

# AGRICULTURAL ALTERNATIVES

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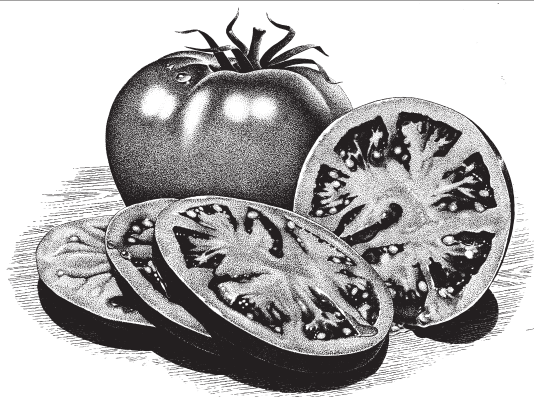
## Tomato Production

Tomatoes lend themselves well to small-scale and part-time farming operations. Many marketing opportunities are available for small-scale growers with multiple fruit colors (red, yellow, orange, and purple) and heirloom varieties, making it easier for growers to find niche markets.

Tomatoes originated in South America—specifically in Peru, Bolivia, and Ecuador. Columbus and other explorers brought tomatoes to Europe by the late 1400s. In Europe and the United States, tomatoes were used only as ornamental plants until the early 1800s because the fruit was thought to be poisonous. Tomatoes are a member of the botanical family *Solanaceae*, which contains many potentially poisonous plants (nightshade, nicotianas [includes tobacco and petunias], Jimson weed [belladonna], and mandrake), as well as edible plants (potatoes, capsicums, and eggplants). All members of this family have toxic alkaloids present in either their leaves or their fruits. Commercial tomato production did not begin until after 1860 when tomatoes were finally accepted by consumers. Since 1890, tomato breeding has developed varieties adopted for use around the world.

Tomatoes come in many different types of fruit—fresh or beefsteak types, grape, saladette, cherry, plum or paste, and others. Producing a mixture of these types may expand your marketing capabilities and prospects. Another recent introduction that may have a market niche is ornamental hanging basket tomatoes for the home garden market. You should determine your customers' desires and market needs before ordering seeds or plants. Producing a variety of types

*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.*



will enable you to offer your customer all of their tomato preferences.

There are two types of tomato plant growth habits: determinate and indeterminate. Determinate tomato plants will grow to a genetically specified height and produce all of their fruiting flowers at one time. Indeterminate tomato plants continue to grow and produce fruiting flowers throughout the entire season.

Heirloom tomato varieties have become popular in many local fresh markets. They are old varieties that have been passed down from generation to generation. They are generally not well suited to large-scale production for various reasons, including difficulty in shipping, lack of fruit firmness, uneven ripening, disease susceptibility, and indeterminate growth habit.

In the United States, tomatoes are harvested for two basic purposes: processing and fresh marketing. In recent years the United States has produced around 300,000 acres of processed tomatoes valued at \$600 to \$700 million and 130,000 acres of fresh-market tomatoes worth \$1.4 to \$1.6 billion (USDA Statistical Services bases value of production on total acres harvested times average price). Pennsylvania produces about 4,000 acres of fresh-market tomatoes with an annual value of between \$15 and \$25 million. Processing tomato production has historically been an important part of the tomato industry in Pennsylvania, but it has declined in significance in the past decade.

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# Marketing

Depending on location, fresh-market tomatoes are produced in Pennsylvania from the first of June (in a high tunnel) to the end of October. Tomato cultivars recommended for Pennsylvania are listed in Table 1. Fresh-market tomatoes are usually sold loose in bulk containers.

**Table 1. Recommended tomato cultivars for Pennsylvania.**

All cultivars are listed in order of maturity (early to late).

A = alternaria stem canker resistant

EBR = early blight resistant

FR = fusarium wilt resistant

N = root rot nematode resistant

RN = root knot nematode resistant

S = stemphylium wilt resistant

TMV = tobacco mosaic virus resistant

TSWV = tomato spotted wilt virus resistant

V = verticillium wilt resistant

## TRADITIONAL ROUND RED FRUIT TYPES

Sun Start (V, FR, S)

Sunrise<sup>a</sup> (V, FR, S)

Fabulous<sup>a</sup> (V, FR, TMV, S, A)

Sunbrite (V, FR)

Mountain Spring<sup>a</sup> (V, FR)

Solar Set<sup>a</sup> (V, FR)

Sunbeam<sup>a</sup> (V, FR)

Crista<sup>a</sup> (V, FR, RN, TSWV)

Mountain Supreme<sup>a</sup> (EBR, V, FR)

Mountain Fresh<sup>a</sup> (V, FR)

Mountain Delight<sup>a</sup> (V, FR)

## SPECIALTY CHERRY TYPES

Sweet Million<sup>a</sup> (FR)

Sweet 100 (V, FR)

Sweet Chelsea<sup>a</sup> (TMV, F, FR, N, larger cherry type)

## YELLOW TYPES

Gold Nugget (cherry tomato)

Mountain Gold<sup>a</sup> (V, FR)

Sunray (FR)

## HEIRLOOM TYPES

Mister Stripy

Prudens Purple

Brandywine Red

Mortgage Lifter

## NOTE

a. Hybrid variety

Six basic marketing alternatives are available to the tomato grower: wholesale markets, cooperatives, local retailers (grocery stores), roadside stands, pick-your-own operations, and processing firms. Options are available for growing processing tomatoes; however, this publication will focus on fresh-market tomatoes.

In wholesale marketing, either you or a shipper can take your crop to the market. Shippers generally sell and transport tomatoes for a predetermined price. Wholesale marketing is subject to the most price fluctuations. Marketing cooperatives generally use a daily pooled cost and price, which spread 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 tomatoes when stores require them. Roadside stands (either your own or another grower's) and pick-your-own operations provide opportunities to receive prices higher than wholesale for your tomatoes, 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 also be willing to accept some waste and assume the risks of having the public come to your farm. For more information on marketing, consult *Agricultural Alternatives: Fruit and Vegetable Marketing for Small-scale and Part-time Growers*, *Agricultural Alternatives: Developing a Roadside Farm Market*, and *Agricultural Alternatives: Cooperatives*.

## Production Considerations

Tomatoes grow best on well-drained soils that have good air and water infiltration rates. You should conduct a soil test prior to planting tomatoes. Lime should be applied to achieve a pH of 5.8 to 6.6 according to soil test recommendations. You can obtain soil test kits at your local extension office.

Tomatoes require a constant supply of moisture during the growing season. However, excess water at any time during growth, especially after fruit set, may increase the fruit's susceptibility to cracking (both radial and concentric), which can reduce fruit quality and yield. For more information on crop irrigation, consult *Agricultural Alternatives: Irrigation for Fruit and Vegetable Production* and *Agricultural Alternatives: Drip Irrigation for Vegetable Production*.

Tomatoes are sensitive to cool night temperatures (below 55°F). The best temperature range for the growing season is between 60° and 90°F; temperatures above 90°F or below 55°F will slow the growth, pollination, and maturation of the crop.

## Planting and Fertilization

Commercially produced tomatoes generally are started as transplants in the greenhouse 42 to 56 days prior to planting in the field. Because tomatoes are a warm-season crop, they should not be transplanted until soil temperatures 3 inches beneath the soil surface reach 60°F. Tomatoes should

be grown on raised beds covered with red or black plastic mulch. Growing the plants with drip irrigation ensures optimum plant growth and yields and allows for easy fertilizer application during the growing season.

Growers generally plant 2,600 to 5,800 plants per acre in single rows with 18 to 30 inches between plants in the row on 5.0- to 6.5-foot centers. A double row of compact tomato varieties also can be planted on each plastic-covered bed (10,000 plants per acre). Fertilizer rates should be based on annual soil test results. Soil testing is vital for a high-quality crop of tomatoes, as many of the causes of poor fruit development and quality are nonbiological and due to poor nutrition. Start the season with an application of fertilizer based on the soil test results. Apply 50 percent of the fertilizer at soil preparation. The best way to determine your in-season fertilizer needs is by using a tissue test. Plant tissue testing should be conducted at the start of flowering and again 2 to 3 weeks later when green fruit are on the vine. Tissue sample kits may be obtained at your local extension office as well as from independent labs. Common nutritional needs at these critical points are additional calcium, magnesium, and potassium, as well as continuing applications of nitrogen and phosphorus. Nutrients are best applied through a fertilizer injection system connected to the drip irrigation system. According to *Knott's Handbook for Vegetable Growers*, tomatoes will require 80 to 90 pounds of N, 100 pounds of P<sub>2</sub>O<sub>5</sub>, and between 100 and 200 pounds of K<sub>2</sub>O during the growing season.

In order to produce high-quality tomatoes, the plants require support off the ground. Many growers use a production system known as the Florida String Weave System. First, wooden stakes 4 to 4.5 feet long and 1 inch square are driven into the ground to a depth of 12 inches. A consistent stake height should be maintained to aid in spray applications without constant adjustment of the boom sprayer. Stakes should be driven between every two plants and twine woven through the stakes to support the tomato stems. Second, twine should be secured to the end stake and strung along one side of the plants by weaving the twine around each stake. Repeat this procedure on the other side. The first level of twine should be at 8 to 10 inches above the ground and the last two levels should be approximately 6 to 8 inches apart. Normally, only three levels of twine are needed. Waiting until wet plants have dried before stringing tomatoes will help reduce the potential for spreading fungal diseases.

## 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 tomatoes, depending on the specific weed problem and tomato growth stage. If infestation levels are mild, early cultivation can help minimize weed problems.

Insects, especially Colorado potato beetles, can be a major problem in tomato production. Initial spring beetle populations generally will not feed on the tomato plants but will mate and lay thousands of eggs per acre. Early control

of adult Colorado potato beetles can prevent crop losses. Aphids, corn ear worm, European corn borer, armyworm, thrips, whiteflies, spider mites, and fruit flies also can cause crop losses. Monitoring insect populations with traps or by weekly scouting will help you determine if you should use insecticides and how often you should spray.

Several tomato diseases can cause crop losses, including bacterial canker, bacterial speck, bacterial spot, leaf blights, viruses, early blight, late blight, anthracnose, and bacterial soft rot. Several fruit disorders are also caused by extremes in soil moisture or weather conditions. These include cat-facing, blotchy ripening, graywall, yellow shoulders, sunburn, sunscald, and fruit cracking. Plant diseases and fruit disorders can be managed by using fungicides and disease-resistant varieties, maintaining proper plant nutrition, rotating crops, and growing in soil with good air and water drainage.

Tomatoes can also be grown organically, but this will require a high level of management and monitoring to be economically successful. For more information about organic vegetable production consult *Agricultural Alternatives: Organic Vegetable Production*.

## Harvest and Storage

Harvesting fresh-market tomatoes is labor intensive and requires multiple pickings. Tomatoes generally are harvested four to six times during the growing season, depending on plant type, maturity, and market value. Tomatoes for the wholesale market are usually picked at the mature green to breaker stage to prevent the fruit from becoming overripe during shipping and handling. Tomatoes may be left on the vine to ripen if you can bring ripe tomatoes to market quickly and in good condition. Markets such as farmers' markets, roadside stands, or other direct markets will allow you to vine-ripen the tomatoes before harvesting. After harvest, growers should check tomatoes for size, color, and defects to ensure marketing a high-quality product.

Tomato storage is determined by maturity. Mature green tomatoes ripen at an optimum temperature range of 63 to 70°F and will not ripen normally if temperatures are higher than 80°F or lower than 55°F. Mature red tomatoes will retain high quality for approximately four to seven days if stored at 90 to 95 percent humidity and 46 to 50°F.

## Local Regulations

All agricultural producers in Pennsylvania, including small-scale and part-time farms, operate under Pennsylvania's Clean Streams Law. A specific part of this law is the Nutrient Management Act. Portions of the Nutrient Management Act (Act 38) may pertain to you, depending on the mix of enterprises you have on your farm (in particular, animal operations). Because all farms are a potential source of surface- or groundwater pollution, you should contact your local Soil and Water Conservation District to determine which regulations may pertain to your operation.

## Sample Fresh-Market Tomato Budget

Summary of estimated costs and returns per acre. Budget based on 500 cartons per acre (25 pounds per carton).

Items	Quantity	Unit	Price	Amount	Your Estimate
<b>Variable costs</b>					
Custom					
Applying calcium lime	0.5	ton	\$30.00	\$15.00	_____
Pest scouting	8	acre	\$10.00	\$80.00	_____
Applying fertilizer	1	acre	\$20.87	\$20.87	_____
Fertilizer (total needs of the plant)					
Nitrogen	85	pound	\$0.45	\$38.25	_____
Phosphorus	100	pound	\$0.32	\$32.00	_____
Potassium	150	pound	\$0.30	\$45.00	_____
Herbicides					
Devrinol	3	pound	\$10.20	\$30.60	_____
Poast	0.5	gallon	\$73.70	\$36.85	_____
Matrix	1	ounce	\$13.50	\$13.50	_____
Sencor/Lexone	0.66	pound	\$17.10	\$11.29	_____
Fungicides					
Bravo Weather Stik	6	gallon	\$49.70	\$298.20	_____
Kocide	8	pound	\$3.00	\$24.00	_____
Manzate 200 DF	48	pound	\$3.00	\$144.00	_____
Tanos 50 W	8	ounce	\$1.39	\$11.12	_____
Copper	1	pound	\$1.90	\$1.90	_____
Insecticides					
Asana XL	10.24	ounce	\$0.64	\$6.55	_____
Vydate L	0.5	gallon	\$70.00	\$35.00	_____
Baythroid	0.17	gallon	\$376.90	\$64.07	_____
Admire	0.18	gallon	\$564.20	\$101.56	_____
<b>Other variable costs</b>					
Land preparation	1	acre	\$52.82	\$52.82	_____
Plastic mulch installation and removal	1	acre	\$69.88	\$69.88	_____
Black, embossed or red plastic mulch	1	acre	\$300.00	\$300.00	_____
Drip irrigation (tape and labor)	1	acre	\$150.00	\$150.00	_____
Tomato transplants	5	thousand	\$90.00	\$450.00	_____
Planting transplants	1	acre	\$89.95	\$89.95	_____
Stakes	2.5	thousand	\$100.00	\$250.00	_____
Labor					
Staking and tying	16	hour	\$8.50	\$136.00	_____
Marketing and advertising	1	acre	\$50.00	\$50.00	_____
Hand harvest	1	acre	\$800.00	\$800.00	_____
Packing/grading	1	acre	\$180.00	\$180.00	_____
Cartons plus lids and shipping	500	carton	\$1.50	\$750.00	_____
Fuel	16.5	gallon	\$2.20	\$36.30	_____
Pest control including labor	1	acre	\$17.44	\$17.44	_____
Repairs and maintenance					
Tractors and implements	1	acre	\$9.82	\$9.82	_____
Interest on operating capital	1	acre	\$42.87	\$42.87	_____
<i>Total variable costs</i>				<i>\$4,394.83</i>	_____
<b>Fixed costs</b>					
Tractors/implements	1	acre	\$60.84	\$60.84	_____
Drip irrigation	1	acre	\$500.00	\$500.00	_____
Land charge	1	acre	\$150.00	\$150.00	_____
<i>Total fixed costs</i>				<i>\$710.84</i>	_____
<b>Total Cost</b>				<b>\$5,105.67</b>	_____

## Net returns for five different yields and prices (per 25-pound carton).

Prices	Yields				
	300	400	500	600	700
\$8.00	-\$1,994	-\$1,550	-\$1,106	-\$662	-\$218
\$9.50	-\$1,544	-\$950	-\$356	\$238	\$832
\$11.00	-\$1,094	-\$350	\$394	\$1,138	\$1,882
\$12.50	-\$644	\$250	\$1,144	\$2,038	\$2,932
\$14.00	-\$194	\$850	\$1,894	\$2,938	\$3,982

### Initial resource requirements for fresh-market tomatoes

- Land: 1 acre
- Labor: 19 hours per acre
- Harvesting: \$800 per acre
- Capital: \$6,000 per acre
- Depreciation on equipment: \$600 per acre
- Equipment needed:
  - Tractor—40 to 60 hp
  - Tillage equipment
  - Transplanter—may be rented
  - Sprayer—boom type
  - Wagon or trailer

## Risk Management

There are several risk-management strategies you may want to employ for your farm. You should insure your buildings and equipment, and you may also want to insure your crops. Insuring your farm may be accomplished by consulting your insurance agent or broker. You can also insure individual crops (like tomatoes) through traditional crop insurance policies and your whole-farm income through a program called AGR-Lite. To obtain AGR-Lite insurance you will need your last five years of Internal Revenue Service (IRS) Schedule F forms. Both types of policies are federally subsidized and are available from private crop insurance agents. Contact a crop insurance agent to see which type of coverage makes the best sense for you.

For more information on agricultural business insurance, please see *Agricultural Alternatives: Agricultural Business Insurance*. More information on crop insurance can be found on the Pennsylvania Crop Insurance Education Web site ([cropsins.aers.psu.edu](http://cropsins.aers.psu.edu)).

## Sample Budget

Included in this publication is a sample fresh-market tomato production budget. This budget utilizes custom hire for some of the field work. Hiring custom operators and labor may be a more viable option for small-scale or beginning producers, considering the large capital expenditures required for equipment. You should also investigate renting specific pieces of equipment like plastic mulch layers. Producers who own equipment should substitute equipment costs for custom-hire costs. This budget summarizes the receipts, costs, and net returns of a tomato enterprise and 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*.

## For More Information

### Publications

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## Association

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

## Some Heirloom Tomato Seed Sources

Johnny's Selected Seeds  
Foss Hill Road  
Albion, ME 04910-9731  
207-437-4395  
www.johnnyseeds.com

Rupp Seeds, Inc.  
17919 County Road B  
Wauseon, OH 43567  
419-337-1841  
www.ruppseeds.com

Tomato Growers Supply Co.  
P.O. Box 60015  
Fort Myers, FL 33906  
1-888-478-7333  
www.tomatogrowers.com

Territorial Seed Co.  
P.O. Box 158  
Cottage Grove, OR 97424-0061  
541-942-9547  
Fax: 888-657-3131  
www.territorial-seed.com

Seeds of Change  
1-888-762-7333  
www.seedsofchange.com

Totally Tomatoes  
334 West Stroud Street  
Randolph, WI 53956-1274  
www.totallytomato.com

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

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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.

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Produced by Information and Communication Technologies in the College of Agricultural Sciences

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Code # UA291

3M9/06mpc3995k