SUGAR BEET VARIETY TRIALS 2006

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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 and results for the Malheur Experiment Station location of the 2006 trials.

Methods

Sugar beet varieties were entered by ACH Seeds, Betaseed, Hilleshog/Syngenta, Holly Hybrids, and Seedex in 2006. Twenty-seven varieties were tested in the Commercial Trial, and 32 varieties (including the four commercial check varieties) were tested in the Experimental Trial. Seed was organized by Amalgamated Sugar Company, Paul, Idaho.

The 2006 sugar beet trials were grown on Owyhee silt loam with winter wheat as the previous crop. A soil test taken on September 26, 2005, showed 39 lb available N/acre in the top 2 ft of soil. The top foot of soil had pH 7.6, 0.81 percent organic matter, 24 ppm P, 379 ppm K, 10 ppm SO_4, 480 ppm Mg, 128 ppm Na, 0.6 ppm Zn, 9 ppm Fe, 8 ppm Mn, 0.4 ppm Cu, and 0.4 ppm B. The grain stubble was chopped and the field was irrigated and disked, then 100 lb P_2O_5/acre, 100 lb S/acre, 13 lb Zn/acre, 2 lb Cu/acre, and 3 lb B/acre fertilizer were applied based on the soil sample analysis.

The field was deep ripped in the fall, plowed, groundhogged, and bedded on 22-inch rows with Telone C17® at 15 gal/acre. On April 13, 2006, the tops were dragged off the beds with a bed harrow and on April 14, Nortron® was applied at 6 pt/acre and incorporated using the bed harrow.

Both the Commercial Trial and the Experimental Trial were planted on April 18. Seed for the 32 varieties tested in the Commercial Trial, and 27 varieties (including the 4 commercial check varieties) tested in the Experimental Trial was organized by Amalgamated Sugar Company. Seeds were planted using John Deere model 71 flexi-planter units with double-disc 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 21, Counter® insecticide was applied in a band over the row at 7.4 lb/acre to protect the emerging seedlings. The first irrigation was applied on April 24 for 24 hours. 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 tension wetter than 50 centibar at 10-inch depth in the beet row.

Beets had emerged by May 4 and had four leaves by May 11. Alleys were hoed on May 15. On May 16 and 17, seedlings were thinned by hand to one plant per 7 inches, and the field was hand weeded during thinning. On May 22, urea was sidedressed to supply 180 lb N/acre.

The field was sidedressed with Temik 15G® at 10 lb/acre on May 27 to control sugar beet root maggot, and recorrugated. The field was irrigated for 24 hours on May 30 to move the insecticide with the wetting front into the sugar beet seedlings' root zone, and irrigated again on June 7. The field was cultivated and recorrugated the final time on June 15. The field was hand weeded on June 12, July 5, July 26, and August 15.

Gem® fungicide at 7 oz/acre plus Super-Six® sulfur at 1 gal/acre were applied by aerial applicator on June 14 for control of powdery mildew. On July 1, Topsin-M® at 20 oz/acre plus Dithane® fungicide at 2 lb/acre were applied by aerial applicator. The first petiole test, taken on July 3, showed nitrate slightly high at 11,852 ppm, when the sufficiency level was 9,426 ppm; all of the other nutrients were sufficient. Sulfur at 6 lb/acre plus Headline® at 12 oz/acre were sprayed by airplane on July 18 to control powdery mildew.

A second petiole test taken on July 17 showed nitrate slightly low at 7,154 ppm, when the sufficiency level was 8,334 ppm; sulphate was slightly deficient; magnesium was marginally sufficient; and all of the other nutrients were sufficient. Epsom salt was applied in irrigation on July 19 to supply 5.8 lb magnesium and 7.6 lb sulphate/acre. The third petiole test, taken on August 3, showed deficiency in zinc and phosphate, which was remedied on August 7 by an aerial application of 0.2 lb Z, 1.5 lb P_2O_5, and 6 lb S/acre. The fourth petiole test, taken on August 14, showed nitrate was deficient at 2,712 ppm when sufficiency was 6,150 ppm, and all of the other nutrients were sufficient.

Sugar beets were harvested on October 10 starting with the Commercial Trial and the Experimental Trial harvest was completed on October 11. 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 hauled each day to the Snake

River Sugar factory 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 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 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 2992Rz', and Holly Hybrids 'Acclaim R'. Reports of previous years' Oregon State University variety trials are available online at www.cropinfo.net.

Results

Surge irrigation approximately once a week maintained the soil water tension wetter than 50 centibar through the growing season (Fig. 1).

Less curly top virus infection was seen in the beet trials this year than in recent years. Powdery mildew foliar symptoms were observed on the sugar beet foliage in these trials, and became more severe in September and early October.

Variety results were grouped by seed company for the Commercial Trial (Table 1) and the Experimental Trial (Table 2). The root weights were tared 10 percent, as explained above. The beets from the border rows in the trials, topped the same and dug with the same harvester, ranged from 1.7 to 2.7 percent tare, plus from 1 to 5 lb of dirt was commingled per ton of beets, so the actual yields were slightly higher than is reported here.

Root yield in the Commercial Trial averaged 48.1 tared ton/acre, with an average sugar content of 16.8 percent (Table 1). The varieties yielding among the highest root yield in

the Commercial Trial were 'Beta 4023R' with 53.8 ton/acre, 'Beta 8600' with 53.6 ton/acre, Crystal '316R' with 53.2 ton/acre, and 'HH Meridian R' with 52.0 ton/acre.

Root yield in the Experimental Trial averaged 48.0 tared ton/acre with an average sugar content of 17.1 percent (Table 2). The varieties yielding among the highest root yield in the Experimental Trial were 'HH 06HX621 R' with 55.6 ton/acre, and 'HH Acclaim R' with 53.3 ton/acre.

Within each seed company's varieties, the varieties are ranked in descending order of estimated recoverable sugar in pounds per acre. A computer problem at the tare lab at Paul, Idaho resulted in 514 samples lost out of 944 taken. Too many plots were missing sugar data to perform a statistical analysis of the lab results. Lab and calculated data reported here are from two to eight replications of available data. Graphical comparisons of the data from the other locations of the Commercial (Fig. 2-5) and Experimental (Fig. 6-9) trials show that the partial data available from the Malheur location generally follow the same trends seen at the other locations.

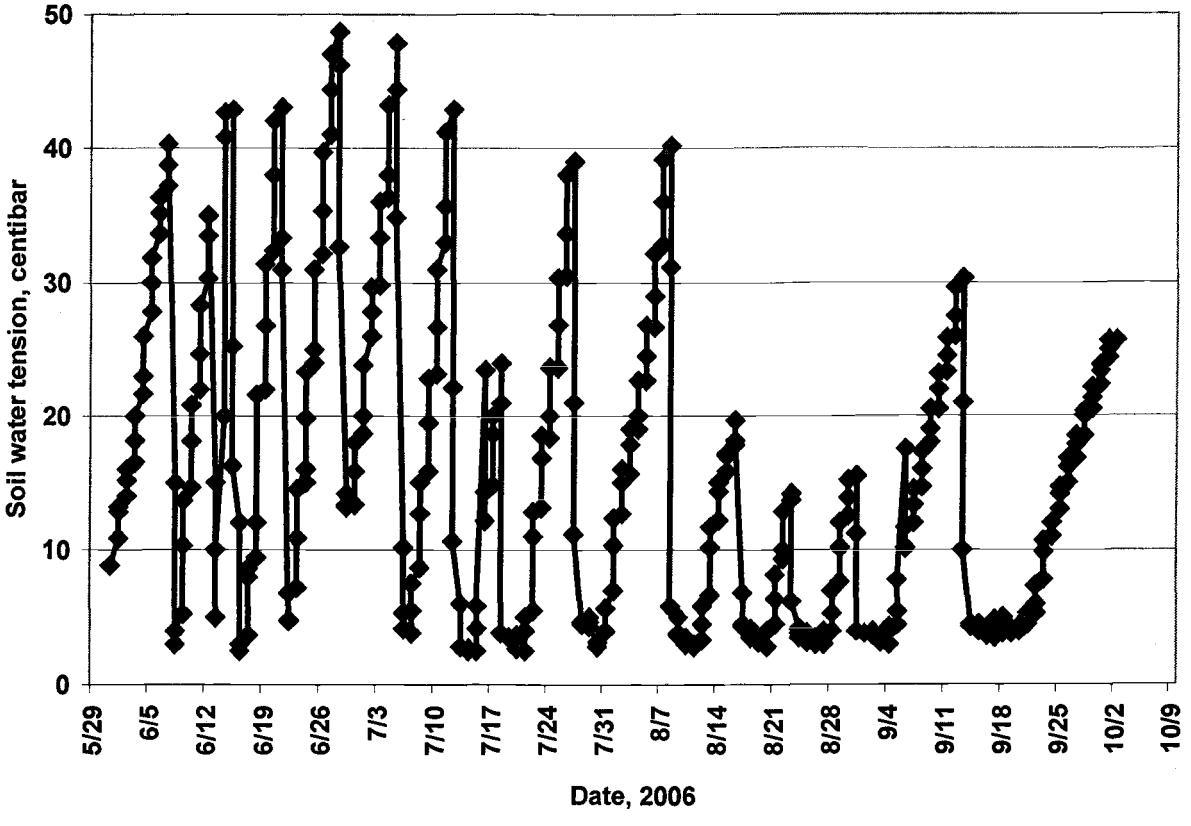

Figure 1. Soil water tension during the 2005 growing season in the commercial sugar beet trial at Oregon State University, Malheur Experiment Station, Ontario, OR.

Table 1. Field performance of commercial sugar beet varieties in the Oregon State University Variety Trial at Malheur Experiment Station, Ontario, OR, 2006.

	Root yield	Sugar content	Gross sugar	Conduc-tivity	Extrac-tion	Estimated recoverable sugar	
Variety	ton/acre	%	lb/acre	mmho	%	lb/ton	lb/acre
ACH Seeds							
Crystal 316R	53.2	16.6	17,718	0.775	84.6	281	14,987
Crystal 217R	50.1	15.9	16,726	0.832	83.7	267	13,992
Crystal 333R	50.1	16.7	16,597	0.833	83.8	280	13,922
Betaseed							
Beta 8600	53.6	16.8	18,116	0.825	84.0	283	15,218
Beta 4720R	53.8	16.0	17,286	0.828	83.8	268	14,481
Beta 4023R	50.3	16.8	16,964	0.869	83.4	280	14,143
Beta 4216R	49.9	16.6	16,516	0.837	83.8	278	13,838
Beta 4773R	46.1	17.3	16,126	0.810	84.3	292	13,592
Beta 4910R	45.0	17.9	15,870	0.793	84.6	303	13,425
Beta 4199R	45.1	17.3	15,583	0.878	83.3	288	12,990
Beta 4490R	44.8	17.6	15,396	0.821	84.2	296	12,959
Hilleshog/Syngenta							
HM PM90	49.7	17.8	17,668	0.711	85.7	305	15,134
HM 2996Rz	50.2	17.0	17,081	0.757	84.9	289	14,502
HM PM21	47.5	17.4	16,627	0.732	85.3	297	14,185
HM 2991Rz	46.5	17.3	16,098	0.639	86.5	299	13,924
HM 2988Rz	46.4	17.3	16,208	0.692	85.8	297	13,909
HM 2999Rz	48.1	16.7	16,211	0.782	84.5	282	13,698
HM 2993Rz	46.6	16.7	15,995	0.761	84.8	283	13,568
HM Owyhee	47.9	16.5	15,735	0.761	84.7	280	13,341
HM 2992Rz	47.5	17.4	15,668	0.810	84.3	294	13,207
HM 2984Rz	45.2	16.2	14,351	0.762	84.7	275	12,152
Holly Hybrids							
HH Meridian R	52.0	16.1	16,795	0.838	83.6	269	14,057
HH Phoenix R	50.4	16.2	16,376	0.829	83.8	271	13,717
HH Eagle R	48.1	16.7	16,125	0.799	84.3	281	13,588
HH Acclaim R	50.1	16.1	16,018	0.792	84.3	271	13,502
HH Condor R	43.3	16.9	14,889	0.710	85.5	289	12,732
HH 142 R	46.7	16.3	14,942	0.821	83.9	273	12,540
Seedex							
SX Cascade	48.5	17.2	16,760	0.719	85.4	294	14,325
SX 1522 Rz	47.9	17.0	16,535	0.750	85.0	289	14,060
SX Raptor Rz	47.5	16.5	15,762	0.834	83.8	277	13,213
SX Puma	45.7	16.6	15,027	0.692	85.7	284	12,876
SX Mammoth Rz	43.4	17.6	15,210	0.804	84.4	297	12,840
Mean	48.1	16.8	16,213	0.782	84.5	284	13,707
LSD (0.05)	2.26	na[a]	na	na	na	na	na

[a]na = not available due to the loss of data at Paul, ID.

Table 2. Field performance of experimental sugar beet varieties in the Oregon State University Variety Trial at Malheur Experiment Station, Ontario, OR, 2006.

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 594R	52.4	17.0	17,793	0.759	84.9	288	15,107
Crystal 595R	52.3	16.6	17,325	0.753	84.9	282	14,704
Crystal 611R	48.4	17.1	16,369	0.724	85.4	292	13,971
Crystal 596R	48.1	17.0	16,531	0.805	84.3	286	13,930
Crystal 599R	47.1	17.4	16,527	0.887	83.3	290	13,764
Crystal 597R	47.7	17.4	16,549	0.898	83.1	289	13,750
Crystal 217R	49.4	16.7	15,952	0.786	84.4	281	13,466
Betaseed							
Beta 5YK0028	49.2	17.5	17,873	0.760	85.0	297	15,184
Beta 6YK0032	47.8	17.8	17,449	0.745	85.2	304	14,871
Beta 6YK0031	47.5	17.3	16,453	0.834	83.9	290	13,808
Beta 4YK0025	47.1	17.4	16,284	0.814	84.2	293	13,714
Beta 6YK0030	44.8	17.3	15,862	0.862	83.6	289	13,257
Beta 4490R	43.6	16.8	13,963	0.878	83.3	280	11,624
Hilleshog/Syngenta							
HM 2992Rz	46.6	17.4	16,221	0.710	85.6	298	13,886
HM 1339Rz	46.0	17.0	15,693	0.796	84.4	286	13,243
Holly Hybrids							
HH 06HX621 R	55.6	16.3	17,883	0.823	83.9	273	15,007
HH Acclaim R	53.3	16.5	17,765	0.790	84.4	279	14,993
HH 06HX620 R	48.3	17.8	16,992	0.672	86.2	306	14,642
HH 05HX555 R	49.8	17.2	17,088	0.754	85.0	292	14,521
HH 06HX623 R	51.7	16.3	16,867	0.798	84.2	274	14,215
HH 06HX626 R	45.1	18.0	16,222	0.646	86.5	312	14,040
HH 06HX625 R	46.0	16.7	15,160	0.751	84.9	283	12,874
HH 06HX624 R	43.0	17.5	14,835	0.784	84.6	296	12,555
HH 06HX622 R	41.4	17.4	14,423	0.747	85.1	296	12,276
Seedex							
SX 1524	47.3	18.2	16,858	0.603	87.1	316	14,687
SX 1523	51.0	16.7	16,966	0.793	84.4	281	14,323
SX 1525	46.6	16.7	15,664	0.782	84.5	282	13,233
Mean	48.0	17.1	16,500	0.777	84.65	289.7	13,970
LSD (0.05)	2.27	na[a]	na	na	na	na	na

[a]na = not available due to the loss of data at Paul, ID.

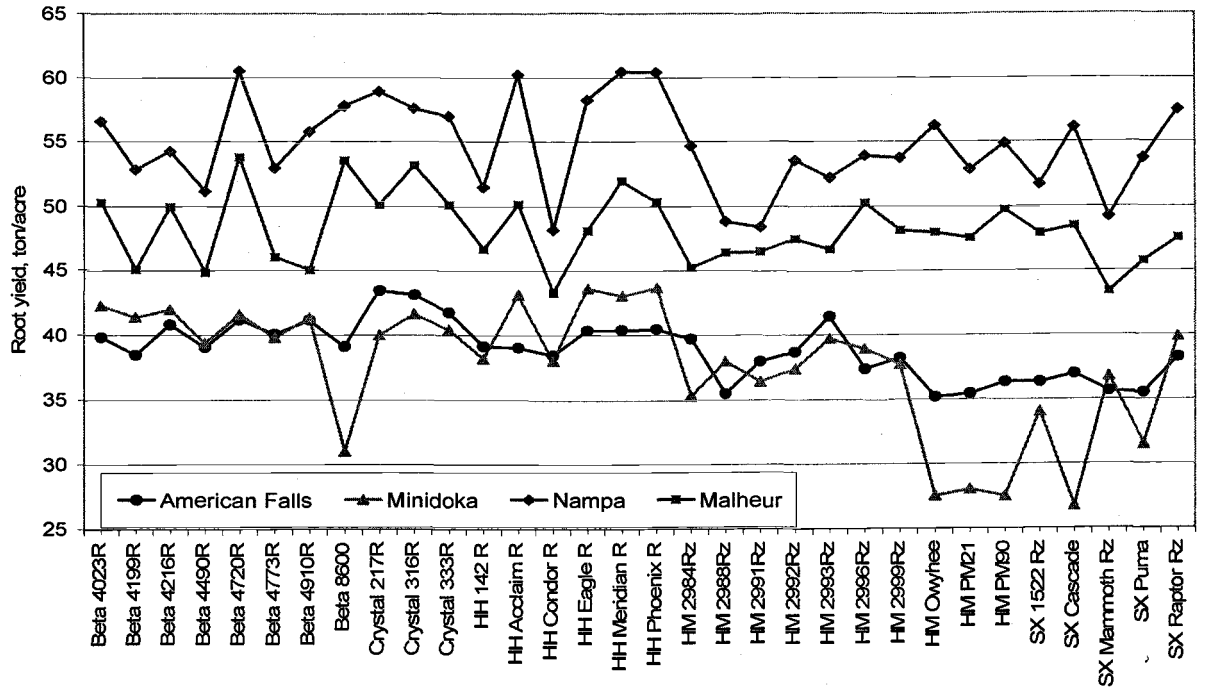

Figure 2. Commercial Trial root yield from sugar beets grown at four locations.

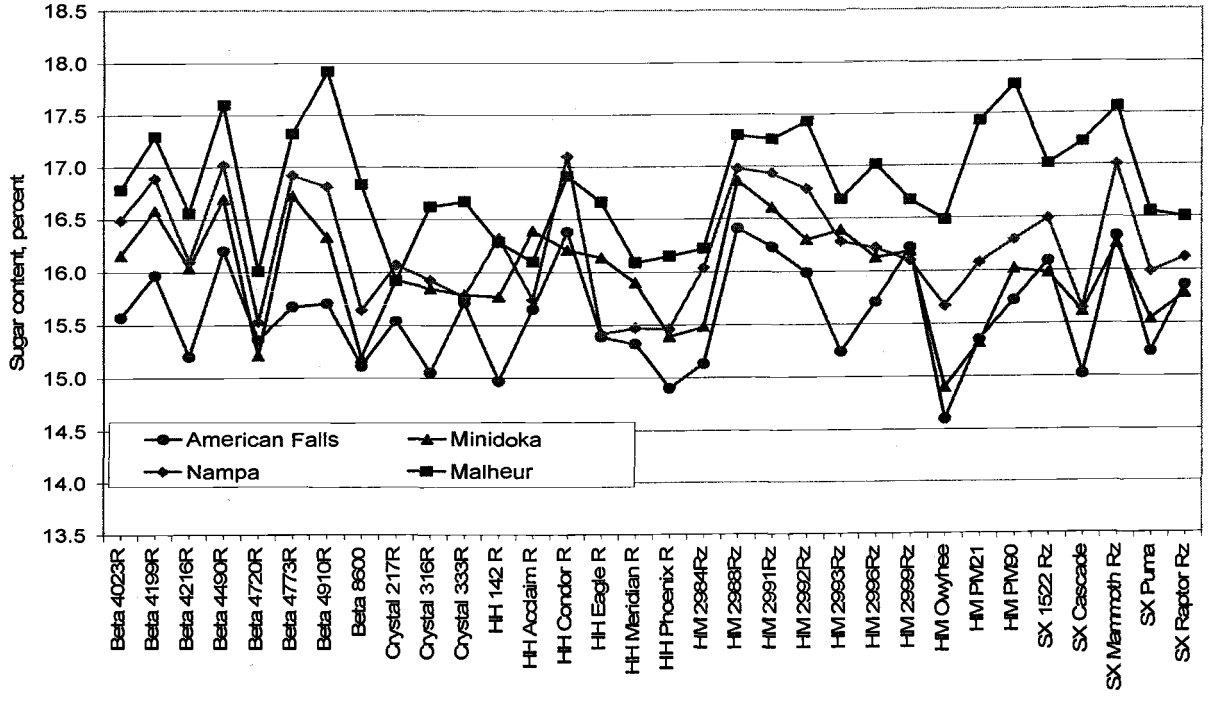

Figure 3. Commercial Trial sugar content from sugar beets grown at four locations.

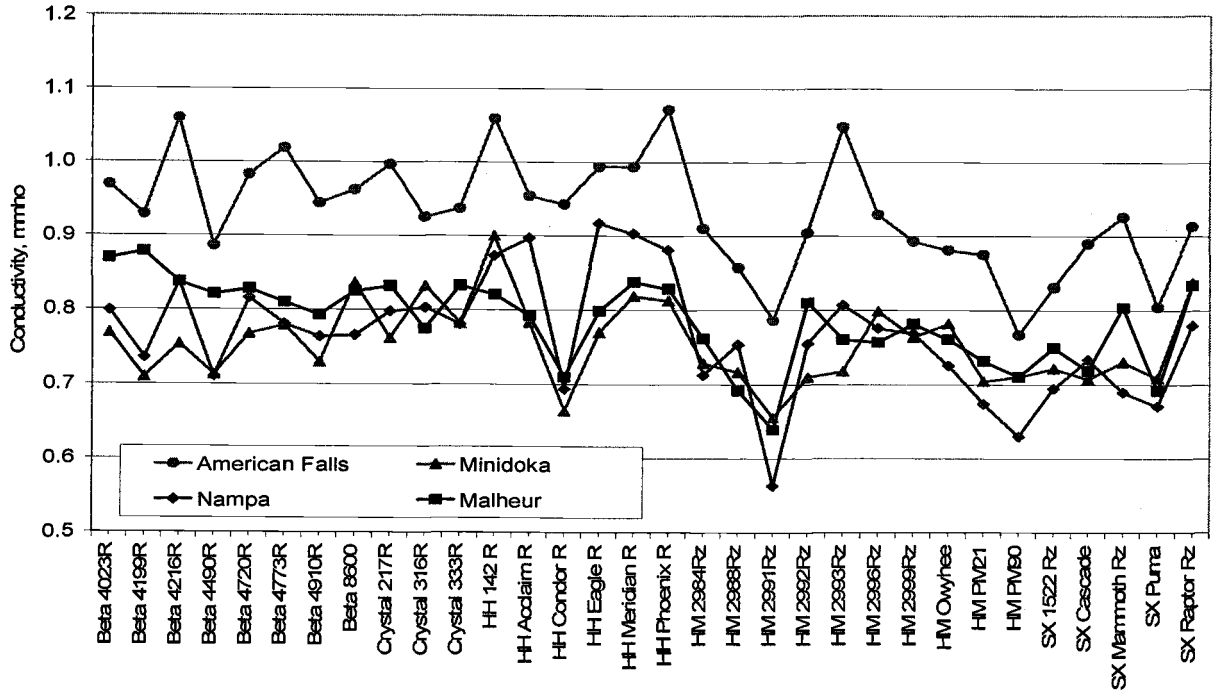

Figure 4. Commercial Trial conductivity for sugar beets grown at four locations.

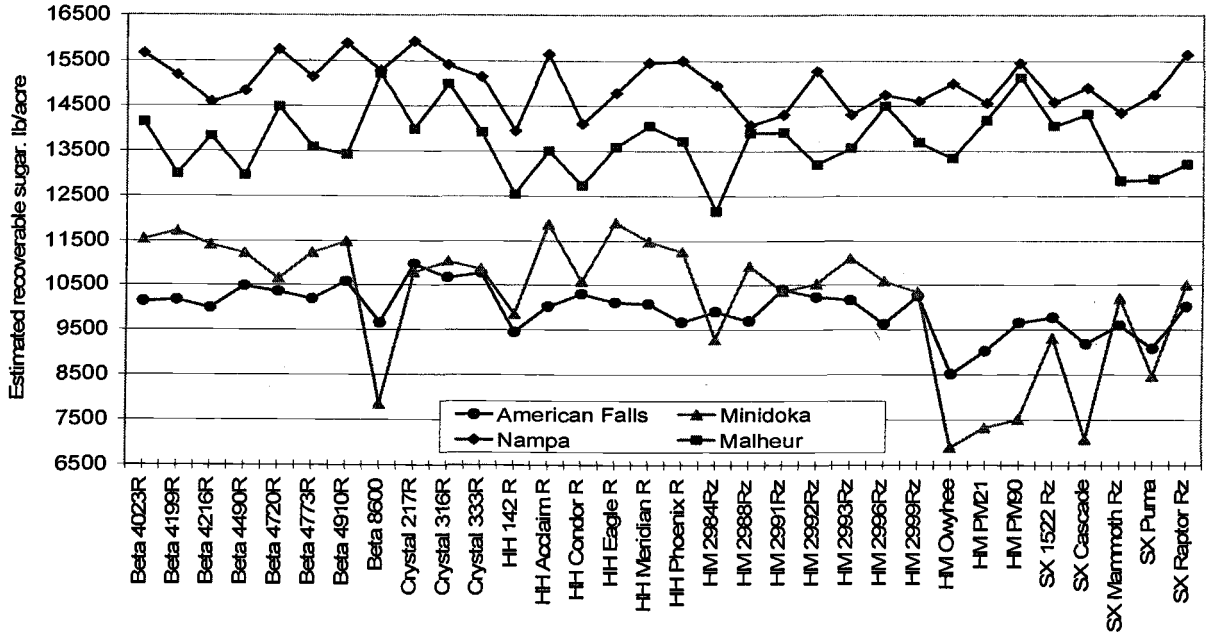

Figure 5. Commercial Trial estimated recoverable sugar from sugar beets grown at four locations.

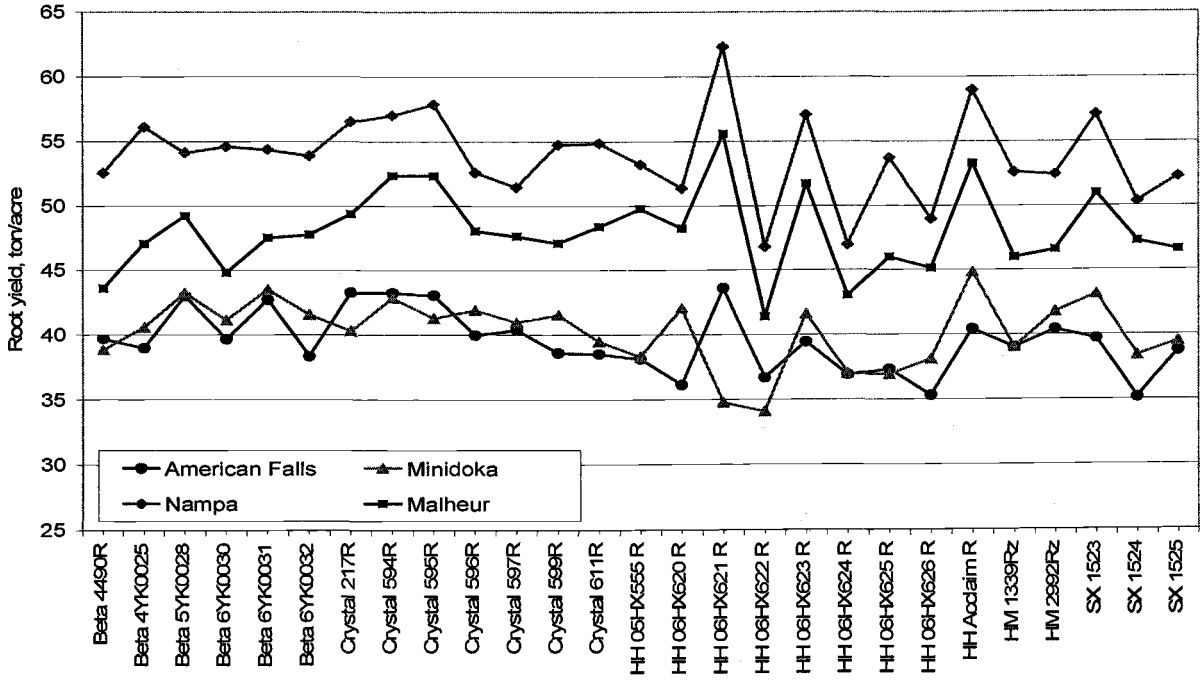

Figure 6. Experimental Trial root yield from sugar beets grown at four locations.

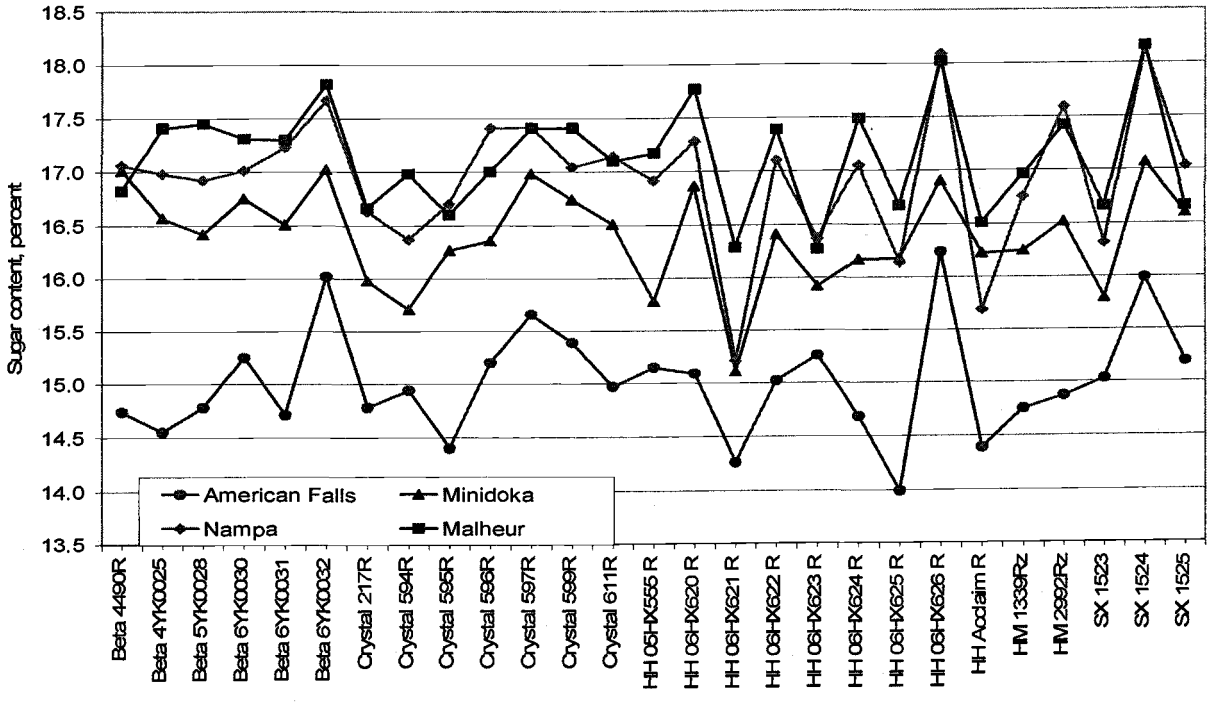

Figure 7. Experimental Trial sugar content of sugar beets grown at four locations.

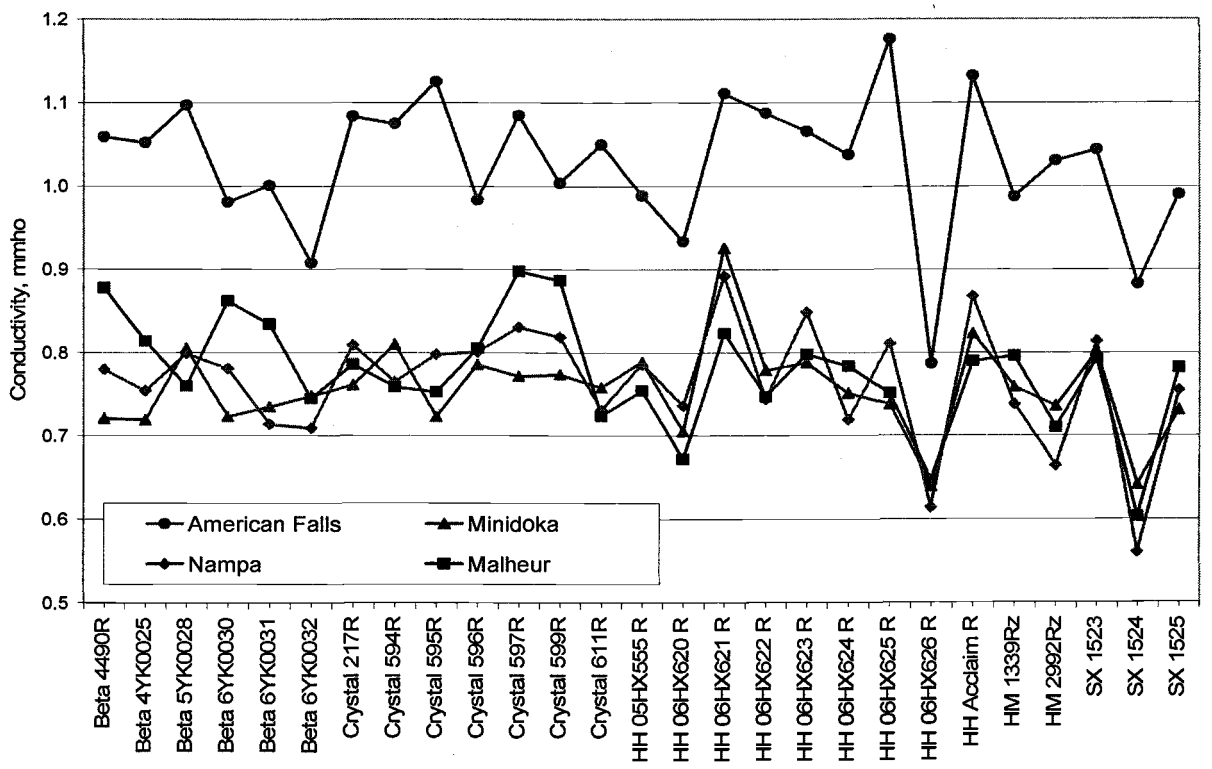

Figure 8. Experimental Trial conductivity of sugar beets grown at four locations.

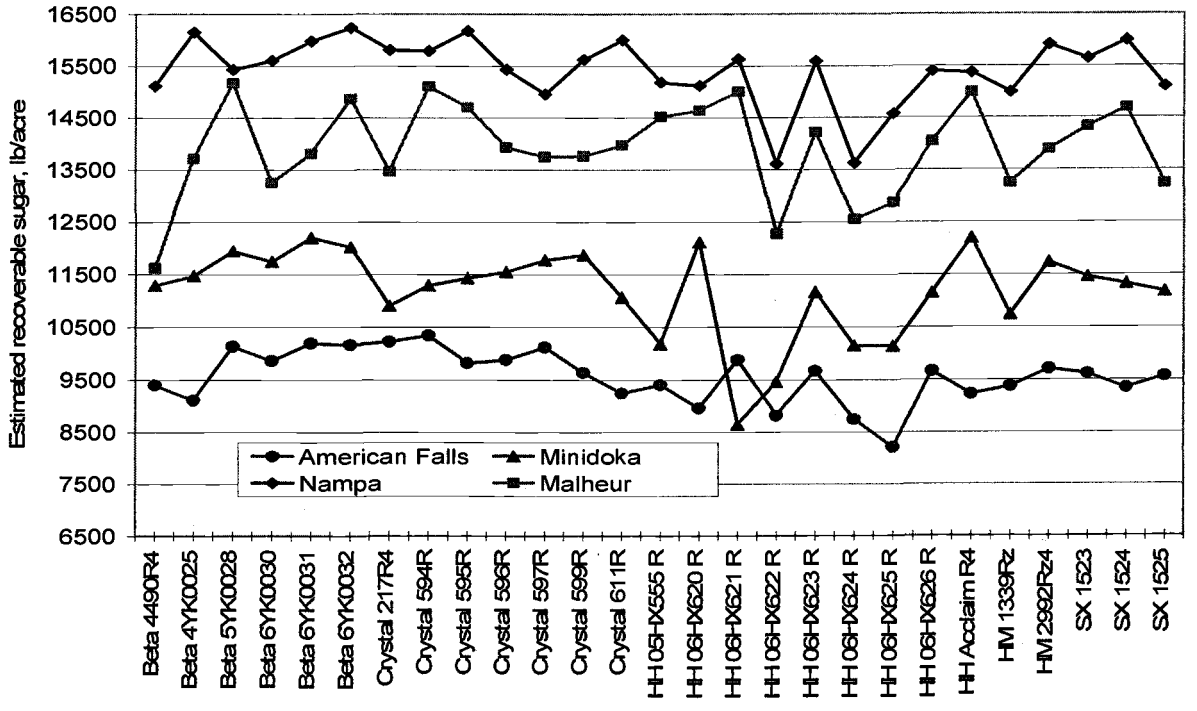

Figure 9. Experimental Trial estimated recoverable sugar from sugar beets grown at four locations.