

# GARLIC (organic) – *Allium sativum*

*“Eat leeks in March and wild garlic in May,  
And all the year after physicians may play.”  
Old Welsh saying*

## Introduction

Garlic and its relatives, onions, leeks, and shallots all belong to the lily family (Liliaceae) and the genus *Allium*. The common garlic ‘family’ plants are:

- Allium sativum* ophioscorodon - hard neck garlic, Syn. *A. sativum* ‘ophio’
- Allium sativum* sativum - soft neck garlic
- Allium ursinum* - ramson’s garlic (not commercially grown)
- Allium vineale* - crow garlic (not commercially grown)
- Allium tuberosum* - chive’s garlic (not commercially grown)
- Allium ampeloprasum* - elephant ‘garlic’ (actually a leek), aka. Gigantum

Most garlic grown in British Columbia is of the hardneck sub-species rather than the softneck, but both do equally well with softnecks having slightly larger bulbs on average. Hardnecks have 4 –12 cloves per bulb and produce a flower stalk called a scape. Softneck type can have up to 24 cloves per bulb and don’t generally have a scape. Both sub-species are planted from September 15<sup>th</sup> to mid October in the interior and much later or all winter in warmer locations. Most strains require a cold period before proper growth will take place and fall planting satisfies this.



Commercial garlic, without specific manipulation, produces no true seed so no crossing or exchange of genetic material can occur naturally. Cultivars come from small changes (micro-mutations) in individual plants that happen naturally and man selects these for propagation. Different shaped cloves might be an example of this.

Elephant garlic is not true garlic but a type of leek, produces large cloves and may develop several small bulbils at the base of the bulb. . It is also much milder than garlic, and can be slightly bitter. It has a large scape, which may be cut and sold to florists. The immature scapes of elephant and hardnecks can be harvested and used for vegetable stir-fry, pesto or pickled.

The chemistry of garlic is complicated, but this quote from ‘Gourmet Garlic Garden’ located at <http://www.gourmetgarlicgardens.com/chemistry.htm> explains it quite simply. “If you slice open a clove of garlic, you will see it is composed of cells separated by cellular walls. Thanks to research conducted in 1951 by two Swiss chemists, Dr. Arthur Stoll and Dr. Ewald Seebeck, we know these cells contain either a cysteine-based sulfur rich amino acid, called alliin or a protein-based enzyme called allinase, which acts as a catalyst and they are kept apart by the cellular walls. The clove had little or no discernible smell until you sliced it allowing these two compounds to mix and form a third compound, diallyl disulphinate, commonly called allicin. .... It is the allicin that is thus formed by chemical action that has the familiar garlic smell. Allicin is a volatile and short-lived (a few hours) compound, which if left alone, will break down into other compounds, such as diallyl disulphide. In a matter of hours it will further degrade into an oily witches brew of bisulphides, trisulphides such as methyl allyl trisulphide, methanethiol, polysulphide and many others”. .... “Raw garlic contains no oil. Oil is not formed until garlic is crushed and then degrades down into the oily mix of sulphorous compounds mentioned above”.....It is the allicin which is garlic’s natural protection from pests and diseases and when we eat fresh garlic it protects us too”..... “There is no way to avoid the aroma of garlic about oneself if one wants it to work”.

# Garlic FACTSHEET



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## Garlic (*Allium sativum*)– Sub-Species and Cultivar (cv) Information

Cultivars in **bold** are available somewhere in Canada (see list in appendix).

There are many other cultivars outside Canada that are not listed here.

Dealers will not ship plants to Canada from the USA or elsewhere without CFIA, Plant Protection permits and phytosanitary certificates.

\*\* **Spanish Roja** a rocambole type, is considered to be the true garlic taste and all other garlic are compared to it

Garlic heat (gleaned from articles)	Garlic storage quality (general assessment)
Very mild = 1	Poor = 1
Mild = 2	Fair = 2
Medium = 3	Medium = 3
Strong = 4	Good = 4
Very strong = 5	Very good = 5

Sub-species of garlic	Types of garlic	Cultivars of garlic	Heat	Storage	Cultivar Comments ( x-x ) = approx. # of cloves/bulb
Ophioscorodon or 'ophios' (hard neck) smaller bulbs, larger cloves and fewer small cloves 8-12 cloves avg.	<b>1. Purple stripe</b> a. Standard type b. Glazed type = G c. Marbled type = M - glazed and marbled have fewer cloves and thicker wrappers than standard - harder to peel than rocambole - very colourful	<b>Asian Tempest =A</b>		3	Long beaks on bulbils
		<b>Bavarian Purple</b>	5	3	Mid season, very hardy, (7-8)
		<b>Brown tempest=M</b>	5	3	(4-7)
		<b>Chesnok red</b>	4	3	Good baker (9-11)
		<b>Chinese Hot</b>	4	3	
		<b>Ferganskij</b>		3	
		<b>Khabar</b>		3	Good for baking
		<b>Kyjev</b>		3	
		<b>Metechie</b>	5	3	
		<b>Persian</b>		3	
		<b>Persian star</b>	3	3	Has long pointed cloves
		<b>Premium N. White</b>		3	Late, very cold tolerant, baker (5-7)
		<b>Purple glazer=G</b>		3	Fat cloves, satiny
		<b>Red Czar=M</b>		3	Very beautiful
		<b>Redgrain</b>		3	Good size bulbs
		<b>Red Rezan=G</b>	4	3	
		<b>Shatilli</b>		3	
		<b>Siberian = M</b>	1	3	Late, large bulb (5-7)
<b>Skuri #2</b>	5	3			
<b>Xi'an</b>		3			
	<b>2. Porcelain</b> - 4-8 plump cloves - strong type - shiny thick white wrapper - very beautiful - good storage	<b>Blazer</b>	4	4	Tall var., few cloves
		<b>Georgian crystal</b>	2	4	(4-7)
		<b>Georgian fire</b>	5	4	Good for salsa, very late (4-7)
		<b>German ex. hardy</b>		4	
		<b>Kyje</b>		4	
		<b>Lenningrad</b>		4	
		<b>Music</b>	4	4	V. large bulb, To 13,000 lb./ac (5-7)
		<b>Polish hardneck</b>		4	Very popular
		<b>Polish Jenn</b>	3	4	Good for cooking (6-8)
		<b>Romanian red</b>		4	(4-5)
		<b>Rosewood</b>	5	4	
		<b>Susan</b>	3	2-4	White Bulb, lt. Pink clove (Very similar to Music) (5)
		<b>Delafield's</b>			
		<b>Yugoslavian</b>	3	4	Cold tolerant (3-6)
		<b>Wild buff</b>	3	4	Few cloves
<b>Zemo</b>	4	4	Generally only 4 cloves		

<b>3. Rocambole</b> <ul style="list-style-type: none"> <li>- 6-11 cloves in circle</li> <li>- cool climate type</li> <li>- very easy to peel</li> <li>- scape has double loop</li> <li>- poor storage type</li> <li>- thin bulb wrapper</li> <li>- brownish cast</li> <li>- great flavour</li> </ul>	<b>Bavarian purple</b>	4	2	Very hardy (7-8)
	<b>Baba Franchuk's</b>	4	2-4	White bulb, dark. Purple clove (9)
	<b>Carpathian</b>	5	2	
	Fish Lake 3	5	2	White bulb, purplish clove (4)
	French red	4	2	Similar to Spanish roja
	<b>German red</b>	5	2	M-L bulb, Large cloves (10-12)
	GSF#65	4	2	Most pungent garlic
	Israeli	4	2	Very uniform cloves (7-9)
	<b>Killarny red</b>		2	Excellent
	<b>Korean purp.</b>	3	2-4	Purple. bulb, pink/bronze clove (9) Roaster
	<b>Legacy</b>		2	
	Mahogany	4	2	Deep brown cloves
	Pitarelli	4	2	Cloves dark brown
	Purple rocambole	4	2	
	<b>Pushlinch</b>	3	2	White bulb, purplish clove
	Red devil	3	2	
	Russian red	4	2	Cold tolerant, large bulbs (8-13)
	<b>Spanish roja **</b>	5	2	Large bulb and cloves (9-12)
	<b>Ukranian hot</b>		2	
	<b>Yugoslavian</b>	3	4	Cold tolerant (10-14)
Wildfire		2	Cold tolerant, brown striped cloves	
Wild rocambole		2	Lt.br/purple blotching	

<b>Unclassified hardnecks</b>	<b>Aliah's</b>	3	2-4	Late, purple bulb/clove (9)
	<b>Alison's</b>	4	2-4	White bulb, purple clove (9)
	<b>Atkin's Russian</b>	4	2-4	Pink bulb, brown clove (8)
	<b>Bogatyr</b>		2-4	Very hardy
	<b>Choparsky</b>		2-4	Very hardy
	<b>Czechoslovakia</b>	2	2-4	Medium size bulb (10)
	<b>Denman Island</b>	3	2-4	Purple bulb, purple & brown clove
	<b>Ethopian</b>		2-4	Grey stripe skin on bulb
	<b>Fauquier</b>		2-4	Small bulb (9)
	<b>Fish Lake 23</b>	4	2-4	Purple bulb, brown. Clove (7)
	<b>Kiev</b>	4	2-4	Large bulb (10)
	<b>Korean purp.</b>	3	2-4	Purple. bulb, pink/bronze clove (9) Roaster
	<b>Mediterranean</b>		2-4	Extra large bulb (11)
	<b>Malpasse</b>		2-4	Large bulb (5)
	<b>N. Quebec</b>	4	2-4	White bulb, pale purple Clove (5)
	<b>Ontairo</b>	2	2-4	White bulb, pale purple Clove (4) easy peel
	<b>Purple max</b>	2	2-4	Purplish bulb and clove,
	<b>Racey (aka. Racey surprise?)</b>	5	2-4	Purplish bulb & clove, braidable (10)
	<b>Salt spring</b>	2	2-4	Purplish bulb & clove,
	<b>Salt spring ear.</b>	4	2-4	Purple bulb (8)
	<b>Salt Spring sel.</b>	4	2-4	White. bulb, purplish clove,
	<b>Stein Mt.</b>	4	2-4	Pink/purple bulb and clove, early 8)
	<b>Tibetan</b>		2-4	Medium bulb (7)
	<b>Thai</b>	4	2-4	Purplish bulb, brow/pink clove (8)
	<b>Ukranian Maniv</b>	3	2-4	Large White bulb, pink clove (7)

Sub-species	Types	Varieties	Heat	Storage	Variety Comments
<b>Sativum</b> (Soft neck) Larger bulbs with many smaller cloves Generally easier to grow than hardnecks and more productive Better generally for roasting, higher soluble solids	<b>1. Artichoke</b> Asiatic type = A Turban type = T - Type mostly found in stores, or common garlic - Asiatic types have plump cloves and very thick skins and produce scapes. Not often found here.	<b>Asian Rose</b>	4	4	Early (7-8)
		<b>Blossom=T</b>		4	Large bulbs
		<b>California early</b>	2	4	Very adaptable
		<b>California late</b>	4	4	Produces bulb shoots (10-12)
		<b>Chamiskuri</b>		4	
		<b>Chendgu#8=T</b>		4	
		<b>Chet's italian red</b>	2	4	Very adaptable (10-20)
		<b>Chinese = A</b>	4	4	Oriental favorite, early
		<b>Chinese Pink</b>		4	Early (9-15)
		<b>Chinese purple = T</b>	5	4	Very early to mature
		<b>Cledor</b>	5	4	Excellent braider (9-10)
		Early Italian purple	4	4	Very vigorous (7-9)
		<b>Early Italian red</b>	4	4	Very productive (18-22)
		<b>Farquier</b>	3	4	
		<b>Fish lake #7</b>		4	Medium bulbs (7)
		<b>French</b>	2	4	Small purple bulb, purp/brown clove, early (9)
		<b>Hungarian</b>		4	(4-5)
		<b>Inchelium red</b>	3	4	Very adaptable, good braiding
		<b>Italian</b>		4	Medium (12)
		<b>Italian Lute</b>		4	
		<b>Limbourg</b>		4	Wht bulb, occ. scape - even cloves (7)
		<b>Lorz Italian</b>	4	4	Heirloom
		<b>Lotus=T</b>		4	
		<b>Machashi</b>		4	Unique
		<b>Mucdi</b>		4	
		<b>Olomuk</b>		4	Large bulbs
		<b>Oregon blue</b>		4	Good for salad dressing (11-20)
		<b>Polish white, aka New York white</b>	4	4	Braids well, no small cloves (11)
		<b>Purple cauldron</b>	4	4	(11-15)
		<b>Pyong Vang=A</b>		4	(6-8)
		<b>Red Janice=T</b>		4	
		<b>Russian red toch</b>	4	4	Very large bulbs
		<b>Russian redneck (aka) R. red = A</b>	4	4	Very winter hardy, early, harvest as soon as leaf browning starts
		<b>Siberian Artichoke</b>		4	
<b>Silver rose</b>	4	4	Very Late (7-10)		
<b>Simonetti</b>	2	4	Monster bulbs		
<b>Susanville Ltd.</b>	4	4	Very adapt., true, roast/braider (11-13)		
<b>Tai Cang=A</b>		4	Light purple cloves (3-6)		
<b>Thermadrone</b>		4	Impressive		
<b>Tzan=T</b>		4			
<b>Uzbek Turban=T</b>		4			
<b>Wild fire=T</b>	5	4			

<b>2. Silverskin</b> - 8-24 smaller cloves in circle - late maturing - hardest to grow well - used for braiding - bulbils/scapes are rare - hard to peel - good raw - Creole type = C & is not very hardy	<b>Ajo Rogo =C</b>		5	Not very hardy in BC
	Burgundy =C	2	5	Not very hardy in BC
	<b>Cledon</b>		5	Large bulbs, excellent braider (9-10)
	Creole red =C		5	Not very hardy in BC
	Idaho silver		5	Good for cold areas
	Locati	4	5	Heirloom, good for north
	Mild french	2	5	Tolerates hot and dry
	<b>Nootka rose</b>		5	Very beautiful
	Rose du Var	3	5	Very beautiful
	Sicilian silver	4	5	Large bulbs
	Silver rose		5	Best for braiding (12-14)
	Silver skin S&H	2	5	Large bulbs, few small cloves (15-20)
	<b>Silver white</b>		5	Very productive (13-16)
	<b>Spanish</b>	3	5	Brown bulb. Lt. brown/yellow clove (12)

## Soils/Nutrients

Garlic prefers a well-drained friable soil with at least 4% organic matter and a pH of 6.0-7.0. Organic matter will help to hold moisture and is especially important in lighter soil types. Stay clear of high clay soils (over 40%clay), compacted soils and any soil with excessive stones that will deform the bulb and influence the size of the bulbs.

You must obtain a soil test from a qualified lab to accurately establish the chemistry and physical aspects of the site. There are a number of labs in BC that can do this testing.

The soil test, will determine what amount of fertilizer is required to bring the site up to optimum levels. Garlic needs approximately 45 kg available N/acre. Some of the N could be applied as a band in the fall but may be lost due to leaching. Apply the first feeding of nitrogen as side dressing very early in the season as garlic is an early starter. The rest of the nitrogen can be applied as 1 or 2 side dressings at about 4-week intervals. No nitrogen should be applied 6 weeks prior to harvest, or after the 4-5 leaf stage.

Phosphorus requirements are about 45 kg. (P<sub>2</sub>O<sub>5</sub>)/acre and can be banded at planting time for best results.

Potassium requirements are about 70 kg. (K<sub>2</sub>O)/acre. Garlic seldom responds to added potassium unless the soil level is very low. If your soil test indicates potassium is required, use a broadcast application before seeding and work into the soil.

Sulfur requirements are about 15-23 kg/acre and will be indicated on the soil test. Apply as a broadcast before planting.

Lime will be needed, depending where you live in BC and the amount needed to bring pH above 6.0 will be indicated by soil test. Most interior soils do not need lime.

Apply micronutrients only as indicated by soil test as some are toxic at high levels and most are available in enough quantity.

Manure can be applied as a nutrient source, but must be applied on the basis of the soil test results. As well, the quality of the manure needs to be tested, to know how much to apply. Manure is a good supplier of organic matter, but usually a low and slow supplier of nutrients, as it releases over a year or two. If you are using manure some of the above mentioned nutrients will only become available over time.

Mulches are probably not necessary in British Columbia, but would help to cool the soil in mid summer

### TYPICAL NUTRIENT CONTENT OF VARIOUS MANURES

Manure	Moisture %	Nutrient Content * kg/tonne (kg/m <sup>3</sup> )		
		Total N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Beef (solid)	68	4.2 (2.1)	4.8 (2.4)	8.2 (4.1)
Dairy (solid)	77	3.9 (2.0)	3.4 (1.7)	9.0 (4.5)
Dairy (liquid)	91	2.9 (2.9)	2.1 (2.1)	4.5 (4.5)
Swine (covered pit)	93	6.3 (6.3)	3.3 (3.3)	3.9 (3.9)
Swine (uncovered pit)	98	3.5 (3.5)	1.5 (1.5)	1.7 (1.7)
Horse (with shavings)	72	2.4 (1.2)	1.7 (0.8)	3.2 (1.6)
Spent mushroom compost	70	5.8 (2.9)	2.5 (1.2)	8.5 (4.2)
Poultry (broiler)	25	31.6 (15.8)	22.8 (11.4)	12.2 (6.1)
Poultry (layer)	50	22.8 (11.4)	29.2 (14.6)	11.2 (5.6)

\* Nutrient values for manure assumes proper storage, handling and application to minimize losses.

Conversions: \*\*

1 tonne of liquid manure = approximately 1000 litres = 1 cu. m. = 220 Imp. gallons.

1 cu.m. = 1.25 cu.yd. = 28 bushels

1 tonne of solid manure = approximately 2 cu.m. = 2.5 cu. yd.

To convert kg/tonne to lb./ton, multiply by 2.0.

To convert kg/cu.m. to lb./cu.yd., multiply by 1.7

\*\*From the 'Vegetable Production Guide for Commercial growers' available from LMHIA at 604-556-3001 for \$20.00.

## **Watering**

When watering garlic the first and possibly only rule is that garlic must not be allowed to dry out, or it will produce smaller bulbs. Keep the upper 6-8 inches of soil moist, but not wet, at all times, as that is where most of the root system will be. Depending on location, up to 60 cm (24") of water might need to be applied per year.

An irrigation system is a must, especially in the interior of BC. Lighter soils will need more frequent water applications, but less water applied per application. Make sure that the sub-soil does not dry out as roots can go down 100 cm (3ft) in good friable soil.

Water stress during the growing season can cause bulbs to be smaller and is thought to also cause a multiple stem disorder. There are various ways to determine when irrigation should be terminated; when there are two-three scales around the bulb; when bulbs are the desired size; when the leaves start to turn yellow; or two weeks before harvest if you have pre-determined this date.

Excess watering near harvest can cause bulb staining and poorer storage quality.

## **Garlic 'Seed' Information/Planting**

The term 'seed' in the garlic world refers to individual cloves separated from a bulb. You can also produce garlic cloves from the bulbils produced on the top of the scape or around the base of the bulb itself, but is a slower process, taking at least two summers to produce a marketable bulb. The pounds of 'seed' needed per acre is very variable as the cloves of different species vary greatly in size. Estimates of the minimum seed required vary from 700-1000 kg/ha (650-900 lbs/ac) and even much more when grown in 4 or 5 row beds and when large cloved varieties are used. In rows 45 cm (18") apart and plants 7.5 cm (3") apart in the row, 116,000 cloves are needed/acre.

To get started, only buy 'seed' from reputable seed companies or packages in garden shops marked seed garlic. Subsequent years you can save your most attractive bulbs as planting stock if you had no disease present in the field. When using your own planting stock, harvest the planting stock bulbs later than your main crop, as harvesting very mature bulbs increases the ease of clove separation.

Softneck garlic should number approximately 75 –80 cloves/lb. Hardnecks will only have 20-30 cloves/lb. as they are typically much larger cloves and therefore cost more per acre to plant. Softnecks usually don't have

scapes/bulbils, while hardnecks almost always do. Scapes produce 4 -30 bulbils in the Rocambole types and 60 -300 in the porcelain type

Manual shelling or 'cracking' and separating individual cloves requires 1.5 to 3 hours per 40 lb. Do not peel the individual cloves. Once cracked, clean cloves must be planted without delay. With manual planting you can do 10 –20 lbs., or 500 – 1000 cloves per hour. Mechanization is available for "cracking" bulbs and sorting cloves into various sizes as well as actually planting in the field. Keep in mind that large cloves yield large bulbs which give large yields. Seeds laid in all positions may result in crooked necks, but yields are not decreased except from those few cloves that are completely inverted, especially in hardneck cultivars.

Generally cloves or 'seed' is planted about 10-15 cm (4-6 in.) apart in the row, four rows to a bed, 17-20 cm (7-8 in.) apart, at a depth of 5-7 cm (2-3 in). Garlic can also be grown in single rows with 45-90 cm (18 to 36in.) spacing between rows. Very large cultivars may need more space.

In BC, garlic is usually planted around September 15<sup>th</sup> to October 10<sup>th</sup> but this can vary considerably from zone to zone. To estimate a planting date, use the average date of first killing frost of the fall or 6 weeks before freeze-up. Spring planting can be done but is not recommended. Spring planting must be done as soon as soil and weather conditions allow so that the minimum cold treatment occurs and enough time is available for bulb growth.

Spring garlic greens, similar to green onions, can be produced by planting quite thickly, in fall or early spring, either small non-commercial cloves or bulbils. If left they often produce a single clove, which can be planted again in the fall to produce regular bulbs or larger 'single' bulbs the following year.

## **Seed Storage/Treatment**

Garlic for seed should be stored at 10°C (50° F) and a humidity of 65 – 70 %. This is hard to achieve without a cooler as it is harvested in the summer when the days can be quite warm. Bulbs to be used for seed can be harvested later in the season, reducing storage time and the skins will deteriorate making cracking easier. Bulbs selected for planting stock are usually stored, with the dry tops attached in unheated warehouses.

Cloves sprout most rapidly at 5-10°C (40 to 50° F), hence prolonged storage at this temperature range should be avoided.

Storage of planting stock at temperatures below 5°C (40° F) may result in rough bulbs, side shoot sprouting and early maturity.

Storage of planting stock at temperatures above 18°C (65° F) may result in delayed sprouting and late maturity.

Whole bulbs store much better than individual cloves. Bulbs which have side growths should be discarded for seed stock, as this characteristic will likely carry on to the next crop.

### **Bulb Storage - General**

For long term storage of bulbs for eating, they need temperatures of 0-5 °C (32-40 ° F) and a humidity in the 50-60% range. They also must have good air circulation such as an open tray or a mesh bag. High humidity will cause sprouting and reduced time in storage. Do not store in a refrigerator as they will lose flavour very quickly and are subject to sprouting, due to the cool temperature and higher humidity. Small lots keep well in a ceramic garlic keeper with holes that can be purchased in stores anywhere. Small homeowner lots, store at 15-18 °C (60-65 ° F) and low humidity. Should store 6-9 months depending on cultivar and species.

### **Weed Control**

Perennial weeds must be controlled before planting, as they can't easily be controlled later. Organic production has no chemicals available for weed control. For non-organic production, see the 'Vegetable Production Guide for Commercial growers' available from LMHIA at 604-556-3001 for \$20.00.

Garlic requires nearly perfect annual weed control, since it emerges slowly, matures in 10 –11 months, and never forms a canopy. Deep cultivation for weed control should be avoided.

One acre of garlic requires 38-56 hours of labour to hand weed. If large mechanized weeding equipment is used, precise seeding must be achieved.

### **Insect Control**

There are no chemicals available for insect control when growing organically. Good weed control, site preparation, site selection and crop rotation are ways to ensure that insect pests don't become a problem, but there are no guarantees.

See the weed section above for non-organic controls available in the vegetable guide. Some of the major

insect problems include nematodes, thrips in specific locations, garlic bulb mites, as well as onion maggots and wireworms.

Nematodes on garlic can cause yellowing of the leaves and splitting or shattering of the basal disk of the bulbs. Other causes of shattering may be too rapid drying of the bulbs after harvest.

Thrips give the leaves a silvery, streaked appearance and may be seen as tiny brownish "threads" along the midribs.

Garlic bulb mites cause irregular shaped, sunken white to tan-coloured areas, or a roughened, pebbled appearance on the surface of the cloves. "Dusty" material often appears in the vicinity of the lesions and on the sheath leaves. They have been found here in BC in a few sites. For more information on garlic pests see the "Vegetable Production Guide for Commercial Growers" (ordering information in additional sources of information section).

### **Disease Control**

It is very important to get properly identified source of garlic, nematodes and disease. A crop rotation that does not include onions, cole crops or canola is the best control measure for diseases on garlic.

Some of the common diseases on garlic are:

White rot, caused by the fungus *Sclerotium cepivorum*, which causes a cakey white growth with black poppy-seed-size dots on the bulb base. These bodies, or sclerotia, are extremely long-lived and are the over-wintering bodies of the fungus. The only control is to avoid planting garlic or onions in the affected ground for at least 5 years or more.

White/Green Mold or *penicillium* disease caused by fungus called *Penicillium hirsutum*. This fungus causes infections on seed cloves when they are damaged during cracking and develops sunken, brownish to tan discolored areas on their surface and may become covered in a white to green to brownish powdery mold. In the spring stunted or weak plants may fail to emerge. Because green mould happens early it is often confused with winter damage. Dry conditions will enhance this disease. Take care when cracking and plant immediately after cracking with large cloves. Straw mulch for soil moisture control may also help.

Virtually all sources of garlic contain some viruses, which may or may not affect the plant. Symptoms of virus infection are colour changes in the leaves.



Aphids are one vector capable of transmitting some viruses from infected to healthy plants.

#### Fusarium Basal Rot

*Fusarium corymbiferum* affects the basal plate of the bulb and root system causing the bulb to shatter when harvested. Avoid wet conditions when soil temperatures are high. Replant in clean soil.

#### Harvesting

How do you tell when a garlic crop is ready to harvest? For hardneck varieties, leave a few indicator scapes. Harvest when these scapes are upright but before the spathe or top has opened. For softneck varieties, harvest when 1/3 of the leaves are brown or drying from the bottom up. For both types you should be able to see the cloves inside the bulb when samples are dug.

Some varieties are examined for clove colour to determine the correct harvest timing. Every grower will develop their own precise timing. Left too long before harvest, depending on variety, the clove wrappers may crack or disappear altogether, making the product unsaleable as well as reducing storage quality. Left too long in the ground may also cause a gray stain to develop on some varieties making them hard to sell. Hardneck garlic matures 2 to 3 weeks after softneck types. Never harvest late for commercial sales, as bulb sheaths may be very thin or gone

If field curing is done, the tops should be left on and used to protect the bulbs from sunscald. This method is not recommended except for short time frames. For harvest and ambient air screen drying, the tops and roots can be cut by hand when dug, leaving about 3 cm of top and 1cm of root. There are mechanical top removal systems available. Bulbs can also be dried with the tops on to be removed later but does require more space.

If bulbs are harvested and hung, in bunches of 12 or so in the drying shed, the tops are always left on for tying. The tops are always left on are for braiding as well. The braiding process is made easier if the plants are dug a bit early to get a fuller and more pliable top for braiding. The major value added step to take with garlic is to braid it. That usually doubles its price per pound.

Depending on the soil type, undercutting may need to be done to loosen the soil, reducing damage to the bulbs. This is especially true for hand harvesting. Handling the plants roughly causes either cuts or bruises.

Yields of up to 12,000 lbs/acre have been achieved and this depends on variety, planting date, pest pressure, nutrients available, site location, soil type and quality and size of planting stock to name a few. For every 1 kg of garlic planted, there should be 5 – 7 kg harvested.

#### Curing

Curing of garlic can be achieved in the field, but in a shed is best. There are many styles of curing from wire racks to hanging from rafters in bundles, using the tops. Whichever method is used, lots of air circulation is a must. After 2-3 weeks at a temp of 30° C, the completely dried tops and roots are trimmed with pruners to 3.0 cm and 1 cm respectively with pruners. If moisture can be squeezed from the ends of the cut stem, then the bulbs should be further cured. Using ambient air will increase the time for drying, but reduce the need for heaters. Garlic can also be trimmed in the field, put into commercial heated/forced air dryers and cured quite quickly. Garlic bulbs are usually stored in 40 lb. onion sacks when dried and trimmed.

Once cured, the storage temperature for market garlic should be close to 0° C and 60-70% humidity. Be careful to not pile too deep as heating within the pile can occur and spoilage will result. Proper storage with good air circulation should make garlic available all year if the proper varieties are chosen. Flavour increases in storage in the short term, then decreases over the long term. By mid summer, stored garlic will have lost some flavour and fresh garlic will be welcomed.

#### Economics

Garlic is a high input crop, both for seed and labour. For more information go to - [http://www.agf.gov.bc.ca/busmgmt/budgets/budget\\_pdf/herb\\_specialty/garlicor.pdf](http://www.agf.gov.bc.ca/busmgmt/budgets/budget_pdf/herb_specialty/garlicor.pdf)

## Sizing and Grading Guidelines

### RECOMMENDED PACKAGES: 30 POUND OR 10 KG BOX

SIZING parameters				
RETAIL NAME	AVERAGE DIAMETER METRIC	COUNT PER KG (approx.)	AVERAGE DIAMETER (imperial)	COUNT PER POUND (approx.)
SUPER COLOSSAL	75 MM	8	3"	3.5
COLOSSAL	70 MM	9	2.75"	4
SUPER JUMBO	65 MM	10	2.5"	4.5
EXTRA JUMBO	55 MM	13	2.25"	6
JUMBO	50 MM	20	2"	9
GIANT	47 MM	23	1 7/8"	11
LARGE TUBE	44 MM	30	1 3/4"	14
MED TUBE	41 MM	33	1 5/8"	15.5
SMALL TUBE	37 MM	44	1 1/2"	20

GRADING parameters
<p><b><u>CANADA #1 - RETAIL MARKET QUALITY</u></b>  <b>SIZE:</b> - 1.5" AND UP  <b>QUALITY:</b>            MATURE, CLEAN BRIGHT, BULBS FIRM AND COMPACT, CLOVES FILLED OUT AND FAIRLY PLUMP. NO STAINING. GRADE DEFECTS WITHIN TOLERANCE.  <b>CONDITION:</b>            WELL CURED AND DRY, NO DAMPNES. LESS THAN 2% SHATTERED CLOVES. NO DECAY</p>
<p><b><u>CANADA COMMERCIAL</u></b>  <b>SIZE:</b>            LARGE: 1-8 PER POUND OR 7-16 PER KG            MEDIUM: 9-14 PER POUND OR 17-29 PER KG            SMALL: 15+ PER POUND OR 30 + PER KG  <b>QUALITY:</b>            NOT SUITED FOR RETAIL SALES. STILL GENERALLY COMPACT, WITH CLOVES FILLED AND PLUMP.  <b>CONDITION:</b>            IN MOST CASES GARLIC IS WELL DRIED AND CURED. BULBS MATERIALLY STAINED WITH GREY OR YELLOWISH DISCOLOURATION, SOME SHOWING DARK SURFACE OR MOULD GROWTH. UP TO 6% DECAY, WITH SOME BULBS HAVING UP TO 2 CLOVES SHOWING DISCOLOURATION. UP TO 15% SHATTERED CLOVES. 5% MAY SHOW SPROUTS.</p>

## Garlic Processing

Garlic can be frozen in any of three ways:

1. Grind or chop the garlic, wrap tightly, and freeze. To use, just grate or break off the amount needed.
2. Freeze the garlic unpeeled and remove cloves as needed.
3. Peel the cloves and puree them with oil in a blender or food processor, using two parts oil to one part garlic. The puree will stay soft enough in the freezer to scrape out parts to use in sautéing.

For drying, use only fresh, firm garlic cloves with no bruises. To prepare, separate and peel cloves. Cut in half lengthwise. No pre-treatment is necessary.

Dry at 140°F (60°C) for two hours, then at 130°F (55°C) until dry. Garlic is sufficiently dry when it is crisp.

To make garlic salt from the dried garlic, powder dried

garlic in a blender until fine. Add four parts salt to one part garlic powder and blend 1 to 2 seconds. If blended longer, the salt will be too fine and will cake.

Peeled cloves can also be submerged in wine and then stored in the refrigerator. The garlic can be used as long as there is no sign of mould growth or yeast on the surface of the wine. Both the garlic-flavoured wine and the garlic may be used. **Do not** store the garlic wine mixture at room temperature because it will rapidly develop mould growth.

Peeled garlic cloves may also be submerged in oil and stored in the **freezer**. Garlic is a low acid vegetable (pH 5.3-6.3) and will support botulism bacteria under certain conditions so **don't store a garlic/oil mixture at room temperature or in the refrigerator**.

Canning garlic is not recommended. Garlic loses most of its flavour when heated.

Pickled garlic is awesome as are green olives stuffed with garlic.

### **Health Aspects**

Perhaps no other plant has been used for so long, in as many cultures and for as many medicinal and culinary purposes as garlic. Some people believe garlic has activity in the following areas

- lowering cholesterol
- reducing the clotting tendencies of blood
- lowering high blood pressure
- antibiotic, antifungal and anti viral activities
- Garlic also contains protein and the B vitamins thiamin and riboflavin, and trace minerals such as zinc, tin, calcium, potassium, aluminium, germanium, selenium and of course, sulfur.

## **Sources of Garlic 'seed'**

- Russell Farms, Herbert Burgess, Vernon BC, 111 Russell Rd., V1H 1L2, 250 545-5514
- Saltspring Seeds, Box 444, Ganges PO, Saltspring Island BC V8K 2W1, 250 537-5269
- Kokotelli's Organic Gardens, Box 1773, Rossland, BC, V0G 1Y0, 250 362-3386
- Roots 'n Spears, Len Caron, 2671 Shoreacre Dr., Castlegar BC, V1N 3L4, 250 359-7514
- Land O Farms, Orville Harrington, RR1 S4 C18, 2188 Newton Rd., Cawston BC, V0H 1C0 250 499-2656
- Dacha Barinka, 46232 Strathcona Road, Chilliwack, British Columbia, V2P 3T2
- A & D farms, 39237 Vye Rd., Abbotsford BC, V3G 1Z8, 604 850-7523
- Mr. Tony Temmer, RR #3Langton OntarioN0E 1G0, 519 586-2451
- Mr. Danny Sciascetti, C/o Susan Farms, 5 Rapallo Dr. Hamilton, OntarioL8T 3X6, 416 575-0142
- Fish Lake Garlic Man, Ted Maczka, RR 2, Demorestville, Ontario, K0K 1W0, 613 476-8030
- William Dam Seeds, Box 8400 Dundas, Ontario L9H 6M1, 905 628-6641
- Richters Herbs, 357 highway 47, Goodwood, Ontario, L0C 1A0, 905 640-6677
- Sonia Stairs and Henry Caron, Boundary Garlic, Box 273 Midway, BC V0H 1M0
- Paridon Horticultural Ltd., 5985 – 104 St. Delta, BC, 604-596-3422
- Van Noort Bulbs, 22264 #10 Hwy, Langley, BC V2Y 2K6, 604-888-6555
- T&T Seeds LTD., Box 1710, Winnipeg Manitoba R3C 3P6
- Flat Creek Farms, 128 Fredrich St., Stratford ON, N5A 3U7, 519 272-1742

## **Sources of Information & Supplies**

- InfoBasket, a British Columbia Government web based information portal <http://infobasket.gov.bc.ca>
- Growing Great Garlic, Ron Engeland, Filaree Productions, R 1, Box 162, Okanogan, WA 98840, 509 422 – 6940
- The BC 'Vegetable Production Guide for Commercial Growers', \$20.00, LMHIA, 1767 Angus Campbell Rd, Abbotsford BC, V3G 2M3, 604 556-3001
- Garlic Seed Foundation, Rose Valley Farm, Rose N.Y. 14542 – 0149
- Ontario Garlic Growers Association, RR1, Lasalette, Ontario N0E 1H0 (\$1.75 / lb.)
- Holland Transplanter Co., 510 East 16<sup>th</sup> St. / P/O. Box 535, Holland MI 49423 – 0535, 616 392 – 3579
- Mechanical Transplanter Co., 1150 South Central, Holland MI 49423, Phone: 616 396 – 8738
- KPR Sales, Inc., P.O. Box 608, 375 West Avenue D, Wendell, ID 83355-0608 ( Toppers and diggers )
- Washington State University Cooperative Extension, Spokane County, 222 N. Havana, Spokane, WA 99202. 509-533-2048
- Keremeos Produce, 400 Second St., Keremeos, BC, V0X 1N0, 250-499-7872, [rdlee@keremeosgarlic.com](mailto:rdlee@keremeosgarlic.com)

## **Garlic Festivals in BC and Contact Names**

Salt Spring Island Hills	In early August Approx. Sept 10	contact Kristie Straarup 250-537-1210, fax 1245 contact Maggie Bahr 250-265-4967, <a href="http://www.geocities.com/garlicfestival/main.htm">www.geocities.com/garlicfestival/main.htm</a>
Forest Grove Abbotsford	Approx. mid Aug. Approx. mid Aug	contact Gail 250-397-2540, fax 2517 contact Becky Burns 604-853-0313

For other information please check out <http://www.infobasket.gov.bc.ca> and search for garlic.

NOTE: There is considerable discussion about cultivars and at least two research people in the USA are doing genetic fingerprinting to see what named cultivars are actually the same. This needs to be done in various areas where garlic is grown and the results correlated. It is believed that there are considerably less cultivars of garlic than are actually listed.

-----Find out who your friends really are, eat garlic-----