

SoilGard is a naturally occurring soil fungus which is an antagonist to plant pathogenic fungi. Uniformly add SoilGard 12G when soilless mixes are being blended by mechanical devices. After one day of incubation, seed or transplants can be added to the treated mix.

### Verticillium Wilt

Best control can be accomplished by a 4- to 5-year rotation with crops other than tomato, potato, pepper, strawberry, or any of the brambles. Varieties which appear to maintain yield in infested fields include Classic, Epic, Vernal, and Viserba.

Soil fumigation will provide some control by delaying symptom expression. Refer to the "Soil Fumigation" section for details on application. Use metam-sodium (Vapam HL at 56 to 75 gallons per acre) with a plastic seal. Broadcast treatments are superior to row treatments.

Grafting Verticillium resistant tomato rootstocks to susceptible eggplant varieties is a viable strategy to reduce the impact of disease.

Before grafting: 1) expose the scion and rootstock to sunshine for two to three days, 2) withhold water from the plants to avoid spindly growth and 3) make sure that the scions and rootstock have stems of a similar diameter. Grafted plants are usually healed and acclimated in a plastic tunnel. The healing and acclimatization are very important for grafted plants to survive. The tunnel is covered with materials that provide shade and maintain a high relative humidity inside the tunnel.

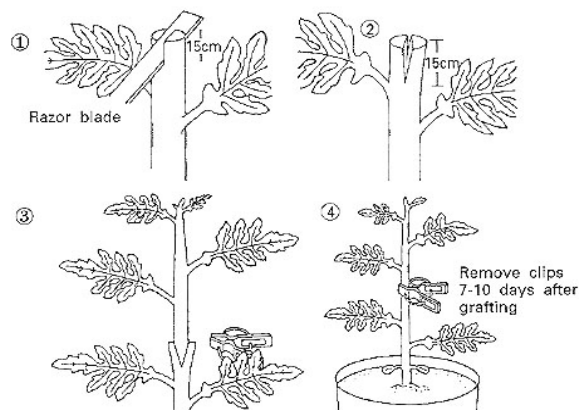


Figure F-1 Schematic Diagram of Cleft Grafting

### Leaf Spots and Fruit Rots

Scout on a regular basis. Begin preventative sprays when weather conditions favor disease development or when symptoms of disease first appears and repeat every 7 to 10 days.

#### Rotate one of the following FRAC code 11 fungicides:

Quadris--6.0 to 15.5 fl oz 2.08SC/A, or  
Cabrio--8.0-12.0 oz 20EG/A (leaf spots only), or  
Flint--2.0-4.0 oz 50 WDG/A

#### With:

maneb--1.5-2.0 lb 75DF/A or OLF

Do not make more than 4 total applications of fungicides from the FRAC code 11 group in a single year.

### Tomato Spotted Wilt Virus (TSWV)

TSWV is spread by thrips from flowering ornamental plants to eggplant. Do not grow any ornamental bedding plants in the same greenhouse as eggplant transplants. Monitor and scout greenhouses for thrips and begin an insecticide control program once observed.

### Phytophthora Blight (*Phytophthora capsici*)

The pathogen causes collar rot, fruit rot, and stem cankers. To minimize the occurrence of the disease, rotate away from susceptible crops (cucurbits, peppers, eggplants, and tomatoes) for as many years as possible. For control of collar rot, plant onto raised beds and use the following:

mefenoxam--1.0 pt (Ridomil Gold) 4EC/A or 1.0 qt (Ultra Flourish) 2E/A. Apply broadcast prior to planting or in a 12 to 16-inch band over the row before or after transplanting. Make two supplemental post-directed applications at 1.0 pt/A Ridomil Gold or 1.0 qt/A Ultra Flourish to 6 to 10 inches of soil on either side of the plants at 30-day intervals. Use formula in the "Calibration for Changing from Broadcast to Band Application" section of Calibrating Granular Application Equipment to determine amount of Ridomil Gold or Ultra Flourish needed per acre when band applications are made.

For suppression of the stem and fruit rot phase of Phytophthora blight, apply the following on a 7 to 10 day schedule. When environmental conditions are conducive for disease development shorten the interval to 5-7 days:

Forum--6.0 fl oz 4.18SC/A plus fixed copper at labeled rates

### Harvesting

Fruits should be harvested when the outside color is still a glossy purple and the seed and pulp are white. Soft fruit and dark seed indicate overmaturity. Fruits must be harvested as they reach maturity to ensure continued fruit set.

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## GARLIC

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### Varieties

Obtain the best strains of Italian or German (late or pink-skinned type) "Rocambole" garlic, or Polish softneck (no hard seed stalk) types that will braid, or elephant types from a local grower who has had success with fall-planted garlic. Unlike many strains sold commercially, such a strain will be hardy and, therefore, will overwinter very well. Avoid the Creole types (also called Early, Louisiana, White Mexican, etc.), since they are not very winter-hardy and do not keep well. Both the Italian and Creole types have a white outer skin covering the bulb, but the Italian type has a pink skin around each clove, whereas the skin around each Creole clove is white. Elephant-type garlic (milder than regular garlic and up to four times larger) may not yield very well when fall-planted in areas with severe cold or extensive freezing and thawing cycles, which cause heaving. The Italian and Elephant types take about 220 days to mature.

Many of the most productive Italian garlic strains will produce seed stalks prior to harvest. Snap these seed stalks just as they begin to coil for best yields. "Rocambole" types

have coiled seedstalks that are perfectly normal and not the result of any poor cultural practice or herbicide contamination.

### Soil Fertility

Maintain a soil pH of 6.2 to 6.8. Fertilize according to soil test recommendations for garlic. In moderately fertile soils, apply about 75 pounds per acre nitrogen (N), 150 pounds per acre phosphate (P<sub>2</sub>O<sub>5</sub>) and 150 pounds per acre potash (K<sub>2</sub>O) and disk about 6 inches deep before planting. When plants are approximately 6 inches tall (about March 15), topdress with 25 pounds per acre nitrogen and repeat the topdressing about May 1. Apply all topdressings to dry plants at midday to reduce chance of fertilizer burn.

Since sulfur may be partially associated with the extent of pungency, you may wish to use ammonium sulfate for the last topdressing (May 1).

Although garlic is commonly grown on muck or light soils, heavier soils will do fine, as long as they are loose and friable (through use of organic matter or cover cropping).

### Planting

Garlic cloves should be planted between about September 15 and October 25 in Central Pennsylvania. They could be planted up to 10 days earlier in the cool, short-season areas and up to 3 weeks later in the warm, long-season areas. Fall-planted garlic establishes an excellent root system and receives a natural cold treatment that produces the highest possible garlic yields. Cloves must be exposed to temperatures between 32° and 50°F (0° and 10°C) for about 2 months prior to the long day-length periods that induce bulbing. Therefore, spring-planted garlic (e.g., Elephant type) may be fairly successful where it can be planted by early March.

Garlic yields tend to increase as the size of the mother bulb increases. The long, slender cloves in the center of the bulb, cloves weighing less than 1 gram, and bulbs with side growths and very poor skin covering of cloves should not be used for planting.

### Spacing

Garlic should be planted 4 by 4 inches apart in triple rows or multiple beds 16 to 18 inches apart. Between-row spacing depends on the equipment available. Clove tops should be covered with 1 to 1½ inches of soil. The cloves must not be so deep that the soil will interfere with the swelling of the bulbs, nor so shallow that rain, heaving from alternate freezing and thawing, and birds will dislodge them. Vertical placement of cloves by hand gives optimum results. Cloves dropped into furrows are likely to lie in all positions and may produce plants with crooked necks.

### Weed Control

Identify the weeds in each field and select recommended herbicides that control those weeds. See Tables E-2 and E-3.

Match preplant incorporated and preemergence herbicide rates to soil type and percent organic matter in each field.

Apply postemergence herbicides when crops and weeds are within recommended size and/or leaf stage.

### Preplant Incorporated or Preemergence

Bensulide--5-6 lb/A. Apply 5 to 6 quarts per acre Prefar 4E before planting and incorporate 1 to 2 inches deep with power-driven rotary cultivators, or apply preemergence and activate with one-half inch of sprinkler irrigation within 36 hours to control most annual grasses. Use the maximum

recommended rate preemergence followed by irrigation to suppress certain annual broadleaf weeds including common lambsquarter, smooth pigweed, and common purslane.

### Postemergence

Bromoxynil—0.125-0.25 lb/A. Apply 4 to 6 fluid ounces per acre Buctril 4E when weeds are 1 to 2 inches tall and the garlic is less than 12 inches tall. Use the lower rate on small weeds and the higher rate on larger weeds or when they are under stress. Use 40 to 100 gallons of spray solution per acre. Concentrated spray solutions increase the risk of crop injury. Good coverage of the weeds is essential for good control. Do not apply within 112 days of harvest when garlic is grown on mineral soil. Do not apply within 60 days of harvest when garlic is grown on muck soil.

Clethodim--0.094-0.125 lb/A. Apply 6 to 8 fluid ounces per acre Select 2EC with oil concentrate to be 1 percent of the spray solution (1 gallon per 100 gallons of spray solution) or 12 to 16 fluid ounces of Select Max 0.97EC with nonionic surfactant to be 0.25% of the spray solution (1 quart per 100 gallons of spray solution) postemergence to control many annual and certain perennial grasses, including annual bluegrass. Select will not consistently control goosegrass. The use of oil concentrate with Select 2EC may increase the risk of crop injury when hot or humid conditions prevail. To reduce the risk of crop injury, omit additives or switch to nonionic surfactant when grasses are small and soil moisture is adequate. Control may be reduced if grasses are large or if hot, dry weather or drought conditions occur. For best results, treat annual grasses when they are actively growing and before tillers are present. Repeated applications may be needed to control certain perennial grasses. Yellow nutsedge, wild onion, or broadleaf weeds will not be controlled. Do not tank-mix with or apply within 2 to 3 days of any other pesticide unless labeled, as the risk of crop injury may be increased, or reduced control of grasses may result. Observe a minimum preharvest interval of 45 days and apply no more than 32 fluid ounces per acre in one season.

Fluazifop--0.125-0.188 lb/A. Apply 0.5 to 0.75 pints per acre Fusilade DX 2E with oil concentrate to be 1 percent of the spray solution (1 gallon per 100 gallons of spray solution) or a nonionic surfactant to be 0.25 percent of the spray solution (1 quart per 100 gallons of spray solution) postemergence to control annual grasses and certain perennial grasses. For best results, treat annual grasses when they are actively growing and before tillers are present. Repeated applications may be needed to control certain perennial grasses. It will not control yellow nutsedge, wild onion, or any broadleaf weed. Do not tank-mix with any other pesticide unless labeled, as the risk of crop injury may be increased, or reduced control of grasses may result. Observe a minimum preharvest interval of 45 days and apply no more than 6 pints per acre in one season. Do not plant corn, sorghum, cereals, or any other grass crop within 60 days of the last application.

Sethoxydim--0.2-0.3 lb/A. Apply 1 to 1.5 pints per acre Poast 1.5EC with oil concentrate to be 1 percent of the spray solution (1 gallon per 100 gallons of spray solution) postemergence to control annual grasses and certain perennial grasses. **The use of oil concentrate may increase the risk of crop injury when hot or humid conditions prevail.** To reduce the risk of crop injury, omit additives or

switch to nonionic surfactant when grasses are small and soil moisture is adequate. Control may be reduced if grasses are large or if hot, dry weather or drought conditions occur. For best results, treat annual grasses when they are actively growing and before tillers are present. Repeated applications may be needed to control certain perennial grasses. Yellow nutsedge, wild onion, or broadleaf weeds will not be controlled. Do not tank-mix with or apply within 2 to 3 days of any other pesticide unless labeled, as the risk of crop injury may be increased, or reduced control of grasses may result. Observe a minimum preharvest interval of 30 days and apply no more than 3 pints per acre in one season.

### Postharvest

Paraquat--0.6 lb/A. **A Special Local-Needs 24(c) label has been approved for the use of Gramoxone Inteon 2SC for postharvest desiccation of the crop in Delaware, New Jersey and Virginia.** Apply 2.4 pints per acre Gramoxone Inteon 2SC as a broadcast spray after the last harvest. Add nonionic surfactant according to the labeled instructions. See the label for additional information and warnings.

## Insect Control

**NOTE:** Copies of specific insecticide product labels can be downloaded by visiting the websites [www.CDMS.org](http://www.CDMS.org) or [www.Greenbook.org](http://www.Greenbook.org). Also, specific labels can be obtained via web search engines.

### Beet Armyworm (BAW)

methomyl (Lannate LV or OLF)  
spinetoram (Radiant 2SC)  
spinosad (Entrust 80W, SpinTor 2SC or OLF)

### Thrips

During hot, dry weather, the population of thrips increases following harvest of adjacent alfalfa or grain. Thrips could, therefore, present the most serious insect problem on garlic. (See "Insect Control" section under Onions. Read and follow specific label directions for use on garlic; if not listed, do not use.)

acetamiprid (Assail 30SG or OLF)  
gamma-cyhalothrin (Proaxis)  
lambda-cyhalothrin (Lambda-Cy, LambdaT, Silencer, Warrior, Warrior II, OLF)  
malathion (Malathion 57EC or OLF)  
permethrin (Perm-up, Pounce 3.2EC or OLF)  
spinetoram (Radiant 2SC)  
zeta-cypermethrin (Mustang MAX, Respect)

**Note:** Use of spinosad or methomyl for beet armyworm control will suppress thrips population.

Pesticide	Use Category <sup>1</sup>	Hours to Reentry <sup>2</sup>	Days to Harvest
<b>INSECTICIDE</b>			
acetamiprid	G	12	7
gamma-cyhalothrin	R	24	14
lambda-cyhalothrin	R	24	14
malathion	G	12	3
methomyl	R	48	7

(table continued)

Pesticide	Use Category <sup>1</sup>	Hours to Reentry <sup>2</sup>	Days to Harvest
<b>INSECTICIDE</b>			
permethrin	R	12,24	1
spinetoram	G	4	1
spinosad	G	4	1
zeta-cypermethrin	R	12	7
<b>FUNGICIDE (FRAC code)</b>			
Cabrio (Group 11)	G	12	7
chlorothalonil (Group M5)	G	12	7
Endura (Group 7)	G	12	7
Forum (Group 40)	G	12	0
iprodione (Group 2)	G	24	0
Pristine (Groups 11 + 7)	G	12	7
Quadris (Group 11)	G	4	0
Ridomil Gold (Group 4)	G	12	7

See Table 3.

<sup>1</sup> G = general, R = restricted

<sup>2</sup> Chemicals with multiple designations are based on product and/or formulation differences. CONSULT LABEL.

## Disease Control

### Damping-off

Use certified seed that has been treated with a fungicide seed treatment. Apply the following before planting to assist with control of damping-off pathogens.

mefenoxam--(Ridomil Gold--0.5-1.0 pt 4EC/A or Ultra Flourish--1.0-2.0 pt 2EC/A) (Pythium only), or metalaxyl (MetaStar)--2.0-4.0 pt 2EC/A (Pythium only), or Quadris--0.40-0.80 fl oz 2.08SC/linear 1,000 row ft. (Rhizoctonia only)

### White Rot

At planting, apply an in-furrow treatment of iprodione--4 pts in 20 gallons of water minimum based on a 38 to 40 inch row spacing; spray both the cloves and the covering soil used to fill the furrow. In treated fields, do not grow crops other than garlic and leafy vegetables during the harvest year, and do not grow garlic, leafy vegetables, tomatoes, root crops, cereal grains, or soybeans during the following year.

### Botrytis Leaf Blight (Blast)

Scout fields on a regular basis. Apply the following when weather conditions favor disease development and repeat twice at 7 to 10 day intervals.

chlorothalonil--1.5 to 3.0 pt 6F/A or OLF, or Endura--6.8 oz 70WG/A, or Pristine--14.5-18.5 oz 38WG/A

Do not make more than 2 consecutive applications of Endura or Pristine before switching to a fungicide with a different mode of action.

### Purple Blotch and Downy Mildew

Scout fields on a regular basis. Apply one of the following when weather conditions favor disease development and repeat at 7 to 10 day intervals.

Forum--6.0 fl oz 4.18SC/A (for downy mildew only; must be tank-mixed with chlorothalonil), or Quadris--6.0-12.0 fl oz 2.08SC/A for Purple blotch or 9.0-15.5 fl oz 2.08SC/A for downy mildew

Cabrio--8.0-12.0 oz 20EG/A (Downy mildew-suppression only), or  
Pristine--18.5 oz 38WG/A (Downy mildew-suppression only), or  
Endura--6.8 oz 70WG/A, (Purple blotch only), or  
chlorothalonil--1.5-3.0 pt 6F/A or OLF (Downy mildew-suppression only)

Do not make more than 2 consecutive applications of either Cabrio, Endura, Forum, Pristine or Quadris before switching to a fungicide with a different mode of action.

### Harvesting and Storage

Fall-planted garlic in central Pennsylvania is ready to harvest about the second week in July. When a few tops fall over, push all of them down and pull a sample. There are only about 10 days to 2 weeks for optimum garlic harvest. Before then, the garlic is unsegmented like an onion; much after that period, the cloves can separate so widely that the outer sheath often splits and exposes part of the naked clove. Picked at the proper time, each clove should be fully segmented and yet fully covered by a tight outer skin.

Run a cutter bar under the bulbs to cut the extensive root system and partially lift them. The bulbs are usually pulled and gathered into windrows. Tops are placed uppermost in the windrow to protect bulbs from the sun, and the garlic is left in the field for a week or more to dry or cure thoroughly. Curing can also be accomplished in a well-ventilated shed or barn. The bulbs must be thoroughly dried before being shipped or stored.

After curing garlic, discard diseased and damaged bulbs. Clean the remaining bulbs to remove the outer loose portions of the sheath, and trim the roots close to the bulb. Braid or bunch together by the tops of the bulbs, or cut off the tops and roots and bag the bulbs like dry onions.

When properly cured, garlic keeps well under a wide range of temperatures. Storage in open-mesh sacks in a dry, well-ventilated storage room at 60° to 90°F (15.6° to 32.2°C) is satisfactory. However, garlic is best stored under temperature and humidity conditions required for onions (32° to 35°F [0° to 1.67°C] and 65 percent relative humidity). Garlic cloves sprout quickly after bulbs have been stored at temperatures near 40°F (4.4°C), so avoid pro-longed storage at this temperature. Garlic stored at above 70 percent relative humidity at any temperature not only molds but also begins to develop roots.

### Marketing

New growers should develop a local retail market (roadside stands, night markets, gourmet restaurants), wholesale shipper, or processing market before planting. The demand for garlic is increasing due to recent reports about the health and medical benefits of garlic. The main markets are New York; Philadelphia; Pittsburgh; Washington, DC; Chicago; and St. Louis.

The markets of the northern and eastern United States will take the bulbs trimmed like dry onions and known as "loose garlic." Frequently, 30 to 50 bulbs are tied in bunches. Bulbs should be graded into three sizes--large, medium, and small. Each string or bunch should contain bulbs of uniform size and of the same variety.

First-class garlic bulbs must be clean and have unbroken outer sheaths. Many of the larger vegetable markets, such as the big chain stores, could retail garlic in the form of clean, uniform cloves, two dozen to a mesh bag. Processors are not

particular about having the cloves enclosed in a neat sheath and occasionally accept sprouted bulbs.

Garlic growing can be very profitable when freshness is stressed and if the tops are braided, tied together, or placed into long, narrow, plastic mesh bags so they can be effectively displayed at roadside or night-market stands.

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