
AGRICULTURAL ALTERNATIVES

Bell Pepper Production

Bell peppers are a crop that lend themselves well to small-scale and part-time farming operations. Various markets exist for growers with small-acreage farms (those with less than 5 acres), and the multiple mature fruit colors (red, yellow, orange, purple, and brown) make it easier for growers to find niche markets. Many field operations, such as land preparation, planting, and harvesting, can be custom hired, and any equipment owned by the grower can be used for other purposes.

Peppers (*Capsicum annuum*), both sweet and hot, originated in Central and South America. Columbus found them growing in the West Indies, but they were not introduced into Europe until the 16th century. Jamaican farmers cultivated four types of hot peppers before 1770 (cherry, scotch bonnet, bell, and finger). According to U.S. Department of Agriculture records, commercial bell peppers were first produced in the southern United States in 1925. Today, seed companies distribute several hundred varieties of both sweet and hot peppers.

Most of the bell peppers harvested in the U.S. are sold as fresh produce. In 1998, the U.S. produced 56,700 acres of bell peppers with a value of \$483 million. (USDA Statistical Services bases value of production on total acres harvested times average price.) Pennsylvania produced 4,000 acres, valued at \$24 million.

This publication was developed by the Small-scale and Part-time Farming Project at Penn State with support from the U.S. Department of Agriculture-Extension Service.



Marketing

Fresh market bell peppers are produced in Pennsylvania from the first of June to the end of October. Pepper cultivars recommended for Pennsylvania are listed in Table 1. Fresh market peppers usually are sold loose in bulk containers. Six basic marketing alternatives are available to the pepper grower: wholesale markets, cooperatives, local retailers (grocery stores), roadside stands, pick-your-own operations, and processing firms.

In wholesale marketing, producers often contract with shippers to market and ship their peppers for a predetermined price. If you do not use a contractor and ship your peppers to the wholesale market yourself, your product will be subject to the greatest price fluctuations. Marketing cooperatives generally use a daily pooled cost and price, which spreads price fluctuations over all participating producers. Local retailers are another possible market, but you must take the time to contact produce managers and provide high-quality peppers when stores require them.

PENNSSTATE



College of Agricultural Sciences
Agricultural Research and Cooperative Extension

Roadside stands (either your own or another grower's) and pick-your-own operations provide opportunities to receive higher than wholesale prices for your peppers, but you may have some additional expenses for advertising, building and maintaining a facility, and providing service to your customers. With pick-your-own operations, you save on harvest costs, but you must be willing to accept some waste. Depending on your location, processors may or may not be a marketing option. Processors are less likely to contract with small-acreage growers. For more information on marketing, consult *Agricultural Alternatives: Fruit and Vegetable Marketing for Small-scale and Part-time Growers*.

Table 1. Recommended bell pepper cultivars for Pennsylvania.

Boynton Bell* (BLSR 1, 2, 3)
King Arthur* (BLSR 2)
Vidi* (PVY, TEV, TMV)
Paladin* (BLSR and Phytop)
Bell Captain* (TMV)
Marengo* (green to yellow fruit)
Renegade (BLSR)
X3R Camelot* (BLSR 1, 2, 3; TMV)
X3R Wizard* (BLSR 1, 2, 3; TMV)
Bell Tower

NOTE: All cultivars are listed in order of maturity (early to late).
BLSR—resistant to bacterial leaf spot.
PVY—resistant to potato virus Y.
TEV—resistant to tobacco etch virus.
TMV—resistant to tobacco mosaic virus.
Phytop—resistant to Phytophthora.

Production Considerations

Bell peppers grow best on well-drained soils that have good water-holding characteristics. Soil should have a pH of 5.8 to 6.6.

Planting and Fertilization

Peppers are started as transplants in the greenhouse six to eight weeks prior to planting in the field. Because peppers are a warm season crop, they should not be transplanted until the soil temperature 3 inches beneath the soil surface reaches 60°F. Peppers should be grown on raised beds covered with black or silver plastic mulch. Providing the plants with drip irrigation ensures optimum plant growth and yields and allows growers to apply injection-based fertilizer during the growing season. For more information on crop irrigation, consult *Agricultural Alternatives: Irrigation for Fruit and Vegetable Production*.

Growers generally plant approximately 10,000 to 14,000 plants per acre in double rows 14 to 18 inches apart on plastic-mulched beds with 16 to 24 inches between plants in the row and with the beds spaced 5 to 6.5 feet apart from their centers. A single row of peppers also can be planted on each bed (5,000 to 6,500 plants per acre).

Fertilizer rates should be based on annual soil test results. If you are unable to conduct a test, the recommended N-P-K application rates are 40-40-80 pounds per acre banded at planting, and a total of 40-40-30 pounds per acre injected through the drip irrigation system over the growing season.

Pest Control

Weed control can be achieved with herbicides, plastic mulch, and a good crop-rotation system. Several preplant and postemergence herbicides are available for peppers, depending on the specific weed problem and pepper growth stage. If infestation levels are mild, early cultivation can minimize weed problems.

Insects are a major problem in pepper production. Aphids, flea beetles, pepper maggots, thrips, and European corn borers all can cause crop losses. Monitoring insect populations with traps or by scouting will help you determine when you should use pesticides and how often you should spray.

Several pepper diseases can cause crop losses, including bacterial leaf spot, phytophthora blight, viruses such as tobacco mosaic virus, and potato virus Y, anthracnose fruit rot, and bacterial soft rot. These diseases can be controlled by using disease-resistant varieties and by having a good crop-rotation system and soils with good air and water filtration.

Harvest and Storage

Most bell peppers are hand harvested two to four times during the growing season. Mechanical harvesters are available for harvesting hot peppers, especially jalapeno, chilies, and hot cherries, with a once over harvest. You will need to grade peppers for size and color and to check for worms and insect damage to ensure marketing a high-quality product.

Cooling the peppers after harvest will remove field heat, which improves shelf life. You should refrigerate the peppers immediately after harvest to maintain quality. Peppers will retain good quality for approximately 14 to 21 days if stored at 90 to 95 percent humidity and 47 to 55°F.

Budgeting

Included in this publication is an annual fresh market pepper production budget. This budget utilizes custom hire for most of the field work, which could be more economical for small-acreage growers. Farmers who own equipment should substitute equipment costs for custom hire costs. The budget summarizes the receipts, costs, and net returns of a pepper enterprise. This sample budget should help ensure that all costs and receipts are included in your calculations. Costs and returns are often difficult to estimate in budget preparation because they are numerous and variable. Therefore, you should think of this budget as an approximation and make appropriate adjustments in the "Your Estimate" column to reflect your specific production and resource situation. More information on the use of crop budgets can be found in *Agricultural Alternatives: Enterprise Budget Analysis*.

Prepared by Michael D. Orzolek, professor of horticulture; George L. Greaser, senior research associate in agricultural economics; and Jayson K. Harper, associate professor of agricultural economics.

Initial resource requirements for fresh market bell peppers

- Land: 1 acre
- Labor: 19 hours
- Harvesting costs: \$700 per acre
- Capital: \$6,000
- Depreciation on equipment: \$600

For More Information

Brewer, T., J. Harper, and G. Greaser. *Agricultural Alternatives: Fruit and Vegetable Marketing for Small-scale and Part-time Growers*. University Park, Pa.: Penn State Cooperative Extension, 1994.

Greaser, G. and J. Harper. *Agricultural Alternatives: Enterprise Budget Analysis*. University Park, Pa.: Penn State Cooperative Extension, 1994.

Hardenburg, R. E., A. E. Watada, and C. Y. Wang. "The Commercial Storage of Fruits and Nursery Stocks." *Agricultural Handbook Number 66* (USDA-ARS). Washington, D.C.: Superintendent of Documents, Government Printing Office, 1986.

Jarrett, A. R., B. L. Goulart, G. L. Greaser, and J. K. Harper. *Agricultural Alternatives: Irrigation for Fruit and Vegetable Production*. University Park, Pa.: Penn State Cooperative Extension, 1995

Lorenz, O. A. and D. M. Maynard. *Knott's Handbook for Vegetable Growers*. New York, N.Y.: John Wiley & Sons, Inc., 1988.

MacNab, A. A., A. E. Sherf, and J. K. Springer. *Identifying Diseases of Vegetables* (AGRS-21). Penn State College of Agricultural Sciences, 1994.

Pennsylvania Commercial Vegetable Production Guide (AGRS-28). Penn State College of Agricultural Sciences, 2000.

Seelig, R. A. "Peppers." *Fruit & Vegetable Facts & Pointers*. Alexandria, Va.: United Fresh Fruit and Vegetable Association, 1968.

Association

Pennsylvania Vegetable Growers Association
RR 1, Box 392
Northumberland, PA 17857-9723

Fresh Market Bell Pepper Budget

Summary of estimated costs and returns per acre.

Item	Quantity or number of operations	Unit	Price	Total	Your Estimate
Variable costs					
Custom					
Applying calcium lime	0.5	ton	\$20.00	\$10.00	_____
Pest scouting	8	acre	\$10.00	\$80.00	_____
Pesticide spraying	8	acre	\$7.20	\$57.60	_____
Preapplied fertilizer (10-10-10)	0.2	tons	\$180.00	\$36.00	_____
Fertilizer (postapplication)					
Nitrogen	40	pound	\$0.22	\$8.80	_____
Phosphorus	40	pound	\$0.28	\$11.20	_____
Potassium	80	pound	\$0.15	\$12.00	_____
Herbicide					
Command	0.125	gallon	\$83.00	\$10.4	_____
Dual 8E	0.15	gallon	\$93.90	\$14.09	_____
Fungicide					
Ridomil Gold	1	pint	\$89.00	\$89.00	_____
Kocide	12	pound	\$3.15	\$37.80	_____
Manzate 200DF	10	pound	\$2.75	\$27.50	_____
Insecticide					
Asana XL	0.069	gallon	\$111.00	\$7.66	_____
Diazinon	0.75	gallon	\$31.00	\$23.25	_____
Baythroid	0.17	pound	\$465.00	\$79.10	_____
Admire	0.18	pound	\$561.00	\$100.98	_____
Other variable costs					
Preapplied fertilizer (10-10-10)	0.2	tons	\$180.00	\$36.00	_____
Disk plowing	1	acre	\$11.80	\$11.80	_____
Cultivation	2	acre	\$8.30	\$16.60	_____
Black, embossed, or silver mulch	1	acre	\$250.00	\$250.00	_____
Drip irrigation (tape and labor)	1	acre	\$150.00	\$150.00	_____
Pepper transplants	18	thsd	\$75.00	\$1,350.00	_____
Labor	48	hour	\$10.00	\$480.00	_____
Marketing and advertising	1	acre	\$100.00	\$100.00	_____
Hand harvesting	1	acre	\$700.00	\$700.00	_____
Packing and grading	1	acre	\$180.00	\$180.00	_____
Cartons	1,100	cartons	\$0.90	\$990.00	_____
Fuel	10.21	gallon	\$0.93	\$9.50	_____
Pest control including labor	8	acre	\$7.20	\$57.60	_____
Repair and maintenance					
Tractors and implements	1	acre	\$15.00	\$15.00	_____
Irrigation labor	1	acre	\$30.00	\$30.00	_____
Interest charge	1	acre	9.5%	\$117.61	_____
<i>Total variable cost</i>				\$5,099.40	_____
Fixed costs					
Tractors	1	acre	\$15.86	\$15.86	_____
Implements	1	acre	\$12.32	\$12.32	_____
Drip irrigation	1	acre	\$500.00	\$500.00	_____
<i>Total fixed cost</i>				\$528.18	_____
Total cost				\$5,627.58	_____

Net returns for five different yields and prices.

Price	Yield (cartons)				
	600	850	1,100	1,250	1,400
\$5.00	-\$2,628	-\$1,378	-\$128	\$622	\$1,372
\$6.50	-\$1,728	-\$103	\$1,522	\$2,497	\$3,472
\$8.00	-\$828	\$1,172	\$3,172	\$4,372	\$5,572
\$9.00	-\$228	\$2,022	\$4,272	\$5,622	\$6,972
\$10.00	\$372	\$2,872	\$5,372	\$6,872	\$8,372

Penn State College of Agricultural Sciences research, extension, and resident education programs are funded in part by Pennsylvania counties, the Commonwealth of Pennsylvania, and the U.S. Department of Agriculture.

This publication is available from the Publications Distribution Center, The Pennsylvania State University, 112 Agricultural Administration Building, University Park, PA 16802. For information telephone (814) 865-6713.

Where trade names appear, no discrimination is intended, and no endorsement by Penn State Cooperative Extension is implied.

Issued in furtherance of Cooperative Extension Work, Acts of Congress May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture and the Pennsylvania Legislature. T. R. Alter, Director of Cooperative Extension, The Pennsylvania State University.

This publication is available in alternative media on request.

The Pennsylvania State University is committed to the policy that all persons shall have equal access to programs, facilities, admission, and employment without regard to personal characteristics not related to ability, performance, or qualifications as determined by University policy or by state or federal authorities. The Pennsylvania State University does not discriminate against any person because of age, ancestry, color, disability or handicap, national origin, race, religious creed, sex, sexual orientation, or veteran status. Direct all inquiries regarding the nondiscrimination policy to the Affirmative Action Director, The Pennsylvania State University, 201 Willard Building, University Park PA 16802-2801; Tel. (814) 865-4700/V; (814) 863-1150/TTY.