

AGRICULTURAL ALTERNATIVES

Highbush Blueberry Production

Blueberries can be a suitable crop for small-scale and part-time farm operations. However, blueberry production is not for everyone due to the specialized cultivation requirements of the plants and the relatively short shelf life of the fruit. The initial investment is high, primarily because of the cost of preparing the land, establishing plants, and installing an irrigation system. However, equipment needs for small plantings are minimal once the plants are established and healthy, well-tended plants can be expected to bear fruit for fifty years or more. Demand for blueberries has been strong in recent years, and fresh-market prices have been relatively high because per capita consumption of blueberries in the United States has been increasing.

To meet this growing consumer demand, commercial blueberry acreage and production has doubled in the past fifteen years. Major increases have occurred in the Pacific Northwest, California, and in the southeastern United States. Half of world's commercial production is from the United States, with considerable production also occurring in Canada and Poland.

Four types of blueberries are grown North America: northern highbush (used in commercial plantings in cooler climates), lowbush (wild fruit harvested commercially in New England), and southern highbush and rabbiteye (used in commercial plantings in the southern United States). This publication focuses on northern highbush blueberry production.

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Marketing

Fresh-market blueberries usually are sold in plastic pint containers covered with lids. Marketing options available to the blueberry grower are wholesale markets, auctions, marketing cooperatives, local retail markets (grocery stores), processors, and direct marketing, including farmers' markets, roadside stands (either your own or another grower's), and pick-your-own operations. With the wholesale option, either you or a shipper takes your crop to the market. Shippers generally sell and transport the blueberries for a predetermined price. This marketing alternative has the greatest price fluctuations. Marketing cooperatives generally use a daily pooled cost and price, which spreads price fluctuations over all participating producers. To sell directly to local retailers, you need to contact produce managers and provide consistent quality when the stores demand the berries. Direct marketing provides an opportunity for you to receive higher-than-wholesale prices for your fruit. However, you may have significant expenses for advertising, building and maintaining a facility, and employing someone to serve your customers. In a pick-your-own operation, you save harvest costs, but you must be willing to accept that some fruit will not be harvested.

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Depending on your location, you may be able to sell your crop to a processor, but processing prices are much more volatile than fresh-market prices. For more information on marketing, consult *Agricultural Alternatives: Fruit and Vegetable Marketing for Small-scale and Part-time Growers* and *Agricultural Alternatives: Developing a Roadside Market*.

Because of increasing demand, prices for fresh-market blueberries have been relatively high, ranging from \$2.00 to \$5.00 per pint. Depending on the grower's location, processing prices have varied in recent years from less than \$0.65 per pound to as much as \$1.50 per pound.

At the present time, U.S. No. 1 (fruit of good average quality) is the only federally recognized blueberry grade. Federal inspectors check the berries primarily to determine the amount of diseased, soft, or leaky fruit. Fruit-marketing cooperatives often have additional criteria to judge berry quality, including flavor, ripeness, odor, and the presence of insects, foreign material, and stems.

Production Considerations

As with other small fruits, blueberries grow best in well-drained soils in full sun. It is often assumed that blueberries are easy to cultivate because they grow wild in poor soil or in wetland areas. The reality, however, is that blueberries have specific requirements that are different from those of most other agricultural crops. Well-drained soils with a low pH and high organic matter content, where native indicator plants such as wild blueberries, rhododendrons, and mountain laurel grow, are usually well suited to commercial blueberry production. Blueberries can also be grown on heavier soils with a high native pH, but special, well-planned measures must be taken if production is to be successful. When the soil type is too heavy (clays or clay loams) and/or the soil is of a limestone parent material, problems with nutrient availability and plant vigor are likely to occur, making close monitoring and frequent nutritional adjustments necessary.

The blueberry plant is a woody shrub with canes originating from the crown. The root system is shallow compared to the size of the plant. Highbush blueberries are usually 4 to 8 feet tall at maturity, but their root system rarely extends deeper than 24 inches. Irrigation is desirable to water the plants and provide frost protection, particularly in low areas. Trickle irrigation is most commonly used because it adds water to the root zone with little loss to the atmosphere and without wetting the fruit. However, sites requiring frost protection also need overhead irrigation capabilities.

Blueberries require a soil pH of 4.5 to 5.0. If the native pH of your soil is above 6.2, blueberry production is not recommended. If the pH is 6.2 or lower, the soil pH can be lowered by adding sulfur. In mineral (clay) soils, adding organic matter in the planting hole as well as using organic mulch is necessary. Growers most often use rotted sawdust, although peat moss or other forms of composted organic matter are suitable. Mushroom compost or other high-pH mulches and soil amendments should not be used.

To help control weeds, grow cover crops, such as rye or sudangrass, for at least one year before planting blueber-

ries. Adding organic matter by plowing under cover crops is particularly beneficial to blueberries, which produce best in soils with high organic matter content.

Growers usually plant blueberries 5 feet apart in rows spaced 8 to 12 feet apart. Use either potted or dormant plants purchased from a reputable nursery. Dormant plants should be planted in early spring, around April, but potted shrubs with foliage should not be planted until after the danger of frost has passed. Tender growth frequently found on these plants can be damaged by temperatures that are below freezing. Fall planting (mid- to late October) may also be used if growers wish to plant at a less busy time of the year, but success will vary depending on fall temperatures, and growers may find that some plants are heaved out of the ground by freeze/thaw cycles. Mulching after planting reduces this problem. Plant availability in the fall is also limited, so you may need to preorder your plants if fall planting is planned.

Apply a mulch of rotted sawdust or other non-alkaline organic mulch to a depth of 4 inches or more at planting, and maintain the mulch throughout the life of the planting. If it is unlikely that the mulch layer will be replenished, it may be better not to mulch at all, as roots will become exposed once the mulch decomposes. Remove flower blossoms for the first two years after planting, and remove about half of the buds in the third year. This practice allows the shrub to put its nutrients into plant establishment. Stunted plants may never recover. Since an established blueberry planting can produce fruit for fifty years or more, sacrificing a few pounds of fruit initially is well worth the cost.

Highbush blueberry plants require annual dormant pruning. Pruning controls crop load, which increases fruit quality. It also invigorates the plant by stimulating new growth from the plant's base. Pruning is usually done toward the end of the dormant season (usually March) when fruit buds are easily recognizable. Pruning involves the removal of small, spindly branches and canes that are poorly positioned, balancing cane ages, and thinning of the centermost canes to increase light penetration to the interior the plant.

Highbush blueberries will produce a small crop, approximately 2,000 pints per acre, in the third year. Fruit production will increase until the plants are about five years old, with average yields of 6,000 pints per acre possible under optimum conditions. Most small blueberry operations harvest their fruit by hand. Mechanical harvesters are available, but you need a large planting to justify the expense.

Much more detailed information on plant establishment and care, including a list of recommended highbush blueberry cultivars, can be found in *The Mid-Atlantic Berry Guide*. By selecting a mix of cultivars, growers can harvest blueberries from late June through late September in Pennsylvania. Due to the recent arrival of a new invasive fruit fly called spotted wing drosophila, growers are encouraged to utilize cultivars that produce fruit early in this season. Doing so avoids much of the damage from spotted wing drosophila, as its populations increase as the season progresses.

Pest Management

Several insect pests and diseases can injure or destroy a blueberry crop, so you need to carefully monitor and treat pests. Some pests affect the fruit, while others attack the plant. Pesticide application is just one management option. You should use a combination of practices, such as selecting a proper site and cultivar, planting disease-free shrubs, cultivating, and using soil amendments, to reduce the potential for disease and insect damage.

Birds are a serious problem on many blueberry farms, sometimes consuming over half the berries. In such cases, you may need to protect the crop with nets, chemical repellents, scare tactics, and noise devices. Of these, only netting results in complete protection year after year. Deer also can cause extensive damage by browsing and trampling the shrubs and eating the ripening berries. Hunting, fencing, and repellents are options for reducing deer damage.

Weeds are another problem that must be controlled in blueberry plantings. Because blueberry shrubs have shallow root systems without root hairs, they are at a disadvantage when competing with weeds for water and nutrients. By avoiding sites with persistent weeds and eliminating weeds before planting, you can greatly reduce many weed problems. Shallow cultivation, herbicide application, and sod maintenance between rows will help control weeds in established plantings.

Postharvest Handling

Proper postharvest handling of blueberries is critical to marketing success. You should cool the picked berries immediately after harvest to remove field heat and improve shelf life. Removing debris and underripe and overripe berries helps maintain quality and improves the appearance of the packaged fruit.

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 your local governing authorities to determine what regulations may pertain to your operation.

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 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 questions to be asked during the inspection can be found at www.ams.usda.gov/fv/gapghp.htm. For more information about GAPs and GHPs, 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 if 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 crop or livestock enterprises. There are crop insurance programs designed to help farmers manage both yield risk and revenue shortfalls. However, individual crop insurance coverage is not available for all crops. If individual coverage is not available for what you grow, you may be able to use the AGR/AGR-Lite program to insure the revenue of your entire farm operation. To use AGR-Lite you must have five years of Internal Revenue Service (IRS) Schedule F forms. For more information concerning crop insurance, contact a crop insurance agent or check the Pennsylvania crop insurance education website at extension.psu.edu/business/crop-insurance.

Finally, the USDA Farm Service Agency has a program called the Noninsured 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 Budgets

The sample budgets included in this publication summarize costs and returns for three phases of highbush blueberry production: land preparation, plant establishment, and fruit production from a mature (five years and older) blueberry planting. Land-preparation costs assume that major tillage and fertilizer application operations will be done either by a custom operator or with rented equipment. If you own the necessary equipment, costs for this equipment should be substituted for the custom costs included in the budget. Budgets for intermediate production years (one- to four-year-old plantings) are not included. They would have lower receipts and harvest costs than for the mature planting. The sample budgets should help ensure that you include all costs and receipts 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. Additional highbush blueberry budgets can be found in *The Mid-Atlantic Berry Guide*. More information on the use of crop budgeting in farm management decision making can be found in *Agricultural Alternatives: Budgeting for Agricultural Decision Making*.

Initial Resource Requirements

- Land: 1 acre
- Labor
 - Establishment: 70 hours
 - Production for years 1–4: 16–75 hours
 - Production for mature planting: 43 hours
 - Custom harvest labor: \$4,000–\$5,200
- Capital
 - Blueberry plants: \$4,000–\$5,000
 - Irrigation system: \$800
- Equipment needed
 - Tractor: 40 to 50 horsepower
 - Airblast sprayer: 50-gal PTO
 - Herbicide sprayer with small (4 foot or shorter) boom

Sample Fresh-market Highbush Blueberry Budget

Per-acre costs for land preparation

Item	Quantity	Unit	Price	Total	Your estimate
Variable costs					
Custom operations					
Soil test	1	acre	\$13.00	\$13.00	_____
Chisel plowing	1	acre	\$20.50	\$20.50	_____
Disking (cover crop)	1	acre	\$20.40	\$20.40	_____
Fertilizer spreading	2	acre	\$10.70	\$21.40	_____
Disk and harrow	2	acre	\$20.00	\$40.00	_____
Planting (cover crop)	1	acre	\$18.30	\$18.30	_____
Moldboard plowing (cover crop)	1	acre	\$24.90	\$24.90	_____
Grass seeding	1	acre	\$14.90	\$14.90	_____
Fertilizer	1	acre	\$357.50	\$357.50	_____
Seed	1	acre	\$69.05	\$69.05	_____
Hand labor	1	acre	\$6.75	\$6.75	_____
Interest	1	acre	\$5.85	\$5.85	_____
<i>Total variable costs</i>				\$612.55	_____
Fixed costs					
Land	1	acre	\$200.00	\$200.00	_____
<i>Total fixed costs</i>				\$200.00	_____
Total costs				\$812.55	_____

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

Sample Fresh-market Highbush Blueberry Budget

Per-acre costs for planting/establishment

Item	Quantity	Unit	Price	Total	Your estimate
Variable costs					
Custom operations					
Fertilizer spreading	2	acre	\$10.70	\$21.40	_____
Fertilizer	1	acre	\$25.00	\$25.00	_____
Herbicides	1	acre	\$122.92	\$122.92	_____
Insecticides	1	acre	\$29.63	\$29.63	_____
Plants	870	plants	\$5.30	\$4,611.00	_____
Drip tape	14,520	feet	\$0.03	\$435.60	_____
Mulch (sawdust)	0.33	acre	\$250.00	\$82.50	_____
Seasonal labor	73.4	hours	\$12.00	\$880.80	_____
Fuel	47.7	gallons	\$3.50	\$166.95	_____
Repairs and maintenance	1	acre	\$89.94	\$89.94	_____
Interest	1	acre	\$250.63	\$250.63	_____
<i>Total variable costs</i>				\$6,716.37	_____
Fixed costs					
Equipment*	1	acre	\$220.54	\$220.54	_____
Land charge	1	acre	\$200.00	\$200.00	_____
<i>Total fixed costs</i>				\$420.54	_____
Total costs				\$7,136.91	_____

*Includes irrigation system.

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

Sample Fresh-market Highbush Blueberry Budget

Per-acre costs for year after planting

Item	Quantity	Unit	Price	Total	Your estimate
Variable costs					
Custom operations					
Plant analysis kit	1	acre	\$10.70	\$10.70	_____
Fertilizer spreading	1	acre	\$25.00	\$25.00	_____
Fertilizer	1	acre	\$13.00	\$13.00	_____
Fungicides	1	acre	\$39.50	\$39.50	_____
Herbicides	1	acre	\$139.44	\$139.44	_____
Insecticides	1	acre	\$29.63	\$29.63	_____
Plants	20	plants	\$5.30	\$106.00	_____
Labor	1	acre	\$344.25	\$344.25	_____
Operator labor	2.8	hours	\$15.00	\$42.00	_____
Fuel	8	gallons	\$3.50	\$28.00	_____
Repairs and maintenance	1	acre	\$13.95	\$13.95	_____
Interest	1	acre	\$26.38	\$26.38	_____
<i>Total variable costs</i>				\$817.85	_____
Fixed costs					
Equipment	1	acre	\$28.62	\$28.62	_____
Land charge	1	acre	\$200.00	\$200.00	_____
Irrigation	1	acre	\$240.00	\$240.00	_____
<i>Total fixed costs</i>				\$468.62	_____
Total costs				\$1,286.47	_____

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

Sample Fresh-market Highbush Blueberry Budget

Per-acre costs for mature production based on 6,000 pints per acre

Item	Quantity	Unit	Price	Total	Your estimate
Variable costs					
Custom operations					
Plant analysis kit	1	acre	\$25.00	\$25.00	_____
Fertilizer spreading	1	acre	\$10.70	\$10.70	_____
Bee rental	1	acre	\$100.00	\$100.00	_____
Fertilizer	1	acre	\$81.25	\$81.25	_____
Herbicides	1	acre	\$171.80	\$171.80	_____
Insecticides	1	acre	\$104.19	\$104.19	_____
Fungicides	1	acre	\$144.01	\$144.01	_____
Labor					_____
Operator	4.6	hours	\$15.00	\$69.00	_____
Seasonal labor	41.6	hours	\$12.00	\$499.20	_____
Harvest labor	6,000	pints	\$0.85	\$5,100.00	_____
Packaging supplies (clam shells and flats)	1	acre	\$1,045.00	\$1,045.00	_____
Marketing expense (% of total)	10%	sales	\$1,800.00	\$180.00	_____
Fuel	15.6	gallons	\$3.50	\$54.60	_____
Repairs and maintenance	1	acre	\$26.50	\$26.50	_____
Interest	1	acre	\$185.08	\$185.08	_____
<i>Total variable costs</i>				\$7,796.33	_____
Fixed costs					
Equipment	1	acre	\$51.13	\$51.13	_____
Land charge	1	acre	\$200.00	\$200.00	_____
Irrigation	1	acre	\$240.00	\$240.00	_____
<i>Total fixed costs</i>				\$491.13	_____
Total costs				\$8,287.46	_____

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/pint	Blueberry yield (pints per acre)				
	5,000	5,500	6,000	6,500	7,000
\$2.00	\$2,766.71	\$3,239.62	\$3,712.54	\$4,185.46	\$4,658.37
\$2.50	\$5,266.71	\$5,989.62	\$6,712.54	\$7,425.46	\$8,158.37
\$3.00	\$7,766.71	\$8,739.62	\$9,712.54	\$10,685.46	\$11,658.37
\$3.50	\$10,266.71	\$11,489.62	\$12,712.54	\$13,935.46	\$15,158.37
\$4.00	\$12,766.71	\$14,239.62	\$15,712.54	\$17,185.46	\$18,658.37

For More Information

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Websites

Cornell University Berry Diagnostic Tool
www.fruit.cornell.edu/berrytool

Rutgers New Jersey Agricultural Experiment Station
Blueberry Bulletin
njaes.rutgers.edu/pubs/blueberrybulletin

Associations

Pennsylvania Vegetable Growers Association
815 Middle Road
Richfield, Pennsylvania 17086-9205
www.pvga.org

U.S. Highbush Blueberry Council
80 Iron Point Circle, Suite #114
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