Effect of Row Spacings on Processing Carrot Root Yields

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Abstract. Total root yields as well as roots <25 and 25-38 mm diameter, were increased in carrot (Daucus carota cv Red Cored Chantenay), as row spacings were decreased from 60 to 15 cm in 2 field experiments. Different within-row seeding rates did not have a significant impact on total yields, but affected yields of various size grades.

Most U.S. carrot processors accept a range of root sizes from about 20 to 65 mm in diameter, but the range of acceptable sizes for fresh market sale is not as great. Webster (15) determined that maximum yields of salable roots were obtained from carrots spaced 4 to 6 cm apart in 30 cm rows (55-83 plants/m²). Warne (14) showed a total yield of roots was highest in 45 cm rows at 2.5 cm within-row spacing (89 plants/m²). When 30 cm rows were used, Warne (14) showed a total yield increase of 48% as populations were increased from 60 to 305 plants/m². Robinson (9) obtained highest root yields at a square grid spacing of 5.1 x 5.1 cm. (384 plants/m²), densities of 1359, 5439, and 22,305 plants/m² produced greater dry matter yields, but the roots did not reach marketable size in 150 days. The highest yield of dry matter was at 10 cm square grid but this spacing produced the earliest roots of marketable size. Kepka et al. (7) reported the largest increase in carrot yield when plant density increased from 37 to 167 plants/m². Bleasdale (2) showed that root size can be controlled by varying inter- and intra-row spacings. Highest yields of 19-32 mm diameter roots were produced in 9 to 13 cm rows at populations of about 400 to 500 plants/m². Bussell (6) produced small finger carrots (roots 13 to 18 mm diameter, 7.5 to 11.5 cm long) using row spacings of 2.5 to 7.5 cm, and he showed that yield increased as the sowing density was increased from 533 to 2500 seeds/m².

The present study was conducted to determine the effect of row spacings on yield of various size grades of roots of 'Red Cored Chantenay', a processing cultivar. Two field experiments were conducted in separate years on a loam soil at the Oregon State University Vegetable Research Farm, Corvallis. Row spacings of 15, 30, 45, and 60 cm were used. Broadcast fertilizer rates of 56 kg N, 74 kg P, 47 kg K/ha and 112 kg N, 148 kg P, 94 kg K/ha were used in Experiment 1, but only the former rate was used in Experiment 2. The fertilizer treatments in Experiment 1 did not have a significant effect on yield, and the yields reported for this experiment are averages of the 2 treatments. Plots were irrigated by overhead sprinklers at 12 to 20 day intervals. Roots were harvested from the center row of multi-row plots and at least 2 border rows remained on each side of the test row for the 15 cm row treatment and at least 1 border row remained on each side of the test row for the 30, 45, and 60 cm row treatments. Roots were separated into the following size grades (mm shoulder diameter): <25, 25-38, 39-51, 52-64, and >64 mm. In Experiment 1 plots were planted with a Planet Jr. hand seeder (plate hole 6) on May 19. Early stand counts were not made, but root counts made about 10 days before harvest indicated the following average

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Table 1. Effects of row spacings on yields of carrots, Expt. 1.

<table>
<thead>
<tr>
<th>Row spacing (cm)</th>
<th>&lt;25 mm Yield (MT/ha)</th>
<th>25-38 mm</th>
<th>39-51 mm</th>
<th>52-64 mm</th>
<th>&gt;64 mm</th>
<th>Total yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>10.5</td>
<td>47.1</td>
<td>38.7</td>
<td>10.8</td>
<td>2.7</td>
<td>109.8</td>
</tr>
<tr>
<td>30</td>
<td>3.4</td>
<td>22.9</td>
<td>36.4</td>
<td>27.4</td>
<td>9.9</td>
<td>100.0</td>
</tr>
<tr>
<td>45</td>
<td>1.6</td>
<td>15.3</td>
<td>32.8</td>
<td>28.0</td>
<td>13.2</td>
<td>90.8</td>
</tr>
<tr>
<td>60</td>
<td>1.1</td>
<td>10.3</td>
<td>28.7</td>
<td>30.2</td>
<td>12.7</td>
<td>83.0</td>
</tr>
<tr>
<td>LSD 5%</td>
<td>2.1</td>
<td>4.4</td>
<td>NS</td>
<td>5.8</td>
<td>5.1</td>
<td>10.5</td>
</tr>
<tr>
<td>LSD 1%</td>
<td>2.9</td>
<td>6.1</td>
<td>NS</td>
<td>8.1</td>
<td>7.2</td>
<td>14.7</td>
</tr>
</tbody>
</table>

NS = Non-significant.

Most of the lifter type carrot harvesters require a row spacing of 25-35 cm or more. It may be feasible to use a series of double or triple rows spaced at 4 to 6 cm, or a wide-band seeding pattern (7), with a spacing between these rows of 40 to 45 cm to accommodate lifter harvesters, but these spacing arrangements were not investigated. In the bed system of carrot growing described by Bleasdale (2), 2-row potato harvesters can be modified to harvest carrots after tops have been removed in a separate operation, thus narrow row plantings are feasible. However, Tucker (11) reported that top-lifting harvesters were less damaging to roots than digger-elevator type harvesters. Yields, size grades, and harvest efficiency could also be influenced by hybrids, planting and harvest dates, and other factors (1, 3, 5, 8, 9, 10).

These results are in agreement with Bleasdale (2, 3, 4) who suggested that yields are higher when plants are more evenly distributed. They are in conflict with results of Bussell (6) where row spacings were quite narrow, ranging from 2.5 to 7.5 cm and plant densities were high, 533 to 2500 seeds/m². Bussell used different cultivars with the objective to produce small, finger carrots.

Although our results show that higher total yields and higher yields of smaller roots of a specified size grade can be achieved through reducing the row spacing from the conventional 60 cm, present harvest systems may limit the application of this knowledge.

Literature Cited

14. ________ 1953. Spacing experiments on vegetables. VII. The growth and yield of globe beet, parsnips, and carrots grown at several spacings in two adjacent fields of different fertility. J. Hort. Sci. 28:114-120.