

Garlic. *Allium sativum*

Family: Amaryllidaceae

History and origin

Garlic is thought to have originated from central Asia (Shanmugavelu, 1989), however the origin of the plant is difficult to trace and other writers such as De Canolle (2006) in his *Origin of Plants* claims that garlic originated in the southwest of Siberia, whence it spread to southern Europe. Garlic is now found growing wild in most Mediterranean countries and where it has a long historical association. The ancient Greeks placed garlic on the piles of stones at the cross roads as a supper for Hecate, the Greek Goddess of cross roads, while the Egyptians invoked as deities at the taking of oaths. Roman soldiers and slaves were often fed garlic although historical manuscripts record a general dislike to the smell which was accounted a sign of vulgarity.

Uses

Culinary uses

It is an important spice or condiment and is chiefly used for flavouring and seasoning vegetable and meat dishes. Most often the bulb is used either eaten raw or cooked. When cooked the whole bulb can be roasted in olive oil in an oven and eaten whole, or the cloves are used as flavouring. Garlic can also be dehydrated and preserved in oil. When home preserving in home care must be taken no get botulism, this can be avoid by refrigerating and not keeping for more than two weeks. Garlic can also be pressed for its oil, and pickled. The garlic flower stems (scapes) are also edible and used in cooking. It is used similar to chives but has a more mild taste.

Medicinal uses¹

In it's medicinal use garlic preparation are given in whooping cough and other lung diseases, stomach complaints (as ulcers of the intestines) disorders resulting from child birth and as a specific remedy for sore eyes and earache. The Italan mafia used to believe that garlic oil was toxic and if it entered your blood stream you would die. As a result they coated their bullets with garlic oil in the hope that if their enemies somehow survived a mafia hit, and were only wounded, them they would die later as a result blood poisoning. This belief is thought to have resulted from deaths that had occurred from congesting garlic oil that has become infected with botulism, a common risk associated with home prepared oils. During the plague it in 1722 in Marseilles it was the principle ingredient for the "*four thieves vinegar*" a protective ointment. The ointment was given the name from the confession of four thieves who used a mixture of garlic and vinegar to protect themselves from the plague while they plundered the riches from dead. In Word War II and many of the earlier wars garlic was used as an antiseptic to treat the wounded.



¹ Grieve, M (2006). Garlic. Botanical.Com[Retrieved 14th March 2008] www.botanical.com .

Companion plants & Intercropping

Garlic deters the Japanese beetle in roses and raspberries. When grown with herbs like lemon grass, rosemary and lavender it can enhance their production of essential oils and it can be planted liberally throughout garden to deter general insect pests

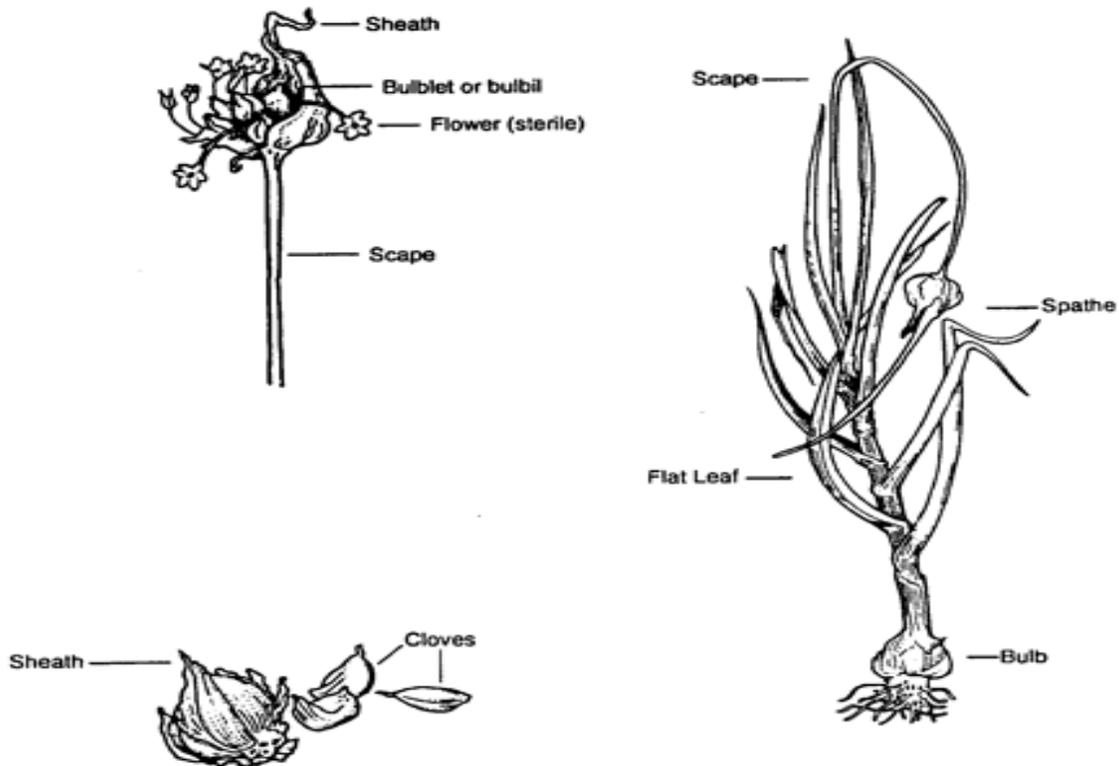
Botany

Unlike the onion the garlic bulb is made up of several bulbils which are commonly referred to as cloves. The cloves are then covered with a thin outer skin. Some varieties produce a flower stalk which is technically referred to as a scape. Flowers if they are produced usually abort and form bulbils instead.

Growth

Physiology garlic is similar to onions. Bulbing occurs when the plant responds to long days and high temperatures. There are two major differences however.

- 1). A period of cool temperature is needed during the growing season for bulbing to occur.
- 2). Garlic does not flower and the “*flower head*” that does occur in some cultivars is actually a vegetative organ, with small bulbils that are inside the head, are actually genetically the same as the plant. When the plant bulbs,
- 3). It does not form a bulb like an onion, but small bulbils develop at the base of the plant.



Ecology

Soils

Fertile, well-drained sandy or silt loam is preferred. Good amount of organic material is required for optimum bulb development. A pH range of 5.5 to 6.8 is optimum for garlic.

Climate

Cooler conditions in the early stages favour vegetative growth. Long days favour bulb development. Garlic roots can tolerate frozen conditions as long as the sudden drops in temperature do not occur. In areas where temperature fluctuations are common, mulching in the first 3-5 weeks can protect roots from adverse conditions. The garlic shoots can withstand temperatures as low as -6°C without damage, while temperatures below -12°C can kill shoots and causes poor bulb development. In Bhutan garlic is grown at elevations 500-2000m above sea level.

Varieties²

There are two types of garlic, the **hardneck** and **softneck** type. Genetically there are 10 major varieties or types within these two categories. Climate can have significant impact on both taste and scape production, and a variety considered a softneck in one location may produce a flower in another. This has led to the renaming of many strains that may instead be genetically the same plant. In Bhutan the variety **Namlo Jagey** is grown, however this writer was unable to find reference to this variety in any of the books, nor on the internet consequently it is possible that the aforementioned variety is an example of such a case. Due to the inability to identify the origin of this variety this writer is also unable to distinguish if this is a softneck or hardneck variety.

Hardneck varieties (*Allium sativum* var *ophioscorodon*)

Hardneck varieties produce a flower stalk (scape), and are often termed as bolting or topsetting varieties. Flowers if they are produced usually abort and form bulbils instead. These are small aerial cloves which are genetically the same as the parent plant. If the aerial cloves are used for propagation they will produce a bulb, but these will be small and take 2-3 years before the bulb reaches marketable size. Hardnecks produce 4-12 cloves per plant, they can't be braided because of a hard flower stalk and do not store well as roots and cloves dry after a few months. Typical hardneck varieties are "Rocamboles," "Purple Stripe," "Glazed Purple Stripe," "Marbled Purple Stripe," and "Porcelain," Other varieties are Asiatic, Crecole and Turban. In cold climates hardneck varieties can be just as productive, or even more productive as softneck varieties.

Softneck varieties (*Allium sativum* var *sativum*)

Softneck varieties do not normally produce a flower stem. These are the most common varieties used for commercial cultivation, due to minimal flower stalk and bulbil production which generally makes them more productive because all the energy goes to producing a bulb, while in **hardnecks** it is diverted to scape production. In some softnecks a partial flower stalk can be produced and bulbils will form directly above the bulb. Softneck varieties normally have a longer shelf life than hardnecks and store for up to six to eight months. Softnecks are also easily braided and contains 10-40 cloves per plant. Softneck varieties are "Artichoke" and "Silverskin"



² Becker, R., Fritz, V., Hutchison, B., Percich, J., Rosen, C., Tong, C & Wright, J. (2007) *Growing Garlic in Minnesota*, University of Minnesota Extension Service [Retrieved 14th March 2008]. www.extension.umn.edu.

Culture Practices

Seeds and Sowing

An acre of land requires 600-800 kgs of good quality cloves. Cloves are sown;

- In the foot hills and mid hills October to November
- In the high hills March to April.

Individual cloves should be separated from the bulb the day of or up to two days before planting. Any later then the cloves tend to dry out. Generally larger bulbils produce the largest bulbs. Though be careful when selecting cloves as often a large clove is in fact two cloves fused together and planting these will resulted in fused plants and flattened bulbs.

Field preparation

In paddy field a pre-planting irrigation is a must. Two to three times deep ploughing each followed by planking are necessary to bring the soil to a good tilth. Proper levelling of the field is very important.

Management

Manures and fertilizers

Apply 8-10 MT of well rotten FYM and 25:30:30 kgs of NPK/acre as basal dose. Top dress the crop with 25 kgs of additional nitrogen when the crop attains 20-25 cm height if necessary.

Incorporate all the FYM and all basal fertilizer into the soil during field preparation. Banding method could be applicable but it is labour intensive.

Method of planting

The garlic cloves are planted in lines. The pointed cloves should not point downwards because otherwise the shoot well become twisted and bent which causes a misshapen bulb. Plant 2-4 cm deep to maintain good plant stand.



Figure .1: Space at 30cm apart, about the size of a match box



Figure 2: Plant cloves pointed upwards (point at the top)

Spacing

Keep a distance of 30cm row to row and 15cm plant to plant maintaining a plant population of 20 plants per square metres.

Weeding/hoeing

2-4 times may be necessary depending upon the weed pressure, soil texture and weather conditions of the locality.

Mulching

Mulches can be used in the first 3-5 weeks of planting to regulate soil temperature and protect the roots from freezing. Use weed free straw and apply at a depth of 75 -100mm. Mulching will also help with the suppression of weeds within the plot.

Irrigation

Garlic has a shallow rooted system and is sensitive to dry conditions. Enough irrigation should be provided so that the available water holding capacity doesn't go below 50%. Three to five times irrigation may be necessary depending upon the moisture retention capacity of the soil, frequency of rainfall, altitude and topography. The most critical stage is during bulbing, although if weather permits, irrigation should be stopped two weeks before harvest to avoid stained wrappers and post-harvest diseases.

Scape removal.

In Hardneck varieties yields was found to be reduced by 30-40% in research undertaken in Minnesota, USA, when scapes were allowed to mature (Becker *et al*, 2007). Given research results it is suggested that scapes be removed just after the beginning of curling. Scapes are edible and when immature can be sold in the market.

Plant protection

Leaf fleck is the common pest problem and this can be treated by spraying with mancozeb @ 2 gm/litre of water.

Harvesting & Handling

Harvesting

Lift the crop with hand at physiological maturity. Delay in harvesting is likely to reduce the quality. Too early harvesting causes loss of yield, wrinkling of the skin and poor keeping properties.



Expected yields

An acre of garlic produces about 4-6 MT saleable cloves.

Drying

It is recommended that in fine weather, clumps of cloves are wind dried in the sun. The stem should be cut off leaving 2.4 cm of stump. One common way to store garlic is to braid it. This is done in a similar manner to braiding hair. Braiding garlic makes it easy to handle and is also an attractive way to display goods at market. It is possible to have braided the garlic to set weights. Another advantage of braiding is it cuts down on the need to use plastic bags. Plastic bags are becoming an environmental problem in most parts of the world. As well as being an ugly addition to the landscape, they are also an extremely bad environmental pollutant. Some plastics take over 100

years to degrade, many produce toxins when burnt and wildlife often die from both ingesting plastic and drowning when caught in floating plastic.

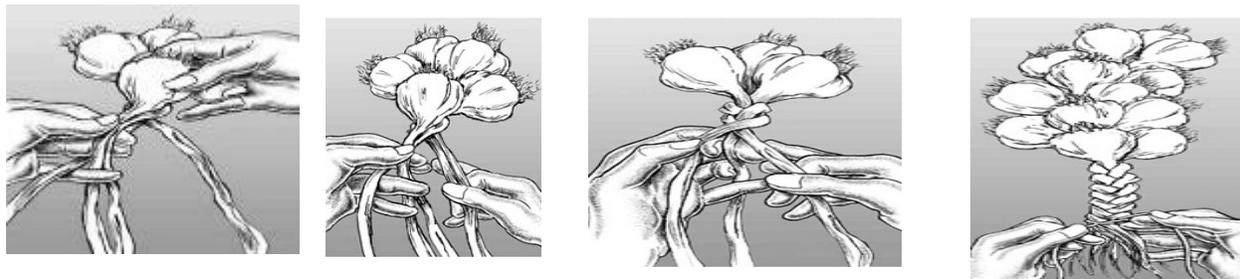


Figure 3 braiding garlic

Storage

Garlic will store well in cool and well-ventilated shed. Low humidity is necessary for prolonged safe storage.

Glossary

- Scape: The leafless stem of a solitary flower or inflorescence
- Bulbils: small bulb that develops from an aerial bulb.
- Clove: one of the small bulbs developed in the axils of the scales of a large bulb
- Spathe: large bract containing an inflorescence.

Review Questions

1. Describe the difference between **hardneck** and **softneck** varieties.
2. Explain how garlic is propagated and why this method is used.
3. What is the climatic requirement of garlic and how can this change the physiology of some varieties.
4. Describe how to set up and plant a garlic plot.
5. What is the water requirement of garlic and when is irrigation important.

References

1. Becker, R., Fritz, V., Hutchison, B., Percich, J., Rosen, C., Tong., C & Wright., J. (2007) *Growing Garlic in Minnesota*, University of Minnesota Extension Service [Retrieved 14th March 2008]. www.extension.umn.edu.
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3. K.G. Shanmugavelu, 1989. *Production Technology of Vegetable Crops*. Oxford & IBH Publishing Co. Pvt. Ltd.
4. RNR RC, Bajo, 1994. Research Recommendations for Wetland Production System. Ministry of Agriculture, Bajo