

# AGRICULTURAL ALTERNATIVES

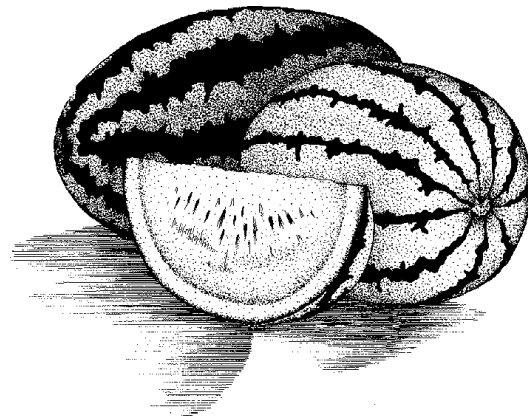
agalternatives.aers.psu.edu

## Watermelon Production

Watermelons lend themselves well to small-scale and part-time farming operations. There are multiple markets for growers with 5 acres or fewer, and many field operations, such as land preparation, planting, and harvesting, can be custom hired.

Watermelons are a member of the Cucurbitaceae family, which includes squash, pumpkins, cucumbers, muskmelons, and gourds. Individual plants produce both male and female flowers, and fruit size varies from 5 to 30 pounds, depending on variety. However, seedless varieties will require pollinators. Fruit shape and appearance are quite varied, ranging from round to cylindrical and a single color to various striped patterns on the fruit surface.

The culture of watermelons goes back to prehistoric times. The watermelon was cultivated in ancient Egypt and verified by David Livingstone (the noted missionary explorer) in the 1850s. When he found great tracts of watermelon (called kengwe) growing wild in the Kalahari Desert and semi-tropical regions of Africa. Even today, in semi-desert districts of Africa watermelons are cultivated as an important source of water during dry periods. Watermelon was widely distributed throughout the remainder of the world by African slaves and European colonists. It was carried to Brazil, the West Indies, Eastern North America, islands of the Pacific, New Zealand, and Australia. Written records indicate that watermelons were cultivated in Massachusetts as early as 1629, before 1664 by the Florida Indians, in 1673 in the Midwest, in 1747 in Connecticut (from seeds that originated in Russia), in 1799 by Indian tribes along the Colorado River, and in 1822 in Illinois. Watermelons are currently grown on all continents throughout the warm regions of the globe.



Most of the watermelons harvested in the United States are sold as fresh produce. According to the National Agricultural Statistics Service, the United States produced 126,000 acres of watermelons in 2009 with a value of \$460 million.

## Marketing

Fresh-market watermelons are produced in Pennsylvania from the end of July to the end of September. Watermelon cultivars recommended for Pennsylvania are listed in Table 1. Fresh-market watermelons usually are sold loose in bulk containers or in 800-pound cardboard bins. When planning production, first consider your ability to market. You should conduct some market research because growers often 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 watermelons for a prede-

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terminated price. If you do not use a contractor and ship your watermelons to a wholesale market yourself, your product will be subject to the greatest price fluctuations. Produce auctions operate weekly; however, you must deliver the watermelons 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 watermelons 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 watermelons, 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*.

## Production Considerations

Watermelons grow best on soils that hold water well and have good air and water infiltration rates. Soil should have a pH of 5.8–6.6. Watermelons are sensitive to cold temperatures, and even a mild frost can severely injure the crop. The best average temperature range for watermelon production during the growing season is between 65°F and 95°F. Temperatures above 95°F or below 50°F will slow the growth and maturation of the crop. Watermelons require a constant supply of moisture during the growing season. However, excess water at any time during crop growth, especially as fruit reaches maturity, can cause the fruit to crack, which will reduce crop yields and fruit quality.

## Planting and Fertilization

Commercial rowers generally transplant approximately 2,800–4,400 plants per acre in single rows 5–8 feet apart on plastic-mulched beds with 24–36 inches between plants in the row. Fertilizer rates should be based on annual soil test results. If you are unable to conduct a test, the recommended N-P-K (nitrogen, phosphorus, potassium) application rates are 40-50-50 pounds per acre banded at planting and 30-50-50

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

VARIETY	AVERAGE DAYS TO MATURITY	AVERAGE FRUIT SIZE (LBS)
<i>Seeded</i>		
Yellow Doll (yellow icebox)	68	5–7
Lantha (FR)	74	12–14
Carson (AR, FR)	85	15–18
Crimson Sweet (AFR, OS)	85	15–25
Sangria	87	22–26
Royal Sweet (FR)	85	20–22
<i>Seedless</i>		
Millennium (FR, AR, OT)	78	16–20
Revolution	80	20–26
Gypsy	82	13–17
Crisp'NSweet	83	15–20
Amarillo	84	15–16
Tri-X 313 (OT)	85	15–18
Super Crisp	85	14–16
Millionaire (OT)	92	18–22
<i>Personal Size</i>		
Vanessa	83	5–7
Leopard	85	4–6
<i>Pollenizers</i>		
SP-4		
Ace		
Sidekick		

Note: Seedless (triploid) watermelons produce fruits having few if any true seeds. Immature, white seed coats and, under certain conditions, a few dark seeds may be present in the fruit.

FR = fusarium resistant

AR = anthracnose resistant

OS = ozone sensitive

OT = ozone tolerant

pounds per acre injected during irrigation, applying no more than 5–7 pounds of nitrogen per application.

In recent years, the production of seedless (triploid) watermelons has equaled or surpassed the production of seeded (diploid) watermelons in Pennsylvania. Commercially produced watermelons (seeded and seedless) are generally started as transplants in the greenhouse 18–24 days prior to planting in the field. However, growing seedless watermelon transplants is more difficult than growing seeded varieties because of difficulties in germinating the seed. The key to success in germinating seedless watermelons is warm soil and limited watering. Water the planting media thoroughly the afternoon before planting, and then do not water again until plants emerge. Soil temperature in the transplant

containers should be maintained at 75–90°F from seeding through early seedling growth.

Because watermelons are a warm-season crop, they should not be transplanted until the soil temperature 3 inches beneath the soil surface reaches 60°F. Watermelons grow best on raised beds covered with black, green, (infrared-transmitting) IRT, or silver plastic mulch, with drip tape buried 2–3 inches below the soil surface. Watering the plants with drip irrigation ensures optimum plant growth and yields and allows growers to apply fertilizer during the growing season. For more information on crop irrigation, consult *Agricultural Alternatives: Irrigation for Fruit and Vegetable Production* and *Agricultural Alternatives: Drip Irrigation for Vegetable Production*.

## Pollination

For seedless watermelon production, a pollinator variety is required (see Table 1). Use a seeded watermelon variety with a distinctly different shape or appearance from the seedless variety that you are growing. Pollinators can be planted in rows using a 2 to 1 ratio with every third and outside row being the seeded variety. The pollinator can also be intermingled in the row with 2-3 to 1 ratio with every third or fourth plant being the pollinator variety. A large honeybee 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 honeybees.

## Pest Management

Weed control can be achieved with herbicides, plastic mulch, and a good crop-rotation system. Several preplant and postemergence herbicides are available for watermelons, depending on the specific weed problem and the growth stage. If infestation levels are mild, early cultivation (prior to vine running) can help reduce weed problems. Insects are a major problem in watermelon production. Cucumber beetle, aphids, seed corn maggot, leafminers, and rindworms (cucumber beetle larvae) can all cause crop losses. Monitoring insect populations with traps and scouting will help you determine when to apply pesticides and how often to spray. Several watermelon diseases can cause crop losses, including bacterial fruit blotch, fusarium wilt, powdery mildew, downy mildew, and gummy stem blight. Viruses such as cucumber mosaic (CMV), squash mosaic (SqMV), and watermelon mosaic (WMV-1, 2) are also a problem. 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 infiltration rates.

Many of the pesticides required for watermelon production are restricted-use pesticides and require a pesticide license to purchase. Pesticide applicator tests are usually

administered at county extension offices so you should contact your local office for dates and times for 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

Watermelons are hand-harvested at full maturity for best taste and texture. Indicators of watermelon fruit maturity include a yellow spot on the fruit surface in contact with soil or plastic mulch; a brown, dried tendril where the fruit stem is joined to the watermelon vine; and a dull surface on top of the fruit. Because individual fruits are pollinated at different times, multiple harvests are usually necessary. After harvest, growers should check watermelons for size, maturity, and pest damage to ensure marketing of a high-quality product. Cooling the watermelons after harvest to 45–50°F will remove field heat and improve shelf life and taste. Watermelons will retain good quality for approximately 21–28 days if stored at 85–90 percent humidity and 47–55°F.

## Environmental Regulations

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

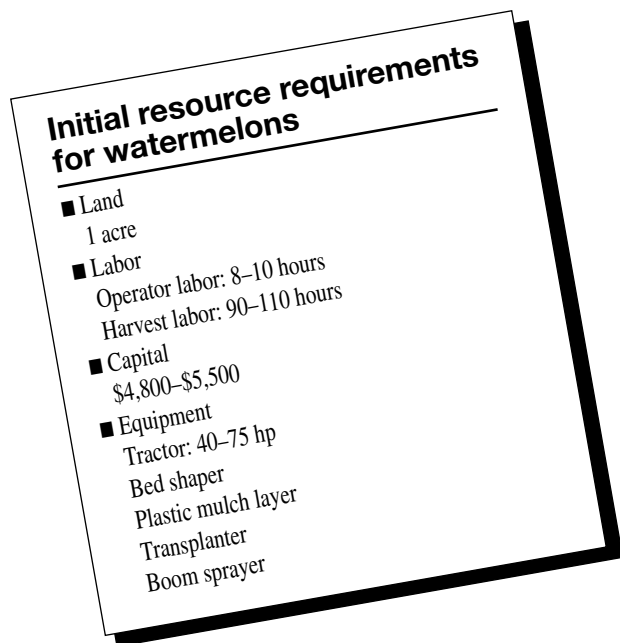
You may wish to consider several risk-management strategies for your operation. First, you should insure your facilities and equipment. This may be accomplished by consulting your insurance agent or broker. Second, you may want to insure your income through a crop insurance program called AGR-Lite.

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. Then contact an agent who sells crop insurance and insure the income of your operation. For more information, see *Agricultural Alternatives: Agricultural Business Insurance*. For more 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

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/fv/gapghp.htm](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 an annual fresh-market watermelon 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 their equipment costs for custom-hire costs. The budget summarizes the receipts, costs, and net returns of a watermelon 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 these budgets 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

Dunn, J. W., J. W. Berry, L. F. Kime, R. M. Harsh, and J. K. Harper. *Agricultural Alternatives: Developing a Roadside Farm Market*. University Park: Penn State Cooperative Extension, 2006.

Dunn, J. W., J. K. Harper, and L. F. Kime. *Agricultural Alternatives: Fruit and Vegetable Marketing for Small-Scale and Part-Time Growers*. University Park: Penn State Cooperative Extension, 2009.

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

Gross, K. C., C. Y. Wang, and M. Saltveit. *The Commercial Storage of Fruits and Nursery Stocks*. USDA-ARS Agricultural Handbook Number 66. Washington, D.C.: Superintendent of Documents, Government Printing Office, 2004.

Kime, L. F., J. A. Adamik, E. E. Gantz, and J. K. Harper. *Agricultural Alternatives: Agricultural Business Insurance*. University Park: Penn State Cooperative Extension, 2004.

Lamont, W. J. Jr., J. K. Harper, A. R. Jarrett, M. D. Orzolek, R. M. Crassweller, K. Demchak, and G. L. Greaser. *Agricultural Alternatives: Irrigation for Fruit and Vegetable Production*. University Park: Penn State Cooperative Extension, 2001.

Lamont, W. J. Jr., 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.

## Sample Watermelon Budget (15-lb average weight)

Summary of estimated costs per acre.

Item	Quantity	Unit	Price	Total	Your Estimate
<b>Variable Costs</b>					
Custom hire*	1	acre	\$249.80	\$249.80	_____
Fertilizer and lime	1	acre	\$151.87	\$151.87	_____
Herbicide	1	acre	\$68.90	\$68.90	_____
Fungicides	1	acre	\$39.55	\$39.55	_____
Insecticide	1	acre	\$138.98	\$138.98	_____
Watermelon transplants	3.6	thousand	\$250.00	\$900.00	_____
Plastic mulch**	7,260	feet	\$0.04	\$290.40	_____
Drip irrigation (tape)	7,260	feet	\$0.03	\$217.80	_____
Drip irrigation operating (water)	21	acre inches	\$20.00	\$420.00	_____
Labor	15	hour	\$10.00	\$150.00	_____
Operator labor	9.45	hour	\$15.00	\$141.75	_____
Hourly labor	0.57	hour	\$13.50	\$7.70	_____
Marketing and advertising	1	acre	\$500.00	\$500.00	_____
Hand harvesting	100	hour	\$12.00	\$1,200.00	_____
Cardboard bins (800 lb)	38	bins	\$12.50	\$475.00	_____
Fuel	19.5	gallon	\$3.10	\$60.45	_____
Repair and maintenance					
Tractors and implements	1	acre	\$33.38	\$33.38	_____
Interest charge	1	acre	7.00%	\$62.67	_____
<i>Total variable costs</i>				<i>\$4,858.45</i>	_____
<b>Fixed Costs</b>					
Tractors	1	acre	\$40.99	\$40.99	_____
Implements	1	acre	\$38.51	\$38.51	_____
Drip irrigation***	1	acre	\$150.00	\$150.00	_____
Land charge	1	acre	\$200.00	\$200.00	_____
<i>Total fixed costs</i>				<i>\$429.50</i>	_____
<b>Total costs</b>				<b>\$5,287.95</b>	_____

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

\*Custom hire includes soil testing, spreading fertilizer and lime, land preparation, pest scouting, and bee rental.

\*\*Plastic mulch may be black, embossed, or IRT green.

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

### Net returns for five different yields and prices

Price	Yield Melons				
	1,000	1,500	2,000	2,500	3,000
\$2.00	\$(2,200.45)	\$(1,744.20)	\$(1,287.95)	\$(831.70)	\$(375.45)
\$2.50	\$(1,700.45)	\$(994.20)	\$(287.95)	\$418.31	\$1,124.56
\$3.00	\$(1,200.45)	\$(244.20)	\$712.06	\$1,668.31	\$2,624.56
\$3.50	\$(700.45)	\$505.81	\$1,712.06	\$2,918.31	\$4,124.56
\$4.00	\$(200.45)	\$1,255.81	\$2,712.06	\$4,168.31	\$5,624.56

MacNab, A. A., A. E. Sherf, and J. K. Springer. *Identifying Diseases of Vegetables*. University Park: Penn State Cooperative Extension, 1994.

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

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

## Associations

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

## Web Sites

Mississippi State University: Vine Crops in Mississippi  
[msucares.com/crops/comhort/vine.html](http://msucares.com/crops/comhort/vine.html)

Purdue University: Diseases and Pests of Muskmelons and Watermelons  
[www.agcom.purdue.edu/AgCom/Pubs/BP/BP-44.html](http://www.agcom.purdue.edu/AgCom/Pubs/BP/BP-44.html)

University of Delaware: Watermelon Production Guide for Delaware and Maryland—Watermelon (and Stockmelon, Pie Melon, or Citron Melon)  
[ag.udel.edu/enwc/faculty/dmcaron/Pollination/watermelon.html](http://ag.udel.edu/enwc/faculty/dmcaron/Pollination/watermelon.html)

University of Georgia: Commercial Watermelon Production  
[www.agmrc.org/media/cms/B996\\_B3D54FD90A36C.pdf](http://www.agmrc.org/media/cms/B996_B3D54FD90A36C.pdf)

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