UK COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY — COLLEGE OF AGRICULTURE

Root Crops

Introduction

Root crops include a number of vegetables belonging to several unrelated plant families. Root crops grown in Kentucky include:

- Crucifer or Mustard Family (Brassicaceae) Daikon (Japanese white radish), horseradish, radishes, rutabagas and turnips
- Goosefoot Family (Chenopodiaceae) Beets
- Parsley or Carrot Family (Apiaceae) Carrots and parsnips
- Sunflower or Aster Family (Asteraceae) Jerusalem artichoke and salsify

Carrots, Daikon radishes, horseradish, parsnips, radishes and rutabagas are raised only for their roots, while beets and turnips may be grown for their tops as well. Salsify is cultivated primarily for its long, tapering root, but the grass-like leaves can also be added to salad greens. Jerusalem artichoke is considered a weed by many; others consider its water chestnut-flavored tubers a gourmet item. The tubers are used fresh in salad, cooked like potatoes or pickled.

Beets

Marketing and Market Outlook

Kentucky-grown root crops are mainly sold through local fresh markets, such as farmers markets, on-farm stands, produce auctions and community supported agriculture (CSA). While they generally do not sell for very much per pound, root crops are fairly inexpensive to grow and make a nice addition to a farmers market mix. Quality heirloom variety root crops have been good sellers in some Kentucky farmers markets. Fresh roots can also be marketed to small, locally owned grocers. Fresh horseradish, used in the Jewish celebration of Passover, and Daikon, an Asian vegetable, could also be sold to specialty or ethnic markets. Growers with access to approved kitchen facilities could process some root crops, such as horseradish, for value-added products. Wholesale opportunities for root crops are few, although Kentucky growers in Pulaski County are supplying parsnips to Wal-Mart.

Carrots can be grown on a limited scale here; however, Kentucky does not have the best soils and climate for large-scale production. Carrot cultivars come in a variety of colors and shapes. A selection of varieties could provide an attractive display for vendors looking for something different. The popular baby or mini carrots sold in many

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grocery stores are actually larger carrots that have been peeled, carved, and polished by machine. These are more accurately referred to as mini-cut carrots. True baby carrots, which are a specialty item, can be difficult and expensive to produce.

One marketing advantage of root crops is that they can be stored until ready to market. Selling root crops demands an attractive presentation, often with other vegetables in the display. Since many consumers are unsure of how to use some root crops, providing preparation instructions, along with recipe ideas, is an excellent way to promote them to customers.

Production Considerations

Select a site with deep, loose, well-drained soil and good air drainage. A soil pH between 6.0 and 6.8 is preferred. Soil should be worked to a depth of 18 to 24 inches for root crops requiring the development of long, straight roots. Root crops can also be grown in well-shaped raised beds on well-drained sites. Raised beds warm up faster in the spring and make water management easier. Root growth can be impaired, yields reduced and harvesting more difficult on heavy soils. Carrots, particularly, tend to develop multi-pronged or forked roots on heavy soils.

Root crops require cool weather conditions and many are direct-seeded in the spring and/or late summer and fall. Horseradish is grown from small root pieces that are planted in early spring. Jerusalem artichoke is planted in the spring using small disease-free tubers or 2 ounce pieces of tubers containing at least two to three buds.

Optimum temperatures for root crop growth ranges from 50°F to 60°F for radishes to 65°F to 75°F for beets. High temperatures can adversely affect root development. For example, the sugar content of beets will be lower when grown in warm weather and they will have a lighter color. In addition, hot weather produces white bands in beet roots.

Irrigation is often necessary to provide uniform moisture for germination, particularly in fall plantings. Continuous moisture throughout the growing season helps maximize yields and quality. Boron may become a limiting element for root crops.

Pest management

Except for those that are botanically related, root crops generally have few specific diseases in common. All are prone to damping-off, seed rots and root decay in wet sites. Leaf spots, blights, downy mildew, aster yellows and rusts may occur in some plantings. Some root crops, particularly carrots and parsnip, are susceptible to root knot nematode. Crops in the Crucifer family are prone to club root, which is primarily managed by maintaining a soil pH above 6.5. Sclerotinia may affect carrots and Jerusalem artichoke. Potential insect pests include aphids, leafminers, flea beetles, and root maggots.

Harvest and storage

Root crops are generally hand-harvested in Kentucky. Some root crops can be dug with a potato harvester or moldboard plow. They should be dug when mature, but before becoming woody and tough. Harvested roots should be washed carefully and packaged according to market requirements. Some root crops, such as beets, carrots, Daikon, turnips and radishes, may be bunched for fresh market with their tops intact. Others, including horseradish, parsnips and rutabagas, are topped after harvest. The storage life for bunched root crops is shorter than for those that have been topped. Depending on the crop, topped roots can be stored for several months under the proper temperature and relative humidity conditions. Carrots, Daikon, parsnips, turnips and rutabagas require similar storage conditions.

Fresh market carrots should be harvested when they are ¾ to 1¼ inches in diameter. True baby carrots should not be allowed to exceed ¾ inch in diameter, although ¼ to ½ inch is more ideal.

Turnips for bunching are harvested when they

are 2 inches in diameter. Bunches consist of four to six plants tied together. When turnips are sold without their tops, they are allowed to reach 3 inches in diameter before harvesting.

Fresh market beets are harvested when they are 1 to 2 inches in diameter and then sold in bunches of three to four roots. Bunched beets can be stored for up to 2 weeks, while beets without tops can be stored for several months.

Radishes are harvested as soon as they reach an edible size, about ¾ to 1¼ inches in diameter. If left too long in the field they will become pithy, pungent and split. Generally eight to thirteen roots are bunched together for fresh market sales. Bunched radishes may only be stored for 1 to 2 weeks. Radishes may also be topped and packaged in plastic bags.

Daikon roots are dug once they have reached the desirable size. Depending on the cultivar and intended market, the roots can be 2 to 4 inches in diameter and more than 6 inches long. Some cultivars grown in deep, loose soils can reach 20 inches or more in length. Daikon radishes are generally tied in bundles of five to twelve roots.

Horseradish is dug once the tops are frozen back. The most desirable roots are 6 to 8 inches in length and 1 inch in diameter. Horseradish may be stored in a cooler, cold cellar or in deep trenches outdoors. Roots may also be left in the ground until needed, but should be harvested before the ground freezes. Horseradish requires a concerted effort to eliminate it after it is established.

Jerusalem artichoke is not harvested until after frost. The large, woody tops need to be cut with a mower prior to harvest. Tubers can be dug by hand or with a potato harvester. Due to their thin skin, tubers must be stored at a very high relative humidity to prevent shriveling. Under the proper temperature and humidity they may be stored for 4 to 5 months. Volunteer plants can pose a problem for several years after harvest.

Labor requirements

Labor needs per acre will vary substantially depending on the method of production, the scale of operation and harvest method. Organic production methods will have higher labor requirements for weed control since herbicides cannot be used. Likewise hand-harvested crops will have higher labor needs than those harvested with a mechanical harvester.

Economic Considerations

Initial investments include land preparation, purchase of seed or seed stock, and possibly the installation of an irrigation system. If a significant amount of root crops will be grown for market, a root cellar or cold storage facility would allow the grower more flexibility in marketing the crop.

Root crop budgets will differ depending on the crop, size of operation and production method. For example, 2006 production costs for commercial-scale, conventional, non-irrigated carrots are estimated at $800 per acre, with harvest and marketing costs of approximately $1,300 per acre. Total expenses per acre, including both variable and fixed, would come to approximately $2,100 per acre. Presuming gross returns of $2,800 per acre, returns to land, capital and management would come to approximately $700 per acre.

Carrots grown on a smaller scale in a market garden for farmers market sales could show the following costs and returns based on a 100-foot row. Seed, fertilizer and fuel are estimated at $28; an additional $10 for machinery depreciation brings total costs to approximately $38. Estimating a good yield of 160 pounds sold at $1 per pound brings returns to labor, management, marketing and land to $122 per 100-foot row.

More Information

- Vegetable Production Guide for Commercial Growers ID-36 (University of Kentucky)
http://www.ca.uky.edu/agc/pubs/id/id36/id36.htm

- Beet Production, HIL-04 (North Carolina State University, 2001) http://www.ces.ncsu.edu/depts/hort/hil/hil-4.html
- Cole Crops and Other Brassicas: Organic Production (ATTRA, 2006) http://attra.ncat.org/attra-pub/cole.html
- Commercial Carrot Production, HIL-9-A (North Carolina State University, 1998) http://www.ces.ncsu.edu/depts/hort/hil/hil-9.html
- Growing Jerusalem Artichokes, HIL-1-A (North Carolina State University, 1999) http://www.ces.ncsu.edu/depts/hort/hil/hil-1-a.html
- Jerusalem Artichoke (University of Wisconsin and University of Minnesota, 1991) http://www.hort.purdue.edu/newcrop/afcm/jerusart.html
- Parsnip (Oregon State University, 2003) http://hort-devel-nwrec.hort.oregonstate.edu/parsnip.html
- Radish (Oregon State University, 2003) http://hort-devel-nwrec.hort.oregonstate.edu/radish.html
- Rutabagas (Swede) and Turnip (Oregon State University, 2004) http://hort-devel-nwrec.hort.oregonstate.edu/rutabaga.html
- Salsify and Scorzonera (Oregon State University, 2003) http://hort-devel-nwrec.hort.oregonstate.edu/salsify.html
- Specialty Crop Profile: Horseradish (Virginia Polytechnic Institute, 2006) http://www.ext.vt.edu/pubs/vegetables/438-104/438-104.html

Photos courtesy of Rosie Lerner, Purdue University *Issued 2007*