

TRANSGENIC SUGAR BEET VARIETY TESTING RESULTS

Corey V. Ransom and Joey Ishida
Malheur Experiment Station
Oregon State University
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Purpose

Transgenic sugar beet varieties were evaluated against standard sugar beet varieties to determine sugar yield potential. The transgenic sugar beet varieties have genes that confer resistance to the nonselective herbicides Liberty and Roundup.

Procedures

Four commercial varieties and four transgenic varieties were evaluated for yield and sugar content in a trial conducted at the Malheur Experiment Station, Ontario, OR. The commercial varieties evaluated included; American Crystal ACH 211, Betaseed 8422, and Hillehog Mono-Hy PM21 and Owyhee. Liberty-resistant varieties were Betaseed 8757 Liberty Link (LL) and 7CG9236 LL. The Roundup-resistant varieties were Hillehog Mono-Hy Pillar Roundup Ready (RR) and 108 RR. Beta 8757 LL and HM Pillar RR had been evaluated in a similar trial in 1997.

Varieties were planted in 4-row plots 23-ft long with 4-ft alleys between plots. Each strip of 4-row plots were also 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 April 17 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-in band over the row at 6 oz/1000 ft.

Betamix Progress at 0.25 lb ai/acre and Poast at 0.10 lb ai/acre were applied for weed control in nontransgenic 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 May 1 and May 19. 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. Because of the wet spring, 30 lb/acre N as urea was broadcast by hand on May 28. The study was sidedressed with 189 lb/acre of N as urea on June 3. Weeds not controlled by herbicide treatments were removed by hand as needed throughout the season. A hail storm on July 4 caused severe injury to sugar beet foliage.

For powdery mildew control, Super Six liquid sulfur was applied July 29 at 1 gal/acre. Sulfur dust at 60 lb/acre was applied to the study by air on July 31 and August 23. Bayleton was applied at 1 lb/acre on August 18.

Sugar beets were harvested October 14 and 15. The foliage was removed by a flail beater and the crowns 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. For quality analysis, a sample of eight beets were taken from each harvested row. The samples were coded and sent to Hillehog Mono-Hy research station in Nyssa, OR, to determine sugar content and quality parameters. The percentage sugar extraction and recoverable sugar were estimated using empirical equations.

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

Results

None of the Roundup-resistant plants died following application of Roundup nor did the Liberty-resistant plants die following applications of Liberty herbicide, suggesting that all transgenic plants contained a herbicide-resistance trait. Three plants bolted in this trial, and all three were from Beta 7CG9236 LL. Bolting plants were pulled from the plots. Differences in hail damage were apparent among the different varieties, and damage was visually estimated July 16. Betaseed varieties had statistically less visible injury (42-48 percent) after the hail than all the other varieties (54-63 percent)(data not shown). Damage appeared to correlate with growth habit, and the Betaseed varieties seemed to grow more upright than the others. Root yields (Table 1) ranged from 39 - 46 tons/acre with HM 108 RR and HM Owyhee producing among the highest root yields. Beta 7CG9236 LL and ACH 211 yielded the lowest. Beta 7CG9236 LL, HM PM21, and ACH 211 had among the highest percentage of sugars, while HM 108 RR and Beta 8422 were among the lowest. Sugar extraction ranged among varieties from 88.64 to 91.44 percent. Estimated recoverable sugar on a per-acre basis was highest with HM Owyhee and PM21. HM PM21, Beta 7CG9236 LL, and ACH 211 and were among the top varieties for estimated recoverable sugars on a pound-per-ton basis.

Table 1. Root yields, sugar yields, and root quality from sugar beet varieties in the transgenic variety trial at the Malheur Experiment Station, Oregon State University, Ontario, OR, 1998.

Company	Variety	Sugar content		Gross	Extraction	Estimated recoverable sugar	
		Root yield ton/acre	%	sugar lb/acre	%	lb/acre	lb/ton
American Crystal	ACH 211	38.74	15.79	12,235	90.28	11,046	285.2
Betaseed	8757 LL	42.64	15.51	13,223	89.16	11,790	276.6
	8422	42.09	15.20	12,791	88.83	11,363	270.0
	7CG9236 LL	38.87	15.97	12,408	90.16	11,186	287.9
Hilleshog Mono-Hy	HM PM 21	44.89	15.92	14,291	91.44	13,068	291.1
	HM Owyhee	45.32	15.53	14,071	90.76	12,771	281.8
	HM 108 RR	46.33	14.97	13,874	88.64	12,299	265.5
	HM Pillar RR	41.23	15.41	12,704	90.05	11,440	277.6
LSD (0.05)		1.30	0.28	435	0.52	416	6.4
Mean		42.51	15.54	13,200	89.92	11,870	279.5