

Date of Harvest Trials

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Introduction

Sugar beets are a biennial crop and will continue to increase in yield and sugar content during the first year of growth until the beets are harvested. This rate of growth and sugar accumulation can vary based on the environmental conditions present in any given year and the health of the sugar beet foliage.

Objective

Starting in 2011 SMBSC began to perform trials to measure the rate of growth of the sugar beets during the period from late July through mid-October. These trials provided rate of growth data for each season for sugar content, tons per acre (TPA), purity, and extractable sugar per acre (ESA). The weekly harvest information could also be used to look at the SMBSC prepile premium and how effectively it compensates shareholders for early harvesting a portion of their sugar beet crop.

Materials and Methods

Trials were established at 2-4 locations across the Cooperative each season since 2011. These trials were often conducted on the same locations as the SMBSC Official Variety Trials. In 2021, the three Date of Harvest Trials were conducted at a location near Murdock, Lake Lillian, and Hector. Trial maintenance was performed similar to the nearby Official Variety Trial, and followed Best Management Practices. Each week during the mid-August to early-October period approximately 180' of row was harvested from each trial location. Harvest was accomplished with a tractor mounted one-row defoliator and one-row sugar beet harvester. The beets harvested each week were placed in tare bags and brought to the SMBSC Tare Lab for weights and quality analysis. Sample analysis included tare, sugar content, and purity. Row lengths were measured each week prior to harvest and these lengths were used to calculate the area harvested. The calculated harvested area for each week was used to determine yield on a per acre basis.

Results and Discussion

The first harvest date for the trial was July 26, 2021. Harvesting continued on a weekly basis until October 12, 2021. Harvest was conducted once a week, although intervals of exactly seven days were unachievable due to weather. A total of twelve harvest timings were completed in 2021. Trials sites had even stands, uniform canopy development, minimal root rot, and minimal CLS.

Table 1 shows the average pounds extractable sugar per acre (ESA) increase per day for each of the past eleven years, between mid-August to early-October. From 2011-2020, the daily average rate of increase in ESA was 80.2 pounds extractable sugar per day. The increase in ESA per day for 2021 of 106.8 pounds was greater than the long-term mean rate of gain. This rate of gain for ESA is a new record, with weekly gains on ESA being 6.1 lbs ESA greater than the prior record. As discussed below, this is driven by abnormally high rates of gain for TPA in 2021. Growth rate across the season for ESA is illustrated in Figure 1.

Table 2 shows the average rate of gain for percent sugar concentration data. The long-term rate of increase on percent sugar is 0.06% per day and approximately 0.41% per week. In 2021, sugar increased more slowly than the long-term average at 0.02% per day and approximately 0.17% per week. This rate is approximately half the rate of increase compared to the eleven-year average. Figure 2 illustrates the data from 2021 for sugar percent rate of gain. Despite rate of gains on sucrose being low, ESA rate of gains were above average, driven by high rate of gains on TPA in 2021.

Table 3 shows the average rate of gain of TPA for the eleven-year period of 2011-2021. The long-term average is 0.21 TPA gained per day, and approximately 1.45 tons per week. The 2021 rate of gain for TPA was the

highest of the eleven seasons of data. This record is shown with a daily rate of gain of 0.37 TPA and approximately 2.61 TPA per week. This rate of gain is 0.60 TPA per week greater than the prior record. Figure 3 illustrates the data collected in 2021.

One of the purposes of the Date of Harvest Trials is to provide data on how well the prepile premium compensates SMBSC producers for their early-harvest deliveries. The prepile premium was instituted at SMBSC to pay an additional premium on early-harvested tons so that they are paid at comparable rates as tons harvested on the first day of main harvest. For 2021, prepile began for SMBSC producers on 8/25/2021 and ended 47 days later on 10/10/2021, with main harvest beginning 10/11/2021.

Data from the 2021 Date of Harvest Trial is found in Table 4. Because the trial had harvest dates earlier than the start of producer's prepile harvest, no calculated estimates are provided for the dates prior to 8/25/2021. These revenue values are left blank because the start date of prepile and the gain there-after influence the daily premium calculation. The 2021 prepile daily premium wasn't designed to compensate for the lower yield and quality of beets harvested prior to 8/25/2021. Although an estimate could be provided by stepping the daily premium back to those dates in question, this would make an assumption that would result in an imperfect estimate. The nature of the prepile premium is to change as the prepile period, the rate of gain, and the final beet payment change. Starting the cooperative prepile period three weeks earlier may result in a different daily premium. Calculating a new daily premium would involve speculation on multiple factors. The simpler method (with least speculation) is to leave these dates out of the estimate, rather than risk false speculation.

Table 4 can be used to track yield and sugar content for the early harvest dates in grey. Table 4 can also be used to compare yield, sugar content, and relative revenue for the non-grey portions of the table. Table 4 shares revenue values as percent of mean (PoM). This is done by treating the harvest date of 10/12/2021 (the nearest to main harvest) as the "mean" and comparing this value to other dates. The nearer a value is to 100.00 the closer the value is the payment on day 1 of main harvest, as a value grows larger than 100, that revenue is more than the first day of main harvest. All of the dates of prepile saw revenues higher than the first day of main harvest. For data generated in the 2021 Date of Harvest Trial, revenue per acre averaged 15.7% greater for those acres where tons were delivered during prepile than at the beginning of main harvest.

It is important to point out that this trial compares "like for like", in that the harvested beets are designed to be as uniform as possible that represent the main part of a given field of sugar beet. This can be different than the prepile harvest that many producers conduct. A common use of prepile allocation at SMBSC is to remove headlands prior to the start of main harvest, which may have yield and quality that differs from the main part of a field. Additionally, if an SMBSC producer would like to calculate actual revenue values, they can do so utilizing the shareholder portal's "Prepile Rates" under "Financial Reports" and the "Revenue Calculator" under "Tools".

Conclusion

Crop Year 2021 saw record rates of growth for yield and extractable sugar per acre for SMBSC producers as well as set a new record for the yield achieved per acre for the Cooperative. This is reflected in the 2021 Date of Harvest Data. Further, the data generated in this trial would support the claim that the prepile premium program worked as designed, paying premiums so that deliveries in the prepile period are at, or above, the payments for deliveries on the first day of main harvest.

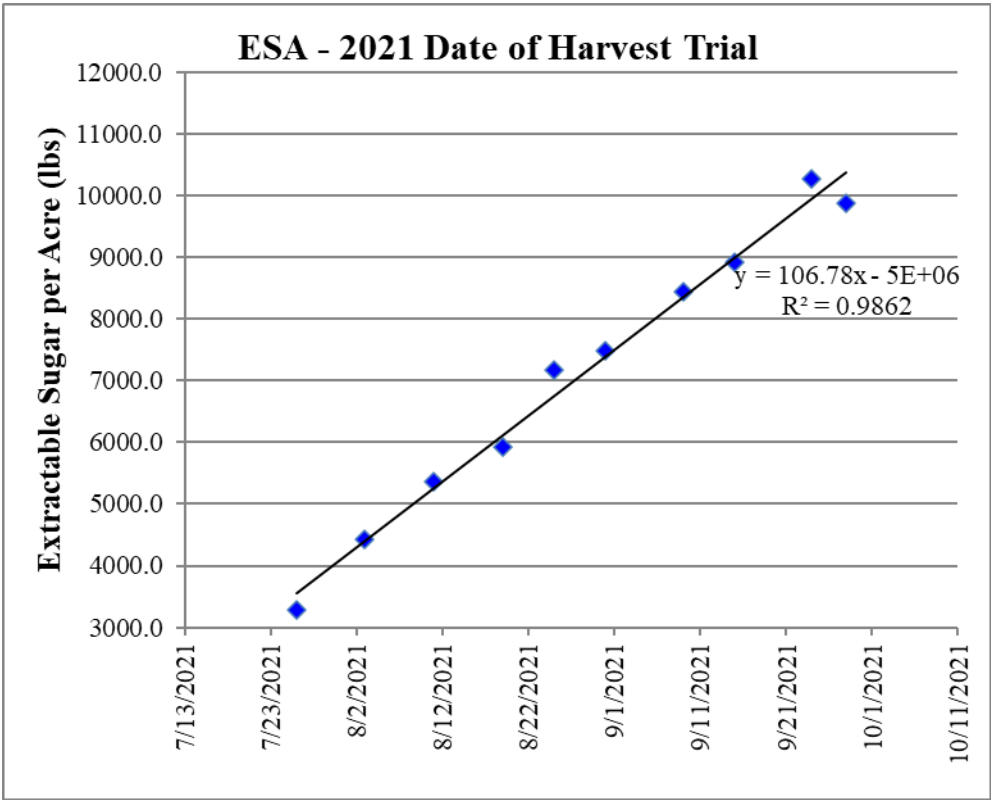


Figure 1. Extractable sugar per acre (ESA) data collected during the 2021 Date of Harvest trials, plotted across the harvest period, depicting a positive trend.

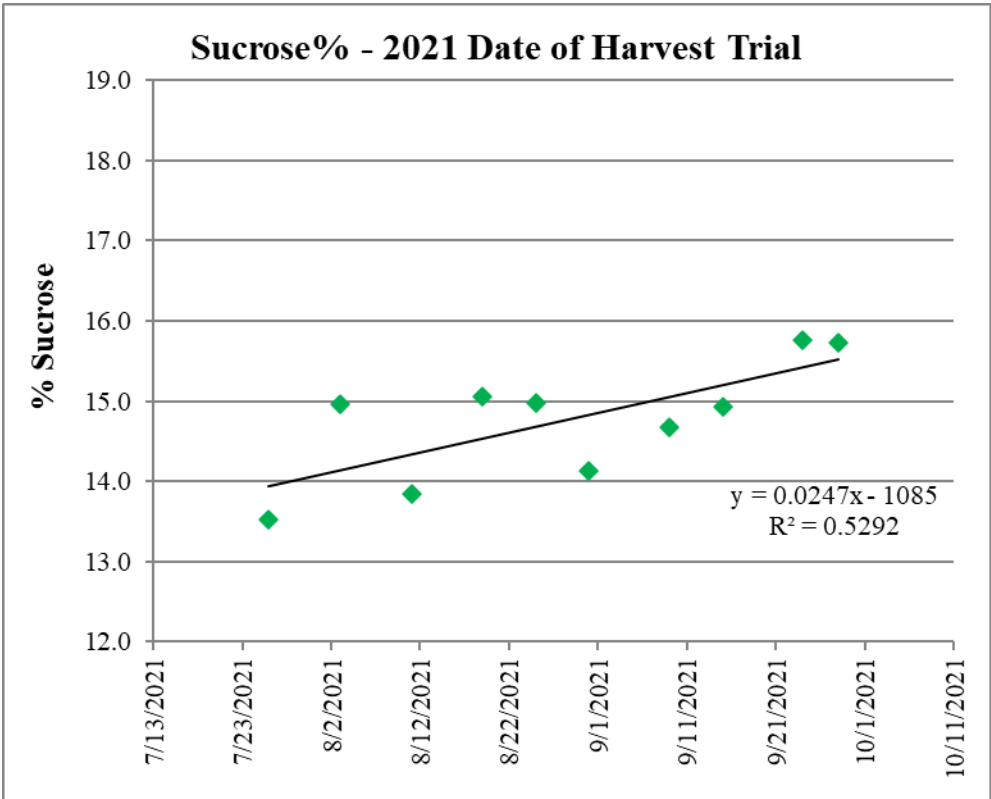


Figure 2. Sugar percent data collected during the 2021 Date of Harvest Trials, plotted across the harvest period, depicting a general positive trend.

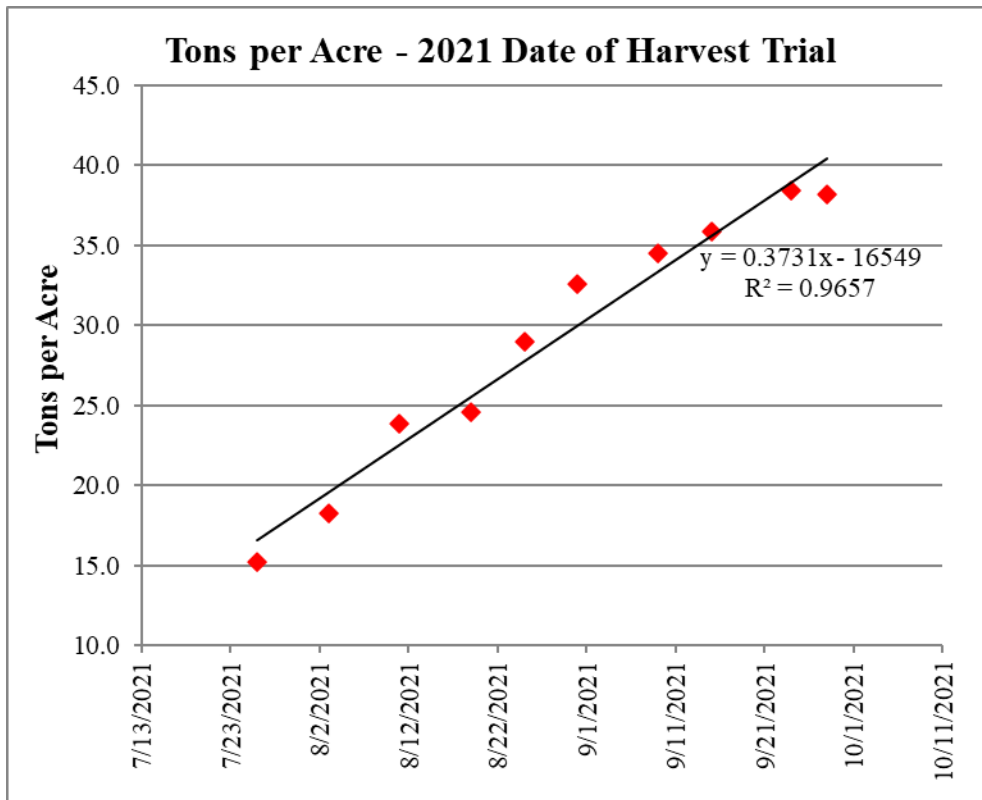


Figure 3. Tons per acre data collected during the 2021 Date of Harvest Trials, plotted across the harvest period, depicting a general positive trend.

Table 1.

<u>2011-2021 Regression Analysis of Extractable Sugar per Acre Increase per Day</u>	
<u>Year</u>	<u>Extractable Sugar per Acre Increase per Day (lbs.)</u>
2011	100.7
2012	89.0
2013	91.6
2014	93.4
2015	99.8
2016	45.7
2017	60.0
2018	63.8
2019	78.6
2020	79.0
Average (2011-2020)	80.2
2021	106.8

Table 2.

<u>2011-2021 Regression Analysis of Percent Sugar Increase per Day</u>		
<u>Year</u>	<u>Percent Sugar Increase per Day (%)</u>	<u>Percent Sugar Increase per Week (%)</u>
2011	0.10	0.68
2012	0.09	0.61
2013	0.05	0.38
2014	0.09	0.60
2015	0.06	0.44
2016	0.03	0.18
2017	0.06	0.40
2018	0.005	0.04
2019	0.04	0.30
2020	0.07	0.47
Average (2011-2020)	0.06	0.41
2021	0.02	0.17

Table 3.

<u>2011-2021 Regression Analysis of Ton per Acre Increase per Day</u>		
<u>Year</u>	<u>Ton per Acre Increase per Day (tons)</u>	<u>Ton per Acre Increase per Week (tons)</u>
2011	0.25	1.74
2012	0.15	1.06
2013	0.29	2.01
2014	0.23	1.59
2015	0.24	1.67
2016	0.14	0.99
2017	0.12	0.82
2018	0.27	1.87
2019	0.24	1.66
2020	0.16	1.12
Average (2011-2020)	0.21	1.45
2021	0.37	2.61

Table 4.

Date	Sugar (%)	Purity (%)	Tons per Acre	ES (%)	EST (lbs)	ESA (lbs)	Revenue without Premium per Acre PoM	Total Payment per Acre with Premium PoM	Week	Date
7/26/2021	13.5	87.9	15.2	10.8	216.1	3284.0			N/A	7/26/2021
8/3/2021	15.0	88.6	18.2	12.2	243.4	4435.0			N/A	8/3/2021
8/11/2021	13.8	88.8	23.9	11.2	224.8	5366.6			N/A	8/11/2021
8/19/2021	15.1	87.5	24.6	12.0	240.6	5917.3			N/A	8/19/2021
8/25/2021	15.0	89.7	28.9	12.4	247.9	7173.3	56.3	123.3	1	8/25/2021
8/31/2021	14.1	88.9	32.5	11.5	230.0	7484.1	53.9	119.7	2	8/31/2021
9/9/2021	14.7	90.5	34.5	12.3	245.2	8455.3	65.6	120.0	3	9/9/2021
9/15/2021	14.9	90.4	35.8	12.5	249.2	8931.0	70.4	116.4	4	9/15/2021
9/24/2021	15.8	91.2	38.4	13.4	267.6	10278.3	86.8	119.0	5	9/24/2021
9/28/2021	15.7	89.2	38.1	13.0	259.0	9879.1	81.0	105.4	6	9/28/2021
10/8/2021	16.6	89.9	41.5	13.9	277.0	11485.5	100.0	106.1	7	10/8/2021
10/12/2021	15.8	91.1	44.1	13.4	268.2	11818.8	100.0	100.0	Main Harves	10/12/2021