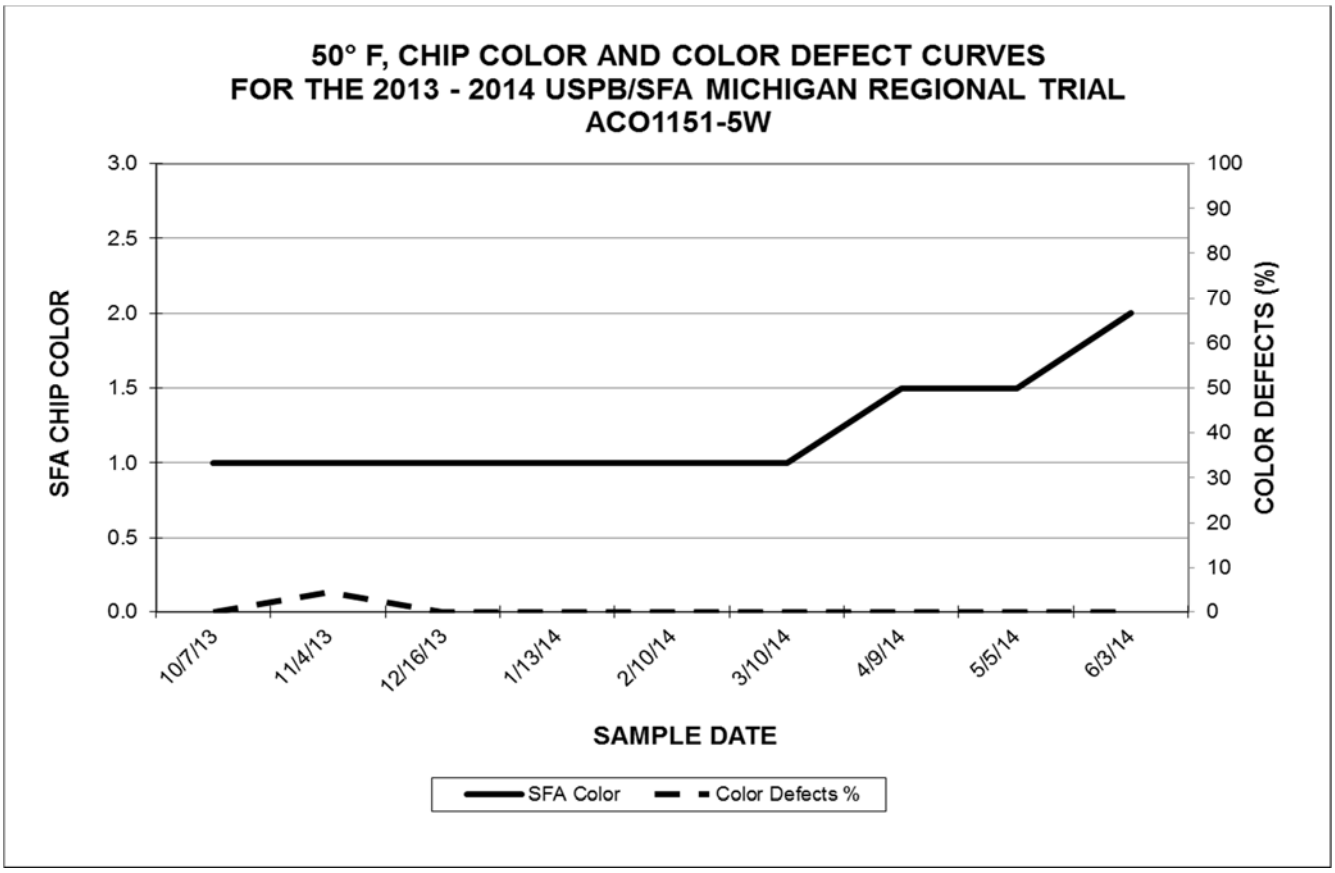

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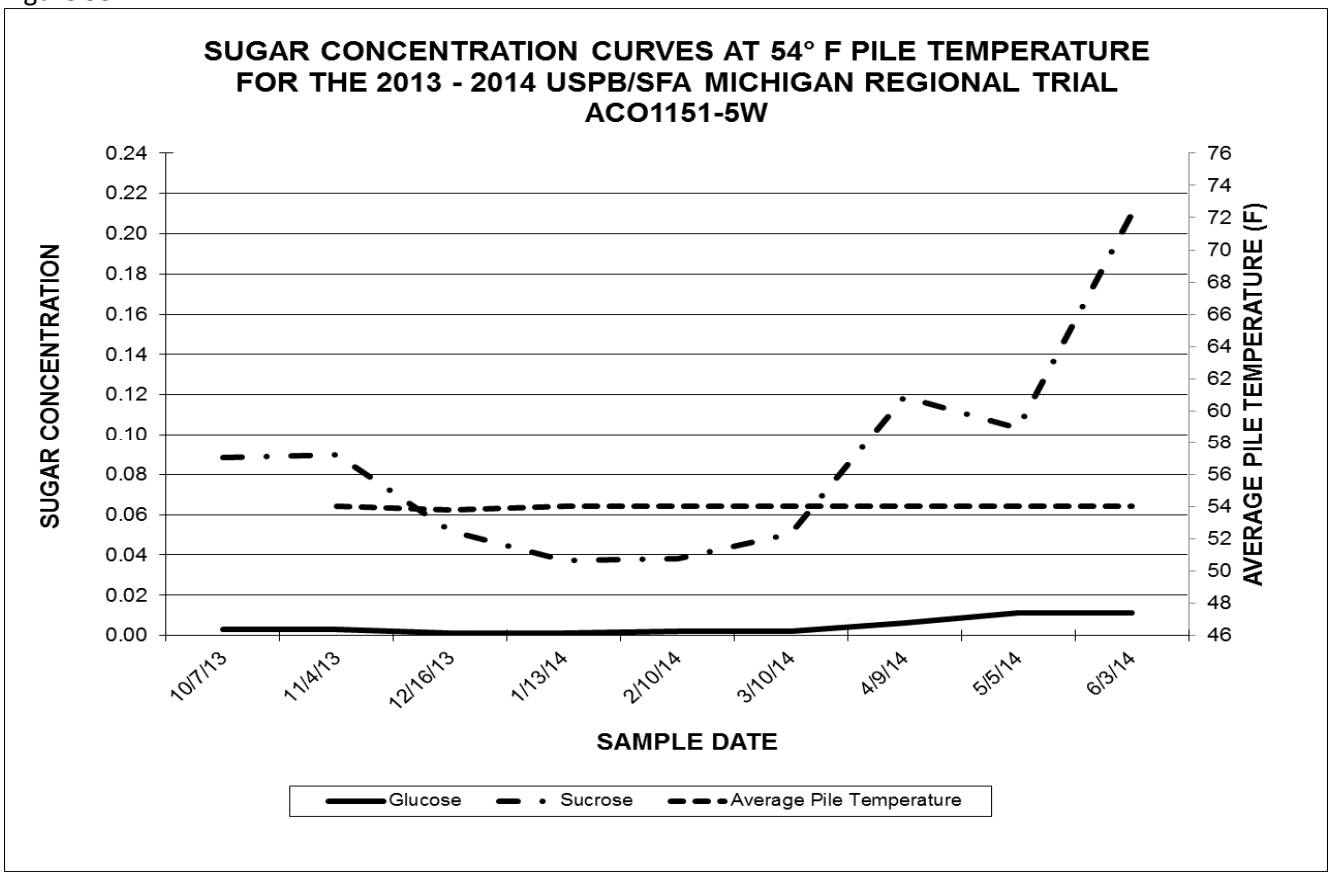

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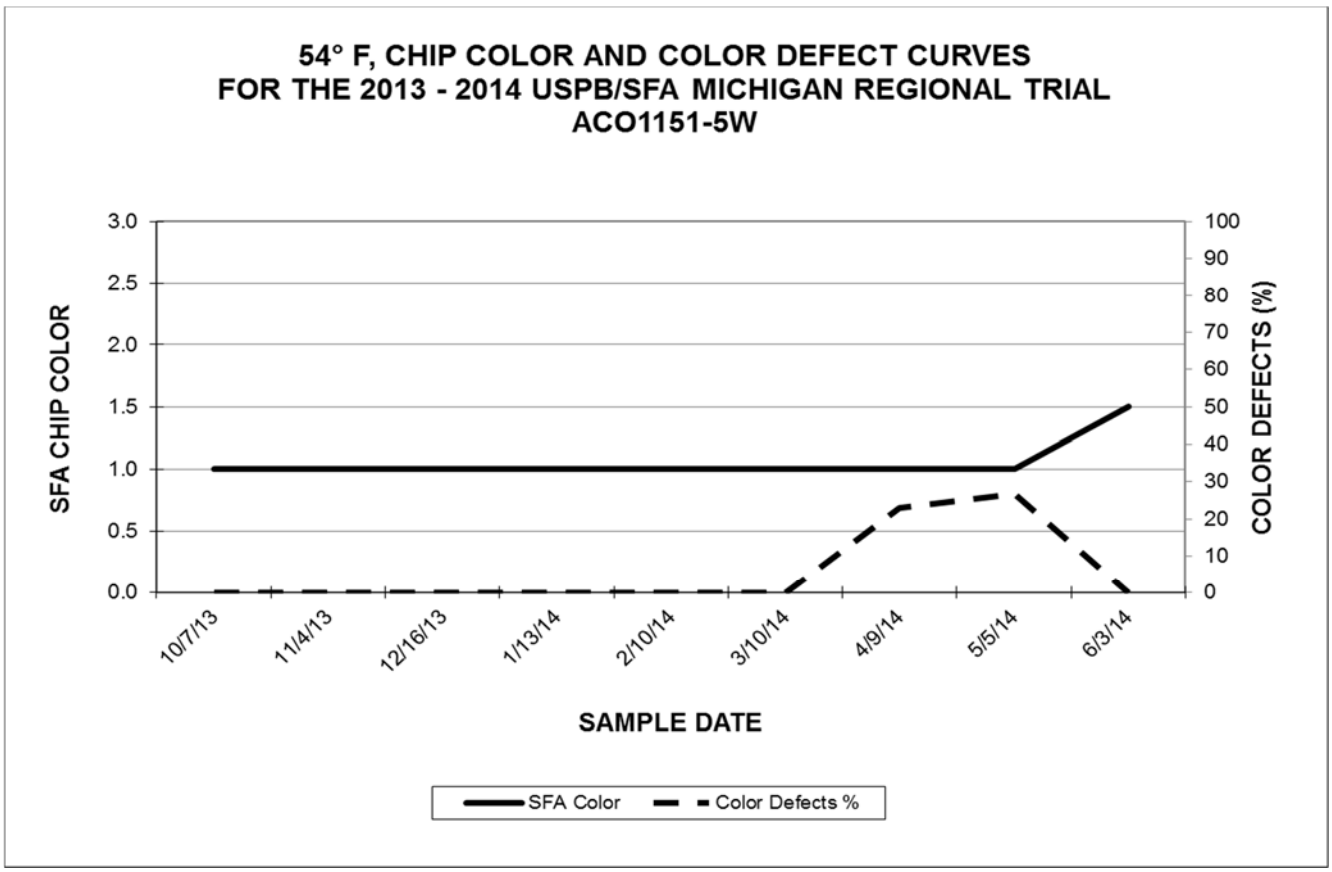

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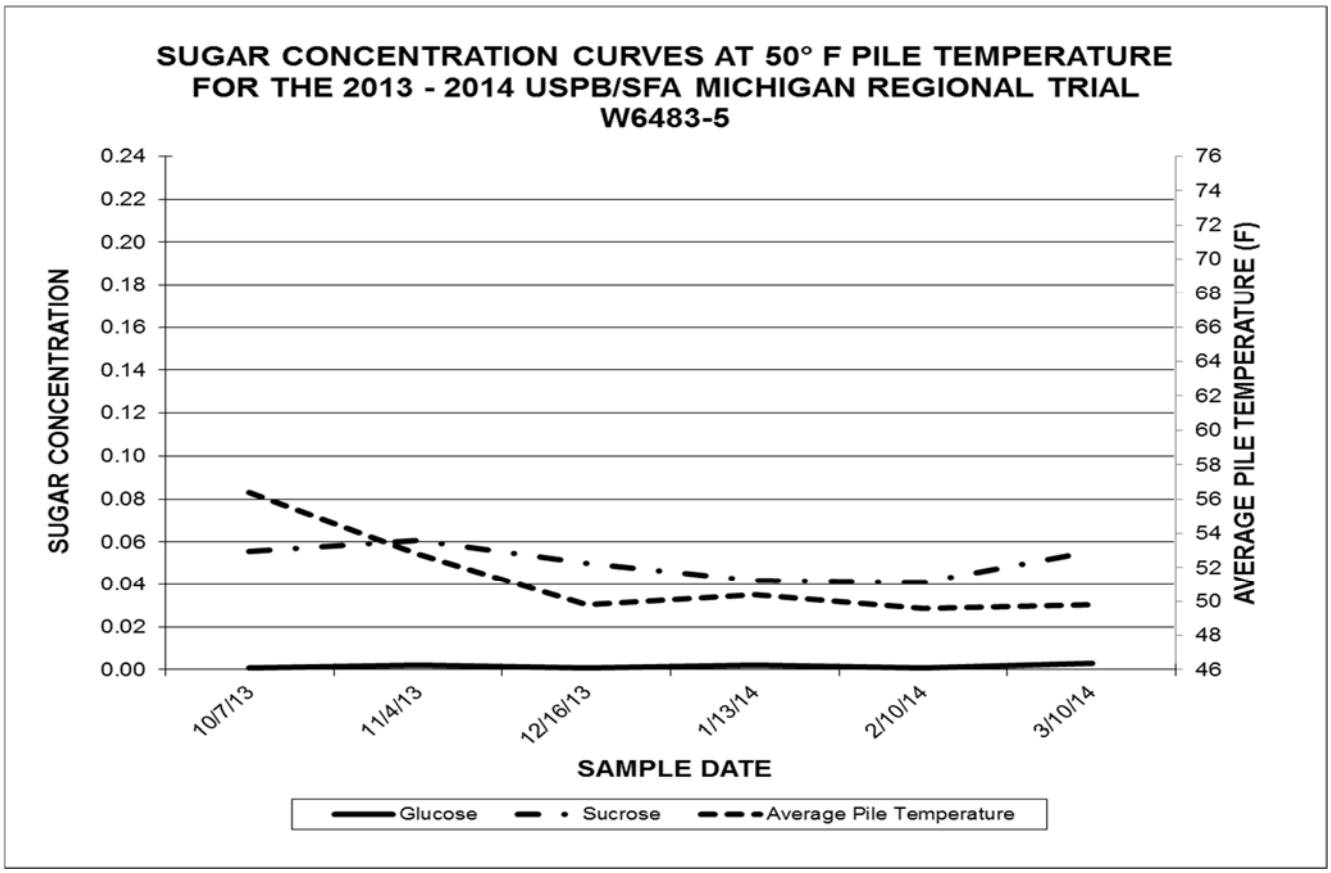

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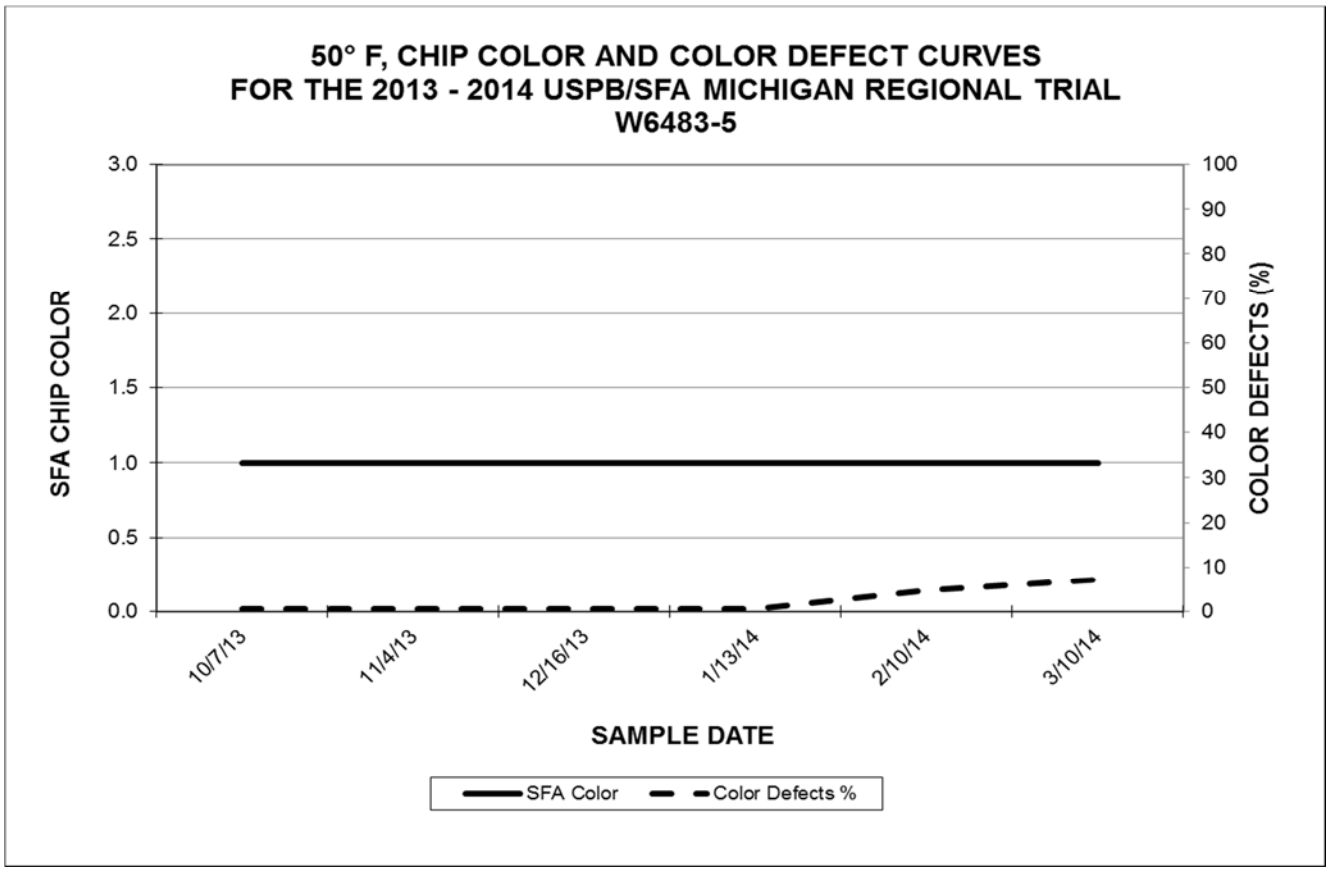

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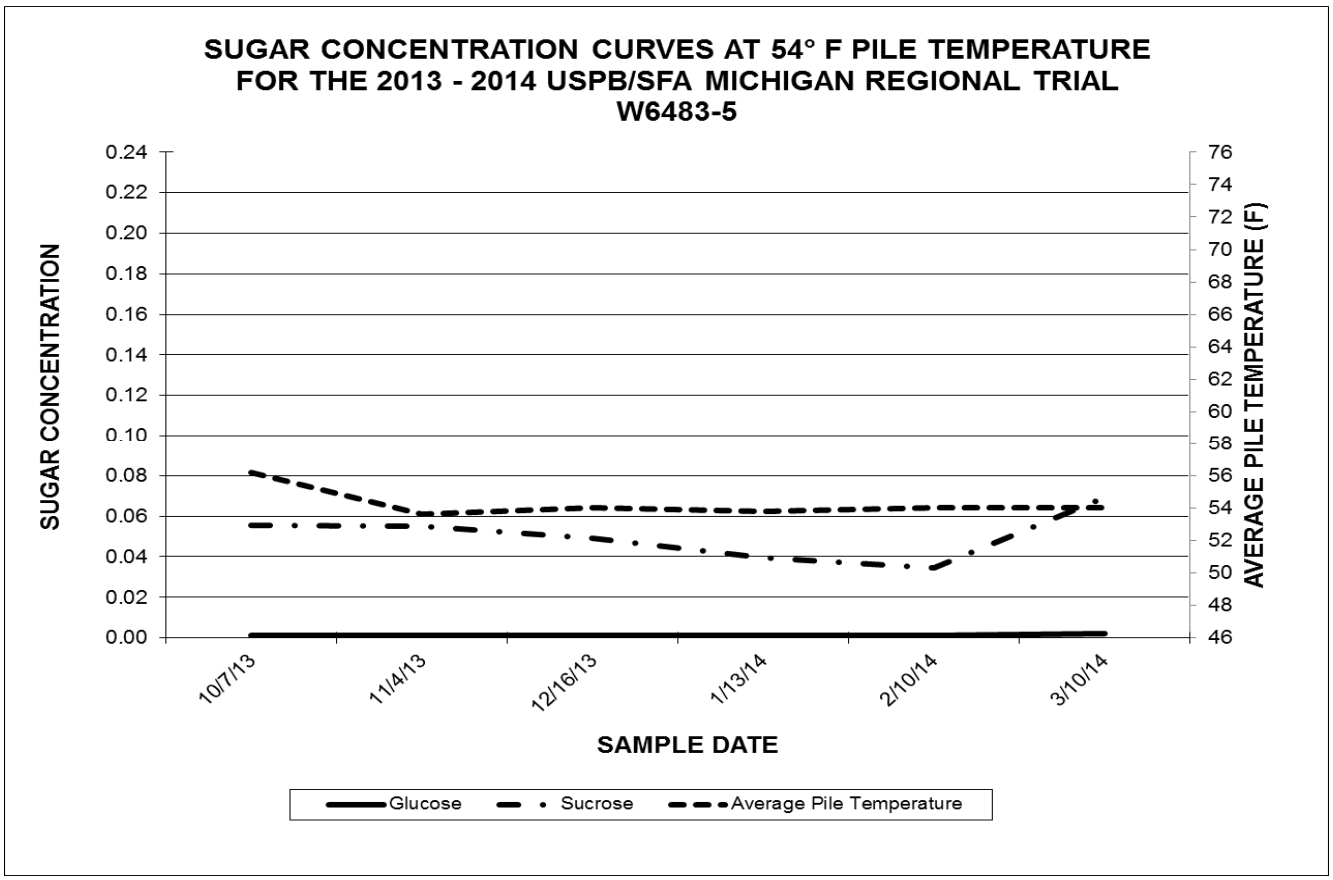

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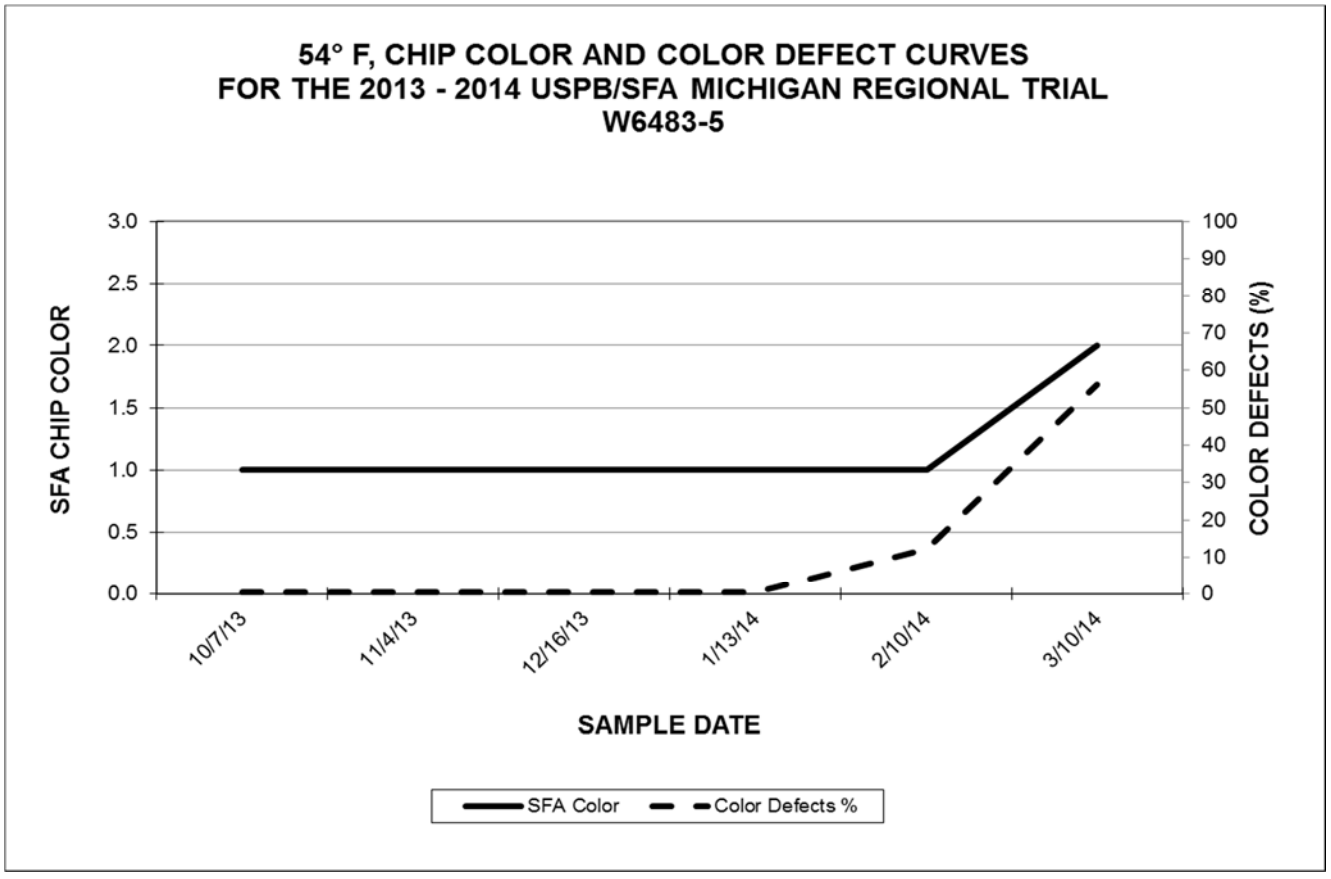

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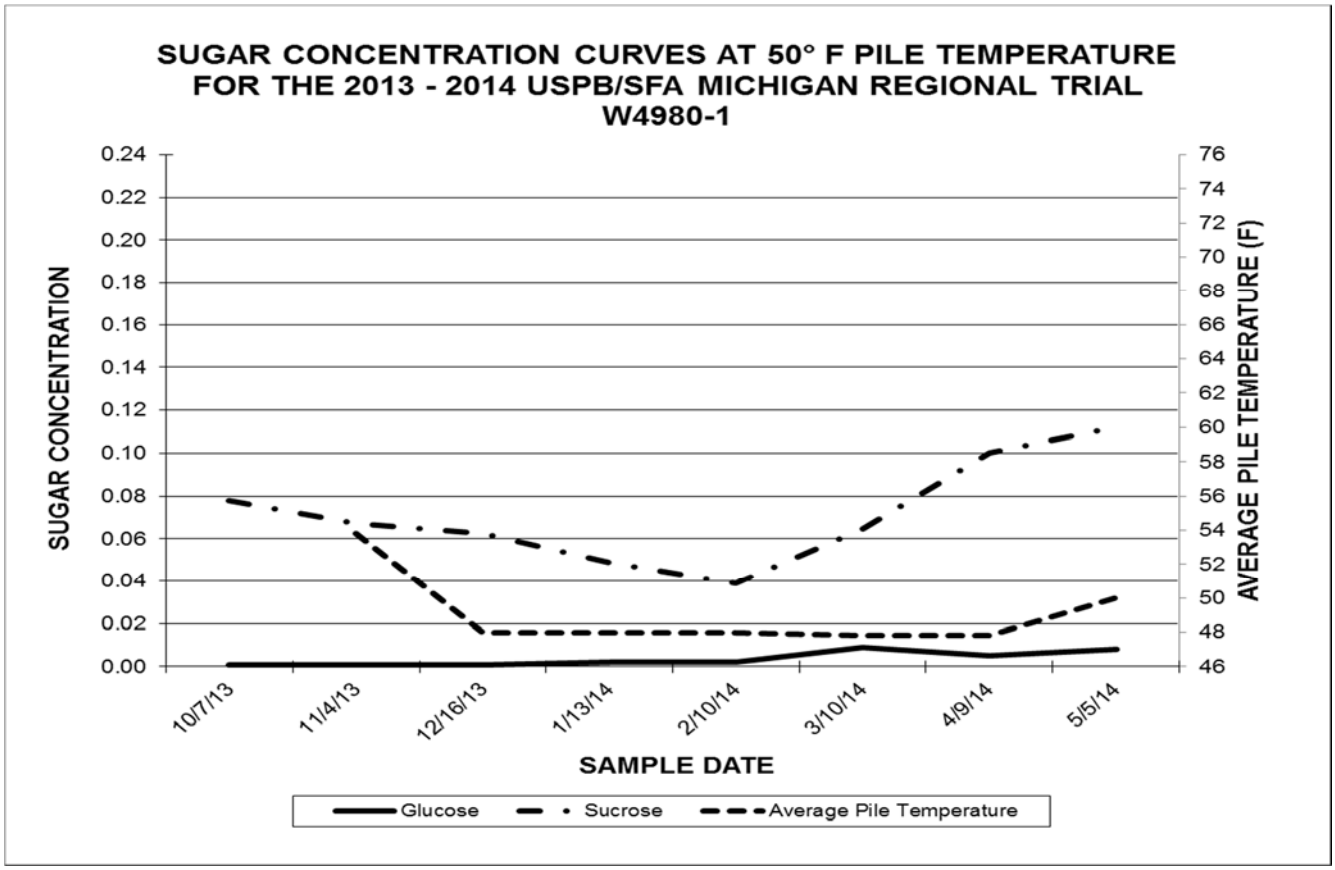

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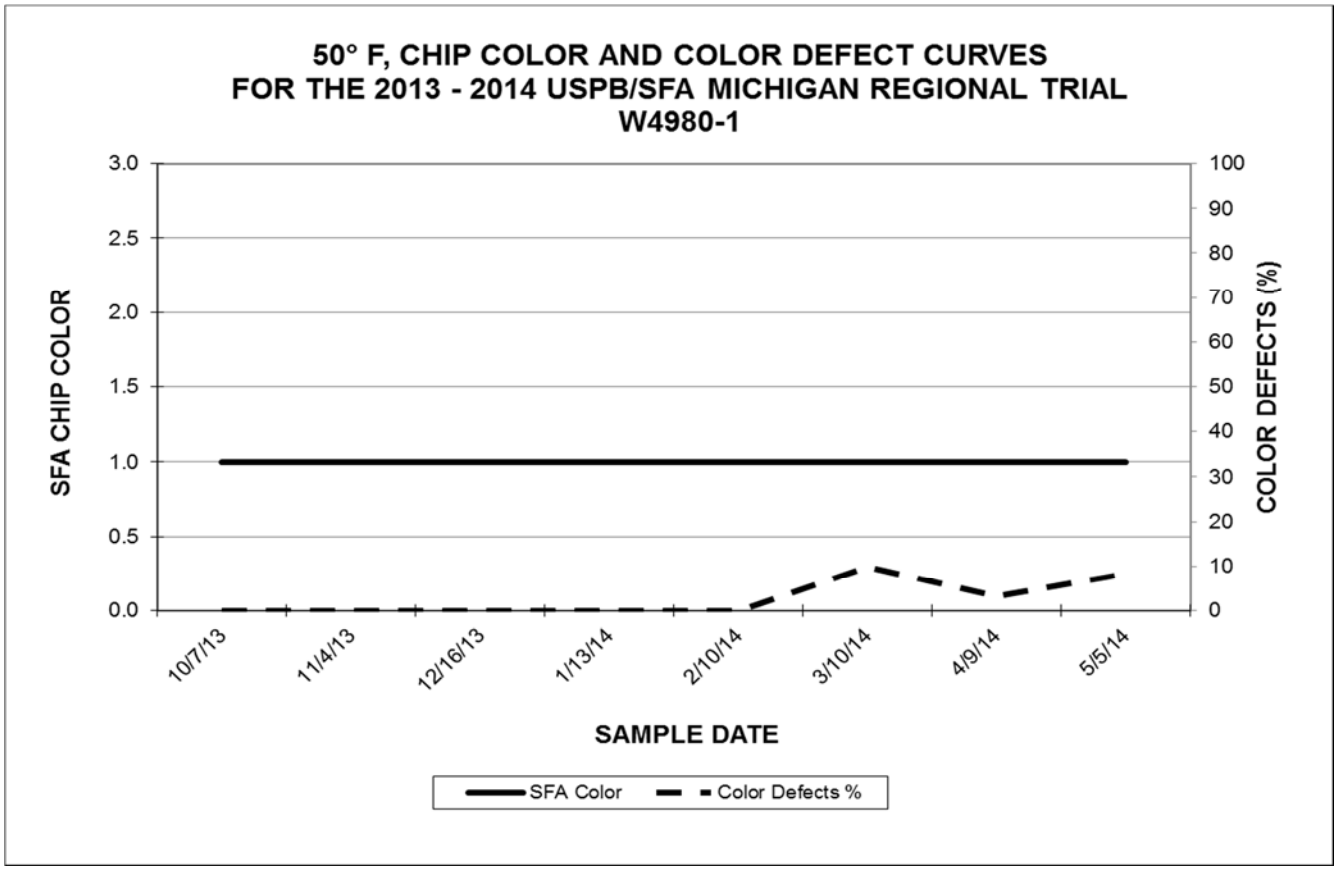

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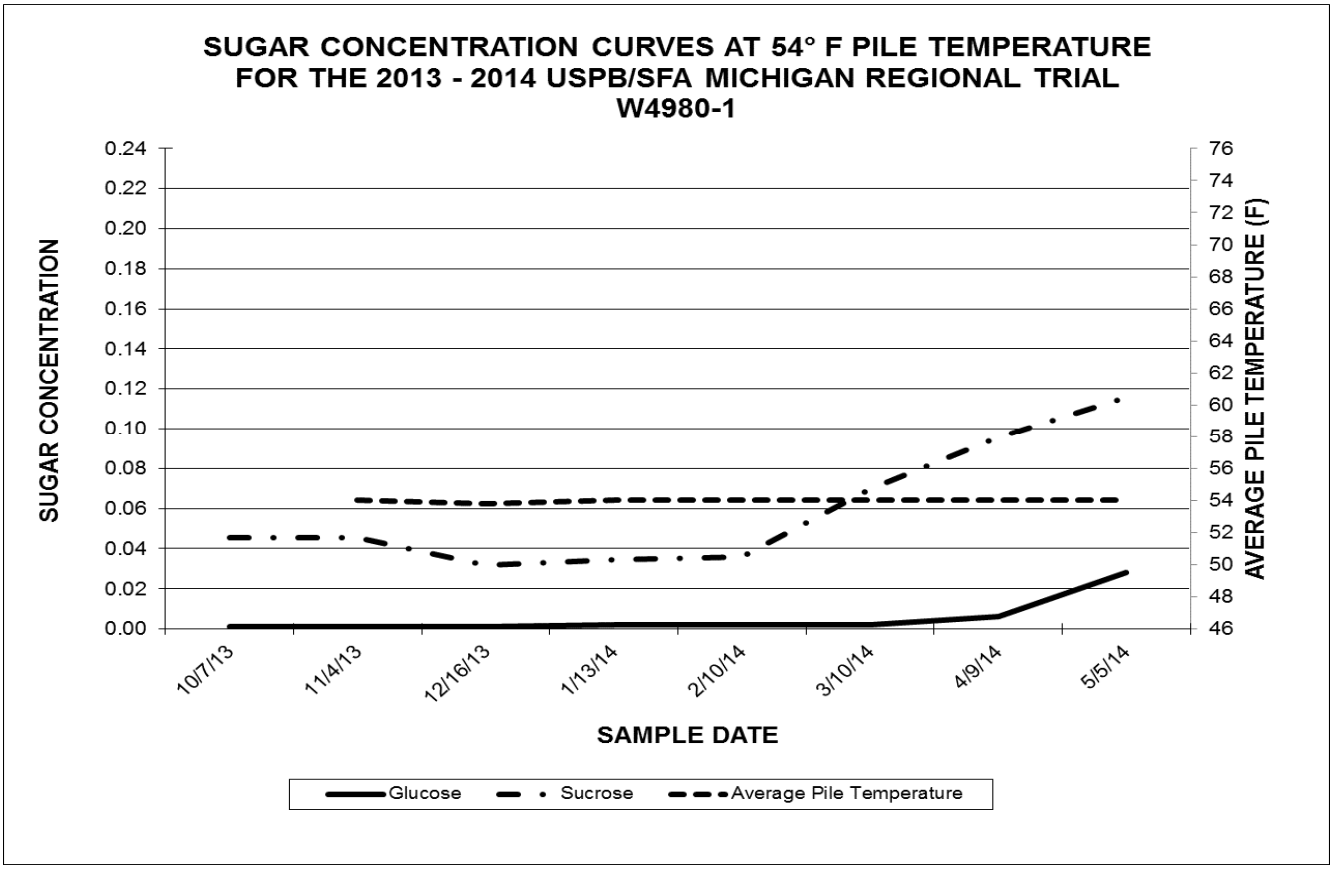

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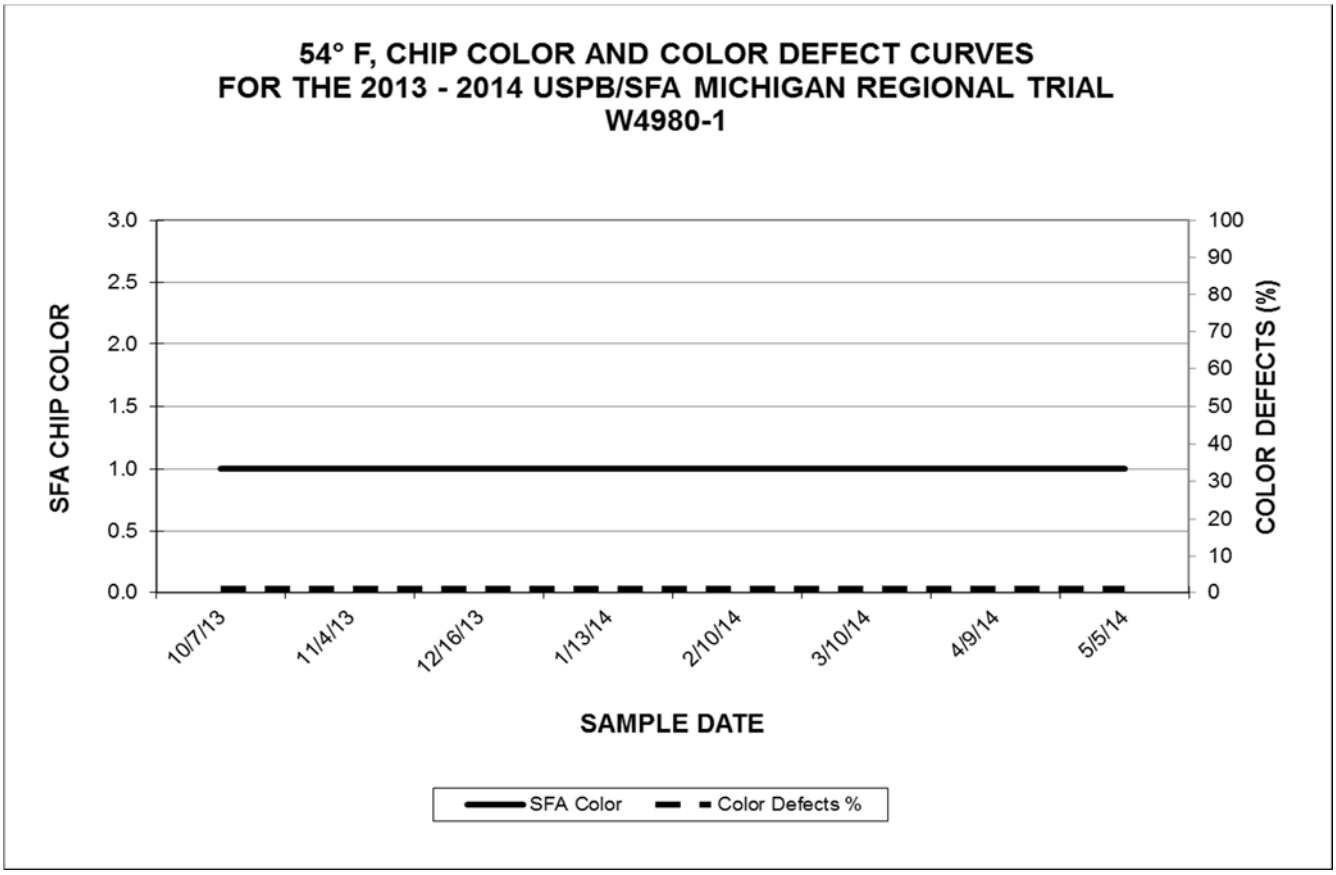

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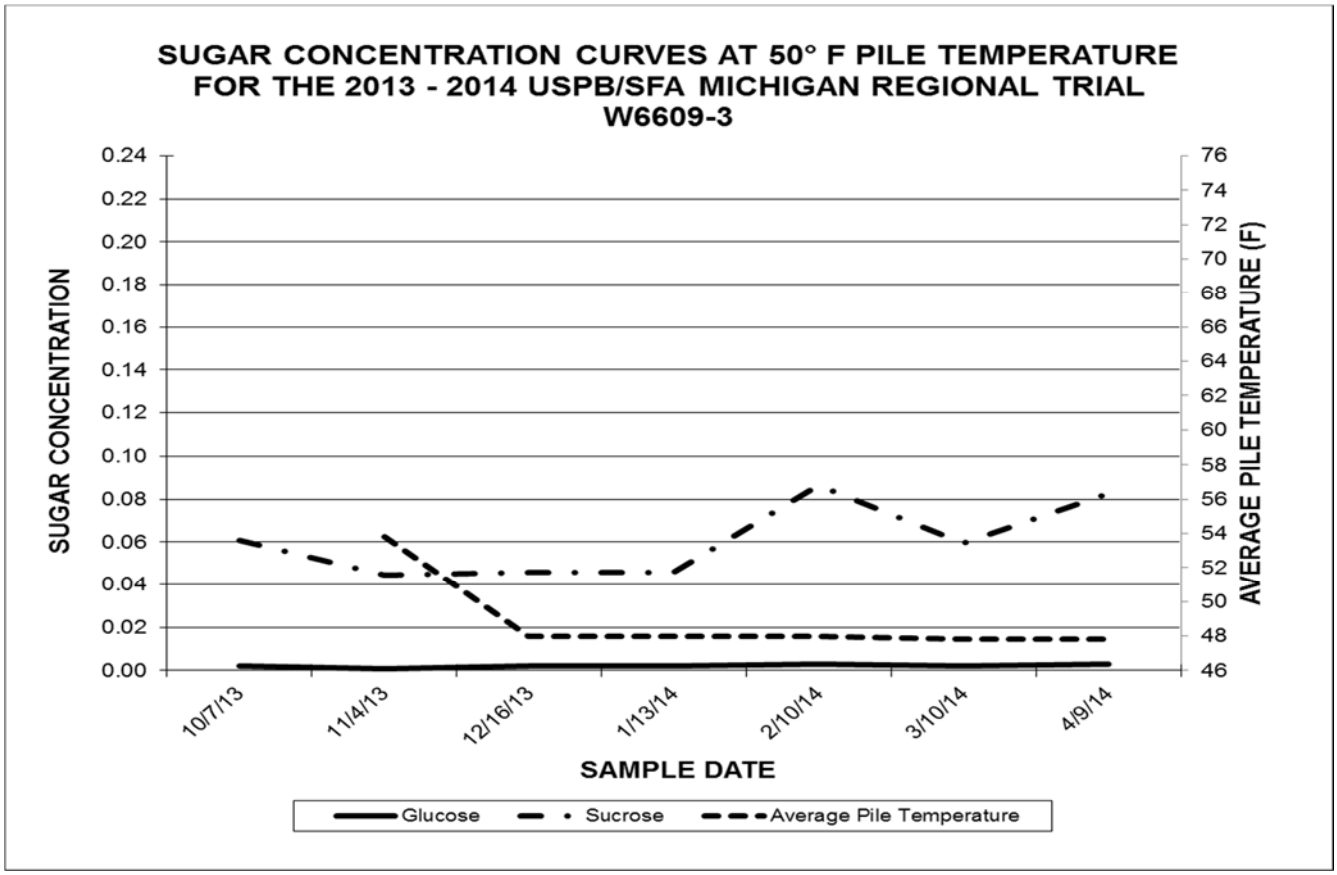

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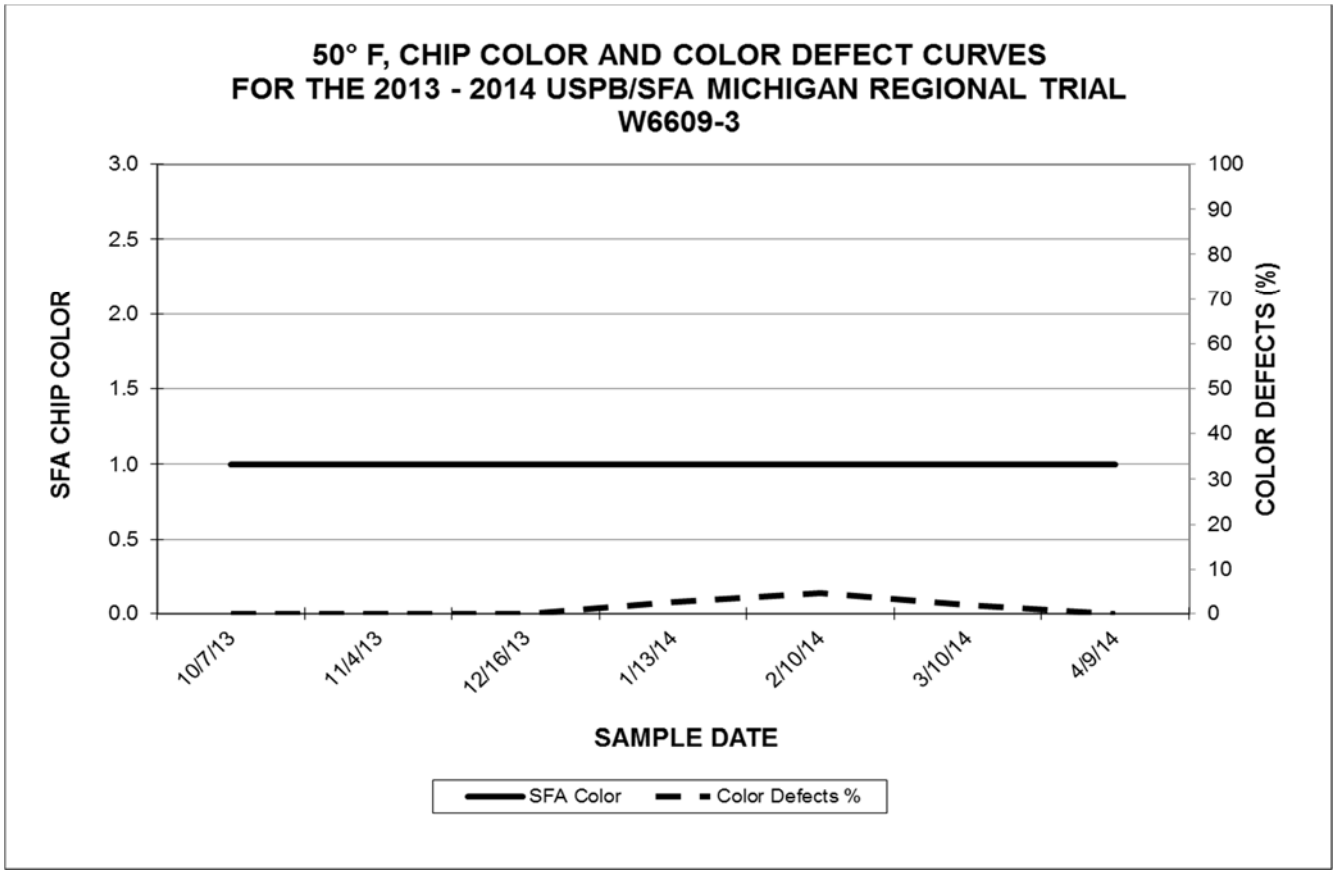

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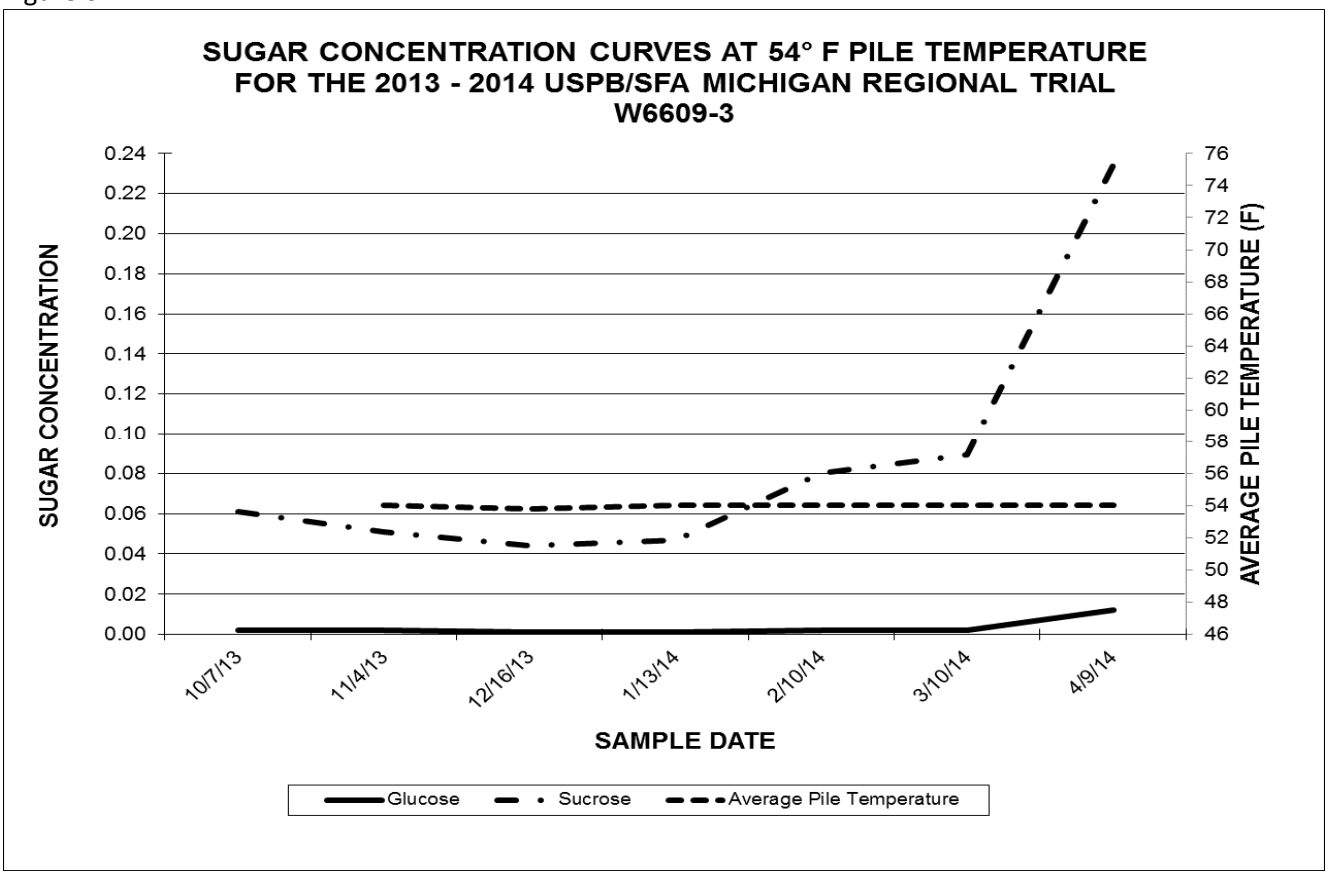

Figure 68.