SUGAR BEET VARIETY TRIALS 2005

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Introduction

The sugar beet industry in southern Idaho and eastern Oregon, in cooperation with Oregon State University, tests commercial and experimental 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 to select the best varieties for sugar production. This report provides the agronomic practices for the Malheur Experiment Station location of the 2005 trials.

Materials and Methods

Sugar beet varieties were entered by ACH Seeds, Betaseed, Hilleshog/Syngenta, Holly Hybrids, and Seedex in 2005. Twenty-six varieties were tested in the Commercial Trial, and 34 varieties (including the four commercial check varieties) were tested in the Experimental Trial. Seed was organized by Amalgamated Sugar Company. The sugar beet trials were grown on Greenleaf silt loam with winter wheat as the previous crop. A soil test taken on September 15, 2004 showed pH 7.6, 3.6 percent organic matter, 73 lb available nitrogen (N)/acre in the top 2 ft of soil, 20 ppm extractable phosphorus (P), 404 ppm exchangeable potassium (K), 11 ppm sulfate (SO_4), 472 ppm magnesium (Mg), 123 ppm sodium (Na), 2.5 ppm zinc (Zn), 17 ppm iron (Fe), 11 ppm manganese (Mn), 1.0 ppm copper (Cu), and 0.6 ppm boron (B).

The grain stubble was chopped and the field was irrigated and disked, then 20 lb N/acre, 100 lb phosphate (P_2O_5)/acre, 150 lb sulfur (S)/acre, 5 lb Zn/acre, 2 lb Cu/acre, and 3 lb B/acre fertilizer was applied in accord with fall soil sample test results. The field was deep ripped in the fall, and in mid-March it was plowed, groundhogged, and bedded on 22-inch rows with a bed harrow.

Nortron® herbicide was applied preplant at 6 pt/acre and incorporated using the bed harrow on March 31. Both the Experimental Trial and the Commercial Trial were planted on April 6. Seeds were planted using John Deere model 71 flexi-planter units with double disk furrow openers and cone seeders fed from a spinner divider that uniformly distributed the seed. 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. The seeding rate was 12 viable seed/ft of row. Each entry was replicated eight times in a randomized complete block design.

On April 14 Counter 15G® was applied in a band over the row at 7.4 lb/acre. The first irrigation, for uniform germination, was applied on May 5 for 24 hours. The irrigation was followed by 2.7 inches of rain through May 18.

Alleys were hoed on May 12. Seedlings were thinned by hand to one plant per 7 inches, and the field was weeded on May 23 and 24.

The field was sidedressed with Temik 15G® at 10 lb/acre on May 24 to control sugar beet root maggot, and recorrugated. The field was irrigated for 24 hours to move the insecticide with the wetting front into the sugar beet seedlings' root zone on May 25. On June 2, urea was sidedressed to supply 180 lb N/acre. The field was cultivated and recorrugated again on June 3 and irrigated on June 7.

The field was furrow irrigated with surge irrigation from gated pipe, using a Waterman LVC-5 surge valve (Waterman Ind. Inc., Exeter, CA). Soil moisture was monitored using Watermark soil moisture sensors Model 200SS (Irrometer Co. Inc., Riverside, CA) connected to an AM400 Hansen datalogger (M.K. Hansen Co., Wenatchee, WA) to maintain the soil water potential wetter than -70 centibar at 10-inch depth in the beet row.

Headline® fungicide was applied at 12 oz/acre by aerial applicator on June 14 for control of powdery mildew. A petiole test was taken on June 28 and showed Zn and S were deficient. On June 28, Dithane® fungicide at 2 lb/acre plus Super-Six sulfur at 6 lb/acre were applied by aerial applicator. On July 1, the field was recorrugated the final time. A petiole test taken on July 10 showed nitrate slightly low at 8,391 ppm, when the sufficiency level was 8,802 ppm, and all of the other nutrients were sufficient.

The field was hand weeded on June 30 and again on August 11. Sulfur at 6 lb/acre was sprayed by airplane on August 20 to control powdery mildew, followed by an application of Gem® at 7 oz/acre on August 25.

The final irrigation was on September 19. Visual estimates of curly top virus foliar symptom severity were recorded for each plot in the Experimental Trial and Commercial Trial on September 16 by USDA personnel. The curly top ratings are not presented here, but will be compiled and presented in a separate report.

Sugar beets were harvested from the Experimental Trial starting on October 10, then rain prevented harvest on the 11th and 12th, and the harvest was completed on October 13. The Commercial Trial was harvested on October 13 and 14. The foliage was flailed and the crowns were removed with rotating knives. All sugar beets in the center two rows of each plot were dug with a two-row wheel-lifter harvester and weighed, and two eight-beet samples were taken from each plot. Samples were delivered each day to the Amalgamated Sugar Company for laboratory analysis of percent sucrose, nitrate concentration, and conductivity.

The root weight data were examined for outliers as is customary for calculations of sugar beet variety data in these trials. Observations more than two standard deviations from the mean for each variety were deleted. Sugar sample data were checked for errors in sugar percentages and conductivity. Any erroneous sample readings were deleted from the data set. The companion samples of all missing or deleted sugar data were good, so no plots were lost.

The weight of sugar beets from each plot was multiplied by 0.90 to estimate tare. Sugar concentrations were "factored" by multiplying measured sucrose by 0.98 to estimate the sugar that would have been lost to respiration if the beets had been stored in a pile. The data for each plot with two samples were averaged for analysis. 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 sucrose sugar concentration in percent.

Variety differences in yield, sucrose content, conductivity, percent extraction, and estimated recoverable sugar were calculated using least-squares means analysis. Sugar beet performance in both trials was compared to the check varieties ACH Seeds 'Crystal 217R', Betaseed 'Beta 4490R', Hilleshog/Syngenta 'HM 2980Rz', and Holly Hybrids 'Acclaim R'. Reports of previous years' Oregon State University variety trials are available online at www.cropinfo.net.

Results and Discussion

Early stand establishment was slow and erratic due to cool temperatures and repeated rain storms. Later on, surge irrigation approximately once a week maintained soil water potential wetter than -70 kPa through the growing season (Fig. 1).

Curly top virus foliar symptoms appeared earlier and were more severe in the beets this year than they had been in recent years. Powdery mildew infection developed on sugar beet foliage in these trials and in neighboring growers' fields. Curly top disease ratings from the official curly top nurseries are reported in Table 1.

Variety results were grouped by seed company for the Commercial Trial (Table 2) and the Experimental Trial (Table 3). Within each seed company's varieties, the varieties are ranked in descending order of estimated recoverable sugar in pounds per acre. The root weights were tared 10 percent, as explained above. The truck loads of border row beets delivered to the Nyssa factory in 2005 from the same field, dug with the same harvester, ranged from 2.1 to 4.3 percent tare, plus 2-3 lb of commingled dirt per ton of beets, so actual yields were probably greater than those reported.

Root yield in the Commercial Trial averaged 40.8 tared ton/acre, average sugar content was 16.8 percent, and average estimated recoverable sugar was 11,700 lb/acre. The

varieties yielding among the highest estimated recoverable sugar in the Commercial Trial were 'HM2992Rz' with 13,355 lb/acre, 'HMPM90' with 13,326, Beta '8600' with 13,291, SX 'Cascade' with 13,275, Beta '4490R' with 12,883, Beta '4199' with 12,829, Crystal '316R' with 12,762, and 'HM PM21' with 12,738 lb/acre.

Root yield in the Experimental Trial averaged 44.5 tared ton/acre, average sugar content was 16.7 percent, and average estimated recoverable sugar was 12,600 lb/acre (Table 2). The varieties yielding among the highest estimated recoverable sugar in the Experimental Trial were Beta '4490R' with 14,532 lb/acre, Crystal '597R' with 14,501, Beta '5YK0028' with 13,999, Beta '3YK0019' (renamed Beta '4910R') with 13,993, 'HM 2998Rz' with 13,592, 'HM 2996Rz' with 13,472, Beta '5YK0027' (renamed Beta '4720R') with 13,453, Crystal '594R' with 13,442, 'HM 2999Rz' with 13,407, and Crystal '599R' with 13,390 lb/acre. For 2006, Beta '2YK0016' was renamed Beta '4216R', and Holly '04HX434' was renamed HH 'Condor R'.

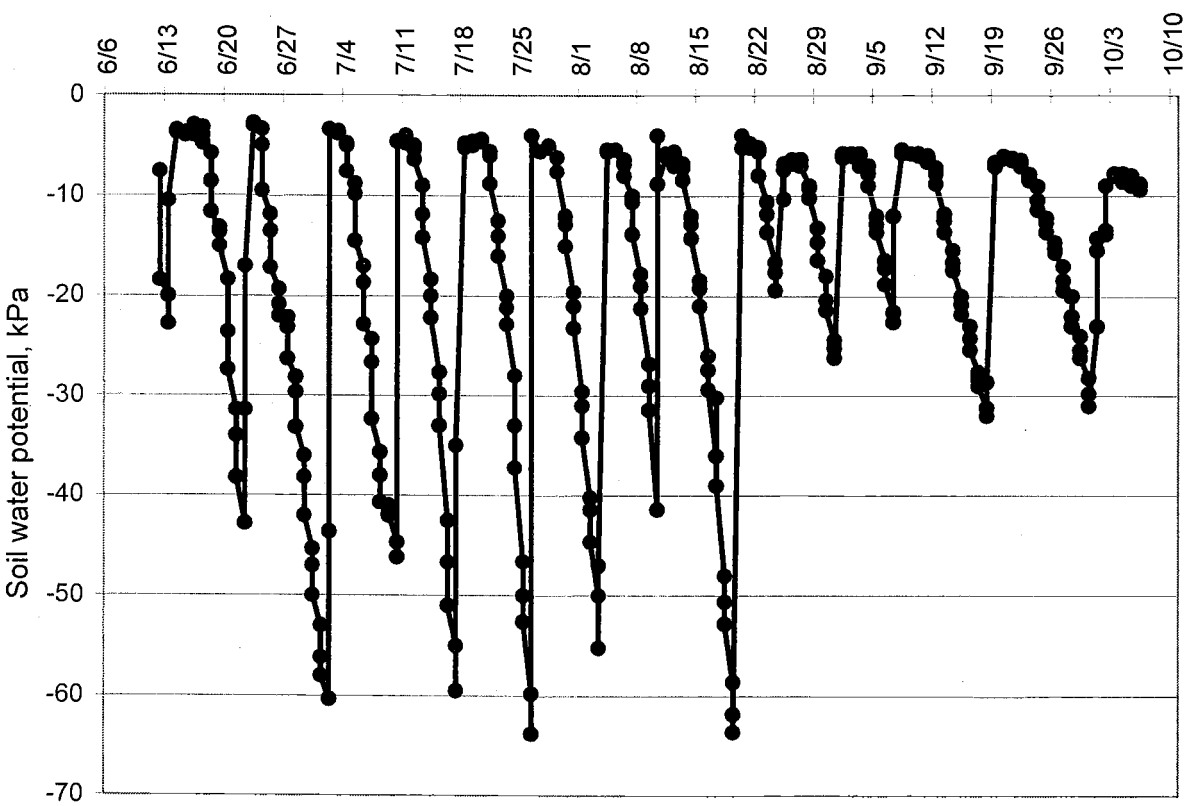

Figure 1. Soil water potential during the 2005 growing season in the commercial sugar beet trial at Oregon State University, Malheur Experiment Station, Ontario, OR.

Table 1. Curly top virus susceptibility data from the Amalgamated Sugar Company report of the 2005 Experimental and Commercial sugar beet variety trials, Malheur Experiment Station, Ontario, OR.

Experimental Trial	2005
HM 2993Rz	4.0*
HM 2996Rz	4.1
HH 05HX555 R	4.1
Crystal 594R	4.2
HH 04HX438 R	4.2
HH 04HX436 R	4.2
HH 05HX521 R	4.2
HM 2999Rz	4.3
Beta 5YK0029	4.3
HH Acclaim R	4.3
SX 1523	4.3
Crystal 595R	4.4
SX 1522	4.4
HH 05HX520 R	4.4
HH 04HX437 R	4.4
HH 05HX523 R	4.4
Beta 2YK0016	4.5
Crystal 596R	4.5
Beta 3YK0019	4.6
HM 2998Rz	4.6
Beta 5YK0027	4.6
Crystal 599R	4.6
Beta 4YK0025	4.6
HH 04HX434 R	4.6
Beta 4YK0024	4.7
Crystal 598R	4.7
Crystal 217R	4.7
Beta 4490R	4.8
HM 2980Rz	4.8
HH 05HX522 R	4.8
Crystal 597R	4.9
Beta 5YK0028	5.0
HM 2997Rz	5.0
Beta 5YK0026	5.3
Susceptible Check	6.4
Resistant Check†	4.6

Commercial Trial	2002	2003	2004	2005
HM Owyhee	3.3	3.5	3.5	3.6
HM PM90	-	-	3.7	4.0
SX Cascade	3.2	3.9	3.8	4.0
HM 2984Rz	3.1	3.9	3.7	4.0
HM PM21	3.1	3.7	3.6	4.1
SX Puma	3.6	4.3	4.2	4.2
HM 2992Rz	-	-	4.5	4.3
HH Acclaim R	3.9	4.5	4.0	4.3
Beta 8600	3.7	4.9	4.6	4.4
Crystal 333R	-	5.3	5.2	4.4
SX Raptor Rz	4.1	5.7	5.0	4.4
Beta 4199R	3.8	5.3	4.7	4.5
Beta 4023R	-	-	4.7	4.5
HH Meridian R	-	5.0	4.4	4.5
Crystal 316R	-	-	4.5	4.6
HM 2989Rz	-	5.3	4.6	4.6
SX Mammoth Rz	-	-	4.5	4.6
Beta 4773R	4.1	5.8	4.9	4.7
Crystal 217R	3.6	5.4	4.9	4.7
Beta 4490R	3.8	4.8	4.7	4.8
HM 2980Rz	4.6	4.9	4.6	4.8
HM 2991Rz	-	-	5.1	4.9
HH Eagle R	4.4	5.1	5.0	5.0
HM 2988Rz	-	5.5	5.1	5.0
HH 142 R	-	4.9	4.7	5.2
HH Phoenix R	4.9	5.0	4.8	5.8
Susceptible Check	5.6	6.8	6.3	6.4
Resistant Check‡	3.5	5.1	4.7	4.6

*Curly top ratings: 0 = no curly top symptoms; 9 = plants killed.
† A factored combined curly top rating of HM Owyhee, Beta 4490R, and Monohikari.
‡ US 41 in 2002 and 2003; a factored combined curly top rating of HM Owyhee, Beta 4490R, and HH 125 in 2004; and a factored combined curly top rating of HM Owyhee, Beta 4490R, and Monohikari in 2005.

Table 2. Field performance of commercial sugar beet varieties in the Oregon State University Variety Trial at Malheur Experiment Station, Ontario, OR, 2005.

Variety*	Root yield	Sugar content	Gross sugar	Conduc-tivity	Extrac-tion	Estimated recoverable sugar	
	ton/acre	%	lb/acre	mmho	%	lb/ton	lb/acre
ACH Seeds							
Crystal 316R	44.60	16.75	14,928	0.706	85.51	286.4	12,762
Crystal 333R	43.09	16.31	14,007	0.789	84.33	275.2	11,811
Crystal 217R	35.10	16.64	11,651	0.739	85.06	283.1	9,907
Betaseed							
Beta 8600†	46.08	16.84	15,512	0.696	85.67	288.5	13,291
Beta 4490R	43.55	17.20	14,981	0.675	86.01	295.9	12,883
Beta 4199R	43.35	17.33	15,025	0.724	85.39	296.0	12,829
Beta 4023R	43.35	16.73	14,486	0.813	84.10	281.4	12,186
Beta 4773R	40.77	16.39	13,364	0.698	85.55	280.4	11,434
Hilleshog/Syngenta							
HM 2992Rz	45.85	16.84	15,429	0.628	86.56	291.5	13,355
HM PM90†	45.61	16.96	15,484	0.669	86.04	291.9	13,326
HM PM21†	43.09	17.12	14,753	0.649	86.33	295.5	12,738
HM 2991Rz	39.43	17.21	13,572	0.520	88.01	303.0	11,943
HM 2984Rz	41.31	16.45	13,571	0.707	85.44	281.1	11,592
HM Owyhee†	40.18	16.75	13,451	0.734	85.16	285.4	11,456
HM 2988Rz	37.25	17.21	12,804	0.614	86.80	298.8	11,117
HM 2989Rz	37.77	17.01	12,837	0.632	86.53	294.4	11,108
HM 2980Rz	38.41	16.79	12,910	0.698	85.63	287.6	11,057
Holly Hybrids							
HH Acclaim R	43.49	16.24	14,121	0.843	83.61	271.6	11,802
HH Meridian R	42.30	16.31	13,797	0.796	84.24	274.9	11,619
HH 142 R	39.84	16.32	12,999	0.750	84.85	277.0	11,030
HH Eagle R	34.28	16.51	11,325	0.594	86.92	287.1	9,847
HH Phoenix R	32.19	16.46	10,586	0.570	87.21	287.1	9,231
Seedex							
SX Cascade†	46.02	16.80	15,452	0.677	85.91	288.6	13,275
SX Puma†	40.91	16.78	13,720	0.655	86.19	289.2	11,822
SX Raptor Rz	38.26	16.56	12,688	0.694	85.64	283.7	10,873
SX Mammoth Rz	34.52	17.19	11,856	0.673	86.04	295.8	10,199
Mean	40.79	16.76	13,666	0.690	85.72	287.4	11,711
LSD (0.05)	3.60	0.35	1,166	0.057	0.77	7.3	1,002
LSD (0.10)	3.02	0.29	977	0.048	0.64	6.1	839
CV (%)	8.9	2.1	8.6	8.3	0.9	2.6	8.6

*All entries were commercial seed obtained locally.
† Entered as a rhizomania-susceptible variety.

Table 3. Field performance of experimental sugar beet varieties in the Oregon State University Variety Trial at Malheur Experiment Station, Ontario, OR, 2005.

Variety	Root yield ton/acre	Sugar content %	Gross sugar lb/acre	Conduc-tivity mmho	Extrac-tion %	Estimated recoverable sugar lb/ton	Estimated recoverable sugar lb/acre
ACH Seeds							
Crystal 597R	51.42	16.68	17,150	0.779	84.55	282.1	14,501
Crystal 594R	47.38	16.72	15,856	0.764	84.76	283.5	13,442
Crystal 599R	46.43	17.10	15,881	0.801	84.34	288.4	13,390
Crystal 596R	46.57	16.56	15,411	0.789	84.39	279.4	12,996
Crystal 595R	46.11	16.61	15,281	0.754	84.86	282.0	12,964
Crystal 598R	41.89	16.89	14,132	0.724	85.32	288.2	12,056
Crystal 217R*	40.87	16.60	13,570	0.709	85.44	283.6	11,597
Betaseed							
Beta 4490R*	50.30	17.05	17,145	0.767	84.77	289.1	14,532
Beta 5YK0028	47.94	17.02	16,321	0.692	85.76	292.0	13,999
Beta 3YK0019	49.16	16.69	16,413	0.724	85.27	284.6	13,993
Beta 5YK0027	45.67	17.16	15,633	0.671	86.05	295.3	13,453
Beta 4YK0025	45.35	17.00	15,430	0.705	85.58	290.9	13,205
Beta 4YK0024	44.92	17.08	15,343	0.744	85.08	290.6	13,053
Beta 2YK0016	48.37	16.20	15,670	0.882	83.07	269.1	13,013
Beta 5YK0029	46.17	16.49	15,197	0.764	84.70	279.5	12,867
Beta 5YK0026	37.51	16.07	12,030	0.723	85.14	273.6	10,235
Hilleshog/Syngenta							
HM 2998Rz	45.16	17.29	15,611	0.596	87.05	301.0	13,592
HM 2996Rz	46.40	17.14	15,906	0.775	84.69	290.2	13,472
HM 2999Rz	47.21	16.83	15,860	0.781	84.55	284.7	13,407
HM 2993Rz	44.07	16.82	14,826	0.784	84.50	284.3	12,538
HM 2980Rz*	42.19	16.86	14,220	0.728	85.25	287.4	12,123
HM 2997Rz	38.73	17.12	13,254	0.666	86.12	294.8	11,409
Holly Hybrids							
HH 05HX555 R	46.54	16.66	15,494	0.840	83.73	278.9	12,974
HH Acclaim R*	46.08	16.24	14,951	0.884	83.06	269.8	12,418
HH 04HX438 R	46.22	16.07	14,837	0.908	82.69	265.7	12,269
HH 05HX520 R	41.52	17.02	14,133	0.681	85.90	292.4	12,142
HH 04HX434 R	41.08	17.01	13,970	0.685	85.84	292.0	11,995
HH 04HX436 R	42.85	16.40	14,056	0.778	84.51	277.2	11,876
HH 05HX522 R	40.96	16.31	13,362	0.761	84.70	276.4	11,327
HH 05HX521 R	42.82	15.74	13,492	0.913	82.56	260.0	11,146
HH 04HX437 R	39.63	16.41	13,013	0.788	84.38	277.0	10,978
HH 05HX523 R	38.23	16.21	12,376	0.770	84.56	274.2	10,470
Seedex							
SX 1522	42.71	16.84	14,380	0.748	84.98	286.2	12,222
SX 1523	44.22	16.36	14,468	0.848	83.57	273.5	12,095
Mean	44.49	16.68	14,843	0.763	84.76	282.9	12,581
LSD (0.05)	4.13	0.44	1,363	0.074	0.99	8.7	1,171
LSD (0.10)	3.46	0.37	1142	0.062	0.83	7.3	982
CV (%)	9.3	2.7	9.3	9.7	1.2	3.1	9.4

*Commercial check variety.