UNDERSTANDING CARROT POPULATIONS

» Total yield and root size of carrots are affected by plant populations.
» Increasing populations can result in higher total yields.
» As population (seeding rate) increases, root diameters decrease.
» Lower populations are used for larger carrots (dicer or jumbo markets), and higher populations are used for smaller carrots (cello, slicer, or cut & peel markets).

CARROT TYPES AND USES

Carrots are grown commercially for several uses; fresh market (cello, jumbo, and bunching) and processing (cut & peel, slicing, and dicing). Most carrots grown commercially in the United States for fresh market and cut-and-peel processing are Imperator types, which are typically 8-10 inches long, with narrow shoulders, and gradually taper to the tip (Figure 1). Chantenay and Danvers types are shorter, larger diameter roots used for processing (dicer) markets. Nantes carrots are typically 8-9 inches long with very cylindrical, blunt tipped roots. They are used for fresh market, and some long Nantes hybrids are used for slicing.1

Carrot varieties differ in their response to higher plant populations. Some varieties do not tolerate the increased competition of higher populations and respond by producing a lot of short, misshapen or forked roots. Some varieties will produce good quality roots at higher than standard populations.

CARROT TYPES AND USES (CONTINUED)

Carrot seed is planted at depths of 1/8 to 1/2 inches, depending on soil type and availability of irrigation. Deeper depths are used in light sandy soils; shallower depths are used in heavier soils. Shallower depths also can be used for irrigated seedbeds where optimal soil moisture levels are maintained. Germination is best at temperatures between 50°F (93% germination in seventeen days) and 85°F (95% germination in 6 days), with germination rates decreasing rapidly at temperatures above 86°F.1,4

The soil in seed beds should be well tilled to maximize seed-to-soil contact and seedling emergence, and steps should be taken to minimize soil crusting, which can significantly interfere with germination and reduce plant stands. Planting on raised beds is best for water management, allowing for rapid drainage away from the root zone, and typically results in improved root shape and smoothness.1

EFFECTS OF DENSITY ON YIELD AND GROWTH

Carrot root yield, size, and quality result from an interaction between the variety used, plant population, and growing conditions. Increasing plant populations (seeding rates) results in increased total root yields until the point where competition for water, nutrients, and light among individual plants starts to lower yield levels. At lower plant densities, roots grow larger while thinner roots are produced at higher densities.1 Larger roots are preferred for processing (dicing) production, and lower population densities are used to promote larger root formation.

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Seeding rates are usually expressed as seeds per foot of row. Dicer varieties may be seeded at 6-12 seeds per foot of row, fresh market or slicer varieties may be seeded at 20-30 seeds per foot of row, and cut-and-peel carrots may be seeded at 60-80 seeds per foot of row (Table 1).

For fresh market production, the highest yields are achieved at population densities of 7.9 to 8.4 plants per square foot (85 to 90 plants per square meter). Higher densities are required to keep the root diameters in a range appropriate for cut-and-peel processing to produce baby carrots.

Carrot seed can be planted with vacuum, belt, or plate seeders. For fresh market production, most growers use vacuum seeders to achieve more precise seed spacing. Pelleted or encrusted seed is often used to improve the size and shape of the seed. This improves the uniformity of spacing, which results in more uniform root size and shape.

Many different row/bed-spacing arrangements may be used. A common method (especially for cut-and-peel production) is to plant twin-rows 2.5 to 3.5 inches apart with 3 to 4 sets of rows, 14 to 18 inches apart, on a bed. For example, 3 twin-rows can be planted on 48-inch wide beds, with the beds on 72-inch centers. Each row is planted as a 3- to 4-inch wide band, achieved using a scatter shoe attached to the planter. This results in 20 to 40 roots per foot of row.

For fresh market and processing growers may use a single row, with 2-3 seed lines per row planted on raised beds on 30-inch centers. Seeding rates are varied in the row to achieve the desired population (Table 1). Precision seeders can also be used for planting (Figure 2). In this system, 3 lines of seed are spaced 1 ½ inches apart with 7 to 8 seed per foot in the outer 2 lines and 5 to 6 seed per foot in the inner line. The lower rate is used when seed germination rates are over 90% or when larger roots are desired. Coated seed are usually required when using precision seeders.

For cut-and-peel production, seeds are sown at a high density, distribute evenly in wide bands, at 80 to 100 seeds per foot of bed with rows 2 to 10 inches apart, with up to 10 rows per bed.

**Sources:**

Table 1. Recommended Seeding Rates for Various Carrot Production Systems.

<table>
<thead>
<tr>
<th>Carrot Use</th>
<th>Seeding Rate per Foot of Row</th>
<th>Population (plants /acre)</th>
<th>Pounds of Seed per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing (dicing)</td>
<td>10-15</td>
<td>180-250,000</td>
<td>1</td>
</tr>
<tr>
<td>Early Cello or Jumbo</td>
<td>16-18</td>
<td>300-350,000</td>
<td>1.5-2.0</td>
</tr>
<tr>
<td>Main Season Cello</td>
<td>20-25</td>
<td>350-450,000</td>
<td>2.0</td>
</tr>
<tr>
<td>Slicer</td>
<td>20-30</td>
<td>450-550,000</td>
<td>4-6</td>
</tr>
<tr>
<td>Cut-and-Peel</td>
<td>60-80</td>
<td>1.1 to 1.3 million</td>
<td>46</td>
</tr>
</tbody>
</table>

For additional agronomic information, please contact your local seed representative. Developed in partnership with Technology, Development & Agronomy by Monsanto.

Individual results may vary, and performance may vary from location to location and from year to year. The information provided in this communication may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible.

ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. The recommendations in this article are based upon information obtained from the cited sources and should be used as a quick reference for information about carrot production. The content of this article should not be substituted for the professional opinion of a producer, grower, agronomist, pathologist and similar professional dealing with these crops.

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