



Broccoli

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Introduction

Broccoli (*Brassica oleracea*) is a cool-season crop that requires moderate temperatures for optimum growth and quality; it performs poorly in hot weather. As a member of the crucifer family, broccoli is closely related to other well-known cole crops, such as cabbage, cauliflower and Brussels sprouts.

Marketing

Fresh market wholesale options for Kentucky broccoli producers include produce auctions, local restaurants, groceries and wholesalers. Retail markets include farmers markets, roadside stands and community supported agriculture (CSA) shares. Kentucky's location and climate also present opportunities for wholesale organic broccoli production.

Market Outlook

Per capita fresh broccoli use increased about 25 percent during the 2010s, from 5.9 pounds in 2011 to about 7.5 pounds per person in 2016. It was the largest five-year increase in consumption since the mid-1990s. Consumers apparently favor fresh broccoli over frozen, as consumption of processed broccoli remained about 2.5 pounds per capita during the 2000s.

Fresh broccoli remains a very popular crop for direct marketing. Fall broccoli production can help extend sales to customers in market channels like farmers markets, CSA and farm-to-school programs. Higher fuel and transportation costs can create wholesale marketing opportunities for bulky produce crops, like broccoli, for growers in non-traditional broccoli production centers, such as Kentucky. Wholesale opportunities for Kentucky



producers have focused on fall broccoli production. Producers interested in growing broccoli on a larger scale should carefully weigh marketing and production costs.

Production Considerations

Cultivar selection

Growers should consider head size, shape and color, as well as yield, earliness and disease resistance when selecting broccoli cultivars. Resistance is available for downy mildew, black rot, *Pseudomonas* bacterial head rot, club root, *Fusarium* yellows and yellowing in storage. Some varieties are better suited for fall production than spring production. In many cases these fall varieties will have some level of resistance or tolerance to downy mildew and grow well as seedlings in the heat of the summer. In Kentucky, fall planted broccoli has higher quality than spring planted because it matures in cooler weather, producing better heads that are more desirable and



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store longer after harvest. Many seed catalogs will denote the cultivar's suitability for spring or fall production. Growers should select only adapted varieties that have the qualities in demand for the intended market.

Hollow stem is an important physiological disorder that detracts from marketability. It is more common in production areas that experience rapid fluctuation in temperature and soil moisture during head development. Sudden growth spurts brought on by heavy rainfall after a prolonged dry period or warming after a cold period can increase the incidence of this disorder. Excessive nitrogen fertilizer and wide plant spacing especially favor rapid plant growth and development of hollow stem. Soils deficient in boron and calcium, or high in potassium are also contributors. Cultivar trials conducted in Eastern Kentucky during 2012-13 indicated some cultivars produced more than 50 percent hollow stems. Trials in Western Kentucky, in 2016-17, indicated cultivars are available that avoided producing hollow stems.

Site selection and planting

Select a site that is well drained; poorly drained soils should be avoided. Slightly rolling land is suitable. This crop will do well on ground that has been in tobacco. Fescue sod ground also works well if the sod is plowed under early in the fall and allowed to decompose.

The ground for spring planting should be plowed in the fall to have the field and crop ready for early sales. Avoid planting spring broccoli too late as it can bolt (flower prematurely) before forming a complete head; anytime later than the middle of April is not recommended. Broccoli excels as a fall crop and should be transplanted by mid-August. In a good year, even a planting set in early September will produce a quality crop. Broccoli can be direct-seeded; however, transplants are required for an early market. Using transplants in the late summer will produce greater fall stand uniformity, as broccoli seedlings have difficulty establishing in dry and hot soils. Tobacco setters or water wheel setters can be used for transplanting. A minimum of 11,000 plants are needed for each acre.

Care is necessary to choose the appropriate spacing for broccoli production. Extra wide plant spacing can lead to much larger heads, while tighter spacing of plants will lead to smaller heads. A spacing of 12 to

14 inches is common for crown cuts, while a 10-inch spacing and double rows are often used for bunching types. Typically, wholesale markets will require a smaller head than direct retail sales. Be sure to determine what size head your market requires to help determine plant density.

Broccoli responds well to plastic mulch and drip irrigation. Raised beds covered in black plastic will encourage earlier spring growth and yields. It is helpful to lay plastic for the spring crop when working ground in the fall, as wet soil can make timely application and planting difficult. If using plastic mulch for a fall crop, growers may want to choose a white-on-black plastic instead of black. This can result in less transplant shock; black plastic can generate excessive heat during late summer. Irrigation is critical for establishing the fall crop.

Pest management

Insect pests can be a major problem in broccoli production, especially in summer plantings for fall harvest. Damage to transplants and older plants can result from cutworms, imported cabbage worm, cabbage looper, diamondback moth larvae and cross-striped cabbage worm. Marketability is reduced when insects feed on leaves and heads. Early detection is critical for controlling these pests. Scouting to monitor populations can help growers determine when and how often pesticides should be applied. Bt is a microbial insecticide that can be used effectively against most types of broccoli pests and is a primary component of organic production. Many other organic and non-organic insecticides are available for use. Several plant diseases (black rot, blackleg and downy mildew) can also result in yield losses. A good crop rotation program and the use of certified disease-free resistant varieties will help in the prevention of many of these diseases. Fungicide/bactericide sprays may also be necessary when pathogens are present and conditions are favorable for infection.

Harvest and storage

Central heads and later-maturing lateral heads are cut by hand before they loosen or begin to discolor from the development of yellow flower petals. Cut the heads with 6 to 8 inches of stem attached. Immediately after harvest, refrigerate to preserve integrity. The heads of broccoli cultivars come in two forms, crown cuts and bunching types. Crown cuts are larger, over 4

inches in diameter, while bunching types are smaller. Both are sold to the wholesale fresh market in waxed cartons. Each carton of bunching type broccoli holds 14 “bunches” of two to three heads each, tied with a rubber band. Larger crown cuts are packed separately in order to avoid compressing or otherwise damaging the heads. Top ice may also be required for wholesale markets.

Labor requirements

Labor needs for 450 boxes per acre using plasticulture are approximately 45 hours per acre for production, 80 hours per acre for harvest, and 25 hours per acre for packing. This assumes a rate of about four boxes per hour for harvest and packing.

Economic Considerations

Initial investments include land preparation and the purchase of seed or production of transplants. An additional start-up cost can include the installation of an irrigation system and plastic mulch.

Production costs (2017) were estimated at \$2,365 per acre, with harvest and marketing costs at \$3,165 per acre. Since returns vary depending on actual yields and market prices, the following per acre returns to land and management are based on three different economic scenarios. Conservative estimates represent the University of Kentucky’s average statewide cost and return estimates assuming 450 boxes produced and sold at \$15 per box in 2017. Figures are for trickle irrigated broccoli.

Pessimistic \$(900)*	Conservative \$312	Optimistic \$1,158
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**Parentheses indicate a negative number, i.e. a net loss*

Selected Resources

- Bt Basics for Vegetable Integrated Pest Management, ID-156 (University of Kentucky, 2005) <http://www.ca.uky.edu/agc/pubs/id/id156/id156.pdf>

- Broccoli Cultivar Trial in Western Kentucky, Fall 2016 and Spring 2017 (University of Kentucky Extension PR-739, 2017 Fruit and Vegetable Research Report, pgs. 22-24) <http://www2.ca.uky.edu/agcomm/pubs/PR/PR739/PR739.pdf>
- Fall Broccoli Cultivar Trial 2012-13 (University of Kentucky Extension PR-688, 2014 Fruit and Vegetable Research Report, pgs. 23-24) <http://www2.ca.uky.edu/agc/pubs/PR/PR688/PR688.pdf>
- Growers’ Guide to Bt, ID-156A (University of Kentucky, 2005) <http://www.ca.uky.edu/agc/pubs/id/id156a/id156a.pdf>
- Vegetable and Melon Budgets (University of Kentucky, 2017) <http://www.uky.edu/ccd/tools/budgets>
- Vegetable Production Guide for Commercial Growers, ID-36 (University of Kentucky) <http://www2.ca.uky.edu/agcomm/pubs/ID/ID36/ID36.pdf>
- Fresh Market Broccoli Production for Georgia: Bulletin 1460 (University of Georgia, 2016) https://secure.caes.uga.edu/extension/publications/files/pdf/B%201460_5.PDF
- Cole Crops and Other Brassicas: Organic Production (ATTRA, 2006) <https://attra.ncat.org/attra-pub/summaries/summary.php?pub=27>

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