

# AGRICULTURAL ALTERNATIVES

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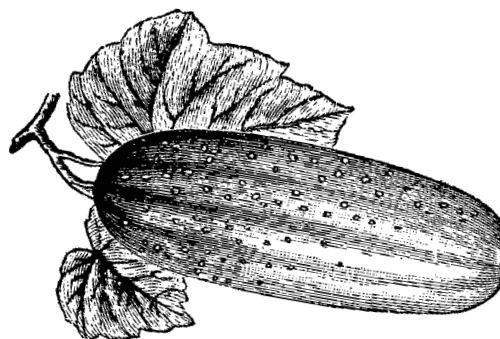
## Cucumber Production

Cucumbers lend themselves well to small-scale and part-time farming operations. Multiple markets exist for growers with fewer than 5 acres, and many field operations, such as land preparation, planting, and harvesting, can be custom hired.

Cucumbers (*Cucumis sativas*) are a member of the Cucurbitaceae family, which also includes squashes, pumpkins, muskmelons, watermelons, and gourds. Normally, cucumber plants are monoecious—they produce both male and female flowers on the same plant. Male flowers appear on the main stem earlier and in much larger numbers than female flowers. Many modern hybrids are gynoecious—they produce only female flowers and are referred to as all-female varieties. Recommended varieties for Pennsylvania are provided in Table 1.

Cucumbers are native to India and were introduced into China 2,000 years ago. They were then brought to Europe, most likely first into Greece, from which their cultivation spread into Italy, Germany, and France. Pliny the Great stated that cucumbers were grown in Africa as well as Italy in his time, and that the Emperor Tiberius (14–37 AD) had cucumbers at his table every day. Cucumbers were grown by Christopher Columbus in Haiti in 1494. In 1539, Hernando De Soto found varieties of cucumbers in Florida that were better than those grown in Spain, and cucumbers were also reported to be grown in Virginia in 1609. Early cucumber varieties were not as smooth or symmetrical as current vari-

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**Table 1. Recommended cucumber varieties for Pennsylvania.**

VARIETY	DISEASE RESISTANCE
<i>Slicing: gynoecious—only female flowers</i>	
Encore*	ALSR, DMR, PMR, SMR
Raider*	SMR
Speedway*	ALSR, AR, DMR, PMR, SMR
Stonewall*	CMVR, SMR, AR, DMR, ALSR, PMR
Dasher II*	ALSR, AR, DMR, PMR, SMR
Thunder*	DMR, PMR, SMR, ZYMVR
Turbo*	ALSR, AR, DMR, PMR, SMR
Striker*	ALSR, AR, DMR, PMR, SMR
<i>Slicing: monoecious—both male and female flowers</i>	
Poinsett 76	
Straight 8	
Marketmore 76	SMR

\*Hybrid variety

AR = Anthracnose resistant

ALSR = Angular leaf spot resistant

PMR = Resistance to powdery mildew

DMR = Resistance to downy mildew

SMR = Scab and mosaic resistance

CMVR = Cucumber mosaic virus resistant

ZYMVR = Zucchini yellow mosaic virus resistant

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eties, and breeding work to produce hybrids did not begin until 1880.

The United States harvests cucumbers for two basic purposes: pickling and fresh marketing. In 2009, the United States produced more than 97,500 acres of pickling cucumbers with a value of over \$180 million and more than 46,000 acres of fresh-market cucumbers valued at over \$220 million. Pennsylvania produced 600 acres of fresh-market cucumbers with a value of around \$6 million.

## Marketing

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Fresh-market cucumbers are usually available in Pennsylvania from the end of June until the end of November. They are traditionally sold in 47- to 55-pound wooden crates or cardboard boxes. Several marketing alternatives are available to the cucumber grower: wholesale marketing, produce auctions, cooperatives, local retailers, roadside stands, and pick-your own operations. When planning production, first consider your ability to market. You should conduct some market research because often growers overestimate their ability to sell in a given market. Production of less than one acre of many vegetable crops is typical for most growers.

In wholesale marketing, producers often contract with shippers to market and ship the cucumbers for a predetermined price. If you do not use a contractor and ship your cucumbers to a wholesale market yourself, your product will be subject to the greatest price fluctuations. Produce auctions operate weekly; however, you must deliver the cucumbers to the auction. 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 good-quality cucumbers when stores require them. Depending on your location, processors may or may not be a marketing option. Processors are less likely to contract with small-acreage growers (those with fewer than 5 acres). For more information on marketing, consult *Agricultural Alternatives: Fruit and Vegetable Marketing for Small-Scale and Part-Time Growers*.

Retail marketing options include roadside stands (either your own or another grower's) and pick-your-own operations, which provide opportunities to receive higher-than-wholesale prices for your cucumbers, 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. Farmer's markets are another retail option, but you should contact the markets well in advance of the marketing season to be sure space is available and to find out what requirements you must follow. For more information about roadside markets, see *Agricultural Alternatives: Developing a Roadside Farm Market*.

## Site Selection

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Cucumbers should be grown on soils that have good water infiltration rates and moisture-holding capacities. The soil should not be compacted and the pH should be 5.8–6.6. Cucumbers are very sensitive to cold, and the plants as well as the fruit can be injured by even a slight frost. The best average temperature range for cucumber production during the growing season is between 65 and 95°F; temperatures above 95°F or below 50°F slow the growth and maturity of the crop. Cucumbers require a constant supply of moisture during the growing season. Moisture fluctuation, especially soil water depletion, will cause growth deformity, which can reduce both the yield and the quality of the crop.

Cucumbers are generally seeded when soil temperatures exceed 60°F and air temperatures do not fall below 50°F at night. In cooler regions, cucumbers can be grown as transplants in the greenhouse 18–24 days prior to planting in the field. Because they are a warm-season crop, they should not be transplanted until the soil temperature reaches 60°F at 3 inches beneath the soil surface. They may be grown on raised beds with black, blue, or silver plastic mulch and using drip irrigation for optimum plant growth and yields. Drip irrigation can be used for fertilizer application during the growing season. Pickling cucumbers are usually grown for processing and without the use of raised beds and plastic mulch.

Slicing cucumbers are generally planted in single rows on plastic beds with 9–12 inches between plants in the row and 4–5 feet between rows. Plant population at this spacing is approximately 8,400–10,500 plants per acre. Pickling cucumbers are normally planted on three row beds where rows are 26–28 inches apart and plants are 2–3 inches apart in the row. This spacing would provide approximately 65,000 plants per acre.

Fertilizer recommendations should be based on annual soil test results. In absence of soil test results, the recommended N-P-K (nitrogen, phosphorus, potassium) application rates for slicing cucumbers is 30-50-50 pounds per acre banded at planting and 30-50-50 pounds per acre injected through the drip-irrigation system during the growing season. For pickling cucumbers, the recommended N-P-K application rate is 60-100-100 pounds per acre.

## Pollination

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A large honey bee population is essential for pollination and fruit set. One hive per acre is recommended for maximum fruit production. Insecticides applied to flowers or weeds in bloom can adversely affect pollinating insect populations, especially honey bees. Seedless cucumbers are parthenocarpic and do not require pollinators for production.

## Pest Management

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Weed control can be achieved with a good crop rotation system, herbicides, and plastic mulch in the case of slicing cucumbers. Several preplant and postemergence herbicides are available for cucumbers, depending on the specific weed problem and the stage of cucumber growth. If infestation levels are mild, early cultivation (prior to vine running) can help minimize weed problems.

Insects can be a major problem in cucumber production. Cucumber beetle, aphids, cutworms, seed corn maggot, leafminers, and mites all can cause crop losses. Monitoring insect populations will help you determine when you should use pesticides and how often you should spray.

Several cucumber diseases—especially bacterial wilt, powdery mildew, downy mildew, angular leaf spot, anthracnose, and phytophthora blight—and viruses such as cucumber mosaic (CMV), zucchini yellow mosaic (ZYMV), and watermelon mosaic (WMV—1, 2) can reduce crop yields. Many of these diseases can be prevented by having a good crop rotation system, using soil with good water and air drainage, and planting disease-resistant varieties.

Many of the pesticides required for cucumber production are restricted-use pesticides and require a pesticide license to purchase. Pesticide applicators tests are usually administered at county extension offices, so you should contact your local office for dates and times of these examinations. When using any pesticides in your enterprise, remember to follow all label recommendations regarding application rates and personal protection equipment (PPE) requirements. Also remember that any Worker Protection Standards (WPS) apply to the owner as well as to employees.

## Harvest and Storage

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For best taste and texture, slicing cucumbers should be harvested when they are 1.25–2 inches in diameter and 6–8 inches in length. Because cucumbers are pollinated at different times, multiple hand-harvests over the field are necessary, usually every other day. To ensure marketing a high-quality product, you should grade cucumbers by size and maturity and check them for insect damage.

Pickling cucumbers are generally harvested by machine and under contract with a local processor, although there is also a limited market for fresh pickling cucumbers.

Removing field heat from cucumbers is critical for extending their shelf life and maintaining a good appearance. Refrigeration immediately after harvest will help guarantee high quality. Cucumbers that are maintained at 55°F and 95 percent relative humidity will retain good quality for approximately 10–14 days.

## Environmental Regulations

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All agricultural operations in Pennsylvania, including small-scale and part-time farming enterprises, operate under the Pennsylvania Clean Streams Law. A specific part of this law is the Nutrient Management Act. Portions of the act may or may not pertain to your operation, depending on whether you have livestock on your farm. However, all operations may be a source of surface or groundwater pollution. Because of this possibility, you should contact your local Soil and Water Conservation District to determine what regulations may pertain to your operation.

## Risk Management

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You may wish to consider several risk-management strategies for your operation. First, you should insure your facilities and equipment. This may be accomplished by consulting your insurance agent or broker. Second, you may want to insure your income through a crop insurance program called AGR-Lite.

To use AGR-Lite you must have 5 years of Internal Revenue Service (IRS) Schedule F forms. If your business structure is either a C or an S corporation, the necessary information can be entered into a Schedule F for crop insurance purposes. You can then contact an agent who sells crop insurance and insure the income of your operation. For more on agricultural business insurance, see *Agricultural Alternatives: Agricultural Business Insurance*. For more information concerning crop insurance, contact a crop insurance agent or check the Pennsylvania crop insurance education Web site at [cropins.aers.psu.edu](http://cropins.aers.psu.edu).

## Good Agricultural Practices and Good Handling Practices

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Good agricultural practices (GAPs) and good handling practices (GHPs) are voluntary programs that you may wish to consider for your operation. The idea behind these programs is to ensure a safer food system by reducing the chances for foodborne illnesses resulting from contaminated products reaching consumers. Also, several major food distribution chains are beginning to require GAPs- and GHPs-certified products from their producers. These programs set standards for worker hygiene, use of manure, and water supply quality.

These handling practices require an inspection from your state Department of Agriculture and there are fees associated with the inspection. Prior to an inspection, you will need to develop and implement a food safety plan and designate a member of your team to oversee this plan. You will need to have any water supply used by your workers or for crop irrigation and pesticide application checked at least twice each year. A checklist of the questions to be asked during the inspection can be found at [www.ams.usda.gov/](http://www.ams.usda.gov/)

[fv/gapghp.htm](#). For more information about GAPs and GHPs, contact your local extension office or your Department of Agriculture.

## Sample Budget

Included in this publication is a sample fresh-market cucumber production budget. This budget utilizes custom hire for most of the field work, which could be more economical for a smaller acreage. Farmers who have their own equipment should substitute their costs for the custom hire. The budget summarizes the receipts, costs, and net returns of a cucumber 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. These budgets are developed for one acre; however, your scale of production should be based on market considerations. More information on the use of crop budgets can be found in *Agricultural Alternatives: Enterprise Budget Analysis*.

## For More Information

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Lamont, W. J., M. D. Orzolek, J. K. Harper, A. R. Jarrett, and G. L. Greaser. *Agricultural Alternatives: Drip Irrigation for Vegetable Production*. University Park: Penn State Cooperative Extension, 2002.

Macher, R., and H. W. Kerr. *Making Your Small Farm Profitable: Apply 25 Guiding Principles/Develop New Crops and New Markets/Maximize Net Profits per Acre*. North Adams, Mass.: Storey Books, 1999.

MacNab, A. A., A. E. Sherf, and J. K. Springer. *Identifying Diseases of Vegetables*. University Park: Penn State Cooperative Extension, 1983.

Maynard, D. M., and G. J. Hochmuth. *Knott's Handbook for Vegetable Growers*. 5th ed. Hoboken, N.J.: John Wiley and Sons Inc., 2006.

Orzolek, M. D., et al. *Pennsylvania Commercial Vegetable Production Guide*. University Park: Penn State Cooperative Extension, 2010.

### Initial resource requirements

- Land: 1 acre
- Production labor: 7–10 hours
- Harvesting and grading: \$1,800–\$2,200 per acre
- Capital: \$6,000–\$6,500
- Equipment:
  - Tractor
  - Plastic mulch layer
  - Vegetable transplanter
  - Boom sprayer

## Fresh-Market Cucumber Budget

Summary of estimated costs per acre

Item	Quantity	Unit	Price	Total	Your Estimate
<b>Variable Costs</b>					
Custom hire*	1	acre	\$184.90	\$184.90	_____
Fertilizer and lime	1	acre	\$146.76	\$146.76	_____
Herbicide	1	acre	\$66.07	\$66.07	_____
Fungicide	1	acre	\$136.25	\$136.25	_____
Insecticide	1	acre	\$108.74	\$108.74	_____
Irrigation operating	21	inches	\$20.00	\$420.00	_____
Cucumber transplants	9.68	thousands	\$50.00	\$484.00	_____
Black plastic mulch	10890	feet	\$0.04	\$435.60	_____
Marketing and advertising	950	cartons	10%	\$1,140.00	_____
Hand harvesting	123	hours	\$12.00	\$1,476.00	_____
Packing and grading	41	hours	\$12.00	\$492.00	_____
Cartons (25 lbs)	950	cartons	\$1.07	\$1,016.50	_____
Fuel	12.6	gallon	\$3.10	\$39.06	_____
Hourly labor	0.58	hours	\$13.50	\$7.83	_____
Repair and maintenance					
Tractors and implements	1	acre	\$21.85	\$21.85	_____
Operator labor	6.46	acre	\$15.00	\$96.90	_____
Interest charge	1	acre	7.0%	\$98.63	_____
<i>Total variable costs</i>				\$6,186.19	_____
<b>Fixed Costs</b>					
Tractors	1	acre	\$25.98	\$25.98	_____
Implements	1	acre	\$23.69	\$23.69	_____
Land charge	1	acre	\$200.00	\$200.00	_____
Irrigation installation**	1	acre	\$150.00	\$150.00	_____
<i>Total fixed costs</i>				\$399.67	_____
<b>Total costs</b>				<b>\$6,585.86</b>	_____

These budgets are developed for one acre; however, your scale of production should be based on market considerations.

\*Custom hire expenses include soil testing, lime application, land preparation, pest scouting, and bee rental.

\*\*Irrigation installation includes filter and mainline to the drip line and is calculated to have a 7-year useful life.

## Net returns for six different yields and prices

Price	Yield (25-pound cartons)					
	800	900	950	1,000	1,050	1,100
\$7.00	\$(334.62)	\$(68.78)	\$64.14	\$197.06	\$329.98	\$462.90
\$8.00	\$465.38	\$831.22	\$1,014.14	\$1,197.06	\$1,379.98	\$1,562.90
\$9.00	\$1,265.38	\$1,731.22	\$1,964.14	\$2,197.06	\$2,429.98	\$2,662.90
\$10.00	\$2,065.38	\$2,631.22	\$2,914.14	\$3,197.06	\$3,479.98	\$3,762.90
\$11.00	\$2,865.38	\$3,531.22	\$3,864.14	\$4,197.06	\$4,529.98	\$4,862.90
\$12.00	\$3,665.38	\$4,431.22	\$4,814.14	\$5,197.06	\$5,579.98	\$5,962.90

Prepared by Michael D. Orzolek, professor of horticulture; Lynn F. Kime, senior extension associate; Steven M. Bogash, extension educator in Franklin County; and Jayson K. Harper, professor of agricultural economics.

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