NSW GOVERNMENT Department of Primary Industries

FACTSHEET

Growing garlic in NSW

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Introduction

In Australia each year, approximately 300 to 500 tonnes of garlic is produced. Fresh consumption of garlic is around 3,500 tonnes imported mainly from China, Africa, Taiwan, New Zealand and the USA. While there has been a decline in production in Australia over the last ten years, there has been a resurgence of interest in Australian garlic in the last two years for the fresh and processing market. Introduction of improved, higher yielding varieties and a greater appreciation of the fresh product at retail level has improved the market prospects for locally grown garlic.

Garlic (*Allium sativum*) is a close relative of onions, leeks and chives. In size and growth habit, garlic resembles the onion. It has a shallow, fibrous root system and a modified and flattened stem which forms the base on which the cloves develop. The foliage leaves are strap-like (onion leaves are round in cross section and hollow). Flowers are produced only sometimes and are sterile. Garlic does not have true seed. As a result, garlic is normally propagated from cloves. Collectively, the cloves comprise the bulb, which is covered by a thin sheath at the base of the foliage leaves.

In southern New South Wales, garlic is planted during March/April and the vegetative phase lasts through winter and into spring. Bulb formation then starts in response to higher temperatures and lengthening days. Maturity is reached from early November to January. High yields can be obtained only if the plant has had sufficient time and favourable conditions before the onset of bulbing. The general rule is the longer the vegetative period, the larger the bulbs and the higher the yield.

Production areas

Griffith, Hay, Balranald and other localities in the south-west produce most of the New South Wales crop. There is also a large number of small garlic production enterprises on the north coast around Coffs Harbour, and the NSW Tablelands around Tenterfield. Garlic can be grown in any district provided water for irrigation is available during dry periods. Substantial quantities are also produced in the Lockyer Valley, (Gatton, Laidley) in Queensland, in Victoria along the Murray and Sunraysia, and south-east South Australia. Relatively dry weather at harvest time is desirable so that the bulbs can dry and mature properly.

Soil and climate

Garlic grows best on fertile, well-drained, loamy soils. Any soil suitable for onions is satisfactory. Heavy clay soils that are not self mulching may cause misshapen bulbs and make harvesting difficult. Soil pH should be in the range 5.5 to 7.0.

The best monthly average temperature range for growing garlic is from 13^0 to 24^0C. For this reason garlic is grown as a winter/spring crop in New South Wales. The potential yield of the plant depends on the amount of vegetative growth made before bulbing commences. Leaf initiation ceases once bulbing starts. The maturity of the bulb is hastened by high temperatures and long days. Dry weather before and after maturity is best for harvesting and curing.

Autumn (March/April) is the main planting time throughout New South Wales. This allows the garlic plant to have a fairly long vegetative period before the higher temperatures and longer days in late spring cause leaf initiation to cease and bulbing to commence.

Varieties

A range of early, mid and late season varieties are grown. A list of some garlic varieties grown in Australia is presented in Table 1. Many garlic varieties are named after their place of origin. It should be noted that often there are several selections of the same variety available. Always check with the seed supplier regarding the origin of the variety

Table 1 Garlic varieties

Variety	Type	Comments
Australian White	mid season	Californian type, large white bulb and cloves, selected in South Australia.
California Early	mid	Popular for temperate climates until recently. White bulbs, flat base allows easy cleaning. A number of selections available.
California Late	late	Late variety for southern areas, very good storage ability, large bulbs, many small cloves with dark pink skin, less popular than previously.
Creole	early	Rarely grown after the 1980s.
Cristo	late	A later variety, white and large bulbs.
Glenlarge	early	Queensland selection of local garlic with large well-formed white bulbs, 6-12 cloves. Similar to Southern Glen.
Italian White	mid	Older popular variety for temperate climates. Many selections. Good storage ability.
Moulinor	mid	Likely to be second to Printanor in Australia. Large white bulbs of a fairly symmetrical nature
New Zealand Purple	mid	Small bulbs with few cloves, cloves are high quality larger- sized and with purple tips. Rarely grown today.
Printanor	mid	French origin and proving to be most popular in Australia and New Zealand. 95% of all New Zealand now grows this variety and the percentage is increasing in Australia.
Southern Glen	early	Queensland selection with large white bulbs, 12-15 cloves, some purpling of clove tips.
Taiwanese strains	early	Suitable for warmer climates (Queensland), has been replaced by Glenlarge and Southern Glen, little-grown nowadays.

Planting material

Garlic is propagated by planting the cloves obtained by breaking apart the bulbs. The number of cloves per bulb varies from about five to thirty, with 12 cloves the normal number expected. Seed or clove garlic is often obtained from other garlic growers because it is a vegetatively propagated crop. Recently a private company released for sale, virus-tested garlic planting material.

Storage temperature can have a marked effect on the subsequent growth of bulbs. The optimum storage temperature for bulbs to be replanted is 10^0C with desired limits of 5^0C and 18^0C. Storage at 4^0C for several months causes rapid sprouting and vigorous early growth. However, bulbs stored at low temperatures may sprout side shoots, mature early and produce rough bulbs.

Do not break bulbs into cloves until shortly before planting because unbroken bulbs store better. To release the cloves, cut off the tops and break the bulbs apart. Large quantities of bulbs can be broken apart by passing them through rubber-faced rollers. With smaller quantities hold the cut top of the bulb over a small pipe connected to a source of compressed air, operated by a foot valve.

The jet of air should be directed at 350 to 700kPa into the bulb to loosen the wrapped leaves. All cloves should be separated to prevent the development of double plants. Discard the small centre cloves.

Figure 1 In NSW, garlic is most commonly grown under furrow or spray irrigation. Well drained soils are essential and the crop grown on beds or narrow hills. This is particularly important where mechanical harvesting is employed.

Land preparation and planting

Choose an area that is not heavily infested with weeds. Garlic, like onions, does not offer weeds much competition because of the limited foliage growth and the rather low plant populations used. Weed control in the early stage is particularly important in growing a good crop. Recommendations of row width and bed size vary. A most common bed width is 1200mm, with between row spacings of 200mm. Plants are normally spaced at 100mm apart. This arrangement is for about 50 plants to the square metre.

Nutrition

Pre-plant soil tests and leaf nutrient analysis should be used to develop any fertiliser programme. Phosphorus and potassium fertilisers are applied and incorporated before planting. Nitrogen and phosphorus are the elements most needed on soils of heavy texture. As a guide on soils with medium phosphorus content use 45 kg phosphorus and 60 to 80 kg nitrogen per hectare. All the phosphorus and half the nitrogen should be applied either at planting (band placed 7 to 10 cm below the row and 3 to 5 cm to the side) or before planting (lightly worked into formed beds). Apply the balance of the nitrogen (20 to 30 kg) as a side-dressing about six to eight weeks after emergence. The first side-dressing of nitrogen may need to be applied from four to six weeks after emergence, followed by a second side-dressing at the same rate after a further four weeks. Avoid nitrogen applications after bulbing commences, as this can result in softer bulbs with shorter shelf life. Where soils test low in phosphorus, it may be better to increase the phosphorus rate to about 85 kg per hectare. Sandy soils may require potassium in addition to nitrogen and phosphorus. A rate of 50 to 80 kg per hectare should be sufficient. Foliar applications of nutrients can be applied to correct minor nutrient deficiencies such as zinc.

Cultivation and weed control

If' cultivation is necessary for weed control or for water infiltration, keep it shallow to avoid root pruning. A knife may be used. Weeds that have emerged in the row must be removed by hand hoeing. In recent years, several minor use permits for several herbicides for garlic were issued by the Australian Pesticides and Veterinary Medicines Authority (APVMA). For details contact the nearest NSW Department of Primary Industries Horticulturist or the APVMA website at www.apvma.gov.au under permits and minor uses.

Irrigation

For optimum yields, water stress should be avoided in garlic crops prior to the first signs of maturity. The fibrous root system is confined to the top 60cm of soil and sufficient water should be applied to wet the soil to this depth. Consequently, irrigation needs to be light and frequent. Cease irrigation when the first signs of maturity are evident (tops yellowing or necks softening). Continued irrigation or rain can discolour bulbs and make the bulb scales rot. Once the garlic plant is mature, water use declines, and soil is likely to remain wet, and possibly damage roots. Rotting exposes the outer cloves, which can then break away and reduce the market value. A suitable soil moisture monitoring device, such as a tensiometer, should be used to measure soil moisture and assist with irrigation scheduling.

Harvesting

The crop is ready to harvest when the plant stems (necks) begin to soften and are partly dry. Delaying harvest several weeks beyond this stage can be detrimental as the cloves are apt to separate and become discoloured and sunburnt. In coastal areas harvesting at an even earlier stage may be needed to avoid bulb disintegration and exposure of the cloves. Harvest usually takes place in mid November at Griffith. A cutter is run just beneath the bulbs to sever the roots and to lift the bulbs. Alternatively, if the crop is grown on beds and the soil is fairly friable, a rod weeder can be used.

Figure 2 Although most garlic in NSW is harvested by hand, mechanical harvesting is sometimes used for processing crops.

The plants are then pulled by hand and placed into shallow heaps. Excess soil on the root can be rubbed off by hand. The tops and roots are clipped off with hand sheep shears. Tops are cut about 2cm above the bulb. The bulbs are then left in shallow layers on clean bags to dry out and cure. If they are to be left in the field for more than an hour or two protect them from sunburn by covering them lightly with cut tops. If

rain or dew is likely to interfere with curing, remove the bulbs from the field to a well ventilated shed. A variation on the above method of harvest is to remove the tops and roots after the bulbs have dried. Pull the plants and stack them in shallow heaps either in the field or in an airy shed and leave them for some days to dry out thoroughly. Then remove the tops and roots either by hand or with a topping and tailing machine, which can also grade the bulbs for size. These machines do not perform well if the tops are green.

Grading and marketing

Grade standards for garlic in New South Wales do exist, however they are not enforced. Grading is essentially market driven and growers know that well-graded lines will always command a higher price than ungraded lines. Consequently, most garlic is graded for size (small, medium and large) before packing into 10kg cartons. At the same time diseased, damaged, and unattractive bulbs, and those with exposed cloves, are graded out. Grading can be done either by hand or by using onion grading machinery. Some growers also remove any discoloured scale leaves and roots by hand rubbing. Small, rough and unattractive bulbs with exposed cloves are sold as factory grade.

Niche markets for garlic include organic garlic and value added products. Potential new markets exist in processing garlic for pharmaceutical products. The health benefits of garlic are widely documented and research has shown that Australian grown garlic contains higher than average levels of alliin which is one of the main “health-giving” compounds in garlic.

In recent years, Australian garlic growers have faced competition from imports of variable quality garlic. Although the Australian supply period is between the months of September to February, imported garlic can be found in the market virtually year round.

*Table 2. Garlic imports – country of origin.**

Country	Month
Spain	September / October
South Africa	Late November to April
New Zealand	March to August
Mexico	May to October
California	May to December
France	August to October
Argentina	January to March
China	May to November

*Table 3. Harvest season for garlic in Australia.**

State	Month
Queensland	September
New South Wales	Early to Mid November
Victoria	Early December / January
South Australia	Early December / January
NE South Australia Mildura	Mid / Late November
Tasmania	Late December / Late January
Gippsland	Late December / Late January

**Source - Australian Garlic Industry Association.*

Storage

Unlike most vegetables, garlic can be stored for extended periods under a fairly broad range of temperatures. The main point is to have the cloves dry and well cured beforehand. Store in open-mesh bags loosely stacked for adequate ventilation in sheds or warehouses, or use bulk bins. If the building is kept cool, dry and well ventilated, garlic will store for at least three months. Sprouting is most rapid at a temperature of at around 4^0C, while humidity above 70% leads to mould growth and root development.

Yield

Garlic yields vary considerably and depend mainly on the planting rate and the length of time the crop spends in the vegetative stage. Most crops yield six to eight tonnes per hectare.

Insect pests

A number of insect pests affect garlic. The following are considered frequent pests.

Onion Thrips and Western Flower Thrips damage is silvery streaks on leaves. Thrips feeding, particularly at bulb formation, can reduce yields. Onion Thrips are yellow/brown 1.3mm long grey insects with fringed wings, while Western Flower Thrips are slightly larger at 1.5mm long. The larvae are creamy coloured and wingless. Rain and overhead irrigation provide some suppression of thrips. To aid the control of thrips avoid planting near grain fields, if possible, because thrips numbers often build up in cereals in spring. Regular monitoring is essential from mid August onwards. Generally, spraying is required when an average of five adult thrips per plant can be counted. Thrips may be controlled by applying an insecticide registered for use in garlic in NSW.

Growth from a clove that has been infested with **Wheat Curl Mite** is twisted, leaves are stunted and bulbs dry out in storage. Infested cloves

usually show some tissue breakdown in the form of one or more brownish sunken spots. The Wheat Curl Mite is about 0.25mm long and has two pairs of legs which are found close to the head. Flood irrigation or heavy winter rains may reduce field populations. To aid the prevention of Wheat Curl Mite damage avoid growing successive garlic crops on the same block, or growing garlic after corn or wheat.

Diseases

Garlic is subject to most of the diseases which attack onions. Those most likely to be encountered in NSW are listed below.

Downy Mildew appears as pale oval spots on the leaves. This disease attacks the leaves, which turn yellow before death. At this stage the fungus can be seen as a grey coating on the leaves. Cool moist weather and dense planting encourage downy mildew. Treatment is by regular spraying with a fungicide for which there is either a minor use permit, or is registered for use in garlic in NSW.

White rot causes root and bulb rots of the plant and can be seen as a white fluffy growth at the base of the plant. Cool and wet conditions encourage it. Lightly infected bulbs can carry the disease through storage and disease can persist in the soil for several years. Therefore select planting material from crops free of the problem.

Virus diseases are prevalent in most planting material and can result in reduced crop yields. The most common viruses in Australian garlic crops are Leek Yellow Stripe Virus, Onion Yellow Dwarf Virus and Shallot Latent Virus.

These viruses can cause stunting, and deterioration in storage, with yellowing and mottling symptoms more noticeable on the younger leaves. Apart from planting infected cloves, viruses generally spread through insect vectors such as aphids. The above viruses often combine, resulting in a complex of symptoms. If possible, growers should select planting material free of virus.

Further information

For further information on garlic culture or on pest and disease control in garlic, contact the National Vegetable Industry Centre, Yanco 02 6951 2611.

Industry association

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