

## Plant Disease Management for Commercial Vegetable Crops

Successful control of vegetable diseases requires an integrated program that includes the use of resistant varieties, crop rotation, balanced soil fertility, weed and insect control, and proper crop culture, as well as the proper selection, timing, and method of applying fungicides, bactericides, or nematicides. Economical control depends on establishing an overall disease management system for the entire farm. Keeping careful records of the crops planted, the problems encountered, and the pesticides used is important.

Because many disease problems originate with seeds or transplants, growers should follow the seed-treatment recommendations given in this chapter and in *Report on Plant Diseases*, no. 915, "Vegetable Seed Treatment" (ordering information is at the end of this chapter) or be sure to obtain planting material that is certified as disease-free.

This chapter lists the registered fungicides and application intervals for various vegetable crops as approved by the Food and Drug Administration (FDA) and the U.S. Environmental Protection Agency (US EPA) as of September 1, 1997, to the best of our knowledge. Tables 1 and 2 give the number of days between the last application at the normal rate and harvest, as well as other restrictions to keep residues within the tolerances set by the FDA. Refer to current labels for information on rates, timing, and methods of application, as well as for information on follow-up crops and other restrictions.

The listing of a chemical as approved for use on a particular crop does not mean that the University of Illinois Cooperative Extension Service or Office of Research recommends its use for that crop. Our specific recommendations for disease control are given in Table 3.

In some instances, a tolerance has been set, but a definite interval has not been established. The absence of an interval for a crop in the listings does not necessarily mean that the fungicide may not be used on that crop. To ensure that the crop produced does not exceed the tolerance, the use of the fungicide would require a restriction such as "Do not apply after first blooms appear" or "Do not apply after edible parts form." This information appears on the product label.

In a few cases, the interval and dosage have been established, but the allowable residue concentration has not been determined. Again, this does not mean that the fungicide may not be used on the crops for which the fungicide is labeled. It does mean, however, that until the tolerance is established, it must be considered as zero. These cases are reviewed each year, and some are canceled when the chemical manufacturer supplies the EPA with additional data.

Growers must follow a program of disease control ensuring that the vegetables produced do not contain excessive fungicide residues. Vegetables marketed with residues exceeding the FDA tolerances may be injurious to consumers, may be confiscated, and may subject the grower to legal action.

*Growers have nothing to fear from the law so long as they use fungicides and other pesticides according to the current labels and only on the crops specified, in the amounts specified, and at the times specified.* The prudent grower keeps a record of the products and trade names used, the percent of active ingredients, dilutions, rates of application per acre, and dates of application.

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*The information in this chapter is provided for educational purposes only. Product trade names have been used for clarity, but reference to trade names does not imply endorsement by the University of Illinois; discrimination is not intended against any product. The reader is urged to exercise caution in making purchases or evaluating product information.*

*Label registrations can change at any time. Thus the recommendations in this chapter may become invalid. The user must read carefully the entire, most recent label and follow all directions and restrictions. Purchase only enough pesticide for the current growing season.*

## Fungicide Application

We recommend that the following practices be used when applying fungicides.

- Cover the foliage uniformly. *Ground application*—Apply 75 to 125 gallons per acre at 100 to 400 pounds per square inch of pressure. Lowering the volumes, pressures, or both may provide adequate coverage; but high-volume, high-pressure applications provide ideal coverage. Make sure the sprayer is functioning properly. Check the nozzles for cleanliness and wear. Boom height, accuracy of pressure gauge, agitation, and calibration should also be checked. *Aerial application*—Apply recommended amounts of pesticide in 3 to 5 gallons of water per acre. Make sure nozzles are properly aligned and clean so that uniform application is achieved. Cover a swath no wider than is reasonable for the aircraft and boom being used. Spray only those fields that are suitable for aerial application. Avoid fields of irregular shape or topography, particularly if they are bounded by power lines, trees, or other obstructions.
- Whenever possible, spray when the air is still or when wind velocity is less than 10 mph.

- Avoid situations where pesticide drift may cause needless problems.
- When it is compatible with the product label, use a spray adjuvant (surfactant). Commonly available surfactants include the following: Bio-Film, Kalo-Bio 88, and Regulaid (for systemic fungicides); DuPont Spreader Sticker; Hopkins-Plyac; Miller—NuFilm P and NuFilm 17; Ortho—Chevron Spray Sticker, Chevron Spreader, and X-77 Spreader; and Rohm & Hass—Triton AG-98 B-1956, and CS-7. Spray adjuvants are most useful on cabbage, cauliflower, Brussels sprouts, onions, and peppers.

## Soil Fumigation

Follow the manufacturer's directions exactly. Fumigants work best in light, loose soils that are free of trash, clods, and lumps. Avoid recontaminating treated soil. It is best to apply fumigants during the fall before planting. In general, the soil temperature must be at least 55° to 60°F at the 6-inch depth, with a time lapse of 21 to 28 days between treating and seeding. Some fumigants require gastight plastic covers. Many fumigants are restricted-use chemicals.

**Table 1. Limitations on Days Between Application and Harvest, and Other Restrictions on Using Fungicides on Vegetables in Illinois**

| Crop                                    | Benlate <sup>a</sup> | Botran | Bravo <sup>b</sup>                    | Mancozeb <sup>c</sup> | Maneb <sup>d</sup> |
|---|----------------------|--------|---------------------------------------|-----------------------|--------------------|
| Asparagus                               | ...                  | ...    | ...                                   | A; root dip           | ...                |
| Beans (dry, lima, snap)                 | 14, 28<br>on lima    | 2, B   | 7 (snap only, B;<br>14 (lima, dry), B | ...                   | 30 (dry only)      |
| Beet, garden                            | ...                  | ...    | ...                                   | ...                   | ...                |
| Broccoli                                | ...                  | ...    | 0                                     | ...                   | 7                  |
| Brussels sprout                         | 7                    | ...    | 0                                     | ...                   | 7                  |
| Cabbage                                 | ...                  | ...    | 0                                     | ...                   | 7                  |
| Cantaloupe (musk-melon, honeydew melon) | 14                   | ...    | 0                                     | 5                     | 5                  |
| Carrot                                  | 4                    | ph     | 0                                     | ...                   | ...                |
| Cauliflower                             | ...                  | ...    | 0                                     | ...                   | 7                  |
| Celery                                  | 7                    | ...    | 7                                     | ...                   | ...                |
| Chinese cabbage                         | 7                    | ...    | 7                                     | ...                   | ...                |
| Corn, sweet and pop                     | ...                  | ...    | 14, B <sup>e</sup>                    | 7, B                  | 7, B               |
| Cucumber                                | 1                    | 0      | 0                                     | 5                     | 5                  |
| Eggplant                                | ...                  | ...    | ...                                   | ...                   | 5                  |
| Endive, escarole                        | ...                  | 14     | ...                                   | ...                   | 10                 |

**Table 1. Limitations on Days Between Application and Harvest, and Other Restrictions on Using Fungicides on Vegetables in Illinois (cont.)**

| Crop             | Benlate <sup>a</sup> | Botran | Bravo <sup>b</sup> | Mancozeb <sup>c</sup> | Maneb <sup>d</sup> |
|------------------|----------------------|--------|--------------------|-----------------------|--------------------|
| Fennel           | ...                  | ...    | ...                | 14                    | ...                |
| Garlic           | ...                  | pp, ph | 7                  | ...                   | ...                |
| Kale             | ...                  | ...    | ...                | ...                   | 10                 |
| Kohlrabi         | ...                  | ...    | ...                | ...                   | 10                 |
| Leek             | ...                  | ...    | 14                 | ...                   | ...                |
| Lettuce          | ...                  | 14     | ...                | ...                   | 10                 |
| Mustard greens   | ...                  | ...    | ...                | ...                   | ...                |
| Onion            | ...                  | pp, ph | green, 14; dry, 7  | 7, D, pb              | 7, D, pb           |
| Parsley          | ...                  | ...    | ...                | ...                   | ...                |
| Parsnip          | ...                  | ...    | 10,B               | ...                   | ...                |
| Peas             | ...                  | ...    | ...                | ...                   | ...                |
| Pepper           | ...                  | ...    | ...                | ...                   | 7                  |
| Potato, Irish    | ...                  | 14,B   | 0                  | 14,C                  | 14,C               |
| Pumpkin          | 1                    | ...    | 0                  | ...                   | 5                  |
| Radish           | ...                  | ...    | ...                | ...                   | ...                |
| Shallots         | ...                  | ...    | 14                 | ...                   | ...                |
| Spinach          | ...                  | ...    | ...                | ...                   | ...                |
| Squash           | 1                    | ...    | 0                  | 5 (summer only)       | 5                  |
| Tomato           | 1                    | 0      | 0                  | 5                     | 5                  |
| Turnip, rutabaga | ...                  | ...    | ...                | ...                   | ...                |
| Watermelon       | 1                    | ...    | 0                  | 5                     | 5                  |

Numbers indicate days between last application and harvest; 0 = up to harvest; . . . = fungicide is not registered for use on that particular vegetable; A = postharvest application to ferns only or to young plantings that will not be harvested; B = do not feed treated tops or forage to livestock; C = do not use treated seed or seed pieces for feed or food; D = do not apply to exposed bulbs; pb = plant bed treatment; ph = postharvest spray or dip; pp = preplant soil treatment.

<sup>a</sup>Do not apply Benlate alone; always use in combination with mancozeb or other labeled protective fungicide such as Captan, Bravo, Dyrene, or maneb. Do not mix with Mertect or Topsin-M.

<sup>b</sup>Chlorothalonil is sold as Bravo W75, 500, 720, and Ultrex. It is also sold in combination with metalaxyl as Ridomil/Bravo 81W, with copper and maneb as Bravo C/M, and with triadimafon as Reach.

<sup>c</sup>Mancozeb is sold as Dithane F-45, Dithane M-45, Dithane DF, Manzate 200 DF, and Penncozeb.

<sup>d</sup>Maneb is sold as Maneb 80 and Maneb Plus Zinc F4.

<sup>e</sup>Do not apply if the crop will be used for processing.

**Table 2. Label Information on Fungicides and Nematicides of Less General Use**

| Fungicide   | Crops and use restrictions  |
|---|---|
| <b>Aldicarb</b><br>(Temik 15G)  | <b>Beans (dry), sweet potato:</b> for nematode control.   |
| <b>Azoxystrobin</b><br>(Quadris)  | <b>Tomato:</b> for anthracnose, early blight, Septoria leaf spot, late blight; 7 days <sup>a</sup> .  |
| bordeaux mixture<br>(many trade names)  | <b>Asparagus, beans, beet, broccoli, Brussels sprout, cabbage, carrot, casaba melon, celery, collard, creshaw melon, cress, cucumber, eggplant, honeydew melon, horseradish, kale, muskmelon, mustard, pepper, Persian melon, potato, pumpkin, radish, rape, rutabaga, spinach, squash, tomato, turnip, watermelon.</b>   |
| copper sulfate<br>(many)  | <b>Beans, broccoli, cabbage, cantaloupe, casaba melon, cauliflower, celery, cucumber, honeydew melon, muskmelon, Persian melon, potato, pumpkin, radish, squash, tomato, watermelon.</b>  |
| copper ammonium carbonate<br>(Copper-Count N)   | <b>Beans, cabbage, cantaloupe, carrot, casaba melon, celery, creshaw melon, cucumber, honeydew melon, lettuce, muskmelon, pepper, Persian melon, potato, squash, tomato, watermelon.</b>  |
| copper hydroxide<br>(Champion, Kocide 101 and 606)                                    | <b>Beans, broccoli, Brussels sprout, cabbage, cantaloupe, carrot, cauliflower, celery, cucumber, eggplant, lettuce, muskmelon, onion, pea, pepper, potato, pumpkin, squash, tomato, watermelon.</b>   |
| copper oxychloride sulfate<br>(COCS, Copro 50, Coxysul, CS-56)                        | <b>Beans, beet, broccoli, Brussels sprout, cabbage, cantaloupe, carrot, casaba melon, cauliflower, celery, creshaw melon, cucumber, eggplant, honeydew melon, lettuce, muskmelon, onion, pea, Persian melon, potato, pumpkin, spinach, squash, tomato, watermelon.</b>  |
| <b>Copper fungicides<sup>b</sup></b><br>tribasic copper sulfate<br>(many trade names) | <b>Beans, beet, broccoli, Brussels sprout, cabbage, cantaloupe, carrot, cauliflower, celery, cucumber, eggplant, honeydew melon, lettuce, muskmelon, onion, pea, pepper, potato, pumpkin, radish, spinach, squash, tomato, watermelon.</b>  |
| <b>Ethoprop</b><br>(Mocap)  | <b>Beans (snap and lima), cabbage, corn (sweet), cucumber, potato, sweet potato:</b> for nematode control.  |
| <b>Fenamiphos</b><br>(Nemacur 15G)  | <b>Brussels sprouts, cabbage, eggplant, garlic, okra:</b> for nematode control.   |
| <b>Fosetyl-AL</b><br>(Aliette)  | <b>Asparagus:</b> spear slime and Phytophthora crown rot, 110 days. <sup>a</sup><br><b>Bok choy, broccoli, Brussels sprout, cabbage, cauliflower, Chinese broccoli, Chinese mustard, collards, kale, kohlrabi, mustard greens, Napa cabbage, rape greens:</b> downy mildew, 3 days. <sup>a</sup><br><b>Balsam pear, Chinese waxgourd, cucumber, gherkin, gourd, melons, summer and winter squash, watermelon:</b> downy mildew, 0 days. <sup>a</sup><br><b>Leafy vegetables:</b> downy mildew, 3 days. <sup>a</sup> |

**Table 2. Label Information on Fungicides and Nematicides of Less General Use (cont.)**

| Fungicide                                       | Crops and use restrictions  |
|---|---|
| <b>Iprodione<sup>c</sup></b><br>(Rovral)        | <p><b>Onion</b> (dry bulb): downy mildew, 7 days.<sup>a</sup><br/> <b>Beans:</b><sup>d</sup> Sclerotinia.<br/> <b>Broccoli:</b> blackleg.<br/> <b>Carrot:</b> Alternaria leaf spot, no more than 8 applications.<br/> <b>Garlic:</b> white rot.<br/> <b>Lettuce:</b> lettuce drop and bottom rot, no more than 3 treatments, 14 days.<sup>a</sup><br/> <b>Onion</b> (dry): Botrytis and Alternaria purple blotch, 7 days.<sup>a</sup><br/> <b>Potato:</b> early blight and white mold, 14 days.<sup>a</sup><br/> The following crops may be rotated after harvest: <b>beans, broccoli, carrot, garlic, lettuce, onion</b> (dry bulb), <b>peanut, potato</b>.<br/> The following crops may be rotated 1 month following the last iprodione application: <b>cotton, root crops, tomato</b>.</p>   |
| <b>Metalaxyl</b><br>(Apron 25WP/Apron XL)       | <p><b>Beans, beet, lentils, okra, pea, soybeans</b> (edible): seed treatment for control of Pythium and Phytophthora damping-off and root rot.</p>  |
| (Ridomil 2E, Ridomil Gold EC, Ridomil Gold WSP) | <p><i>Bedding plants</i> to control Pythium damping-off: <b>Asparagus, broccoli, cabbage, cauliflower, cucurbits, legumes, lettuce, onion, spinach, squash, tomato</b>. Apply 2 to 4 pt per acre as preplant broadcast in 50 gal of water (1 to 2 fl oz or 2 to 4 tbsp per 150 sq yd of bed in 2 gal of water) before or at the time of seeding to the surface of the beds and lightly incorporate or follow with ½ in. of sprinkler irrigation water. Do not use for disease control in greenhouse crops. Do not dip plants in solutions containing Ridomil 2E, or crop injury may occur.</p> <p><i>Field use</i>—<b>Asparagus:</b> Phytophthora crown and spear rot.<br/> <b>Beans</b> (all), <b>lentils, pea, soybeans</b> (edible): Pythium damping-off and root rot when used at 1 pt per 13,000 linear ft of row, either in-furrow or in a 7-in. band at planting.<br/> <b>Broccoli, cabbage, cauliflower:</b> Pythium damping-off and Phytophthora basal stem rot. Applications may be broadcast using 4 pt per acre, applied at planting in 20 to 50 gal of water, or at 4 to 8 pt per acre, incorporated into the upper 2 in. Seven-in. band applications at 2 pt per 13,000 linear ft of row are also labeled.<br/> <b>Cucurbit vegetables:</b> Pythium damping-off and cottony leak. Applications may be in a 7-in. band over the row at planting or at 4 to 8 pt per acre broadcast, using 20 to 50 gal of water. Broadcast applications may be incorporated to the 2-in. depth.<br/> <b>Lettuce</b> (head), <b>onion, spinach:</b> Pythium damping-off. Apply either broadcast or banded at planting. Follow label directions.<br/> <b>Eggplant, pepper:</b> Pythium damping-off, Phytophthora crown rot, 7 days.<sup>a</sup><br/> <b>Tomato:</b> Pythium damping-off, 7 days.<sup>a</sup>Apply either broadcast or banded immediately before or after planting in 20 to 50 gal of water. Pythium and Phytophthora fruit and root rots. Incorporate with irrigation.</p> |

**Table 2. Label Information on Fungicides and Nematicides of Less General Use (cont.)**

| Fungicide   | Crops and use restrictions   |
|---|--|
| <b>Metalaxyl (cont.)</b><br>(Ridomil 5G, Ridomil Gold GR) | <b>Lettuce</b> (head): Pythium damping-off. Preplant incorporated or preemergence applications.<br><b>Tomato</b> : Pythium damping-off. Pythium and Phytophthora fruit and root rots, 7 days. <sup>a</sup>   |
| (Ridomil/Bravo 81, Ridomil Gold/Bravo)                    | <b>Broccoli, cabbage, cauliflower</b> : downy mildew and Alternaria leaf spot, 7 days. <sup>a</sup><br><b>Cucumber, melons, squash</b> : downy mildew, anthracnose, Cercospora leaf spot, gummy stem blight, leaf blight and scab.<br><b>Onion</b> <sup>c</sup> (dry bulb, seed, and green): downy mildew, Botrytis leaf blight (blast), and purple blotch; dry, 7 days, and green, 21 days. <sup>a</sup><br><b>Potato</b> : late blight, tuber and storage rots (Pythium or Phytophthora), early blight and Botrytis vine rot, 7 days. <sup>a</sup><br><b>Tomato</b> : late blight, early blight, anthracnose, and gray leaf spot, 7 days. <sup>a</sup> |
| (Ridomil/Copper, Ridomil Gold/Copper)                     | <b>Carrot, radish</b> : diseases caused by Oomycete fungi, 7 days. <sup>a</sup><br><b>Cucurbit vegetables</b> : downy mildew, 5 days. <sup>a</sup><br><b>Pepper</b> : Pythium damping-off, Phytophthora crown rot, 7 days. <sup>a</sup><br><b>Potato</b> : late blight, tuber and storage rots, 7 days. <sup>a</sup><br><b>Spinach</b> : white rust and downy mildew, 21 days. <sup>a</sup><br><b>Tomato</b> : Phytophthora fruit rot, late blight, bacterial speck, bacterial spot, 7 days. <sup>a</sup>  |
| (Ridomil Gold MZ, Ridomil MZ58)                           | <b>Cucumber, melons, summer squash</b> : downy mildew, 5 days. <sup>a</sup><br><b>Onion</b> (dry, seed): downy mildew, 7 days. <sup>a</sup><br><b>Potato</b> : late blight, other Pythium or Phytophthora diseases, 14 days. <sup>a</sup><br><b>Tomato</b> : late blight, 5 days. <sup>a</sup>   |
| (Ridomil PC 11G Ridomil Gold PC)                          | <b>Beans</b> (dry and green): <sup>d</sup> Damping-off and seedling rots caused by Pythium and Rhizoctonia. Apply 12 oz per 1,000 ft of row at planting time.  |
| <b>Oxamyl</b><br>(Vydate L)                               | <b>Carrot, cucurbits, eggplant, pepper, potato, sweet potato</b> : for nematode control. Apply before or at planting. Apply in transplant water for pepper or as foliar spray for peppers and vine crops, 7 days. <sup>a</sup>   |
| <b>PCNB</b><br>(Terraclor)                                | <b>Beans</b> : base of plants <i>before</i> blossoming, soil and seed treatment at planting, or foliar spray. Do not feed treated bean vines to livestock. Do <i>not</i> apply after first bloom.<br><b>Broccoli, Brussels sprout, cabbage, cauliflower</b> : transplant solution (¾ pt per plant) or row treatment before transplanting.<br><b>Garlic</b> : soil and seed treatment at planting.<br><b>Pepper, tomato</b> : soil treatment at or before planting.<br><b>Tomato</b> (greenhouse): transplant solution (½ pt of 0.2% per plant).  |
| <b>Propiconazole</b><br>(Tilt)                            | <b>Corn</b> (sweet and pop): Helminthosporium leaf blights, rusts, grey leaf spot, and eye spot. Sweet corn, 14 days. <sup>b</sup> Do not apply more than 16 fl oz per acre. Do not apply to popcorn after silking. Do not harvest for forage within 14 days of application for sweet corn or 30 days for popcorn.   |

**Table 2. Label Information on Fungicides and Nematicides of Less General Use (cont.)**

| Fungicide   | Crops and use restrictions  |
|---|---|
| <b>Streptomycin</b><br>(Agrimycin 17, Agri-Strep, Streptomycin 17)      | <b>Pepper, tomato:</b> plant beds only (200 ppm spray).<br><b>Potato:</b> seed-piece treatment only (100 ppm dip or dust). Soak cut seed pieces less than 30 min. Do not use treated seed for food or feed.   |
| <b>Sulfur</b>   | Exempt when used with good agricultural practices. See label.   |
| <b>Terbufos</b><br>(Counter 15G)  | <b>Corn</b> (sweet and pop): apply in band or furrow at planting.   |
| <b>Thiabendazole</b><br>(Mertect 340F)                                  | <b>Carrot:</b> storage rot control.<br><b>Sweet potato:</b> “seed” root treatment. Do not use treated pieces for food or feed.<br><b>Potato:</b> seed-piece treatment and storage rot control.  |
| <b>Thiophanate methyl</b><br>(TOPS 2.5D)<br>(Topsin-M70W, Topsin M4.5F) | <b>Potato:</b> seed-piece treatment.<br><b>Beans:</b> white mold and gray mold. Snap or dry beans, 14 days; <sup>a</sup> lima, 28 days. <sup>a</sup><br><b>Celery:</b> early and late blight, 7 days. <sup>a</sup><br><b>Cucurbits:</b> 0 days. <sup>a</sup><br><b>Onion:</b> apply in furrow at planting.  |
| <b>Thiram</b>   | <b>Beans, beet, broccoli, Brussels sprout, cabbage, cantaloupe, carrot, cauliflower, collard, corn, cucumber, eggplant, endive, kale, kohlrabi, lentils, lettuce, mustard, okra, onion</b> (bulb, seed, and set), <b>pea, pepper, pumpkin, radish, spinach, squash, Swiss chard, tomato, turnip, watermelon:</b> seed treatment. WARNING: Do not use treated seed for food, feed, or oil.<br><b>Onion:</b> furrow treatment.<br><b>Tomato:</b> for leaf spots and fruit rot, 0 days. <sup>a</sup> |
| <b>Triadimefon</b><br>(Bayleton, 50WP)                                  | <b>All cucurbits:</b> powdery mildew. May apply a maximum of 1 lb/A/yr.   |
| <b>Triphenyltin</b><br>(Du-Ter, Super-Tin 4L)                           | <b>Carrot</b> <sup>d</sup> : Alternaria leaf spot and late blight, 14 days. <sup>a</sup><br><b>Potato:</b> early and late blight, 7 days. <sup>a</sup> May be applied through irrigation systems (solid set or center pivot only).  |
| <b>Vinclozolin</b><br>(Ronalin)   | <b>Lettuce</b> (head or leaf): Sclerotinia drop, 28 days. <sup>a</sup> No more than 6 lb/A/season.<br><b>Onion</b> (dry): white rot, Botrytis blight, neck rot, 18 days. <sup>a</sup> No more than 10 lb/A/season.  |

<sup>a</sup>Number of days between last application and harvest.<sup>b</sup>There are many other copper materials, but these are most widely available and labeled for use on vegetable crops. Exempt from tolerance if used with good agricultural practices; not exempt if used at the time of harvest or after harvest. See label.<sup>c</sup>Phytotoxicity to crop or follow-up crop. See label.<sup>d</sup>Do not feed treated tops or forage to livestock.

**Table 3. Condensed Recommendations on Management for Diseases of Commercial Vegetable Crops for 1998**

| Vegetable and disease  | Disease management practices  |
|--|---|
| <b>Asparagus</b><br>Crown or root rots, seedling blights, and wilt | No resistant varieties are available for control of these diseases. Treating the crowns with mancozeb may aid in control. Phytophthora can be controlled using Ridomil Gold EC applied over the bed. These diseases are best managed by good asparagus culture. Provide optimal soil fertility and weed, insect, and rust control. Avoid excessive cutting. Avoid acidic (low-pH) and poorly drained soils. |
| Rust, Cercospora, and other leaf and branchlet blights             | Grow rust-resistant varieties. Apply mancozeb to nonharvested fields up to August 15 and to harvested fields only after harvest. Applications should be made at 7- to 10-day intervals. Control is needed in 1- and 2-year beds, even with resistant varieties.   |
| <b>Beans (snap, dry, wax, and Lima)</b>                            |   |
| Most diseases  | When possible, use rotations of 2 to 3 years or longer between bean crops and practice strict sanitation.   |
| Seed decay, damping-off, seedborne stem blights, and root rots     | Plant only western-grown, certified seed in a seedbed that is warm (60° to 65°F), well prepared, and well drained. Treat seed with Apron XL plus thiram or captan and an insecticide. In-furrow sprays of Ridomil Gold (EC, WSP, or PC) or seed treatment with Apron XL may be helpful for early season root-rot control. PCNB may be used to help control Rhizoctonia.                                     |
| Root rots  | Pythium root rot can be controlled using Ridomil Gold (EC, WSP, or PC) as a band or furrow treatment at planting. Maintain optimal soil fertility. Utilize rotations of at least 2 to 3 years with other crops.   |
| Bacterial blights  | Plant only western-grown, certified seed. Utilize crop rotations of 2 to 3 years. Avoid cultivating when beans are wet. Field applications of 2 to 4 lb of fixed copper (for example, Kocide 101) per acre provide good control of brown spot and halo blight, but only moderate control of common or fuscous blight. Do <i>not</i> use copper on fresh-market lima beans.                                  |
| Rust, anthracnose, and other fungal leaf, pod, and stem diseases   | Utilize crop rotations of 2 to 3 years. Apply Bravo at 7- to 10-day intervals starting when disease first appears. Rust-resistant varieties are available for some types of beans. Sulfur also may be used but may be phytotoxic at high temperatures.  |
| Gray mold  | Apply Benlate, Bravo, Rovral, or Topsin-M at 25% bloom, and repeat at full bloom. Thorough coverage of blossoms is essential.   |
| White mold   | Apply Benlate, Botran (snap beans only), Rovral, or Topsin-M at 25% bloom, and repeat at full bloom.  |

**Table 3. Condensed Recommendations on Management for Diseases of Commercial Vegetable Crops for 1998 (cont.)**

| Vegetable and disease                             | Disease management practices  |
|---|---|
| <b>Beans (Snap, Dry Wax, and Lima) (cont.)</b>    |   |
| Mosaic virus diseases                             | Plant varieties with resistance to bean common mosaic, NY15 strain of common mosaic, and bean yellow mosaic. Avoid planting near clovers, birdsfoot trefoil, gladiolus, and so forth.   |
| Soybean cyst nematode                             | Rotate at least 2 to 3 years with corn, small grains, alfalfa, or other nonhost crop. Do <i>not</i> include soybeans in the rotation. Temik may be used on dry beans.   |
| Root-knot and lesion nematodes                    | Apply Mocap (snap or lima beans) or Temik (dry beans only) at planting.   |
| <b>Beet (garden), Swiss chard</b>                 |   |
| Seed rot, damping-off, and seedborne leaf spot    | Sow in a well-prepared seedbed. Treat seed with Apron (for Pythium), captan, or thiram. Make sure boron levels are adequate. Several soluble-boron formulations are available.  |
| Cercospora leaf spot                              | Apply fixed copper weekly at the first sign of disease. Separate new from old plantings.  |
| <b>Carrot, parsnip</b>                            |   |
| Seed rot, damping-off                             | Treat seed with captan or thiram. Plant in well-drained seedbed. Avoid overwatering.  |
| Cercospora leaf spot, Alternaria leaf blight      | Apply Bravo, Du-Ter, or Rovral at 7- to 10-day intervals. Start when disease first threatens and repeat as needed.  |
| White mold  | Use a crop rotation of 3 to 4 years.  |
| Aster yellows                                     | Use insecticides to control leafhoppers that transmit the mycoplasma. Excellent early season leafhopper control is essential. Control must occur before leafhoppers feed.   |
| Root-knot nematode                                | Fumigate mineral soils with Telone II, Vapam, or Vorlex; or practice a 3-year rotation with corn or other nonhost crops. Control broadleaf weed hosts. Vydate L (carrot only) may be applied at planting in-furrow or broadcast 1 week before planting. |
| Parsnip canker, leaf spot, and mildew             | Spray with fixed copper 3 times at 10-day intervals at first sign of disease. Ridge soil over the shoulders to prevent canker infections.   |
| <b>Celery, parsley</b>                            |   |
| Seed rot, damping-off, and seedborne leaf blights | Treat seed with hot water, then captan or thiram. If damping-off starts, spray 2 to 3 times at 5- to 7-day intervals with Bravo (celery only) or fixed copper. Seed 2 to 3 years old is free of late blight.  |
| Leaf blights and spots (celery only)              | Spray Benlate, Bravo, or Topsin-M at 7- to 10-day intervals.  |
| Aster yellows and root-knot nematode              | See the section on carrot and parsnip.  |

**Table 3. Condensed Recommendations on Management for Diseases of Commercial Vegetable Crops for 1998 (cont.)**

| Vegetable and disease  | Disease management practices  |
|--|---|
| <b>Corn (sweet and pop)</b>  |   |
| Seed rot, seedling blights, and seedborne diseases   | Plant seed treated with captan or thiram plus an insecticide. Plant shallow in warm, well-drained soil.   |
| Goss's bacterial wilt  | Use 2- to 3-year crop rotations when using susceptible corn (dent or sweet) varieties.  |
| Stewart's disease  | Plant resistant varieties, or control corn flea beetles on young plants with an insecticide.  |
| Smut   | Plant tolerant varieties. Control corn borers as first tassels appear.  |
| Maize dwarf mosaic, chlorotic dwarf, and wheat streak mosaic   | Control johnsongrass and volunteer wheat. Plant wheat after the fly-free date. Plant resistant or tolerant varieties.   |
| "Helminthosporium" leaf blights and anthracnose leaf blight  | Plant resistant varieties. Spray Bravo, mancozeb, maneb, or Tilt when disease first appears. Crop rotation and clean tillage helps reduce disease risk.   |
| Rusts  | Plant resistant varieties. Spray as for "Helminthosporium" blights.   |
| Nematodes  | Apply Counter or Mocap (sweet corn only) at planting time.  |
| <b>Crucifer crops (broccoli, Brussels sprout, cabbage, cauliflower, Chinese cabbage, collard, kale, kohlrabi, mustard, radish, rutabaga)</b> |   |
| Seed rot, damping-off, black rot, blackleg, Alternaria leaf spot   | Sow only western-grown, hot water-treated seed. Seed also should be treated with thiram or captan. Place seedbeds where no crucifer has grown for 4 years or more and where water will not drain from fields recently planted to crucifers. Ridomil Gold (EC or WSP) applied at planting time controls Pythium damping-off and Phytophthora basal stem rot.   |
| Wirestem ( <i>Rhizoctonia</i> )  | Incorporate PCNB-captan in the upper 3 in. of soil before planting, or drench after planting.   |
| Clubroot   | Use only healthy transplants. Avoid soils with a history of clubroot. If clubroot is present, adjust soil pH to 7.2 with hydrated lime. Rotate out of cruciferous crops for 7 years. Apply PCNB (Terraclor 75WP) in transplant water; use $\frac{3}{4}$ pt per plant.   |
| Black rot and blackleg   | Use a crop rotation of 4 years or more. Use only hot water-treated seed. Use care in selecting plant bed sites. Be sure no drainage occurs to the seedbed from old plantings. Control wild mustard and other cruciferous weeds. Purchase only certified, disease-free transplants, and do not dip before planting. Sprays of fixed copper may help control black rot. Rovral may be used to control blackleg on broccoli. Bravo applied to control downy mildew also may help control blackleg. Some cabbage varieties resistant to black rot are available. Losses are generally lower where direct seeding is used. |

**Table 3. Condensed Recommendations on Management for Diseases of Commercial Vegetable Crops for 1998 (cont.)**

| Vegetable and disease  | Disease management practices   |
|--|--|
| <b>Crucifer crops (broccoli, Brussels sprout, cabbage, cauliflower, Chinese cabbage, collard, kale, kohlrabi, mustard, radish, rutabaga) (cont.)</b> |  |
| Downy mildew, Alternaria leaf spot, and other fungal leaf diseases   | Rotate with noncruciferous crops and use disease-free seed or transplants. Apply Bravo, maneb, or Ridomil Gold/Bravo at weekly intervals. Start applications in seedbed or when plants are young. Aliette and Ridomil may be used to control downy mildew on some cruciferous crops. |
| Internal tipburn   | Plant resistant varieties. Avoid overfertilizing, especially with nitrogen.  |
| Fusarium yellows   | Plant only yellows-resistant varieties.  |
| Radish black root  | Plant resistant varieties. Avoid planting radishes in severely infested soil.  |
| Nematodes  | Mocap (cabbage only) or Nema-cur (Brussels sprout and cabbage only) may be applied at planting.  |
| <b>Cucurbits (cucumber, muskmelon or cantaloupe, pumpkin, squash, watermelon)</b>  |  |
| General  | Use a crop rotation of 3 to 4 years. Grow resistant varieties whenever possible.   |
| Seed rot, damping-off, and seedborne diseases  | Plant only certified, western-grown seed treated with captan or thiram. Damping-off may be treated with a captan or Ridomil Gold (EC or WSP) seedbed drench. Plant shallow in warm soil.   |
| Bacterial wilt   | Provide season-long control of striped and spotted cucumber beetles. Start as the plants begin to emerge. Planting-time treatment with Furadan provides moderate control for 3 to 4 weeks. Supplemental insecticide use is necessary.  |
| Anthracnose, scab, blossom blights, gummy stem blight, and black rot   | Grow resistant varieties when possible. Spray weekly with Benlate, Bravo, mancozeb, maneb, or Topsin M. Start when vines begin to run. Store only blemish-free fruit.  |
| Downy mildew and Alternaria leaf blight  | Practice a 2- to 3-year rotation. Grow resistant varieties when possible. Maintain ample but not excessive nitrogen fertility. Apply Bravo, mancozeb, or maneb weekly. Ridomil Gold/Bravo provides excellent control of downy mildew.  |
| Fruit spots and rots   | Maintain fungicide schedule as for anthracnose throughout the season. Avoid harvest injuries.  |
| Fusarium wilt  | Grow only resistant varieties.   |
| Angular leaf spot  | Practice crop rotations of 3 to 4 years. Resistant cucumber varieties are available. Apply fixed-copper sprays in combination with Bravo. Start applications early in the season.  |

**Table 3. Condensed Recommendations on Management for Diseases of Commercial Vegetable Crops for 1998 (cont.)**

| Vegetable and disease   | Disease management practices  |
|---|---|
| <b>Cucurbits (cucumber, muskmelon or cantaloupe, pumpkin, squash, watermelon) (cont.)</b> |   |
| Powdery mildew  | Apply Bayleton at the first sign of disease and again 10 to 14 days later. Where Benlate is applied to control other diseases, powdery mildew is controlled under moderate disease pressure. Plant resistant varieties where possible.  |
| Mosaic viruses  | Control aphids and beetles in the field. Eliminate broadleaf weeds around field borders before plant establishment. Plant only mosaic-resistant cucumbers.  |
| Root-knot nematode  | Fumigate with Vapam, Telone C-17, Telone II, or Vorlex in the fall before planting; or use Furadan or Vydate L at planting.   |
| <b>Eggplant</b>   |   |
| Seed rot, damping-off, and seedborne diseases   | Plant hot water-treated seed when possible. Treat the seed with captan or thiram. Ridomil may be used for Pythium damping-off.  |
| Phomopsis blight, Alternaria leaf spot, Cercospora leaf spot, and anthracnose             | Follow good sanitary practices. Use a crop rotation of 2 to 3 years. Avoid bruising fruit; handle carefully at all times. Apply maneb at 7- to 10-day intervals, beginning at first fruit cluster.  |
| Verticillium wilt and nematodes   | Fumigate the soil with Vapam, Vorlex, or methyl bromide plus chloropicrin. Planting under a black plastic mulch helps reduce disease severity. Vydate L controls nematodes.   |
| <b>Horseradish</b>  |   |
| Leaf spots and white rust   | Practice a 2-year field rotation with any other crop. Apply fixed-copper fungicides. Start when conditions are wet or dews are heavy. Continue until a killing frost occurs.  |
| Brittleroot   | Plant clean sets. Control leafhoppers that spread the disease agent.  |
| <b>Lettuce, endive, escarole</b>  |   |
| Seed rot, damping-off, and gray mold  | Treat seed with captan or thiram. In the field or seedbed, work Botran into the soil before planting and spray Botran 7 days after transplanting. Repeat when plants are 50% mature. Ridomil Gold (EC, WSP, or GR) as a soil application at seeding controls Pythium damping-off on head lettuce. |
| Aster yellows and mosaic viruses  | Control leafhoppers and aphids throughout the season. Early season control is most important.   |
| Rhizoctonia bottom rot, Sclerotinia drop, and gray mold                                   | Plant on raised beds, and deep-plow when possible. Apply Ronalin or Rovral at the 3-leaf stage and again 10 and 20 days later. Botran applications as previously described may help. Use 100 gal of water carrier per acre.   |
| Gray mold   | Apply Botran (leaf type only) at 7- to 10-day intervals.  |
| Nematodes   | Apply Telone C-17, Telone II, Vapam, or Vorlex in the field in the fall before planting. In greenhouses, steaming the soil provides control.  |

**Table 3. Condensed Recommendations on Management for Diseases of Commercial Vegetable Crops for 1998 (cont.)**

| Vegetable and disease  | Disease management practices  |
|--|---|
| <b>Okra</b>  |   |
| Seed rot and damping-off   | Treat seed with captan or thiram plus Apron XL. Plant in warm, well-drained soil.   |
| Fusarium and Verticillium wilts                                      | Fumigate soil with Vapam, Vorlex, or methyl bromide plus chloropicrin.  |
| <b>Onions, garlic, leek, chives, shallot</b>                         |   |
| Smut, seed rot, and damping-off                                      | Treat the seed with captan or thiram. Use Methocel sticker to pellet the seed with fungicide. Use 1/3 lb of active ingredient to 20 lb of seed for set onions and 6 lb of active ingredient to 8 lb of seed for bulb onions. Mancozeb or Ridomil Gold may be used as an in-furrow drench at planting. |
| Blast, downy mildew, Alternaria purple blotch, and Botrytis neck rot | Apply Bravo, mancozeb (dry onions only), maneb, Ronalin, or Rovral weekly. Begin spraying with the first ozone alert. Continue until harvest. Use Ridomil Gold/Bravo or Ridomil Gold MZ (dry onions only) when downy mildew appears.  |
| Bulb and stem nematode and root-knot nematode                        | Fumigate with Telone C-15, Telone II, Vapam, or Vorlex. Eradicate volunteer plants from fields with a history of bulb and stem nematode.  |
| White rot of garlic  | Apply Rovral on cloves and in furrow covering soil. Plant disease-free cloves in well-drained soil.   |
| Fusarium basal rot   | Avoid heavily infested fields. Grow resistant varieties. Cure bulbs rapidly and properly.   |
| Storage decays   | Maintain excellent control of leaf diseases in the field. Maintain dry storage conditions.  |
| Yellow dwarf   | Control aphids. Keep old and new plantings as far apart as possible. Destroy volunteer onions.  |
| <b>Peas</b>  |   |
| Seed rot and seedling and seedborne diseases                         | Plant western-grown seed treated with captan or thiram and Apron XL plus an insecticide. Graphite at 1 oz per bushel may be added to reduce friction in the drill.  |
| Root rots  | Index production fields. Avoid planting in fields with an index of 75 or higher. In fields with a lower root rot index, apply dinoseb (Premerge 3) or trifluralin preplant incorporated. Ridomil Gold (EC or WSP) in the seed furrow gives good Pythium damping-off and root rot control.             |
| Fusarium wilt and near wilt and viral diseases                       | Grow resistant varieties. Viruses are spread by aphids. Plant as early as possible in well-fertilized and well-drained soil. Rotate 4 or more years.  |
| Powdery mildew   | Apply sulfur dust or spray when mildew first appears and temperatures are less than 80°F. Two applications, a week apart, provide good control. Plant resistant varieties.  |

**Table 3. Condensed Recommendations on Management for Diseases of Commercial Vegetable Crops for 1998 (cont.)**

| Vegetable and disease  | Disease management practices  |
|--|---|
| <b>Pepper</b><br>Seed rot, damping-off, and seedborne diseases             | Use only western-grown seed and treat with hot water or a household bleach (Clorox) soak. The bleach soak helps control seedborne bacterial spot. Using 1 part bleach to 3 parts water, soak 1 minute. Use 1 gal of fresh solution to 1 lb of seed. Rinse thoroughly before treating with captan or thiram seed protectant. Ridomil may be used to control Pythium damping-off.   |
| Bacterial spot   | Use crop rotations of 2 to 3 years, excluding small grains and tomatoes. Control broadleaf weeds in and around field borders. Apply fixed copper plus streptomycin (200 ppm) to seedlings. After transplanting, apply fixed copper at 5- to 7-day intervals. The addition of maneb to the copper can increase the effectiveness of the application. Purchase only certified, disease-free transplants. Maintain a high, balanced level of soil fertility. |
| Phytophthora crown rot   | Plant on raised beds in well-drained soil. Treat soil with Ridomil Gold (EC or WSP). Rotate to nonsolanaceous crops for 3 to 4 years.   |
| Anthracnose, Cercospora leaf spot, other fungal leaf spots, and fruit rots | Use disease-free seed. Practice 3-year crop rotation. Burn or plow down crop refuse after harvest. Apply maneb at 7- to 10-day intervals when disease first appears.  |
| Nematodes  | Add Vydate L to transplant water and supplement with foliar applications. Follow label directions.  |
| Verticillium wilt  | Fumigate soil with Vapam, Vorlex, or methyl bromide plus chloropicrin.  |
| Viral diseases   | Grow resistant varieties. Control aphids that transmit viruses. Eliminate broadleaf weeds within 150 ft of fields before crop is established. Plant only healthy transplants.   |
| <b>Potato (Irish)</b><br>General   | Purchase only certified seed. Seed-production fields should be inspected for viral, nematode, and fungal disease problems. Good sanitation and seed-handling practices reduce losses.   |
| Seed piece decay, seedborne diseases, Verticillium wilt, and blackleg      | Treat seed with captan, mancozeb, maneb, or TOPS 2.5D. Keep seed storage at approximately 40°F during the winter. In the spring, warm the seed to 65° to 70°F for 2 to 3 weeks before cutting. Streptomycin may be added to fungicide dusts to improve the control of bacterial diseases. Avoid bruising seed during handling.  |
| Scab   | Plant resistant varieties. Do <i>not</i> apply manure or other organic matter immediately before the potato crop. Maintain acidic soil.   |
| Storage rots   | Store healthy, sound, unbruised mature potatoes. Maintain a proper storage environment. Apply Mertect 340-F as a spray to unwashed tubers before storage to help control Fusarium dry rot.  |

**Table 3. Condensed Recommendations on Management for Diseases of Commercial Vegetable Crops for 1998 (cont.)**

| Vegetable and disease                              | Disease management practices   |
|--|--|
| <b>Potato (irish) (cont.)</b>                      |  |
| Rhizoctonia  | Use a Terraclor soil treatment. Practice a 3-year rotation. Avoid deep planting.   |
| Verticillium wilt                                  | Practice crop rotation and use only seed free of <i>Verticillium</i> . Control root-knot and root-lesion nematodes. Soil fumigation with Vapam or Vorlex may be practical.   |
| Nematodes  | Where soil samples indicate damaging levels of nematodes, apply Temik or Vydate L, or fumigate with Telone C-17, Vapam, or Vorlex.   |
| Early blight and late blight, leak, and pink rot   | Apply Bravo, mancozeb, or maneb on a 5- to 10-day schedule. Maintain an adequate supply of nitrogen throughout the season to provide good control of early blight. Use Ridomil Gold/Bravo or Ridomil Gold MZ only where late blight, leak, and pink rot are threats. Avoid bruising tubers, especially in hot weather. |
| Viral diseases and purple-top wilt (Aster yellows) | Plant only certified seed. Control aphids and leafhoppers with insecticides. Practice clean cultivation. Rogue first-infected plants, including tubers.  |
| <b>Rhubarb (greenhouse only)</b>                   |  |
| Botrytis leaf rot                                  | Apply Botran (3 days to harvest) or fixed copper after budding and at weekly intervals.  |
| Crown and root rots                                | Plant only in well-drained soil. Maintain optimal soil fertility. Drench the crowns with fixed copper at 3 lb per acre in the early spring and after harvest if crown rot is a problem.  |
| <b>Spinach</b>                                     |  |
| Seed rot and damping-off                           | Treat seed with captan or thiram. Apply Ridomil Gold (EC or WSP) for Pythium damping-off.  |
| Downy mildew or blue mold and white rust           | Grow downy mildew-resistant varieties. Apply Aliette as a foliar spray when conditions favor disease development, and continue on a 7- to 21-day interval. A soil application of Ridomil Gold (EC or WSP) can also help control downy mildew and white rust.   |
| Cucumber mosaic virus or blight                    | Grow tolerant varieties. Control aphids that spread the virus.   |
| <b>Sweet potato</b>                                |  |
| Black rot, root rot, Fusarium wilt, and scurf      | Grow resistant varieties. Use clean soil in plant beds and maintain a temperature of 80° to 85°F. Plant disease-free roots and use crop rotations of 3 to 4 years. Dip the roots or sprouts in Botran or Mertect 340-F.  |
| Storage rots                                       | Fumigate storage crates and houses with formaldehyde. Cure and store only healthy, blemish-free roots.   |
| Nematodes  | Plant resistant varieties. Practice crop rotation. Dasanit (suppression only), Mocap, Temik, or Vydate L may be used for chemical control; or fumigate in the fall with Vapam or Vorlex.   |

**Table 3. Condensed Recommendations on Management for Diseases of Commercial Vegetable Crops for 1998 (cont.)**

| Vegetable and disease  | Disease management practices  |
|--|---|
| <b>Tomato (field)</b>  |   |
| Seed decay, damping-off, and seedborne diseases  | Plant seed that has been soaked in hot water or household bleach and that has been treated with captan or thiram. See treatment for pepper seed. Use Ridomil Gold (EC or WSP) drench for Pythium damping-off in the seedbed.  |
| Bacterial spot, speck, and canker  | Purchase only certified, disease-free plants. Use crop rotations of 3 to 4 years, excluding peppers and small grains. In the seedbed, spray with fixed copper plus streptomycin. After transplanting, spray with fixed copper plus mancozeb or Bravo C/M. Once established, bacterial spot and canker are difficult to control.   |
| Septoria blight, early blight, anthracnose, buckeye rot, gray leaf spot; leaf mold, gray mold, and white mold ( <i>Sclerotinia</i> ) | Practice 2- to 3-year crop rotation. Apply Bravo, mancozeb, or Quadris on a 7- to 10-day schedule after the first sign of disease or after the first fruits form. A soil-surface spray of mancozeb after the last cultivation improves anthracnose control. Benlate may be used for Botrytis, white mold, and leaf mold control. Ridomil Gold (EC or WSP) or Ridomil Gold/Bravo helps control buckeye rot, Pythium fruit rots, and late blight. |
| Late blight  | Avoid planting tomatoes near potatoes. Destroy potato tuber cull piles and volunteer potato plants near tomato plantings. Plant disease-free, certified transplants. Practice good field sanitation. Apply Ridomil Gold Bravo or Ridomil Gold MZ on 14-day intervals; or apply Bravo, mancozeb, or Quadris on 5- to 7-day intervals.  |
| Blossom-end rot  | Mulch plants, or maintain uniform soil moisture. Four weekly applications of calcium nitrate starting when fruits are grape-sized may reduce losses. Avoid cultivation close to plants.   |
| Verticillium and Fusarium wilts  | Grow only resistant (VF) varieties. Avoid soils with a history of wilt.   |
| Viral diseases   | Take care to avoid infecting seedlings. Start with virus-free seed. Control insects and broadleaf weeds in and around fields. See greenhouse tomatoes below.  |
| Nematodes  | Plant root knot-resistant varieties. Dasanit or Vydate L may be applied at planting. Fall fumigation with Vapam or Vorlex also may be used.   |
| <b>Tomato (greenhouse)</b>   |   |
| Viral diseases   | Start with hot water-treated seed. Do not allow the use of tobacco on the premises. Smokers should wash their hands with soap and hot water before working with plants. If possible, plant TMV-resistant hybrids. Control insects. Remove the first infected plants if possible.  |
| Botrytis gray mold, leaf mold, gray leaf spot, and early blight  | Avoid excessive humidity by heating and venting, especially at night during the fall, early winter, and early spring. Spray weekly with Bravo, mancozeb, or Ziram. Botran as a directed spray controls stem canker; cover stems up to 18 to 24 in. from ground.   |
| Nematodes, root rots, and soilborne TMV  | Steam the plant beds. Plant resistant varieties whenever available.   |

## Using Nematicides

Use nematicides only where soil analysis shows a nematode problem to be present. Follow soil sampling instructions in *Report on Plant Diseases (RPD)* no. 1100, "Collecting and Submitting Soil Samples for Nematode Analysis." Both no. 1100 and no. 915 (discussed earlier) are available from the Department of Crop Sciences, N-533 Turner Hall, 1102 South Goodwin Avenue, Urbana, IL 61801.

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