



Bell Peppers

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Introduction

Although bell pepper (*Capsicum annuum*) is a warm-season annual when grown in temperate regions, it is actually an herbaceous perennial when cultivated in tropical areas, such as its native Latin America. Bell peppers are considered “sweet” since they lack the pungent chemical (capsaicin) present in hot peppers.

Marketing

Peppers are grown in Kentucky primarily for fresh market sales. Fresh market options include roadside stands, local wholesalers and retailers, wholesale markets, farmers markets, community supported agriculture (CSA) subscriptions, produce auctions, restaurants and institutional foodservice. Bell peppers were one of the top three fresh vegetables with acreage increases in Kentucky during the early 2000s. In the past Kentucky farmers also grew considerable acreages of peppers for processing, but that ended when the processing companies closed or moved out-of-state.

Market Outlook

Bell pepper use per year increased in the U.S. from 8 pounds per capita in 2000 to just under 11 pounds per person in 2014. Per capita use remained around 11 pounds per person through 2017. Greenhouse-grown peppers imported from other countries have increased year-round supplies for U.S. consumers. Although consumption increases have slowed since the early 2000s, fresh bell peppers (including organic peppers) remain a growth category for produce growers in Kentucky and nationwide. California and Florida dominate fresh bell pepper production, producing about 80 percent of annual volumes. Other major producers include Georgia, Michigan, New Jersey, North Carolina and Ohio. The U.S. continues importing



fresh bell peppers from Canada, Mexico and Europe to satisfy increasing consumer demand.

Production Considerations

Variety selection

Bell pepper varieties differ in such horticultural traits as fruit size, shape (e.g. blocky versus elongated), number of lobes, flavor and disease resistance. Standard green bell varieties typically ripen to red when left on the plant long enough; however, specialty bell peppers include varieties that ripen to colors other than red. These specialty bells may be yellow, orange, brown, white, and even purple at maturity. Compared to green bell peppers, colored bells are more difficult and expensive to produce because a longer time to maturity is required. Growers

should select only adapted varieties that have the qualities in demand for the intended market. Due to the prevalence of bacterial leaf spot in Kentucky, only hybrid varieties with leaf spot resistance are recommended for commercial production.



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While resistance to bacterial leaf spot has helped reduce losses to this devastating disease, new races of the pathogen have been isolated to which there is currently no resistance.

Site selection and planting

Bell peppers grow best in deep, fertile, well-drained soils at a pH of 6.5-7.0. Avoid planting in low-lying fields next to creeks and rivers since these sites are subject to high humidity and moisture conditions and therefore especially prone to bacterial spot epidemics. Producers should also avoid fields where long-residual corn or soybean herbicides have been used, since herbicide carryover can cause serious injury to peppers.

Pepper fields should be located as far away from tobacco plantings as possible due to potential spread of aphid-vectoring viruses from tobacco to peppers. It is also advisable not to grow peppers after other solanaceous crops (such as tobacco, tomatoes, potatoes and eggplants) or vine crops (such as cucumbers, melons, etc.) for a period of three years since all of these crops are susceptible to some of the same diseases. Peppers do extremely well following fescue sod.

Growing hybrid bell pepper varieties in double rows on raised beds covered with black plastic mulch and drip irrigation has resulted in high yields of excellent quality peppers in Kentucky. This double row system will require approximately 14,500 transplants per acre depending on in-row spacing. While many growers choose a 12-inch in-row spacing, those with markets for extra-large or jumbo peppers generally space plants farther apart (from 15 to 18 inches within the row). A bed shaper/plastic layer and a setter that will transplant through plastic are essential for this production system, as well as an adequate water source for irrigation.

Pest management

Bacterial spot remains a serious risk to pepper plantings in many parts of the state. It is recommended that all Kentucky growers use resistant varieties and follow a copper-plus-maneb preventative spray regimen. Growers should also be extremely careful when growing or purchasing transplants from out-of-state. Transplants infected with bacterial leaf spot can result in total losses. Other diseases that may result in crop losses include Phytophthora blight, viruses, anthracnose fruit rot and bacterial soft rot. The most important insect pest of peppers is the European corn borer. Using pheromone traps or scouting to monitor populations can help the grower

determine when and how often insecticides should be applied. Controlling weeds will also aid in disease and insect pest control. Herbicides, plastic mulch and a good rotation system can help control weeds. Growing bell peppers to full maturity will also increase their exposure and susceptibility to anthracnose; rain shelters or high tunnels can help reduce incidence of this important fungal disease.

Nutrient management

An annual soil test is recommended before planting in order to establish how much potassium and phosphorus is needed for the future crop. Soil samples should be collected three to six months prior to planting in case lime is needed to raise the soil pH. A soil pH between 6.5 and 7.0 is optimal. When growing in the field or in soil, apply all the necessary phosphorus and potassium and half of the required nitrogen for the season before planting. Refer to UK's ID-36 for more detailed fertilization instructions.

Blossom end rot is a common abiotic problem in peppers. Abiotic means that the problem is not caused by a living organism such as a bacterium or fungus; it is usually nutritional or environment-related. Blossom end rot is a result of insufficient calcium in the developing pepper fruit. Symptoms appear at the bottom or blossom-end of the fruit as a soft, sunken, dark area. Fruit then become unmarketable. Blossom end rot may mean that there is deficient calcium in the soil. However, it can also commonly be the result of poor water management with long or frequent periods of drought stress on the plant, which means that calcium cannot be transported to the developing fruit. Excessive nitrogen fertilization may also contribute to blossom end rot. Maintain sufficient calcium content in the soil (through annual soil testing) and an optimal irrigation schedule.

Harvest and storage

Green bell peppers are hand-harvested for fresh market when they are at the mature green stage. Colored or specialty bell peppers are allowed to fully ripen on the plant. Colored peppers generally weigh more than green fruit. Fruit must be handled carefully to prevent skin breakage and punctures that could lead to decay. Cooling peppers to 45-50°F as soon as possible after harvest will extend their shelf life. Once the fruit is cooled, peppers can be stored for two to three weeks under the proper conditions. Peppers are usually packed in 1¹/₉-bushel waxed corrugated cartons (33 pounds), or according to the preference of your particular market/buyer.

Labor requirements

Production will require approximately 25 hours per acre, while harvest requires 125 hours per acre. Grading and packing require another 75 hours per acre. Black plastic removal (post-harvest) will require an additional 10 hours per acre. Currently there are no good options for recycling black plastic in Kentucky so it will need to be disposed of. A plastic roller that reels up the plastic and drip tape can reduce the volume that requires disposal.

Economic Considerations

Initial investments include land preparation and the purchase of seed or transplants. Additional start-up costs can include the installation of an irrigation system and black plastic mulch. Production costs for 1,500 boxes (1¹/₉-bushel) of fresh market bell peppers (trickle irrigated) are estimated at \$4,815 per acre, with harvest and marketing costs at \$8,750 per acre. Total costs per acre, including both variable and fixed costs, are approximately \$14,600.

Since returns vary depending on actual yields and market prices, the following returns to land and management are based on three different economic scenarios. Each large-scale scenario assumes a \$600 owner-operator labor cost. Conservative estimates represent the University of Kentucky's statewide cost and return estimates for 2017 assuming a price of \$10 per box.

Return to land and management, fresh market

| PESSIMISTIC | CONSERVATIVE | OPTIMISTIC |
|-------------|--------------|------------|
| \$(1,660)* | \$(188) | \$3,163 |

*Parentheses indicate a negative number, i.e. a net loss

Small-scale bell pepper production for direct marketing can be profitable for producers able to obtain premium prices. Production budgets for Kentucky, in 2017, estimated a \$250 return above variable costs and returns to land, capital and management of \$180 per 100-foot row of bell peppers. The small-scale estimates included 20 boxes of peppers sold at an equivalent of \$30 per box. Small-scale production costs may vary widely, depending on the farm situation and production practices.



Selected Resources

- IPM Scouting Guide for Common Pests of Solanaceous Crops in Kentucky, ID-172 (University of Kentucky, 2008) 2 MB file <http://www.ca.uky.edu/agc/pubs/id/id172/id172.pdf>
- Kentucky Pepper Integrated Crop Management (University of Kentucky, 2000) <https://ipm.ca.uky.edu/files/ipm13pep.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>
- Bell Pepper Cultivar Evaluation, Central Kentucky (University of Kentucky Extension PR-739, 2017 Fruit and Vegetable Research Report, pgs. 28-30) <http://www2.ca.uky.edu/agc/pubs/PR/PR688/PR688.pdf>

Podcast

- Value-added Pepper Products (University of Kentucky, 2014) <http://www.uky.edu/ccd/sites/www.uky.edu/ccd/files/peppers.mp3>

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