Vegetable Fodder & Forage Crops for Livestock Production:

Carrots

WASHINGTON STATE UNIVERSITY EXTENSION FACT SHEET • FS032E

There is interest among farmers in western Washington and many other regions of the United States to grow forage and fodder crops to meet their own livestock production needs. Forage is defined in this publication as feedstuff that animals search for and consume, and commonly refers to the non-reproductive portions of plants, while fodder refers to all plant portions which are harvested, stored, and fed to animals (Barnes et al., 1995). Successful local production of forage and fodder crops requires a review of past practices and the latest research on crop varieties as it applies to specific growing conditions.

Historically, livestock production relied on a large diversity of crops to sustain animals year-round, including vegetable root crops such as fodder beets, turnips, rutabagas, carrots, and sugar beets (Delwiche, 1924). Vegetable fodder crops were produced in significant amounts in the maritime Pacific Northwest until 1935, but by 1955 production was limited to a few acres (Schoth, 1957). As the scale of livestock production increased and intensified, livestock and fodder production became separate operations, each located in regions that were most conducive to optimizing production and minimizing costs. New cropping systems arose to best fit large-scale livestock production needs.

Now, new varieties of vegetable forage and fodder crops are available that promise larger yields, better storability, and greater flexibility in use. These new varieties offer the potential for western Washington livestock producers to grow an increasing amount of their own livestock feed that is well adapted to the growing environment, affordable to produce, and a good source of livestock nutrition.

This fact sheet is part of a series that presents production information for carrots, fodder beets, turnips, rutabagas, kale, and chicory in western Washington. More information can be found at http://whatcom.wsu.edu/ag/agriculture.htm.

Family, genus, and species: Apiaceae (formerly Umbelliferae)
Daucus carota ***L. Photo by Tanya Stefanec.***

Background

Cultivated carrots originated in central Asia (OSU, 2004). Historical records show they were first used medicinally, but quickly became a food source for both humans and livestock. Cultivation of carrots is recorded in Europe as far back as the tenth century A.D.

European settlers brought carrots to North America in the 1600s (Ashworth, 2002). In the United States today, more than 82,000 acres of carrots are harvested annually primarily for human consumption, with a value in excess of $550 million dollars (National Agricultural Statistics Service, 2010). In Washington state 10,385 acres of carrots were harvested in 2007 (National Agricultural Statistics Service, 2010). Culled carrots from the food industry are commonly fed to livestock (Sorensen, 2000).

Uses

Carrots can be a nutritious feed for all types of livestock. Carrot leaves, stems, and roots are highly palatable to

livestock (Fraser et al., 1907); however, leaves can accumulate high amounts of nitrates, and ruminant consumption should be carefully monitored (Lardy and Anderson, 2009). Carrot roots are especially valued for their high beta-carotene content and were historically used as winter feed for dairy cattle to produce yellow coloring in butter and cream (Watson, 1949). Current research indicates that incorporating carrots into the diets of dairy cows increases the amounts of vitamin A and fatty acids in their milk (Nalecz-Tarwacka et al., 2003).

Carrots have 85–90% moisture content, 91% of the metabolizable energy of corn (dry matter basis [DM]), 12% dry matter (DM), 84% total digestible nutrients (TDN), and about 10% crude protein (Rust and Buskirk, 2008; Lardy and Anderson, 2009).

Feeding rate. Cattle can be fed 40–60 lbs of carrots per day. Horses can be fed up to 20 lbs per day. For pigs and poultry, substitute 8 lbs of carrots for 1 lb of meal (Watson, 1949).

Production

Carrots are biennial plants that produce a root in the first year and a flower in the second year. Depending on the variety, roots range from 2 to 36 inches in length (Ashworth, 2002). The storage root is a modified stem and taproot composed of an inner pithy layer (core) and an outer layer. The outer layer has higher feed value than the inner layer. Varieties well-suited for livestock are generally selected for the largest outer-to-inner layer ratio (Fraser et al., 1907).

There is extensive information regarding vegetable carrot production, and a carrot fodder crop can be grown using the same guidelines. The following information is key to successful carrot production for livestock feed. See the Resource section of this fact sheet for further details.

Cultivars. There are currently hundreds of carrot cultivars available. These cultivars are mainly classified into four main groups: Imperator, Nantes, Danvers, and Chantenay. Imperator (approx. 100 days to harvest) carrots are 9–10 inches long with small shoulders and a gradually tapered taproot. Nantes (approx. 70 days) are 6 inches long, uniform in diameter, and taper immediately to the tip. Danvers (approx. 80 days) cultivars are large in diameter (> 3 inches), 7 inches long, and have been selected for "slice and dice" processing. Danvers cultivars have also been selected for a small core, and so may be the best suited modern cultivars for fodder production, as the core has lower feed value than the outer layer. Chantenay (approx. 80 days) have very large shoulders, average 5 inches in length, and have a large distinct core that makes them less suitable for livestock fodder.

For an extensive list of specific cultivars, refer to Simon (2010). Most vegetable seed companies carry carrot seed, and all are acceptable for livestock fodder. However, only one carrot cultivar is specifically referenced for use as a fodder crop: Yellow Austrian Lobbericher (World Carrot Museum, 2008).

Soil characteristics. Carrots require a well-drained fine-textured or sandy soil to prevent forking (Fraser et al., 1907). Heavy soils and soil compaction can cause deformation and stunting in roots (Sorensen, 2000). Carrots tolerate a wide range of pH values (4.2–8.7), but prefer a pH from 5.5 to 7.0 (OSU, 2004; Duke, 1998). Apply lime only if the soil pH is lower than 5.2 (OSU, 2004).

Test the soil each spring to determine the best fertilizer application rates for your site. In general, for mineral soils, apply 75–120 lbs of nitrogen, 60–150 lbs of phosphorus, and 60–180 lbs of potassium (OSU, 2004). Excess nitrogen can cause splitting and lead to prolific tops and thus increased susceptibility to diseases (Sorensen, 2000).

Seeding. Carrot seed is slow to germinate. Sow 2–7 lbs of seed per acre depending on seed quality (OSU, 2004; Fraser et al., 1907). Carrots are well suited to being grown in beds of 2–4 rows. Raised beds can reduce disease problems, specifically cavity spot caused by *Pythium violae* (Sorensen, 2000; OSU, 2004). Beds should be raised 4–6 inches, with 40–72 inches between bed centers, depending on cultivation equipment. If growing carrots in rows, space rows 12–15 inches apart to encourage a smaller inner core and larger outer core. Whether planting in a bed or a row, space seeds 2–3 inches apart within the row (OSU, 2004; Duke, 1998; Fraser et al., 1907).

Carrots are well suited to early seeding; in western Washington they can be seeded as early as mid-March through the beginning of July. A soil crust can prevent carrot seedlings from emerging, but continuously saturated soil can invite fungal diseases. Irrigate just enough to maintain a moist and loose soil surface (OSU, 2004).

Weed management. Carrot germination and initial growth are slow and young seedlings do not compete well against vigorous weeds. It is particularly difficult to control in-row weeds, which can cause the greatest yield reductions if allowed to establish prior to canopy closure. Use a false seed bed technique to control early weeds and flaming just prior to carrot seedling emergence is effective, as long as the weeds are very young (just visible to the naked eye). The use of cultivation techniques early in the season that do not throw soil into the carrot row, such as spring-tine harrow, have shown to be effective (Peruzzi et al., 2007). When the root develops and the carrot top is several inches above the soil surface, displacing soil into the row is an effective weed control strategy for carrots. See Peachey (2010) for herbicides labeled for growing carrots in the Pacific Northwest.

Yield

Carrot harvest yields vary between 29 and 40 tons per acre depending on the variety and crop management practices (Sorensen, 2000). In general, 35 tons of harvested carrots = 70,000 lbs fresh feed = 8,400 lbs dry matter. The formula of 5 lbs DM/cow/day is used to calculate how many cows can be fed per day. In this example, 1 acre could feed 10 cows 25% of their dry matter intake for 168 days.

Harvest

Harvest carrots for fodder as late as possible in the season to achieve the largest root. For best storability, harvest carrots before a killing frost (Fraser et al., 1907).

Storage

Carrots should be topped prior to storage, but it is not necessary to wash them to enhance storability. Topped carrots can be stored 7–9 months at 32°F and 99% humidity. If stored in unlined bins, carrots can lose up to 10% of their weight due to moisture loss. If carrots are stored in the same area as fruits and vegetables giving off ethylene, the carrots may develop a bitter flavor.

Resources

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Use pesticides with care. Apply them only to plants, animals, or sites as listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

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FS032E