NebGuide

University of Nebraska–Lincoln Extension, Institute of Agriculture and Natural Resources

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G2221

Garlic Production in the Home Garden

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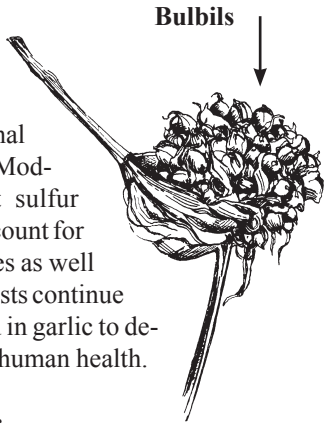
Garlic provides flavor to many of our favorite recipes. It's relatively easy to grow, and there are plenty of varieties from which to choose.

Garlic, *Allium sativum* L., is used as a seasoning in many foods from around the world. It isn't considered a major vegetable because consumption is generally small due to its strong flavor. But without garlic, many of our popular dishes would lack the flavor and character that make them favorites. Fortunately, garlic is relatively easy to grow in the home garden. The most difficult decision may be deciding what kind of garlic to plant since there are over 100 cultivars available from specialty suppliers!

Garlic is thought to have originated in the same area of central Asia as onions. Like the onion, it has been used for culinary and medicinal purposes throughout history. Modern science has shown that sulfur compounds found in garlic account for many of its healthful properties as well as its distinctive flavor. Scientists continue to study the compounds found in garlic to determine how they function in human health.



Kinds of Garlic

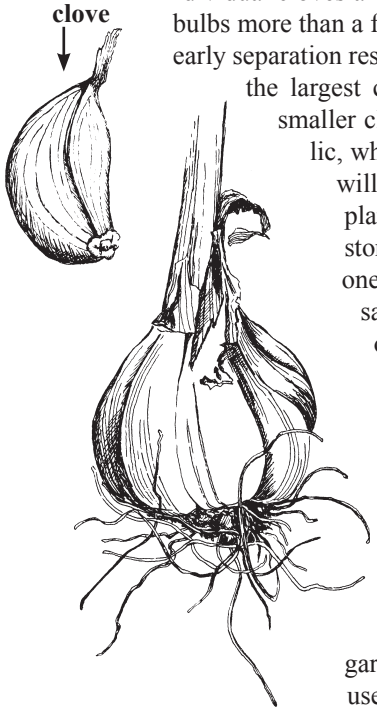
There are two main types of garlic — hardneck and softneck. Each has several distinct groups and cultivars. Hardneck garlic produces a woody flower stalk and also is known as "top-setting" garlic because it produces clusters of bulbils after the mostly sterile flowers bloom. Many hardneck types tend to produce large underground bulbs made up of a few large cloves and yield best when planted in the fall. Research has shown that yields will increase if the flower stalks are removed before the bulbils form. If left to grow, the bulbils, which are about the size of a popcorn kernel, can be eaten or can be planted, but it will take 2 to 3 years to produce a full-sized bulb from the bulbil. Bulbils can also be planted for garlic greens.

Softneck garlic does not form a woody stalk but has flexible leaves that can be braided. Bulbs of softneck types usually have more individual cloves and yield higher than hardneck types. Softneck types also are generally better adapted to a wide range of climates and can be spring-planted with more success than spring-planted hardneck varieties. However, garlic connoisseurs say that softneck varieties lack the subtle flavor differences found in hardneck cultivars.

Garlic Culture

Garlic is as easy to grow as onions and produces well in Nebraska when planted in October or very early spring. It is propagated from cloves (bulblets) or bulbils (topsets) because, except for a few recently discovered fertile clones, garlic flowers are sterile and will not produce true seed.

Garlic forms a compound bulb consisting of individually wrapped cloves or bulblets. Each clove consists of a bud enclosed in two modified leaves. One of the leaves is used by the plant as a food-storage organ, the other leaf forms a thin, dry protective layer.



Just before planting, separate bulbs into their individual cloves and sort by size. Do not divide the bulbs more than a few days before planting because early separation results in decreased yields. Reserve the largest cloves for planting and use the smaller cloves for cooking. Elephant garlic, which is really a bulbing leek, also will yield better if large cloves are planted. Conversely, when planting storage onions and shallots from sets, one should select the smallest bulbs, saving large onion sets for green onion production.

In general, removal of bloom stalks will help increase yields of onion family members. However, the flowers can be left if topsets are desired.

The fine, young leaves of sprouted garlic bulbils look like newly sprouted grass. The foliage has a fresh garlic flavor and is excellent when used in salad dressing, stir fry, and other recipes that call for fresh garlic. Garlic bulbils for greens can be planted directly in the garden or in pots or flats for winter production. If left to grow and

not harvested for greens, garlic bulbils will grow into a larger single bulb. These are known as "rounds" and also may occur when small cloves are planted. Rounds also can be caused by poor growing conditions throughout the season or planting a cultivar that is not adapted to local conditions. If thinned and left to grow or if rounds are replanted for a second year of growth, they usually will develop into normal full-sized bulbs.

Soil Preparation

Garlic grows best in well-drained, friable loam soils that are fertile and high in organic matter. If your soil is high in clay or sand, add organic matter to break up clay particles for better drainage. Organic matter also will help a sandy soil hold more water. Gardeners who grow good onion crops can grow garlic. Like onions, garlic needs a steady and fairly high level of nutrients in the soil while actively growing because the roots lack the hairs that normally aid in nutrient absorption. When preparing soil for planting, apply 3 to 4 pounds of 10-10-10 fertilizer per 100 square feet (or follow soil test recommendations) and spread 1 to 3 inches of organic matter such as chopped leaves, dry grass clippings, compost or sphagnum peat over the soil surface. Use a spading fork to turn over and break up the soil and begin mixing in the organic matter. One can also use a rototiller to prepare the soil, but remember that over-tilling can destroy the soil structure. When incorporating organic matter that must be decayed, such as dry leaves and grass clippings, it is best to do it a few weeks prior to planting so soil microbes will have a chance to start breaking it down.

Fall or very early spring planting is required because dormant cloves and young garlic plants must be exposed to cold temperatures of 32 to 50°F for one to two months to induce bulb formation. Care should be taken to ensure that they are not planted so deep that the soil will hamper their expansion or so shallow that rain will wash them out.

For best yields, garlic should be planted in early- to mid-October (four to six weeks before the ground freezes) depending on your location in Nebraska. Planting before mid-September or in November is not recommended. If planted too early, the plant may develop too much under high temperatures, resulting in winter-kill of the top growth which will decrease the number of cloves formed the following spring or it may not form any cloves. If planted too late, insufficient root growth will occur before the soil freezes and shoot development will be delayed in the spring. It should begin growing (mostly the root) and then go dormant when cold weather arrives. Plant the cloves 3 to 5 inches apart in an upright position (pointed end up) to ensure good emergence and straight necks. Cover cloves to a depth of about 2 to 3 inches. Allow 12 to 24 inches between rows. Garlic also lends itself well to wide-row planting; space cloves 5 inches apart in all directions in foot-wide rows or raised beds. This requires considerably less garden space for the same yield, but weeding must be done by hand. Water thoroughly after planting to stimulate growth. The soil must be kept evenly moist during active growth. Dry soil will result in irregularly shaped bulbs. A light application of mulch (1 to 2 inches) after the ground freezes will help prevent frost heaving throughout the winter.

If you miss planting your crop in the fall, the bulbs may be planted very early in the spring, in March or April. Early spring planting will provide cool enough temperatures to trigger bulbing and will permit full leaf development from the planted clove. Longer days and warmer temperatures of late spring trigger bulb development from the planted clove. As soon as bulbing starts, leaf initiation ceases. Therefore, for highest yields, the cloves must be planted early enough to permit the development of large vegetative plants during the short, cool days of March and April. The yield potential of the plants depends on the amount of vegetative growth before bulbing begins.

Garlic is quite drought-sensitive. A weekly application of 1 inch of water should increase yields if rainfall is lacking. Garlic has shallow, coarse roots that do not obtain soil nutrients as efficiently as other crops. Several light applications of nitrogen once vigorous leaf growth appears in the spring are better than a heavily fertilized bed, especially on sandy soils where nitrogen is easily leached. Do not fertilize after the plants have begun bulbing because too much nitrogen while maturing can cause garlic to store poorly.

Fall-planted garlic is ready to harvest from late June to mid-July so one should reduce watering to let the plants dry down a week or so before harvest. The outer bulb covering disintegrates fairly quickly and the bulbs will shatter if they are not harvested at their peak, so one should monitor their development. When the lower third of the leaves are yellow, dig or pull a few plants to check the development of the bulbs. If the bulbs have segmented into cloves which can be separated, it is time to harvest. If the bulbs haven't yet segmented, leave the remaining plants for a week or two and then check them again. When mature, each bulb should be fully segmented and still fully covered by a tight outer skin.

After pulling, lay the bulbs on screens in the shade or in a well-ventilated room to cure, protecting them from moisture. Bulbs should be cured for 2 to 4 weeks at 75 to 90°F and low humidity. If you want to braid your softneck crop, allow the tops to wilt for 2 to 3 days and then braid them tightly and allow to finish curing. Tight braids are necessary as the stems will continue to shrink as they dry.

If not braided, trim the tops to about 2 inches long and roots to 1/4 inch after the bulbs have cured. If there is moisture in the stem when you trim the tops, continue to cure the bulbs for a few more days, then check again. Softneck garlic usually takes longer to cure because there are more rows of cloves in each bulb. Leave the outer covering on to reduce moisture loss and mechanical damage. Store garlic in mesh bags so there is good air circulation.

Storing Fresh Garlic

Commercially, garlic is stored near 32°F. Home refrigerators usually set for about 45°F, are too warm for ideal long-term storage. Garlic begins sprouting when stored at 42 to 52°F. Instead, store bulbs in a cool, dry, well-ventilated place, in well-ventilated containers such as mesh bags. Storage life is three to five months depending on the type and cultivar, when stored in cool (<60°F), dry, dark conditions. The relative humidity in storage should be 50 to 60 percent to reduce root swelling and mold growth. Damp basements are not desirable places to store garlic.

Choosing Cultivars

While hundreds of cultivars of garlic have been described, most consumers are only familiar with 'California White,' the main type available in grocery stores. There are five main classification groups of garlic and approximately 100 cultivars available from specialty mail-order sources.

Since garlic is susceptible to viruses which may lower yields, it is a good idea to purchase garlic for planting from a certified disease-free source. Bulbs may be available from local garden stores or can be purchased from mail order sources. Although possibly infected with viruses, many people have success in planting bulbs purchased from the grocery store. Inspect the cloves carefully. Don't plant cloves that show any sign of disease or injury.

For a wider choice in cultivars, you can order garlic from mail-order garlic specialists as well as many standard seed catalogues. A list of seed companies is available in NebGuide G1895 *General and Specialty Mail-Order Seed Sources*. Two companies specializing in garlic are listed at the end of this NebGuide.

Types of Garlic

Within the two main types of garlic, there are five groups. Hardneck garlic groups include Purple Striped, Porcelain and Rocambole. Softneck garlic groups include Artichoke and Silverskin.

Within each group are several varieties or cultivars. The most distinct growing types are the Rocamboles. The plants send up flower stalks (scapes) that are distinctly twisted or coiled, sometimes even double-coiled. This coiling is perfectly normal and is not the result of any poor cultural practice or herbicide contamination. As the plants mature, the scapes uncoil and bulbils are formed at the top.

Porcelain varieties have very large cloves that are sometimes mistaken for Elephant Garlic. They have very tall seed stalks, white wrappers and store well.

Purple Stripe varieties usually have 8 to 12 long, crescent-shaped cloves and are covered with purple-striped outer wrappers. They are recommended for cooking as the flavor is retained well.

Included in the Artichoke group are many common types of garlic such as 'California Early.' These strains are vigorous and productive and most do not set bulbils on top. They grow well in most areas and will store for several months. They are the easiest type of garlic to grow and yield well even when planted in the spring.

Silverskin varieties are not as well adapted to all locations but are still productive. They have thin stalks that make braiding easy and the bulbs' white skins are quite attractive.

Pests

Garlic has few pest problems in Nebraska. To prevent problems with bulb rots and root maggots, avoid areas of the garden where you have previously grown onions or garlic and poorly drained areas. Occasionally, the onion maggot larva can be seen in the garlic cloves upon harvesting. The typical symptom is premature dying of the leaf tips. Control involves sanitation since sprays are not available. Onion maggot is only a problem following wet, cold periods on soils high in organic matter.

Thrips may feed on garlic, spreading viruses and reducing yields. In Nebraska, both onion and western flower thrips are a problem in all onion-related crops from mid-June on, especially in rural areas when wheat is drying down. Thrips are hard to see. Adults are very small (1/25 inch long) and they usually feed deep in the neck of the garlic leaves where they are protected from natural enemies and pesticide sprays. Thrips puncture the outer layer of the leaves with their rasp-like mouthparts and feed on sap and bits of leaf tissue. Leaves develop silvery blotches, streaks or scratch-like markings. You may be familiar with thrips damage on corn leaves or privet hedges. Hot, dry weather is favorable for increased thrips activity and crop injury.

Good cultural practices can limit thrips populations. Destroy or bury plant residue after harvest to eliminate overwintering sites. Spray when injury is first noticed. Because garlic leaves have a waxy surface, it is important to add a surfactant to the insecticide if it does not already contain one. Spray with malathion, covering the leaves and down into the neck where the insects hide. Usually at least two sprays are required, applied seven days apart. You must wait at least three days after spraying malathion. Be sure to carefully read the pesticide label and follow all directions carefully.

Blue Mold Rot

Before planting, check each clove for signs of blue mold rot caused by *Penicillium* spp. This storage disease causes pitting followed by a dry shriveling of the clove and eventually the production of an obvious powdery blue-green mold. It occurs if garlic is harvested prematurely or if stored under poor ventilation. Careful selection of cloves at planting can reduce the incidence of this disease. Discard any infected cloves or bruised cloves as they will decay in the soil and not grow.

Why did my garlic turn blue?

All garlic contains anthocyanins, water-soluble pigments that can turn blue or purple under acidic conditions. When garlic is used in canning pickles, the blue color may develop. Bluish garlic is usually seen in canned products when the garlic is immature or under-cured. The blue color does not affect the taste or edibility of the product.

Can I make garlic oil or vinegar?

Regardless of its flavor potency, garlic is a low-acid vegetable. The pH of garlic is in the range of 5.3 to 6.3 which will support the growth and subsequent toxin production of the bacterium *Clostridium botulinum*.

Moisture, room temperature, lack of oxygen, and low-acid conditions all favor the growth of *Clostridium botulinum*. When growing, the bacterium produces an extremely potent, but tasteless, toxin that causes the illness botulism. If untreated, death can result within a few days of consuming the toxic food. Fresh garlic-in-oil mixtures stored at room temperature provide these perfect conditions for producing

the botulism toxin. Homemade preparations of garlic-flavored oil should be stored in the freezer. **Do not store *garlic-in-oil* at room temperature or in the refrigerator!** Garlic also may be pureed in oil and stored in the freezer. Peel and then puree the cloves in a blender or food processor using two parts vegetable or olive oil to one part garlic. The puree will stay soft enough in the freezer to scrape out needed amounts for stir-frying or sauteeing.

Peeled, lightly mashed cloves may be submerged in wine or vinegar and stored in the refrigerator. Dry white or red wine or white or wine vinegars may be used. The garlic/liquid mixture should not be used after four months in the refrigerator and should be discarded. **Do not store at room temperature!** Discard both the cloves and the liquid if there are signs of mold or yeast growth on the surface of the wine or vinegar.

Garlic and Human Health

Garlic has been used in folk medicine for thousands of years to treat all sorts of ailments. Today, scientists continue to research and debate the benefits of garlic in human health. Numerous scientific papers have been published on the various effects of garlic on human and animal subjects. You can find more information on scientific studies at research libraries and by searching on the Internet.

One of the benefits that garlic may have is lowering total serum cholesterol and triglycerides while raising HDL (good cholesterol) and lowering LDL (bad) cholesterol. Allicin, which forms once a clove is crushed or otherwise damaged, is believed by some scientists to be one of the beneficial compounds in garlic. In double blind studies using garlic supplements, people who took the equivalent of one clove of garlic per day for several weeks had a significant improvement in their serum cholesterol levels, lowering it an average of 12 percent.

Ajoene is a breakdown component of allicin and helps to prevent clumping of platelets. Garlic inhibits the formation of fibrinogen which promotes formation of blood clots. You should inform your doctor if you regularly take garlic supplements or consume raw garlic, especially if you are taking a blood-thinning medicine or routinely use aspirin.

Garlic also has shown promise in cultures and laboratory animals as an anti-carcinogen. Future research will hopefully give us a better understanding of how garlic works in the human body.

This brief overview of garlic in human health is meant to increase your knowledge of ongoing research in the use of plants for medicinal purposes. Because everyone is different, a physician must diagnose conditions and supervise the use of healing herbs to treat individual health problems. You should talk with your doctor before adding supplements or large amounts garlic or onions to your diet. Since onions and garlic can increase blood clotting time, one should be especially careful if one already takes prescription anti-coagulants.

Pet owners should be aware that while many animals like the flavor of garlic and cooked onions, they can make cats, dogs, horses, cattle, and other animals very ill. Compounds in garlic and onions destroy the red blood cells of many animal species, causing hemolytic anemia. Prolonged feeding of garlic or onions may cause death of the animal. If you have a question concerning consumption of any plant or plant part by your animal, contact a veterinarian.

Resources

Duke, James A. 1999. Dr. Duke's Essential Herbs. St. Martin's Press. ISBN 1-57954-183-6

Lau, Benjamin. 1999. *Garlic and You: the Modern Medicine*. Apple Pub Co Ltd; ISBN: 1896817025

Mail-order Sources Specializing in Garlic

Filaree Farm
182 Conconully Hwy.
Okanogan, WA 98840
phone: (509) 422 6940
http://www.filareefarm.com/

Irish Eyes, Inc.
P.O. Box 307
Thorp, WA 98946
Phone: (509) 964-7000
email: potatoes@irish-eyes.com
www.irish-eyes.com

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