2021-2022
Spreckels Sugar
RESEARCH REPORT

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2021-2022 Sugar Beet Emergence Utilizing Furrow and Sprinkler Irrigation - Field Data Project

Mark Bloomquist – Spreckels Sugar

Justification:

The Imperial Valley climate can be very severe for the emergence of seedling sugar beet plants. The daily high temperatures in September are often in excess of 100 degrees F. In addition to these temperatures, many of the soils in the Imperial Valley have salt levels that can create emergence issues for small-seeded crops. Traditionally sugar beet is furrow irrigated in the Imperial Valley. However, there has been increasing interest in utilizing solid set sprinkler pipe during the germination and emergence period and then converting the field to furrow irrigation once the sugar beet stand is established. This project was set up to attempt to quantify if there are emergence differences between these two irrigation methods. If differences do exist, do these differences equate to a root yield and quality difference at harvest?

Objective:

The objective of this project is to determine if an advantage exists to sprinkler irrigation versus furrow irrigation during the germination and emergence period. Comparisons will include emergence percent, root yield, and quality. The project will create and utilize a database of 2021-2022 Imperial Valley sugar beet fields to gather data and analyze any differences between the two types of irrigation.

Material and Methods:

This project is not a replicated small plot research project but a collection of data from current year production fields in the Imperial Valley of California. The Agricultural Team at Spreckels Sugar collected stand counts on 80 sugar beet fields in September – November 2021. Within each field, the Agriculturists were instructed to collect 20 stand counts scattered throughout the field. The stand counts consisted of counting all the emerged sugar beets in 10 feet of row per location in the field. These stand counts were averaged on a field basis to establish the sugar beet population for every field in the database. The average stand count per field was used to calculate each field's percent emergence. In addition to the stand counts, the Agriculturists collected the following information from the farmers for each field: variety, seed spacing, planting date, first water date, and sprinkler or furrow irrigation. All this information was input into the ArcGIS Collector App (ESRI), which allowed the spatial display of the field locations. The data was exported into Excel (Microsoft Corp.) for analysis.

During the harvest season, Spreckels Sugar Agriculturists measure all partially harvested fields each week to obtain a weekly root yield and quality for each field and a weekly yield average for the company. Weekly results for each irrigation project field were added to the sprinkler/furrow irrigation database. The weekly root yield and quality allowed for yield comparison and revenue per acre calculations for sprinkler and furrow irrigated fields every week.

Results:

Harvest began on March 27, 2022, at Spreckels Sugar. Weekly harvest data was accumulated and summarized starting on April 5, 2022. Fields included in the irrigation project were summarized each week by irrigation type, and emergence percent, yield parameters, and estimated revenue per acre was calculated for the harvested acreage. Since September can have the most challenging conditions for emergence, the fields planted in September were the fields utilized in the data to be presented. The results shown are the average of the fields harvested each week for each irrigation type. Table 1 compares sprinkler versus furrow irrigation fields for the first seven weeks of the 2022 harvest season. Gross revenues were estimated and calculated by using a Spreckels Sugar Revenue Calculator with $0.335/pound NSP.

Table 1: Comparison of sprinkler versus furrow irrigated fields planted in September 2021 and harvested during the first five weeks of the 2022 harvest.

Week Ending	Sprinkler/Furrow	Acres	Emergence	ESA	Rev/Acre
4/4/22	Sprinkler	770	64.4	8,744	$1,774
4/4/22	Furrow	451	63.5	7,923	$1,611
4/11/22	Sprinkler	585	65.9	9,534	$1,942
4/11/22	Furrow	201	60.8	8,792	$1,791
4/18/22	Sprinkler	241	74.2	9,857	$2,007
4/18/22	Furrow	401	60.1	10,045	$2,048
4/25/22	Sprinkler	58	57.3	10,911	$2,223
4/25/22	Furrow	302	60.2	10,458	$2,132
5/2/22	Sprinkler	208	60.8	11,746	$2,393
5/2/22	Furrow	196	50.7	11,079	$2,255

Figure 1 shows the advantage of sprinkler versus furrow irrigated fields for extractable sugar per acre for each of the five weeks. In all but one of the five weeks of data, the sprinkler irrigated fields out yielded the furrow irrigated fields for extractable sugar per acre. The average advantage for the sprinkler irrigated fields was 499 pounds of extractable sugar per acre.
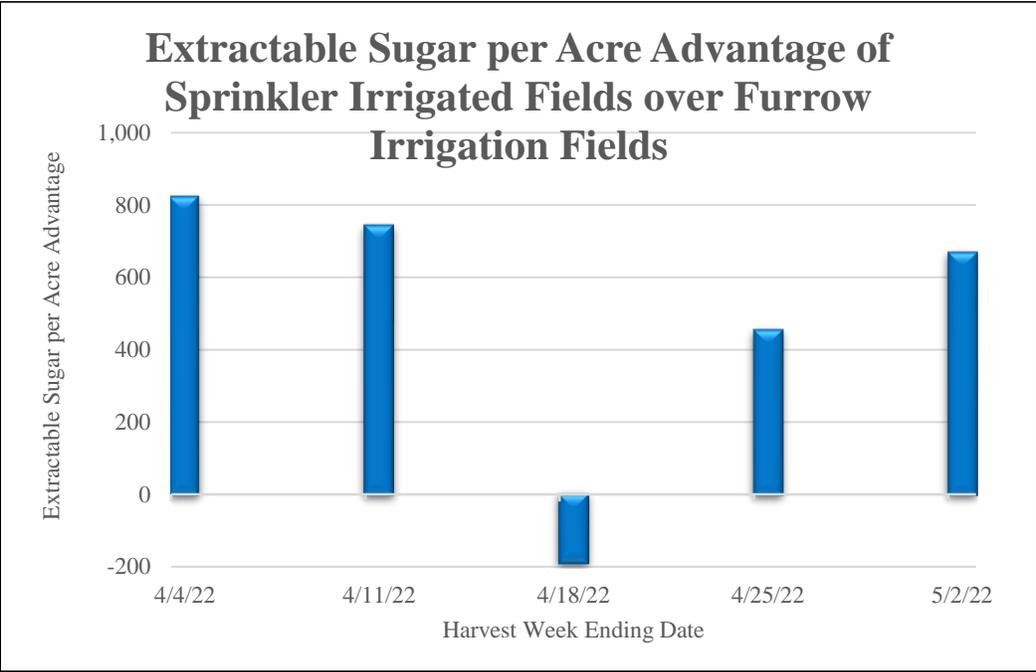
Figure 1: Extractable sugar per acre advantage of sprinkler irrigated fields versus furrow irrigated fields from the first seven weeks of the 2022 harvest season.

Figure 2 shows the advantage of sprinkler irrigated fields over furrow irrigated fields over the first five weeks of harvest. The revenue per acre difference shown is a gross revenue per acre value and does not include any costs associated with either type of irrigation system. Figure 2 illustrates that in all but one of the five weeks shown, sprinkler irrigated fields had higher revenue per acre than the furrow irrigated fields. This revenue advantage averaged $100 per acre over the five-week period.
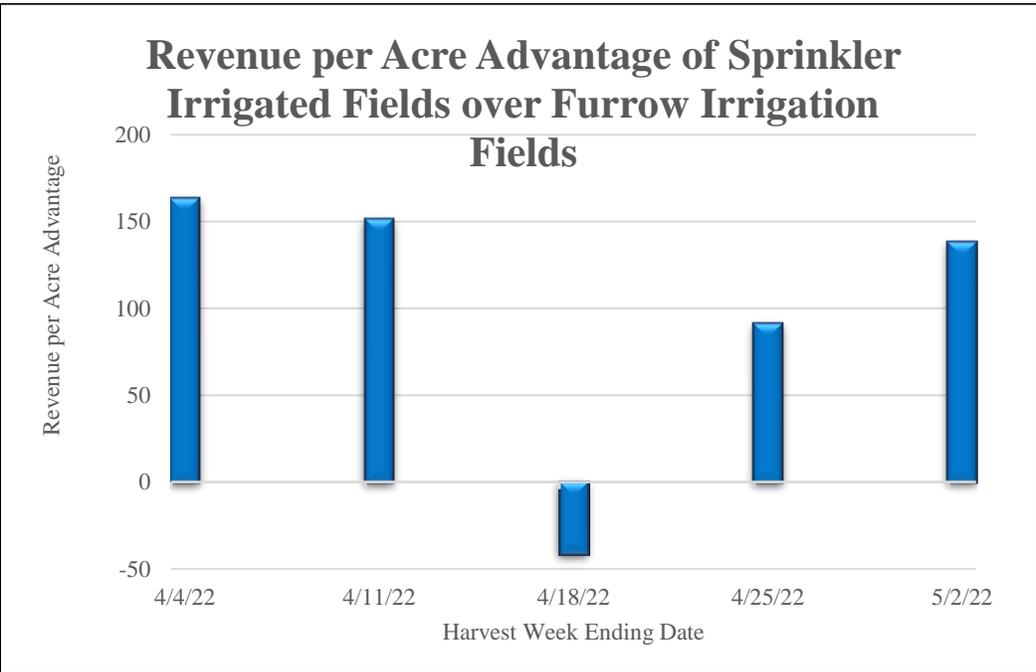
Figure 2: Revenue per acre advantage of sprinkler irrigated fields versus furrow irrigated fields from the first five weeks of the 2022 harvest season.

The data shown in this report is the second year of data from this project. This project was also conducted in the 2020-2021 growing season. In the 2020-2021 season, sprinkler irrigated fields yielded 1,119 lbs. of extractable sugar per acre and $222 per acre over a seven-week harvest period. The complete 2020-2021 season results can be viewed in the 2020-2021 Spreckels Sugar Research Report (http://www.spreckelssugar.com/Agronomy/Research.aspx). This project will be repeated for the 2022-2023 growing season to obtain the third season of data.

In addition to the field project, a research trial to compare sprinkler versus furrow irrigation was conducted for the 2021-2022 growing season and will be repeated for the 2022-2023 growing season.

This irrigation project would not have been possible without the efforts of the Spreckels Sugar Agriculturists collecting the field information and stand counts on the fields during the fall of 2021. Thank you to Israel Santiago, Dimitri Boratynski, and Lauren Hutchinson for collecting the field data. Thank you to Sergio Bastidas for providing the weekly yield data and Shelby Drye and Dimitri Boratynski for organizing and prioritizing this project.

2021-2022 Sugar Beet Emergence Utilizing Furrow and Sprinkler Irrigation – Research Trial

Mark Bloomquist – Spreckels Sugar

Justification:

The Imperial Valley climate can be very harsh for the emergence of seedling sugar beet plants. The daily high temperatures in September are often in excess of 100 degrees F. In addition to these temperatures, many of the soils in the Imperial Valley have salt levels that can create emergence issues for small-seeded crops. Traditionally sugar beet is furrow irrigated in the Imperial Valley. However, there has been increasing interest in utilizing solid set sprinkler pipe during the germination and emergence period and then converting the field to furrow irrigation once the sugar beet stand is established. This project was set up to attempt to quantify if there are emergence differences between these two irrigation methods. If differences do exist, do these differences equate to a root yield and quality difference at harvest?

Objective:

The objective of this project is to determine if an advantage exists to sprinkler irrigation versus furrow irrigation during the germination and emergence period. Comparisons will include emergence percent, root yield, and quality. The project consists of a replicated research trial conducted at the Imperial Valley Research Center in Brawley, CA. The trial compared the use of sprinkler irrigation to furrow irrigation during the emergence period. Two varieties were utilized to compare variety responses to the two irrigation types.

Material and Methods:

In the fall of 2021, a research trial was initiated at the Imperial Valley Research Center, Brawley, CA. The trial was conducted as a randomized complete block in a split-plot arrangement with three replications. Irrigation type (sprinkler, furrow) was the whole plot, and variety was the subplot. The two varieties utilized in the trial were Beta 5678 and SV 983. The irrigation strips were set up as 12-row strips with 12 rows of unplanted area between the strips. The unplanted area separated the irrigation treatments to prevent water from the sprinkler treatments from reaching the adjacent strip. Figure 1 is a map of the trial site.

Prior to listing beds, 100 pounds per acre of MAP fertilizer (11-52-0) was applied to the trial area. Once beds were listed, 140 pounds of nitrogen per acre was injected into the bed as urea ammonium nitrate liquid fertilizer (32-0-0). The beds were shaped, and the trial was planted on September 15, 2021, at a 3" seed spacing. Following planting, irrigation basins were constructed on the furrow irrigation strips, and sprinkler pipe was installed in the sprinkler irrigation strips. Table 1 shows the dates irrigation treatments were applied. The sprinkler treatment utilized 5/64" nozzles and 40 psi. The furrow irrigation was applied with a 1" siphon tube in each row.
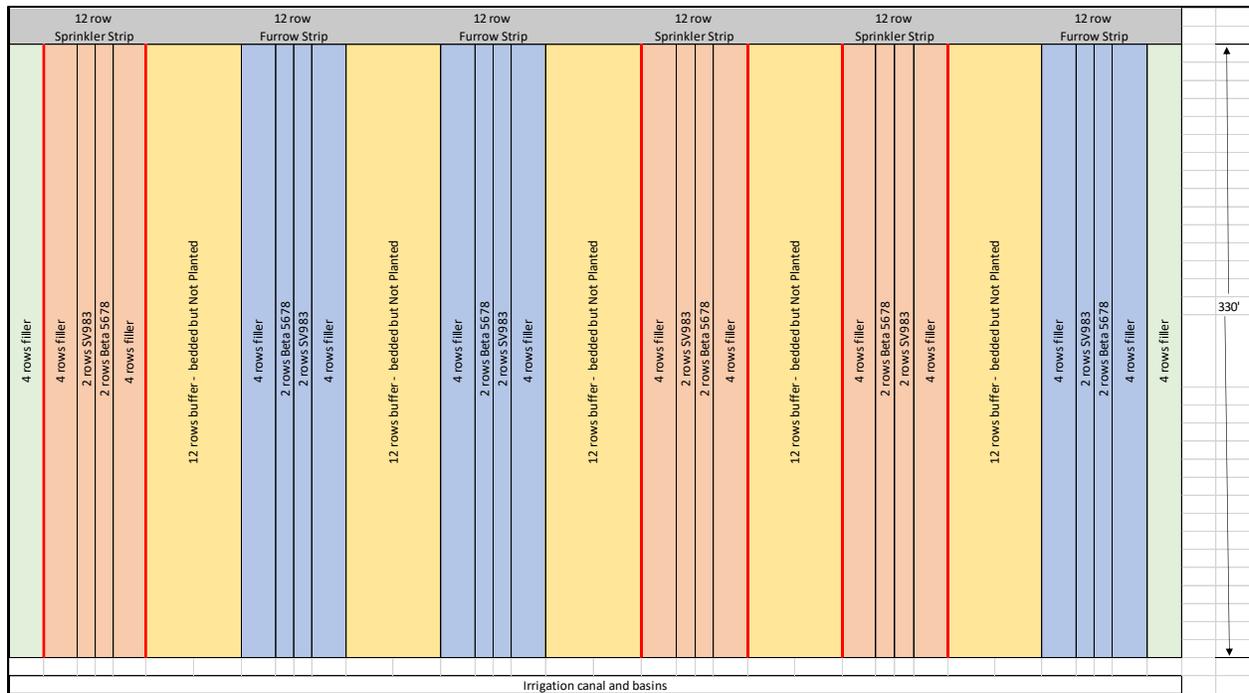
Figure 1. Trial map of 2021-2022 Irrigation Trial.

Table 1. Emergence irrigation treatments.

Irrigation Treatment	Date	Hours of Water Application
Sprinkler	September 16, 2021	24 hours
Sprinkler	September 20, 2021	12 hours
Sprinkler	September 23, 2021	6 hours
Furrow	September 16, 2021	12 hours
Furrow	September 23, 2021	12 hours

Emergence stand counts were taken on September 29. Stand counts were taken for both varieties on each subplot by counting all the emerged beets per range. This provided ten stand counts per variety per replicate. For the analysis, stand counts were converted to sugar beet plants per 100 feet of row. Crop protection products were applied to the trial on an as-needed basis during the growing season. After the initial irrigation treatments, the entire trial was converted to furrow irrigation, and all treatments received the same irrigation practices and amounts of water.

The trial was harvested on April 11, 2022. Root yields were collected in each variety and each irrigation treatment with a two-row research harvester. Plot weights were recorded on the harvester, and a sub-sample of the beets was obtained for quality analysis at the Spreckels Sugar tare lab. The trial was analyzed as an RCBD in a split-plot arrangement with sampling. The analysis was conducted utilizing Proc Mixed in SAS 9.4. Treatment differences were considered significant at a 0.1 significance level.

Results:

Table 2 contains the results of the statistical analysis. An interaction occurred with the emergence percent and sugar beet stand. The interaction appeared to be caused by a difference in magnitude. The emergence and stand counts for SV 983 were greater than Beta 5678 for both the sprinkler and furrow irrigation treatments. Figure 2 illustrates the emergence of both varieties in sprinkler and furrow irrigation treatments. Figure 3 shows the stand counts of both varieties in the sprinkler and furrow irrigation treatments.

The sprinkler treatment was significantly greater in extractable sugar per acre than the furrow irrigation treatment. Table 3 contains the yield information for the sprinkler and furrow irrigation treatments. There were statistically significant root yield and quality differences between the two varieties in the study. SV 983 was statistically greater than Beta 5678 for root yield and extractable sugar per acre. Beta 5678 had a statistically greater sugar percentage than SV 983. The variety root yield and quality results are shown in Table 4.

Table 2. Statistical analysis of the 2021-2022 trial.

Term	Emergence	Beet Stand	Tons/Acre	Sugar %	ESA
Irrigation Type	0.0011	0.0011	0.299	0.891	0.094
Variety	<0.0001	<0.0001	0.0003	0.001	0.010
I x V	<0.0001	<0.0001	0.279	0.194	0.173
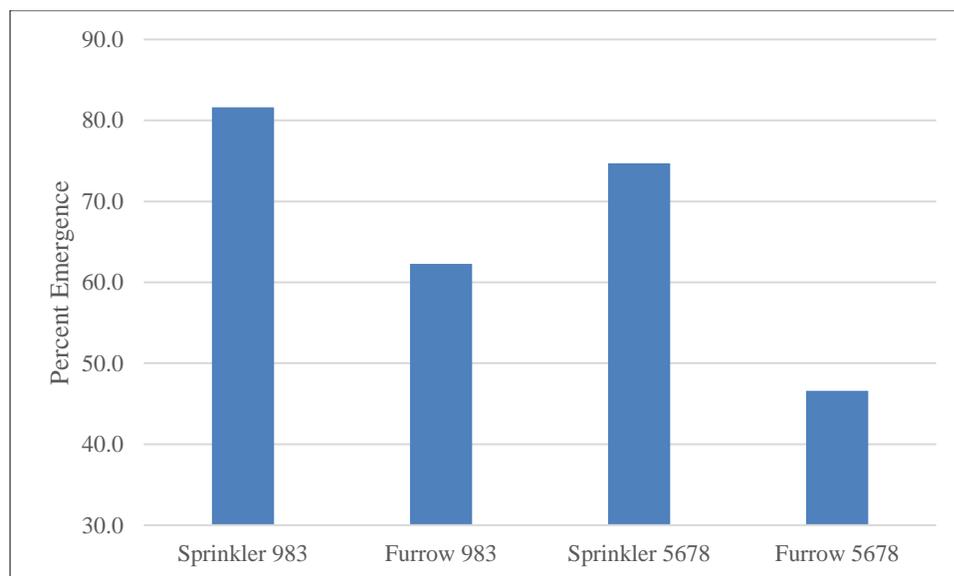
Figure 2. Emergence percent of SV983 and Beta 5678 for both the sprinkler and furrow treatments.
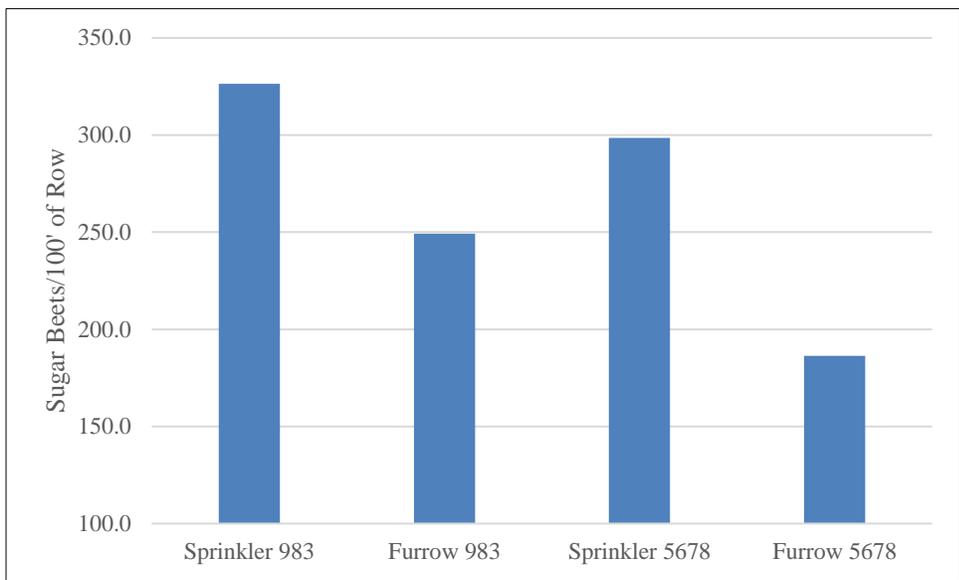
Figure 3. Sugar beet stand counts per 100' of row of SV983 and Beta 5678 for both the sprinkler and furrow treatments.

Table 3. Yield results by irrigation treatment.

Irrigation Type	Tons/Acre	Sugar %	ESA
Sprinkler	33.3	18.2	10,102a
Furrow	31.9	18.2	9,790b
Pr>F	0.30	0.89	0.09
alpha	0.1	0.1	0.1
Reps	3	3	3

Table 4. Yield results by variety.

Variety	Tons/Acre	Sugar %	ESA
SV 983	33.8a	18.0b	10,190a
Beta 5678	31.5b	18.3a	9,702b
Pr>F	0.0003	0.0013	0.0095
Alpha	0.1	0.1	0.1
Reps	3	3	3

Conclusions:

In the first season of this early season irrigation trial, sugar beet emergence and the stand was increased by sprinkler irrigation compared to furrow irrigation during the germination and emergence period. The extractable sugar per acre was 310 lbs. greater with the sprinkler treatment. The results shown are from the first year of the project. This trial is being repeated at the Imperial Valley Research Center for the 2022-2023 growing season.

Nitrogen Rate Effect on Sugar Beet Varieties Grown in the Imperial Valley of California, 2020 – 2021 and 2021– 2022 growing seasons

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Justification: Growers in the Imperial Valley have adopted glyphosate resistant varieties in their sugar beet production system. Nitrogen application is one of the most important factors in producing good quality sugar beet. Many new varieties have been developed with the glyphosate resistant genetics and little is known about the varieties response in tonnage and quality to N fertilizer application rates. Kaffka 2007 reported that the optimum N application rate for sugar beets harvested in June and July was 220 lb N/A with another 100 lb nitrate-N/A in the surface 43 inches of soil at planting. A number of research reports found on the Spreckels Sugar website (www.spreckelsugar.com) Research Reports tab report on recent field research on N application in the Imperial Valley. The research by Lamb, Santiago, and Bloomquist, resulted in varied responses from the use of N fertilizer in the Imperial Valley from 2013 to 2018. New information is needed because of the introduction of glyphosate resistant varieties and the increased production capacity of these new varieties.

Objective:

1. Determine the effect of nitrogen rate on sugar beet varieties.

Materials and Methods: An experiment was established at two locations in the Imperial Valley of California in fall of 2020, Imperial Valley Research Center (IVRC20) and near Holtville (Holtville20) and one location in the fall of 2021 (IVRC21). The treatments were the factorial combination of eight nitrogen application rates (0, 40, 80, 120, 160, 200, 240, and 280 lb N/A) and two sugar beet varieties. These varieties were chosen using the results from the Official Variety Trials (OVT) conducted in the Imperial Valley. The varieties were a top tonnage variety (Beta 5678) and a top-quality variety (SV 983). Two additional varieties included in an incomplete factorial design (Beta 5460 and SV 2997). These varieties were chosen based on popularity in the case of Beta 5460 and new genetics in the case of SV 2997. The N application rates for the additional varieties were 0 and 200 lb N/A. The soil test values for each site are listed in Table 1. At both sites in 2020 - 2021, the soil nitrate-N to a depth of four feet was above optimum. In 2021 – 2022 (IVRC21) the soil nitrate-N to a depth of four feet was only 29 lb N/acre. At the IVRC20 and IVRC21, a pre-plant application of phosphate fertilizer (11-52-0 MAP) was applied to all plots. This supplied 11 lb N/acre. With the preplant MAP application at IVRC21, the total N available for the crop was 40 lb N/acre. At the Holtville20 site, 100 lbs urea/acre and 250 lb MAP/acre were pre-plant applied by the cooperator. This supplied 74 lb N/acre. The nitrogen source for the treatments was liquid UAN (32-0-0). The N fertilizer treatments were applied pre-plant. The treatments for this study are in Table 2. The study had four replications at the IVRC20 and IVRC 21, and six replicates

at Holtville20. The IVRC20 site was planted October 7, 2020, the Holtville20 site was planted October 14, 2020, and IVRC21 was planted September 27, 2021. Petioles from the most recently matured leaves were be sampled February 25, 2021 at IVRC20, March 2, 2021 at Holtville20, and March 1, 2022 at IVRC21 to determine the effect of the treatments on the nitrogen status of the sugar beet plants. The roots were harvested June 3, 2021 at IVRC20 and July 7 and 8, 2021 at Holtville20 and June 3, 2022 at IVRC21. Root quality was determined by the Spreckels Sugar quality laboratory.

Table 1. Soil test values for IVRC20 and Holtville20 in fall 2020 and IVRC21 in fall 2021.

Soil test	IVRC 20	Holtville 20	IVRC 21
Nitrate-N (0-4 ft.) lb N/A	280	228	29
Olsen P (0-1 ft.) ppm	13	14	12
K (0-1 ft.) ppm	473	258	397

Table 2. Treatments for the Nitrogen rate and application time study.

Treatment number	N rate	Variety
1	0	Beta 5678
2	40	Beta 5678
3	80	Beta 5678
4	120	Beta 5678
5	160	Beta 5678
6	200	Beta 5678
7	240	Beta 5678
8	280	Beta 5678
9	0	SV 983
10	40	SV 983
11	80	SV 983
12	120	SV 983
13	160	SV 983
14	200	SV 983
15	240	SV 983
16	280	SV 983
17	0	Beta 5460
18	200	Beta 5460
19	0	SV 2997
20	200	SV 2997

Results and Discussion:

IVRC20 2020 – 2021:

N rate for Beta 5678 and SV 983

Root yield and extractable sucrose per acre were significantly affected by variety at IVRC in the 2020 – 2021 growing season, Table 3. Root yield and extractable sucrose per acre were greater for SV 983 than Beta 5678, Table 4. The differences were 4.3 ton per acre and 1382 lb per acre for root yield and extractable sucrose per acre, respectively. Nitrogen fertilizer did not affect root yield or extractable sucrose per acre. The initial soil nitrate-N was large at 280 lb N/acre so the lack of response was not a surprise.

Extractable sucrose per ton was affected by N fertilizer application, Table 3 and 4. There was a slight interaction between variety and N fertilizer rate, 0.13. This interaction is illustrated in Figure 1. The extractable sucrose per ton decreases as the N fertilizer rate increases for Beta 5678. The response for SV 983 for extractable sucrose per ton with N rate increasing was an increase to a maximum at 120 lb N per acre and then a decrease with increasing N application above 120 lb N per acre. In general, the increased application of N fertilizer reduced extractable sucrose per ton.

Petiole nitrate-N sampled in late February 2021 was greater for Beta 5678 compared to SV 983. Fertilizer N rate of application increased petiole nitrate-N concentration, Table 5. and Figure 2. As the fertilizer N rate was increased the petiole nitrate-N concentration increased.

Table 3. Statistical analysis of N rate for Beta 5678 and SV 983 for root yield, extractable sucrose per ton, extractable sucrose per acre, purity, and petiole nitrate-N at IVRC20 grown in the 2020 - 2021 growing season.

		Extractable sucrose		Purity	Petiole nitrate-N
Term	Root yield	lb/Ton	lb/Acre	%	ppm
Rep	0.001	0.0003	0.90	0.13	0.23
Variety	0.0001	0.93	0.0001	0.26	0.03
N rate	0.24	0.02	0.80	0.11	0.0001
Variety X Nrate	0.51	0.13	0.42	0.34	0.34
C.V. (%)	4.7	3.5	5.0	1.2	39.9
Grand mean	66.9	292	19526	89.3	1514

Table 4. The means for N rate by Variety for Beta 5678 and SV 983 for root yield, extractable sucrose per ton, and extractable sucrose per acre at IVRC20 grown in 2020 – 2021 growing season.

N rate	Root yield			Extractable sucrose					
	Beta 5678	SV 983	Mean	Beta 5678	SV 983	Mean	Beta 5678	SV 983	Mean
lb N/A	ton/A			lb/ton			lb/A		
0	59.2	67.6	63.4	307	296	300	18169	20004	19087
40	63.5	69.5	66.5	299	285	292	18983	19836	19399
80	65.1	68.8	67.2	304	294	299	19541	20671	20219
120	65.6	72.8	68.7	280	292	285	18315	20494	19249
160	65.3	69.1	67.2	286	298	293	19029	20578	19914
200	65.1	66.3	65.6	298	296	297	19535	19577	19556
240	66.6	68.5	67.5	279	294	285	18590	20643	19470
280	67.6	69.8	68.6	285	281	282	19353	19523	19466
Mean	64.8	69.1		291	292		18861	20243	

Table 5. The means for N rate by Variety for Beta 5678 and SV 983 for purity, and petiole nitrate-N at IVRC20 grown in 2020 – 2021 growing season.

N rate	Root purity			Petiole nitrate-N		
	Beta 5678	SV 983	Mean	Beta 5678	SV 983	Mean
lb N/A	%			ppm		
0	90.1	90.0	90.1	350	372	362
40	89.8	88.4	89.1	648	862	755
80	89.5	89.6	89.5	1133	285	709
120	89.2	88.8	89.0	1783	1412	1597
160	89.7	89.6	89.7	1927	1507	1717
200	90.6	89.1	89.8	884	812	843
240	88.4	89.5	88.8	2942	1665	2394
280	88.6	88.2	88.4	3701	3519	3610
Mean	89.5	89.1		1195	1165	
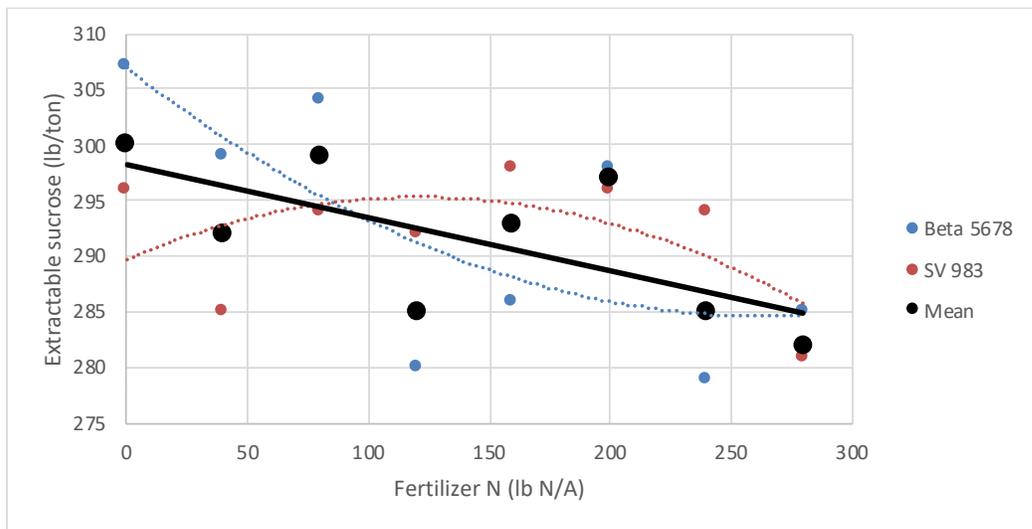
Figure 1. The effect of fertilizer N on extractable sucrose per ton at IVRC20 during the 2020 – 2021 growing season.
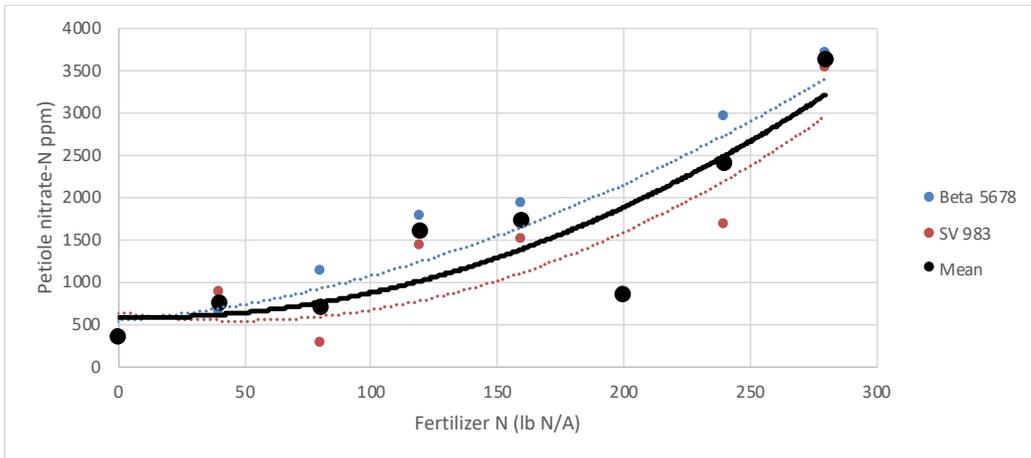
Figure 2. The effect of N fertilizer on petiole nitrate-N at IVRC20 during the 2020 – 2021 growing season.

N response for Beta 5678, SV 983, Beta 5460, and SV 2997 at IVRC20

Two additional sugar beet varieties were included in the study to understand the effect of N fertilizer on a wider selection of varieties. These varieties were Beta 5460 and SV 2997. These were compared at the 0 and 200 lb N per acre N rates.

Root yield was affected by variety and had an interaction between variety and N rate application, Table 6. The interaction was caused by a non-response to N fertilizer application by SV 983, Beta 5460, and SV 2997 and a response to N fertilizer by Beta 5678, Table 7. The response to N by Beta 5678 was not significant when the extended N treatments were used in the study (see earlier discussion). Extractable sucrose per acre was not affected by the treatments. This leads to the conclusion that the interaction for root yield is not important.

Extractable sucrose per ton was not significantly affect by variety or N fertilizer application, Table 6 and 7.

Table 6. Statistical analysis for response of Beta 5678, SV 983, Beta 5460, and SV 2997 to 200 lb N/A for root yield, extractable sucrose per ton, extractable sucrose per acre, purity, and petiole nitrate-N at IVRC20 grown in the 2020 - 2021 growing season.

		Extractable sucrose		Purity	Petiole nitrate-N
Term	Root yield	lb/Ton	lb/Acre	%	ppm
Rep	0.07	0.03	0.21	0.14	0.16
Variety	0.05	0.22	0.31	0.37	0.09
N rate	0.96	0.76	0.97	0.17	0.007
Variety X Nrate	0.10	0.12	0.28	0.09	0.33
C.V. (%)	4.5	3.5	4.6	0.9	65.9
Grand mean	65.5	296	19323	90.0	664

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Table 7. The means for N rate by Variety for response of Beta 5678, SV 983, Beta 5460, and SV 2997 to 200 lb N/A for root yield, extractable sucrose per ton, and extractable sucrose per acre at IVRC20 grown in the 2020 - 2021 growing season.

	Root yield			Extractable sucrose					
	0 lb N/A	200 lb N/A	Mean	0 lb N/A	200 lb N/A	Mean	0 lb N/A	200 lb N/A	Mean
Variety	ton/A			lb/ton			lb/A		
Beta 5678	59.2	65.1	62.6	307	298	302	18169	19535	18852
SV 983	67.6	66.3	67.0	296	296	296	20004	19577	19791
Beta 5460	66.6	65.8	66.1	302	291	297	19884	19294	19589
SV 2997	68.3	65.8	66.5	284	297	291	18635	19258	19009
Mean	65.4	65.5		297	295		19222	19416	

There was a significant interaction between variety and N application rate for beet root purity, Table 6. For SV 983 and SV 2997 purity was not affect by the addition of N fertilizer, Table 8, while purity was increased for Beta 5678 with N fertilizer addition and decreased for Beta 5460. These differences are not large.

Petiole nitrate-N was affected by both variety and N fertilizer application rate, Table 6. The addition of N fertilizer increased the petiole nitrate-N for all varieties, Table 8. Beta 5460 had the greatest petiole-nitrate-N, followed by Beta 5678 and SV 983. The variety with the least petiole nitrate-N concentration was SV 2997.

Table 8. The means for N rate by Variety for response of Beta 5678, SV 983, Beta 5460, and SV 2997 to 200 lb N/A for purity and petiole nitrate-N at IVRC20 grown in the 2020 - 2021 growing season.

	Root purity			Petiole nitrate-N		
	0 lb N/A	200 lb N/A	Mean	0 lb N/A	200 lb N/A	Mean
Variety	%			ppm		
Beta 5678	90.1	90.6	90.4	350	884	617
SV 983	90.0	89.1	89.6	372	812	592
Beta 5460	90.7	89.1	90.0	554	1526	970
SV 2997	89.9	90.0	89.9	402	543	482
Mean	90.2	89.7		425	903	

Holtville20 2020 – 2021:

N rate for Beta 5678 and SV 983 at Holtville20

Root yield was significantly affected by variety at Holtville20 in the 2020 – 2021 growing season, Table 9. Root yield was greater for SV 983 than Beta 5678, Table 10. The difference was 2.8 ton per acre for root yield. Nitrogen fertilizer did not affect root yield.

Extractable sucrose per ton was affected by Variety and N fertilizer application, Table 9 and 10. Extractable sucrose per ton was greater for SV983 compared to Beta 5678. This difference is small. The extractable sucrose per ton has a small decrease as the N fertilizer rate increased particularly at the application of 280 lb N/A.

Extractable sucrose per acre was not significantly affec[MB1]ted by Variety or N application, Tables 9 and 10.

Root purity was significantly affected by variety and N rate, Table 9 and 11. Beta 5678 has a greater root purity compared to SV983. This difference is only 0.6 %. The application of N decreases root purity from 90.1 to 88.7 %.

Petiole nitrate-N sampled late February 2021 was not significantly affected by variety. Nitrogen application increased petiole nitrate-N concentration, Tables 9 and 11.

The lack of response to N fertilizer is not totally surprising. The initial residual nitrate-N was 228 lb N/acre and then add the amount of N applied by the cooperator as urea and MAP, 74 lb N/acre totaled 302 lb N/acre. This is considerable.

Table 9. Statistical analysis of N rate for Beta 5678 and SV 983 for root yield, extractable sucrose per ton, extractable sucrose per acre, purity, and petiole nitrate-N at Holtville20 grown in the 2020 - 2021 growing season.

		Extractable sucrose		Purity	Petiole nitrate-N
Term	Root yield	lb/Ton	lb/Acre	%	ppm
Rep	0.41	0.04	0.29	0.07	0.0001
Variety	0.01	0.07	0.20	0.04	0.65
N rate	0.38	0.0001	0.64	0.06	0.0001
Variety X Nrate	0.15	0.52	0.27	0.26	0.89
C.V. (%)	4.7	3.8	5.6	1.4	24.4
Grand mean	80.6	252	20299	89.6	2403

Table 10. The means for N rate by Variety for Beta 5678 and SV 983 for root yield, extractable sucrose per ton, and extractable sucrose per acre at Holtville20 grown in 2020 – 2021 growing season.

N rate	Root yield			Extractable sucrose					
	Beta 5678	SV 983	Mean	Beta 5678	SV 983	Mean	Beta 5678	SV 983	Mean
lb N/A	ton/A			lb/ton			lb/A		
0	78.3	83.3	81.0	260	251	256	20259	20934	20597
40	79.5	78.6	79.0	262	259	260	20746	20460	20587
80	74.9	83.9	79.4	256	252	254	19138	20993	20065
120	80.3	81.6	81.0	250	249	249	19748	20595	20217
160	79.8	81.8	80,6	263	252	257	20870	20541	20738
200	77.5	81.4	79.4	249	256	253	19587	20695	20141
240	81.5	81.6	81.5	249	251	250	20287	20464	20376
280	82.0	83.6	82.8	243	233	238	20007	19269	19679
Mean	79.2	82.0		254	251		20083	20525	

Table 11. The means for N rate by Variety for Beta 5678 and SV 983 for purity, and petiole nitrate-N at Holtville20 grown in 2020 – 2021 growing season.

N rate	Root purity			Petiole nitrate-N		
	Beta 5678	SV 983	Mean	Beta 5678	SV 983	Mean
lb N/A	%			ppm		
0	90.9	89.3	90.1	1520	1897	1708
40	90.4	89.9	90.2	1949	1854	1901
80	90.2	89.2	89.7	2009	1662	1836
120	89.1	88.8	88.9	2622	2833	2728
160	90.6	89.2	89.9	2749	2878	2814
200	89.2	90.3	89.7	2857	1820	1839
240	89.8	89.6	89.7	3024	3057	3040
280	88.9	88.4	88.7	3278	3445	3362
Mean	89.9	89.3		2376	2431	

N response for Beta 5678, SV 983, Beta 5460, and SV 2997 at Holtville20

Two additional sugar beet varieties were included in the study to understand the effect of N fertilizer on a wider selection of varieties. These varieties were Beta 5460 and SV 2997. These were compared at the 0 and 200 lb N per acre N rates.

In this comparison, application of N did not affect any of the measured parameters, Tables 12, 13, and 14. This is like the results of the full N rate study with only Beta 5678 and SV 983.

Variety affected root yield, extractable sucrose per ton, and extractable sucrose per acre, Table 12. Beta 5678 and 5460 had root yield that was less than SV983 and 2997N, Table 13.

Extractable sucrose per ton was similar for Beta 5678, Beta 5460, and SV983. The significant difference is because SV 2997 extractable sucrose per ton is less than the other three varieties, Table 13.

Extractable sucrose per acre was significantly affected by variety, Table 12. The variety with the greatest extractable sucrose per acre was Beta 5460, followed by SV983, Beta 5678, and SV 2997, Table 13.

Table 12. Statistical analysis for response of Beta 5678, SV 983, Beta 5460, and SV 2997 to 200 lb N/A for root yield, extractable sucrose per ton, extractable sucrose per acre, purity, and petiole nitrate-N at Holtville20 grown in the 2020 - 2021 growing season.

		Extractable sucrose		Purity	Petiole nitrate-N
Term	Root yield	lb/Ton	lb/Acre	%	ppm
Rep	0.95	0.15	0.54	0.17	0.0005
Variety	0.06	0.0002	0.06	0.33	0.68
N rate	0.25	0.18	0.87	0.30	0.82
Variety X Nrate	0.18	0.27	0.44	0.12	0.34
C.V. (%)	5.0	4.3	6.4	1.6	30.3
Grand mean	80.2	252	20202	90.0	1845

Table 13. The means for N rate by Variety for response of Beta 5678, SV 983, Beta 5460, and SV 2997 to 200 lb N/A for root yield, extractable sucrose per ton, and extractable sucrose per acre at Holtville20 grown in the 2020 - 2021 growing season.

	Root yield			Extractable sucrose					
	0 lb N/A	200 lb N/A	Mean	0 lb N/A	200 lb N/A	Mean	0 lb N/A	200 lb N/A	Mean
Variety	ton/A			lb/ton			lb/A		
Beta 5678	78.3	77.5	77.9	260	249	255	20259	19587	19923
SV 983	83.3	81.4	82.3	251	256	253	20934	20695	20815
Beta 5460	77.2	81.8	79.3	261	260	261	20163	21251	20612
SV 2997	79.5	82.9	81.2	244	232	238	19562	19276	19419
Mean	79.6	80.9		255	250		20226	20177	

Table 14. The means for N rate by Variety for response of Beta 5678, SV 983, Beta 5460, and SV 2997 to 200 lb N/A for purity and petiole nitrate-N at Holtville20 grown in the 2020 - 2021 growing season.

	Root purity			Petiole nitrate-N		
	0 lb N/A	200 lb N/A	Mean	0 lb N/A	200 lb N/A	Mean
Variety	%			ppm		
Beta 5678	90.9	89.2	90.0	1520	1857	1688
SV 983	89.3	90.3	90.8	1897	1820	1859
Beta 5460	90.6	90.3	90.5	1925	2007	1966
SV 2997	90.0	89.0	89.5	2117	1619	1868
Mean	90.2	89.7		1865	1826	

IVRC21 2021 – 2022:

N rate for Beta 5678 and SV 983 at IVRC21

Root yield was significantly affected by N rate at IVRC21 in the 2021 – 2022 growing season, Table15. Root yield was increased with the addition of nitrogen fertilizer, Table 16. The increase to root yield was not maximized at 280 lb N/A, Figure 3. Variety did not affect root yield.

Extractable sucrose per ton was not affected by N fertilizer application or variety, Table 15 and 16.

Extractable sucrose per acre was affected by N fertilizer application, Table 15 and 16. Similar to root yield, extractable sucrose per acre was increased by increased application of N fertilizer with the maximum occurring with the application of 280 lb N/A, Figure 4. Variety did not affect extractable sucrose per acre.

Root purity was not significantly affected by N fertilizer application or variety, Table 15 and 17.

Petiole nitrate-N sampled early March 2022 had a significant interaction in response between N fertilizer application and variety, Table 15 and 17, Figure 5. The petiole nitrate-N for Beta 5678 was increased by the addition of N fertilizer while SV983 was not.

The response of root yield and extractable sucrose per acre was expected because the residual nitrate-N in the surface 4 feet of soil plus the N in the pre-plant phosphate

application was low, 40 lb N/A. The lack of effect of the N fertilizer on extractable sucrose per ton and purity was surprising. Normally the addition of this much N fertilizer would decrease quality.

Table 15. Statistical analysis of N rate for Beta 5678 and SV 983 for root yield, extractable sucrose per ton, extractable sucrose per acre, purity, and petiole nitrate-N at IRVC21 grown in the 2021 - 2022 growing season.

Term	Root yield	Extractable sucrose lb/Ton	Extractable sucrose lb/Acre	Purity %	Petiole nitrate-N ppm
Rep	0.46	0.10	0.56	0.54	
Variety	0.53	0.38	0.83	0.25	0.08
N rate	0.001	0.14	0.002	0.11	0.1
Variety X Nrate	0.32	0.43	0.40	0.57	0.07
C.V. (%)	8.5	3.5	7.8	0.9	112
Grand mean	55.3	307	16975	89.0	744

Table 16. The means for N rate by Variety for Beta 5678 and SV 983 for root yield, extractable sucrose per ton, and extractable sucrose per acre at IVRC21 grown in 2021 – 2022 growing season.

N rate	Root yield Beta 5678	Root yield SV 983	Root yield Mean	Extractable sucrose Beta 5678	Extractable sucrose SV 983	Extractable sucrose Mean	Beta 5678	SV 983	Mean
lb N/A		ton/A			lb/ton			lb/A	
0	47.7	46.0	47.0	314	312	313	14985	14254	14672
40	52.4	57.0	54.9	307	298	302	16075	16927	16548
80	57.2	52.9	54.3	300	309	306	17164	16323	16604
120	52.6	53.4	53.1	319	310	314	16757	16535	16630
160	57.2	60.5	58.1	306	292	302	17515	17678	17561
200	59.5	60.0	59.6	317	305	310	18800	18194	18436
240	58.0	55.2	56.2	309	314	312	17906	17312	17510
280	55.5	62.8	60.1	304	304	304	16846	19051	18224
Mean	54.4	56.1	55.3	309	306	307	16815	17110	16975
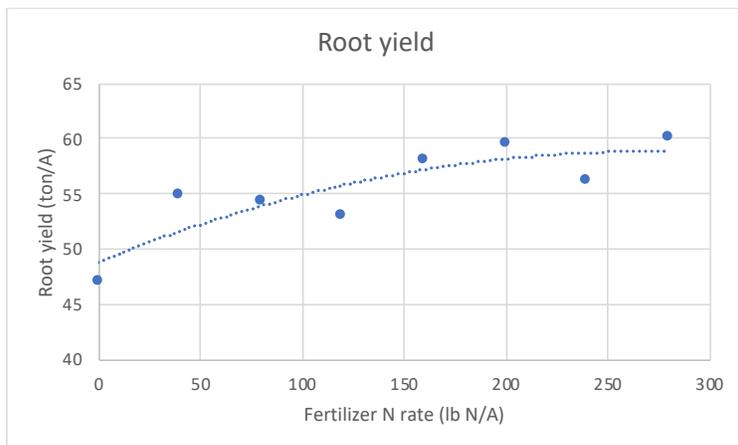
Figure 3. The effect of fertilizer N on root yield at IVRC21 during the 2021 – 2022 growing season.
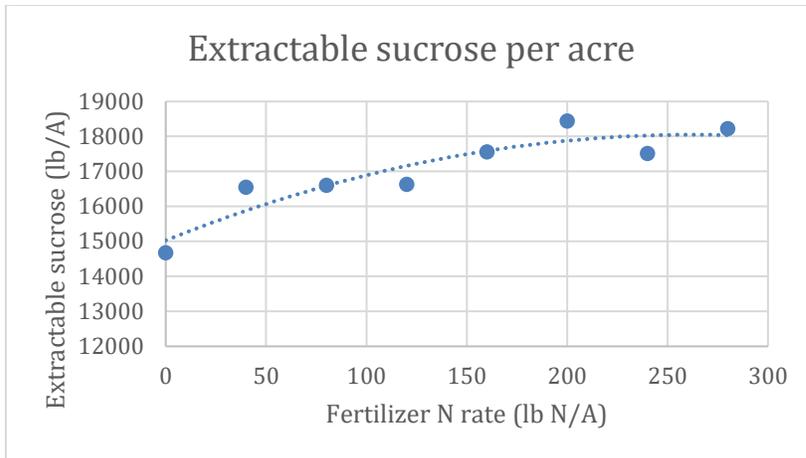
Figure 4. The effect of fertilizer N on extractable sucrose per acre at IVRC21 during the 2021 – 2022 growing season.

Table 17. The means for N rate by Variety for Beta 5678 and SV 983 for purity, and petiole nitrate-N at IVRC21 grown in 2021 – 2022 growing season.

N rate	Root purity			Petiole nitrate-N		
	Beta 5678	SV 983	Mean	Beta 5678	SV 983	Mean
lb N/A	%			ppm		
0	90.9	90.1	90.5	293	1142	718
40	89.9	89.3	89.6	290	452	371
80	89.9	89.7	89.7	901	390	646
120	90.1	89.5	89.7	905	336	621
160	90.2	89.1	89.9	94	531	313
200	89.9	89.8	89.8	1375	724	1050
240	89.9	90.0	89.0	1350	322	836
280	88.6	89.3	90.0	2060	740	1400
Mean	90.0	89.6	89.0	909	580	744
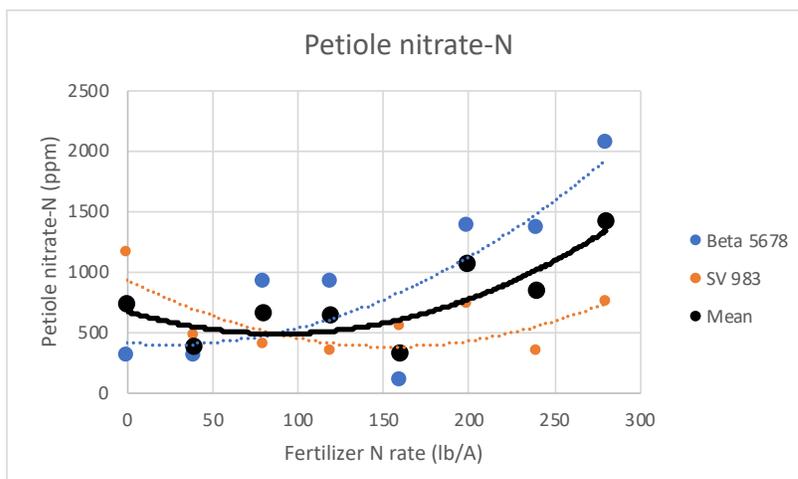
Figure 5. The effect of fertilizer N on petiole nitrate-N in early March at IVRC21 during the 2021 – 2022 growing season.

N response for Beta 5678, SV 983, Beta 5460, and SV 2997 at IVRC21

Two additional sugar beet varieties were included in the study to understand the effect of N fertilizer on a wider selection of varieties. These varieties were Beta 5460 and SV 2997. These were compared at the 0 and 200 lb N per acre N rates.

In this comparison, application of N increased root yield and extractable sucrose per acre, Tables 18 and 19. These results were similar for root yield and extractable sucrose per acre in the full N rate study with only Beta 5678 and SV 983. Purity was significantly reduced by the addition of 200 lb N/A of fertilizer, Tables 18 and 20. The petiole nitrate-N was increased with the addition of fertilizer N, Tables 18 and 20. The addition of N fertilizer did not significantly affect extractable sucrose per ton, Tables 18 and 19.

Variety did not affect any of the parameters measured, Tables 18, 19, and 20.

Table 18. Statistical analysis for response of Beta 5678, SV 983, Beta 5460, and SV 2997 to 200 lb N/A for root yield, extractable sucrose per ton, extractable sucrose per acre, purity, and petiole nitrate-N at IVRC21 grown in the 2021 - 2022 growing season.

		Extractable sucrose		Purity	Petiole nitrate-N
Term	Root yield	lb/Ton	lb/Acre	%	ppm
Rep	0.68	0.25	0.91	0.14	0.81
Variety	0.47	0.46	0.42	0.67	0.99
N rate	0.002	0.68	0.0007	0.08	0.02
Variety X Nrate	0.68	0.94	0.64	0.75	0.65
C.V. (%)	11.0	4.1	10.3	0.9	119
Grand mean	55.2	309	17033	90.1	276

Table 19. The means for N rate by Variety for response of Beta 5678, SV 983, Beta 5460, and SV 2997 to 200 lb N/A for root yield, extractable sucrose per ton, and extractable sucrose per acre at IVRC21 grown in the 2021 - 2022 growing season.

	Root yield			Extractable sucrose					
	0 lb N/A	200 lb N/A	Mean	0 lb N/A	200 lb N/A	Mean	0 lb N/A	200 lb N/A	Mean
Variety	ton/A			lb/ton			lb/A		
Beta 5678	47.7	59.5	51.6	314	317	315	14985	18800	16256
SV 983	46.0	59.7	52.8	312	305	309	14254	18194	16224
Beta 5460	54.0	60.9	57.4	313	310	311	16853	18860	17856
SV 2997	54.8	62.0	57.9	303	302	302	16527	18681	17450
Mean	50.9	60.6		310	308		15748	18639	

Table 20. The means for N rate by Variety for response of Beta 5678, SV 983, Beta 5460, and SV 2997 to 200 lb N/A for purity and petiole nitrate-N at IVRC21 grown in the 2021 - 2022 growing season.

	Root purity			Petiole nitrate-N		
	0 lb N/A	200 lb N/A	Mean	0 lb N/A	200 lb N/A	Mean
Variety	%			ppm		
Beta 5678	90.9	89.9	90.5	25	576	209
SV 983	90.1	89.8	89.9	137	339	238
Beta 5460	90.2	89.8	90.0	118	538	328
SV 2997	90.4	89.6	90.0	233	402	305
Mean	90.4	89.8		128	460	

Summary:

At IVRC20 and Holtville20, root yield and extractable sucrose per acre were not affected by the addition of N fertilizer. Extractable sucrose per ton at IVRC was reduced with increasing N fertilizer application. This reduction was reflected in the petiole nitrate-N concentrations from samples collected in late February. Variety did not affect the response to N fertilizer application at either site. The lack of N response at both sites was explained by the large amounts of residual soil nitrate-N at the beginning of the study.

Root yield and extractable sucrose did increase with increasing application of fertilizer N at the IVRC21 site. This was caused by a low residual soil nitrate-N. All the varieties responded similarly to the addition of N.

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2021-2022 Imperial Valley Official Variety Trial Procedures

Mark Bloomquist – Spreckels Sugar

Four Official Variety Trial locations were planted. Two of these trials were planted on early harvest fields, and two of the trials were planted on late harvest fields. Trials were planted with an ERMAS vacuum planter. Plots were two 30"-rows wide by twenty-five feet long. Each variety was replicated eight times across each trial. The experimental design of the trials was a randomized complete block. Emergence counts were taken approximately 21-28 days after planting. After the emergence counts were taken, plots were thinned to a uniform spacing and all doubles were removed. Final stand counts were taken following thinning.

Weed control, insect control, and disease control applications were applied by the trial cooperator to match the practices of the field. Weed escapes were removed throughout the season to prevent competition with the sugar beets.

Prior to harvest, row lengths were taken on each harvest row to calculate yield at harvest. All plots were defoliated using a 4-row defoliator with scalpers. Each two-row plot was harvested using a 2-row research harvester. All beets harvested from the two rows were weighed on a scale on the harvester and a sample of beets was taken for quality analysis at the Spreckels Sugar Tare Lab.

All varieties in their second year of testing and beyond were entered into various disease nurseries to evaluate the disease tolerance of the varieties. Rhizomania was evaluated at the Beet Sugar Development Foundation's Rhizomania Nursery by Dr. Carl Strausbaugh in Kimberly Idaho. Curly Top was evaluated at the Beet Sugar Development Foundation's Curly Top Nursery by Dr. Carl Strausbaugh in Kimberly Idaho. Powdery Mildew was evaluated by Dr. Stephen Kaffka at Davis California.

Data is summarized and merged with the previous two years of data to evaluate the varieties for approval. The Imperial Valley Policy sets out guidelines for minimum performance standards of the varieties. Varieties that meet all the approval criteria are approved for shareholders to plant their 2022-2023 sugar beet crop.

2021-2022 Imperial Valley Official Variety Trial Locations

Trial Name	Cooperator	Canal/Gate	Plant Date	Harvest Date
Early Harvest Loc. 1	Horizon Farms	Hemlock 11S	9/15/21	3/30/22
Early Harvest Loc. 2	Lance Reeves	Marigold 8	9/25/21	4/6/22
Late Harvest Loc. 1	Gary Mamer	Township 26	10/13/21	7/7/22
Late Harvest Loc. 2	Fritz Ruegger	Spruce Main 26	10/6/21	6/1/22

Imperial Valley Early Harvest Official Variety Trials
1 Year Data (2022)

Variety	Approval Status for 2022-23 crop	Extractable Sugar/Acre	Extractable Sugar/Ton	Gross Sugar/Acre	Tons/ Acre	% Sugar	Purity	Final Stand**	% Bolt	Percent Emergence*	Curly Top	% of Mkt.	Powdery Mildew	% of Mkt. Avg.	Rhizomania Root Rating
BTS 5255		10,819	272.7	13,471	39.4	17.0	87.2	214	0.0	53.4	--		--		--
Hilleshog HIL2421		8,318	270.3	10,495	31.0	17.0	86.6	212	0.0	49.0	--		--		--
BTS 5678	Full Approval	10,573	267.1	13,245	39.4	16.8	87.0	213	0.0	54.5	5.1		--		--
SV 983	Full Approval	9,940	266.4	12,454	37.3	16.7	87.0	202	0.0	38.1	5.5	103.8	--		--
BTS 5239		9,260	264.7	11,795	34.8	16.9	86.0	212	0.0	49.9	--		--		--
BTS 5104		9,771	264.1	12,276	37.1	16.6	86.8	212	0.0	58.5	5.2	98.1	--		--
BTS 511N		9,945	264.0	12,562	37.8	16.7	86.5	212	0.0	53.0	5.2	98.1	--		--
SV 1927		10,161	263.0	12,703	38.7	16.5	87.2	212	0.0	58.5	--		--		--
BTS 520N		10,175	262.9	12,823	39.0	16.6	86.7	212	0.0	52.1	--		--		--
SV 1913N		9,258	262.0	11,786	35.4	16.7	86.2	211	0.0	47.1	5.4	101.9	--		--
SV 1915		9,846	261.7	12,443	37.9	16.5	86.8	211	0.0	49.6	5.3	100.0	--		--
BTS 5460	Full Approval	9,910	261.2	12,490	38.0	16.5	86.7	213	0.0	52.0	5.3	100.0	--		--
BTS 5294		9,223	260.2	11,669	35.4	16.5	86.4	212	0.0	48.4	--		--		--
BTS 5281		8,625	257.5	10,937	33.5	16.3	86.4	211	0.0	46.6	--		--		--
SV 501	Full Approval	9,562	257.3	12,046	37.3	16.2	86.8	212	0.0	60.2	4.9	92.5	--		--
BTS 5775	Full Approval	9,235	256.4	11,735	36.3	16.3	86.3	206	0.0	42.4	5.6	105.7	--		--
SV 602	Full Approval	10,602	255.8	13,293	41.4	16.1	87.1	211	0.0	49.4	5.4	101.9	--		--
SV 911		10,361	252.9	13,073	41.0	16.0	86.8	212	0.0	50.2	5.3		--		--
Hilleshog HIL2420		9,946	252.7	12,550	39.5	15.9	86.8	211	0.0	47.9	--		--		--
Mean of Fully Approved (22-23)		9,970	260.7	12,544	38.3	16.4	86.8								
97% of Fully Approved (22-23)		9,671	252.9	12,167	37.1	15.9	84.2								
CV%		2.9	2.3	2.5	2.5	1.9	0.6	7.6	--	2.3	5.1				
LSD (0.05)		587.0	NS	640.8	2.0	NS	NS	8.1	--	NS	0.4				

Cooperator	Planted	Harvested	Plot Size	Notes:
Horizon Farms	9/15/21	3/30/22	2 rows. 30" rows.	Experimental Design: RCBD
Lance Reeves	9/25/21	4/6/22	2 rows. 30" rows.	Experimental Design: RCBD

Varieties ranked by Extractable Sugar per Ton.

* Emergence counts taken prior to thinning and converted to a percent.

** Final Stand counts converted to beets per 100 foot of row. Final stand counts taken after thinning.

Imperial Valley Early Harvest Official Variety Trials
2 Year Data (2021-2022)

Variety	Approval Status for 2022-23 crop	Extractable Sugar/Acre	Extractable Sugar/Ton	Gross Sugar/Acre	Tons/Acre	% Sugar	Purity	Final Stand**	% Bolt	Percent Emergence*		Curly Top	% of Mkt.	Powdery Mildew***	% of Mkt.	Rhizomania Root Rating
BTS 511N																
2022 Trial		9,945	264.0	12,562	37.8	16.7	86.5	212	0.0	53.0		5.2	98.1	--	--	--
2021 Trial		12,020	292.0	14,391	40.8	17.5	89.7	224	0.0	57.2		--	--	7.5	111.7	--
Average		10,983	278.0	13,477	39.3	17.1	88.1	218	0.0	55.1						
SV 983	Full Approval															
2022 Trial		9,940	266.4	12,454	37.3	16.7	87.0	202	0.0	38.1		5.5	103.8	--	--	--
2021 Trial		12,329	286.6	14,676	42.9	17.1	89.8	223	0.0	42.4		5.8	98.0	6.4	95.3	2.4
Average		11,135	276.5	13,565	40.1	16.9	88.4	213	0.0	40.3						
SV 1915																
2022 Trial		9,846	261.7	12,443	37.9	16.5	86.8	211	0.0	49.6		5.3	100.0	--	--	--
2021 Trial		12,326	287.9	14,697	43.0	17.2	89.8	224	0.0	50.2		--	--	6.1	90.8	--
Average		11,086	274.8	13,570	40.5	16.9	88.3	218	0.0	49.9						
BTS 5678	Full Approval															
2022 Trial		10,573	267.1	13,245	39.4	16.8	87.0	213	0.0	54.5		5.1	96.2	--	--	--
2021 Trial		12,097	282.0	14,499	42.7	16.9	89.7	222	0.0	38.4		5.9	99.7	7.4	110.2	2.0
Average		11,335	274.6	13,872	41.1	16.9	88.4	218	0.0	46.5						
BTS 5460	Full Approval															
2022 Trial		9,910	261.2	12,490	38.0	16.5	86.7	213	0.0	52.0		5.3	100.0	--	--	--
2021 Trial		11,512	280.4	13,878	40.8	16.9	89.5	223	0.0	48.3		5.6	94.6	7.8	116.1	2.1
Average		10,711	270.8	13,184	39.4	16.7	88.1	218	0.0	50.2						
SV 1913N																
2022 Trial		9,258	262.0	11,786	35.4	16.7	86.2	211	0.0	47.1		5.4	101.9	--	--	--
2021 Trial		10,890	278.7	13,267	39.5	17.0	88.9	220	0.0	45.6		--	--	2.3	34.2	--
Average		10,074	270.4	12,527	37.5	16.9	87.6	216	0.0	46.4						
BTS 5104																
2022 Trial		9,771	264.1	12,276	37.1	16.6	86.8	212	0.0	58.5		5.2	98.1	--	--	--
2021 Trial		11,508	275.3	13,935	41.9	16.6	89.3	224	0.0	52.5		--	--	8.0	119.1	--
Average		10,640	269.7	13,106	39.5	16.6	88.1	218	0.0	55.5						
SV501	Full Approval															
2022 Trial		9,562	257.3	12,046	37.3	16.2	86.8	212	0.0	60.2		4.9	92.5	--	--	--
2021 Trial		11,901	276.5	14,341	43.1	16.7	89.4	225	0.0	51.2		5.9	99.7	6.1	90.8	2.4
Average		10,732	266.9	13,194	40.2	16.5	88.1	219	0.0	55.7						
BTS 5775	Full Approval															
2022 Trial		9,235	256.4	11,735	36.3	16.3	86.3	206	0.0	42.4		5.6	105.7	--	--	--
2021 Trial		11,476	273.4	13,838	42.5	16.5	89.5	210	0.0	29.0		6.3	106.5	6.2	92.3	2.6
Average		10,356	264.9	12,787	39.4	16.4	87.9	208	0.0	35.7						
SV 602	Full Approval															
2022 Trial		10,602	255.8	13,293	41.4	16.1	87.1	211	0.0	49.4		5.4	101.9	--	--	--
2021 Trial		12,398	269.8	14,867	45.8	16.2	89.7	221	0.0	43.1		6.0	101.4	6.4	95.3	2.6
Average		11,500	262.8	14,080	43.6	16.2	88.4	216	0.0	46.3						
SV 911																
2022 Trial		10,361	252.9	13,073	41.0	16.0	86.8	212	0.0	50.2		5.3	100.0	--	--	--
2021 Trial		12,770	267.2	15,387	47.7	16.2	89.4	222	0.0	44.1		--	--	7.2	107.2	--
Average		11,566	260.1	14,230	44.4	16.1	88.1	217	0.0	47.2						
Mean of Fully Approved (22-23)		10,961	269.4	13,447	40.6	16.6	88.2	215.1			2022 Mean	5.3	100	--	--	--
97% of Fully Approved (22-23)		10,632	261.3	13,043	39.4	16.1	85.6	208.6			2021 Mean	5.9	100	6.7	100	2.4

CV%

2022 Trial	2.9	2.3	2.5	2.5	1.9	0.6	7.6	--	2.3		5.1			
2021 Trial	5.4	2.2	5.1	4.9	1.7	0.8	2.3	--	8.3		7.0		7.7		n/a

LSD (0.05)

2022 Trial	587.0	NS	640.8	2.0	NS	NS	8.1	--	NS		0.4			
2021 Trial	428.1	4.2	491.4	1.4	0.2	0.5	3.6	--	2.8		0.5		0.6		0.5

Cooperator	Planted	Harvested	Plot Size	Notes:
Horizon Farms	9/15/21	3/30/22	2 rows. 30" rows.	Experimental Design: RCBD
Lance Reeves	9/25/21	4/6/22	2 rows. 30" rows.	Experimental Design: RCBD
Russell Allen	9/23/20	4/13-14/21	2 rows. 30" rows.	Experimental Design: RCBD
Brian Hair	10/28/20	5/17-18/21	2 rows. 30" rows.	Experimental Design: RCBD

Varieties ranked by Extractable Sugar per Ton.

* Emergence counts taken prior to thinning and converted to a percent.

** Final Stand counts converted to beets per 100 foot of row. Final stand counts taken after thinning.

*** 2021 Powdery mildew ratings are average of two raters at 2021 EH Location 2 yield trial. Ratings on 1-9 scale. 1 = low disease, 9 = high disease

Variety	Approval Status for 2022-23 crop	Extractable Sugar/Acre	Extractable Sugar/Ton	Gross Sugar/Acre	Tons/Acre	% Sugar	Purity	Final Stand**	% Bolt	Percent Emergence*		Curly Top	% of Mkt.	Powdery Mildew***	% of Mkt. Avg.	Rhizomania Root Rating
SV 983	Full Approval															
2022 Trial		9,940	266.4	12,454	37.3	16.7	87.0	202	0.0	38.1		5.5	103.8	--	--	--
2021 Trial		12,329	286.6	14,676	42.9	17.1	89.8	223	0.0	42.4		5.8	98.0	6.4	95.3	2.4
2020 Trial		10,786	299.9	12,785	36.0	17.8	90.4	207	0.0	53.1		5.3	95.8	--	--	2.3
Average		11,018	284.3	13,305	38.7	17.2	89.1	211	0.0	44.5						
BTS 5678	Full Approval															
2022 Trial		10,573	267.1	13,245	39.4	16.8	87.0	213	0.0	54.5		5.1	96.2	--	--	--
2021 Trial		12,097	282.0	14,499	42.7	16.9	89.7	222	0.0	38.4		5.9	99.7	7.4	110.2	2.0
2020 Trial		10,111	279.4	12,137	36.2	16.8	89.8	233	0.0	69.9		5.2	94.0	--	--	1.6
Average		10,927	276.2	13,294	39.4	16.8	88.8	223	0.0	54.3						
BTS 5460	Full Approval															
2022 Trial		9,910	261.2	12,490	38.0	16.5	86.7	213	0.0	52.0		5.3	100.0	--	--	--
2021 Trial		11,512	280.4	13,878	40.8	16.9	89.5	223	0.0	48.3		5.6	94.6	7.8	116.1	2.1
2020 Trial		9,540	280.2	11,489	34.1	16.9	89.5	228	0.0	57.3		5.2	94.0	--	--	1.6
Average		10,321	273.9	12,619	37.6	16.8	88.6	221	0.0	52.5						
SV 501	Full Approval															
2022 Trial		9,562	257.3	12,046	37.3	16.2	86.8	212	0.0	60.2		4.9	92.5	--	--	--
2021 Trial		11,901	276.5	14,341	43.1	16.7	89.4	225	0.0	51.2		5.9	99.7	6.1	90.8	2.4
2020 Trial		9,900	283.0	11,804	35.0	16.9	90.1	209	0.0	36.8		5.6	101.2	--	--	2.2
Average		10,454	272.3	12,730	38.5	16.6	88.8	215	0.0	49.4						
BTS 5775	Full Approval															
2022 Trial		9,235	256.4	11,735	36.3	16.3	86.3	206	0.0	42.4		5.6	105.7	--	--	--
2021 Trial		11,476	273.4	13,838	42.5	16.5	89.5	210	0.0	29.0		6.3	106.5	6.2	92.3	2.6
2020 Trial		9,158	279.7	11,050	32.8	16.9	89.4	214	0.0	44.3		5.8	104.8	--	--	2.1
Average		9,956	269.8	12,208	37.2	16.6	88.4	210	0.0	38.6						
SV 602	Full Approval															
2022 Trial		10,602	255.8	13,293	41.4	16.1	87.1	211	0.0	49.4		5.4	101.9	--	--	--
2021 Trial		12,398	269.8	14,867	45.8	16.2	89.7	221	0.0	43.1		6.0	101.4	6.4	95.3	2.6
2020 Trial		10,439	276.1	12,454	37.8	16.5	90.2	184	0.0	22.4		6.1	110.2	--	--	2.3
Average		11,146	267.2	13,538	41.7	16.3	89.0	205	0.0	38.3						

		Extractable Sugar/Acre	Extractable Sugar/Ton	Gross Sugar/Acre	Tons/Acre	% Sugar	Purity					Curly Top	% of Mkt.	Powdery Mildew	% of Mkt. Avg.	Rhizomania Root Rating
Mean of Fully Approved (22-23)		10,637	274.0	12,949	38.9	16.7	88.8			2022 Mean		5.3	100	--	--	--
97% of Fully Approved (22-23)		10,318	265.7	12,560	37.7	16.2	86.1			2021 Mean		5.9	100	6.7	100	2.4
										2020 Mean		5.5	100	--	--	2.0

CV%

2022 Trial		2.9	2.3	2.5	2.5	1.9	0.6	7.6	--	2.3		5.1		--		--
2021 Trial		5.4	2.2	5.1	4.9	1.7	0.8	2.3	--	8.3		7.0		7.7		n/a
2020 Trial		4.9	1.7	5.0	5.3	1.2	0.6	3.8	--	7.8		3.6		--		n/a

LSD (0.05)

2022 Trial		587.0	NS	640.8	2.0	NS	NS	8.1	--	NS		0.4		--		--
2021 Trial		428.1	4.2	491.4	1.4	0.2	0.5	3.6	--	2.8		0.5		0.6		0.5
2020 Trial		482.9	4.9	586.3	1.9	0.2	0.6	8.3	--	4.1		0.2		--		0.2

Cooperator	**Planted**	**Harvested**	**Plot Size**		**Notes:**
Horizon Farms	9/15/21	3/30/22	2 rows. 30" rows.		Experimental Design: RCBD
Lance Reeves	9/25/21	4/6/22	2 rows. 30" rows.		Experimental Design: RCBD
Russell Allen	9/23/20	4/13-14/21	2 rows. 30" rows.		Experimental Design: RCBD
Brian Hair	10/28/20	5/17-18/21	2 rows. 30" rows.		Experimental Design: RCBD
Cameron Ranches	9/14/19	4/6/20	2 rows. 30" rows.		Experimental Trial Design : 4X4 lattice

Varieties ranked by Extractable Sugar per Ton.

* Emergence counts taken prior to thinning and converted to a percent.

** Final Stand counts converted to beets per 100 foot of row. Final stand counts taken after thinning.

*** 2021 Powdery mildew ratings are average of two raters at 2021 EH Location 2 yield trial. Ratings on 1-9 scale. 1=low disease, 9 = high disease

2021-2022 Imperial Valley Early Harvest Official Variety Trial Results - Location 1

Entry	Entry Name	Extractable Sugar per Ton	Extractable Sugar per Acre	Gross Sugar per Acre	Tons per Acre	Percent Sugar	Extractable Sugar Percent	Percent Purity	Brei N (ppm)	Percent Tare	Percent* Emergence	Final Stand** Beets/100'	Percent Bolters
1	Hilleshog HIL2421	287.8	8357.5	10396.3	29.2	17.8	14.4	87.4	38.4	2.7	45.4	207.4	0.0
2	Hilleshog HIL2420	266.0	9989.8	12307.3	37.6	16.3	13.3	88.2	32.7	1.4	44.8	208.8	0.0
3	SV 1927	289.7	10773.1	13027.3	37.0	17.6	14.5	89.1	29.7	2.5	64.0	207.8	0.0
4	SV 1915	290.9	10023.0	12226.7	34.4	17.7	14.6	88.7	26.4	2.4	52.6	209.9	0.0
5	SV 1913N	283.6	9349.4	11630.4	32.8	17.6	14.2	87.4	37.1	3.5	52.7	209.0	0.0
6	SV 911	268.3	10601.4	13061.3	39.6	16.5	13.4	88.1	46.4	1.3	53.3	208.4	0.0
7	SV 983	283.5	10153.2	12418.4	35.4	17.3	14.2	88.5	26.9	1.1	35.9	188.2	0.0
8	SV 602	278.8	11267.2	13708.6	40.1	17.0	14.0	88.8	35.4	1.1	49.7	210.4	0.0
9	SV 501	279.5	10128.0	12339.9	36.4	17.0	14.0	88.7	36.1	1.9	61.2	210.6	0.0
10	BTS 520N	286.6	10656.9	13125.9	37.6	17.6	14.3	87.9	64.9	2.1	53.3	208.6	0.0
11	BTS 5294	279.3	9235.4	11433.6	32.8	17.3	14.0	87.5	69.0	1.2	48.7	208.3	0.0
12	BTS 5281	279.9	9082.4	11230.8	32.4	17.3	14.0	87.6	30.5	2.3	46.1	208.9	0.0
13	BTS 5255	287.1	11132.9	13622.4	38.0	17.6	14.3	88.2	24.6	1.7	53.0	212.5	0.0
14	BTS 5239	286.3	9522.6	11870.0	33.0	17.8	14.3	87.2	68.8	2.7	48.2	207.4	0.0
15	BTS 511N	286.3	10360.8	12786.6	36.0	17.7	14.3	87.7	30.5	2.3	54.1	208.6	0.0
16	BTS 5104	282.9	10256.1	12642.1	36.4	17.4	14.2	87.8	30.3	2.1	57.3	210.6	0.0
17	BTS 5775	280.6	9581.2	11904.2	34.4	17.4	14.0	87.4	68.5	1.1	45.3	195.0	0.0
18	BTS 5678	282.6	10879.1	13375.2	38.2	17.5	14.1	88.0	63.7	1.6	58.9	211.0	0.0
19	BTS 5460	277.4	10116.2	12487.4	36.6	17.1	13.9	87.8	53.4	2.2	54.8	210.9	0.0
	Trial mean	281.9	10077.2	12399.7	35.7	17.4	14.1	88.0	42.8	1.9	51.5	207.5	
	CV (%)	2.2	3.9	3.7	3.8	1.7	2.3	0.7	34.8	15.8	10.4	3.4	
	Residual	52.6	223801.2	289348.1	2.6	0.1	0.1	0.5	266.0	0.1	36.7	58.4	
	LSD (0.05)	7.1	463.6	527.2	1.6	0.3	0.4	0.7	16.0	0.4	5.9	7.5	
	Reps	8	8	8	8	8	8	8	8	8	8	8	

*Emergence counts taken prior to thinning and converted to a percent.
**Final stand counts taken after thinning and converted to beets per 100' of row.

Cooperator: Horizon Farms
Plant Date: September 15, 2021
Harvest Date: March 30, 2022
Plot size: 2 row, 30" rows.
Experimental Design: RCBD. Analyzed utilizing spatial analysis.

2021-2022 Imperial Valley Early Harvest Official Variety Trial Results - Location 2

Entry	Entry Name	Extractable Sugar per Ton	Extractable Sugar per Acre	Gross Sugar per Acre	Tons per Acre	Percent Sugar	Extractable Sugar Percent	Percent Purity	Brei N (ppm)	Percent Tare	Percent* Emergence	Final Stand** Beets/100'	Percent Bolters
1	Hilleshog HIL2421	252.8	8277.9	10593.1	32.7	16.2	12.6	85.8	201.0	2.4	52.6	215.6	0.0
2	Hilleshog HIL2420	239.3	9902.4	12793.4	41.3	15.5	12.0	85.3	271.7	1.4	51.0	213.5	0.0
3	SV 1927	236.3	9548.3	12377.7	40.3	15.3	11.8	85.2	317.8	1.9	53.0	215.2	0.0
4	SV 1915	232.5	9668.0	12659.4	41.4	15.2	11.6	84.8	292.1	2.2	46.6	212.4	0.0
5	SV 1913N	240.4	9165.9	11941.8	38.0	15.7	12.0	85.0	254.8	2.8	41.5	212.4	0.0
6	SV 911	237.4	10120.0	13084.9	42.4	15.4	11.9	85.5	269.4	1.5	47.0	214.7	0.0
7	SV 983	249.2	9726.1	12490.3	39.1	16.0	12.5	85.5	190.1	1.3	40.3	216.6	0.0
8	SV 602	232.8	9937.2	12877.8	42.7	15.1	11.7	85.4	264.2	1.0	49.0	211.0	0.0
9	SV 501	235.1	8994.9	11751.1	38.2	15.4	11.7	84.9	314.6	1.6	59.2	213.7	0.0
10	BTS 520N	239.1	9693.0	12519.3	40.3	15.5	12.0	85.5	296.4	1.7	50.8	215.5	0.0
11	BTS 5294	241.1	9210.8	11904.2	38.0	15.6	12.1	85.3	277.8	1.9	48.0	215.7	0.0
12	BTS 5281	235.1	8167.5	10643.4	34.6	15.3	11.7	85.1	264.6	4.0	47.1	213.7	0.0
13	BTS 5255	258.3	10504.6	13320.3	40.8	16.4	12.9	86.2	210.8	1.8	53.8	214.7	0.0
14	BTS 5239	243.1	8997.1	11720.7	36.5	15.9	12.2	84.8	274.9	3.4	51.6	215.5	0.0
15	BTS 511N	241.6	9529.1	12336.7	39.5	15.7	12.1	85.3	261.9	3.8	51.8	215.4	0.0
16	BTS 5104	245.2	9285.6	11909.7	37.7	15.7	12.3	85.8	242.7	3.4	59.6	213.8	0.0
17	BTS 5775	232.1	8887.8	11566.1	38.1	15.1	11.6	85.1	342.9	1.9	39.5	216.7	0.0
18	BTS 5678	251.6	10267.0	13113.9	40.6	16.1	12.6	86.0	253.2	1.9	50.1	215.2	0.0
19	BTS 5460	244.9	9704.4	12491.8	39.3	15.8	12.3	85.6	228.9	2.3	49.1	214.7	0.0
	Trial mean	241.5	9452.0	12215.6	39.0	15.6	12.1	85.4	264.7	2.2	49.6	214.5	
	CV (%)	2.9	5.3	4.9	4.2	2.3	2.9	0.7	11.6	32.6	8.4	1.1	
	Residual	61.9	325228.3	452567.9	3.4	0.2	0.2	0.5	1112.4	0.7	23.3	6.4	
	LSD (0.05)	7.8	564.6	666.0	1.8	0.4	0.4	0.7	33.0	0.8	4.8	2.5	
	Reps	8	8	8	8	8	8	8	8	8	8	8	

*Emergence counts taken prior to thinning and converted to a percent.
**Final stand counts taken after thinning and converted to beets per 100' of row.

Cooperator: Lance Reeves
Plant Date: September 25, 2021
Harvest Date: April 6, 2022
Plot size: 2 row, 30" rows
Experimental Design: RCBD. Analyzed utilizing spatial analysis.

Imperial Valley Late Harvest Official Variety Trials
1 Year Data Summary (2022)

Variety	2022-2023 Marketing Approval	Extractable Sugar/ Acre	Extractable Sugar/Ton	Gross Sugar/ Acre	Tons / Acre	% Sugar	Purity	Final Stand**	% Bolt	% Rot***	Percent Emergence*	Curly Top	% of Mkt. Avg.	Powdery Mildew	% of Mkt. Avg.	Rhizomania Root Rating
BTS 5239		19,577	307.1	23,440	64.9	18.3	90.0	234	0.1	6.1	41.7	--	--	--		--
BTS 511N		20,623	294.1	24,614	71.6	17.5	90.4	232	0.0	1.5	43.1	5.2	97.5	--		--
BTS 5678	Full Approval	18,995	288.0	22,703	66.6	17.1	90.0	232	0.0	9.0	45.1	5.1	95.6	--		--
BTS 5255		20,856	286.4	24,944	73.8	17.0	90.2	233	0.0	0.4	44.4	--	--	--		--
BTS 5460	Full Approval	20,059	283.4	24,299	71.9	17.0	89.5	231	0.2	2.7	47.5	5.3	99.4	--		--
SV 1915		18,954	282.9	23,014	69.1	17.0	89.3	231	0.0	12.4	42.4	5.3	99.4	--		--
SV1927		18,971	282.7	22,934	67.8	17.0	89.6	233	0.3	17.4	43.5	--	--	--		--
BTS 5294		15,446	281.9	18,546	54.5	16.9	89.7	235	0.0	29.4	45.2	--	--	--		--
BTS 5281		17,630	279.8	21,184	63.8	16.7	89.8	232	0.0	16.8	42.9	--	--	--		--
BTS 5775	Full Approval	18,985	279.7	22,931	68.0	16.8	89.5	226	0.1	10.1	43.1	5.6	105.0	--		--
BTS 520N		15,818	276.9	19,048	55.9	16.7	89.5	233	0.0	29.6	45.4	--	--	--		--
SV 1913N		14,560	276.5	17,622	51.8	16.7	89.1	221	0.5	30.9	35.4	5.4	101.3	--		--
BTS 5104		19,432	276.0	23,500	71.4	16.6	89.5	231	0.0	10.7	47.2	5.2	97.5	--		--
Hilleshog HIL2421		12,767	270.2	15,613	46.3	16.6	88.1	234	0.1	43.0	40.8	--	--	--		--
SV 2997	Limited Approval	18,488	264.6	22,606	71.0	16.1	89.0	232	0.7	10.1	45.1	5.2	97.5	--		--

													Mean of Fully Approved Varieties			
Mean of Fully Approved (22-23)		19,346	283.7	23,311	68.8	17.0	89.7					2022 Mean	5.3	100	--	--
97% of Fully Approved (22-23)		18,766	275.2	22,612	66.8	16.5	87.0									
LSD (0.05)		1081.4	6.6	1282.9	4.0	0.3	0.7	4.2	0.3	5.1	4.8	0.4			
C.V.		8.6	3.4	8.5	9.0	2.6	1.1	2.6	315.4	30.1	15.9	5.1			

Varieties ranked by Extractable Sugar per Ton

Disease nursery ratings: Lower numbers are more resistant, higher numbers are more susceptible.

*Emergence counts taken prior to thinning and converted to a percent.

**Final stand counts converted to beets per 100 foot of row. Final stand counts taken after thinning.

***Percent rot is from LH OVT Location #1 only. No rot present at Location #2.

Cooperator	Planted	Harvested	Plot Size
Ruegger Farms	10/6/2021	6/1/2022	2 rows. 30" rows
Gary and Brett Mamer	10/13/2021	7/7/2022	2 rows. 30" rows

Imperial Valley Late Harvest Official Variety Trials
2 Year Data (2021-2022)

Variety	2022-2023 Marketing Approval	Year	Extractable Sugar/ Acre	Extractable Sugar/ Ton*	Gross Sugar/ Acre	Tons/ Acre	% Sugar	Purity	Final Stand**	% Bolt	% Rot***	Percent Emergence*	Curly Top Rating	% of Mkt. Avg.	Powdery Mildew Rating#	% of Mkt. Avg.	Rhizomania Root Rating*
BTS 511N		2022	20,623	294.1	24,614	71.6	17.5	90.4	232	0.0	1.5	43.1	5.2	97.5	--		--
		2021	18,053	310.4	21,014	58.5	18.0	91.9	233	0.0	0.0	63.4	--	--	6.6	94.7	--
		Average	19,338	302.2	22,814	65.0	17.8	91.1	232	0.0	0.8	53.2					
BTS 5678	Full Approval	2022	18,995	288.0	22,703	66.6	17.1	90.0	232	0.0	9.0	45.1	5.1	95.6	--		--
		2021	17,311	302.3	20,147	57.4	17.6	91.7	232	0.0	0.0	49.2	5.9	99.4	7.6	109.1	2.0
		Average	18,153	295.2	21,425	62.0	17.4	90.9	232	0.0	4.5	47.2					
SV 1915		2022	18,954	282.9	23,014	69.1	17.0	89.3	231	0.0	12.4	42.4	5.3	99.4	--		--
		2021	18,861	303.2	22,096	62.2	17.8	91.2	231	0.0	0.0	61.8	--	--	5.2	74.6	--
		Average	18,908	293.0	22,555	65.6	17.4	90.3	231	0.0	6.2	52.1					
BTS 5460	Full Approval	2022	20,059	283.4	24,299	71.9	17.0	89.5	231	0.2	2.7	47.5	5.3	99.4	--		--
		2021	17,525	299.8	20,409	58.3	17.5	91.6	232	0.0	0.0	59.1	5.6	94.4	6.9	99.0	2.1
		Average	18,792	291.6	22,354	65.1	17.3	90.6	232	0.1	1.4	53.3					
BTS 5104		2022	19,432	276.0	23,500	71.4	16.6	89.5	231	0.0	10.7	47.2	5.2	97.5	--		--
		2021	18,360	300.2	21,253	61.1	17.4	92.1	230	0.0	0.0	54.4	--	--	7.8	112.0	--
		Average	18,896	288.1	22,376	66.3	17.0	90.8	231	0.0	5.4	50.8					
BTS 5775	Full Approval	2022	18,985	279.7	22,931	68.0	16.8	89.5	226	0.1	10.1	43.1	5.6	105.0	--		--
		2021	17,815	295.0	20,852	60.5	17.2	91.5	226	0.0	0.0	40.0	6.3	106.2	6.4	91.9	2.6
		Average	18,400	287.4	21,892	64.3	17.0	90.5	226	0.1	5.1	41.6					
SV 1913N		2022	14,560	276.5	17,622	51.8	16.7	89.1	221	0.5	30.9	35.4	5.4	101.3	--		--
		2021	17,624	295.0	20,914	59.8	17.5	90.4	230	0.0	0.0	59.1	--	--	2.1	30.1	--
		Average	16,092	285.7	19,268	55.8	17.1	89.7	226	0.3	15.5	47.2					
SV 2997	Limited Approval	2022	18,488	264.6	22,606	71.0	16.1	89.0	232	0.7	10.1	45.1	5.2	97.5	--		--
		2021	18,586	278.0	21,948	66.9	16.4	90.9	228	0.0	0.0	46.9	6.1	102.8	6.9	99.0	2.8
		Average	18,537	271.3	22,277	69.0	16.3	90.0	230	0.4	5.1	46.0					
SV 604N not tested 2022	Nematode Specialty Approval Early-Mid Harvest	2022	--	--	--	--	--	--	--	--	--	--	--		--		--
		2021	16,969	280.1	20,217	60.7	16.7	90.4	232	0.0	0.0	58.8	5.7	96.1	4.7	67.5	2.3
		Average	--	--	--	--	--	--	--	--	--	--					

		Extractable Sugar/ Acre	Extractable Sugar/ Ton	Gross Sugar/ Acre	Tons/ Acre	% Sugar	Purity
Mean of Fully Approved (22-23)		18,448	291.4	21,890	63.8	17.2	90.6
97% of Fully Approved (22-23)		17,895	282.6	21,233	61.9	16.7	87.9

Mean of Fully Approved Varieties

	Curly Top Rating	% of Mkt. Avg.	Powdery Mildew Rating	% of Mkt. Avg.	Rhizomania Root Rating
2022 Mean	5.3	100.0	--		--
2021 Mean	5.9	100.0	7.0	100.0	

	Year	Ext. Sug/Acre	Ext. Sug/Ton	Gross Sug/Acre	Tons/Acre	% Sugar	Purity	Final Stand	% Bolt	% Rot	Percent Emergence	Curly Top Rating		Powdery Mildew Rating		Rhizomania Root Rating
LSD (0.05)	2022	1081.4	6.6	1282.9	4.0	0.3	0.7	4.2	0.3	5.1	4.8	0.4		--		--
	2021	932.7	5.6	1071.7	3.1	0.2	0.6	5.2	--	--	5.3	0.5		0.5		0.5
C.V.	2022	8.6	3.4	8.5	9.0	2.6	1.1	2.6	315.4	30.1	15.9	5.1		--		--
	2021	4.7	1.8	4.6	4.5	1.3	0.6	2.1	--	--	8.9	7.0		6.9		--

Varieties ranked by Extractable Sugar per Ton
Disease nursery ratings: Lower numbers are more resistant, higher numbers are more susceptible.
* Emergence counts taken prior to thinnng and converted to a percent.
**Final stand counts converted to beets per 100 foot of row. Final stand counts taken after thinning.
***2022 Percent rot is from LH OVT Location #1 only. No rot present at Location #2.
2021 Powdery mildew data is from ratings taken at 2020-2021 Late Harvest Loc. 2 yield trial. Rating scale 1-9 with lower ratings meaning less disease and higher ratings meaning more disease.

Cooperator	Planted	Harvested	Plot Size
Ruegger Farms	10/6/2021	6/1/2022	2 rows -- 30 inch rows
Gary and Brett Mamer	10/13/2021	7/7/2022	2 rows -- 30 inch rows
Jason Taylor	10/12/2020	6/9/2021	2 rows -- 30 in. 4 x 4 lattice

Imperial Valley Late Harvest Official Variety Trials
3 Year Data (2020-2022)

Variety	2022-2023 Marketing Approval	Year	Extractable Sugar/Acre	Extractable Sugar/Ton	Gross Sugar/Acre	Tons/Acre	% Sugar	Purity	Final Stand**	% Bolt	% Rot^w	Percent Emergence*	Curly Top Rating	% of Mkt. Avg.	Powdery Mildew Rating#	% of Mkt. Avg.	Rhizomania Root Rating
Beta 5678	Full Approval	2022	18,995	288.0	22,703	66.6	17.1	90.0	232	0.0	9.0	45.1	5.1	95.6	--	--	--
		2021	17,311	302.3	20,147	57.4	17.6	91.7	232	0.0	0.0	49.2	5.9	99.4	7.6	109.1	2.0
		2020	21,057	294.2	24,882	72.7	17.4	90.8	231	0.0	1.9	75.9	5.2	96.3	--	--	1.6
		Average	19,121	294.8	22,577	65.6	17.4	90.8	232	0.0	3.6	56.7					
BTS 5460	Full Approval	2022	20,059	283.4	24,299	71.9	17.0	89.5	231	0.2	2.7	47.5	5.3	99.4	--	--	--
		2021	17,525	299.8	20,409	58.3	17.5	91.6	232	0.0	0.0	59.1	5.6	94.4	6.9	99.0	2.1
		2020	20,735	290.0	24,537	73.3	17.1	90.7	234	0.1	0.2	71.1	5.2	96.3	--	--	1.6
		Average	19,440	291.1	23,082	67.8	17.2	90.6	232	0.1	1.0	59.2					
BTS 5775	Full Approval	2022	18,985	279.7	22,931	68.0	16.8	89.5	226	0.1	10.1	43.1	5.6	105.0	--	--	--
		2021	17,815	295.0	20,852	60.5	17.2	91.5	226	0.0	0.0	40.0	6.3	106.2	6.4	91.9	2.6
		2020	21,856	285.0	26,032	78.3	17.0	90.3	230	0.0	0.7	65.8	5.8	107.4	--	--	2.1
		Average	19,552	286.6	23,272	68.9	17.0	90.4	227	0.0	3.6	49.6					
SV 2997	Limited Marketing	2022	18,488	264.6	22,606	71.0	16.1	89.0	232	0.7	10.1	45.1	5.2	97.5	--	--	--
		2021	18,586	278.0	21,948	66.9	16.4	90.9	228	0.0	0.0	46.9	6.1	102.8	6.9	99.0	2.8
		2020	20,745	269.5	24,987	79.1	16.2	89.8	233	0.1	0.2	81.3	5.6	103.7	--	--	2.4
		Average	19,273	270.7	23,180	72.3	16.2	89.9	231	0.3	3.4	57.8					
SV 604N not tested 2022	Nematode Specialty Approval Early-Mid Harvest	2022	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		2021	16,969	280.1	20,217	60.7	16.7	90.4	232	0.0	0.0	58.8	5.7	96.1	4.7	67.5	2.3
		2020	17,348	256.8	21,130	68.5	15.6	89.1	228	0.2	0.1	57.8	5.4	100.0	--		2.1
		Average	--	--	--	--	--	--	--	--	--	--					

	Extractable Sugar/Acre	Extractable Sugar/Ton	Gross Sugar/Acre	Tons/Acre	% Sugar	Purity		Mean of Fully Approved Varieties		Curly Top		Powdery Mildew	% Mkt Avg	Rhizomania
Mean of Fully Approved (22-23)	19,371	290.8	22,977	67.4	17.2	90.6		2022 Mean	5.3	100.0	--	--	--	
97% of Fully Approved (22-23)	18,790	282.1	22,288	65.4	16.7	87.9		2021 Mean	5.9	100.0	7.0	100.0	2.2	
								2020 Mean	5.4	100.0	--	--	1.8	

		Year													
LSD (0.05)		2022	1081.4	6.6	1282.9	4.0	0.3	0.7	4.2	0.3	5.1	4.8	0.4		--	--
		2021	932.7	5.6	1071.7	3.1	0.2	0.6	5.2	--	--	5.3	0.5		0.5	0.5
		2020	775.8	6.2	859.9	3.1	0.3	0.5	2.8	0.5		4.9			--	0.2
C.V.		2022	8.6	3.4	8.5	9.0	2.6	1.1	2.6	315.4	30.1	15.9	5.1		--	--
		2021	4.7	1.8	4.6	4.5	1.3	0.6	2.1	--	--	8.9	7.0		6.9	n/a
		2020	4.3	2.4	4.0	4.7	1.9	0.6	1.3	326.6		7.5			--	n/a

Varieties ranked by Extractable Sugar per Ton

Disease nursery ratings: Lower numbers are more resistant, higher numbers are more susceptible.

* Emergence counts taken prior to thinning and converted to a percent.

** Final stand counts converted to beets per 100 foot of row. Final stand counts taken after thinning.

#2021 Powdery mildew data is from ratings taken at 2020-2021 Late Harvest Loc. 2 yield trial. Rating scale 1-9 with lower ratings meaning less disease and higher ratings meaning more disease.

^w Percent rot data for 2020 is from Westmoreland site only. No rot present at Ruegger site. 2022 Rot data is from Location #1 only. No rot at Location #2.

Cooperator	Planted	Harvested	Plot Size
Ruegger Farms	10/6/2021	6/1/2022	2 rows -- 30 inch rows
Gary and Brett Mamer	10/13/2021	7/7/2022	2 rows -- 30 inch rows
Jason Taylor	10/12/2020	6/9/2021	2 rows -- 30 in. 4 x 4 lattice
Fritz Ruegger	10/12/2019	6/17/2020	2 rows -- 30 in. 4 x 4 lattice
Westmoreland Farms	10/10/2019	8/10-11/2020	2 rows -- 30 in. 4 x 4 lattice

2021-2022 Imperial Valley Late Harvest Official Variety Trial Results - Location 1
Cooperator - Gary and Brett Mamer

Entry	Entry Name	Extractable Sugar per Ton	Extractable Sugar per Acre	Gross Sugar per Acre	Tons per Acre	Percent Sugar	Extractable Sugar Percent	Percent Purity	Brei N	Percent Tare	Percent Emergence*	Final Stand Beets/100'**	Percent Bolters***	Percent Rot+
1	Hilleshog HIL2421	233.9	8595	11073	38.0	15.1	11.7	85.7	50.2	1.0	33.1	234	0.3	43.0
2	SV 2997	232.9	19090	23976	82.2	14.6	11.7	87.6	61.5	1.0	36.5	233	0.8	10.1
3	SV 1927	249.9	18508	22980	74.3	15.5	12.5	87.8	80.0	0.6	34.7	229	0.3	17.4
4	SV 1915	249.7	18678	23320	75.3	15.5	12.5	87.7	64.1	0.7	36.7	231	0.0	12.4
5	SV 1913N	245.2	10896	13822	42.7	15.5	12.3	86.9	62.0	0.9	35.7	212	0.8	30.9
6	BTS 520N	243.2	12574	15663	50.5	15.2	12.2	87.6	64.4	1.1	38.4	233	0.0	29.6
7	BTS 5294	250.8	13052	16150	51.9	15.5	12.6	88.0	64.2	0.8	41.1	232	0.0	29.4
8	BTS 5281	251.2	17914	22072	71.4	15.5	12.6	88.4	49.5	1.5	37.3	232	0.0	16.8
9	BTS 5255	261.4	22562	27495	85.9	16.0	13.1	88.8	48.0	1.0	37.5	232	0.0	0.4
10	BTS 5239	275.4	20835	25420	76.1	16.8	13.8	88.8	78.2	1.6	35.8	232	0.1	6.1
11	BTS 511N	265.8	23015	27889	86.9	16.1	13.3	89.2	45.9	1.4	34.0	229	0.0	1.5
12	BTS 5104	245.7	19766	24578	80.5	15.3	12.3	87.8	59.3	1.2	38.1	229	0.0	10.7
13	BTS 5775	243.7	19140	23809	76.7	15.2	12.2	87.7	78.1	0.8	43.3	228	0.0	10.1
14	BTS 5678	259.9	18974	23250	73.1	15.9	13.0	88.5	65.2	1.4	36.6	229	0.0	9.0
15	BTS 5460	256.9	21819	27007	84.9	15.9	12.9	88.0	52.8	1.0	41.7	230	0.4	2.7
	Trial mean	251.0	17694.5	21900.4	70.0	15.6	12.6	87.9	61.6	1.1	37.4	229.7	0.2	15.3
	CV (%)	3.9	8.6	8.3	8.6	2.6	3.9	1.2	22.6	24.3	19.9	1.1	264.3	30.1
	Residual	118.3	3162898.6	4509254.1	46.6	0.2	0.3	1.4	233.3	0.1	66.9	8.3	0.2	27.3
	LSD (0.05)	10.7	1742.9	2081.0	6.7	0.4	0.5	1.2	15.0	0.3	8.0	2.8	0.4	5.1

*Emergence counts taken prior to thinning and converted to a percent.

**Final stand counts taken after thinning and converted to beets per 100' of row.

***Bolters were counted on a per plot basis and the percent was calculated by dividing the bolters present by the total number of beets per plot.

+Rot beets were counted on a per plot basis prior to harvest and the percent was calculated by dividing the rot beets present by the total number of beets per plot.

Harvest Notes:

Prior to harvest, all beets with visual rot symptoms were removed from the row, thus preventing rot beets from being harvested. Yields are calculated with good beets remaining in each plot.

Plant Date: October 13, 2021
Harvest Date: July 7, 2022
Plot size: 2 row, 30" rows.
Experimental Design: RCBD with spatial analysis

2021-2022 Imperial Valley Late Harvest Official Variety Trial Results - Location 2

Cooperator - Ruegger Farms

Entry	Entry Name	Extractable Sugar per Ton	Extractable Sugar per Acre	Gross Sugar per Acre	Tons per Acre	Percent Sugar	Extractable Sugar Percent	Percent Purity	Brei N	Percent Tare	Percent Emergence[*]	Final Stand Beets/100[**]	Percent Bolters[***]	Mildew Rating[+]	Percent Blinkers[++]	Percent Rot
1	Hilleshog HIL2421	305.4	16252	19248	53.0	18.1	15.3	90.5	16.9	0.8	48.0	234	0.0	7.6	5.5	0.0
2	SV 2997	294.9	17903	21161	60.1	17.4	14.7	90.7	15.9	0.8	52.4	234	0.6	5.1	1.8	0.0
3	SV 1927	315.3	19622	23018	62.6	18.4	15.8	91.2	15.6	0.5	52.9	237	0.3	5.3	4.8	0.0
4	SV 1915	312.4	18629	21931	60.3	18.4	15.6	90.8	16.4	0.6	48.5	234	0.0	4.7	5.2	0.0
5	SV 1913N	307.2	18029	21124	58.9	18.0	15.4	91.2	15.3	0.6	34.8	237	0.1	3.7	7.0	0.0
6	BTS 520N	310.9	18538	21600	59.3	18.1	15.5	91.5	17.6	1.0	53.0	233	0.0	6.8	1.1	0.0
7	BTS 5294	314.8	17972	21015	57.2	18.4	15.7	91.1	18.4	0.7	48.8	236	0.0	5.6	0.0	0.0
8	BTS 5281	311.1	17521	20449	56.4	18.2	15.6	91.4	15.8	1.0	48.4	234	0.0	4.5	1.3	0.0
9	BTS 5255	311.8	19306	22489	61.9	18.2	15.6	91.6	12.4	0.7	51.3	234	0.0	5.5	2.0	0.0
10	BTS 5239	336.8	18185	21214	53.7	19.6	16.9	91.1	18.9	0.8	45.5	234	0.0	5.7	0.6	0.0
11	BTS 511N	319.7	18042	21006	56.1	18.7	16.0	91.3	16.0	0.9	50.9	234	0.0	5.0	1.7	0.0
12	BTS 5104	304.5	18620	21781	60.9	17.8	15.2	91.2	15.6	1.0	56.9	232	0.0	7.3	0.9	0.0
13	BTS 5775	309.4	18288	21383	58.4	18.1	15.5	91.2	19.3	0.7	41.8	231	0.1	6.6	1.1	0.0
14	BTS 5678	315.3	18976	22049	60.3	18.3	15.8	91.8	14.0	0.9	54.8	235	0.0	6.1	0.4	0.0
15	BTS 5460	310.8	18285	21423	58.6	18.2	15.5	91.1	14.4	0.7	52.0	232	0.0	6.3	2.3	0.0
	Trial mean	312.0	18278	21393	58.5	18.3	15.6	91.2	16.1	0.8	49.3	234	0.1	5.7	2.4	
	CV (%)	1.8	4.1	3.9	4.3	1.6	1.8	0.5	20.3	30.1	8.3	0.9	401.2	10.4	57.9	
	Residual	42.3	763600.9	965622.7	8.7	0.1	0.1	0.3	14.0	0.1	21.4	5.8	0.1	0.4	2.2	
	LSD (0.05)	6.4	856.4	963.0	2.9	0.3	0.3	0.5	3.7	0.3	4.5	2.4	0.3	0.6	1.5	

*Emergence counts taken prior to thinning and converted to a percent.

** Final stand counts taken after thinning and converted to beets per 100' of row.

*** Bolters were counted on a per plot basis and the percent was calculated by dividing the bolters present by total number of beets per plot.

[+] Mildew ratings were taken on May 2, May 9, and May 16 on a 1-9 scale with 1 = low pressure and 9 = heavy pressure. Ratings are an average of the three rating dates.

[++] Blinkers were counted on a per plot basis and the percent was calculated by dividing the blinkers present by the total number of beets per plot. Rhizomania was present in the field surrounding the trial.

Plant Date: October 6, 2021
Harvest Date: June 1, 2022
Plot size: 2 row, 30" rows.
Experimental Design: RCBD with spatial analysis

2022 BSDF Curly Top Nursery Results

Dr. Carl Strausbaugh - USDA/ARS Kimberly, Idaho

Entry	Entry Name	North Farm Location 1			North Farm Location 2			Overall
		29-Jun	6-Jul	19-Jul	29-Jun	6-Jul	19-Jul	
1	BTS 5460	4.4 a-c	5.2 b-e	6.5 a-d	4.0 b-d	5.4 a-d	6.0 a-c	5.3 a-c
2	BTS 5678	4.3 b-d	5.0 c-f	6.4 a-d	3.9 de	5.0 b-f	6.2 a-c	5.1 cd
3	BTS 5775	4.6 ab	5.5 a-d	6.9 a-c	4.2 ab	5.6 a	6.4 ab	5.6 a
4	BTS 5104	4.2 b-d	5.3 a-e	6.3 b-e	4.2 a-c	5.0 b-f	6.0 a-c	5.2 b-d
5	BTS 511N	4.4 a-d	5.3 a-e	6.4 a-e	4.0 c-e	5.1 a-f	6.0 a-c	5.2 a-d
6	SV 501	4.3 b-d	5.0 d-g	5.8 d-f	3.9 de	4.9 c-f	5.5 c-e	4.9 de
7	SV 602	4.5 a-c	5.6 a-c	6.8 a-c	3.9 de	5.5 ab	6.2 a-c	5.4 a-c
8	SV 983	4.4 a-c	5.2 b-e	7.2 a	4.2 a-c	5.3 a-d	6.8 a	5.5 ab
9	SV 911	4.6 ab	5.8 a	7.2 a	3.8 de	4.8 d-g	5.8 bc	5.3 a-c
10	SV 1913N	4.1 b-e	5.2 b-e	6.5 a-d	4.1 a-d	5.4 a-c	6.8 a	5.4 a-c
11	SV 1915	4.5 ab	5.6 a-c	7.0 ab	4.0 c-e	4.9 c-f	6.0 a-c	5.3 a-c
12	SV 2997	4.0 c-f	4.9 e-g	6.7 a-c	4.0 b-d	5.0 b-f	6.2 a-c	5.2 cd
Check 1		3.4 g	4.1 h	4.3 g	3.9 de	4.2 g	4.9 de	4.1 g
Check 2		3.6 fg	4.5 gh	6.0 c-e	3.7 e	5.1 a-f	6.3 a-c	4.9 de
Check 3		3.9 d-f	4.4 h	5.0 fg	3.8 de	4.5 fg	4.7 e	4.4 fg
Check 4		3.7 e-g	4.6 f-h	5.5 ef	3.7 e	4.6 e-g	5.6 b-d	4.6 ef
Check 5		4.8 a	5.7 ab	6.1 b-e	4.4 a	5.2 a-e	5.7 b-d	5.3 a-c
Mean		4.2	5.1	6.3	4	5	5.9	5.1
CV		7.6	7.8	9.7	5.3	8.5	9.9	5.1
P > F		<0.0001	<0.0001	<0.0001	0.0017	0.0016	0.0004	<0.0001
LSD		0.5	0.6	0.9	0.3	0.6	0.8	0.4

Check 1 = SV836705RR, moderate resistant check.
Check 2 = SX018, moderate susceptible check.
Check 3 = B-51, moderate resistant check.
Check 4 = B-52, moderate susceptible check,
Check 5 = SV027, susceptible check.

2022 BSDF Rhizomania Nursery Results Imperial Valley OVT
Cooperator: Dr. Carl Strausbaugh
USDA/ARS - Kimberly Idaho

Entry[z]	Variety	Foliar rating (% susceptible)[y]	Root rating[x]	Sucrose content (%)	Nitrate (ppm)	Conductivity (mmhos)	Root yield (tons/A)	ERS (lb/A)[w]
1	BTS 5460	1 cd	1.9 e	15.44 a-d	257 b-e	0.83	39.27 a	10,148 a
2	BTS 5678	0 d	2.0 e	15.58 a-c	399 a	0.8	38.52 a	10,094 a
5	BTS 511N	1 d	1.8 e	15.72 a	305 a-c	0.83	37.12 a	9,767 a
6	SV 501	0 d	2.3 d	15.28 a-e	148 ef	0.77	34.20 b	8,826 b
4	BTS 5104	0 d	2.4 cd	15.45 a-d	220 b-f	0.81	32.67 bc	8,468 bc
3	BTS 5775	3 cd	2.4 cd	15.66 ab	172 d-f	0.83	31.17 cd	8,177 bc
10	SV 1913N	1 cd	2.6 bc	15.19 b-e	340 ab	0.81	30.84 cd	7,862 cd
12	SV 2997	2 cd	2.8 b	15.01 d-f	194 c-f	0.79	29.48 de	7,448 de
9	SV 911	17 b	2.7 b	14.89 ef	337 ab	0.87	27.73 e	6,845 e
11	SV 1915	3 cd	2.7 b	14.58 fg	286 a-d	0.85	24.46 f	5,940 f
8	SV 983	11 bc	2.7 b	15.08 c-f	259 b-e	0.77	22.46 f	5,722 fg
7	SV 602	21 b	2.8 b	14.12 gh	342 ab	0.92	22.36 f	5,209 g
Check		100 a	4.1 a	13.65 h	125 f	0.88	14.55 g	3,287 h
Mean		12	2.6	15.05	260	0.83	29.6	7,523
$P > F$[v]		<0.0001	<0.0001	<0.0001	0.0004	0.0957	<0.0001	<0.0001
LSD		11	0.3	0.51	125	NS	2.66	723

[z] BTS 4D20 was included as the BNYVV susceptible check cultivar (bold). The highlighted entries were marginal to failing (grey = marginal, yellow = failed, and red = failed badly).

[y] Foliar rating = percentage of foliage with rhizomania symptoms (narrow yellow upright leaves).

[x] Root rating using a scale of 0-9 (0 = healthy and 9 = dead; Plant Disease 93:632-638); ≥ 3 would be considered susceptible).

[w] Estimated recoverable sucrose (ERS) = extraction x 0.01 x gross sucrose where extraction
= 250 + [1255.2 x (conductivity -15000) x (percent sucrose - 6185)]/(percent sucrose x [98.66 - (7.845 x conductivity)]).

[v] $P > F$ was the probability associated with the F value. Within each variable, means followed by the same letter did not differ significantly based on Fisher's protected least significant difference (LSD; α = 0.05). NS = not significant