

TRANSGENIC SUGAR BEET VARIETY TESTING RESULTS

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Introduction

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 non-selective herbicides Liberty and Roundup. Parent varieties of the transgenic sugar beet varieties were also included in the trial.

Methods

Four commercial varieties, two transgenic varieties, and the parent lines of the transgenic varieties were evaluated in a trial conducted at the Malheur Experiment Station, Ontario, Oregon. The commercial varieties evaluated included; American Crystal ACH 211, Betaseed 8422, and Hillehog Mono-Hy HM WSPM9 and HM WS91. The transgenic varieties and their parent lines were Beta Seed 8757 Liberty Link (LL) and 8757 and Hillehog Mono-Hy HM 104 Roundup Ready (RR) and HM Pillar.

Varieties were planted in 4-row plots 23 feet long. Varieties were separated with 4-foot alleys between plots and from adjacent plots by an unplanted row. The unplanted row served as a buffer to reduce the possibility of injuring non-resistant sugar beets 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 21 using a cone-seeder mounted on a John Deere model 71 Flexi-planter. After planting, the trial was corrugated and Counter 15 G was applied in a 7-inch band over the row at 6 oz/1000 ft of row.

Betamix Progress at 0.25 lb ai/acre and Poast at 0.10 lbs ai/acre were applied to all plots except the HM 104 Roundup Ready and the 8757 Liberty Link varieties. Roundup at 0.56 lb ai/acre was applied to plots planted with HM 104 RR, and Liberty at 0.26 lb ai/acre was applied to plots planted with 8757 LL. Herbicide treatments were applied May 10, May 27, and June 5. The first application was made while sugar beets were at the cotyledon to two-leaf stage of growth, and the last application was to 9-inch tall sugar beets. All treatments were applied at 20 GPA with CO₂-pressurized backpack sprayer. Plots were cultivated May 23, May 29, and June 9. On May 23, sugar beet stands were thinned to one plant for every 7 inches of row. The study was sidedressed with 242 lb/acre of N as urea on May 28. Weeds not controlled by herbicide treatments

were removed by hand as needed throughout the season.

Sulfur dust at 60 lb/acre was applied to the study by air on July 27 and August 28. Bayleton was applied at 1 lb/acre on July 31.

Sugar beets were harvested October 16. 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. A sample of eight beets was taken from each harvested row. The samples were coded and sent to Hillehog Mono-Hy research station in Nyssa, Oregon, for analysis.

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

A small percentage of the 8757 LL seed was not resistant to Liberty, so the first Liberty application was made to 2-leaf sugar beets, and then the beets were thinned to stand after non-resistant plants had died. The 8757 LL variety also had a small percentage of bolters. The flowering stalks were removed from bolting plants weekly throughout the season. The Roundup-resistant variety, HM 104 RR, had a distinctive growth pattern early in the season. Plants were healthy but the leaves appeared to grow more horizontal to the soil. As the season progressed, the growth difference was less apparent.

The HM 104 RR had the highest root yield, while its untransformed parent line, HM Pillar had lower root yields than any other variety (Table 1). All other varieties had similar root yields. The cultivar HM Pillar had the highest sucrose content while HM 104 RR had among the lowest. Both transgenic cultivars, 8757 LL and HM 104 RR, were among the most productive based on the estimated yield of recoverable sugar per acre.

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, Oregon, 1997.

Company	Variety	Root yield ton/acre	Sugar content %	Gross sugar lb/acre	Extraction %	Estimated recoverable sugar	
						lb/acre	lb/ton
American Crystal	ACH 211	41.53	16.39	13,610	90.6	12,331	297.1
Betaseed	8757 LL	43.37	16.59	14,386	90.58	13,030	300.5
	8757	42.54	16.33	13,897	90.35	12,558	295.1
	8422	41.44	15.98	13,238	89.92	11,902	287.3
Hilleshog Mono-Hy	HM104 RR	45.58	15.88	14,484	89.81	13,011	285.3
	HM WSPM9	43	16.04	13,789	91.08	12,558	292.1
	HM WS91	42.52	16.13	13,713	90.93	12,468	293.2
	HM Pillar	38.62	17	13,126	91.92	12,064	312.4
LSD (0.05)		1.69	0.29	561	0.47	525	6.5
Mean		42.33	16.29	13,780	90.65	12,490	295.4