

AGRICULTURAL ALTERNATIVES

Garlic Production

Garlic is a crop that is well suited to a small acreage or as part of a larger direct-marketing operation looking to diversify its mix of crops. It is well adapted for production in all parts of the United States. Yield and quality will vary with climate, region, altitude, soil and pH, cultural practices, and the variety of garlic. The term “biological elasticity” describes garlic’s ability to acclimate to these factors over time. No one practice is best suited for every situation. You will want to talk with local growers who have experience growing garlic and experiment with different cultural practices and varieties to discover the best combination for your operation.

Garlic (*Allium sativum*) is a member of the lily family. Garlic has been cultivated for thousands of years and is widely used for both its culinary and medicinal attributes. Although it is not certain when garlic was first discovered, it was probably dispersed by nomadic humans several thousand years ago. As early as the eighth century B.C. garlic was growing in Babylon, and Chinese scholars mentioned garlic as early as 3000 B.C.

Garlic consumption has quadrupled in the United States since 1980 and now stands at about 2 pounds per capita. Around 24,000 to 26,000 acres of garlic are planted annually in the United States with total production of around 400 million pounds. U.S. production is concentrated in California, with smaller acreages in Oregon, Nevada, Washington, and New York. About one-half of U.S. garlic production is sold in the fresh market; the other half is dehydrated. The average price of garlic has been around \$60 per cwt., but wholesale fresh-market prices have been consistently 3 to 4 times higher. The United States is the world’s largest importer of garlic, primarily from China, Argentina, and Mexico.



Marketing

Garlic can be sold by the pound, by the braid or rope, and at farmers’ markets by the individual bulb or by a bundle of freshly dug bulbs. Retail garlic prices vary considerably. Supermarkets generally sell garlic at around \$2.00 per pound, while some organic grocers sell garlic for as high as \$4.00 or \$5.00 per pound. Direct-market prices can go as high as \$1.00 or more per bulb for specialty varieties. At the wholesale level, garlic is normally traded as 5-, 22-, and 30-pound boxes; 3-pound ropes and braids; and cases of 48 2-bulb boxes.

When entering into commercial production it is very important to know the preferences of your customers. Garlic flavors range from very mild (elephant garlic) to very strong (Romanian Red). Find out what your customers prefer before selecting varieties.

Local retailers are another possible market, but you must take the time to contact produce managers and provide good-quality garlic when stores require it. Sale of your garlic through a roadside stand (either your own or another grower’s) can provide opportunities to

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receive higher prices, but this will require some additional expenses for advertising, building and maintaining a facility, and providing service to your customers. For more information on marketing, consult *Agricultural Alternatives: Fruit and Vegetable Marketing for Small-scale and Part-time Growers*.

Types of Garlic

Garlic may generally be divided into two subspecies: *ophioscorodon* (hardneck or topset garlic) and *sativum* (softneck or artichoke garlic). Hardneck garlic produces elongated flower stalks (technically called scapes) and bulbils at the top of the stalk. Softneck garlic does not produce bulbils, except in times of stress.

Hardneck garlic may be purple, purple striped, or white and is represented by varieties such as Roja, German Red, Valencia, Continental, and Creole. Creole garlic, a late variety covered with a deep purple skin, is the type grown in Mexico, South America, and the Imperial Valley of California.

With some hardneck varieties, seed stalks may often be topped with a cluster of small capsules called bulbels (also referred to as bulbils, topsets or, erroneously, bulblets). Although bulbels are sometimes used to produce small garlic bulbs, the seed stalks should be removed to maximize bulb size. The term bulblet is more correctly applied to the small round bulbs embedded in the scales of or attached to the large main bulb of certain cultivars and types.

Softneck garlic is also referred to as Silverskin, artichoke, or Italian garlic. Softneck types are best represented by the varieties California Early and California Late. Silverskin garlic may also be differentiated into many-cloved or few-cloved varieties, and may also be tan, all white, or purple tinged. Numerous strains exist, having been selected over the years by the various companies that produce them for dehydration or growers producing them for fresh market. Silverskin garlic rarely, if ever, produces seed stalks.

Elephant garlic (*Allium ampeloprasum*) is not true garlic but a type of leek that produces very large cloves (often only 3 or 4 per bulb). Several small bulblets may also develop. Its flavor is milder than garlic and can be slightly bitter. It also produces a large seed stalk that may be cut and sold to florists. The tender, fleshy lower portion of the seed stalk is also prized for stir-fried Asian dishes. Elephant garlic is sold mainly through farmers' markets, specialty produce stores, or specialty produce sections of supermarkets. More recently, sales to specialty processors for medicinal or health food use have increased.

Site Selection

Garlic can be grown successfully in any well-drained soil. Fusarium bulb rot and other bulb diseases are a major problem for garlic grown on poorly drained soils. Soils that are rich in organic matter with a pH of 6.0–6.5 are best. Heavy clay or stony soils are difficult to work in and may cause misshapen bulbs. Your local climate and soil conditions must be taken into consideration when selecting garlic cultivars. You must practice good crop rotations and should plant garlic following a heavy cover crop such as buckwheat or rye. Cover crops discourage pests, reduce disease inoculum, build soil organic matter, and limit weed pressure.

Planting

Garlic is planted in the fall and should be grown on raised beds covered with black, green IRT (infrared transmitting), or blue plastic mulch with drip irrigation. On smaller operations garlic is often “set” or planted by placing each clove by hand into raised beds with rows 6–12 inches apart and cloves spaced 4–6 inches apart (depending on the size bulb grown). Larger growers use specialized “cups” on their transplanters to place cloves at similar spacings as allowed by the machinery. Most garlic cultivars are planted 1 to 1.5 inches deep; Elephant garlic should be planted 2 to 2.5 inches deep.

Garlic cloves should be set early enough in the fall so that a good root system can develop before the ground freezes, but late enough to prevent shoot emergence above the soil line. Garlic sprouts often emerge a few inches above the soil prior to truly cold weather. Unless temperatures get extremely cold, little damage will result. Using 2 to 4 inches of straw mulch at planting can reduce this damage and will also help preserve moisture, discourage frost heaving, and prevent most weeds.

Irrigation

Garlic needs a steady supply of moisture to develop market-sized bulbs. The application of 1 inch of water per week during dry periods through mid-June will ensure good sizing. Avoid irrigating garlic after this period to encourage maturation and to discourage bulb diseases. For more information on crop irrigation, consult *Agricultural Alternatives: Irrigation for Fruit and Vegetable Production* and *Agricultural Alternatives: Drip Irrigation for Vegetable Production*.

Fertilization

Garlic requires heavy fertilization; for commercial production, 125 pounds of nitrogen, 150 pounds of phosphorus, and 150 pounds of potassium per acre are required. Soil tests should be conducted and phosphorus, potassium, and lime applied and incorporated before planting. Manure may be used instead of commercial fertilizers, but it should be analyzed to determine the amount of actual nutrients contained in the manure. To reduce fertilizer runoff, nitrogen applications should be split. Apply one 75-pound application at planting, a 25-pound application at 6-inch height, and the remaining 25 pounds around May 1. Granular fertilizer can be applied by banding or broadcasting; liquid fertilizers can be injected through a drip irrigation system. Apply all topdressings to dry plants at midday to reduce the chance of fertilizer burn.

Cultural Practices

Retail customers pay premium prices for large garlic bulbs. To meet this demand a grower must remove the scape (flower stalk) as soon as it is visible. If the scape is allowed to develop it will compete with the bulb for nutrients, resulting in a reduction in bulb size and quality. Once removed, scapes should be disposed of off-site to limit them as a source of disease inoculum.

Weed Control

Garlic is a weak competitor with other plants and does not thrive in weedy fields. Growers must start with a weed-free planting bed and mulch with clean straw after planting. There are only a limited number of herbicides currently registered for use in garlic. Herbicide recommendations can be found in the most recent issue of the *Pennsylvania Commercial Vegetable Production Guide*.

Insects and Diseases

Onion thrips are the major insect pest of garlic in the eastern United States and cause a bronzing or whitening of the garlic foliage. Adults and larvae overwinter in clover, alfalfa, and small grain fields. Specific insect management recommendations for garlic can be found in the *Pennsylvania Commercial Vegetable Production Guide*. Several diseases affect garlic including basal rot (*Fusarium*), white rot (*Sclerotinia*), and occasionally *Botrytis*. Long crop rotations and the planting of disease-free stock will limit most of these diseases.

Harvest and Storage

Garlic is ready to harvest when 40–60 percent of the leaves have yellowed (garlic generally has 6 leaves). Garlic maturation is a function of day length. Most varieties are ready by mid-July (with some minor differences between varieties). Early harvests reduce storage quality, while bulbs that are harvested too late will start to split open. Split bulbs have no commercial value and can only be utilized as planting stock. Be sure to discard any planting stock that has blemishes or obvious disease signs.

Because garlic is ready to eat after harvest, curing is only important if you intend to store it. For this reason, many growers who market garlic directly to retail customers do not cure it after harvest. If long-term storage is desired, freshly harvested garlic can be cured by placing it on racks with good airflow. The racks should be placed in a location out of direct sunlight and the weather for approximately 3 weeks or until the outer 2 leaves are completely dry. Many smaller growers spread their bulbs on the wooden floor of a barn to cure. Once cured, trim the tops and roots and clean the remaining soil from the bulb. The cured bulbs should be placed in clean cardboard boxes or burlap bags and stored at 32–35°F and 65–75 percent relative humidity.

Risk Management

There are several risk management strategies you should consider for your operation, including liability, property, and crop insurance. Discuss the types of coverage you may need with your insurance agent or broker. If you are engaged in direct marketing (especially roadside stands or pick-your-own) or agritainment activities you need adequate liability protection. You may also want to purchase crop insurance as either a traditional crop-based policy or whole-farm revenue protection (AGR-Lite coverage). To apply for traditional crop insurance you will need yield records, and for AGR-Lite you will need your last 5 years of Internal Revenue Service (IRS) Schedule F forms. For more information on agricultural business insurance, please see *Agricultural Alternatives: Agricultural Business Insurance*. For more information on crop insurance, contact a crop insurance agent or check the Penn State Crop Insurance Education website at extension.psu.edu/business/crop-insurance.

Sample Budget

Included in this publication is a sample fresh-market garlic production budget and price sensitivity analysis. The budget summarizes the receipts, costs, and net returns of a garlic enterprise. This sample budget should help ensure that all costs and receipts are included in your calculations. Costs and returns are often difficult to estimate in budget preparation because they are numerous and variable. Therefore, you should think of this budget as an approximation and make appropriate adjustments in the “Your Estimate” column to reflect your specific production and resource situation. While the budget is calculated for one acre, a small planting of no more than one-tenth of an acre is recommended to allow you to fine-tune your production and marketing skills with this crop. More information on the use of crop budgets can be found in *Agricultural Alternatives: Budgeting for Agricultural Decision Making*.

For More Information

Garlic Seed Foundation

C/O Rose Valley Farm
Rose, NY 14542-0149
315-587-9787

Growing Great Garlic by Ron L. Engeland (1994). Northwind Farm Publications. Available through the Garlic Seed Foundation.

Pennsylvania Commercial Vegetable Production Recommendations. Available through Penn State Extension county offices. Ask for the most recent edition.

Knotts Handbook for Vegetable Growers, 4th ed., by Oscar A. Lorentz and Donald N. Maynard.

Initial Resource Requirements

- Land: usually one acre or less;
depends on market demand
- Labor: 190 hours
 - Land preparation and planting: 25 hours
 - Harvesting and packaging: 165 hours
- Capital: \$14,000 to \$17,000
- Equipment: Tractor (20 horsepower)
 - Tillage equipment
 - Hand sprayer
 - Packaging supplies

Sample Garlic Budget

Summary of estimated costs and returns for one acre of production. Budget based on 6,000 pounds of production.

Item	Quantity	Unit	Price	Total	Your Estimate
Variable costs					
Custom operations					
Soil test	1	test	\$13.00	\$13.00	
Spreading lime	1	acre	\$13.80	\$13.80	
Fertilizer spreading	1	acre	\$10.60	\$10.60	
Moldboard plowing	1	acre	\$22.60	\$22.60	
Disking (2x)	1	acre	\$37.80	\$37.80	
Harrowing	1	acre	\$14.50	\$14.50	
Pest scouting	1	acre	\$35.00	\$35.00	
Lime and Fertilizer					
Lime	0.5	ton	\$10.00	\$5.00	
N	75	pound	\$0.30	\$22.50	
P	138	pound	\$0.33	\$45.54	
K	138	pound	\$0.25	\$34.50	
Garlic bulbs	1,000	pound	\$7.50	\$7,500.00	
Herbicides	1	acre	\$108.80	\$108.80	
Plastic mulch/drip tape	10,890	feet	\$0.06	\$653.40	
Labor					
Operator labor	1.5	hour	\$15.00	\$22.50	
Planting labor	20	hour	\$12.00	\$240.00	
Implement labor	3.4	hour	\$12.00	\$40.80	
Harvest labor	165	hour	\$12.00	\$1,980.00	
Packaging	2,000	bags	\$0.40	\$800.00	
Marketing costs	12%	total sales	\$24,000.00	\$2,880.00	
Diesel fuel	42	gallons	\$3.85	\$161.70	
Repairs and maintenance	1	acre	\$78.66	\$78.66	
Interest on operating capital	1	acre	\$542.79	\$542.79	
Total variable costs				\$15,263.49	
Fixed costs					
Tractors	1	acre	\$55.18	\$55.18	
Implements*	1	acre	\$140.77	\$140.77	
Land charge	1	acre	\$200.00	\$200.00	
Total fixed costs				\$395.95	
Total costs				\$15,659.44	

*Includes irrigation system.

It is customary for producers to keep enough cloves for replanting the following season. This should be factored into subsequent budgets. 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 for conventional production-retail marketing.

Price per pound	Garlic yield (pounds per acre)				
	5,000	5,500	6,000	6,500	7,000
\$2.00	(\$4,716.11)	(\$4,187.77)	(\$3,659.44)	(\$3,131.11)	(\$2,602.77)
\$3.00	\$283.89	\$1,312.23	\$2,340.56	\$9,500.56	\$11,000.56
\$4.00	\$5,283.89	\$6,812.23	\$8,340.56	\$16,000.56	\$18,000.56
\$5.00	\$10,283.89	\$12,312.23	\$14,340.56	\$22,500.56	\$25,000.56
\$6.00	\$15,283.89	\$17,812.23	\$20,340.56	\$29,000.56	\$32,000.56



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