



AGRONOMIC SPOTLIGHT



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.



Figure 1. Carrots planted less densely produce roots that are larger in diameter (carrots on the left), suitable for fresh-market or slicing, while higher density plantings result in roots suitable for cut-and-peel production.

BASIC PLANTING REQUIREMENTS

Carrots are always planted by direct seeding, as transplanting results in forked, misshapen roots.² Carrot seeds are fairly small and slow to germinate. Because the

cost of hand thinning seedlings is prohibitively expensive, seeding rates should be as accurate as possible to achieve the desired plant stands, based on the estimated viability of the seed.

Seeding rates vary from 250,000 seeds/acre for some dicer varieties to 500-600,000 seeds/acre for cello or slicer varieties, while rates of 1.3-1.5 million seeds per acre are common for the cut-and-peel market.³

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).

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.

TABLE 1. RECOMMENDED SEEDING RATES FOR VARIOUS CARROT PRODUCTION SYSTEMS. ⁴			
Carrot Use	Seeding Rate per Foot of Row	Population (plants /acre)	Pounds of Seed per Acre
Processing (dicing)	10-15	180-250,000	1
Early Cello or Jumbo	16-18	300-350,000	1-1.5
Main Season Cello	20-25	350-450,000	1.5-2.0
Slicer	20-30	450-550,000	2.0
Cut-and-Peel	60-80	1.1 to 1.3 million	4-6

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.⁵ 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.

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.

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.

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

Sources:

- ¹ Swiader, J.M., Ware, G.M., and McCollum, J.P., 1992. Producing vegetable crops. Interstate Publishers Inc., Danville, IL, p. 279.
 - ² Kelley, W.T., MacDonald, G., and Phatak, S.C. 2009. Commercial production and management of carrots. University of Georgia, UGA Extension, Publication B 1175.
 - ³ Nuñez, J., Hartz, T., Suslow, T., McGriffen, M., and Natwick, E. 2008. Carrot production in California. University of California Division of Agriculture and Natural Resources Publication 7226.
 - ⁴ Sanders, D. 1998. Commercial carrot production: horticulture information leaflet. North Carolina State University Extension.
 - ⁵ Fritz, V., Tong, C., Rosen, C., and Nennich, T. 2013. Carrots – vegetable crop management. Commercial Fruit and Vegetable Production. University of Minnesota Extension.
- <http://www.extension.umn.edu/garden/fruit-vegetable/carrots-vegetable-crop-management/>
Websites verified 01/31/2017



Figure 2. Seeding carrots on raised beds with a vacuum seeder with 3 seed lines per bed.

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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