

# 12 VEGETABLE PEST MANAGEMENT

Give the soil your utmost attention. Prevention of problems begins with good soil organic matter. Organic matter helps soil particles bind together. Good soil tilth has good nutrient and water holding capacities. It also stimulates the life of the soil—those things that in turn recycle nutrients into the forms that plants can readily use.

## MANAGING INSECT PESTS

Several mechanical and cultural practices may be used to help reduce insect pests in home vegetable gardens. Some are more practical than others, and success will depend in part on your willingness to work at them. An integrated approach to pest management (combining strategies) is often best.

One of the most important strategies in dealing with insects is to learn about their habitat, behavior, life cycle, what they feed on, and whether they are actually pests. This information will help you decide what to do. Most insects found in the garden are not pests, and some are even beneficial. The following practices help manage insect pests in vegetable gardens:

1. Maintain vigorous, healthy plants. Evidence suggests that plants growing under stressful conditions are more likely to be attacked and suffer serious damage. Fertilization, liming, too little or too much water, and planting too close together can all adversely affect plants. Check the fertility and pH of soil regularly and make adjustments as needed. Thin plants to the recommended spacing.
2. Planting the same crop in the same place year after year may cause pest buildup. Rotate crops,

especially where soil insects such as grubs, wireworms, and maggots are a problem. Do not plant crops susceptible to grubs or wireworms where grass grew the previous year.

3. Choose varieties recommended for your area and, where available, varieties resistant to pests known to occur in your area. For example, butternut squash is resistant to the squash vine borer.
4. Sanitation in and around the garden is very important. Many vegetable pests overwinter on weeds or plant debris in or near the garden. Remove weeds and organic mulches, which can provide ideal homes for insects, slugs, and snails.
5. Avoid bringing insect-infested plants into the garden. Carefully check transplants for the presence of insects before purchasing and planting.
6. Consider altering time of planting: could the pest be avoided by planting earlier or later?
7. Handpick pests off the plants and destroy them. Insects may be killed by placing them in a bucket of soapy water.
8. Physical barriers placed around plants can control some insects. Barriers include:
  - a. Cardboard collars (or roofing paper), 4 in. high, placed around young transplants to prevent cutworms from cutting the stems. Squares of tarpaper or carpeting placed securely around the stems of young crops of the cabbage family can prevent the cabbage maggot fly from depositing eggs at the base of the plant.
  - b. Row covers placed over the plants until the pest is gone or the plants are large enough to need the covers removed. All covers should be removed about four to six weeks into the season because temperatures during midsummer get too hot. Remember that some plants such as cucumber, eggplant, melons, and squash need to be pollinated by insects to yield a crop. Peppers may also benefit from insect pollinators. Commercial covers made of polypropylene, polyester, or polyvinyl alcohol are available, but cheesecloth or screening can also be used. All of these covers let light and water in and allow continued plant growth. Even ventilated plastic row covers help keep out many pests.
9. Mulching materials such as aluminum foil may repel aphids, thrips, and other insects. Although expensive, mulching may be practical on a small scale.
10. Traps, such as yellow sticky boards, can be used to help monitor insect populations, but they are seldom sufficient to give control. They do, however, help keep whitefly populations low as long as the sticky material is replaced periodically when insects cover the boards.
11. Take advantage of natural enemies, predators, and parasites. Learn to recognize those that are almost always present and conserve them. Small wasps parasitize aphids, leaving bronze or gray and bloated aphid “mummies.” Immature lady beetles and lacewings, which resemble small alligators, are also frequently present. Others include spiders, predatory mites, predatory bugs, predatory flies, and ground beetles.

**Augmentation.** The introduction of predators, parasites, or diseases is becoming more practical as we learn more about managing the pest system. Remember when introducing or maintaining predators or parasites, beneficial insects will move elsewhere if there are insufficient hosts to feed on.

12. Pesticides may also be used as part of the pest management program. Be sure to use only the amount you need and to treat only the

crops that need treating. Spot treatments are effective and may be practical for home gardens.

- a. *Note:* Even if a pesticide is botanical in origin, it may be toxic. Some botanical insecticides are more toxic than some of the commonly available synthetic chemicals.
- b. Biorational pesticides such as *Bacillus thuringiensis* (Bt), a toxin produced by bacteria that kills caterpillars, are an alternative to some chemical pesticides.
- c. Insecticidal soaps and horticultural oils are also an alternative to some traditional chemical pesticides and may be useful for certain pests, especially aphids, in the home garden.
- d. Diatomaceous earth, a desiccant, is sometimes used to control insects, slugs, and snails. Once it gets wet and compacted, however, it loses its effectiveness.

Before using any pesticide, check the label. Both the crop you want to treat and the pest you are treating for must be listed on the label. If not, do not use the pesticide. No matter which methods you choose, keep a record of what you did and whether it was successful. Such a record should be a great help in the future when you are faced with similar pest management decisions.

## MINIMIZING VEGETABLE DISEASES

To grow a healthy vegetable garden—one with few or no diseases—some general practices can be followed. The following 10 steps will maintain healthy plants and reduce the need for fungicides. You may be able to devise others that are especially suited to your garden.

1. *Choose resistant or tolerant varieties.* This is the easiest and most important way to manage plant diseases. The letter abbreviations used to describe the resistance of a variety (e.g., VF = Verticillium

and Fusarium wilt resistant, PM = powdery mildew resistant or tolerant) are listed in seed catalogs or can be explained by your county Cooperative Extension agent.

Resistant varieties resist infection by a particular disease agent and show little or no disease. Tolerant varieties may show symptoms but still yield the same as resistant varieties or susceptible ones protected with pesticides. When available, choose varieties that are resistant or tolerant to a disease that has been a problem.

2. *Purchase treated seed.* Seed may come pretreated with a dusting of a fungicide, or you may dust the seed with a fungicide. See Part II, Table 16. This coating will help prevent the seed from rotting in the soil before germination and can help protect the emerging seedling from damping-off. If seed rot or damping-off has been a problem in your garden, treating the seed with a fungicide will help.
3. *Purchase disease-free seed, transplants, and propagating material.* Begin with healthy plant material to help plants quickly become established in the garden. Plant materials that are unhealthy to begin with never yield as much as healthy ones or may die while still young. Reputable seed companies sell only disease-free plant materials. Some seeds are hot-water treated to remove infectious agents. Some are tested to reduce the risk of seedborne viruses. When shopping for transplants or other propagating material, take time to examine the plant stock thoroughly to make sure it is healthy and vigorous. If you save your own seed, harvest it from healthy plants and dry it thoroughly. Store such seed in properly labeled, airtight containers in a cool, dry place.
4. *Select a sunny, well-drained location.* A sunny area with well-drained soil is an ideal site for vigorous growth of plants. Shaded, poorly drained areas result in weak

and spindly plants that are easy targets for disease organisms. Even if such plants remain alive and free of infectious disease, they will not yield as much as strong and burly plants.

5. *Improve the soil environment.* When there is no other choice for a garden site but a heavy, wet soil, plant in raised beds or ridged rows so the soil around the plants' roots will be drier. Heavy, wet soils discourage healthy root growth and encourage root rots. When a garden is established on sloped terrain, plant in terraced beds to reduce soil erosion over delicate, young plants and newly sown seed. Soils that are dry and sandy may be mulched with a variety of materials (such as straw, grass clippings, or black plastic) to help retain moisture. A soil environment that is favorable to healthy root development supports the growth of healthy plants.
6. *Water and feed plants.* Plants require 1 inch of rainfall per week for best growth. If rainfall is inadequate, water the garden. Water plants in the morning so they will dry off quickly above ground, reducing the chances of disease spread. Avoid using overhead sprinkler irrigation because it can promote the development and spread of leaf, flower, and fruit infections. Trickle irrigation is best because it puts water directly in the root zone, does not wet the plants above ground, and does not encourage soil splashing. Plants that are fertilized properly at planting time and sidedressed will grow better and be healthier. Always use a complete fertilizer or incorporate a well-rotted manure or rich compost into the soil. Avoid overfertilization because this injures plant roots.
7. *Space plants to allow air circulation.* High humidity and moisture favor the development of diseases on plants. Allowing enough room for plants to grow and space for air

to circulate around mature plants reduces humidity and promotes rapid drying of plant surfaces. This helps reduce incidence of disease.

8. *Practice cleanliness in the garden.* Always remove and destroy or discard (in the trash) plant materials that show signs of disease. Work in the garden when plants are dry because moisture on plants aids the spread of infectious diseases. Composting, unless the pile becomes very hot, does not effectively eliminate diseases from plant refuse under New York State climatic conditions. For this reason, it is unwise to compost any diseased plant material. At the end of the growing season, clean up all crop debris because disease agents overwinter in debris and may infect new plants the following season.
9. *Plant a fall cover crop and plow it under the following spring.* After cleaning up the garden, sow a grass, such as perennial rye, that will begin to grow that fall. This cover crop will protect the topsoil from erosion during the winter. The following spring plow under the ryegrass to enrich the soil with fresh organic matter or "green manure." This practice also helps reduce the populations of certain soilborne disease agents. Noninfectious agents flourish on green manure in the soil and tend to inhibit the infectious ones.
10. *Rotate crops.* Successive planting of one crop family in the same area for many seasons promotes the buildup of disease agents in the soil. Thus the disease becomes more severe over time. Rotate plants to different areas of the garden to help reduce the losses

caused by soilborne disease agents. Avoid successive planting within crop families or crop types such as crucifers (cabbage, broccoli, turnip, radish), cucurbits (melon, cucumber, squash), solanaceous plants (tomato, eggplant, potato, pepper), grasses (sweet corn, cover crops such as rye), legumes (bean, pea), and root crops (carrot, beet, onion).

### TROUBLESHOOTING IN THE HOME GARDEN

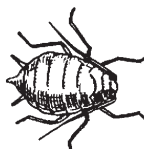
The following are common problems many gardeners encounter during the growing season. Possible solutions are listed.

1. *Failure of tomatoes, peppers, and eggplant to set fruit (blossom drop).* If plants are growing well, this problem is frequently caused by adverse night temperature (below 60° F and above 70° F). Very seldom does heavy use of nitrogen fertilizers cause blossom drop, nor does sprinkler irrigation.
2. *Blossom-end rot of tomatoes and peppers.* This is caused by a calcium deficiency that develops when soil moisture fluctuates (drought, heavy rains) or there is excessive nitrogen fertilizer. Proper irrigation, fertilization, and adequate mulch usually prevent it. Some varieties are more susceptible than others.
3. *New leaves on cucumber plant suddenly wilt.* Leaves may show dead areas and fruit may be mottled. The most likely cause is cucumber mosaic virus, a common disease. Bacterial wilt and root rot are other possible causes of the wilting. A sudden rise in temperature or depleted soil moisture also causes wilting, but plants soon recover.

4. *Lettuce and spinach go to seed.* This is normal for these crops under warm temperatures and long days. Planting in the spring and selecting the proper variety are remedies.
5. *Kernels develop irregularly on sweet corn ears.* This may be caused by inadequate pollination. Planting sweet corn in blocks of several short rows rather than a single long row may help.
6. *Snap bean flowers fail to develop.* High daytime temperature (above 90° F) is often the cause. Setting usually resumes when temperature drops.
7. *Tomato fruits are rough and misshapen.* This is often associated with low temperatures (50°–60° F) while flowers are forming. The problem is worse on some varieties. The first fruit often are the most misshapen.
8. *Cucumbers are off-shaped (e.g., crooked, nubbins).* This often occurs because of low soil moisture. Cool temperatures at the time flowers are developing can be a cause. Poor pollination because of lack of bees or low number or male flowers is also a possibility.

Table 14 gives cultural pest management practices. Pesticide guidelines are found in Part II. Table 16.

**Table 14. Vegetable pest management**

| <i>Plant</i>                                                                                                                                                                                                                                         | <i>Pest/Disease</i>                                                       | <i>Description/Cultural Management</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Asparagus</b><br><br><br>Common asparagus beetle                                                                                                                 | Fusarium wilt and crown rot<br><br>Asparagus beetles (common and spotted) | Use disease-free crowns or seed. If you are starting with seedlings, do not overharvest. Rogue plants that are severely diseased: remove and discard or destroy entire infested plant along with immediately surrounding soil and soil clinging to roots.<br><br>Handpick in small plantings.                                                                                                                                                                                                                                                                                                          |
| <b>Beans</b>                                                                                                                                                                                                                                         | Bacterial blights<br><br>Bean common mosaic virus, strains BV-1 and NY 15 | Avoid wetting foliage if possible. Water early in the day so aboveground plant parts will dry as quickly as possible. Avoid crowding plants; space apart to allow air circulation. Eliminate weeds around plants and garden area to improve air circulation. Do not save your own seed.<br><br>Rogue plants: remove and discard or destroy entire infested plant along with immediately surrounding soil and soil clinging to roots. Use resistant varieties, including Lancer, Provider, Blue Bush 274, Golden Butterwax, Royal Burgundy, Tendercrop, and Improved Tendergreen. Manage insect vectors |
| <div style="text-align: center;">  <p>Bean leaves mosaic virus-FPO</p> </div> <p>Bean leaves showing mosaic and distortion caused by bean common mosaic virus</p> |                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                      | White mold                                                                | Avoid wetting foliage if possible. Water early in the day so aboveground plant parts will dry as quickly as possible. The following recommendations are very important: Avoid crowding plants; space apart to allow air circulation. Eliminate weeds around plants and garden area to improve air circulation. In autumn, rake and dispose of all fallen or diseased leaves and fruit. Crop rotation is essential.                                                                                                                                                                                     |
| <br>Aphid                                                                                                                                                         | Aphids                                                                    | Check for evidence of natural enemies such as gray-brown and bloated parasitized aphids (mummies) and alligatorlike larvae of lady beetles and lacewings. Wash off with water occasionally as needed early in the day. A hard stream of water can be used to remove many aphids from plants.                                                                                                                                                                                                                                                                                                           |
|                                                                                                                                                                                                                                                      | Leafhoppers                                                               | Small, light green to gray wedge-shaped insects that suck plant juices, causing stunting, and carry virus diseases. No cultural control available.                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

*continued*



**Table 14. Vegetable pest management** *(continued)*

| <i>Plant</i>                                                                  | <i>Pest/Disease</i>        | <i>Description/Cultural Management</i>                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Beans</b> <i>(continued)</i>                                               | Mexican bean beetle        | Handpick beetles and eggs in small plantings. Plant early to avoid this pest. Plow under infested plants after harvest.                                                                                                                                                                                                                                                                                                                       |
|                                                                               | Seedcorn maggot            | Avoid heavy manure or organic matter in the garden, which attracts maggot flies and encourages egg laying. Purchase insecticide-treated seed. Use gloves to plant.                                                                                                                                                                                                                                                                            |
|                                                                               | Spider mites (two-spotted) | Wash off with water occasionally as needed early in the day. A hard stream of water can be used to remove many mites from plants.                                                                                                                                                                                                                                                                                                             |
| <b>Beet</b>                                                                   | Cercospora leaf spot       | Avoid wetting foliage if possible. Water early in the day so aboveground plant parts will dry as quickly as possible. Avoid crowding plants; space apart to allow air circulation. Eliminate weeds around plants and garden area to improve air circulation. In autumn, rake and dispose of all fallen or diseased leaves and fruit.                                                                                                          |
|                                                                               | Leafminer                  | Cover plants with fine netting or cheesecloth or floating row cover to protect them from adult flies. Handpick and destroy infested (mined) leaves. Control weeds.                                                                                                                                                                                                                                                                            |
| <b>Cabbage, cauliflower, broccoli, Brussels sprouts, and other cole crops</b> | Clubroot                   | Locate new plants in a part of the garden different from previous year's location. If that is not possible, remove infested soil and replace with fresh soil. Purchase healthy transplants or start seed in sterile potting mix or fresh ground. Rogue plants: remove and discard or destroy entire infested plant along with immediately surrounding soil and soil clinging to roots. If soil is infested, add lime to raise soil pH to 7.2. |
|                                                                               | Cabbage aphids             | Check for natural enemies such as gray-brown and bloated parasitized aphids (mummies) and alligatorlike larvae of lady beetles and lacewings. Wash off with water occasionally as needed early in the day. A hard stream of water can be used to remove many aphids from plants.                                                                                                                                                              |
|                                                                               | Cabbage root maggot        | White maggot (larva) attacks all plants of cabbage family. Larvae tunnel in and feed on roots of plants. Damage causes wilting early on, death of plants a little later.                                                                                                                                                                                                                                                                      |
|                                                                               | Cabbageworms               | Handpick. Row covers may be useful on small plantings to help protect plants from early damage. Put in place at planting and remove before temperatures get too hot (midsummer).                                                                                                                                                                                                                                                              |
|                                                                               | Flea beetles               | Use row covers to help protect plants from early damage. Put in place at planting and remove before temperatures get too hot (midsummer). Control weeds.                                                                                                                                                                                                                                                                                      |

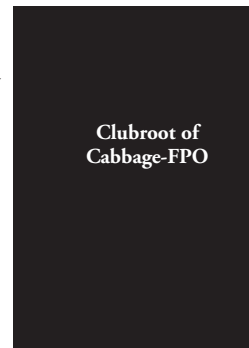


Cabbage root maggots



Flea beetle

ACTUAL SIZE



Clubroot of cabbage



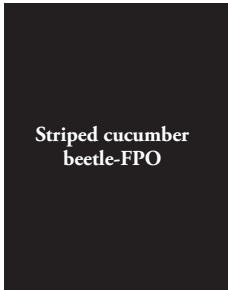
Imported cabbageworm

**Table 14. Vegetable pest management** (*continued*)

| <i>Plant</i>              | <i>Pest/Disease</i>                            | <i>Description/Cultural Management</i>                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Carrot and parsnip</b> | Carrot rust fly                                | Harvest all carrots by September 1 in upstate New York, by August 20 farther south, to avoid second brood injury.                                                                                                                                                                                                                                                                                                                           |
|                           | Carrot weevil                                  | Clean up garden debris in autumn. Entomophagous nematodes are available: apply as directed on label.                                                                                                                                                                                                                                                                                                                                        |
|                           | Leafhopper                                     | Leafhoppers spread disease, causing carrots to be woody, hairy, and bitter. No cultural control is available.                                                                                                                                                                                                                                                                                                                               |
| <b>Corn</b>               | Rust                                           | Avoid wetting foliage if possible. Water early in the day so aboveground plant parts will dry as quickly as possible. Avoid crowding plants; space apart to allow air circulation. Eliminate weeds around plants and garden area to improve air circulation. Plant resistant or tolerant varieties: Top Notch, Temptation, Sweet Rhythm, Wizard, Sweet Symphony, Silverado. Standards like Sweet Sue and Silver Queen are very susceptible. |
|                           | Closeup of rust pustules on a corn leaf        |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                           | Smut                                           | Pick and remove galls before they break open. Plant tolerant varieties: Top Notch, Temptation, Sweet Rhythm, Sweet, Symphony, Zenith.                                                                                                                                                                                                                                                                                                       |
|                           | European corn borer, corn earworm              | Destroy cornstalks in fall to kill overwintering larvae of European corn borer. Plant early to avoid corn earworm.                                                                                                                                                                                                                                                                                                                          |
|                           | Seedcorn maggot                                | Avoid heavy manure or organic matter in garden, which attracts adults and encourages egg laying. Do not overwater. Use insecticide-treated seed; wear gloves when planting.                                                                                                                                                                                                                                                                 |
| <b>Cucumber</b>           | Bacterial wilt ( <i>Erwinia tracheiphila</i> ) | Rogue plants: remove and discard or destroy infested plants. Control cucumber beetles that spread the bacteria. See Striped or spotted cucumber beetles. Control as soon as they appear. Some varieties are less susceptible to bacterial wilt but may not be readily available. Watermelon is immune.                                                                                                                                      |
|                           | Cucumber mosaic virus                          | Rogue plants: remove and discard or destroy infested plants. Plant resistant varieties such as Pacer, Marketmore 76, Dasher II, Slicemaster, Spacemaster, and Sweet Success. Manage aphids that spread virus. Eliminate perennial weeds such as milkweed, marshcress, and yellow rocket, and avoid planting next to susceptible ornamentals.                                                                                                |
|                           | Powdery mildew                                 | Avoid crowding plants: space apart to allow air circulation. Eliminate weeds around the plants and garden area to improve air circulation. In autumn, rake and dispose of all fallen or diseased leaves and fruit. Plant resistant varieties such as Marketmore 76, Slicemaster, and Raider.                                                                                                                                                |
|                           | Scab                                           | Avoid wetting foliage if possible. Water early in the day so aboveground plant parts will dry as quickly as possible. Avoid crowding plants; space apart to allow air circulation.                                                                                                                                                                                                                                                          |

*continued*

**Table 14. Vegetable pest management** *(continued)*

| <i>Plant</i>                                                                                                                                                                                                                                                | <i>Pest/Disease</i>                 | <i>Description/Cultural Management</i>                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Cucumber</b> <i>(continued)</i><br><br><br>Striped cucumber beetle                                                                                                       | Aphids                              | Eliminate weeds around plants and garden area to improve air circulation. In autumn, rake and dispose of all fallen or diseased leaves and fruit. Do not save your own seed. Plant resistant varieties such as Pacer, Marketmore 76, Raider, and Slicemaster.                                                                                                                                 |
|                                                                                                                                                                                                                                                             | Squash vine borer                   | Check for natural enemies such as gray-brown and bloated parasitized aphids (mummies) and alligatorlike larvae of lady beetles and lacewings. Wash off with water occasionally as needed early in the day. A hard stream of water can be used to remove many aphids from plants.                                                                                                              |
|                                                                                                                                                                                                                                                             | Striped or spotted cucumber beetles | Remove borers by hand. See Squash. Destroy crop residues after harvest.                                                                                                                                                                                                                                                                                                                       |
|                                                                                                                                                                                                                                                             |                                     | Construct tents of fine netting or cheesecloth or use floating row cover over young transplants and seedlings. Put in place at planting and remove before temperatures get too hot (midsummer). Control of beetles is important to prevent bacterial wilt in cucumbers but less important with other vine crops.                                                                              |
| <b>Eggplant</b><br><br><br>Colorado potato beetle<br><br><br>Flea beetle<br>ACTUAL SIZE | Verticillium wilt                   | Most serious disease of eggplant. Rogue plants: remove and discard or destroy entire infested plant along with immediately surrounding soil and soil clinging to roots. Set into soil never planted to tomatoes, peppers, or strawberries. If you cannot locate new plants in a part of the garden different from previous year's location, remove infested soil and replace with fresh soil. |
|                                                                                                                                                                                                                                                             | Aphids                              | Wash off or crush.                                                                                                                                                                                                                                                                                                                                                                            |
|                                                                                                                                                                                                                                                             | Colorado potato beetle              | Handpick beetles, larvae, and eggs.                                                                                                                                                                                                                                                                                                                                                           |
|                                                                                                                                                                                                                                                             | Flea beetles                        | Control weeds. Use row covers to help protect plants from early damage. Put in place at planting and remove before temperatures get too hot (midsummer).                                                                                                                                                                                                                                      |
| <b>Muskmelon</b>                                                                                                                                                                                                                                            | Bacterial wilt                      | See Cucumber.                                                                                                                                                                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                                                                             | Fungal leaf spots                   | Avoid wetting foliage if possible. Water early in the day so aboveground plant parts will dry as quickly as possible. Avoid crowding plants; space apart to allow air circulation. Eliminate weeds around plants and garden area to improve air circulation. In autumn, rake and dispose of all fallen or diseased leaves and fruit. Verify diagnosis.                                        |
|                                                                                                                                                                                                                                                             | Fusarium wilt                       | Locate new plants in a part of the garden different from the previous year's location. If that is not possible, remove infested soil and replace with fresh soil. Plant tolerant varieties such as Iroquois, Harper Hybrid, Saticoy, Pulsar, or Athena.                                                                                                                                       |
|                                                                                                                                                                                                                                                             | Powdery mildew                      | See Cucumber. Choose varieties resistant to powdery mildew.                                                                                                                                                                                                                                                                                                                                   |
|                                                                                                                                                                                                                                                             | Squash vine borer                   | See Squash.                                                                                                                                                                                                                                                                                                                                                                                   |

**Table 14. Vegetable pest management** (*continued*)

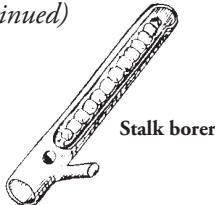
| <i>Plant</i>  | <i>Pest/Disease</i>                                                | <i>Description/Cultural Management</i>                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Onion</b>  | Purple blotch ( <i>Alternaria porri</i> ) and Botrytis leaf blight | Avoid wetting foliage if possible. Water early in the day so aboveground plant parts will dry as quickly as possible. Avoid crowding plants; space apart to allow air circulation. Eliminate weeds around plants and garden area to improve air circulation. Practice plant sanitation: when plants are not wet, carefully remove and destroy or discard affected plant parts. In autumn, rake and dispose of all fallen or diseased leaves and fruit. |
|               | Onion maggot                                                       | Locate new plants in a part of the garden different from previous year's location. If that is not possible, remove infested soil and replace with fresh soil.                                                                                                                                                                                                                                                                                          |
|               | Thrips                                                             | No cultural controls are available.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Pea</b>    | Powdery mildew                                                     | Avoid wetting foliage if possible. Water early in the day so aboveground plant parts will dry as quickly as possible. Avoid crowding plants; space apart to allow air circulation. Eliminate weeds around plants and garden area to improve air circulation. Practice plant sanitation: when plants are not wet, carefully remove and destroy or discard affected plant parts. In autumn, rake and dispose of all fallen or diseased leaves and fruit. |
|               | Seed decay and seedling root rots                                  | Locate new plants in a part of the garden different from previous year's location. If that is not possible, remove infested soil and replace with fresh soil. Plant seed as early as possible. Improve soil drainage.                                                                                                                                                                                                                                  |
|               | Wilt                                                               | Locate new plants in a part of the garden different from previous year's location. If that is not possible, remove infested soil and replace with fresh soil. Plant seed as early as possible. Improve soil drainage.                                                                                                                                                                                                                                  |
|               | Aphids                                                             | Check for natural enemies such as gray-brown and bloated parasitized aphids (mummies) and alligatorlike larvae of lady beetles and lacewings. Water off with water occasionally as needed early in the day. A hard stream of water can be used to remove many aphids from plants.                                                                                                                                                                      |
|               | Seedcorn maggot                                                    | Avoid heavy manure or organic matter in the garden because they attract maggot flies and encourage egg laying.                                                                                                                                                                                                                                                                                                                                         |
| <b>Pepper</b> | Cucumber mosaic virus                                              | Rogue plants: remove and discard or destroy entire infested plant. Control aphids that spread the virus (see following entry). Eliminate perennial weed sources (such as milkweed, marshcress, and yellow rocket) and avoid planting next to susceptible ornamentals.                                                                                                                                                                                  |

Cucumber  
mosaic virus-FPO

Cucumber mosaic virus infection of pepper causes ringspots and oak-leaf patterns

*continued*



| Plant                                                                                                              | Pest/Disease                                                                                                                                                               | Description/Cultural Management                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Pepper</b> <i>(continued)</i>  | Aphids<br><br>Borers                                                                                                                                                       | <p>Check for natural enemies such as gray-brown and bloated parsitized aphids (mummies) and alligatorlike larvae of lady beetles and lacewings. Water off with water occasionally as needed early in the day. A hard stream of water can be used to remove many aphids from plants.</p> <p>Remove by hand. Destroy infested fruit.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Potato</b>                                                                                                      | Early blight and late blight<br><br><br><br><br><br><br><br><br><br>Scab<br><br><br><br><br><br><br><br><br><br>Viral diseases<br>Aphids<br><br><br>Colorado potato beetle | <p>Use certified seed. Avoid wetting foliage if possible. Water early in the day so aboveground plant parts will dry as quickly as possible. Avoid crowding plants; space apart to allow air circulation. Eliminate weeds around plants and garden area to improve air circulation. In autumn, rake and dispose of all fallen or diseased leaves and fruit or tubers. Locate new plants in a part of the garden different from previous year's location. Resistant or moderately resistant varieties include Allegany, Elba, Rosa, and Sebago.</p> <p>The fungus that causes late blight has recently become a major threat to home gardens and commercial growers because of the migration of new strains (genotypes) into the United States. The disease can readily spread from home gardens to commercial fields. Verification of a late blight diagnosis and implementation of prompt control measures are highly recommended. The newly arrived strains are more aggressive than previous strains. Cultural control measures such as those listed above may not adequately control these new strains. It is highly recommended that the use of protectant fungicides (mancozeb, chlorothalonil, or copper) be seriously considered.</p> <p>Use certified seed. Locate new plants in a part of the garden different from previous year's location. If that is not possible, remove infested soil and replace with fresh soil. Lower soil pH to 5.2 with sulfur. Plant resistant varieties: Chieftan, Norland, Russet Burbank, Russet Rural, and Superior.</p> <p>Use certified seed. Control aphids (see below)</p> <p>Check for natural enemies such as gray-brown and bloated parsitized aphids (mummies) and the alligatorlike larvae of lady beetles and lacewings. Water off with water occasionally as needed early in the day. A hard stream of water can be used to remove many aphids from plants.</p> <p>Handpick beetles, eggs, and larvae.</p> |

**Table 14. Vegetable pest management** (*continued*)

| <i>Plant</i>                                                                        | <i>Pest/Disease</i> | <i>Description/Cultural Management</i>                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Potato</b> ( <i>continued</i> )                                                  | Flea beetles        | Use row covers to help protect plants from early damage. Put in place at planting and remove before temperatures get too hot (midsummer). Control weeds.                                                                                                                                                                                                                                                                                                |
|                                                                                     | Leafhoppers         | Wash small nymphs off with a hard stream of water early in the day.                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Pumpkins</b>                                                                     | Powdery mildew      | Avoid wetting foliage if possible. Water early in the day so aboveground plant parts will dry as quickly as possible. Avoid crowding plants; space apart to allow air circulation. Eliminate weeds around plants and garden area to improve air circulation.                                                                                                                                                                                            |
|                                                                                     | Aphids              | See Cucumber.                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                                                                                     | Cucumber beetle     | See Cucumbers.                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                                                                                     | Spider mites        | See Beans.                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                                                                     | Squash bug          | Handpick. Bury or compost plant residues after harvest.                                                                                                                                                                                                                                                                                                                                                                                                 |
|                                                                                     | Squash vine borer   | See Squash.                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Radish and turnip</b>                                                            | Clubroot            | See Cabbage.                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                                                     | Maggots             | Use row covers made of nonwoven fabrics. Hoops can be used to make a tent area over rows or as floating row covers. For radish, weekly plantings can be made. Some will avoid maggot attack.                                                                                                                                                                                                                                                            |
| <b>Rhubarb</b>                                                                      | Fungal leaf spot    | Avoid wetting foliage if possible. Water early in the day so aboveground plant parts will dry as quickly as possible. Avoid crowding plants; space apart to allow air circulation. Eliminate weeds around plants and garden area to improve air circulation. Practice plant sanitation: when plants are not wet, carefully remove and destroy or discard affected plant parts. In autumn, rake and dispose of all fallen or diseased leaves and stalks. |
|                                                                                     | Curculio            | Handpick adults. Remove broadstemmed weeds from area.                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Spinach</b>                                                                      | Leafminer           | See Beet.                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|  |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Squash</b>                                                                       | Bacterial wilt      | See Cucumber.                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                                                                                     | Powdery mildew      | See Pumpkins, except for resistant varieties.                                                                                                                                                                                                                                                                                                                                                                                                           |



*continued*

**Table 14. Vegetable pest management** *(continued)*

| <i>Plant</i>                                                                                                                                                                                                                   | <i>Pest/Disease</i>              | <i>Description/Cultural Management</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Squash</b> <i>(continued)</i><br><br> <p>Squash vine borer-FPO</p> <p>Squash vine borer</p>                                                 | Scab                             | See Cucumber, except for resistant varieties.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                                                                                | Viral disease                    | Rogue plants: remove and discard or destroy entire infested plant along with immediately surrounding soil and soil clinging to roots. Eliminate wild cucumber and milkweed nearby. Plant the variety Multipik to mask symptoms on fruit. Control aphids early in the season (see Cucumber).                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                                                                                                                                                                                                                                | Squash bug                       | See Pumpkins.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                                                                                | Squash vine borer                | Remove by hand. Butternut squash is resistant.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|  <p>Scab infections on summer squash-FPO</p> <p>Scab infections on summer squash</p>                                                        |                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Tomato</b><br><br> <p>Large, dark spots on tomato leaf-FPO</p> <p>Large, dark spots caused by early blight infections on a tomato leaf</p> | Blossom end rot                  | Water during drought or mulch to keep moisture level constant. Grow on soil high in organic matter. Fertilize properly. Avoid cultivating close to plants.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                                                                                                                                                                                                                | Catface                          | Grow locally recommended varieties and provide adequate fertilizer and water for vigorous growth.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                                                                                                                                                                                                                | Early blight, Septoria leaf spot | Locate new plants in a part of the garden different from previous year's location. If that is not possible, remove infested soil and replace with fresh soil. Avoid wetting foliage if possible. Water early in the day so aboveground plant parts will dry as quickly as possible. Avoid crowding plants; space apart to allow air circulation. Eliminate weeds around plants and garden area to improve air circulation. Practice plant sanitation: when plants are not wet, carefully remove and destroy or discard affected plant parts. In autumn, rake and dispose of all fallen or diseased leaves and stalks. Septoria occurs early in the season, preferring cool, wet weather. Use clean transplants and remove lower infected leaves. |
|                                                                                                                                                                                                                                | Fusarium wilt                    | Locate new plants in a part of the garden different from previous year's location. If that is not possible, remove infested soil and replace with fresh soil. Rogue plants: remove and discard or destroy entire infected plant along with immediately surrounding soil and soil clinging to roots. Plant resistant varieties such as Pik-Red, Better Boy, Duke, Freedom, Supersonic, Jet Star, Springset, and Floramerica.                                                                                                                                                                                                                                                                                                                      |
|                                                                                                                                                                                                                                | Late blight                      | See Potato.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                                                                                                                                                                                                                                | Verticillium wilt                | Locate new plants in a part of the garden different from previous year's location. If that is not possible, remove infested soil and replace with fresh soil. Rogue plants: remove and discard or destroy entire infected plant along with immediately surrounding soil and soil clinging to roots. Plant resistant varieties: Supersonic, Jackpot, Basketvee, Sunny, Jet Star, and Springset.                                                                                                                                                                                                                                                                                                                                                   |

**Table 14. Vegetable pest management** (*continued*)

| <i>Plant</i>                                                                                                 | <i>Pest/Disease</i>    | <i>Description/Cultural Management</i>                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Tomato</b> ( <i>continued</i> )                                                                           | Aphids                 | Check for natural enemies such as gray-brown and bloated parasitized aphids (mummies) and alligatorlike larvae of lady beetles and lacewings. Water off with water occasionally as needed early in the day. A hard stream of water can be used to remove many aphids from plants. |
| <br>Cutworm                 | Colorado potato beetle | Handpick and destroy beetles, eggs, and larvae.                                                                                                                                                                                                                                   |
|                                                                                                              | Cutworms               | Control weeds. Cardboard collars around each plant give good protection.                                                                                                                                                                                                          |
| <br>Greenhouse whitefly-FPO | Flea beetle            | Use row covers to help protect plants from early damage. Put in place at planting and remove before temperatures get too hot (midsummer). Control weeds.                                                                                                                          |
|                                                                                                              | Hornworm               | Handpick larvae. This pest is frequently controlled by natural enemies.                                                                                                                                                                                                           |
|                                                                                                              | Whiteflies             | Do not purchase whitefly-infested transplants; inspect carefully before purchasing.                                                                                                                                                                                               |
| <br>Tomato hornworm-FPO   |                        | Tomato hornworm                                                                                                                                                                                                                                                                   |

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