

TRANSGENIC SUGAR BEET VARIETY TESTING RESULTS

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Purpose

Transgenic sugar beet varieties were compared to standard commercial sugar beet varieties for beet yield, sugar content, and extractable sugar. The transgenic sugar beet varieties tested have genes that confer resistance to the non-selective herbicides Liberty and Roundup.

Procedures

Four commercial varieties and five transgenic varieties were evaluated for yield and sugar content in a trial conducted at the Malheur Experiment Station, Ontario, Oregon. The commercial varieties were American Crystal ACH 211, Betaseed 8422, and Hillehog Mono-Hy PM21 and Owyhee. The Liberty resistant varieties were Betaseed 8757 Liberty Link (LL), Betaseed 7CG9236 LL, and American Crystal ACH 9903 LL. The Roundup resistant varieties were Hillehog Mono-Hy HM 108 Roundup Ready (RR) and HM 118 RR. ACH 9903 LL and HM 118 RR were new variety entries in this trial, whereas the other transgenic varieties had been tested in 1998.

Varieties were planted in four-row plots 23 ft long with 4-ft alleys between plots. Rows were 22 in wide. Each strip of 4-row plots also was separated from adjacent plots by an unplanted row. The unplanted row served as a buffer to reduce the possibility of injuring non-transgenic plots while applying Roundup and Liberty herbicides to the resistant sugar beet varieties. Each entry was replicated eight times in a randomized complete block experimental design. Sugar beet varieties were planted on April 5 using a cone-seeder mounted on a John Deere model 71 Flexi-planter. On April 6, the trial was corrugated and Counter 20 CR was applied in a 7-in band over the row at 6 oz/1,000 ft of row.

As the seed emerged, bird predation reduced the stand in replications 7 and 8. Sugar beet seed was hand planted on April 19 into the holes where the seed had been removed. By the time the trial was thinned, a full stand had been established.

Betamix Progress at 0.25 lb ai/acre was applied for weed control in non-transgenic varieties. Roundup at 0.75 lb ai/acre was applied to plots planted with Roundup resistant varieties, and Liberty at 0.26 lb ai/acre was applied to plots planted with Liberty resistant varieties. Herbicide treatments were applied only once, on May 10. All treatments were applied at 20 gpa with a CO₂-pressurized backpack sprayer. On May

18, sugar beet stands were thinned to one plant for every 7 in of row. The beets were sidedressed with 230 lb/acre of N as urea on June 2. Weeds not controlled by the herbicide treatments were removed by hand as needed throughout the season.

For powdery mildew control, sulfur dust at 60 lb/acre was applied by air on July 3 and again on August 4. Super Six liquid sulfur (1 gallon/acre) and Lannate were applied August 30.

Sugar beets were harvested on October 4. The foliage was removed with a flail beater, and the crowns were clipped with rotating scalping knives. Roots were harvested from the center two rows of each plot using a single-row, wheel-type lifter-harvester. The combined weights of sugar beets from both rows were used to calculate root yield. Root yields were adjusted for a 5 percent tare. A sample of eight beets was taken from each harvested row for quality analysis. The samples were coded and sent to Hillehog Mono-Hy Research Station in Nyssa, Oregon, to determine beet pulp sugar content and purity. The percent sugar extraction and recoverable sugar were estimated using empirical equations.

Data were analyzed using ANOVA, and variety means were separated using a protected least significant difference at the 5 percent level, LSD (0.05).

Results

Except for the bird predation of seedlings, the crop grew normally during the season. No bolting plants were observed for any of the varieties in the trial.

The average root yield for this trial was 40.65 ton/acre and the average percent sugar was 17.63 percent. Beet yields ranged from 44.34 tons/acre for HM 108 RR to 38.23 ton/acre for ACH 211. Beta 7CG9236 LL was among the highest in percent sugar, and HM 108 RR was among the lowest. Calculated percent extraction ranged from 93.27 percent for HM PM 21 to 91.84 percent for Beta 8422 and 91.76 percent for HM 108 RR. Recoverable sugar ranged from 13,867 lb/acre for Beta 7CG9236 LL to 12,337 lb/acre for Beta 8422. Beta 7CG9236 LL, HM 108 RR, HM Owyhee, Beta 8757 LL, and HM PM 21 had among the highest estimated recoverable sugars. Beta 8422 and HM 108 RR produced the least sugar per ton of beets, while the three Liberty resistant varieties, Beta 8757 LL, Beta 7CG936 LL, and ACH 9903 LL, produced among the highest sugar per ton of beets.

Table 1. Root yields, sugar yields, and root quality data from sugar beet varieties in the transgenic variety trial at the Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1999.

Variety	Root yield	Sugar content	Gross sugar	Extraction	Estimated recoverable sugar	
	ton/acre	%	lb/acre	%	lb/acre	lb/ton
American Crystal						
ACH 211	38.23	17.74	13,574	92.59	12,569	328.6
ACH 9903 LL	39.47	18.02	14,224	92.82	13,202	334.5
Betaseed						
8422	38.97	17.25	13,434	91.84	12,337	316.8
8757 LL	40.08	18.01	14,433	92.74	13,384	334.1
7CG9236 LL	41.05	18.21	14,955	92.72	13,867	337.8
Hilleshog Mono-Hy						
HM PM 21	40.96	17.45	14,293	93.27	13,332	325.5
HM Owyhee	42.25	17.38	14,691	92.94	13,655	323.2
HM 108 RR	44.34	16.98	15,049	91.76	13,811	311.6
HM 118 RR	40.49	17.62	14,266	92.15	13,146	324.8
Mean	40.65	17.63	14,324	92.54	13,256	326.3
LSD (0.05)	2.1	0.29	711	0.3	659	5.9