



AGRICULTURAL ALTERNATIVES

Apple Production

Apples may be grown in many parts of the country and lend themselves well to part-time farming operations. The initial investment for apples can be high depending on the production method chosen, land preparation, and initial investment in the trees. A commercial orchard is expected to be productive for at least 20 years, so this investment will be spread over a longer period of time than many crops. Depending on the amount of land devoted to the orchard, production method, and tree size, equipment costs may be held to a minimum. If the orchard is a part of an existing agricultural operation, you may already have much of the needed equipment.

Apple production will require many hours of labor, depending on the size of the orchard. Land preparation and planting will require at least two people. During the summer months, the orchard will require mowing, multiple pesticide applications, and fruit thinning. Depending on the mix of varieties and orchard size, additional labor may be required at harvest time. Although you may be able to accomplish these tasks with family members and local part-time labor, use of hired labor may also be necessary.

According to the United States Department of Agriculture's (USDA) National Agricultural Statistics Ser-



vice, more than 5,000 farms with almost 85,000 acres of apples are located in the northeastern United States. Pennsylvania produces 400 to 500 million pounds of apples per year and ranks fourth in the nation for apple production. The majority of the production is centered in the southcentral part of Pennsylvania (due in large part to the topography of the land), but apples can be found commercially throughout the Commonwealth.

Marketing

Depending on the apple varieties produced (commonly referred to as "cultivars"), most apples are harvested and marketed from late August through October. If regular cold storage is used, the marketing season can be extended through March. If controlled-atmosphere

(CA) storage is available, the marketing season may be extended through July. Apples may be sold directly to consumers (usually through a farmer's market or roadside stand), marketed wholesale to packers, or sold to processors.

Apples marketed wholesale are traditionally sold to a fruit packer or processor. Fruit packers grade and pack apples for the fresh market. Fresh-market apples typically yield a higher return than processed apples. Processors use apples to make apple sauce, apple juice, and a variety of other products. It is recommended that you explore marketing options prior to ordering the trees from the nursery so the cultivars that best fit meet expected demand.

Apples sold through a roadside stand need to be of the highest quality. This will ensure repeat customers from year to year. Roadside marketers generally sell a wide variety of cultivars so the marketing season is not interrupted. Roadside marketing is time consuming, but it can also be very financially rewarding. When direct marketing, you will also need a marketing plan for fruit that cannot be sold as first quality. These alternative markets may include selling apples at different price points and in bulk quantities or using them to make processed apple products like cider, dried apples, or apple butter. Selling processed apple products is a good way to help diversify your product mix and extend the marketing season for your apples. However, there are many regulations and risks involved with food processing activities. If you want to pursue this option, it is better in most situations for you to contract with someone who has the necessary facilities and experience to process your apples for you. For more on marketing, refer to "Agricultural Alternatives: Fruit and Vegetable Marketing for Small-scale and Part-time Growers." For more on roadside marketing, refer to "Agricultural Alternatives: Developing a Roadside Market."

Site Selection

The success of any orchard is directly related to planning and preparation. The ideal site for an orchard consists of rolling or sloping land to enhance air drainage during periods of spring frosts. The best site is south

facing with a slope of between 4 and 8 percent because operating equipment on steeper slopes may be difficult. Sites with deep, well-drained soils are preferred because shallow, poorly drained soils cause root system problems. Consult a county soil map prior to site selection. Soil maps may be obtained at your county extension office or from USDA's Farm Service Agency.

Another consideration when choosing a site is irrigation. Regardless of the type of irrigation system used, locating the orchard close to a water source will simplify setting up the system and reduce operating expenses. For more information on overhead and drip irrigation for tree fruit production, consult "Agricultural Alternatives: Irrigation for Fruit and Vegetable Production" and "Agricultural Alternatives: Drip Irrigation for Vegetable Production."

Land Preparation

The land should be prepared as if planting a traditional field crop. The soil should be plowed and leveled with a disk and harrow. Starting with an even orchard floor will reduce the possibility of standing water and make fruit harvesting and transportation easier. Establishing an orchard in well-prepared soil rather than established sod will also aid in keeping the tree rows and row middles free of broadleaf weeds.

Prior to planting trees, a soil fertility test and nematode survey are recommended. Penn State provides a soil testing service through the Agricultural Analytical Services Laboratory for a fee. You can contact the lab by going to its website (agsci.psu.edu/aasl) or calling 814-863-0841. You will want to request a complete nutrient analysis plus organic matter. Nematode testing services are available from the University of Delaware Plant Diagnostic Clinic (at extension.udel.edu/ag/plant-diseases/ud-plant-diagnostic-clinic) or by calling 302-831-1390) or the Virginia Tech Nematode Assay Laboratory (<https://www.ppws.vt.edu/extension/nematode-laboratory/index.html>) or by calling 540-231-4650). The two tests may be taken at the same time, but the soil samples must be handled differently. Consult the instructions on both kits to ensure accurate results.

The results from the soil test provide recommenda-

tions for any soil amendments such as lime and/or fertilizer needed prior to orchard establishment. The best way to add soil amendments for an orchard is to incorporate them into the soil prior to planting trees. The nematode survey is critical before planting to determine if any treatments are needed to eliminate harmful nematodes. Left untreated, nematodes may damage the root system of the trees and can stunt or kill them before they bear fruit. This will result in uneven tree growth and delayed or decreased production.

Ordering Trees

Trees should be purchased from a reputable nursery to ensure they are true to variety and free of disease. Most nurseries also provide a guarantee of survivability; check for this guarantee before ordering trees. The nursery can also offer advice concerning tree and row spacing. In recent years due to a shortage of apple rootstocks, trees may need to be ordered two years in advance.

The size of the mature tree will depend on the cultivar and rootstock of the tree. The rootstock, however, is the dominant factor that controls tree size. Most commercial growers are now utilizing dwarf rootstocks because they are easier to prune and harvest. Another advantage of dwarf rootstocks is their earlier production. They usually produce fruit in the second or third season after planting as compared to five years for the larger trees. Recommended dwarf rootstocks include Malling 9 (M.9, which has many clones of varying vigor), Budagovsky 9 (B.9, known for its cold hardiness), and fire-blight-resistant rootstocks like Geneva 41 (G.41), Geneva 11 (G.11), and Geneva 935 (G.935). Trees planted on dwarfing rootstocks will need to be supported by a trellis or individual posts. Semi-dwarf rootstocks are still available, but they produce a larger tree that comes into bearing later. Some of these rootstocks will benefit from providing tree support, but others do not require it. In order of increasing size they are Malling 26 (M.26), Malling 7 (M.7), and Malling Merton 111 (MM.111). A third alternative is to utilize interstem trees, which have a vigorous rootstock with a dwarfing rootstock grafted onto it, followed by the cultivar. The result is a three-part tree that is slightly

smaller than a semi-dwarf tree but does not normally need support. Interstem trees are, however, more expensive than the standard two-part tree.

The apple cultivars you choose to plant will depend largely on how you intend to market your fruit. Most apple growers who sell fruit directly to the consumer will need to choose five to six cultivars that spread their harvest out over a period of time (this also helps spread out the need for harvest labor). Direct retail marketers may also wish to consider specialty or niche markets. For example, there is a growing awareness of heirloom cultivars as a market alternative. Growers who sell their fruit through a packing house or to a processor may only want to plant two or three different cultivars. Recommended fresh-market cultivars for Pennsylvania include Empire, Fuji, Gala, Ginger Gold, Golden Delicious, Honeycrisp, McIntosh, and Red Delicious, with new varieties continuously being developed. It is best to approach the packing house first to see what cultivars they normally sell. The most common processing cultivars planted in Pennsylvania are Golden Delicious and York Imperial. Other cultivars that can be grown for processing include Granny Smith, Gravenstein, Idared, McIntosh, Northern Spy, and Rome Beauty. Not all of these cultivars can be grown in all areas of Pennsylvania. Consult your Penn State Extension county office to determine which cultivars are best suited for your area and if any cultivars are in higher demand for your region.

Certain cultivars of apples are resistant to apple scab. Apple scab is the most serious disease problem in producing apples in Pennsylvania. Using scab-resistant cultivars can reduce the amount of fungicides that need to be applied. Some of the cultivars that are resistant to apple scab include Crimson Crisp, Crimson Topaz, Enterprise, GoldRush, Liberty, and Redfree. People wishing to produce organic apples (which can be very challenging in a humid climate) should consider growing apple-scab-resistant cultivars. Consult your local extension office for additional scab-resistant cultivars.

A more thorough discussion of apple cultivars and rootstocks can be found in the *Penn State Tree Fruit Production Guide* or at extension.psu.edu/plants/tree-fruit/commercial-tree-fruit-production/cultivars-and-rootstocks.

Layout and Planting

Regardless of whether you are laying out an orchard on level or sloping land, care should be taken to make the rows as evenly spaced as possible. The distance between the rows should be the same throughout the orchard. Placing stakes in the rows prior to planting will help to ensure the distance between the rows is the same throughout. This should be strived for whether planting in straight rows or on a contour. The maximum size of the tree will determine the distance between the rows and the distance between the trees in the row. The number of trees required per acre for various tree spacings can be found in Table 1.

When planning the orchard, early blooming cultivars that are most susceptible to frost should be placed in areas with the best air drainage. Later blooming and ripening cultivars can be placed lower on hillsides or in areas more prone to frost. If possible, orchard rows should be laid out so they are oriented running north to south to maximize exposure to sunlight. If this is not possible due to slope consideration, position the rows on the contour to facilitate safe spraying and machinery operation.

Pollenizers and Pollination

To ensure adequate pollination in the spring, it is necessary to plant more than one cultivar in the orchard. Apple cultivars are self-unfruitful, which means they will not pollinate themselves and you need to plant at least two different cultivars with overlapping bloom periods. Some cultivars have nonviable pollen, so at least three different cultivars are required. Planting several cultivars will also ensure having fruit to market throughout the harvest season because they mature at different times.

Pollenizers can be placed as solid separate rows (but no more than two to three rows from a cultivar that is to be pollinated) or in the row with other cultivars. If the pollenizers are placed in the rows, use cultivars that look different so that the harvesters do not accidentally pick this fruit along with the main cultivar. Bees generally move down the row, not across rows, when pollinating. By placing pollenizer cultivars in the row, better pollination is possible. Your nursery can recommend cultivars that will pollinize other cultivars.

A large honey bee population is essential for complete pollination and fruit set. One hive per acre is recommended for maximum fruit production. If you

Table 1. Number of trees per acre at various tree spacings.

		SPACING (IN FEET) BETWEEN TREES							
		5	6	7	8	9	10	11	12
SPACING (IN FEET) BETWEEN ROWS	8	1,089	907	777	680				
	9	968	806	691	605	537			
	10	871	726	622	544	484	435		
	11	792	660	565	495	440	396	360	
	12	726	605	518	453	403	363	330	302
	13	670	558	478	418	372	335	304	279
	14	622	518	444	388	345	311	282	259
	15	580	484	414	363	322	290	264	242
	16	544	453	388	340	302	272	247	226
	17	512	427	366	320	284	256	232	213

do not have your own honey bees, you will need to contact a beekeeper to provide hives. Care must be taken with insecticides applied at flowering because they can adversely affect pollinating insect populations, especially honey bees. Honey production may provide an additional diversification opportunity for orchardists. More information on bees and honey production can be found in “Agricultural Alternatives: Beekeeping.”

In recent years many different insects have been recognized for their role as pollinators. For more information on solitary bees and wild pollinators, go to the Mid-Atlantic Apiculture Research and Extension Consortium website (agdev.anr.udel.edu/maarec).

Production Considerations

In the United States, anyone desiring to purchase restricted-use pesticides is required to have a pesticide applicators license. Even some materials used in organic production now require a license. In Pennsylvania, the licensing procedure is handled by the Pennsylvania Department of Agriculture. Please check with your state regarding these requirements.

Because of the complexity of apple production and the large number of pests and diseases that attack both trees and fruit, this publication cannot cover all necessary production practices and procedures. For more information on the diseases and conditions affecting apples, consult the *Penn State Tree Fruit Production Guide*, which can be purchased from your Penn State Extension county office. This valuable guide describes appropriate cultural and chemical treatments for the control of insects, diseases, and weeds. More information, including factsheets and a fruit production newsletter, can be found online at extension.psu.edu/plants/tree-fruit.

Thinning

Once the fruit has set, thinning of the fruit is required to ensure large, marketable fruit and flowering (“return bloom”) in the following year. Thinning may be accomplished chemically and/or by hand. The earlier thinning is completed, the larger the fruit will be at

harvest and the better the return bloom for the following year. If chemical thinning is used, follow all label directions for rate and the timing of the applications. If the thinning is completed by hand, begin thinning no later than mid-June. This allows for a natural phenomenon called “June drop” to occur so less time will be required for hand thinning. June drop occurs approximately 3 to 4 weeks after bloom when a small percentage of the apples that did not begin to grow will naturally drop.

Fertilization

Nutritional requirements of apple trees vary through their lifetimes and are influenced by such factors as rootstock, crop load, soil type, and weather conditions. In addition to nitrogen, phosphorus, and potassium, apple trees need adequate levels of calcium, boron, copper, and zinc to maintain the health of the tree and produce quality fruit. After planting, soil tests and leaf analyses are recommended at least once every three years. A leaf analysis is the most accurate way to check if applied soil amendments are being used by the tree. Leaf analysis test kits can be purchased at your Penn State Extension county office or ordered online at agsci.psu.edu/aasl.

Pruning and Training

There are many different pruning and training systems used in apple production. Your choice of rootstock and tree spacing will have a large impact on the system you use. Common training systems used in Pennsylvania include the central leader system, vertical axe, tall spindle, and various forms of trellising. At the Tree Fruit Resources Website (extension.psu.edu/plants/tree-fruit) under “Fruit Culture” is a link to “Cookbook Guidelines for Apple Training Systems.” Regardless of the system you use, you will need to prune and train the trees annually beginning the year you plant the trees and continue for the life of the orchard. Most pruning is done during late winter before the trees leaf out in the spring. Some growers also prune trees during the summer to increase light penetration into the trees to improve fruit color.

Harvest and Storage

Whether apples are marketed fresh or processed, they are traditionally harvested by hand into large wooden or plastic bins that vary in size from 20 to 25 bushels each. Extreme care must be taken not to bruise or damage the fruit during the harvest process because this reduces quality and storability and will reduce the returns realized from the sale of the apples.

Even if some family labor is used for harvest, outside labor may be necessary to harvest the crop in a timely manner. If you use hired labor, you are required to follow all laws and regulations concerning hired labor. More information concerning hired labor can be found in the *Penn State Tree Fruit Production Guide*, “Agricultural Alternatives: Starting or Diversifying an Agricultural Business,” and “Agricultural Alternatives: Agricultural Business Insurance.”

There are two methods of storing apples. The first is regular cold storage, which involves refrigerating apples at 30 to 36°F. Water is traditionally used to increase humidity to slow loss of moisture from the apples. The second method used is controlled-atmosphere (CA) storage, which requires removing oxygen from a sealed, refrigerated room and adding carbon dioxide to slow the maturation process. Apples stored in CA storage can be held until June or July before use.

There is a plant growth regulator called SmartFresh® that can help to extend the storage life of the fruit. It works by delaying the development of ethylene, a naturally occurring plant hormone that speeds ripening. Shortly after harvest the fruit is “gassed” in an enclosed container for 24 hours. This can extend the storage life of the fruit for several months beyond what can normally be achieved through regular cold storage.

Environmental Impacts

In the normal course of operations, farmers handle pesticides and other chemicals, may have manure to collect and spread, and use equipment to prepare fields and harvest crops. Any of these routine on-farm activities can be a potential source of surface water or groundwater pollution. Because of this possibility, you must understand the regulations to follow concerning the proper handling and application of chemicals and the disposal and transport of waste. Depending on the watershed where your farm is located, there may be additional environmental regulations regarding erosion control, pesticide leaching, and nutrient runoff. Contact your soil and water conservation district, extension office, zoning board, state departments of agriculture and environmental protection, and local governing authorities to determine what regulations may pertain to your operation.

Good Agricultural Practices and Good Handling Practices

Good Agricultural Practices (GAP) and Good Handling Practices (GHP) 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 GAP- and GHP-certified products from their producers. These programs set standards for worker hygiene, use of manure, and water supply quality.

These practices require an inspection from a designated third party 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 someone in your operation 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 ques-

tions to be asked during the inspection can be found at www.ams.usda.gov/fv/gapghp.htm. For more information about GAP and GHP, contact your local extension office or your state's department of agriculture.

Risk Management

You should carefully consider how to manage risk on your farm. First, you should insure your facilities and equipment. This may be accomplished by consulting your insurance agent or broker. It is especially important to have adequate levels of property, vehicle, and liability insurance. You will also need workers compensation insurance if you have any employees. You may also want to consider your needs for life and health insurance and whether or not you need coverage for business interruption or employee dishonesty. For more on agricultural business insurance, see “Agricultural Alternatives: Agricultural Business Insurance.”

Second, check to see if there are multi-peril crop insurance programs available for your farm enterprises. There are crop insurance programs designed to help farmers manage both yield risk and revenue shortfalls. Apple production involves large initial investments and can be very risky; weather-related crop losses are common and crop prices can be highly variable. Individual crop insurance policies for apples (if available in your county) or a Whole Farm Revenue Protection policy can help you reduce these risks. Coverage for apples is based on the actual production history (APH) of your operation; you can select between 50 and 75 percent of your APH yield to protect and you can insure your crop as either fresh market or processing. You may also want to consider the use of a separate hail insurance policy to better protect against this type of often very localized damage. Whole Farm Revenue Protection (WFRP) provides a risk management safety net for all commodities on your farm under one insurance policy. You can buy

WFRP alone or with other buy-up level (additional) federal crop insurance policies. Coverage levels range from 50 to 85 percent of your expected revenue or whole farm historic average revenue (based on your 1040-F information), whichever is lower. For more information concerning crop insurance, contact a crop insurance agent or check the Pennsylvania Crop Insurance Education Website at extension.psu.edu/crop-insurance.

Finally, the USDA Farm Service Agency has a program called the Non-insured Assistance Program (NAP) that is designed to provide a minimal level of yield risk protection for producers of commercial agricultural products that don't have multi-peril crop insurance coverage. NAP is designed to reduce financial losses when natural disasters cause catastrophic reduction in production. NAP coverage is available through your local USDA Farm Service Agency office. The application fee for this program may be waived for eligible limited-resource farmers.

Sample Budget

Included in this publication are two sample fresh-market apple budgets—one for land preparation and planting, and one for mature production. The budgets summarize the receipts, costs, and net returns at various stages of an apple enterprise. The sample budgets 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 approximations 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: Budgeting for Agricultural Decision Making.”

Sample Apple Budget: Land Preparation and Planting

Per-acre costs for land preparation and establishment based on 605 trees per acre.

ITEM	LAND PREPARATION	YOUR COSTS	PLANTING	YOUR COSTS	TOTAL	YOUR ESTIMATE
Variable Costs						
Custom operations						
Spreading lime	\$6.50					
Moldboard plowing	\$22.60					
Disking	\$37.80					
Harrowing	\$29.00					
Spread fertilizer	\$8.50					
Grass seeding	\$12.50					
Lime	\$40.00				\$40.00	
Fertilizer	\$86.75		\$4.42		\$91.17	
Grass seed	\$84.00				\$84.00	
Trees*			\$7,491.00		\$7,491.00	
Herbicides			\$93.96		\$93.96	
Insecticides			\$10.27		\$10.27	
Fungicides			\$90.71		\$90.71	
Drip tape			\$339.77		\$339.77	
Bar soap			\$681.00		\$681.00	
Tree guards			\$681.00		\$681.00	
Trellis system			\$3,457.86		\$3,457.86	
Rodenticide			\$10.00		\$10.00	
Labor	\$300.00		\$831.00		\$1,131.00	
Operator labor	\$39.14		\$268.74		\$307.88	
Diesel fuel	\$24.91		\$232.55		\$257.46	
Repairs and maintenance						
Tractors	\$19.39		\$52.77		\$72.16	
Equipment**	\$15.98		\$159.95		\$175.93	
Interest on operating capital	\$17.98		\$584.45		\$602.43	
<i>Total Variable Costs</i>	<i>\$745.05</i>		<i>\$14,989.45</i>		<i>\$15,734.50</i>	
Fixed Costs						
Tractors	\$15.98		\$106.76		\$122.74	
Implements**	\$19.39		\$346.67		\$366.06	
Land charge	\$200.00		\$200.00		\$400.00	
<i>Total Fixed Costs</i>	<i>\$235.37</i>		<i>\$653.43</i>		<i>\$888.80</i>	
Total Costs	\$980.42		\$15,642.88		\$16,623.30	

*Tree cost based on standard cultivars on dwarfing rootstocks for quantities over 500 trees. Royalties of up to \$1.50 or more per tree are charged on many of the newer cultivars.

**Includes irrigation system.

You should monitor local markets and contact suppliers to determine current prices for all items contained in this sample budget.

Sample Apple Budget: Mature Production

Per-acre costs for a mature planting based on 605 trees per acre.

ITEM	QUANTITY	YOUR QUANTITY	UNIT	PRICE	YOUR PRICE	TOTAL	YOUR ESTIMATE
Variable Costs							
Custom operations							
Spread fertilizer	1		acre	\$8.50		\$8.50	
Pest scouting	1		acre	\$40.00		\$40.00	
Bee rental	1		acre	\$100.00		\$100.00	
Lime plus spreading	0.5		ton	\$26.50		\$13.25	
Fertilizer	1		acre	\$35.40		\$35.40	
Herbicides	1		acre	\$139.14		\$139.14	
Fungicides	1		acre	\$465.07		\$465.07	
Insecticides	1		acre	\$408.45		\$470.23	
Foliar fertilizers/spray additives	1		acre	\$44.29		\$44.29	
Chemical thinning	1		acre	\$13.56		\$13.56	
Trellis maintenance	1		acre	\$90.00		\$90.00	
Labor							
Seasonal	24.4		hours	\$12.00		\$292.80	
Operator	5.75		acre	\$15.00		\$86.25	
Pruning	1		acre	\$454.00		\$454.00	
Harvesting	1		acre	\$1,600.00		\$1,600.00	
Marketing expense	10%		total sales	\$5,600.00		\$560.00	
Diesel fuel	68		acre	\$2.80		\$190.40	
Repairs and maintenance							
Tractors	1		acre	\$37.36		\$37.36	
Equipment*	1		acre	\$132.82		\$132.82	
Other							
Insect traps	1		acre	\$38.00		\$38.00	
Rodenticide	1		acre	\$10.00		\$10.00	
Crop insurance							
Fresh-market apple (50% coverage)	1		acre	\$315.00		\$315.00	
Apple fresh market (SCO)	1		acre	\$72.00		\$72.00	
Additional inputs							
Additional inputs							
Interest on operating capital	1		acre	\$108.74		\$108.74	
<i>Total Variable Costs</i>						\$5,316.81	
Fixed Costs							
Tractors	1		acre	\$74.25		\$74.25	
Implements*	1		acre	\$295.97		\$295.97	
Land charge	1		acre	\$200.00		\$200.00	
Additional inputs							
<i>Total Fixed Costs</i>						\$570.22	
Total Costs						\$5,887.03	

*Includes irrigation system.

You should monitor local markets and contact suppliers to determine current prices for all items contained in this sample budget.

Net returns for five different yields and prices.

PRICES PER BUSHEL	APPLE YIELD (BUSHELS PER ACRE)				
	600	700	800	900	1,000
\$5.00	\$(2,347.03)	\$1,932.10	\$2,431.97	\$2,931.85	\$3,431.72
\$6.00	\$(1,747.03)	\$2,632.10	\$3,231.97	\$3,831.85	\$2,271.72
\$7.00	\$(1,147.03)	\$3,332.10	\$4,031.97	\$4,731.85	\$3,271.72
\$8.00	\$(547.03)	\$4,032.10	\$4,831.97	\$5,631.85	\$4,271.72
\$9.00	\$52.97	\$4,732.10	\$5,631.97	\$6,531.85	\$5,271.72

Initial Resource Requirements

- Land: 1 acre
- Labor
 - Land preparation: 27 hours
 - Planting: 25 hours
 - Production labor (scouting, thinning, pruning, spraying, and mowing harvest labor): 48 hours
- Capital
 - Equipment: \$20,000 to \$30,000
 - Land preparation and planting: \$12,000 to \$13,000 per acre
 - Production years: \$4,000 to \$5,000 per acre
- Equipment
 - Tractor (minimum 45 horsepower)
 - Airblast orchard sprayer
 - Herbicide sprayer
 - Rotary mower
 - Tillage equipment
 - Containers (bulk bins, bushel crates, boxes)
 - Pruning equipment
 - Harvesting equipment

For More Information

Publications

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Sommerville, W. *Pruning and Training Fruit Trees* (Practical Horticulture). Woburn, Mass.: Butterworth-Heinemann, 1997.

Associations

Many states have horticultural societies or fruit growers associations. Many of these may be found through the following sources.

American Society for Horticulture Science
7931 East Boulevard Drive
Alexandria, VA 22308
www.ahs.org

International Fruit Tree Organization
16020 Swingley Ridge Rd., Suite 300
Chesterfield, MO 63017
www.ifruittree.org

North American Fruit Explorers
1716 Apples Road
Chapin, IL 62628
www.nafex.org

State Horticultural Association of Pennsylvania
697 Mountain Road
Orrtanna, PA 17353
www.shonline.org

Websites

Disease Management Guidelines for Organic Apple Production in Ohio
www.caf.wvu.edu/kearneysville/organic-apple.html

Fruit Production for the Home Gardener
extension.psu.edu/plants/gardening/fphg

Grower's Guide to Organic Apples
www.ento.vt.edu/Fruitfiles/VirginiaAppleSite.html

Guide to Farming in Pennsylvania
extension.psu.edu/business/farm/guide

ID-137: Total Quality Assurance: Apple Production: Best Management Practices
www.ca.uky.edu/agc/pubs/id/id137/id137.htm

Organic and Low-Spray Apple Production
attra.ncat.org/attra-pub/apple.html

University of Vermont Virtual Orchard
orchard.uvm.edu

Virtual Orchard
www.virtualorchard.net

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extension.psu.edu

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