

TRANSGENIC SUGAR BEET VARIETY TESTING RESULTS

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Introduction

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

Methods

Four commercial sugar beet varieties and six 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 Mustang', Betaseed '8757', and Hillehog Mono-Hy 'PM 21' and 'Owyhee'. The Liberty-resistant varieties were Betaseed '8757 Liberty Link (LL)', '7CG9236 LL' and American Crystal 'ACH 9903 LL'. The Roundup-resistant varieties were Hillehog Mono-Hy 'HM 108 Roundup Ready (RR)', 'HM 127 RR', 'HM 125 Rz RR', Betaseed '8757 RR' and '7CG9236 RR'. 'HM 118 RR', 'HM 127 RR', 'HM 125 Rz RR' and Betaseed '8757 RR' were new variety entries in this trial, whereas the other transgenic varieties had previously been tested in 1999. One variety entered in the 1999 trial, 'HM 118', was not entered in the trial this year.

Varieties were planted in four-row plots 23 ft long with 4-ft alleys between plots. Rows were 22 inches wide. Each strip of four-row plots was separated from adjacent plots by an unplanted row. The unplanted row served as a buffer to reduce the possibility of injuring nontransgenic 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 14 using a cone-seeder mounted on a John Deere model 71 Flexi-planter. After planting, the trial was corrugated and Counter 20 CR was applied in a 7-inch band over the row at 6 oz/1,000 ft of row. On April 21, Lilliston rollers were run over the top of each row by hand to break a moderate crust that had formed.

Roundup (0.75 lb ae/acre) was applied on April 18 to the trial prior to sugarbeet emergence. Betamix Progress at 0.25 lb ai/acre was applied for weed control in nontransgenic varieties. Roundup at 0.75 lb ae/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 on May 5 to sugar beets with four leaves and May 20 to sugar beets with eight leaves. All postemergence

treatments were applied at 20 gal/acre with a CO₂-pressurized backpack sprayer. On May 10, sugar beet stands were thinned to one plant for every 7 inches of row. The beets were sidedressed with 240 lb/acre of N as urea on May 22. Weeds not controlled by the herbicide treatments were removed by hand as needed throughout the season.

At some point, the package labels for Betaseed '7CG9236 LL' and '7CG9236 RR' were switched. Following the initial postemergence herbicide application, both varieties died from Roundup and Liberty injury, respectively. Testing of seed from the original seed packages confirmed that they were mislabeled.

On May 23, Temik 15G (10 lb/acre) was applied for sugar beet root maggot control. For powdery mildew control, Super Six liquid sulfur (1 gal/acre) was applied on June 28, and sulfur dust was applied July 11 and August 3, at 30 lb/acre. A double application of sulfur dust (50 lb/acre) was made on August 28. All sulfur treatments were applied by air.

Sugar beets were harvested on October 2. 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 two-row, wheel-type lifter-harvester. The total sugar beet weight from each plot was used to calculate root yield. Root yields were adjusted for a 5 percent tare. Two samples of eight beets each were taken from each plot 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 test at the 5 percent level, LSD (0.05).

Results

Except for minimal early season plant losses from sugar beet root maggot damage and heavy powdery mildew pressure 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 42.94 ton/acre (Table 1) which was almost 2 tons higher than in 1999. The average percent sugar was 15.30 percent, which was over 2 percent less than in 1999. Beet yields ranged from 45.47 tons/acre for 'HM 125 Rz RR' to 40.78 ton/acre for 'ACH 9903 LL'. 'Beta 8757 LL' and 'ACH 9903 LL' were among the highest in percent sugar, while 'HM 108 RR' was among the lowest in percent sugar and the lowest for percent extraction. 'HM PM 21' had the highest percent extraction at 90.44 percent. 'HM PM 21', 'Beta 8757 LL', and 'HM 125 Rz RR' had among the highest gross and estimateable sugar per acre, while 'ACH 9903 LL',

'Beta 8757 LL', 'HM PM 21', and 'HM 127 RR' had among the highest recoverable sugar per ton of beets. 'HM 108 RR' produced the least sugar per ton of beets.

Table 1. Root yields, sugar yields, and root quality data from sugar beet varieties in the transgenic variety trial, Malheur Experiment Station, Oregon State University, Ontario, OR, 2000.

Variety	Root yield	Sugar content	Gross sugar	Extraction	Estimated recoverable sugar	
	ton/acre	%	lb/acre	%	lb/acre	lb/ton
American Crystal						
ACH Mustang	43.11	14.72	12,694	88.93	11,289	261.9
ACH 9903 LL	40.78	16.03	13,084	89.39	11,697	286.6
Betaseed						
Beta 8757	41.89	15.19	12,724	88.61	11,275	269.3
Beta 8757 LL	43.79	15.83	13,862	89.57	12,417	283.6
Beta 8757 RR	42.31	15.66	13,249	88.77	11,762	278.1
Beta 7CG9236 LL	--	--	--	--	--	--
Beta 7CG9236 RR	--	--	--	--	--	--
Hilleshog Mono-Hy						
HM PM 21	43.94	15.66	13,765	90.44	12,449	283.3
HM Owyhee	43.23	15.19	13,139	89.57	11,772	272.2
HM 108 RR	43.94	14.30	12,576	88.06	11,077	251.9
HM 127 RR	40.97	15.65	12,814	89.45	11,463	280.0
HM 125 Rz RR	45.47	14.81	13,476	89.17	12,019	264.2
Mean	42.94	15.30	13,138	89.20	11,722	273.1
LSD (0.05)	1.71	0.35	600	0.53	550	7.3