Effect of Row Width and Plant Spacing on Yield and Sucrose Concentration of Sugarbeets

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When Arizona received an allotment of acres in 1964 for sugarbeet production, research was needed on various agronomic aspects of sugarbeet culture including row widths and plant spacings. Commercial experience with row widths for sugarbeets had been confined to 40-inch double-row beds used in seed beet production. In the only other growing area with comparable climatic conditions, the Imperial Valley of California, growers use both double- and single-row beds. Although row width and plant spacing studies had been conducted in other areas of production, most of these were not applicable to Arizona's fall planted crop. Consequently, a two year study was initiated in 1965 to determine the effect of row width and plant spacing on sugarbeet production in central Arizona. The results of this study have been published in the Journal of the American Society of Sugar Beet Technologists (1).

Sugarbeets for this study were grown in the 1965-66 and 1966-67 seasons. The variety S-301H was planted in September each year at the Mesa Farm. Plantings were made on 40-inch double-row and 24- and 30-inch single-row beds. Row widths on the 40-inch bed were 12 inches on top and 28 inches between the beds. Beets were hand thinned to in-row spacings of 5, 10 and 15 inches. Harvests were made on April 20, June 7 and July 13 each year. Each row width was replicated 4 times.

Results

Row Widths

Results of the study are summarized in Table 1. The row widths compared had little influence on root yield when harvest was in April. However, when harvest was in June or July the 40-inch double-row beds produced higher root yields than the 30-inch beds. The 24-inch beds resulted in root yields similar to those of the 40-inch double-row beds.

Sucrose concentration was not affected by row width until July. At that time the 40-inch double-row and 24-inch beds produced higher sucrose concentrations than the 30-inch beds. Each year sucrose concentrations decreased during June and July with the largest decreases occurring at the 30-inch row width.

Sugar yields were higher each year on the 40-inch double-row beds than on the 30-inch beds. Beets grown on 40-inch double-row beds produced an average of 900 lbs more sugar per acre than those on 30-inch beds. As with root yield, the 24-inch beds produced sugar yields nearly as high as those on 40-inch double-row beds.

Plant Spacing

In-the-row plant spacing influenced root yields each year. Beets
spaced 10 inches apart produced higher root yields than those spaced 5 inches apart. Yields were variable at the 15-inch spacing, being as high as those at the 10-inch spacing one year and lower the next. The 5- and 15-inch spacings yielded the lowest when used in combination with 30-inch beds.

Each year large numbers of small unharvestable roots (less than 2 inches in diameter) were produced at the 5-inch spacing when harvest was in April. These unharvestable roots represented 2.5 tons per acre of the total root yield of the 5-inch spacing. Plantings intended for early harvest in central Arizona should be thinned to a spacing of 10 inches to promote development of harvestable root sizes.

Discussion

Research conducted here and in other growing areas has generally shown that close row widths have an advantage over wide row widths in yield. Some of the advantages and disadvantages associated with the narrow 24-inch single-row and 40-inch double-row widths have been summarized in "Advances in Sugarbeet Production: Principles and Practices" (2). This summary is pertinent to our discussion of row widths and is reprinted here as follows:

1. Higher per acre plant populations are possible and small skips or gaps in the stand can be tolerated.
2. Yield of roots, gross sugar and extractable sugar per acre tend to be higher, especially in areas where the growing season is restricted.
3. The harvest of a greater percentage of smaller roots is invariably accompanied by a higher sucrose concentration.
4. Furrow irrigation can be more difficult, since the furrows are narrower and less clearly defined.
5. Cultural operations are generally slower and more expensive to accomplish. This is especially true of mechanical and chemical weed control as well as harvest operations.
6. More rows per acre increase the costs of thinning and weeding labor.
7. The presence of high salinity conditions or other factors which may affect germination and emergence of seedlings often favors the double-row bed or narrow single rows.

Summary

In general, yields decreased as the row width was increased from 12-28 inches (40-inch double-row bed) to 30 inches. Yields produced on 24-inch single-row beds were nearly as high as those on 40-inch double-row beds. A plant spacing of 10 inches gave the best yields regardless of whether 40-inch double-row or 30-inch single-row beds were used.
References


Table 1. The effect of row width and plant spacing on root yield, sucrose concentration and sugar yield of sugarbeets harvested at different dates (average of two years data).

<table>
<thead>
<tr>
<th>Row Width</th>
<th>Plant Spacing</th>
<th>Yield of Roots Harvest Date</th>
<th>Sucrose Concentration Harvest Date</th>
<th>Yield of Sugar Harvest Date</th>
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<td>Inches</td>
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<td>June 7</td>
<td>July 13</td>
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