

SUGAR BEET VARIETY 2003 TESTING RESULTS

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Introduction

The sugar beet industry, in cooperation with Oregon State University (OSU), 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 combined data to choose the best varieties for sugar beet production. This report provides the agronomic practices, experimental procedures, and sugar beet yields and quality for the OSU Malheur Experiment Station location of the 2003 trials.

Methods

The sugar beet trials were grown on an Owyhee silt loam that had grown winter wheat the year before. The field was plowed and disked, then 82 lb P_2O_5 /acre, 93 lb K_2O /acre, 99 lb SO_4 /acre, 3 lb Zn/acre, 47 lb Mg/acre, 1 lb Mn/acre, 2 lb Cu/acre, and 1 lb B/acre fertilizer was applied according to fall soil sampling results. The field was then ripped, disked, groundhogged, fumigated with Telone C17 at 20 gal/acre, and fall bedded on 22-inch rows.

On March 29 the beds were remade using a spike-tooth bed harrow and preplant herbicide Nortron SC at 6 pint/acre was applied and incorporated using the bed harrow. A soil test taken on April 3, 2003, showed 51 lb NO_3 /acre available in the top foot of soil, 24 ppm extractable P, 322 ppm exchangeable K, 2.5 ppm Zn, pH 7.3, and 1.3 percent organic matter.

Sugar beet varieties were entered by ACH Seeds, Betaseed, Hillebrand/Syngenta, Holly Hybrids-Spreckels, and Seedex in 2003. Twenty-seven varieties were tested in the Commercial Trial, and 32 varieties (including 4 commercial check varieties) were tested in the Experimental Trial. Seed for the Commercial Trial was organized by Amalgamated. Seed of varieties in the Experimental Trial was sent by the seed companies. Both the Experimental Trial and the Commercial Trial were planted on March 31. Seeds were planted with John Deere model 71 flexi-planter units with double disc furrow openers and cone seeders fed from a spinner divider to uniformly distribute the seed. The seeding rate was 12 viable seed/ft of row. Each entry was replicated eight times in a randomized complete block design.

On April 4 Counter 20CR was applied in a band over the row at 8.6 lb/acre (5 oz/1,000 ft of row). On April 10 Roundup herbicide was applied at 1 quart/acre, and on April 11

crust busters were rolled over the rows to ensure uniform emergence. Full emergence was observed on April 14. On May 2, Betamix Progress at 24 oz/acre, Upbeet at 0.5 oz/acre, and Stinger at 3 oz/acre were applied for weed control. On May 14, urea was sidedressed to supply 170 lb N/acre. Seedlings were thinned by hand to one plant every 6.4 inches in the row on May 19 and 20. Plots of each variety were four rows wide by 23 ft long, with 4-ft alleys separating tiers of plots. The field was sidedressed with Temik at 10 lb/acre on May 21 to control sugar beet root maggot. On May 22, trifluralin was applied at 1.5 pint/acre and incorporated with an Alloway cultivator.

The field was furrow irrigated with surge irrigation from gated pipe. Irrigation was monitored with Watermark (Irrrometer Co. Inc., Riverside, CA) soil moisture sensors 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. The first irrigation was applied on May 23, for 16 hours, to move the insecticide with the wetting front into the sugar beet seedlings' root zone. The field was recorruigated the final time on June 10.

Headline fungicide was applied at 12 oz/acre by aerial applicator on June 17 for control of powdery mildew. Headline fungicide at 12 oz/acre with liquid sulfur at 12 lb S/acre was applied by aerial applicator on July 17. Sulfur dust was applied at 40 lb S/acre by aerial applicator on July 20. A petiole test was taken on July 31, and 0.2 lb B/acre was applied in the irrigation water. Topsin M at 0.5 lb/acre with 0.44 lb S/acre, 0.22 lb Fe/acre, 0.22 lb Mn/acre, and 0.33 lb Zn/acre was applied by aerial applicator on August 4. On August 7, 4.6 lb N/acre, 10 lb SO₄/acre, 0.25 lb Zn/acre, and 0.25 lb Cu/acre were applied in the irrigation water. On August 11, a second petiole test was taken, and on August 14, 7.8 lb N/acre, 10.7 lb P₂O₅/acre, 1.2 lb K₂O/acre, 9.5 lb SO₄/acre, 0.02 lb B/acre, 0.01 lb Fe/acre, 0.01 lb Zn/acre, and 0.21 lb Cu/acre were applied in the irrigation water. The final irrigation was on September 23.

Sugar beets were harvested from the Commercial Trial on October 22 and 23, and from the Experimental Trial on October 23 and 24. 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 Snake River Sugar factory in Nyssa for laboratory analysis of percent sucrose (Sug), nitrate concentration, and conductivity (Cond).

The root weight data were examined for outliers as is customary for calculations of sugar beet variety data by Amalgamated 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 with the erroneous readings being dropped from the data set. The companion samples of all missing or deleted sugar data were good, so no plots were lost due to sugar sample errors. The weight of sugar beets from each plot was multiplied by 0.95 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 with two samples from each plot were averaged for analysis. The percent extraction (Ext) was calculated using the formula:

$$\text{Ext} = 250 + [(1,255.2 * \text{Cond}) - (15,000 * \text{Sug}) - 6,185] / \text{Sug} * (98.66 - 7.845 * \text{Cond})$$

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 4490 R', Hillehog/Syngenta 'HM2986 Rz', and Seedex 'Raptor Rz'. OSU reports of previous years' variety trials are available online at cropinfo.net.

Results

Stand establishment was excellent in the 2003 sugar beet variety trials at Malheur Experiment Station, with frequent gentle rains that totaled 1.12 inches in April and 1.52 inches in May. Record heat of 110°F on July 22, along with prolonged heat throughout the growing season, stressed the sugar beets. Hot, dry weather during the summer promoted powdery mildew infection on sugar beet foliage in growers' fields in the area. Powdery mildew developed on foliage in these trials in September. Record heat in October may have reduced potential sugar content increases.

Variety performance was grouped by seed company for the Commercial Trial (Table 1) and the Experimental Trial (Table 2). Within each seed company's varieties, the varieties are ranked in descending order of estimated recoverable sugar in pounds per acre.

Root yield in the Commercial Trial averaged 50.32 ton/acre, average sugar content was 17.27 percent, and average estimated recoverable sugar was 14,702 lb/acre. The varieties yielding among the highest estimated recoverable sugar in the Commercial Trial were 'Beta 8600' with 16,209 lb/acre, 'SX Cascade' with 15,605 lb/acre, 'HH125' with 15,564 lb/acre, 'SX Orbit' with 15,429 lb/acre, and 'Beta 8220B' with 15,388 lb/acre.

Data for the Experimental Trial are reported in Table 2. Root yield in the Experimental Trial averaged 50.22 ton/acre, with average sugar content 17.96 percent, and average estimated recoverable sugar 15,289 lb/acre. The varieties yielding among the highest estimated recoverable sugar in the Experimental Trial were 'HM2990' with 16,795 lb/acre, '03HX351RZ' with 16,315 lb/acre, 'HM2987' with 16,265 lb/acre, 'SX 1520' with 16,213 lb/acre, and 'Crystal 316 R' with 16,109 lb/acre.

Table 1. Commercial sugar beet variety root yield, sugar content, root quality, and recoverable sugar from varieties entered in the trial at Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.

Variety	Root yield	Sugar content	Gross sugar	Conductivity	Extraction	Estimated recoverable sugar	
	ton/acre	%	lb/acre	mmho	%	lb/ton	lb/acre
Hilleshog/Syngenta							
HM 2980RZ	52.38	17.35	18,188	0.859	83.61	290.2	15,214
HM Oasis	50.94	17.27	17,591	0.695	85.77	296.3	15,090
HM 1642	49.25	17.75	17,494	0.766	84.91	301.5	14,867
HM PM21	49.65	17.41	17,308	0.693	85.82	298.9	14,864
HM Owyhee	51.77	16.89	17,468	0.746	85.02	287.3	14,858
HM 2984RZ	48.16	17.34	16,709	0.740	85.19	295.4	14,235
HM 2986RZ	47.81	17.35	16,598	0.736	85.23	295.8	14,156
Holly Hybrids-Spreckels							
HH 125	50.36	17.96	18,087	0.683	86.05	309.1	15,564
PhoenixRZ	53.64	16.97	18,207	0.844	83.74	284.2	15,246
AcclaimRZ	53.30	16.79	17,906	0.879	83.23	279.6	14,912
EagleRZ	53.24	16.52	17,591	0.870	83.30	275.3	14,652
HH 120	48.92	17.14	16,770	0.823	84.05	288.3	14,099
Seedex							
SX Cascade	53.03	17.05	18,082	0.651	86.30	294.3	15,605
SX Orbit	50.30	17.84	17,955	0.694	85.88	306.5	15,429
SX RaptorRZ	51.98	17.00	17,664	0.834	83.88	285.1	14,815
SX Puma	48.46	16.93	16,377	0.703	85.59	289.8	14,023
ACH Seeds Inc.							
ACH Mustang	50.45	17.20	17,359	0.818	84.13	289.4	14,609
Crystal 9906R	44.38	17.61	15,624	0.759	84.98	299.3	13,278
Crystal 217R	44.44	17.75	15,771	0.853	83.77	297.4	13,215
Betaseed							
Beta 8600	57.38	16.71	19,187	0.788	84.43	282.3	16,209
Beta 8220B	55.27	16.63	18,383	0.842	83.69	278.3	15,388
Beta 8859	49.13	17.74	17,430	0.650	86.43	306.7	15,056
Beta 4199R	49.22	17.85	17,575	0.829	84.10	300.3	14,783
Beta 4490R	50.11	17.32	17,357	0.818	84.16	291.6	14,612
Beta 4773R	48.02	17.65	16,952	0.825	84.12	297.0	14,264
Beta 4035R	48.58	17.26	16,770	0.826	84.02	290.2	14,095
Beta 8348	48.85	16.87	16,495	0.846	83.69	282.5	13,811
Mean	50.32	17.27	17,365	0.780	84.64	292.4	14,702
LSD (0.05)	2.66	0.48	1,018	0.053	0.75	9.8	899
LSD (0.10)	2.23	0.40	853	0.044	0.63	8.2	754
CV (percent)	5.3	2.8	5.9	6.8	0.9	3.4	6.1

Table 2. Experimental sugar beet variety root yield, sugar content, root quality, and recoverable sugar from varieties entered in the trial at Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.

Variety	Root yield ton/acre	Sugar content %	Gross sugar lb/acre	Conductivity mmho	Extraction %	Estimated recoverable sugar lb/ton lb/acre	
Hilleshog/Syngenta							
HM 2990	53.00	18.40	19,489	0.681	86.15	317.0	16,795
HM 2987	50.96	18.37	18,727	0.626	86.86	319.2	16,265
HM 2988RZ	48.86	18.43	18,016	0.705	85.84	316.5	15,467
HM 2986RZ	49.71	17.90	17,800	0.764	84.98	304.3	15,128
HM 2989RZ	48.21	18.20	17,560	0.773	84.91	309.2	14,913
Holly Hybrids-Spreckels							
03HX351RZ	55.36	17.47	19,349	0.809	84.30	294.6	16,315
01HX047RZ	52.41	17.88	18,738	0.691	85.92	307.3	16,100
00HX011RZ	52.08	17.76	18,501	0.679	86.06	305.7	15,931
03HX359RZ	52.57	17.44	18,332	0.854	83.69	292.0	15,344
03HX356	49.87	18.14	18,075	0.797	84.58	307.0	15,289
03HX353RZ	47.20	18.57	17,536	0.717	85.71	318.4	15,033
02HX226RZ	49.56	17.57	17,414	0.765	84.90	298.3	14,786
03HX355RZ	46.25	17.97	16,604	0.811	84.37	303.2	14,009
Seedex Inc.							
SX1520	52.01	18.11	18,828	0.681	86.10	311.8	16,213
SX RaptorRZ	52.96	17.70	18,739	0.835	84.00	297.3	15,739
SX1519	52.08	17.70	18,427	0.867	83.57	295.8	15,398
SX1521	46.86	18.64	17,474	0.762	85.13	317.4	14,877
SX1518	38.98	18.49	14,426	0.723	85.61	316.6	12,355
ACH Seeds Inc.							
Crystal 316R	51.92	18.16	18,880	0.743	85.30	309.9	16,109
Crystal 318R	50.42	18.05	18,186	0.651	86.46	312.2	15,721
Crystal 317R	51.46	17.85	18,374	0.779	84.76	302.4	15,571
Crystal 103	52.14	17.78	18,513	0.829	84.08	299.0	15,565
Crystal 319R	51.71	17.43	18,033	0.904	83.01	289.4	14,974
Crystal 217R	45.21	18.00	16,274	0.869	83.60	301.0	13,605
Betaseed							
Beta 2YK0016	51.86	17.98	18,651	0.851	83.84	301.6	15,638
Beta 3YK0019	50.75	18.10	18,369	0.801	84.52	305.9	15,524
Beta 4490R	50.42	18.04	18,193	0.825	84.18	303.6	15,316
Beta 3YK0021	52.33	17.46	18,278	0.881	83.34	291.0	15,229
Beta 3YK0018	49.90	17.87	17,828	0.753	85.12	304.2	15,176
Beta 2YK0014	52.01	17.28	17,969	0.819	84.13	290.7	15,118
Beta 3YK0022	48.95	18.13	17,740	0.769	84.94	308.0	15,069
Beta 3YK0020	48.39	17.89	17,306	0.822	84.20	301.3	14,576
Mean	50.22	17.96	18,024	0.780	84.82	304.6	15,289
LSD (0.05)	2.17	0.47	866	0.056	0.77	9.2	759
LSD (0.10)	1.82	0.39	726	0.047	0.64	7.8	636
CV (percent)	4.3	2.6	4.8	7.2	0.9	3.0	5.0