2014 SUGAR BEET VARIETY TRIALS

Lamont D. Saunders and Clinton C. Shock, Malheur Experiment Station, Oregon State University, Ontario, OR

Introduction

The sugar beet industry in southern Idaho and eastern Oregon, in cooperation with Oregon State University (OSU), tests sugar beet varieties at multiple locations each year to identify varieties with high sugar yield and root quality. A seed advisory committee evaluates the data each year and selects the best varieties for sugar production. This report provides the agronomic practices and results for the OSU Malheur Experiment Station sugar beet variety trial at Ontario, Oregon in 2014.

Methods

The 2014 sugar beet trials were planted on Owyhee silt loam soil where winter wheat was the previous crop. In the fall of 2013 the wheat stubble was shredded and the field was irrigated and disked. A soil sample showed pH of 7.5, total nitrogen (N) at 54 lb/acre, phosphorus at 21 ppm, sulfur (S) at 18 ppm, boron (B) at 0.7 ppm, potassium (K) at 310 ppm, calcium at 2682 ppm, copper (Cu) at 1.8 ppm, manganese (Mn) at 7 ppm, iron at 18 ppm, magnesium at 598 ppm, and zinc at 3.7 ppm. Based on soil analyses and estimated crop needs, the field received 64 lb/acre of N, 200 lb/acre of phosphate (P_2O_5), 100 lb/acre of K, 100 lb/acre of elemental S, 1 lb/acre of Mn, and 1 lb/acre of B on September 05, 2013. The field was ripped, plowed, and worked down in the fall. The field was bedded to 22-inch beds and 15 gal/acre of Telone® C-17 was shanked into the beds on November 4, 2013.

Sugar beets were planted on April 08, 2014 at a seeding rate of 8 viable seeds/ft of row. Plots of each variety were 4 rows wide (22-inch row spacing) by 23 ft long, with a 4-ft alley separating each tier of plots. Each entry was replicated eight times in a randomized complete block design. On April 16, Counter® 15G was applied in a band over each row at 7.4 lb/acre. Soil moisture was monitored using Watermark soil moisture sensors (Irrometer Co. Inc., Riverside, CA). Soil moisture was maintained at a soil water tension wetter than 70 centibars (kPa) at 8-inch depth in the beet row for the duration of the season. The entire trial was broadcast sprayed with Roundup Ultra® at 32 oz/acre on May 12. The spray solution (30 gal/acre) contained 5% ammonium sulfate (AMS) as well as a non-ionic surfactant. Beets began to emerge on April 16. On June 3 and again on July 7, the trial was broadcast sprayed with Roundup Ultra® at 22 oz/acre. The spray solution contained 5% AMS as well as a non-ionic surfactant at a spray rate of 30 gal/acre.

Seedlings were thinned by hand to 1 plant per 7 inches on May 20-21. On May 27, urea was side dressed to supply 170 lb N/acre and Temik® at 7.5 lb/acre, then promptly irrigated. Petiole tests were taken on June 12, June 24, and July 15. Based on petiole analyses, 20 lb N plus 10 lb S were applied through the irrigation water on June 16. Based on petiole analyses, 7 lb N plus 1.5 lb S plus 0.1 lb Cu plus 0.2 lb B were applied by air on July 5.

Powdery mildew was controlled by applying Inspire™ fungicide at 7 oz/acre plus 5 lb/acre S on July 12 and again on August 8; Gem™ fungicide was applied at 5 oz/acre plus 5 lb S/acre on July 26 and Proline® at 7 oz/acre on August 23.

Commercial varieties were harvested on October 7, 2014. Experimental varieties were harvested on October 9, 2014. The foliage was flailed and the crowns were removed mechanically with rotating disks. All sugar beets in the center two rows of each plot were dug with a two-row wheel-lifter harvester, weighed, and two seven-beet samples were taken from each plot. Samples were transported daily to the Amalgamated Sugar Company (Paul, ID) for laboratory analysis of sucrose, nitrate, and conductivity. The root weight data were examined for outliers as is customary for calculations of sugar beet variety data in these trials. The root weights for each plot and the average of the two laboratory samples were used to calculate beet yields and sugar yields. Sugar sample data were checked for errors in sugar percentages and conductivity. Any clearly erroneous sample readings were deleted from the data set. Observations more than two standard deviations from the mean for each variety were deleted.

Sugar concentrations were "factored" by multiplying measured sucrose by 0.98 to compensate for the sugar that would have been lost to respiration if the beets had been stored in a pile. The percent extraction was calculated using the formula:

Ext = 250 + [(1,255.2 · Cond) - (15,000 · Sug) - 6,185] / Sug ∗ (98.66 - 7.845 · Cond) where Ext is percent extraction, Cond is the electrical conductivity in mmho, and Sug is the percent sucrose concentration.

Variety differences in yield, sucrose content, conductivity, percent extraction, and estimated recoverable sugar were calculated using least-squares means analysis. The varieties are listed in the tables of results in descending order of estimated recoverable sugar/acre. Reports of previous years' Oregon State University sugar beet variety trials are available online at www.cropinfo.net. Beet susceptibility to curly top virus was rated at Kimberly, ID in the Beet Sugar Development Foundation trials.

Results

Variety results were grouped by the estimated recoverable sugar per acre. Root yield for beet varieties in the Commercial Trial averaged 48.67 tared ton/acre and the beets averaged 16.98% sugar content (Table 1). The sugar beet variety in the Commercial Trial with the highest root yield was BTS 20RR28 (59.31 ton/acre), which also had the highest recoverable sugar per acre (16,936 lb/acre). Varieties differed in their resistance to curly top virus.

Root yield in the Experimental Trial averaged 47.99 tared ton/acre and the beets averaged 17.67% sugar content (Table 2). Sugar beet varieties with among the highest root yields were BTS 241 (59.12 ton/acre), Crystal A404NT, HH SV36602RR, and HM 9611RR. The varieties with among the highest recoverable sugar per acre were Crystal A404NT (17,530 lb/acre), BTS 241, and HM 9611RR.

Acknowledgements

This project was funded by Amalgamated Sugar Company, Oregon State University, Malheur County Education Service District, and supported by Formula Grant no. 2014-31100-06041 and Formula Grant no. 2014-31200-06041 from the USDA National Institute of Food and Agriculture. Carl Strausbaugh of the USDA provided the curly top disease ratings.

Table 1. Performance of commercial Roundup Ready® sugar beet varieties in the Amalgamated Sugar Co. LLC Variety Trial at the Malheur Experiment Station, Oregon State University, Ontario, OR, 2014.

	Root yield	Sugar content	Gross sugar	Conduc-tivity	Extrac-tion	Estimated recoverable sugar[a]			Curly top ratings		
Variety	(ton/acre)	(%)	(lb/acre)	(mmhos)	(%)	(lb/ton)	(lb/acre)		2013	2014	2yr Ave
BTS 20RR28	59.31	16.49	19557	0.618	86.60	285.6	16936	a	5.0	4.7	4.9
SX RR1534	52.30	17.51	18319	0.644	86.47	302.9	15842	b	5.2	5.3	5.3
Crystal A399NT	54.33	16.89	18340	0.640	86.40	291.9	15839	b	6.1	5.0	5.6
SX 1521NRR	48.92	17.57	17182	0.653	86.37	303.5	14838	bc	5.6	5.1	5.4
Crystal RR240NT	49.84	17.38	17324	0.686	85.91	298.6	14884	bc	5.7	5.6	5.7
BTS 21RR25	52.27	16.72	17465	0.719	85.34	285.3	14904	bc	5.2	4.9	5.1
HH SV36203NRR	49.56	17.54	17358	0.720	85.48	299.8	14835	bcd	5.5	5.7	5.6
SX RR1535	51.46	16.77	17253	0.686	85.77	287.8	14796	bcd	5.8	5.0	5.4
Crystal RR933	52.23	16.54	17267	0.684	85.76	283.7	14810	bcd	6.5	6.8	6.7
HM 9338RR	53.06	16.35	17346	0.708	85.41	279.3	14815	bcd	4.6	4.5	4.6
Crystal RR892	51.11	16.98	17334	0.748	85.02	288.7	14738	cd	5.1	4.8	5.0
HH SV36004RR	50.51	16.97	17127	0.685	85.83	291.4	14691	cde	5.1	5.3	5.2
HH SV36106RR	49.05	17.23	16888	0.660	86.21	297.1	14560	c-f	5.2	4.7	5.0
HM 9341RR	48.05	17.22	16542	0.618	86.76	298.8	14352	c-f	6.0	5.6	5.8
BTS 27RR20	48.45	17.11	16609	0.765	84.80	290.2	14085	c-f	5.1	5.0	5.1
SX 1517RR	48.02	17.02	16363	0.667	86.08	293.1	14083	c-f	5.7	4.8	5.3
BTS 236N	47.86	17.00	16266	0.611	86.80	295.2	14120	c-f	5.8	5.9	5.9
BTS 29RR3N	49.63	16.90	16756	0.689	85.77	289.9	14373	c-f	6.0	5.6	5.8
SX 1502RR	50.12	16.87	16911	0.692	85.72	289.2	14495	c-f	5.9	4.9	5.4
HM 9295RR	49.52	16.67	16518	0.597	86.91	289.8	14357	c-f	5.0	4.2	4.6
HH SV36005RR	51.01	16.22	16547	0.719	85.24	276.6	14102	c-f	5.9	6.1	6.0
HH SV36602RR	54.99	15.76	17332	0.826	83.71	264.0	14520	c-f	4.9	4.9	4.9
BTS 22RR5N	46.24	18.01	16665	0.669	86.24	310.7	14370	c-f	5.5	5.3	5.4
HM PM9172RR	48.87	16.38	16005	0.658	86.06	281.9	13772	d-g	4.7	4.4	4.6
Crystal RR275	48.10	16.73	16095	0.771	84.66	283.3	13628	e-h	5.2	4.8	5.0
HH SV36209RR	45.31	17.37	15717	0.623	86.72	301.3	13625	fgh	-	6.0	-
BTS 60RR27	45.93	17.17	15774	0.650	86.33	296.5	13617	fgh	-	6.5	-
HM RT9334RR	48.04	16.59	15941	0.717	85.34	283.2	13604	fgh	5.0	5.1	5.1
Crystal 9930RR	45.50	16.82	15293	0.751	84.93	285.8	12993	ghi	-	-	-
Crystal RR081	41.46	17.68	14651	0.583	87.29	308.6	12786	g-j	-	6.2	-
HM RT9418RR	44.70	16.78	14992	0.760	84.81	284.5	12720	g-j	5.0	4.4	4.7
Crystal RR022NT	42.71	17.21	14698	0.691	85.81	295.4	12616	hij	5.8	6.2	6.0
HM 4236RR	38.86	17.63	13703	0.598	87.09	307.1	11936	ij	6.9	6.8	6.9
BTS 49RR33	39.56	17.23	13628	0.651	86.34	297.6	11764	j	6.1	6.6	6.4
LSD (0.05)	3.46	0.45	1229	0.070	0.93	8.8	1065				
Grand Mean	48.67	16.98	16509	0.681	85.88	291.8	14177				

[a]Estimated recoverable sugar amounts followed by different letters are significantly different. If the same letter is shared, the amounts are not statistically different.

Table 2. Performance of experimental Roundup Ready® sugar beet varieties in the Amalgamated Sugar Co. LLC Variety Trial at the Malheur Experiment Station, Oregon State University, Ontario, OR, 2014.

	Root yield	Sugar content	Gross sugar	Conduc-tivity	Extrac-tion	Estimated recoverable sugar[a]			Curly top rating
VARIETY	(ton/acre)	(%)	(lb/acre)	(mmhos)	(%)	(lb/ton)	(lb/acre)		2014
Crystal A404NT	58.89	17.31	20382	0.678	86.00	297.8	17530	a	4.9
BTS 241	59.12	16.45	19452	0.671	85.92	282.7	16710	ab	5.6
HM 9611RR	56.69	16.50	18716	0.616	86.64	286.0	16217	abc	6.2
HH SV36602RR	58.27	15.93	18562	0.820	83.83	267.3	15577	bcd	4.9
HH SVRR044	52.54	17.10	17980	0.672	86.03	294.2	15469	bcd	5.6
BTS 27RR20	51.91	17.31	17941	0.689	85.84	297.1	15399	b-e	5.0
Crystal A467	54.08	16.70	18011	0.744	85.00	284.0	15303	cde	5.7
HM 9501RR	53.12	16.73	17786	0.721	85.31	285.4	15175	c-f	5.1
Crystal RR892	51.43	17.16	17663	0.728	85.31	292.8	15062	c-g	4.8
HH SVRR042	50.36	17.10	17218	0.642	86.42	295.5	14878	c-g	5.8
Maribo 401RR	49.91	17.21	17171	0.603	86.95	299.2	14937	c-g	6.1
SX Yuma RR	49.88	17.19	17143	0.594	87.05	299.4	14931	c-g	6.5
SX RR1545	50.73	17.03	17267	0.671	86.03	293.0	14852	d-g	5.4
HM 9606RR	49.90	17.25	17197	0.657	86.25	297.6	14828	d-h	5.4
BTS 243	50.99	16.92	17237	0.679	85.90	290.7	14805	d-i	5.0
HM 9612RR	50.65	17.18	17372	0.731	85.28	293.0	14808	d-i	4.9
HM 9295RR	50.26	16.88	16964	0.603	86.88	293.3	14735	d-i	4.2
HH SVRR043N	48.71	17.49	17040	0.634	86.59	303.0	14755	d-i	5.3
HM 9622RR	50.45	16.76	16882	0.660	86.12	288.6	14536	d-j	5.6
Crystal A488NT	49.22	17.25	16959	0.719	85.44	294.8	14488	d-j	5.0
SX RR1533N	48.29	17.10	16490	0.596	87.01	297.5	14351	d-j	5.8
Maribo 123RR	47.83	17.40	16612	0.606	86.93	302.5	14439	d-j	5.7
Crystal AX44	45.04	17.94	16156	0.581	87.37	313.4	14114	e-j	6.3
BTS 245	46.59	17.01	15832	0.559	87.47	297.6	13848	f-k	6.6
BTS 242	45.00	17.76	15976	0.661	86.29	306.6	13792	g-k	5.3
HH SVRR041	48.24	16.24	15694	0.659	86.01	279.5	13504	h-l	4.9
HM NT9505RR	44.15	17.42	15379	0.549	87.68	305.4	13482	i-l	6.1
BTS 36RR11	46.13	17.06	15743	0.770	84.73	289.3	13352	jkl	-
HM 425RR	42.15	17.30	14576	0.671	86.08	297.8	12546	klm	6.0
Maribo 102RR	40.07	18.11	14494	0.574	87.47	316.8	12681	klm	7.0
Maribo 109RR	39.37	18.00	14173	0.630	86.74	312.2	12281	lm	5.9
BTS 244	36.86	18.29	13463	0.554	87.77	321.1	11818	mn	6.8
Crystal RR228	36.62	17.95	13158	0.593	87.21	313.1	11470	mn	6.3
HM 4303RR	33.24	18.30	12174	0.526	88.13	322.6	10729	n	7.2
BTS 246	32.52	18.76	12189	0.598	87.29	327.5	10641	n	6.9
LSD (0.05)	4.55	0.46	1549	0.077	1.02	9.3	1345		
Grand Mean	47.99	17.27	16501	0.648	86.36	298.4	14240		

[a]Estimated recoverable sugar amounts followed by different letters are significantly different. If the same letter is shared, the amounts are not statistically different.