

ROW SPACING AND PLANT POPULATION IN ROUNDUP-RESISTANT SUGAR BEETS

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

Transgenic sugar beet varieties provide potential for reducing cultivation for weed control in sugar beets. If cultivation was eliminated, row spacing and plant population could be modified to maximize sugar production. A trial was conducted to evaluate different row spacing and plant populations for sugar production in Roundup-resistant sugar beets.

Procedures

Hilleshog Mono-Hy Pillar Roundup Ready (RR) sugar beets were planted with a tool-bar planter in 22-in and 11-in rows. Within each row spacing, plant spacing was varied from 6 to 16 in between plants. Plant populations ranged from 23,760 to 71,280 plants/acre.

Varieties were planted in 4- or 7-row plots, 7.33-ft wide and 23-ft long with a 4-ft alley between plots. Plots were replicated six times in a randomized complete block design. Sugar beets were planted on a 2-in spacing April 21 and thinned to the different spacings on May 18. After planting, Counter 20 CR was applied in a 7-in band over the row at 6 oz/1000 ft of row.

Roundup at 0.75 lb ai/acre was applied for weed control May 8, June 8, and June 22. On May 18, sugar beet stands were thinned to the respective plant populations. Sugar beets were fertilized by broadcasting 189 lb/acre of N as urea in June. 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 also was applied by air on July 31 and August 23. Bayleton was applied at 1 lb/acre on August 18.

Sugar beets were topped and harvested by hand October 15 and 16. Roots were harvested from the center two rows of plots with 22-in row spacings and from the center three rows of plots with 11-in row spacing. The combined weights of sugar beets were adjusted for the area they were harvested from and used to calculate root yield on a per-acre basis. Root yields were adjusted for a 5 percent tare. For quality analysis,

approximately 20 lb of beets were taken from each plot. Samples were coded and sent to the 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 variety means were separated using a protected least significant difference at the 5 percent level, LSD (0.05).

Results

The results of this trial suggested that a combination of row spacing and spacing within the row have the greatest effect on sugar beet yield and quality. Root yields for sugar beets grown in 11-in rows with a 16-in spacing produced higher yields than sugar beets grown in 22-in rows with 6- or 8-in spacing within the row (Table 1). Yields were similar for the other configurations. Larger spacing both within and between rows produced larger beets than closer spacings.

Sugar content of beets grown in 11-in rows were higher than sugar content of sugar beets grown in 22-in rows with the exception of beets grown in 22-in rows with 6 in between plants. Sugar extraction was also greater for beets grown on a 12-in spacing in 11-in rows than for sugar beets grown at 8- or 12-in spacings in 22-in rows.

Estimated recoverable sugar per acre was highest with sugar beets grown on 12- or 16-in spacings in 11-in rows in comparison to sugar beets grown in 22-in rows. Estimated recoverable sugar per ton of sugar beets was also greater for sugar beets grown in 11-in rows compared to 22-in rows, with the exception of the 6-in plant spacing within the 22-in rows.

Sugar content appeared to be less affected by in row spacing when grown on 11-in rows than when grown on 22-in rows. Growing sugar beets on 11-in rows may reduce the effects of in-the-row spacing on sugar content and has the potential to increase total sugar production. In addition to potentially higher yields, narrow-row sugar beets form a canopy over the soil earlier in the season (data not shown) and may be more competitive with weeds than sugar beets in 22-in rows.

Table 1. Root yields, sugar yields, and root quality for sugar beets grown in different row spacings and plant populations at the Malheur Experiment Station, Oregon State University, Ontario, OR, 1998.

Plant population	Row spacing	Plant spacing	Beet size	Root yield	Sugar content	Gross sugar	Extraction	Estimated recoverable sugar	
plants/acre	-----in-----		lb	ton/acre	%	lb/acre	%	lb/acre	lb/ton
23,760	22	12	3.14	37.36	14.54	10,783	86.45	9,322	251.1
35,640	22	8	1.96	34.93	15.09	10,697	87.10	9,317	263.8
47,520	22	6	1.49	35.33	15.35	10,852	88.34	9,592	271.2
35,640	11	16	2.47	44.03	15.55	13,634	88.34	12,047	274.9
47,520	11	12	1.76	41.76	15.74	13,070	89.19	11,665	280.2
71,280	11	8	1.11	39.55	15.62	12,361	88.41	10,927	276.2
LSD (0.05)			0.36	6.63	0.41	2,045	1.33	1,830	10.4
Means 22-in Rows			2.2	35.87	14.99	10,777	87.30	9,410	262.0
Mean 11-in Rows			1.78	41.78	15.64	13,022	88.65	11,546	277.1