

# Commercial Vegetable Disease Control Guide 2015



# Commercial Vegetable Disease Control Guide

2015

Prepared by Steve Bost, professor (Extension plant pathologist), in cooperation with research and Extension personnel of the Entomology and Plant Pathology Department and Plant Sciences Department of the University of Tennessee. The Southeastern Vegetable Extension Workers group is also gratefully acknowledged.

extension.tennessee.edu/publications/Documents/W141.pdf

## Cover Photos:

Upper left: Late blight on tomato leaf.

Upper right: Downy mildew on underside of pumpkin leaf.

Lower left: Blight of squash caused by *Phytophthora capsici*.

Lower right: Basil downy mildew.

## Contents

I. Cultural Practices for Disease Control..	3
II. Chemical and Biological Control..	4
A. Seed Treatment.	5
1. Seed Disinfestation..	5
Table 1. Water Bath Temperatures and Soaking Times for Seeds..	5
2. Seed Protection..	6
Table 2. Common Seed Treatments for Disease Control.	6
B. Soil Fumigation .	7
Table 3. Soil Fumigants for Vegetable Crops.	7
C. Nematicide Applications.	7
Table 4. Non-fumigant Nematicides for Vegetable Crops.	8
D. Fungicide and Bactericide Sprays.	9
1. The Purpose of Table 5..	9
2. Designing a Spray Program.	9
Table 5. Foliar, Soil and Post-harvest Applications of Disease Control Products.	10
Appendix 1. Chemical Control Products..	39
Appendix 2. Resistance Management.	44
Table 1. Resistance Management Groups for Disease Control Products for Vegetables..	44
Appendix 3. Cucurbit Spray Program.	45
Table 1. Suggested Fungicide Spray Program for Cucurbit Crops.	45
Table 2. Relative Effectiveness of Disease Control Products in Cucurbit Crops..	46
Appendix 4. Tomato Spray Program.	47
Table 1. Suggested Fungicide Spray Program for Tomato.	47
Table 2. Relative Effectiveness of Disease Control Products in Tomato..	48

## Pesticide Safety

- Follow the directions, and heed all precautions on the labels.
- Know any hazards that the pesticide might present – to you or anyone else.
- Avoid prolonged inhalation of pesticide sprays or dusts; wear personal protective equipment and clothing if specified on the container.
- If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first-aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on the skin or clothing, remove the clothing immediately and wash skin thoroughly.
- Comply with the Worker Protection Standard (WPS). The WPS requires the agricultural employer to be responsible for reducing the pesticide exposure of employees. The WPS mandates pesticide safety education, specific restricted entry intervals (REI's), personal protective equipment and worker access to information. A product's WPS specific requirements are found in the Agricultural Use section of the label. All require employers to notify workers of a pesticide application with a display at a central location.

- Comply with the Right-To-Know law. Have the product labels readily available for workers to see. Have the Material Safety Data Sheet (MSDS) for each product available for workers to see and for rescue or fire personnel to use in case of emergency.
- Store pesticides in original containers under lock and key – out of the reach of children and animals – and away from food and feed.
- Apply pesticides so they do not endanger humans, livestock, crops, beneficial insects, fish and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants or in ways that may contaminate water or leave illegal residues.
- Do not clean spray equipment or dump excess spray material near ponds, streams or wells. Do not use the same equipment for insecticides or fungicides that you use for herbicides.
- Restricted-use products may only be purchased and applied by certified applicators or persons under their direct supervision. There are categories of applicators, and a test must be passed to become a certified applicator in the appropriate category. Once the test is passed, the applicator must be recertified periodically through continuing education.
- The USDA requires that records are kept for the use of all restricted-use products. Forms are available at your county Extension office. Record keeping is advisable for nonrestricted pesticides as well.
- Dispose of empty pesticide containers promptly and according to the law.



## **Precautionary Statement**

To protect people and the environment, pesticides should be used safely. This is everyone's responsibility, especially the user. Read and follow label directions carefully before you buy, mix, apply, store or dispose of a pesticide. According to laws regulating pesticides, they must be used only as directed by the label.

## **Disclaimer Statement**

This publication contains pesticide recommendations that are subject to change at any time. The recommendations in this publication are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. The label always takes precedence over the recommendations found in this publication.

Use of trade or brand names in this publication is for clarity and information; it does not imply approval of the product to the exclusion of others that may be of similar, suitable composition, nor does it guarantee or warrant the standard of the product. The author(s), the University of Tennessee Institute of Agriculture and University of Tennessee Extension assume no liability resulting from the use of these recommendations.

# Foreword: What Is a Plant Disease?

The term **plant disease**, as used in this publication, refers to a plant problem caused by a pathogen, such as a fungus, bacterium, virus or nematode. Other types of plant problems include **disorders**, caused by cultural or environmental factors, and **pest damage**, caused by insects or other animals that feed on or otherwise damage plants. This publication only deals with pathogen control and does not address disorders and pest damage.

## I. Cultural Practices for Disease Control

Chemical control practices comprise a large part of this publication, because they change so frequently, but make up only a small part of the overall disease control program. Cultural practices are the backbone of disease control.

### **Crop Rotation**

Rotating fields to unrelated crops each year will decrease the populations of many types of disease-causing organisms in the soil. Because pathogens tend to attack several members of one plant family but not another, crop rotations should involve different families. Grass crops or corn almost always make a good rotation crop. At least two years should be allowed between plantings of the same family, but the longer the rotation, the less likely that an early-season outbreak of a disease will occur. The vast majority of plant diseases are lessened even by one year out of a crop.

Crop rotation is effective in reducing pathogens that spend at least part of their life cycle in the soil, which applies to most of them. Examples of pathogens that do not survive in the soil and, thus, are not controlled by crop rotation, include the rusts, the downy mildews, the powdery mildews and viruses other than tobacco mosaic. Crop rotation is very effective against pathogens that survive short periods in the soil on plant debris, such as those that cause foliar and fruit diseases. Crop rotation will reduce, but not eliminate, soil inhabitants that are long-lived, such as *Phytophthora* and *Fusarium*.

### **Proper environment**

Provide the crop with favorable drying conditions and soil drainage so that the plants are not exposed to prolonged wet conditions, which favor both root and foliar diseases. Select sites that are not lined by trees and have good internal soil drainage. Using raised beds, reducing plant densities and foregoing sprinkler irrigation are considerations for minimizing diseases. Weeds can increase diseases by interfering with drying conditions and by providing an alternate host for certain pathogens.

### **Resistant Varieties**

The use of resistant varieties is one of the most economical ways of controlling vegetable diseases. Resistance to a disease should be employed if a farm or the vicinity has a history of the disease. Especially when used in combination with crop rotation, varieties with resistance to soilborne diseases will result in the longterm decline of the pathogen population. The use of resistance to foliar disease will decrease the reliance on chemical control. Resistant varieties are not available to all diseases or may only be effective against certain strains. Resistant varieties may become ineffective as pathogens develop the ability to overcome the resistance.

### **Good Crop Husbandry**

Plants that have good, but not excessive, vigor are the most resistant to disease. Plants weakened by improper soil pH, inadequate fertilization, crowding, weed competition or planting when the soil is too cool are more subject to pathogen invasion and disease development. Lush growth caused by excessive fertilization can decrease drying conditions. Follow closely all production recommendations for each crop.

### **Prevent Disease Introduction**

Often the most effective and successful control of a disease is to prevent it from occurring in the first place. Many diseases are difficult to deal with after they appear, as they lack adequate controls.

Disease-free seed and transplants are a must. Do not save seed, as they have a greater risk of harboring pathogens. External appearance of seed or transplants cannot be relied upon as an indicator of the presence of the pathogen, as there are usually no symptoms. Buy certified transplants, understanding that certification is no guarantee of freedom from disease. Buy seed that is certified and, if possible, has been tested for bacterial pathogens. Hot water and chlorine bleach treatments of seed decrease the chance of pathogen infestation, but do

not substitute for the certification process. The western U.S. is a preferred source of seed because the arid climate decreases the chance of disease transmission. However, western-grown seed is not always available.

Some disease-causing organisms can be introduced to a field on contaminated equipment or containers. Cultivate noninfested vegetable fields before moving to fields infested with particularly troublesome pathogens. Equipment or containers that have been used in infested fields should be washed with a strong stream of water and disinfested with a bleach solution before being used in other fields.

Avoid using tobacco while working in tobacco mosaic-susceptible crops, such as tomato and pepper. Tobacco mosaic virus is carried in tobacco products and is easily transmitted on workers' hands. Workers should wash their hands thoroughly in soap and water after handling tobacco and before they work with tobacco mosaic-susceptible plants.

### **Remove the Pathogen**

Destroy the overwintering habitat of the pathogen, such as crop debris left in the field. The most practical way to do this is to disk it into the soil. Most pathogens are unable to survive once the crop residue decomposes, and disking it in enhances the decomposition process. Eliminate cull piles by burying before the next crop is planted.

Removing diseased plant parts from the field is not a common practice in vegetable production but may have a role in certain systems, such as asparagus production. As a perennial crop, disking crop debris at the end of the growing season is not an option. However, removing the debris and burning it reduces overwintering inoculum of foliar diseases.

Roguing, or removing entire plants from the field, may be used in certain situations for reducing inoculum. It generally is only effective when done immediately upon the first detection of a disease, with the goal of arresting an epidemic in its initial stage. Furthermore, roguing can actually result in increased disease by scattering the pathogen during the removal process (e.g., southern blight) or by causing insect vectors to scatter (e.g., tomato spotted wilt virus).

## **II. Chemical and Biological Control**

Biological and chemical controls are available for management of diseases caused by fungi, bacteria and nematodes. Although there are no viricides, virus diseases that are vectored by insects may be managed with certain insecticides.

**Plant diseases cannot be controlled satisfactorily just by spraying.** Disease control should be approached as a program that integrates all of the cultural practices mentioned above. Applications of sprays, dusts, fumigants, etc. for plant disease control should only be considered supplements to the cultural practices.

The use of certain strains of bacteria and fungi to control plant pathogens is called **biological control** or **biocontrol**. Some of these organisms are commercially available and can be quite effective in certain situations. Biocontrols offer the advantage of lessened environmental impact and increased worker safety. Often, biocontrols work more slowly and tend not to be as effective as synthetics when disease pressure is high. Certain biocontrol products are listed in the recommendations if adequate research has been conducted to elucidate their role.

**Chemical control** of plant diseases includes synthetic and naturally occurring compounds. Most chemicals affect the pathogen directly while some, such as Actigard, induce plant resistance to certain pathogens.

Disease-control products include seed treatments, soil sprays, soil fumigation, nematicides, foliar sprays and post-harvest treatments. Products available for use are addressed in the sections that follow. Only brief instructions for use are provided; **always refer to the label for full instructions, restrictions and other information.**

## A. Seed Treatment

Seed treatment accomplishes plant disease control by reducing seedling disease as well as mature-plant diseases caused by seed-borne pathogens. Most seedling diseases are caused by pathogens found in the soil, whereas those pathogens found on or in the seeds tend to cause mature-plant diseases. Seed disinfestation and seed protection are types of seed treatments used to reduce diseases.

### 1. Seed Disinfestation

Seeds can be disinfested, i.e., cleaned of most pathogens carried on the seeds, by treatment with hot water, chlorine bleach or trisodium phosphate. Hot water also kills some of the bacteria carried inside the seed. None of these treatments provides residual protection against organisms encountered in the soil after planting. Treatment of seeds with fungicides is required for such protection.

Most seed companies offer seed treatment options, and it is recommended that you utilize such services, rather than attempt to treat the seeds yourself. Unless the procedures are adhered to closely, much damage can be done during the seed treatment process. For example, an entire lot of seeds can be contaminated with bacterial pathogens that spread in water that is not hot enough; seed germination can be reduced by water that is just slightly too hot. Furthermore, many fungicide seed treatments can only be applied by a commercial seed treater and are not available for purchase by the grower. Pelletized seed must be treated prior to the coating process.

**Hot water treatment:** Pre-warm seed in a cheesecloth bag for 10 minutes in 100 degree F water. Place pre-warmed seed in a water bath that will constantly hold the water at the recommended temperature (see Table 1). Length of treatment and temperature of water must be exact. Agitation of the water during the treatment cycle will help maintain a uniform temperature in the water bath. After treatment, dip the bag in cool water to stop the heating action. Spread seed out on paper towel to dry. A seed treatment fungicide can then be applied to protect against pathogens in the soil.

*Caution:* Hot water treatment can reduce germination to some degree. The viability of older seed (more than 1 year old) may be drastically reduced. A small sample of seed should be treated and tested for germination before the entire lot is treated. Vegetable seeds other than those listed in Table 1 should **not** be hot-water treated. These seeds may be severely harmed by hot water treatment and other methods should be used. Included are beans, sweet corn, onions and, especially, cucurbits other than cucumber.

**Table 1. Water bath temperatures and soaking times for selected vegetable seeds.**

Crop	Temp. (°F)	Minutes
Brussels sprouts, cabbage, eggplant, spinach and tomato	122	25
Broccoli, cauliflower, cucumber, carrot, collard, kale, kohlrabi, rutabaga and turnip	122	20
Mustard, cress and radish	122	15
Pepper	125	30
Lettuce and celery	118	30

**Bleach treatment:** Pathogens can be removed from the surface of seeds with bleach treatments. This method is particularly useful for control of bacterial diseases such as bacterial spot of tomato or pepper. Mix 1 quart of bleach (sodium hypochlorite) with 4 quarts of water and a few drops of dish detergent to decrease surface tension. Soak seed for 1 minute, remove and rinse seed thoroughly in running tap water for 5 minutes; spread seeds on paper towels to dry. North Carolina State University reports that tomato seeds can be soaked in this bleach solution for 40 minutes without serious harm to the seeds. Treat a small sample size and test for seed germination before the entire lot is treated. After drying, a seed treatment fungicide may be applied.

Tobacco mosaic virus on pepper and tomato seeds can be reduced with a **trisodium phosphate treatment**. Soak seeds for 15 minutes in a 10 percent solution, rinse and dry before treating with household bleach.

## 2. Seed Protection

The purpose of seed protection is to reduce the plant stand loss effect of seed rots and damping-off, caused by soilborne fungi. Most vegetable seed is pretreated by the seed company, using treatments aimed at the common fungi. Captan and thiram are the most common treatments used. If you have unusual seedling disease problems, refer to Table 2 for appropriate treatments and request them when you place your seed order with the company. Certain products can be applied on the farm; follow label directions in treating your own seeds.

**Table 2. Common seed treatments for disease control.**

Product	Active Ingredient	Pathogen Controlled	Crop
Allegiance-FL Allegiance Dry	metalaxyl	Pythium, suppression of Phytophthora	Most vegetables
Apron Maxx	mefenoxam and fludioxonil	Pythium, Rhizoctonia, Fusarium, suppression of Phytophthora	Legume vegetables
Apron XL LS	mefenoxam	Pythium, suppression of Phytophthora	Most vegetables
Captan 400-C, others	captan	Rhizoctonia, suppression of Pythium, Fusarium and miscellaneous other fungi	Most vegetables
Coronet	pyraclostrobin, boscalid	Rhizoctonia, Penicillium, Fusarium	Brassica, bulb, cucurbit and legume vegetables
Dividend Extreme	difenaconazole, mefenoxam	Rhizoctonia, Fusarium, Pythium	Sweet corn
Tebuzol/Orius	tebuconazole	Fusarium	Sweet corn
Dynasty	azoxystrobin	Rhizoctonia, suppression of Pythium, Fusarium and miscellaneous fungi	Legume vegetables, sweet corn
FarMore D300	azoxystrobin, mefenoxam, and fludioxonil	Rhizoctonia, Pythium, and Fusarium, suppression of Phytophthora	Tomatoes, peppers, lettuce, spinach, carrots, onions, cucumbers, melons, squash, watermelon, broccoli, cabbage and cauliflower
Kodiak	Bacillus subtilis strain GB03	Rhizoctonia, Fusarium, Alternaria, Aspergillus	Legume vegetables
Maxim 4FS	fludioxonil	Fusarium, Rhizoctonia, Helminthosporium, Aspergillus, Penicillium	Most vegetables and herbs
Prevail	carboxin	Rhizoctonia	Beans
Protector-D	thiram	Rhizoctonia, suppression of Pythium, Fusarium and miscellaneous other fungi	Beans
Rancona 3.8FS	ipconazole	Rhizoctonia, Fusarium, Penicillium, Aspergillus	Legume vegetables
Thiram 50WP 42-S Thiram	thiram	Rhizoctonia, suppression of Pythium, Fusarium and miscellaneous other fungi	All vegetables
Stamina	pyraclostrobin	Rhizoctonia	Brassica, cucurbit, bulb, and legume vegetables, sweet corn
Trilex	trifloxystrobin metalaxyl	Fusarium, Rhizoctonia, Pythium and other fungi	Beans
Vitavax-34	carboxin	Rhizoctonia	Beans

**Table 2. Common seed treatments for disease control, continued.**

Vitaflo-280	carboxin, thiram	Rhizoctonia, suppression of Pythium, Fusarium and miscellaneous other fungi	Beans, sweet corn
-------------	------------------	---	-------------------

## B. Soil Fumigation

This method will reduce, but not eliminate, fungal, bacterial and nematode pathogens in the soil prior to planting. Some fumigants also provide weed and soilborne insect control. Table 3 contains a brief description of application methods for labeled fumigants. Refer to the label for complete instructions and restrictions. Soil should be warm, well-worked and free from undecomposed plant debris and have adequate moisture for seed germination.

**Table 3. Soil fumigants for vegetable crops.**

Note: All soil fumigant applications must be in compliance with the EPA's risk mitigation requirements (buffer zones, personal protective equipment, fumigant management plans, etc.).

Vegetable Crop	Product	Broadcast Rate/Acre*	Remarks
Most Vegetables	Telone II (for nematodes only)	9 - 12 gal	Chisels should be inserted 12 in. deep and spaced 12 in. apart for broadcast applications. Wait at least 2-3 weeks before planting.
	SMDC (Metam CLR, Vapam, or Sectagon 42) K-Pam HL Pic-Clor 60 Telone C-17 Telone C-35	40 - 100 gal 30 - 60 gal 19.5 - 31.5 gal 10 - 17 gal 13 - 20.5 gal	Multipurpose fumigants. See label for chisel depth and spacing and plant-back restrictions. Wait 2-3 weeks before planting, or longer in cold, wet soil, or if odor persists. Plastic film improves effectiveness.
	Dominus	10 - 40 gal (25 - 40 gal for cucurbit crops and fruiting vegetables)	A biofumigant. Shank injected or via drip irrigation. Wait at least 10 days before planting. Rates for greenhouses are the same as for field.
	Paladin	40 - 51 gal (355 - 455 lb)	Shank injection. VIF films only. Film applied immediately and kept in place at least 12 days. Plant-back interval 21-42 days, depending on soil temperature.
Pepper, tomato, eggplant, cucumber, melons (all), squash (all)	Paladin EC	42 - 54 gal (347 - 479 lb)	For application through drip irrigation. See Paladin remarks.

\* In-row applications reduce the per-acre rates proportionately to row spacing and row width.

## C. Nematicide Applications

Nematode control is needed in fields in which root galling has been found in the past. At the end of each growing season, plants should be dug up in several locations in each field and examined for evidence of root galling. This direct method of detection of the root-knot nematode is the most accurate. If desired, soil samples can be submitted to a laboratory for analysis. This method can detect all types of nematodes, but root inspection will detect root-knot, which is the most important nematode in vegetable production in Tennessee.

Products for controlling nematodes, called nematicides, serve as supplements to cultural practices, not as substitutes. Nematicides are of two types: fumigants and non-fumigants. For fumigant products, see "Soil Fumigants," above. Non-fumigant products are provided in Table 4.



**Table 4. Non-fumigant nematicides for vegetable crops.**

Product Choices	Application Method	Formulated Rate		Schedule and Remarks
		Per Acre	Per 100 sq ft or 100 ft row	
<b>Bean, snap and lima</b>				
Mocap - various formulations	Broadcast or banded	See label	See label	Incorporate 2 in. to 4 in. deep. See label.
<b>Cabbage</b>				
Mocap - various formulations	Broadcast or banded	See label	See label	Incorporate 3 in. deep. See label.
<b>Carrot</b>				
Vydate 2L	Preplant broadcast	2 gal	--	Apply within 1 week before planting, incorporate into soil 4 in. to 6 in. deep.
	In seed furrow	1 - 2 gal	--	
<b>Cucumber</b>				
Mocap - various formulations	Banded only	See label	See label	Incorporate 2 in. to 4 in. deep. See label.
<b>Cucurbits (cucumber, squash, cantaloupe, watermelon, honeydew, pumpkin)</b>				
Vydate 2L	Preplant broadcast	1 - 2 gal	--	Incorporate 2 in. to 4 in. deep. First application 2 - 4 weeks after planting; repeat 2 - 3 weeks later. Do not treat within 1 day of harvest.
	Foliar spray	2 - 4 pt	--	
Nimitz 4EC - transplanted crops only	Broadcast, banded or drip irrigation	3.5 - 5 pt	See label	Apply at least 7 days before planting by broadcasting and incorporating, banding and incorporating or by drip irrigation.
<b>Eggplant</b>				
Vydate 2L	Postplant band	1 gal	--	Apply 2 - 3 weeks after transplanting; repeat 4 weeks later. Incorporate by water or mechanically.
	Foliar	4 pt	--	
Nimitz 4EC - transplanted crops only	Broadcast, banded or drip irrigation	3.5 - 5 pt	See label	Apply at least 7 days before planting by broadcasting and incorporating, banding and incorporating or by drip irrigation.
<b>Pepper</b>				
Vydate 2L - bell peppers only	Transplant water	2 pt in 200 gal water	--	Use as a supplement to transplant treatment 14 days after transplanting. Repeat at 1- to 2-wk intervals.
	Drip irrigation	2 - 4 pt in 40 - 200 gal water	--	
Nimitz 4EC - all types, transplanted crops only	Broadcast, banded or drip irrigation	3.5 - 5 pt	See label	Apply at least 7 days before planting by broadcasting and incorporating, banding and incorporating or by drip irrigation.
<b>Potato</b>				
Mocap - various formulations	Broadcast or banded	See label	See label	Incorporate 2 to 4 in. deep. See label.
Vydate 2L	At planting in-furrow	1 - 2 gal in 20 gal water	--	Begin when early season control has diminished.
	Foliar	2 - 4 pt	--	

**Table 4. Non-fumigant nematicides for vegetable crops, continued.**

Product Choices	Application Method	Formulated Rate		Schedule and Remarks
		Per Acre	Per 100 sq ft or 100 ft row	
<b>Sweetpotato</b>				
Mocap - various formulations	Broadcast or banded	See label	See label	Incorporate 2 to 4 in. deep. See label.
Vydate 2L	Preplant broadcast	2 gal in 20 gal water	--	Thoroughly incorporate into soil 4 in. to 6 in. deep within 1 week of planting.
	Transplant water	1 - 2 gal in 200 gal water	--	
<b>Sweet corn</b>				
Mocap - various formulations	Banded only	See label	See label	Incorporate 2 in. to 4 in. deep. See label.
Counter 15G	Row, 30-in. minimum	Maximum of 8.7 lb	0.8 oz	Place granules directly in the seed furrow behind planter shoe.
<b>Tomato</b>				
Vydate 2L	Foliar	2 - 4 pt	--	Spray when plants are established. Repeat at 1- to 2-week intervals.
	Drip irrigation	2 - 8 pt	--	Apply at first irrigation; repeat every 1 to 2 wks. Use 2 pt to 4 pt while plants are small, increasing gradually to 8 pt.
Nimitz 4EC - transplanted crops only	Broadcast, banded or drip irrigation	3.5 - 5 pt	See label	Apply at least 7 days before planting by broadcasting and incorporating, banding and incorporating or by drip irrigation.

## D. Fungicide and Bactericide Sprays

### 1. The Purpose of Table 5

In Table 5, chemical and biological control product choices are provided for the major diseases on the major crops in Tennessee. This table is not a spray schedule; it provides product choices for a number of diseases for each crop. It is intended as a reference, so that the grower can develop a spray program suitable for his/her farm situation. Diseases that are important to you may not be a factor elsewhere, and vice versa.

### 2. Designing a Spray Program

In general, incorporate the chosen products into a spray program that features disease prevention while minimizing the number of applications and abides by product label restrictions. Excessive use of chemicals is expensive and increases the chances of resistance development in the pathogen populations.

- Disease control must be approached preventively, for the most part. Plan your program by selecting broad-spectrum, protectant fungicides such as mancozeb or chlorothalonil that are labeled for the crop.
- Use Table 5 to determine which products are labeled for use and are effective against the diseases that are important on your farm. Use efficacy tables, if available, to compare the fungicides for effectiveness on those diseases. Two such tables can be found in Appendices 3 and 4. Price should also be a consideration in product selection.
- When to begin spraying depends on the crop, the weather, the disease history in the field and when the crop was planted. On crops that are highly subject to foliar diseases, such as tomatoes, the spray program should begin as soon as the first week after planting, especially on late plantings.
- How often to spray depends on the weather, but usually is in the 7- to 14-day range. Five-day intervals, if allowed by the label, may be necessary if certain difficult-to-control diseases are present and rainy weather occurs. Rainy weather favors most diseases, and more frequent sprays are needed under such conditions.

- Scout the crop regularly and add specialized fungicides to the program as appropriate for diseases such as late blight of tomato, downy mildew of cucurbits, powdery mildew of cucurbits and *Phytophthora capsici* blight of several crops.
- Engage in resistance management for those fungicides that are at risk for losing effectiveness (Appendix 2). The at-risk group includes the strobilurins, which are commonly used in vegetable production. Most at-risk fungicides must be alternated with non-related fungicides, although some can be applied two consecutive times before rotating to a non-related fungicide.
- Most products have a labeled limit on the number of times or the amount applied to a crop. Abide by these limits in designing your program. They are found on the label and in Table 5.
- Heed the preharvest interval (PHI). It may be necessary to make an alternate choice of fungicides during the harvest period. For example, the 5-day PHI of mancozeb on tomato interferes with the harvest schedule.

**Table 5. Foliar, soil and post-harvest applications of disease-control products.**

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season	Remarks
<b>ALL VEGETABLES</b>						
<b>Post-harvest rots</b>		sodium hypochlorite (various brands)	See label			Submerge 2 min., rinse. Change solution when visibly dirty. Never permit chlorine solution to fall below 25 ppm.
		hydrogen dioxide	See label			See label
		peroxyacetic acid + hydrogen peroxide (various brands)	See label			See label
<b>ASPARAGUS</b>						
<b>Rust</b> Brick-red pustules on ferns.	3	Rally 40W	5 oz	180	6 app	Apply only to fern stage. Begin at first appearance of disease. Rally and tebuconazole should be alternated with non-Group 3 fungicides. Jersey male hybrids are resistant to rust.
	3	tebuconazole 3.6F	4 - 6 fl oz	180	3 app	
	M	mancozeb 80WP <sup>4</sup>	2 lb	180	8 lb	
	M	chlorothalonil 6L <sup>4</sup>	2 - 4 pt	190	12 pt	
	M	sulfur	See label	0	NL	
<b>Cercospora leaf spot (blight)</b> Tan spots with purple margins.	3	mancozeb 80WP <sup>4</sup>	2 lb	180	8 lb	Apply only to fern stage. Apply mancozeb at 10-day intervals, beginning at first appearance of disease. The minimum re-treatment interval for chlorothalonil is 14 days.
	M	chlorothalonil 6L <sup>4</sup>	2 - 4 pt	190	12 pt	
<b>Fusarium crown and root rot</b> Deterioration of root system and poor growth of plants.	M	mancozeb 80WP <sup>4</sup>	1 lb/100 gal Preplant root dip.			See label. Chemical control is limited. Avoid acidic and poorly drained soils. Avoid excessive cutting. Jersey male hybrids tolerant.
<b>Stemphyllium purple spot</b> Purple lesions with brown centers on spears and ferns.	11	Quadris 2.08F	6 - 15.5 fl oz	100	92 fl oz	Do not make more than 1 application of Quadris or Flint before alternating with a fungicide with a different mode of action. Remove and destroy fern debris in fall.
	11	Flint 50WG	3 - 4 oz	180	3 app	
	M	chlorothalonil 6L <sup>4</sup>	2 - 4 pt	190	12 pt	
<b>BEAN, SNAP</b>						
<b>Alternaria leaf and pod spot</b> Dark flecks on pods and leaves, and large brown leaf spots.	2	iprodione 4F	1.5 - 2 pt	*	2 app	Alternate with a fungicide with a different mode of action after each application of Headline, Quilt or Quadris or 2 consecutive apps of Fontelis. See Priaxor label for tank mix warnings. *Apply no later than peak bloom.
	3,11	Quilt 1.66SC	14 fl oz	7	3 app	
	7,11	Priaxor 4.17SC	4 - 8 fl oz	7	2 app	
	7	Fontelis 1.67SC	14 - 30 oz	0	72 fl oz	
	11	Quadris 2.08F	6 - 15.5 fl oz	0	92 fl oz	
	11	Headline 2.09	6 - 9 fl oz	7	18 fl oz	

## Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season	Remarks
<b>BEAN, SNAP (CONT'D)</b>						
<b>Anthracnose</b> Dark, sunken spots on pods and stems with pinkish ooze.	1	thiophanate methyl 70WG	1.375 - 3 pt	7	12 pt	Use Western-grown seed. If plants become infected, do not work in fields while plants are wet. Spray at 7- to 10-day intervals. Alternate with a fungicide with a different mode of action after each application of Headline, Quilt or Quadris or 2 consecutive apps of Fontelis. See Priaxor label for tank mix warnings.
	3,11	Quilt 1.66SC	14 fl oz	7	3 app	
	7,11	Priaxor 4.17SC	4 - 8 fl oz	7	2 app	
	7	Fontelis 1.67SC	14 - 30 fl oz	0	72 fl oz	
	11	Headline 2.09F	6 - 9 fl oz	7	18 fl oz	
	11	Quadris 2.08F	6 - 15.5 fl oz	0	92 fl oz	
	M	chlorothalonil 6L <sup>4</sup>	1.375 - 3 pt	7	12 pt	
<b>Bacterial blights</b> Water-soaked spots on leaves and pods. Red margin and sometimes a yellow halo around spot.	M	fixed copper	See label	0	NL	Use Western-grown seed. If plants become infected, do not work in fields while plants are wet.
<b>Gray mold (Botrytis)</b> Gray moldy growth on pods and stems.	1	thiophanate methyl 70WP	1.5 - 2 lb	14	4 lb	Begin at 10 - 25% bloom. Repeat at peak bloom. Rotate to a different mode of action. See label for frequency of required rotation. See Priaxor label for tank mix warnings. *Apply no later than peak bloom.
	2	iprodione 4F	2 pt	*	2 app	
	7	Endura 70 WG	8 - 11 oz	7	2 app	
	7,11	Priaxor 4.17SC	4 - 8 fl oz	7	2 app	
	7	Fontelis 1.67SC	14 - 30 fl oz	0	72 fl oz	
	9,12	Switch 62.5 WG	11 - 14 oz	7	56 oz	
	12	Cannonball 50WP	7 oz	7	28 oz	
	29	Omega 4.17SC	0.5 - 0.85 pt	14	1.75 pt	
	M	chlorothalonil 6L	3 pt	7	12 pt	
<b>Mosaic viruses</b> Leaves yellowed, crinkled or speckled. Leaves cupped, runners killed.						Use resistant varieties. Half runners are most susceptible, particularly "Pink." Successive plantings help spread out risk.
<b>Pod tip rot (Rhizoctonia)</b>	3	Rally 40WP	4 - 5 oz	0	20 oz	Begin applications when pods begin to develop. Repeat at 7- to 10-day intervals if conditions remain favorable.
<b>Powdery mildew</b> White, powdery mold on surface of leaves.	7	Endura 70WG	8 - 11 oz	7	2 app	Alternate with a fungicide with a different mode of action after each application of Headline or 2 consecutive apps of Fontelis. See Priaxor label for tank mix warnings. Use resistant varieties.
	7,11	Priaxor 4.17 SC	4 - 8 fl oz	7	2 app	
	7	Fontelis 1.67SC	14 - 30 fl oz	0	72 fl oz	
	11	Headline 2.09F	6 - 9 fl oz	7	18 fl oz	
	M	sulfur	see label	0	NL	
<b>Rusts</b> Reddish-bronze pustules on leaves, stems and pods.	3	Rally 40W	4 - 5 oz	0	20 oz	Spray plants when rust first appears and repeat at 7- to 10-day intervals. Alternate with a fungicide with a different mode of action after each application of Headline, Quilt or Quadris or 2 consecutive apps of Fontelis. See Priaxor label for tank mix warnings.
	3	tebuconazole 3.6F	4 - 6 fl oz	7	24 fl oz	
	3,11	Quilt 1.66SC	14 fl oz	7	3 app	
	7	Endura 70WG	8 - 11 oz	7	2 app	
	7,11	Priaxor 4.17 SC	4 - 8 fl oz	7	2 app	
	7	Fontelis 1.67SC	14 - 30 fl oz	0	72 fl oz	
	11	Headline 2.09F	6 - 9 fl oz	7	18 fl oz	
	11	Quadris 2.08F	6 fl oz	0	92 fl oz	
	M	chlorothalonil 6L <sup>4</sup>	3 pt	7	12 pt	
<b>Seedling disease</b> Rots of seeds and death of seedlings (damping off) and root rots.		<i>For Rhizoctonia and Pythium:</i>				Ridomil Gold PCGR, Blocker and Fontelis are in-furrow applications. Quadris can be used either in-furrow at planting or in a 7-inch band over the row prior to or shortly after emergence. Rotate fields, avoid double-cropping beans and turn under plant debris well in advance of planting. See UT Extension publication SP 277-O.
	4,14	Ridomil Gold PCGR	0.75 lb/1000 row ft			
	4,11	Uniform 3.72SC	0.34 fl oz/1000 row ft			
		<i>For Rhizoctonia only:</i>				
	11	Quadris 2.08F	0.4 - 0.8 fl oz/1000 row ft			
	14	Blocker 4F	2 - 3 pt			
	7	Fontelis 1.67SC	1.2 - 1.6 fl oz/1000 row ft			

## Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season	Remarks
<b>BEAN, SNAP (CONT'D)</b>						
<b>White mold (Sclerotinia)</b> White moldy growth on pods and stems.	1	thiophanate methyl 70WG	1 - 1.5 lb	14	4 lb	Spray at 10 - 25% bloom; repeat at full bloom. Botran may be applied at 7-day intervals. Rotate to a different mode of action. Refer to product labels for frequency of rotation required. *Apply no later than peak bloom.
	2	iprodione 4F	1.5 - 2 pt	*	2 app	
	7	Endura 70WG	8 - 11 oz	7	2 app	
	7	Fontelis 1.67SC	16 - 30 fl oz	0	72 fl oz	
	12	Cannonball 50WP	7 oz	7	28 oz	
	12,9	Switch 62.5 WG	11 - 14 oz	7	56 oz	
	14	Botran 75WP	2.67 lb	2	5.33 lb	
	29	Omega 4.17SC	0.5 - 0.85 pt	14	1.75 pt	
<b>BEAN, DRY (Navy, Pinto, Kidney, Lima, Southern pea, etc.)</b>						
<b>Anthracnose</b> Dark brown to brick-red spots on stems and pods.	1	thiophanate methyl 70WG	1 - 2 lb	28	4 lb	Begin applications during early bloom stage and repeat at 7- to 10-day intervals. Refer to Priaxor, Quadris, Quadris Opti, Quilt, Vertisan and Headline labels for resistance management guidelines. See Priaxor label for tank mix warnings.
	3,11	Quilt 1.66SC	14 fl oz	14	3 app	
	7	Vertisan 1.67EC	14 - 20 fl oz	21	41 fl oz	
	7,11	Priaxor 4.17SC	4 - 8 fl oz	21	2 app	
	11	Headline 2.09F	6 - 9 fl oz	21	18 fl oz	
	11	Quadris 2.08F	6 - 15.5 fl oz	14	92 fl oz	
	M	chlorothalonil 6L <sup>4</sup>	1.375 - 2 pt	14	8 pt	
	M,11	Quadris Opti 5.5SC	1.6 - 2.4 pt	14	4 app	
<b>Gray mold (Botrytis)</b> Gray, moldy growth on pods and stems.	1	thiophanate methyl 70WG	1 - 2 lb	21	4 lb	Begin applications during early bloom stage and repeat at 7- to 10-day intervals. Rotate to a different mode of action after 2 applications of Switch. See Priaxor label for tank mix warnings. *Apply no later than peak bloom.
	2	iprodione 4F	1.5 - 2 pt	*	2 app	
	7	Endura 70 WG	8 - 11 oz	21	2 app	
	7	Vertisan 1.67EC	14 - 20 fl oz	21	41 fl oz	
	7,11	Priaxor 4.17SC	4 - 8 fl oz	21	2 app	
	12	Cannonball 50WP	7 oz	14	28 oz	
	12,9	Switch 62.5 WG	11 - 14 oz	14	56 oz	
	29	Omega 4.17SC	0.5 - 0.85 pt	30	1.75 pt	
<b>Rusts</b> Reddish-bronze pustules.	3	tebuconazole 3.6F	4 - 6 fl oz	14	12 fl oz	Begin applications when conditions become favorable for rust and repeat at 7- to 10-day intervals. Refer to Quadris, Vertisan, Quilt and Headline labels for resistance management guidelines. See Priaxor label for tank mix warnings.
	3,11	Quilt 1.66SC	14 fl oz	14	3 app	
	7	Endura 70WG	8 - 11 oz	21	2 app	
	7	Vertisan 1.67EC	14 - 20 fl oz	21	41 fl oz	
	7,11	Priaxor 4.17 SC	4 - 8 fl oz	21	2 app	
	3	Proline 480 4SC	5.7 fl oz	7	3 app	
	11	Headline 2.09F	6 - 9 fl oz	21	18 fl oz	
	11	Quadris 2.08F	6 - 15.5 fl oz	14	92 fl oz	
	M	chlorothalonil 6L <sup>4</sup>	1.375 - 2 pt	14	8 pt	
	<b>BEAN, LIMA</b>					
<b>Anthracnose</b> Reddish-brown spots on leaves, pods and stems.	1	thiophanate methyl 70WG	1 - 2 lb	7	2 app	Plant disease-free seed and rotate lima beans with other crops. Start applications of fungicide at first bloom and continue at 7- to 10-day intervals. Alternate Quadris with a different mode of action.
	11	Quadris 2.08F	6 - 15.5 fl oz	0	92 fl oz	
<b>Seedling disease</b> Rots of seeds and death of seedlings (damping off) and root rots.	<i>For Rhizoctonia and Pythium:</i>					Ridomil Gold PCGR, Blocker and Fontelis are in-furrow applications. Quadris can be used either in-furrow at planting or in a 7-inch band over the row prior to or shortly after emergence. Rotate fields, avoid double-cropping beans and turn under plant debris well in advance of planting. See UT Extension publication SP 277-O.
	4,14	Ridomil Gold PCGR	0.75 lb/1000 row ft			
	4,11	Uniform 3.72SC	0.34 fl oz/1000 row ft			
	<i>For Rhizoctonia only:</i>					
	11	Quadris 2.08F	0.4 - 0.8 fl oz/1000 row ft			
	14	Blocker 4F	2 - 3 pt			
7	Fontelis 1.67SC	1.2 - 1.6 fl oz/1000 row ft				

## Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/	Remarks
					Season	
<b>BEAN, LIMA (CONT'D)</b>						
<b>White mold (Sclerotinia)</b> White moldy growth on pods and stems.	1	thiophanate methyl 70WG	1 - 2 lb	14	4 lb	Spray at 10 - 25% bloom; repeat at full bloom. Rotate to a different mode of action. See product label for frequency of rotation required. * Apply no later than peak bloom.
	2	iprodione 4F	1.5 - 2 pt	*	2 app	
	7	Endura 70WG	8 - 11 oz	7	2 app	
	7	Fontelis 1.67SC	16 - 30 fl oz	0	72 oz	
	12	Cannonball 50WP	7 oz	7	28 oz	
	12,9	Switch 62.5 WG	11 - 14 oz	7	56 oz	
	29	Omega 4.17SC	0.5 - 0.85 pt	14	1.75 pt	
<b>BEET</b>						
<b>Rust</b> Bronze pustules.	7	Fontelis 1.67SC	16 - 30 fl oz	0	61 fl oz	Spray at first appearance and repeat at 7- to 10-day intervals; 14-day intervals for tebuconazole. Rotate to a non-related fungicide after each application of Gem, Cabrio or Quadris and after 2 consecutive apps of Fontelis or Merivon.
	11	Gem 4.17SC	1.9 - 2.9 fl oz	7	4 app	
	11	Quadris 2.08F	6 - 15.5 fl oz	0	92 fl oz	
	M	sulfur	See label	0	NL	
<b>Leaf spots</b> Various leaf spots.	3	tebuconazole 3.6F	3 - 7.2 fl oz	7	28 fl oz	
	7	Fontelis 1.67SC	16 - 30 fl oz	0	61 fl oz	
	11,7	Merivon 4.17SC	4 - 5.5 fl oz	7	3 app	
	11	Quadris 2.08F	6 - 15.5 fl oz	0	123 fl oz	
	11	Cabrio 20EG	8 - 12 oz	0	3 app	
	11	Gem 4.17SC	1.9 - 2.9 fl oz	7	56 fl oz	
<b>Pythium</b> Damping off and root rot.	4	Ridomil Gold SL	1 - 2 pt/treated acre	NA	1 app	Apply only before planting (incorporated into top 2 inches of soil) or at planting on surface. May be broadcast or banded.
	4	MetaStar 2E AG	4 - 8 pt/treated acre	NA	1 app	
	4	Ultra Flourish	2 - 4 pt/treated acre	NA	1 app	
	43	Presidio 4SC	3 - 4 fl oz	2	12 fl oz	
<b>BROCCOLI, BRUSSELS SPROUTS, CABBAGE, CAULIFLOWER</b>						
<b>Alternarial leaf spot</b> Target spots on older leaves. Small, black spots may also occur.	3	Procuré 4L	6 - 8 fl oz	1	18 fl oz	Apply on 7- to 14-day intervals until disease is under control. Refer to product labels for resistance management guidelines for Endura, Cabrio, Fontelis, Inspire Super, Quadris, Quadris Top and Switch. Mancozeb only for broccoli and cabbage. Not all mancozeb products are labeled for these crops; check label.
	4,M	Ridomil Gold Bravo SC	1.5 pt	7	4 app	
	7	Endura 70WG	6 - 9 oz	0	2 app	
	7	Fontelis 1.67SC	14 - 30 fl oz	3	72 fl oz	
	9,3	Inspire Super	16 - 20 fl oz	7	80 fl oz	
	11	Quadris 2.08F	6 - 15.5 fl oz	0	92 fl oz	
	11	Cabrio 20EG	12 - 16 oz	0	4 app	
	11,3	Quadris Top	14 fl oz	1	56 fl oz	
	12,9	Switch 62.5EG	11 - 14 oz	7	56 oz	
	M	chlorothalonil 6L <sup>4</sup>	1.5 pt	0	16 pt	
	M	mancozeb 75DF	1.6 - 2.1 lb	7	12.8 lb	
<b>Downy mildew</b> Yellow leaf spots with gray flecks.	4,M	Ridomil Gold Bravo SC	1.5 pt	7	4 app	Actigard must be used preventively and repeated at 7-day intervals. Other materials: 7- to 10-day intervals until disease is under control. Do not make more than 1 application of Quadris, Ranman or Reason or 2 consecutive apps. of Cabrio, Presidio, Revus or Zampro before alternating with a fungicide with a different mode of action. Use adjuvant with Revus and Ranman. <b>Mancozeb only for broccoli and cabbage.</b> Not all mancozeb products are labeled for these crops; check label.
	11	Cabrio 20EG	12 - 16 oz	0	4 app	
	11	Reason 4.13 SC	5.5 - 8.2 fl oz	2	24.6 fl oz	
	11	Quadris 2.08F	6 - 15.5 fl oz	0	92 fl oz	
	21	Actigard 50WG	1 oz	7	4 oz	
	21	Ranman 3.33SC	2.75 fl oz	0	6 app	
	33	Aliette 80WG	2 - 5 lb	3	7 app	
	40	Revus 2.08SC	8 fl oz	1	4 app	
	40,45	Zampro 4.33SC	14 fl oz	0	42 fl oz	
	43	Presidio 4SC	3 - 4 fl oz	2	12 fl oz	
	M	chlorothalonil 6L <sup>4</sup>	1.5 pt	0	16 pt	
	M	mancozeb 75DF	1.6 - 2.1 lb	7	6 app	
	M	Mankocide 61.1DF	1 - 3 lb	7	8.8 lb	
<b>Black leg</b> Lower stem turns brown and rots causing a canker.	2	iprodione 4F (Broccoli only)	2 pt	0	2 app	Use certified disease-free seeds or transplants. Direct spray to base of plant and adjacent soil surface.

## Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season		Remarks
<b>BROCCOLI, BRUSSELS SPROUTS, CABBAGE, CAULIFLOWER (CONT'D)</b>							
<b>Black rot</b> Yellow to brown, V-shaped spots on edge of leaves.	P1	Actigard 50WG	1 oz	7	4 oz	Use certified disease-free seeds or transplants. Use tolerant varieties of cabbage. See Extension publication SP 277-P. Wait 7-10 days after thinning or transplanting to apply Actigard. Mankocide for broccoli and cabbage only.	
	M	fixed copper	see label	0	label		
	M	Mankocide 61.1DF	1 - 3 lb	7	8.8 lb		
<b>Bacterial soft rot</b> Dark, soft rot. Favored by hot, wet conditions.						Control of black rot will also help control bacterial soft rot. Avoid mechanical damage to the crop.	
<b>Rhizoctonia damping off and wire stem</b> Young plants stunted; stem hard and constricted.	11	Quadris 2.08F	0.4 - 0.8 fl oz/1000 row ft			Quadris applied as a 7-inch band shortly after planting, covering the lower stem and soil surface. Blocker sprayed as 8-inch band on the row at the time of or immediately after seeding.	
	7	Blocker 4F	18 - 27 fl oz/1000 row ft				
<b>Pythium damping off</b> Dark rot of roots and stem	4	Ridomil Gold SL	0.25 - 0.5 pt	NA	1 app	Apply preplant incorporated into top 2 inches or at planting as a soil spray or in drip irrigation.	
	4	MetaStar 2E AG	1 - 2 pt	NA	1 app		
	4	Ultra Flourish	0.5 - 1 pt	NA	1 app		
	43	Presidio 4SC	3 - 4 fl oz	2	12 fl oz		
<b>Club root</b> Galls or clubs on roots. Plants are pale and stunted.	NC	hydrated lime	1500 lb			Broadcast and work lime into soil by disking within 3 days before planting. Ranman and Blocker applied as transplant solutions at 1.7 fl oz and ½ pt per plant, respectively.	
	21	Ranman 3.33SC	13 - 25 fl oz/100 gal				
	14	Blocker 4F	3 pt				
<b>Powdery mildew</b> White, powdery growth on leaves.	3	Procure 4L	6 - 8 fl oz	1	18 fl oz	Apply when disease first appears; continue at 7- to 14-day intervals. See product labels for resistance management guidelines.	
	7	Endura 70WG	6 - 9 oz	0	2 app		
	7	Fontelis 1.67SC	14 - 30 fl oz	3	72 fl oz		
	9,3	Inspire Super	16 - 20 fl oz	7	80 fl oz		
	11	Cabrio 20 EG	12 - 16 fl oz	0	4 app		
	11,3	Quadris Top	14 fl oz	1	56 fl oz		
	12,9	Switch 62.5WG	11 - 14 oz	7	56 oz		
<b>Rhizoctonia bottom rot</b> Rot begins at lower part of head.	7	Endura 70WG	6 - 9 oz	0	2 app	Begin applications prior to disease development.	
<b>White mold (Sclerotinia)</b> Soft, wet rot and white fungal growth on head.	7	Endura 70WG	6 - 9 oz	0	2 app	Begin applications prior to disease development.	
	7	Fontelis 1.67SC	16 - 30 fl oz	3	72 fl oz		
<b>CANTALOUPE - See MELONS</b>							

## Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season	Remarks	
<b>CARROT</b>							
<b>Alternaria blight</b> Numerous dark brown spots which may coalesce.	2	iprodione 4F	1 - 2 pt	0	4 app	Spray at first appearance and repeat at 7- to 10-day intervals. Alternaria blight can spread rapidly. Refer to Fontelis, Quadris, Quadris Opti, Cabrio, Endura, Merivon, Pristine, trifloxystrobin and Switch labels for resistance management guidelines.	
	7	Endura 70WG	8 - 11 oz	0	5 app		
	7	Fontelis 1.67SC	16 - 30 fl oz	0	61 fl oz		
	11	Cabrio 20EG	8 - 12 fl oz	0	3 app		
	11	Quadris 2.08F	9 - 15.5 fl oz	0	123 fl oz		
	11	trifloxystrobin					
		Flint 50WG	2 - 3 oz	7	4 app		
		Gem 4.17SC	1.9 - 2.9 fl oz	7	4 app		
	11,3	Quadris Top 2.72SC	12 - 14 fl oz	7	56 fl oz		
	11,7	Merivon 4.17SC	4 - 5.5 oz	7	3 app		
	11,7	Pristine 38WG	8 - 10.5 oz	0	6 app		
	11,M	Quadris Opti 5.5SC	2.4 pt	0	6 app		
	12,9	Switch 62.5WG	11 - 14 oz	7	56 oz		
	29	Omega 4.17SC	1 pt	7	4 app		
	M	chlorothalonil 6L <sup>4</sup>	1.5 - 2 pt	0	20 pt		
<b>Cercospora leaf spot</b> Small, dark brown to black spots on leaves.	7	Fontelis 1.67SC	16 - 30 fl oz	0	61 fl oz		
	11	Cabrio 20EG	8 - 12 oz	0	3 app		
	11	Quadris 2.08F	9 - 15.5 fl oz	0	123 fl oz		
	11	trifloxystrobin					
		Flint 50WG	2 - 3 oz	7	4 app		
		Gem 4.17SC	1.9 - 2.9 fl oz	7	4 app		
	11,3	Quadris Top 2.72SC	12 - 14 fl oz	7	4 app		
	11,3	Quilt 1.66SC	14 fl oz	14	55 fl oz		
	11,7	Merivon 4.17SC	5.5 fl oz	7	3 app		
	11,7	Pristine 38WG	8 - 10.5 oz	0	6 app		
	11,M	Quadris Opti 5.5 SC	2.4 pt	0	6 app		
	M	chlorothalonil 6L <sup>4</sup>	1.5 - 2 pt	0	20 pt		
<b>Southern blight</b> White fungal growth on lower stem.		SMDC	See Table 3	NA	1 app	SMDC and Telone C35 are pre-plant soil fumigants. Fontelis, Omega and Quadris Top are foliar sprays, applied at 7- to 14-day intervals. See labels for resistance management programs.	
		Telone C35	See Table 3	NA	1 app		
	7	Fontelis 1.67SC	16 - 30 fl oz	0	61 fl oz		
	11,3	Quadris Top 2.72SC	12 - 14 fl oz	7	4 app		
	29	Omega 4.17SC	1 pt	7	4 app		
<b>CAULIFLOWER (SEE BROCCOLI)</b>							
<b>COLLARD, MUSTARD, KALE</b>							
<b>Alternaria leaf spot</b> Dark brown leaf spots.	3	tebuconazole 3.6F	3 - 4 fl oz	7	16 fl oz	Begin applications prior to disease onset and follow 7- to 10-day schedule during rainy weather. Maintain thin plant stand and avoid low-lying or poorly drained soils. See labels for resistance management guidelines for all products other than copper. <b>Endura and Switch not for Cercospora.</b>	
	7	Endura 70WG	6 - 9 oz	14	2 app		
	7	Fontelis 1.67SC	14 - 30 fl oz	3	72 fl oz		
	9,3	Inspire Super 2.82SC	16 - 20 fl oz	7	80 fl oz		
<b>Cercospora leaf spot</b> Tan leaf spots with yellow haloes.	11	Quadris 2.08F	6 - 15.5 fl oz	0	46 fl oz		
	11,3	Quadris Top	12 - 14 fl oz	1	56 fl oz		
	12,9	Switch 62.5WG	11 - 14 oz	7	56 oz		
	M	fixed copper	see label	0	NL		
<b>Downy mildew</b> Yellow leaf spots with white to gray mold on underside.	4	Ridomil Gold SL	0.125 - 0.25 pt	7	4 app		Actigard must be used preventively and repeated at 7-day intervals. Other materials: 7- to 10-day (14, for Ridomil) intervals until disease is under control. Do not make more than 1 app. of Reason or Ranman or 2 apps. of dimethomorph, Revus or Zampro before alternating with a fungicide with a different mode of action. Forum, Presidio and Ridomil must be tank mixed with a fungicide with a different mode of action. Use adjuvant with Revus. Do not tank mix Aliette with copper fungicides.
	11	Reason 4.13 SC	5.5 - 8.2 fl oz	2	24.6 fl oz		
	21	Ranman 3.33SC	2.75 fl oz	0	6 app		
	33	Aliette 80WDG	3 - 5 lb	3	7 app		
	40	Forum 4.18F	6 fl oz	0	5 app		
	40	Revus 2.08SC	8 fl oz	1	4 app		
	40,45	Zampro 4.33SC	14 fl oz	0	42 fl oz		
	43	Presidio 4SC	3 - 4 fl oz	2	12 fl oz		
	M	fixed copper	see label	1	NL		
P1	Actigard 50WG	1 oz	7	4 oz			



## Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season		Remarks
<b>COLLARD, MUSTARD, KALE (CONT'D)</b>							
<b>Powdery mildew</b> White, powdery growth on leaves.	3	Procure 4SC	6 - 8 fl oz	1	18 fl oz	Apply when disease first appears; continue at 7- to 14-day intervals if needed. Sulfur not for Alternaria. See labels for resistance management guidelines for all products other than sulfur.	
	3	tebuconazole 3.6F	3 - 4 fl oz	7	16 fl oz		
	7	Endura 70WG	6 - 9 oz	0	2 app		
	7	Fontelis 1.67SC	14 - 30 fl oz	3	72 fl oz		
<b>Alternaria leaf spot</b> Dark brown leaf spot	9,3	Inspire Super 2.82SC	16 - 20 fl oz	7	80 fl oz		
	11,3	Quadris Top	14 fl oz	1	56 fl oz		
	12,9	Switch 62.5WG	11 - 14 oz	7	56 oz		
	M	sulfur	see label	0	NL		
<b>Rhizoctonia bottom rot</b> Firm rot of stem.	7	Endura 70WG	6 - 9 oz	0	2 app	Begin applications prior to disease development. Fontelis not for Rhizoctonia.	
	7	Fontelis 1.67SC	16 - 30 fl oz	3	72 fl oz		
<b>Sclerotinia stem rot</b> Soft rot of stem with white mold.							
<b>CORN, SWEET</b>							
<b>Blights</b> Spots on leaves and drying or blighting of leaves.	3	propiconazole 3.6EC	2 - 4 fl oz	14	16 fl oz	Begin applications when conditions favor disease development and repeat at 7- to 10-day intervals. Quilt and propiconazole applied on 7- to 14-day schedule. Waiting time for use as livestock forage: 0 days for Vertisan, 7 days for Priaxor, 14 days for propiconazole and Stratego. Sweet corn treated with other listed products cannot be used as forage. See Quilt, Priaxor, Quadris, Stratego, Vertisan or Headline label for resistance management guidelines. See Priaxor for tank mix warnings. *Chlorothalonil for fresh market only.	
	7	Vertisan 1.67EC	10 - 24 fl oz	7	48 fl oz		
	11	Headline 2.09F	0.75 - 2 pt	14	12 pt		
<b>Rusts</b> Bronze, elongate spots.	11	Quadris 2.08F	6 - 12 fl oz	7	6 app		
	11,3	Quilt 1.66SC	6.2 - 9 fl oz	7	123 fl oz		
	11,3	Stratego 2.08SC	10.5 - 14 fl oz	14	56 fl oz		
	11,7	Priaxor 4.17SC	4 - 8 fl oz	7	2 app		
	M	chlorothalonil 6L <sup>4*</sup>	10 fl oz	14	30 fl oz		
M	mancozeb 80WP <sup>4</sup>	1.5 lb	7	22.5 lb			
<b>Maize dwarf mosaic</b> Plants stunted, leaves reddened or yellowed.						Plant early and avoid fields heavily infested with johnsongrass. Plant tolerant varieties if johnsongrass is present.	
<b>Stewart's wilt</b> Brown, wavy streaks in leaves.						Control corn flea beetle, which vectors the causal bacterium.	
<b>CUCUMBER, FIELD (For assistance with fungicide selection, see Appendix 3 for a suggested spray program and relative effectiveness of fungicides)</b>							
<b>Angular leaf spot</b> Brown, angular spots that usually fall out.	P1	Actigard 50WG	0.5 - 1 oz	0	8 oz	Spray at first appearance and repeat at 7- to 14-day intervals. Copper can injure young plants. Avoid applying Actigard to stressed plants. Plant resistant varieties.	
	M	fixed copper	see label	0	label		
<b>Bacterial wilt</b> Individual runners wilt; later, entire plant wilts and dies.						Apply insecticide to control cucumber beetles, which spread the disease. See insect control section of this publication.	
<b>Belly rot</b> Soft, sunken rot on side of fruit in contact with soil.	M	chlorothalonil 6L <sup>4</sup>	2 pt	0	21 pt	Applied to foliage every 7 - 10 days, beginning at vine tip-over.	
	1	+ thiophanate methyl 70WG	0.5 lb	0			
	11	Quadris 2.08F	11 - 15.5 fl oz	1	92 fl oz	Apply at the 1- to 3-leaf stage and again just prior to vine tip-over or 10 - 14 days later, whichever comes first.	

Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season		Remarks
<b>CUCUMBER, FIELD (CONT'D) (For assistance with fungicide selection, see Appendix 3 for a suggested spray program and relative effectiveness of fungicides)</b>							
<b>Alternaria leaf spot</b> Tan target spots on leaves, followed by blighting.	7	Fontelis 1.67SC	12 - 16 fl oz	1	67 fl oz		Begin applications prior to disease onset. Repeat every 7 - 10 days. Do not make consecutive applications of Cabrio, Pristine, Merivon, Quadris, Quadris Top or Quadris Opti; these products should be alternated with non-Group 11 fungicides. Rotate to a different mode of action after 2 applications of Switch, Fontelis or Inspire Super. See Cabrio, Quadris and Quadris Opti labels for restrictions on tank mix partners. <b>Switch and Fontelis not for anthracnose or downy mildew. Inspire Super and Merivon not for downy mildew.</b>
	9,3	Inspire Super 2.82SC	16 - 20 fl oz	7	80 fl oz		
	11	Cabrio 20EG	12 - 16 oz	0	4 app		
	11	Quadris 2.08F	11 - 15.5 fl oz	1	92 fl oz		
<b>Anthracnose</b> Sunken spots on fruit and tan leaf spots that tear.	11,3	Quadris Top	10 - 14 fl oz	1	56 fl oz		Rotate to a different mode of action after 2 applications of Switch, Fontelis or Inspire Super. See Cabrio, Quadris and Quadris Opti labels for restrictions on tank mix partners. <b>Switch and Fontelis not for anthracnose or downy mildew. Inspire Super and Merivon not for downy mildew.</b>
	11,7	Merivon 4.17SC	5.5 fl oz	0	3 app		
	11,7	Pristine 38WG	12.5 - 18.5 oz	0	4 app		
	11,M	Quadris Opti 5.5SC	3.2 pt	1	4 app		
<b>Downy mildew</b> Large, yellow spots that turn necrotic.	M	chlorothalonil 6L <sup>4</sup>	1.5 - 3 pt	0	21 pt		<b>Switch and Fontelis not for anthracnose or downy mildew. Inspire Super and Merivon not for downy mildew.</b>
	M	mancozeb 80WP <sup>4</sup>	2 - 3 lb	5	25.6 lb		
	M,4	Ridomil Gold Bravo SC	2.5 - 3.25 pt	0	4 app		
	M,4	Ridomil Gold MZ	2.5 lb	5	4 app		
<b>Gummy stem blight</b> Brown leaf spots. Cracks on stems with gummy ooze.	11	<i>For gummy stem blight only:</i> Sovran 50WG	4.8 oz	0	4 app		
	3	Topguard 1.04SC	10 - 14 fl oz	0	4 app		
<b>Downy mildew</b> (Additional products)	11	Reason 4.13F	5.5 fl oz	14	4 app	Begin applications prior to infection, 7- to 10-day spray schedule. Shorten spray intervals when downy mildew is active. Most of these products require alternation with downy mildew fungicides with a different mode of action or tank mix with a protectant fungicide such as chlorothalonil or mancozeb. See label. Presidio, applied through drip irrigation for soilborne disease control, will provide some control of downy mildew.	
	11	Tanos 50WG	8 oz	3	4 app		
	21	Ranman 3.33SC	2.1 - 2.75 fl oz	0	6 app		
	22,M	Gavel 75DF	1.5 - 2 lb	5	8 app		
	27	Curzate 60DF	3.2 - 5 oz	3	30 oz		
	28	Previcur Flex 6F	1.2 pt	2	6 pt		
	40	Revus 2.08SC	8 fl oz	0	4 app		
	40	Forum 4.18F	6 fl oz	0	5 app		
	43	Presidio 4SC	3 - 4 fl oz	2	12 fl oz		
	45,40	Zampro 4.33SC	14 fl oz	0	42 fl oz		
	<b>Phytophthora blight</b> Rot of fruit covered with thin, white mold.	21	Ranman 3.33SC	2.75 fl oz	0		6 app
33		phosphorous acid:	6 fl oz	0	5 app		
		Agri-Fos	8 fl oz	0	4 app		
		Fosphite	3 - 4 fl oz	2	12 fl oz		
		ProPhyt					
		Phostrol	1.25 qt/A	0	6 app		
40		Forum 4.18F	1 - 3 qt	0	NL		
40		Revus 2.08SC	1 - 3 qt	0	NL		
43	Presidio 4SC	2.5 - 5 pt	0	7 app			
45,40	Zampro 4.33SC	14 fl oz	0	42 fl oz			
<b>Powdery mildew</b> White, powdery mold on surface of leaves.	3	tebuconazole 3.6F	4 - 6 fl oz	7	24 fl oz	For varieties susceptible to powdery mildew: Apply chlorothalonil on a preventive, 7- to 10-day schedule. Add one of the other listed products when powdery mildew appears. Do not apply sulfur if temperatures exceed 90 F. Thorough coverage is critical for chlorothalonil and sulfur. All other fungicides must be rotated to a different mode of action after the second consecutive application. Allow at least 14 days between Torino applications. <b>Resistance to the strobilurins (Cabrio, Quadris, Sovran and Flint) is widespread in cucurbit powdery mildew in Tennessee.</b>	
	3	Rally 40W	2.5 - 5 oz	0	24 oz		
	3	Procure 50WP	4 - 8 oz	0	40 oz		
	3	Topguard 1.04SC	10 - 14 fl oz	0	3 app		
	7	Fontelis 1.67SC	12 - 16 fl oz	1	67 fl oz		
	9,3	Inspire Super 2.82SC	16 - 12 fl oz	7	80 fl oz		
	11,3	Quadris Top	10 - 14 fl oz	1	56 fl oz		
	11,7	Merivon 4.17SC	5.5 fl oz	0	3 app		
	11,7	Pristine 38WG	12.5 - 18.5 oz	0	4 app		
	12,9	Switch 52.5WG	11 - 14 oz	1	56 oz		
	M	chlorothalonil 6L <sup>4</sup>	2 - 3 pt	0	21 pt		
	M	sulfur	see label	0	NL		
	M,11	Quadris Opti 5.5SC	3.2 pt	1	4 app		
	U	Torino 0.85SC	3.4 oz	3	6.8 oz		

**Foliar, soil and post-harvest applications of disease-control products**

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season		Remarks
<b>CUCUMBER, FIELD (CONT'D) (For assistance with fungicide selection, see Appendix 3 for a suggested spray program and relative effectiveness of fungicides)</b>							
<b>Scab</b> Sunken spots on fruit.	M	chlorothalonil 6L <sup>4</sup>	2 - 3 pt	0	21 pt	Resistant varieties widely available.	
	M	mancozeb 80WP <sup>4</sup>	2 - 3 lb	5	25.6 lb		
	M,4	Ridomil Gold/Bravo	2 - 3 lb	0	4 app		
<b>Seedling disease</b> Failure of seedlings to emerge or death after emergence.	11	<i>Rhizoctonia:</i> Quadris 2.08F	0.4 - 0.8 fl oz/1000 row ft			Quadris: Can be used either in-furrow at planting or in a 7-inch band over the row prior to or shortly after emergence.	
	4	<i>Pythium:</i> Ridomil Gold 4SL	1 - 2 pt/treated acre	--	1 app	Ridomil Gold: Apply preplant incorporated, as surface band or through drip irrigation. Previcur Flex: Applied via transplant water, drip irrigation, sprinklers or directed to lower portion of plants and soil.	
	28	Previcur Flex 6F	1.2 pt	2	6 pt		
<b>CUCUMBER, GREENHOUSE</b>							
<b>Angular leaf spot, downy mildew, powdery mildew</b>	M	fixed copper	See label	0	NL	Apply weekly, beginning when plants begin to vine.	
<b>Anthracnose, Cercospora leaf spot, downy mildew, scab, target spot</b>	M,33	Catamaran	4 pt/43,560 sq ft	1	50 pt	Spray at first appearance of disease, repeat at weekly intervals. Observe label precautions for Catamaran.	
	M	mancozeb 80WP <sup>4</sup>	1.5 - 2 lb/100 gal	5	25.6 lb		
<b>Gummy stem blight, Alternaria leaf blight</b>	12,9	Switch 62.5WG	11 - 14 oz/43,560 ft <sup>2</sup>	1	56 oz	Spray at first appearance of disease, repeat at weekly intervals. Observe label precautions for Catamaran. Rotate to a different mode of action after the second application of Switch.	
	M	mancozeb 80WP <sup>4</sup>	1.5 - 2 lb/100 gal	5	25.6 lb		
	M,33	Catamaran	6 pt/43,560 ft <sup>2</sup>	1	50 pt		
<b>Gummy stem blight, anthracnose, target spot</b>	1	3336 70WP (transplant production only)	0.7 lb/43,560 ft <sup>2</sup>	NA	4.2 lb	Apply at 7- to 14-day intervals, alternating with non-related fungicides.	
<b>Powdery mildew</b>	3	Procuire 4L (transplant production only)	4 - 8 fl oz/43,560 ft <sup>2</sup>	NA	40 fl oz	Spray at first sign of disease and repeat at 14-day intervals, if needed. Do not apply Microthiol Disperss if temps will exceed 90 F within the 3 days following spraying. Rotate to a different mode of action after the second application of Switch and after each application of Ph-D. 3336 70WP can be used in transplant production, but resistance in this fungus is common.	
	3	Rally 40WP	2.5 - 5 oz/43,560 ft <sup>2</sup>	0	24 oz		
	7	Fontelis 1.67SC	0.75 - 1 TBSP/gal/1360 sq ft	1	2.1 fl oz/1360 sq ft		
	12,9	Switch 62.5WG	11 -14 oz/43,560 ft <sup>2</sup>	1	56 oz		
	19	Ph-D 11.3WG	6.2 oz/43,560 ft <sup>2</sup>	0	5 app		
	M	Microthiol Disperss	2 lb/43,560 ft <sup>2</sup>	0	NL		
<b>Pythium root rot</b>	28	Previcur Flex	see label		6 app	Applied as a root drench. See label for use directions.	
<b>Sclerotinia white mold</b>	7	Fontelis 1.67SC	1 TBSP/gal/1360 ft <sup>2</sup>	1	2.1 fl oz/1360 sq ft	Botran may be re-applied after 14 days. Contans is a biological. Apply to soil about 3 months prior to planting. Till 2 in. to 8 in. deep. After 2 consecutive apps of Fontelis, rotate with Botran.	
	14	Botran 75WP	1.33 lb/100 gal	1	1.33 lb		
	NC	Contans WG	0.75 - 1.5 oz/1000 ft <sup>2</sup>	NA	NL		
<b>EGGPLANT</b>							
<b>Leaf blights, fruit rots</b> Various spots on leaves and fruits.	7	Fontelis 1.67SC	10 - 24 fl oz	0	72 fl oz	Begin spraying when disease is expected and repeat at 7- to 10-day intervals. See Quadris, Flint, Cabrio, Fontelis and Priaxor labels for resistance management guidelines. See Priaxor label for tank mix warnings.	
	7,11	Priaxor 4.17SC	4 - 8 fl oz	7	3 app		
	11	Cabrio 20EG	8 - 12 oz	0	96 oz		
	11	Flint 50WG	3 - 4 fl oz	3	5 app		
	11	Quadris 2.08F	6 - 15.5 fl oz	0	61 fl oz		
	M	fixed copper	See label	0	NL		
	M	Bravo Weather Stik 6SC	1.5 pt	3	12 pt		

## Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/		Remarks
					Season		
<b>EGGPLANT (CONT'D)</b>							
<b>Phytophthora blight - crown and root phase</b> Rapid wilt and death of plants in wet areas of field.	4	Ridomil Gold EC	1 pt/treated acre	7	3 app		Plant on raised beds, improve field drainage, and do not plant wet areas. Crown and root phase is caused by root infections. Ridomil Gold and Ultra Flourish are soil-applied at planting and up to 2 supplemental applications at 30-day intervals. Apply Ranman in transplant water or direct to base of plant at time of transplanting. Apply Presidio as a soil spray or in drip irrigation. Apply Zampro at planting in drip or as spray directed to plant base and root zone.
	4	Ultra Flourish	2 pt/treated acre	7	3 app		
	21	Ranman 3.33SC	2.75 fl oz	0	6 app		
	33	phosphorous acid: Fosphite . . . . .	Pre-plant root dip: 2 qt/100 gal Drip irrig.: 2-3 qt in at least 100 gal	0	NL		
	43	Presidio 4SC . . . . .	3 - 4 fl oz	2	12 fl oz		
	45,40	Zampro 4.33SC . . . . .	14 fl oz	4	42 fl oz		
<b>Phytophthora blight - fruit phase</b> Liver-colored rot of fruit.	40	Forum 4.18F	6 fl oz	0	5 app		Forum, Presidio, Ranman and Zampro are foliar-applied every 7 - 10 days as a tank mix with and alternated with products with a different mode of action. Agri-Fos is foliar-applied every 21 days; Fosphite, every 2 - 4 weeks (see label). Although not labeled for Phytophthora blight, <b>copper</b> sprays have been shown to be helpful in suppressing this disease.
	33	phosphorous acid: Agri-Fos Fosphite	1.25 qt 1-3 qt	0 0	6 app NL		
	43	Presidio 4SC	3 - 4 fl oz	2	12 fl oz		
	21	Ranman 3.33SC	2.75 fl oz	0	6 app		
	45,40	Zampro 4.33SC	14 fl oz	4	42 fl oz		
<b>Southern blight</b> Plants wilt and die. White mold often seen on base of stem.	7	<u>At planting</u> Fontelis 1.67SC	1 - 1.6 fl oz/1000 row ft				Fontelis applied at planting as a drench or in drip irrigation. Max rate per acre is 24 fl oz. Post-plant applications require complete coverage of the lower stem. Fontelis is applied 5 - 10 days after planting, with a 2 <sup>nd</sup> application 14 days later.
	11	<u>Post-planting</u> Cabrio 20EG	12 - 16 oz	0	96 oz		
	7	Fontelis 1.67SC	16 - 24 fl oz	0	72 fl oz		
<b>GINSENG</b>							
<b>Phytophthora root rot and leaf blight</b> Wilt, soft rot of root, wet blight of leaves.	4	Ridomil Gold EC	0.75 pt	NA	1 app		Begin Aliette in spring, continue at 7-day intervals. Mix in at least 100 gal water/A. Apply Ridomil Gold EC or MetaStar in 100 - 400 gal water to soil surface in spring before plants begin growing.
	4	Ridomil Gold GR	15 lb	9	60 lb		
	4	MetaStar 2E AG	1.5 qt	NA	1 app		
	33	Aliette/Linebacker 80WG	5 lb	31	9 app		
<b>Alternaria leaf spot</b> Tan leaf spots.	2	iprodione 4F	1.5 - 2 pt	36	5 app		Spray first appearance and repeat at 7- to 10-day intervals. All of these products other than Bravo and mancozeb must be involved in resistance management programs. See labels for details.
	7	Fontelis 1.67SC	16 - 30 fl oz	0	61 fl oz		
	11	Gem 4.17SC	1.9 - 2.9 fl oz	7	4 app		
	11	Quadris 2.08F	6 - 15.5 fl oz	0	123 fl oz		
	11	Cabrio 20EG	8 - 12 oz	0	3 app		
	12,9	Switch 62.5WG	11 - 14 oz	7	56 oz		
	29	Omega 4.17SC	1 - 1.5 pt	30	6 pt		
	M	mancozeb 80WP <sup>4</sup>	2 lb	30	12 app		
M	Bravo Weather Stik 6SC	1.5 pt	3	12 pt			
<b>Seedling disease</b> Failure of seedlings to emerge or death after emergence.	11	Quadris 2.08F	0.4 - 0.8 fl oz/1000 row ft				Can be used either in-furrow at planting or in a 7-inch band over the row prior to or shortly after emergence. Use the higher rates if disease pressure is high.
	43	Presidio 4SC	3 - 4 fl oz	2	12 fl oz		
<b>KALE (SEE COLLARD)</b>							

## Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season	Remarks
<b>LETTUCE, FIELD</b>						
<b>Bottom rot (Rhizoctonia)</b> Wet, brown rot begins on lower leaves and progresses into head.	2	iprodione 4F	1.5 - 2 pt	14	3 app	Apply at 3-leaf stage to just after thinning and repeat at 10-day intervals, if needed. Direct nozzles to cover lower part of plants and surrounding soil surface. Do not disturb soil after spraying.
	11	Quadris 2.08F	0.4 - 0.8 fl oz/1000 row ft			Can be used either in-furrow at planting or in a 7-inch band over the row prior to or shortly after emergence. Use the higher rates where disease pressure is high.
<b>Botrytis rot</b> Gray, fuzzy mold.	2	iprodione 4F	1.5 - 2 pt	14	3 app	Apply when conditions are favorable for infection. Botran rate depends on timing; see label. Rotate Fontelis, Merivon and Cannonball to a different mode of action after 2 consecutive apps. Merivon can cause injury; test on a small portion of the crop before broadscale use.
	7	Endura 70WG	8 - 11 oz	14	2 app	
	7	Fontelis 1.67SC	14 - 24 fl oz	3	72 fl oz	
	12	Cannonball 50WP	7 oz	0	28 oz	
	14	Botran 75WP	2 - 5.3 lb	14	5.3 lb	
<b>Drop (Sclerotinia)</b> Wet rot of head with white, cottony mold.	11,7	Merivon 4.17SC	8 - 11 fl oz	1	3 app	Direct spray to lower part of plants and soil. Botran: Rate depends on timing. Apply prior to emergence in a 4- to 6-in. band, and just after thinning. Endura: Apply just after emergence or transplanting and repeat if needed. Iprodione: Apply at 3-leaf stage to just after thinning and repeat at 10-day intervals, if needed. Rotate Fontelis, Merivon and Cannonball to a different mode of action after 2 consecutive apps. See warning for Merivon use.
	2	iprodione 4F	1.5 - 2 pt	14	3 app	
	7	Endura 70WG	8 - 11 oz	14	2 app	
	7	Fontelis 1.67SC	16 - 24 fl oz	3	72 fl oz	
	12	Cannonball 50WP	7 oz	0	28 oz	
<b>Downy mildew</b> Yellow spots, turning necrotic.	P1	Actigard 50WG	0.75 - 1 oz	7	4 oz	Begin applications after thinning. Do not apply to stressed crop.
	11	Reason 4.13 F	5.5 - 8.2 fl oz	2	4 app	Alternate with fungicide with a different mode of action.
	11	Quadris 2.08F	12 - 15.5 fl oz	0	92 fl oz	Alternate with a fungicide with a different mode of action. See label for tank mix precautions.
	11	Tanos 50WG	8 - 10 oz	1	48 oz	Tank mix and alternate with fungicide with a different mode of action.
	27	Curzate 60DF	3.2 - 5 oz	3	30 oz	Must tank mix with a protectant fungicide such as mancozeb.
	28	Previcur Flex 6F	2 pt	2	8 pt	Tank mix and alternate with fungicide with a different mode of action.
	40	Forum 4.18F	6 fl oz	0	5 app	Tank mix and alternate with fungicide with a different mode of action. Max. of 2 consecutive applications.
	40	Revus 2.08SC	8 fl oz	1	4 app	Max. of 2 consecutive applications before rotating to a fungicide with a different mode of action. Use with an adjuvant.
	43	Presidio 4SC	3 - 4 fl oz	2	12 fl oz	Tank mix and alternate with fungicide with a different mode of action.
	45,40	Zampro 4.33SC	14 fl oz	0	42 fl oz	Max. of 2 consecutive applications before rotating to a fungicide with a different mode of action.
	M	mancozeb 80WP <sup>4</sup>	2 lb	10	12.8 lb	

## Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season	Remarks
<b>LETTUCE, FIELD (CONT'D)</b>						
<b>Pythium root rot and seedling disease</b>	4	Ridomil Gold 4EC	1 - 2 pt/treated acre	NA	1 app	Apply Ridomil, Ultra Flourish and MetaStar preplant incorporated or surface application at planting. Apply Previcur Flex via transplant water, drip irrigation, sprinklers or by directing nozzles to the lower portion of the plant and soil.
	4	Ultra Flourish 2EC	2 - 4 pt/treated acre	NA	1 app	
	4	MetaStar 2E AG	4 - 8 pt/treated acre	NA	1 app	
	28	Previcur Flex 6F	2 pt	2	8 pt	
<b>LETTUCE, GREENHOUSE</b>						
<b>Leaf spots, downy mildew</b>	M	mancozeb 80WP <sup>4</sup>	1.6 - 2 lb/43,560 ft <sup>2</sup>	10	12.8 lb	Begin applications at first appearance of disease.
	M	fixed copper	See label	0	NL	
<b>Botrytis</b>	12	Cannonball 50WP	7 oz/43,560 sq ft	0	28 oz	Spray 7 days after transplanting and when half mature. Do not make more than 2 consecutive applications of Decree or Cannonball before rotating to a different mode action.
	14	Botran 75WP (leaf lettuce only)	2.6 lb/43,560 sq ft	14	2 app	
	17	Decree 50WDG	1.5 lb/43,560 sq ft	3	3 lb	
<b>Powdery mildew</b>	M	sulfur	5 lb/43,560 sq. ft.	0	NL	Do not apply if temperature will exceed 90 F within the next 3 days.
<b>Sclerotinia drop</b>	NC	Contans WG	0.75 - 1.5 oz/1000 sq ft	NA	NL	Contans is a biological. Apply to soil about 3 months prior to planting. Till 2 in. to 8 in. deep. Cannonball is a foliar spray; must be rotated to a different mode action after 2 applications. <b>Botran</b> as used for control of Botrytis should provide some control of Sclerotinia.
	12	Cannonball 50WP	7 oz/43,560 sq ft	0	2 app	
<b>Pythium root rot</b>	28	Previcur Flex 6F (leaf lettuce only)	see label	2	6 app	See label for information on timing of applications.
<b>MUSTARD (SEE COLLARD)</b>						
<b>MELONS - Cantaloupe, watermelon, and other melons (For assistance with fungicide selection, see Appendix 3 for a suggested spray program and relative effectiveness of fungicides)</b>						
<b>Alternaria leaf spot</b> Brown, target spots on leaves.	7	Fontelis 1.67SC	12 - 16 fl oz	1	67 fl oz	Begin applications prior to disease onset. Repeat every 7 - 10 days. Do not make consecutive applications of Cabrio, Pristine or Quadris; these products should be alternated with non-Group 11 fungicides. See Cabrio and Quadris labels for restrictions on tank mix partners. Switch, Fontelis and Luna Experience must be rotated to a different mode of action after the second application. <b>Note:</b> Spraying mature watermelons with chlorothalonil products, including Quadris Opti, may result in sunburn of the upper surface of the fruit. See label for restrictions on the use of the product. Luna Experience: 10- to 14-day spray interval; use high rate for gummy stem blight and anthracnose. <b>Switch and Fontelis not for anthracnose, downy mildew or Cercospora. Inspire Super and Merivon not for downy mildew. Luna Experience not for downy mildew or Cercospora.</b>
	9,3	Inspire Super 2.82SC	16 - 20 fl oz	7	80 fl oz	
	11	Cabrio 20EG	12 - 16 oz	0	4 app	
	11	Quadris 2.08F	11 - 15.5 fl oz	1	92 fl oz	
<b>Anthracnose</b> Brown leaf spots and sunken spots on fruit.	11,3	Quadris Top	10 - 14 fl oz	1	56 fl oz	
	11,7	Merivon 4.17SC	5.5 fl oz	0	3 app	
	11,7	Pristine 38WG	12.5 - 18.5 oz	0	4 app	
<b>Downy mildew</b> Large yellow spots that turn necrotic.	11,M	Quadris Opti 5.5SC	3.2 pt	1	4 app	
	12,9	Switch 62.5 WG	11 - 14 oz	7	56 oz	
	M	mancozeb 80WP <sup>4</sup>	2 - 3 lb	5	25.6 lb	
	M	chlorothalonil 6L <sup>4</sup>	1.5 - 3 pt	0	21 pt	
<b>Gummy stem blight</b> Large brown leaf spots. Gum may ooze from stem cankers.	M,4	Ridomil Gold Bravo SC	2.5 - 3.25 pt	0	4 app	
	M,4	Ridomil Gold MZ	2.5 lb	5	4 app	
	11	<i>For gummy stem blight only:</i> Sovran 50WG	4.8 oz	0	4 app	
<b>Cercospora leaf spot</b> Tiny, dark brown spots.	3	Proline 480 4SC	5.7 fl oz	7	17.1 fl oz	
	3	tebuconazole 3.6F	8 fl oz	7	24 fl oz	
		<i>For watermelon only:</i>				
	7,3	Luna Experience 3.34SC	6 - 17 fl oz	7	34 fl oz	

Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season		Remarks
<b>MELONS (CONT'D) (For assistance with fungicide selection, see Appendix 3 for a suggested spray program and relative effectiveness of fungicides)</b>							
<b>Downy mildew</b> (Additional products)	11	Reason 4.13F	5.5 fl oz	14	4 app		Begin applications prior to infection, 7- to 10-day spray schedule. Shorten spray intervals when downy mildew is active. Most of these products require alternation with downy mildew fungicides with a different mode of action or tank mix with a protectant fungicide such as chlorothalonil or mancozeb. See label. Presidio, applied through drip irrigation for soilborne disease control, will provide some control of downy mildew.
	11	Tanos 50WG	8 oz	3	4 app		
	21	Ranman 3.33SC	2.1 - 2.75 fl oz	0	6 app		
	22,M	Gavel 75DF	1.5 - 2 lb	5	8 app		
	27	Curzate 60DF	3.2 - 5 oz	3	30 oz		
	28	Previcur Flex 6F	1.2 pt	2	6 pt		
	40	Forum 4.18F	6 fl oz	0	5 app		
	40	Revus 2.08SC	8 fl oz	0	4 app		
	43	Presidio 4SC	3 - 4 fl oz	2	12 fl oz		
	45,40	Zampro 4.33SC	14 fl oz	0	42 fl oz		
<b>Phytophthora blight</b> Rot of fruit covered with thin, white mold.	21	Ranman 3.33SC	2.75 fl oz	0	6 app		Forum, Presidio, Ranman, Revus and Zampro must be involved in resistance management programs. See labels. Phosphorus acid products: Apply preventively on 7- to 14-day schedule, beginning after plants become established. See product labels. Exception for Fosphite: Apply at 2- to 4-week intervals (see label). Although not labeled for Phytophthora blight, <b>copper fungicides</b> have been shown to be helpful in suppressing this disease.
	33	phosphorous acid:					
		Agri-Fos	1.25 qt/A	0	6 app		
		Fosphite	1 - 3 qt	0	NL		
		ProPhyt	1 - 3 qt	0	NL		
		Phostrol	2.5 - 5 pt	0	7 app		
	40	Forum 4.18F	6 fl oz	0	5 app		
	40	Revus 2.08SC	8 fl oz	0	4 app		
	43	Presidio 4SC	3 - 4 fl oz	2	12 fl oz		
	45,40	Zampro 4.33SC	14 fl oz	0	42 fl oz		
<b>Seedling disease</b> Failure of seedlings to emerge or death after emergence.	<i>Rhizoctonia:</i>						Quadris: Can be used either in-furrow at planting or in a 7-inch band over the row prior to or shortly after emergence. Ridomil Gold: Apply preplant incorporated, as surface band or through drip irrigation. Previcur Flex: Applied via transplant water, drip irrigation, sprinklers or directed to base of plants and soil.
	11	Quadris 2.08F	0.4 - 0.8 fl oz/1000 row ft				
	<i>Pythium:</i>						
	4	Ridomil Gold 4SL	1 - 2 pt/treated acre	--	1 app		
	28	Previcur Flex 6F	1.2 pt	2	6 pt		
<b>Powdery mildew</b> White, powdery mold on surface of leaves.	3	tebuconazole 3.6F	4 - 6 fl oz	7	24 fl oz		For varieties susceptible to powdery mildew: Apply chlorothalonil on a preventive, 7- to 10-day schedule. Add one of the other listed products when powdery mildew appears. Do not apply sulfur if temperatures exceed 90 F. Pristine and Quintec must be rotated with fungicides with different modes of action. All other fungicides must be rotated to a different mode of action after the second consecutive application. <b>Resistance to the strobilurins (Cabrio, Quadris, Sovran and Flint) is widespread in cucurbit powdery mildew in Tennessee.</b>
	3	Rally 40W	2.5 - 5 oz	0	24 oz		
	3	Procur 50WP	4 - 8 oz	0	40 oz		
	7	Fontelis 1.67SC	12 - 16 fl oz	1	67 fl oz		
	9,3	Inspire Super 2.82SC	16 - 20 fl oz	7	80 fl oz		
	11,3	Quadris Top	10 - 14 fl oz	1	56 fl oz		
	11,7	Merivon 4.17SC	5.5 fl oz	0	3 app		
	11,7	Pristine 38WG	12.5 - 18.5 oz	0	4 app		
	12,9	Switch 62.5 WG	11 - 14 oz	1	56 oz		
	13	Quintec 2.08F	4 - 6 fl oz	3	4 app		
	M	chlorothalonil 6L <sup>4</sup>	2 - 3 pt	0	21 pt		
	M	sulfur	see label	0	NL		
	U	Torino 0.85SC	3.4 fl oz	3	6.8 fl oz		
<i>For watermelons only:</i>							
7,3	Luna Experience 3.34SC	6 - 17 fl oz	7	34 fl oz			
3	Topguard 1.04SC	10 - 14 fl oz	0	4 app			
<b>Fusarium wilt</b> Yellowing and wilting of leaves.	3	Proline 480 4SC	5.7 fl oz	7	17.1 fl oz	Apply through drip irrigation one time, early in the season.	
<b>OKRA</b>							
<b>Pod blight (whisker rot)</b> Young pods fail to develop and deteriorate.							Remove several upper leaves to improve sunlight penetration and air circulation. Poor pollination can also affect pods.

## Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season	Remarks
<b>OKRA (CONT'D)</b>						
<b>Powdery mildew, leaf spots</b>	3	tebuconazole 3.6F	4 - 6 fl oz	3	24 fl oz	Not often a problem. See label for resistance management guidelines.
	3	Topguard 1.04SC	14 fl oz	0	3 app	
	11	Quadris 2.08F	6 - 15.5 fl oz	0	61 fl oz	
	M	Bravo Weather Stik 6SC	1.5 pt	3	12 pt	
<b>Seedling disease</b> Poor stand.	4	Apron XL LS (seed treatment)	0.32 - 0.64 fl oz/cwt			Use thiram-treated seed. Plant in warm soil. Quadris can be used either in-furrow at planting or in a 7-inch band over the row prior to or shortly after emergence.
	11	Quadris 2.08F	0.4 - 0.8 fl oz/1000 row ft			
<b>Verticillium wilt</b> Yellowing of leaves. Brown discoloration inside stem.		SMDC	See nematode section			Rotate with non-solanaceous crops.
<b>ONION, GREEN</b>						
<b>Downy mildew</b> Pale green, oval, sunken spots on leaves. Purplish mold in spots.	11	Cabrio 20EG	12 oz	7	6 app	Apply when conditions become favorable for disease and repeat at 7- to 10-day intervals; Pristine: 14-day intervals. Quadris, Quadris Opti, Quadris Top, Cabrio, Pristine, Tanos and Reason should be rotated with non-Group 11 fungicides after each application. Forum, Fontelis, Switch, Inspire Super, Vanguard, Presidio, Revus, Merivon, Scala and Zampro should be rotated with fungicides from a different resistance management group after the second consecutive application. See resistance management sections of labels. Forum and Presidio must be tank mixed with non-related fungicides. See labels for plantback restrictions. Use silicone surfactant with Revus.  * The 9 fl oz rate is for tank mixes; use the 18 fl oz rate when not mixed with another fungicide.
	11	Quadris 2.08F	9 - 15.5 fl oz	0	92 fl oz	
	11	Reason 4.13F	5.5 fl oz	7	4 app	
	11	Tanos 50WG	8 oz	3	84 oz	
	11,M	Quadris Opti 5.5SC	2.4 - 3.7 pt	14	3 app	
	M	chlorothalonil 6L <sup>4</sup>	1.5 - 3 pt	14	3 app	
	M,4	Ridomil Gold Bravo SC	2.5 pt	14	2 app	
	40	Forum 4.18F	6 fl oz	0	5 app	
	40	Revus 2.08SC	8 fl oz	7	3 app	
	43	Presidio 4SC	3 - 4 fl oz	2	12 fl oz	
	45,40	Zampro 4.33SC	14 fl oz	0	42 fl oz	
	<b>Leaf blight (Botrytis)</b> White spots on leaves followed by dieback.	7	Endura 70WG	6.8 oz	7	
7		Fontelis 1.67SC	16 - 24 fl oz	3	72 fl oz	
9		Vanguard 75WG	10 oz	7	28 oz	
9		Scala 5SC*	9 - 18 fl oz	7	54 fl oz	
9,3		Inspire Super 2.82SC	16 - 20 fl oz	14	60 fl oz	
11,7		Merivon 4.17SC	8 - 11 fl oz	7	3 app	
11,7		Pristine 38WG	14.5 - 18.5 oz	7	6 app	
12,9		Switch 62.5WG	11 - 14 oz	7	54 fl oz	
M		chlorothalonil 6L <sup>4</sup>	1.5 - 3 pt	14	3 app	
M,4		Ridomil Gold Bravo SC	2.5 pt	14	2 app	
<b>Purple blotch (Alternaria)</b> Purple target spots on leaves.		Same as for Botrytis, or	Same as for Botrytis			
	3	Cabrio 20EG	12 oz	7	6 app	
	3	tebuconazole 3.6F	4 - 6 fl oz	7	24 fl oz	
	11	Quadris 2.08F	6 - 12 fl oz	0	92 fl oz	
	11,3	Quadris Top	14 fl oz	7	42 fl oz	
	11	Reason 4.13F	5.5 fl oz	7	4 app	
	11	Tanos 50WG	8 oz	3	84 oz	
	11,3	Quadris Top	14 fl oz	7	42 fl oz	
	11,3	Quilt 1.66SC	14 - 27.5 fl oz	14	55 fl oz	
	11,M	Quadris Opti 5.55SC	2.4 - 3.7 pt	14	3 app	



## Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/	Remarks
					Season	
<b>ONION, DRY</b>						
<b>Downy mildew</b> Pale green, oval, sunken spots on leaves. Purplish mold in spots.	11	Cabrio 20EG	12 oz	7	6 app	Apply when conditions become favorable for disease and repeat at 7- to 10-day intervals. Rovral applied at 14-day intervals. Do not apply mancozeb to exposed bulbs. Do not tank mix Aliette with copper materials. See labels for plantback restrictions. See resistance management sections of labels. Forum, Presidio and Tanos must be tank-mixed with non-related fungicides. Use silicone surfactant with Revus.
	11	Quadris 2.08F	9 - 15.5 fl oz	0	92 fl oz	
	11	Reason 4.13F	5.5 fl oz	7	4 oz	
	11	Tanos 50WG	8 oz	3	84 oz	
	11,M	Quadris Opti 5.5SC	2.4 - 3.7 pt	14	3 app	
	29	Omega 4.17SC	1 pt	7	6 app	
	33	Aliette 80WDG	2 - 3 lb	7	7 app	
	40	Revus 2.08SC	8 fl oz	7	4 app	
	40	Forum 4.18F	6 fl oz	0	5 app	
	43	Presidio 4SC	3 - 4 fl oz	2	12 fl oz	
	45,40	Zampro 4.33SC	14 fl oz	0	42 fl oz	
	M	chlorothalonil 6L <sup>4</sup>	1.5 - 3 pt	14	3 app	
	M	mancozeb 80WP <sup>4</sup>	3 lb	7	32 lb	
M,4	Ridomil Gold Bravo SC	2.5 pt	7	4 app		
<b>Leaf blight (Botrytis)</b> White spots on leaves followed by dieback.	2	iprodione 4F	1.5 pt	7	5 app	Apply when conditions become favorable for disease and repeat at 7- to 10-day intervals. Iprodione: 14-day intervals. Do not apply mancozeb to exposed bulbs. See labels for plantback restrictions. See resistance management sections of labels. Tanos must be tank-mixed with non-related fungicides. Scala: 9 fl oz rate for tank mixes; 18 fl oz rate when used alone.
	7	Endura 70WG	6.8 oz	7	6 app	
	7	Fontelis 1.67SC	16 - 24 fl oz	3	72 fl oz	
	9	Scala 5SC	9 - 18 fl oz	7	54 fl oz	
	9	Vangard 75WG	10 oz	7	28 oz	
	9,3	Inspire Super 2.82SC	16 - 20 fl oz	7	80 fl oz	
	11,7	Merivon 4.17SC	8 - 11 fl oz	7	3 app	
	11,7	Pristine 38WG	14.5 - 18.5 oz	7	6 app	
	11,M	Quadris Opti 5.5SC	1.6 - 3.2 pt	7	3 app	
	12,9	Switch 62.5WG	11 - 14 oz	7	56 oz	
	29	Omega 4.17SC	1 pt	7	6 app	
	M	chlorothalonil 6L <sup>4</sup>	1.5 - 3 pt	7	20 pt	
	M,4	Ridomil Gold Bravo SC	2.5 pt	7	4 app	
<b>Purple blotch (Alternaria)</b> Purple target spots on leaves.	Same as for Botrytis, or		Same as for Botrytis			
	3	tebuconazole 3.6F	4 - 6 fl oz	7	12 fl oz	
	11	Cabrio 20EG	12 oz	7	6 app	
	11	Quadris 2.08F	6 - 12 fl oz	0	92 fl oz	
	11	Reason 4.13F	5.5 fl oz	7	4 app	
	11	Tanos 50WG	8 oz	3	84 oz	
	11,3	Quadris Top	14 fl oz	7	56 fl oz	
	11,3	Quilt 1.66SC	14 - 27.5 fl oz	14	55 fl oz	
	M	mancozeb 80WP <sup>4</sup>	3 lb	7	32 lb	
<b>PEA, ENGLISH</b>						
<b>Ascochyta blight</b> Lesions on stems, pods, and leaves.	7	Endura 70WG	8 - 11 oz	7	2 apps	Alternate with a fungicide with a different mode of action after each application of Quadris or 2 consecutive apps of Fontelis or Priaxor.
	7	Fontelis 1.67SC	14 - 30 fl oz	0	72 fl oz	
	7,11	Priaxor 4.17SC	4 - 8 fl oz	7	16 fl oz	
	11	Quadris 2.08F	6 - 15.5 fl oz	0	92 fl oz	
<b>Seedling disease</b> Pythium	4	Ridomil Gold SL	0.5 - 1 pt/treated A	NA	1 app	Preplant incorporated. See label for band rates.
	4	MetaStar 2E AG	2 - 4 pt/treated acre	NA	1 app	
<b>Seedling disease</b> Rhizoctonia	11	Quadris 2.08F	0.4 - 0.8 fl oz/1000 row ft			Quadris can be used either in-furrow at planting or in a 7-inch band over the row prior to or shortly after emergence.
<b>PEA, SOUTHERN (Succulent only -- For dried pea culture, see "Bean, Dry.")</b>						
<b>Rusts</b> Bronze pustules.	3,11	Quilt 1.66SC	14 fl oz	7	42 fl oz	Spray at early bloom and repeat at 7- to 14-day intervals. Alternate with a fungicide with a different mode of action after each application of Quilt, Headline or Quadris or 2 apps of Fontelis.
	7	Fontelis 1.67SC	14 - 30 fl oz	0	72 fl oz	
	7	Endura 70WG	8 - 11 oz	7	2 app	
	11	Headline 2.09F	6 - 9 fl oz	7	2 app	
	11	Quadris 2.08F	6 - 15.5 fl oz	0	92 fl oz	

## Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season		Remarks
<b>PEA, SOUTHERN (CONT'D) (Succulent only -- For dried pea culture, see "Bean, Dry.")</b>							
<b>Powdery mildew</b> Dull white, felt-like growth on leaves.	7	Fontelis 1.67SC	14 - 30 fl oz	0	72 fl oz	Begin applications at first appearance of mildew and repeat at 7- to 14-day intervals. Alternate with a different mode of action after each application of Headline or 2 consec. apps of Fontelis.	
	7	Endura 70WG	8 - 11 oz	7	2 app		
	11	Headline 2.09F	6 - 9 fl oz	7	2 app		
	M	sulfur	See label	0	NL		
<b>Mosaic viruses</b> Distortion of leaves and pods. Leaf mottling.						Use virus-free seed. Plant resistant varieties.	
<b>Seedling disease</b> Pythium	4	Ridomil Gold SL	0.5 - 1 pt/treated A	NA	1 app	Preplant incorporated. See label for band rates.	
	4	MetaStar 2E AG	2 - 4 pt/treated A	NA	1 app		
<b>Seedling disease</b> Rhizoctonia	11	Quadris 2.08F	0.4 - 0.8 fl oz/1000 row ft			Quadris can be used either in-furrow at planting or in a 7-inch band over the row prior to or shortly after emergence.	
<b>White mold (Sclerotinia)</b> White mold growth on pods and stems.	7	Fontelis 1.67SC	16 - 30 fl oz	0	72 fl oz	Apply at first appearance and 7 - 10 days later, if needed. Rotate to different mode of action. See label for frequency of rotation required.	
	7	Endura 70WG	8 - 11 oz	7	2 app		
	12,9	Switch 62.5WG	11 - 14 oz	7	56 app		
	29	Omega 4.17SC	0.5 - 0.85 pt	14	1.75 pt		
<b>PEPPER</b>							
<b>Bacterial spot</b> Black, brown, or tan, angular spots on leaves. Dark, raised spots on fruits. Plants shed infected leaves.	M	fixed copper plus	See label	0	Label	For best results, apply before disease appears. Repeat at 5- to 10-day intervals. <b>High levels of resistance to copper are widespread in Tennessee populations of bacterial spot.</b> Alternatives to copper are encouraged. Adding Tanos to copper and mancozeb may slightly enhance efficacy. Resistant varieties are recommended. Use disease-free seed and transplants.	
	M	mancozeb 80WP <sup>4</sup>	1.6 - 3.2 lb	7	19.2 lb		
	M	Mankocide 61.1DF	2 - 3 lb	7	39 lb		
	NC	AgriPhage	1 pt	0	NL		
	P1	Actigard 50WG CHILI PEPPERS ONLY	0.33 - 0.75 oz	14	6 app	Chili peppers only. Do not apply to stressed plants. Begin sprays before disease onset. See label precautions.	
<b>Blossom-end rot</b> Tan sunken areas on blossom end and side of fruit.		calcium chloride	4 lb/100 gal			Spray at first appearance. Provide proper soil pH. Avoid planting on droughty soils. Irrigate and provide uniform soil moisture.	
<b>Cercospora leaf spot</b> Circular spots with gray centers develop on leaves.	3	Topguard 1.04SC	14 fl oz	0	4 app	Apply as soon as disease appears and continue as needed on a 7- to 10-day schedule. See Quadris, Quadris Top and Cabrio labels for resistance management guidelines.	
	11	Cabrio 20EG	8 - 12 oz	0	96 oz		
	11	Quadris 2.08F	6 - 15.5 fl oz	0	61 fl oz		
<b>Anthraxnose</b> Sunken spots on ripening fruit.	11,3	Quadris Top	12 - 14 fl oz	0	55 fl oz		
	M	mancozeb 80WP <sup>4</sup>	1.6 - 3.2 lb	7	19.2 lb		
	M	Bravo Weather Stik 6SC	1.5 pt	3	12 pt		

**Foliar, soil and post-harvest applications of disease-control products**

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season		Remarks
<b>PEPPER (CONT'D)</b>							
<b>Phytophthora blight - crown and root phase</b> (Caused by root infections.) Rapid wilt and death of plants in wet areas of field.	4	MetaStar 2E AG	4 - 8 pt/treated acre	7	12 pt		Plant on raised beds, improve field drainage and do not plant wet areas. MetaStar, Ridomil Gold and Ultra Flourish are soil-applied at planting and up to 2 supplemental soil applications at 30-day intervals. Ranman is applied in transplant water or as a foliar spray. Presidio may be applied in drip irrigation, but must be mixed with a fungicide with a different mode of action. Zampro can be applied as a directed spray at transplanting or in drip irrigation. Omega can be applied as a soil drench at planting, at 1.5 pt/A; foliar applications should begin at 7 days after planting and repeated at 7- to 14-day intervals, with rates and intervals dependent on disease pressure.
	4	Ridomil Gold 4EC	1 pt/treated acre	7	3 app		
	4	Ultra Flourish 2EC	2 pt/treated acre	7	3 app		
	21	Ranman 3.33SC	2.75 pt	0	16.5 fl oz		
	29	Omega 4.17SC	1 - 1.5 pt	30	9 pt		
	33	phosphorous acid:					
		Fosphite.....	Pre-plant root dip: 2 qt/100 gal Drip irrig.: 2-3 qt in at least 100 gal	0	NL		
		ProPhyt.....	Drench to transplants: 4 pt/100 gal In-furrow drench:	0	NL		
	43	Presidio 4SC.....	5 fl oz/1,000 ft row	2	12 fl oz		
	45,40	Zampro 4.33SC.....	3 - 4 fl oz 14 fl oz	4	42 fl oz		
<b>Phytophthora blight - foliar and fruit phase</b> Blighting of some shoots and fruit; plant usually remains alive.	11	Tanos 50WG	8 - 10 oz	3	72 oz	Foliar sprays, for protection against infection by air-borne spores. Tanos, Presidio, Ranman, Reason, Revus, Forum and Zampro must be involved in resistance management programs. See labels. Spray intervals for phosphorous acid products: Agri-Fos: 1 - 2 wks; Fosphite: 2 - 4 weeks (see label). Phostrol: 2 - 3 weeks; ProPhyt: weekly. Although not labeled for Phytophthora blight, <b>copper</b> sprays have been shown to be helpful in suppressing this disease.	
	11	Reason 4.13 SC	8.2 fl oz	14	24.6 fl oz		
	21	Ranman 3.33SC	2.75 fl oz	0	16.5 fl oz		
	33	phosphorous acid:					
		Agri-Fos	1.25 - 2 qt	0	6 app		
		Fosphite	1 - 3 qt	0	NL		
		Phostrol	1 - 2 qt	0	NL		
		ProPhyt	3 qt	0	NL		
	40	Forum 4.18F	6 fl oz	0	5 app		
	40	Revus 2.08SC	8 fl oz	1	4 app		
	43	Presidio 4SC	3 - 4 fl oz	2	12 fl oz		
	45,40	Zampro 4.33SC	14 fl oz	4	42 fl oz		
	M,4	Ridomil Gold Copper	2.5 lb	7	4 app		
M	Mankocide 61.1DF	2 - 3 lb	7	39 lb			
<b>Southern blight</b> Plants wilt and die. White mold often seen on base of stem.	<u>At planting</u>					Blocker applied in transplant water at ½ pt per plant. Fontelis applied at planting as a drench or in drip irrigation. Max rate per acre is 24 fl oz. Post-plant applications require complete coverage of the lower stem. Fontelis is applied 5 - 10 days after planting, with a 2 <sup>nd</sup> application 14 days later.	
	14	Blocker 4F	4.5 - 7.5 pt/100 gal				
	7	Fontelis 1.67SC	1 - 1.6 fl oz/1000 row ft				
	<u>Post-planting</u>						
	11	Cabrio 20EG	12 - 16 oz	0	96 oz		
7	Fontelis 1.67SC	16 - 24 fl oz	0	72 fl oz			
<b>POTATO</b>							
<b>Black leg</b> Stem turns black. Plant wilts and dies.	25	streptomycin sulfate 21.2WP	0.5 lb/100 gal			Soak cut seed pieces for 30 min. and plant.	

Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season	Remarks
<b>POTATO (CONT'D)</b>						
<b>Early blight</b> Brown target spots followed by blighting of foliage.	2	iprodione 4F	1 - 2 pt	14	4 app	Start applications when plants are 4- to 6-in. high and continue at 7- to 10-day intervals. Alternate Ridomil products with protectant fungicide on 7-day schedule. See labels for other restrictions. See Endura, Evito, Headline, Luna, Quadris, Quadris Opti, Quadris Top, Priaxor, Reason, Revus Top, Scala, Tanos and Vertisan labels for resistance management guidelines. Scala and Tanos must be tank mixed with an early-blight fungicide with a different mode of action.
	7	Endura 70WG	2.5 - 4.5 oz	30	2 app	
	7	Vertisan 1.67EC	10 - 24 fl oz	7	72 fl oz	
	9	Scala 5SC	7 fl oz	7	35 fl oz	
	9,7	Luna Tranquility 4.16SC	4 fl oz	7	12 fl oz	
	11	Reason 4.13F	5.5 - 8.2 fl oz	14	24.6 fl oz	
	11	Tanos 50WG	6 - 8 oz	14	6 app	
	11	Evito 480SC	3.5 fl oz	7	6 app	
	11	Headline 2L	6 - 9 fl oz	3	2 app	
	11	Quadris 2.08F	6 - 12.5 fl oz	14	123 fl oz	
	11,3	Quadris Top	8 - 14 fl oz	14	55 fl oz	
	11,7	Priaxor 4.17SC	4 - 8 fl oz	7	3 app	
	11,M	Quadris Opti 5.5SC	1.6 pt	14	6 app	
	40,3	Revus Top	5.5 - 7 fl oz	14	28 fl oz	
	M	chlorothalonil 6L <sup>4</sup>	1 - 1.5 pt	7	15 pt	
	M	mancozeb 80WP <sup>4</sup>	2 lb	14	15 lb	
	M,4	Ridomil Gold Bravo SC	2.5 pt	14	3 app	
M,4	Ridomil Gold MZ	2.5 lb	14	3 app		
<b>Late blight</b> Irregular dead areas on leaves. Plants appear scalded.	11	Reason 4.13F	5.5 - 8.2 fl oz	14	24.6 fl oz	Late-blight fungicides should be tank-mixed with and/or alternated with a broad-spectrum protectant fungicide such as chlorothalonil or mancozeb. The purpose is to discourage resistance and to provide control of early blight. Begin applications when late blight is imminent, repeat at 5- to 7-day intervals. See product labels for resistance management guidelines.
	11	Tanos 50WG	8 oz	14	6 app	
	21	Ranman 3.33SC	1.4 - 2.75 fl oz	14	10 app	
	22,M	Gavel 75DF	1.5 - 2 lb	14	6 app	
	27	Curzate 60DF	3.33 oz	14	7 app	
	28	Previcur Flex 6F	1.7 - 1.2 pt	14	6 pt	
	29	Omega 500F 4.2L	5.5 fl oz	14	3.5 pt	
	40	Forum 4.18F	4 - 6 fl oz	4	5 app	
	40	Revus 2.08SC	5.5 - 8 fl oz	1	32 fl oz	
	40	Revus 2.08SC	5.5 - 8 fl oz	14	32 fl oz	
40,3	Revus Top	5.5 - 7 fl oz	14	28 fl oz		
45,40	Zampro 4.33SC	11 - 14 fl oz	4	42 fl oz		
<b>Fusarium tuber rot</b> Dry, brown rot of stored tubers.	1	Mertect 340-F	0.42 fl oz/ton of tubers			Mist unwashed tubers on a conveyor line entering storage with enough of the solution to provide complete coverage. Tubers may be treated again before shipment if necessary.
<b>Rhizoctonia stem canker (black scurf)</b> Dark stem rot, poor growth.	<i>Seed-piece treatment:</i>					Apply Blocker as an in-furrow spray to the seed and cover with soil during planting operation. Quadris and Vertisan can be used either in-furrow at planting or in a 7-inch band over the row prior to or shortly after emergence. Use the higher rates where disease pressure is high. <b>*Blocker and Vertisan not for silver scurf.</b>
	11	Dynasty 0.83SC	0.10 - 3.75 fl oz/100 lb seed			
	12	Maxim 0.5 D	0.5 lb/100 lb seed			
	12	Maxim 4FS	0.08 fl oz/100 lb seed			
	12,M	Maxim MZ	seed			
7,M	Moncoat MZ 7.5 D	0.5 lb/100 lb seed				
<b>Silver scurf</b> Light areas with silvery sheen on surface of tuber.	<i>Soil treatment:</i>					
	11	Quadris 2.08F.....	0.4 - 0.8 fl oz/1000 row ft			
	7	Vertisan 1.67EC*	0.7 - 1.6 fl oz/1,000 row ft			
	14	Blocker 4F*.....	5 - 10 pt for 34-in. row spacing			
<b>Scab</b> Rough, scabby spots on tubers.						Use disease-free seed. Where soil is infested with scab organism, use resistant variety and rotate crops. See UT Extension publication SP 277-G.

## Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/	Remarks
					Season	
<b>POTATO (CONT'D)</b>						
<b>White mold (Sclerotinia)</b> Dying stems with black, raisin-like structures inside.	2	iprodione 4F	2 pt	14	4 app	Begin when plants are 6- to 8-in. tall or when conditions favor disease development. Omega can be repeated at 7- to 10-day intervals. Apply Endura 2 times at 14-day intervals.
	3	Quash 50WG	4 oz	1	16 oz	
	7	Endura 70WG	5.5 - 10 oz	30	2 app	
	29	Omega 500F 4.2L	5.5 - 8 fl oz	14	3.5 pt	
<b>PUMPKIN AND WINTER SQUASH (For assistance with fungicide selection, see Appendix 3 for a suggested spray program and relative effectiveness of fungicides)</b>						
<b>Angular leaf spot</b> Brown, angular-shaped spots.	P1	Actigard 50 WG	0.5 - 1 oz	0	8 oz	Spray at first appearance and repeat on 7- to 10-day schedule. Discontinue in dry weather. Fruit most susceptible when small and expanding rapidly. Do not apply Actigard to stressed plants. Requires activation time.
	M	fixed copper	See label	0	NL	
<b>Bacterial spot</b> (Xanthomonas) Small, tan fruit spot with dark margin.						
<b>Anthracnose</b> Black, circular spots on fruit.	7	Fontelis 1.67SC	12 - 16 fl oz	1	67 fl oz	Begin applications prior to disease onset. Repeat every 7 - 10 days. Do not make consecutive applications of Cabrio, Flint, Sovran, Merivon, Pristine, Quadris, Quadris Top or Quadris Opti; these products should be alternated with non-Group 11 fungicides. Switch, Fontelis and Inspire Super must be rotated to a different mode of action after the second application. See Cabrio, Quadris, Quadris Opti labels for restrictions on tank mix partners. <b>Fontelis, Sovran and Switch not for anthracnose, downy mildew, or plectosporium blight. Inspire Super and Merivon not for downy mildew.</b>
	9,3	Inspire Super	16 - 20 fl oz	7	80 fl oz	
	11	Cabrio 20EG	12 - 16 oz	0	4 app	
<b>Downy mildew</b> Small spots, initially yellow, turning brown. Extensive blighting.	11	Flint 50WG	1.5 - 2 oz	0	4 app	
	11	Quadris 2.08F	11 - 15.5 fl oz	1	92 fl oz	
	11	Sovran 50WG	4.8 oz	0	4 app	
<b>Gummy stem blight (black rot)</b> Black, circular spots on fruit.	11,3	Quadris Top	10 - 14 fl oz	1	56 fl oz	
	11,7	Merivon 4.17SC	5.5 fl oz	0	3 app	
	11,7	Pristine 38WG	12.5 - 18.5 oz	0	4 app	
<b>Plectosporium (Microdochium) blight</b> White spots on stem and fruit.	11,M	Quadris Opti 5,5SC	3.2 pt	1	4 app	
	12,9	Switch 62.5 WG	11 - 14 oz	1	56 oz	
	M	chlorothalonil 6L <sup>4</sup>	1.5 - 3 pt	0	21 pt	
<b>Downy mildew</b> (Additional products)	M	mancozeb 80WP <sup>4</sup>	2 - 3 lb	5	8 app	Add to the spray program when downy mildew is reported in the vicinity or there is a moderate- to high-risk warning for your area at <a href="http://cdm.ipmpipe.org/">http://cdm.ipmpipe.org/</a> . Repeat at 7- to 10-day intervals. Most of these products require alternation with downy mildew fungicides with a different mode of action or tank mix with a protectant fungicide such as chlorothalonil.
	M,4	Ridomil Gold Bravo SC	2.5 - 3.25 pt	0	4 app	
	11	Reason 4.13F	5.5 fl oz	14	4 app	
	11	Tanos 50WG	8 oz	3	4 app	
	21	Ranman 3.33SC	2.1 - 2.75 fl oz	0	6 app	
	22,M	Gavel 75DF	1.5 - 2 lb	5	8 app	
	27	Curzate 60DF	3.2 - 5 oz	3	30 oz	
	28	Previcur Flex 6F	1.2 pt	2	6 pt	
	40	Forum 4.18F	6 fl oz	0	5 app	
	40	Revus 2.08SC	8 fl oz	0	4 app	
43	Presidio 4SC	3 - 4 fl oz	2	12 fl oz		
<b>Phytophthora blight</b> Rot of fruit covered with thit, white mold.	45,40	Zampro 4.33SC	14 fl oz	0	42 fl oz	Foliar sprays. Forum, Presidio, Ranman, Revus and Zampro must be involved in a resistance management program. Phosphorus acid products: Apply preventively on 7- to 14-day schedule, beginning after plants become established. See product labels. Exception for Fosphite: Apply at 2- to 4-week intervals (see label). Although not labeled for Phytophthora blight, <b>copper fungicides</b> have been shown to be helpful in suppressing this disease.
	21	Ranman 3.33SC	2.75 fl oz	0	6 app	
	33	phosphorous acid:				
		Agri-Fos	1.25 qt	0	6 app	
		Fosphite	1 - 3 qt	0	NL	
		ProPhyt	1 - 3 qt	0	NL	
		Phostrol	2.5 - 5 pt	0	7 app	
	40	Forum 4.18F	6 fl oz	0	4 app	
	40	Revus 2.08SC	8 fl oz	0	5 app	
	43	Presidio 4SC	3 - 5 fl oz	2	12 fl oz	
45,40	Zampro 4.33SC	14 fl oz	0	42 fl oz		
<b>Mosaic viruses</b> Green patterns on fruit.						Reflective mulches, aphid control and weed control may be of some value.

**Foliar, soil and post-harvest applications of disease-control products**

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/	Remarks
					Season	
<b>PUMPKIN AND WINTER SQUASH (CONT'D) (For assistance with fungicide selection, see Appendix 3 for a suggested spray program and relative effectiveness of fungicides)</b>						
<b>Powdery mildew</b> White, powdery mold on surface of leaves.	3	tebuconazole 3.6F	4 - 6 fl oz	7	24 fl oz	For varieties susceptible to powdery mildew: Apply chlorothalonil on a preventive, 7- to 10-day schedule. Add one of the other listed products when powdery mildew appears. Thorough coverage is critical for chlorothalonil and sulfur. Pristine, Merivon and Quintec must be alternated with fungicides with different modes of action; all other fungicides must be rotated after the second consecutive application. <b>Resistance to the strobilurins (Cabrio, Quadris, Sovran and Flint) is widespread in cucurbit powdery mildew in Tennessee.</b>
	3	Rally 40W	2.5 - 5 oz	0	24 oz	
	3	Procure 50WP	4 - 8 oz	0	40 oz	
	3	Topguard 1.04SC	10 - 14 fl oz	0	4 app	
	3,9	Inspire Super	16 - 20 fl oz	7	80 fl oz	
	7	Fontelis 1.67SC	12 - 16 fl oz	1	67 fl oz	
	9,12	Switch 62.5 WG	11 - 14 oz	1	56 oz	
	11,3	Quadris Top	10 - 14 fl oz	1	56 fl oz	
	11,7	Merivon 4.17SC	5.5 fl oz	0	3 app	
	11,7	Pristine 38WG	12.5 - 18.5 oz	0	4 app	
	13	Quintec 2.08SC	4 - 6 fl oz	7	24 fl oz	
	U	Torino 0.85SC	3.4 fl oz	3	6.8 fl oz	
	M	wettable sulfur	see label	0	NL	
M	chlorothalonil 6L <sup>4</sup>	2 - 3 pt	0	21 pt		
<b>SPINACH</b>						
<b>Downy mildew (blue mold)</b> Yellow spots on upper leaf surface. Gray downy fungus on underside of leaf.	11	Cabrio 20EG	12 - 16 oz	0	4 app	Start fungicide applications at first sign of disease and continue at 7- to 10-day intervals as necessary. Where white rust has been a problem in the past, spraying should start when the first true leaves develop. Begin Actigard applications at first or second true leaf; do not use if plants are under stress. Ridomil Gold Copper must be used with preplant Ridomil Gold EC soil application. (See below.) Aliette/Linebacker can cause speckling if leaves remain wet for long periods. Adjust spray pH to 6.0 or above. Quadris can contribute to phytotoxicity under certain conditions. Use caution with regard to tank mixes and adjuvants when treating spinach with Quadris. Curzate must be tank mixed with a protectant. See Quadris, Presidio, Reason, Ranman, Cabrio, Revus and Zampro labels for resistance management guidelines.
	11	Tanos 50WG	8 - 10 oz	1	48 oz	
	11	Reason 4.13SC	5.5 - 8.2 fl oz	2	24.6 fl oz	
	P1	Actigard 50WG 60DF	0.75 oz	7	3 app	
	27	Curzate	5 oz	1	30 oz	
	33	Aliette/Linebacker 80WDG	3 - 5 lb	3	7 app	
	40	Revus 2.08SC	8 fl oz	1	4 app	
	43	Presidio 4SC	3 - 4 fl oz	2	12 fl oz	
	45,40	Zampro 4.33SC	14 fl oz	0	42 fl oz	
	M	fixed copper	see label	0	NL	
M,4	Ridomil Gold Copper	2.5 lb	21	2 app		
<b>White rust</b> Yellow spots on upper leaf surface. White powdery mass on underside of leaf.	11	Cabrio 20EG	8 - 12 oz	0	4 app	
	11	Quadris 2.08F	6 - 15.5 fl oz	0	92 fl oz	
	11	Reason 4.13SC	2.1 - 2.75 fl oz	0	5 app	
	11	Tanos 50WG	8 - 10 oz	1	48 oz	
	P1	Actigard 50WG	0.75 oz	7	3 app	
	21	Ranman 3.33SC	2.1 - 2.75 fl oz	0	5 app	
	43	Presidio 4SC	3 - 4 fl oz	2	12 fl oz	
	M	fixed copper	see label	0	NL	
M,4	Ridomil Gold Copper	2.5 lb	21	2 app		
<b>Anthraxnose</b> Water-soaked dark gray spots.	11	Cabrio 20EG	12 - 16 oz	0	4 app	
	11	Quadris 2.08F	6 - 15.5 fl oz	0	4 app	
	M	fixed copper	See label	0	NL	
<b>Cercospora leafspot</b> Small, tan spots.						
<b>Rhizoctonia seedling disease</b> Failure of seedlings to emerge or death after emergence.	11	Quadris 2.08F	0.4 - 0.8 fl oz/1000 row ft			Can be used either in-furrow at planting or in a 7-inch band over the row prior to or shortly after emergence. Use the higher rates where disease pressure is high.
<b>Pythium seedling disease</b> Dark rot of roots and stem.	4	MetaStar 2E AG	4 - 8 pt/treated acre	21	11 pt	Ridomil and Ultra Flourish are applied preplant incorporated or surface band at planting. For downy mildew and white rust control, shank in 0.25 pt/A Ridomil, 1 pt MetaStar or 0.5 pt/A Ultra Flourish after first and second cuttings.
	4	Ridomil Gold 4SL	1 - 2 pt/treated acre	21	2.75 pt	
	4	Ultra Flourish 2EC	2 - 4 pt/treated acre	21	5.5 pt	
<b>Downy mildew</b> (See above)						
<b>White rust</b> (See above)						

**Foliar, soil and post-harvest applications of disease-control products**

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season		Remarks
<b>SQUASH, SUMMER (For assistance with fungicide selection, see Appendix 3 for a suggested spray program and relative effectiveness of fungicides)</b>							
<b>Angular leaf spot</b> Brown, angular-shaped spots.	M	fixed copper	See label	0	NL		Spray at first appearance and continue on 7- to 10-day schedule. Discontinue in dry weather.
	P1	Actigard 50WG	0.5 - 1 oz	0	8 oz		Do not apply to stressed plants.
<b>Blossom blight (wet rot)</b> Blossoms and fruits rot; whisker-like fungal growth.							Select sites and plant spacings that provide good air circulation for rapid drying.
<b>Downy mildew</b> Tiny, yellow spots on leaves followed by blighting.	11	Cabrio 20EG	12 - 16 oz	0	4 app		Begin applications prior to disease onset. Repeat every 7 - 10 days. Do not make consecutive applications of Cabrio, Flint, Pristine, Quadris or Quadris Opti; these products should be alternated with non-Group 11 fungicides. See Cabrio, Quadris and Quadris Opti labels for restrictions on tank mix partners. See Flint label for downy mildew control.
	11	Flint 50WG	1.5 - 2 oz	0	4 app		
	11	Quadris 2.08F	11 - 15.5 fl oz	1	92 fl oz		
	11,3	Quadris Top	10 - 14 fl oz	1	56 fl oz		
	11,7	Pristine 38WG	12.5 - 18.5 oz	0	4 app		
	11,M	Quadris Opti 5.5SC	3.2 pt	1	4 app		
<b>Plectosporium (Microdochium) blight</b> White dashes on stem surface.	22,M	Gavel 75DF	1.5 - 2 lb	5	8 app		
	M	chlorothalonil 6L <sup>4</sup>	1.5 - 3 pt	0	21 pt		
	M	mancozeb 80WP <sup>4</sup>	2 - 3 lb	5	25.6 lb		
	M,4	Ridomil Gold Bravo SC	2.5 - 3.25 pt	0	4 app		
	M,4	Ridomil Gold MZ	2.5 lb	5	4 app		
<b>Downy mildew</b> (Additional products)	11	Reason 4.13F	5.5 fl oz	14	4 app		Begin applications prior to infection, 7- to 10-day spray schedule. Most of these products require alternation with downy mildew fungicides with a different mode of action or tank mix with a protectant fungicide such as chlorothalonil or mancozeb. Presidio, applied through drip irrigation for soilborne disease control, will provide some control of downy mildew.
	11	Tanos 50WG	8 oz	3	4 app		
	21	Ranman 3.33SC	2.1 - 2.75 fl oz	0	6 app		
	22,M	Gavel 75DF	1.5 - 2 lb	5	8 app		
	27	Curzate 60DF	3.2 - 5 oz	3	30 oz		
	28	Previcur Flex 6F	1.2 pt	2	6 pt		
	40	Revus 2.08SC	8 fl oz	0	4 app		
	40	Forum 4.18F	6 fl oz	0	4 app		
	40	Presidio 4SC	3 - 4 fl oz	2	12 fl oz		
	45,40	Zampro 4.33SC	14 fl oz	0	42 fl oz		
<b>Phytophthora blight - crown and root phase</b> (Caused by root infections.) Wilt and death of plants in wet areas of field.	4	MetaStar 2E AG	4 - 8 pt/treated acre	7	12 pt		Plant on raised beds, improve field drainage and do not plant wet areas. MetaStar, Ridomil Gold and Ultra Flourish are soil-applied at planting and up to 2 supplemental soil applications at 30-day intervals. Ranman is applied in transplant water or as a foliar spray. Presidio may be applied in drip irrigation, but must be mixed with a fungicide with a different mode of action. Zampro can be applied as a directed spray at transplanting or in drip irrigation.
	4	Ridomil Gold 4EC	1 pt/treated acre	7	3 app		
	4	Ultra Flourish 2EC	2 pt/treated acre	7	3 app		
	21	Ranman 3.33SC	2.75 pt	0	16.5 fl oz		
	33	phosphorous acid: Fosphite.. . . . .	Pre-plant root dip: 2 qt/100 gal Drip irrig.: 2-3 qt in at least 100 gal	0	NL		
		ProPhyt. . . . .	Drench to transplants: 4 pt/100 gal In-furrow drench:	0	NL		
	43	Presidio 4SC. . . . .	5 fl oz/1,000 ft row	2	12 fl oz		
	45,40	Zampro 4.33SC . . . . .	3 - 4 fl oz 14 fl oz	4	42 fl oz		
<b>Phytophthora blight</b> Rot of fruit covered with thin, white mold.	21	Ranman 3.33SC	2.75 fl oz	0	6 app		Forum, Presidio, Ranman, Revus and Zampro must be involved in a resistance management program. Phosphorus acid products: Apply preventively on 7- to 14-day schedule, beginning after plants become established. See product labels. Exception for Fosphite: Apply at 2- to 4-week intervals (see label). Although not labeled for Phytophthora blight, <b>copper fungicides</b> have been shown to be helpful in suppressing this disease.
	33	phosphorous acid: Agri-Fos	1.25 qt	0	6 app		
		Fosphite	1 - 3 qt	0	NL		
		ProPhyt	1 - 3 qt	0	NL		
		Phostrol	2.5 - 5 pt	0	7 app		
	40	Forum 4.18F	6 fl oz	0	5 app		
	40	Revus 2.08SC	8 fl oz	0	4 app		
	43	Presidio 4SC	3 - 4 fl oz	2	12 fl oz		
	45,40	Zampro 4.33SC	14 fl oz	4	42 fl oz		

## Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>	Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season	Remarks
<b>SQUASH, SUMMER (CONT'D) (For assistance with fungicide selection, see Appendix 3 for a suggested spray program and relative effectiveness of fungicides)</b>					
<b>Mosaic viruses</b> Greening of fruit. Leaves mottled, vines stunted.					The precocious yellow-stemmed varieties mask the fruit-greening effects. Some resistant varieties for certain viruses.
<b>Powdery mildew</b> White, powdery mold on surface of leaves.	3 tebuconazole 3.6F 3 Rally 40W 3 Procuire 50WP 3 Topguard 1.04SC 7 Fontelis 1.67SC 9,3 Inspire Super 11,3 Quadris Top 11,7 Merivon 4.17SC 11,7 Pristine 38WG 11,M Quadris Opti 5.5SC 12,9 Switch 62.5 WG U Torino 0.85SC M wettable sulfur M chlorothalonil 6L <sup>4</sup>	4 - 6 fl oz 2.5 - 5 oz 4 - 8 Oz 10 - 14 fl oz 12 - 16 fl oz 16 - 20 fl oz 10 - 14 fl oz 5.5 fl oz 12.5 - 18.5 fl oz 3.2 pt 11 - 14 oz 3.4 fl oz See label 2 - 3 pt	7 0 0 0 1 7 1 0 0 1 1 3 0 0	24 fl oz 24 fl oz 40 Oz 4 app 67 fl oz 80 fl oz 56 fl oz 3 app 4 app 4 app 56 oz 6.8 fl oz NL 21 pt	For varieties susceptible to powdery mildew: Apply chlorothalonil on a preventive, 7- to 10-day schedule. Add one of the other listed products when powdery mildew appears. Thorough coverage is critical for chlorothalonil and sulfur. All other fungicides must be rotated to a different mode of action after 1 to 2 applications (see label). <b>Resistance to the strobilurins (Cabrio, Quadris, Sovran and Flint) is widespread in cucurbit powdery mildew in Tennessee.</b>
<b>Scab</b> Sunken or raised spots on fruit.	M chlorothalonil 6L <sup>4</sup> M mancozeb <sup>4</sup> 4,M Ridomil Gold Bravo	2 - 3 pt 2 -3 lb 2 - 3 lb	0 5 0	21 pt 25.8 lb 4 app	Begin applications prior to disease onset. Repeat every 7 - 10 days. Ridomil Gold Bravo limited to 4 applications per crop. See label for other restrictions.
<b>SWEETPOTATO</b>					
<b>Plant Bed</b>					
<b>Black rot</b> Black spot on roots. Dry, black decay extends in flesh of root.	1 Mertect 340F	8 fl oz/7.5 gal water			Dip seed roots for 1 - 2 minutes and plant immediately. Do not use treated roots for food or feed. Four-year crop rotation.
<b>Scurf</b> Brownish-black "stain" on surface of potato.	14 Botran 75WP 1 Mertect 340F	1 lb/7.5 gal (dip) or 3 - 3.75 lb/14 gal for 1000 sq ft (spray) 8 fl oz/7.5 gal water			Dip seed potatoes 10 - 15 seconds, drain and bed promptly; or spray over bedded potatoes before covering with soil. Dip seed roots for 1 - 2 minutes and plant immediately. Do not use treated roots for food or feed.
<b>Southern blight (Sclerotial blight)</b> Plants die, white growth on lower stem.	14 Botran 75WP	1 lb/7.5 gal (seed dip) or 3 - 3.75 lb/14 gal for 1000 sq ft (bed spray)			Dip seed potatoes 10 - 15 seconds, drain and bed promptly; or spray over bedded potatoes before covering with soil.
<b>Field</b>					
<b>Southern blight (Sclerotial blight), Rhizoctonia stem canker, Pythium root rot</b>	11 Quadris 2.08F	0.4 - 0.8 fl oz/1000 row ft			Apply in-furrow at planting or banded shortly after planting.
<b>Foliar diseases</b> Leaf spots, powdery mildew, rust	7 Vertisan 1.67EC 11 Headline 2.09F 11 Quadris 2.08F 11,3 Quadris Top 2.72SC	10 - 24 fl oz 6 - 12 fl oz 9 - 15.5 fl oz 8 - 14 fl oz	7 3 0 14	72 fl oz 2 app 123 fl oz 56 fl oz	See product labels for resistance management guidelines.
<b>Soil rot (pox)</b> Circular sunken areas on fleshy roots; feeder roots blackened.					Low pH reduces soil rot, but control should be centered around crop rotation and the use of resistant varieties.



## Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>	Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season	Remarks
<b>SWEETPOTATO (CONT'D)</b>					
<b>Stem rot (Fusarium wilt)</b> Plants yellow and stunted.					Use certified seed potatoes of a resistant variety.
<b>Post-Harvest</b>					
<b>Sanitation</b> Various rots.	Calcium hypochlorite 65%	10 oz/100 gal			Spray or dip 2 - 5 minutes. Proper curing is best control. See PB1054.
<b>Rhizopus rot</b> Gray, fuzzy mold.	14 Botran 75WP	Dip: 1 lb/100 gal			Dip roots for 5 - 10 seconds in well agitated suspension. Do not rinse.
		Spray: 1 lb/100 gal			Spray immediately after washing. Do not rinse after treatment.
	12 Scholar SC	Dip: 16 - 32 fl oz/100 gal			Dip for 30 seconds and allow sweet-potatoes to drain. Add 8 fl oz to 100 gal after 500 bushels are treated. After each 1,000 bushels treated, drain and flush the tank and refill with fresh suspension.
		Spray: 16 fl oz/200,000 lb			Ensure proper coverage of sweetpotatoes.
<b>TOMATO, PLANT BED, OUTDOOR (For transplant production in greenhouses, see "Tomato, greenhouse")</b>					
<b>Damping off</b> Lower stem shrivels and seedling collapses.	<i>Rhizoctonia</i>				Use fungicide-treated seed. See "Seed Treatment" section of this publication.
	<i>Pythium, Phytophthora</i>	28 Previcur Flex	32 fl oz/1000 sq ft at seeding 16 fl oz/1000 sq ft after emergence	NA	2 app
<b>Botrytis (gray mold)</b> Gray, fuzzy growth.	M chlorothalonil 6L <sup>4</sup>	1.38 - 2 pt/43,560 sq ft	NA	20 pt	Spray first true leaves, repeat at weekly intervals. For outdoor beds only.
<b>Early blight</b> Brown spots on leaves or stem.					
<b>Bacterial canker, spot, speck</b> Tiny, dark brown to black spots on leaves.	sodium hypochlorite (Clorox)	1 qt in 4 qt water	NA	NL	Wash seed for 40 min in solution with continuous agitation; air dry promptly. Use 1 gal solution per 1 lb seed.
	25 streptomycin sulfate	1 lb/100 gal	NA	NL	<b>For transplant production only.</b> Apply if symptoms appear and repeat at 4- to 5-day intervals until transplanting.
	NC AgriPhage	3 - 8 fl oz/9600 sq ft	NA	NL	Apply every day if symptoms present. Do not mix with copper products.

Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season		Remarks
<b>TOMATO, FIELD (For assistance with fungicide selection, see Appendix 4 for a suggested spray program and relative effectiveness of fungicides)</b>							
<b>Bacterial spot and speck</b> Small, dark spots on foliage and fruit.	P1	Actigard 50WG	0.33 - 0.75 oz	14	8 app		Actigard is a plant resistance activator. Under certain conditions, this product may lead to reductions in yield. Refer to label for disclaimer. Begin applications within 1 week of transplanting. Make up to 8 applications, at weekly intervals. After the eighth application, switch to copper sprays if bacterial diseases are present. Begin Actigard applications at 0.33 oz/A, increasing to 0.75 oz/A as plants grow.
	M	fixed copper +	See label	0	Label		<b>High levels of resistance to copper are widespread in TN populations of bacterial spot.</b> Alternatives to copper are encouraged. Adding Tanos to copper and mancozeb may slightly enhance efficacy. Labeled pre-mixes containing copper may also be used, but provide no advantage over this mixture.
	M	mancozeb 80WP <sup>4</sup>	1.5 lb	5	22.4 lb		
	NC	AgriPhage	1 pt	0	NL		May be useful where copper-resistant bacterial strains are present. Cannot be tank-mixed with copper. Use as part of cooperative program with Omni-Lytics, (866-285-2644), which formulates the bacteriophage to match your bacterial strains. Resample frequently, to accommodate strain shifts.
<b>Blossom-end rot</b> Firm, sunken area on blossom end of fruit.		calcium chloride	4 lb/100 gal	0	4 app		Apply as soon as problem is detected or earlier. Maintain adequate calcium level in soil and uniform soil moisture. Avoid excessive irrigation when plants are small.
<b>Early blight</b> Brown target spots followed by blighting of foliage.	7	Fontelis 1.67SC	10 - 24 fl oz	0	72 fl oz		Start spraying soon after plants are set and repeat at 7- to 10-day intervals. All products other than chlorothalonil and mancozeb must be involved in resistance management programs. See Cabrio, Quadris and Priaxor labels for precautions on tank mixes.
	7,11	Priaxor 4.17SC	4 - 8 fl oz	0	3 app		
	9,3	Inspire Super 2.82SC	16 - 20 fl oz	0	47 fl oz		
	11	Cabrio 20EG	8 - 12 oz	0	96 oz		
<b>Anthracnose</b> Circular, sunken spots on ripe fruit.	11	Quadris 2.08F	5 - 6.2 fl oz	0	37 fl oz		
	11	Tanos 50WG	6 - 8 oz	3	72 oz		
<b>Septoria leaf spot</b> Small, gray circular leaf spots with dark borders.	11,3	Quadris Top 2.72SC	8 fl oz	0	47 fl oz		
	11,M	Quadris Opti 5.5SC	1.6 pt	0	5 app		
	M	chlorothalonil 6L <sup>4</sup>	1.38 - 2.75 pt	0	20 pt		
	M	mancozeb 80WP <sup>4</sup>	2 - 3 lb	5	22.4 lb		
<b>Target spot</b> Tan leafspots with bullseye pattern.							
<b>Fusarium wilt</b> Bright yellowing of foliage. Brown color inside stem.							Crop rotation, fumigation and resistant varieties are treatments. Maintain soil pH between 6.5 and 7.0.
<b>Buckeye fruit rot</b> Circular, zonate bands within large spot on fruit, worse on lower clusters.	4,M	Ridomil Gold Bravo SC	2.5 pt	14	3 app		All are foliarly applied. Certain mefenoxam and metalaxyl products can be applied in drip irrigation, but have 28-day PHI's.
	4,M	Ridomil Gold Copper	2 lb	14	3 app		
	11	Quadris 2.08F	5 - 6.2 fl oz	0	37 fl oz		
	11,M	Quadris Opti 5.5SC	1.6 pt	0	5 app		
	22,M	Gavel 75DF	1.5 - 2 lb	5	8 app		
	43	Presidio 4SC	3 - 4 fl oz	2	12 fl oz		

**Foliar, soil and post-harvest applications of disease-control products**

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season	Remarks	
<b>TOMATO, FIELD (CONT'D) (For assistance with fungicide selection, see Appendix 4 for a suggested spray program and relative effectiveness of fungicides)</b>							
<b>Gray mold (Botrytis)</b> Gray, fuzzy mold on blighted foliage and fruits.	7	Endura 70WG	9 - 12.5 oz	0	25 oz	Endura may only be applied 2 times per season when applied at the gray mold rate. It is labeled for early blight control at 2.5 - 3.5 oz/A. Scala must be tank mixed with one of the other listed fungicides. Rotate to a different mode of action after 2 applications of Switch or Fontelis.	
	7	Fontelis 1.67SC	10 - 24 fl oz	0	72 fl oz		
	9	Scala 5SC	7 fl oz	1	35 oz		
<b>Early blight</b> (See above for additional products)	9,12	Switch 62.5WG	11 - 14 oz	0	56 oz	Rotate to a different mode of action after 2 applications of Switch or Fontelis.	
	M	chlorothalonil 6L <sup>4</sup>	2.75 pt	0	20 pt		
<b>Leaf mold</b> Yellow spots on upper surface of leaf, olive to gray mold on underside.	11	Tanos 50WG	8 oz	3	72 oz	Tanos must be tank mixed with and alternated with a non-strobilurin fungicide such as chlorothalonil or mancozeb.	
	11	Quadris Top 2.72SC	8 fl oz	0	47 fl oz		
	M	chlorothalonil 6L <sup>4</sup>	2.75 pt	0	20 pt		
	M	mancozeb 80WP <sup>4</sup>	1.5 - 3 lb	5	22.4 lb		
<b>Late blight</b> Large, irregular spots on leaves; firm rot of fruit.	11	Cabrio 20EG	8 - 16 fl oz	0	96 oz	Begin applications before onset of disease and repeat on a 5- to 10-day schedule. Use 5- to 7-day intervals during mild, wet weather or if late blight is present. Most of these products require alternation with late blight fungicides with a different mode of action. Tank mix with a protectant fungicide such as chlorothalonil or mancozeb. Most late blight strains are resistant to Ridomil. Do not use Revus Top on small-fruited varieties (mature fruit less than 2 in.).	
	11	Quadris 2.08SC	6.2 fl oz	0	37 fl oz		
	11	Reason 4.13F	5.5 - 8.2 fl oz	14	24.6 fl oz		
	11	Tanos 50WG	6 - 8 oz	3	72 oz		
	21	Ranman 3.33SC	2.1 - 2.75 fl oz	0	6 app		
	22,M	Gavel 75DF	1.5 - 2 lb	5	8 app		
	27	Curzate 60DF	3.2 - 5 oz	3	30 oz		
	28	Previcur Flex 6F	0.7 - 1.5 pt	5	7.5 pt		
	40	Forum 4.18F	6 fl oz	4	5 app		
	40	Revus 2.08SC	5.5 - 8 fl oz	1	32 fl oz		
	40,3	Revus Top	5.5 - 7 fl oz	1	28 fl oz		
	43	Presidio 4SC	3 - 4 fl oz	2	12 fl oz		
	45,40	Zampro 4.33SC	14 fl oz	4	42 fl oz		
<b>Phytophthora blight</b> ( <i>P. capsici</i> ) Rot of roots and crown.	M	chlorothalonil 6L <sup>4</sup>	2 - 2.75 pt	0	20 pt	Apply as a soil spray at planting in water or liquid fertilizer. Make subsequent application as soil spray or in drip irrigation at 4 - 6 wks after planting. Make second drip application as needed up to 4 wks before harvest. Base the rate on a 7-in. band.	
	4	MetaStar 2E AG	2 - 4 qt	28	6 qt		
	4	Ridomil Gold 4SL	1 - 2 pt/treated acre	28	3 pt		
	4	Ultra Flourish 2EC	2 - 4 pt/treated acre	28	6 pt		
	33	phosphorous acid: Fosphite	Pre-plant root dip: 2 qt/100 gal Drip irrig.: 2 - 3 qt in at least 100 gal	0	NL		
	43	Presidio 4SC	3 - 4 fl oz	2	12 fl oz		
	21	Ranman 3.33SC	2.75 fl oz	0	6 app		
	45,40	Zampro 4.33SC	14 fl oz	4	42 fl oz		
							Apply Fosphite at 2- to 4-week intervals in drip irrigation (see label).
							Apply as a soil spray or in drip irrigation. Must be mixed with a fungicide with a different mode of action.
					Apply in transplant water or to the base of the plant at transplanting. Can also be applied to the foliage, but must involve in a resistance management program (see label).		
					Apply at planting as a spray directed to plant base and root zone or in drip irrigation.		

## Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season		Remarks
<b>TOMATO, FIELD (CONT'D) (For assistance with fungicide selection, see Appendix 4 for a suggested spray program and relative effectiveness of fungicides)</b>							
<b>Pythium root and stem rot</b> Dark, watery rot of lower stem of young plants.	4	MetaStar 2E AG	2 - 4 qt	28	6 qt	Apply as a soil spray at planting in water or liquid fertilizer. Make subsequent application as soil spray or in drip irrigation at 4 - 6 wks after planting. For drip irrigation, base rate on a 7-in. band.	
	4	Ridomil Gold 4SL	1 - 2 pt/treated acre	28	3 pt		
	4	Ultra Flourish 2EC	2 - 4 pt/treated acre	28	6 pt		
	_____						
	33	Aliette/Linebacker 80WG	2.5 - 5 lb	14	20 lb	Foliar sprays.	
	28	Previcur Flex 6F	1.5 pt	5	7.5 pt	Apply via transplant water, drip irrigation, sprinklers or by directing nozzles to the lower portion of the plant and surrounding soil.	
<b>Sclerotinia stem rot (timber rot)</b> Dry, brown rot on stem. Black, raisin-like structures form inside stem.	11	Cabrio 20EG	12 - 16 oz	0	96 oz	Requires alternation with fungicides with a different mode of action. The Endura and Fontelis tomato labels do not include this disease; however, applied as for early blight control, they should provide some control of Sclerotinia.	
<b>Southern blight</b> Plants wilt and die. White mold often seen on base of stem.	<u>At planting</u>					Blocker applied in transplant water at ½ pt per plant. Fontelis applied at planting as a drench or in drip irrigation. Max rate per acre is 24 fl oz. Post-plant applications require complete coverage of the lower stem. Fontelis is applied 5 - 10 days after planting, with a 2 <sup>nd</sup> application 14 days later.	
	14	Blocker 4F	4.5 - 7.5 pt/100 gal				
	7	Fontelis 1.67SC	1 - 1.6 fl oz/1000 row ft				
	<u>Post-planting</u>						
	11	Cabrio 20EG	12 - 16 oz	0	96 oz		
	7	Fontelis 1.67SC	16 - 24 fl oz	0	72 fl oz		
<b>Verticillium wilt</b> Subtle wilting and yellowing.						Crop rotation, fumigation and resistant varieties are treatments.	
<b>TOMATO, GREENHOUSE</b>							
Begin spray program when conditions are favorable for disease or as soon as disease appears. Repeat at weekly intervals. Ventilate houses well, provide continuous air circulation and maintain relative humidity below 90%. Use leaf mold-resistant varieties. Protect bumblebee hives when applying these products.							
<b>TRANSPLANT PRODUCTION</b> - Do not use any of these products on young plants unless experience has indicated that such use is safe.							
<b>Early blight, gray leaf spot, late blight, leaf mold</b>	M	mancozeb 80WP <sup>4</sup>	1.5 - 2 lb/43,560 sq ft	NA	22.4 lb	Apply in 100 gal of water.	
<b>Botrytis - general</b>	17	Decree 50WG	1.5 - 2 lb/43,560 sq ft	NA	6 lb	Do not make more than 2 app. of Decree or Fontelis or 1 app. of Ph-D before rotating with a different mode of action.	
	19	Pd-D 11.3WDG	6.2 oz/43,560 sq ft	0	5 app		
	7	Fontelis 1.67SC	1 - 1.5 TBSP/ gal/1360 sq ft	0	2.2 fl oz/ 1360 sq ft		
	NC	Serenade	2 - 6 qt/43,560 sq ft	NA	NL		
<b>Bacterial spot and speck</b>	18	streptomycin sulfate 17W	1 lb/100 gal	NA	NL	<b>For transplant production only.</b> Apply if symptoms appear and repeat at 4- to 5-day intervals until transplanting.	
	NC	AgriPhage	3 - 8 fl oz/ 9600 sq ft	NA	NL	Apply every day if symptoms present. Do not mix with copper products.	

**Foliar, soil and post-harvest applications of disease-control products**

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/	Remarks
					Season	
<b>TOMATO, GREENHOUSE (CONT'D)</b>						
Pythium root rot	28	Previcur Flex 6F	Stock solution: 12.8 fl oz/100 gal	NA	2 app	Before transplanting: Apply stock solution to pre-wet cubes at 3.4 - 6.8 fl oz per cube. Refer to label for application to soil or soilless seed beds.
	21	Ranman 3.33 SC	3 fl oz/100 gal	NA	1 app	Drench the growing medium at time of planting or anytime thereafter up until 1 week before transplanting.
	NC	Zonix Biofungicide	300 - 500 ppm	0	NL	Apply as a drench 48 hr prior to seeding and repeat at 5-day intervals or as needed.
<b>AFTER TRANSPLANTING IN GREENHOUSE</b>						
Early blight, gray leaf spot, late blight, leaf mold	11	Tanos 50WG	6 - 8 oz/43,560 sq ft	3	72 oz	<b>Potential for phytotoxicity exists for Catamaran. Do not apply as a mixture with any other product.</b> Tanos must be tank mixed with and alternated with a non-Group 11 fungicide such as mancozeb.
	M	Catamaran	4.5 pt/43,560 sq ft	0	50 pt	
	M	mancozeb 80WP <sup>4</sup>	1.5 - 2 lb/100 gal	5	22.4 lb	
Botrytis - stem canker	14	Botran 75WP	1 lb/100 gal	10	4 app	Botran is sprayed to stem of plant from ground level up to height of 18-24 inches.
Botrytis - general	7	Fontelis 1.67SC	1 - 1.5 TBSP/ gal/1360 sq ft	0	2.2 fl oz/ 1360 sq ft	Foliar sprays. Do not make more 2 app. of Decree or Fontelis or 1 app of Ph-D before rotating to a different mode of action. Scala must be tank-mixed with a different mode of action fungicide. Ventilate for at least 2 hours after Scala application to avoid plant damage.
	9	Scala 5SC	7 fl oz/100 gal	1	35 fl oz	
	17	Decree 50WG	1.5 - 2 lb/43,560 sq ft	0	6 lb	
	19	Pd-D11.3WDG	6.2 oz/43,560 sq ft	0	5 app	
	NC	Serenade	2 - 6 qt/43,560 sq ft	0	NL	
	M	Catamaran	4.5 pt/43,560 sq ft	0	50 pt	
Bacterial speck, bacterial spot, early blight, late blight, Septoria leaf spot	M	fixed copper	see label	0	NL	Foliar sprays.
Pythium root rot	28	Previcur Flex	Stock solution: 12.8 fl oz/100 gal	5	4 app	After transplanting: Apply stock solution through drip system at 3.4 - 6.8 fl oz per cube. Limit to 3.4 fl oz during first 2 weeks after transplanting.
	14	Terramaster 4EC	0.01% solution, e.g., 6.5 fl oz/500 gal	3	4 app	Apply through drip system, no sooner than 3 weeks after transplanting, in volume of 6 - 8 fl oz per plant. Reapply as needed, but no sooner than 3 weeks after a previous application.
	NC	Zonix Biofungicide	300 - 500 ppm	0	NL	In soil and growing media, apply as a drench 48 hr prior to transplanting and repeat at 5-day intervals or as needed. Recirculating hydroponics or ebb-and-flow in rock wool or peat/perlite mixtures: Inject to achieve desired concentration and repeat at 5-day intervals or as needed..
Sclerotinia stem rot (timber rot)	NC	Contans WG	0.75 - 1.5 oz/1000 sq ft	NA	NL	Biological. Apply to soil about 3 months prior to planting. Till 2 in. to 8-in. deep. <b>Botran</b> or <b>Fontelis</b> as used for control of Botrytis should provide some control of timber rot.

## Foliar, soil and post-harvest applications of disease-control products

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/	Remarks	
					Season		
<b>TOMATO, GREENHOUSE (CONT'D)</b>							
<b>Powdery mildew</b>	19	Veranda O 11.4 WDG	6.2 oz/43,560 sq ft	0	5 app	Apply preventively and continue as needed on 10- to 14-day intervals. Alternate with a different mode of action.	
	7	Fontelis 1.67SC	1 - 1.5 TBSP/ gal/1360 sq ft	0	2.2 fl oz/ 1360 sq ft		
	4	Rally 40WP	2.5 - 4 oz/43,560 sq ft	0	1.25 lb		Spray at first sign of mildew and repeat at 14-day intervals.
	M	sulfur 90WP	5 lb/43,560 sq ft	0	NL		Extended spray intervals may be possible. Reapply only if mildew resumes activity. Do not apply if temps will exceed 90 F within 3 days.
<b>TURNIP GREENS</b>							
<b>Alternaria leaf spot</b> Dark brown leaf spots.	7	Fontelis 1.67SC	14 - 30 fl oz	3	72 fl oz	Begin prior to disease onset and follow 7- to 10-day schedule during rainy weather. Maintain thin plant stand and avoid low-lying or poorly drained soils. Rotate to a fungicide with a different mode of action after one application of Quadris or Quadris Top, or two applications of Inspire Super. <b>Tebuconazole and Quadris not for anthracnose.</b>	
	3	tebuconazole 3.6F	3 - 4 fl oz	7	16 fl oz		
	3,9	Inspire Super 2.82SC	16 - 20 fl oz	7	80 fl oz		
<b>Anthracnose</b> Small, tan spots on leaves and stems.	3,11	Quadris Top 2.72SC	12 - 14 fl oz	1	56 fl oz		
	11	Quadris 2.08F	6 - 15.5 fl oz	0	46 fl oz		
	M	fixed copper	See label	0	Label		
<b>Cercospora leaf spot</b> Tan spots, yellow haloes.	4	Ridomil Gold SL	0.125 - 0.25 pt	7	4 app		
	P1	Actigard 50WG	0.5 - 1 oz	7	4 app		
	21	Ranman 3.33SC	2.75 fl oz	0	6 app		
	40	Forum 4.18F	6 fl oz	0	5 app		
	M	fixed copper	See label	0	NL		
<b>Downy mildew</b> Yellow leaf spots with white mold on underside.	4	Ridomil Gold SL	0.125 - 0.25 pt	7	4 app		
	P1	Actigard 50WG	0.5 - 1 oz	7	4 app		
	21	Ranman 3.33SC	2.75 fl oz	0	6 app		
	40	Forum 4.18F	6 fl oz	0	5 app		
	M	fixed copper	See label	0	NL		
<b>Powdery mildew</b> White, powdery growth on leaves.	3	Procure 4SC	6 - 8 fl oz	1	18 fl oz		
	3	tebuconazole 3.6F	3 - 4 fl oz	7	16 fl oz		
	7	Fontelis 1.67SC	14 - 30 fl oz	3	72 fl oz		
	9,3	Inspire Super 2.82SC	16 - 20 fl oz	7	80 fl oz		
<b>Alternaria leaf spot</b> Dark brown leaf spot.	9,12	Switch 62.5WG	11 - 14 oz	7	56 oz		
	11	Quadris 2.08F	9 - 15.5 fl oz	0	123 fl oz		
	11,3	Quadris Top 2.72SC	12 - 14 fl oz	0	56 fl oz		
	M	sulfur	See label	0	NL		
<b>Pythium and Phytophthora</b> Damping off and root rot.	4	Ridomil Gold SL	1 - 2 pt/treated acre	NA	1 app		
	4	MetaStar 2E AG	4 - 8 pt/treated acre	NA	1 app		
	4	Ultra Flourish	2 - 4 pt/treated acre	NA	1 app		
<b>TURNIP, RUTABAGA (Harvested for roots only)</b>							
<b>Alternaria leaf spot</b> Dark brown leaf spots.	3	tebuconazole 3.6F (turnip only)	4 - 7.2 fl oz	7	28 fl oz	Rotate to a different mode of action after 1 application of trifloxystrobin, Cabrio or Quadris or 2 consecutive applications of Fontelis, Merivon or Switch. Cultural practices are important: Maintain thin plant stand and avoid poorly drained soils. Planting in rows provides better drying conditions than broadcasting. <b>Tebuconazole, Merivon and Fontelis not for anthracnose.</b>	
	7	Fontelis 1.67SC	16 - 30 fl oz	0	61 fl oz		
<b>Anthracnose</b> Small, tan spots on leaves and stems.	11,7	Merivon 4.17SC	5.5 fl oz	7	3 app		
	11	Cabrio 20EG	8 - 12 oz	0	3 app		
	11	Quadris 2.08F	6 - 15.5 fl oz	0	123 fl oz		
	11	trifloxystrobin					
<b>Cercospora leaf spot</b> Tan spots, yellow haloes.		Flint 50WG	2 - 3 oz	7	4 app		
		Gem 4.17SC	1.9 - 2.9 fl oz	7	4 app		
<b>Downy mildew</b> Yellow leaf spots with white mold on underside.	21	Actigard 50WG	0.5 - 1 oz	7	4 app		

**Foliar, soil and post-harvest applications of disease-control products**

Disease and Major Symptoms	Product Choices and Mode of Action Group <sup>1</sup>		Rate <sup>2</sup>	PHI <sup>3</sup>	Maximum Use/Acre/Season	Remarks
<b>TURNIP, RUTABAGA (Harvested for roots only) (CONT'D)</b>						
<b>Powdery mildew</b> White, powdery growth on leaves.	3	tebuconazole 3.6F (turnip only)	4 - 7.2 fl oz	7	28 fl oz	Apply at early leaf stage and repeat every 10 - 14 days, if necessary. Rotate to a different mode of action after 1 application of trifloxystrobin or Quadris or 2 consecutive applications of Fontelis, Merivon or Switch.
	7	Fontelis 1.67SC	16 - 30 fl oz	0	61 fl oz	
	9,12	Switch 62.5WG	11 - 14 oz	7	56 oz	
	11	Cabrio 20EG	8 - 12 oz	0	3 app	
	11	trifloxystrobin				
		Flint 50WG	2 - 3 oz	7	4 app	
		Gem 4.17SC	1.9 - 2.9 fl oz	7	4 app	
	11,7	Merivon 4.17SC	5.5 fl oz	7	3 app	
M	sulfur	See label	0	NL		
<b>Pythium and Phytophthora</b> Damping off and root rot.	4	Ridomil Gold SL	1 - 2 pt/treated acre	NA	1 app	Apply preplant incorporated into top 2 in. or at planting as a soil spray.
	4	MetaStar 2E AG	4 - 8 pt/treated acre	NA	1 app	
	4	Ultra Flourish	2 - 4 pt/treated acre	NA	1 app	
	43	Presidio 4SC	3 - 4 fl oz	7	12 fl oz	Apply at planting as a soil spray.
<b>WATERMELON - See MELONS</b>						

FOOTNOTES USED IN TABLE 5:

- <sup>1</sup> See Appendix 2 for strategies for preventing the development of pathogen resistance to fungicides.
- <sup>2</sup> Rates are amount of formulation per acre unless otherwise stated. Usually 100 gallons of water are required to give adequate coverage with boom sprayers. Less water is required with air blast or mist blower-type sprayers.
- <sup>3</sup> PHI (preharvest interval) is the minimum number of days between last application and harvest.
- <sup>4</sup> Where mancozeb 80WP is recommended, flowable formulations and dry flowable formulations of mancozeb can be used at the labeled rate. Where chlorothalonil 6L is recommended, other formulations can also be used. Refer to product labels for rates.

## Appendix 1

### Chemical Control Products for Diseases of Vegetables

This listing does not imply any recommendations, but is provided solely as a reference. List of trade names is not complete.

Common Name	Trade Names	Type	Mode of Action Group	REI* (hours)	Formulations
acibenzolar-S-methyl	Actigard	PA	P1	12	50% WDG
allyl isothiocyanate	Dominus	Fum		120	8.19L
ametoctradin + dimethomorph	Zampro	F	45 + 40	12	4.33 L
azoxystrobin	Equation Quadris Satori Trevo	F	11	4	2.08 L
azoxystrobin + chlorothalonil	Quadris Opti	F	11 + M	12	0.5 L + 5 L
azoxystrobin + difenoconazole	Quadris Top	F	11 + 3	12	1.67 L + 1.05 L
azoxystrobin + propiconazole	Quilt	F	11 + 3	24	0.62 L + 1.04 L
boscalid	Endura	F	7	12	70%WDG
chlorothalonil	Bravo Chloronil Chlorothalonil Echo Equus Initiate	F	M	48	4.2 L, 6 L, 82.5% WDG 6 L 4.2 L, 6 L 4.2 L, 90%DF 6 L, 82.5% WDG 4.2 L, 6 L
coppers, fixed	Camelot O Champ Cupro 5000 Cuprofix Ultra 40 Disperss Cuproxtat Kocide MasterCop Nu-Cop	B,F	M	24-48	Various
copper-sulfur	Top Cop with Sulfur	F	M	24	1 + 6.25 L
cyazofamid	Ranman	F	21	12	3.33 L
cyflufenamid	Torino	F	U	4	0.85L
cymoxanil	Curzate	F	27	12	60% DF
cyprodinil	Vanguard	F	9	12	75%WDG
cyprodinil + fludioxonil	Switch	F	9 + 12	12	37.5% + 25% WDG
dicloran	Botran	F	14	12	75% WP
1,3-dichloropropene	(R)Telone II	Fum		120	94% L
1,3-dichloropropene	(R)Pic-Chlor 60	Fum		120	39% + 59.6% L
+ chloropicrin	(R)Telone C-17	Fum		120	78.3% + 16.5% L
	(R)Telone C-35	Fum		120	63.1% + 34.7% L
difenoconazole + cyprodinil	Inspire Super	F	3 + 9	12	0.73 L + 2.09 L
dimethomorph	Forum	F	40	24	4.18 L
dimethyl disulfide	(R)Paladin (R)Paladin EC	Fum Fum		120 120	98.8% L 93.8% EC
famoxadone + cymoxanil	Tanos	F	11 + 27	12	50%WG
fenamidone	Reason	F	11	12	4.13 L
fenhexamid	Decree	F	17	12	50% WDG



## Chemical Control Products for Diseases, *Continued*

Common Name	Trade Names	Type	Mode of Action Group	REI* (hours)	Formulations
fluazinam	Omega	F	29	48	4.2L
fluensulfone	Nimitz	N		0	4 L
fludioxonil	Cannonball WP Maxim Scholar	F	12	12	50% WP 0.5% D, 4 L 1.92 SC
fluopyram + tebuconazole	Luna Experience	F	7 + 3	12	3.34 L
fluopyram + pyrimethanil	Luna Tranquility	F	7 + 9	12	4.16 L
fluopyram + trifloxystrobin	Luna Sensation	F	7 + 11	12	4.2L
fluopicolide	Presidio	F	43	12	4 L
fluoxastrobin	Evito 480SC	F	11	12	4 L
flutolanil + mancozeb	Moncoat MZ	F	7 + M	24	1.5% + 6% D
fluxapyroxad + pyraclostrobin	Priaxor Merivon	F	7 + 11	12	4.17 L
fosetyl-Al	Aliette Linebacker	F	33	12	80% WDG 80% WDG
iprodione	Rovral Iprodione Meteor Nevado	F	2	24	4 L 4 L 4 L 4L
kresoxim-methyl	Sovran	F	11	12	50 WG
mancozeb	Dithane DF Rainshield Dithane F45 Dithane M45 Koverall Manzate Flowable Manzate Pro-Stik Penncozeb Penncozeb DF Penncozeb 4FL Roper DF Rainshield	F	M	24	75% DF 4 L 80% WP 75% WP 4 L 75% DF 80% WP 75% DF 4 L 75%DF
mandipropamid	Revus	F	40	4	2.08 L
mandipropamid + difenoconazole	Revus Top	F	40 + 3	12	2.08 + 2.08 L
mefenoxam	Ridomil Gold SL Ultra Flourish	F	4	48	4 L 2 L
mefenoxam + azoxystrobin	Uniform	F	4 + 11	0	1.04 + 2.68 L
mefenoxam + chlorothalonil	Flouronil Ridomil Gold Bravo	F F	4 + M 4 + M	48 48	4.5% + 72% WP 3.3% + 33.1% L
mefenoxam + copper	Ridomil Gold Copper	F	4 + M	48	5% + 60% WP
mefenoxam + mancozeb	Ridomil Gold MZ	F	4 + M	48	4% + 64% WP
mefenoxam + PCNB	Ridomil Gold PC	F	4 + 14	48	0.5% + 10% G
metconazole	Quash	F	3	12	50% WDG
methyl bromide + chloropicrin	(R)Terr-O-Gas 50 (R)Terr-O-Gas 67	Fum		72	50% + 50% L 67% + 33% L
metiram	Polyram	F	M	24	80% DF
metalaxyl	MetaStar	F	4	48	2 L
myclobutanil	Rally (formerly Nova)	F	3	24	40% WP
oxamyl	Vydate L	N		48	2 L
PCNB	Blocker	F	14	12	4 L, 10% G

## Chemical Control Products for Diseases, *Continued*

Common Name	Trade Names	Type	Mode of Action Group	REI* (hours)	Formulations
penthiopyrad	Fontelis Vertisan	F	7	12	1.67SC 1.67EC
phosphorous acid	Agri-Fos Fosphite ProPhyt Phostrol	F	33	4	3.35 L 3.90 L 4.2 L 4.32 L
phosphorous acid + tebuconazole	Viathon	F	33 + 3	12	4.08 L
polyoxin D zinc salt	Ph-D	F	19	4	11.3% WDG
potassium bicarbonate	Armcarb 100	F	NC	4	85% WP
potassium methyl dithiocarbamate	K-Pam HL	Fum		48	54% L
propamocarb	Previcur Flex	F	28	12	6 L
propiconazole	Bumper Tilt Propiconazole PropiMax	F	3	24	3.6 L
propiconazole + trifloxystrobin	Stratego	F	3 + 11	24	2.08 L
prothioconazole	Proline	F	3	12	4L
pyraclostrobin	Cabrio Headline	F	11	12	20% WDG 2.09 L
pyraclostrobin + boscalid	Pristine	F	7 + 11	24	38%WG
pyrimethanil	Scala	F	9	12	5 L
quinoxifen	Quintec	F	13	12	2.08 L
ramnolipid biosurfactant	Zonix	F	NC	4	8.5% L
sodium methyl dithiocarbamate (metam sodium)	Metam CLR Sectagon 42 Vapam	Fum		72	33% L
streptomycin sulfate	Ag Streptomycin Agri-mycin 17 Firewall	B	18	4	21% WP
sulfur	Kumulus Liquid Sulfur Six Microthiol Disperss Drexel Sulfur Thiolux	F	M	24	80% DF 6 L 80% DF 90% WP 80% DF
tebuconazole	Amtide Tebu Monsoon Onset Orius Savannah Tebuconazole Tebusha Tebuzol Toledo	F	3	12	3.6 L
thiabendazole	Mertect 340-F	F	1	12	3.8 L
thiophanate-methyl	Incognito Topsin-M Thiophanate Methyl T-Methyl	F	1	12	85%WDG, 4.5L 70% WP, 70% WDG, 4.5 L 85% WDG 70% WP, 4.5 L

## Chemical Control Products for Diseases, *Continued*

Common Name	Trade Names	Type	Mode of Action Group	REI* (hours)	Formulations
trifloxystrobin	Flint Gem	F	11	12	50% WDG 4.17 L
triflumizole	Procure	F	3	12	50% WP, 4L
triphenyltin hydroxide	Super Tin	F	30	48	80% WP
ziram	Ziram 76	F	M	48	76% DF
zoxium + mancozeb	Gavel	F	22 + M	48	8.3% + 66.7% DF

\* REI (restricted entry interval) is the time immediately after a pesticide application when entry into the treated area is limited. Refer to the product label for early-entry requirements.

**Guide to abbreviations used:** (R) = restricted-use pesticide; B = bactericide; F = fungicide; Fum = fumigant; N = nematicide; PA = plant activator; G = granules; DF = dry flowable; D = dust; WDG = water dispersible granules; WP = wettable powder; L = liquid. Liquid formulations are expressed as pounds of active ingredient per gallon unless percent is specified.

### Trade Name Cross-Reference

Trade Name	Common Name	Trade Name	Common Name	Trade Name	Common Name
Actigard	acibenzolar-S-methyl	Linebacker	fosetyl-AI	Ranman	cyazofamid
Ag Streptomycin	streptomycin sulfate	Liquid Sulfur Six	sulfur	Reason	fenamidone
Agri-Fos	phosphorous acid	Luna Experience	fluopyram + tebuconazole	Revus	mandipropamid
Agri-mycin 17	streptomycin sulfate	Luna Sensation	fluopyram + trifloxystrobin	Revus Top	mandipropamid + difenoconazole
Aliette	fosetyl-AI	Luna Tranquility	fluopyram + pyrimethanil	Ridomil Gold Bravo	mefenoxam + chlorothalonil
Amtide Tebu	tebuconazole	Manzate Flowable	mancozeb	Ridomil Gold Copper	mefenoxam + copper
Armcarb 100	potassium bicarbonate	Manzate Pro-Stik	mancozeb	Ridomil Gold MZ	mefenoxam + mancozeb
Blocker	PCNB	MasterCop	copper sulfate pentahydrate	Ridomil Gold PC	mefenoxam + PCNB
Botran	dicloran	Maxim	fludioxonil	Ridomil Gold SL	mefenoxam
Bravo	chlorothalonil	Mertect 340-F	thiabendazole	Roper DF Rainshield	mancozeb
Bumper	propiconazole	Merivon	fluxapyroxad + pyraclostrobin	Rovral	iprodione
Cabrio	pyraclostrobin	Metam CLR	sodium methyl dithiocarbamate (metam sodium)	Satori	azoxystrobin
Camelot O	copper octanoate	MetaStar	metalaxyl	Savannah	tebuconazole
Cannonball WP	fludioxonil	Meteor	iprodione	Scala	pyrimethanil
Champ	copper hydroxide	Microthiol Disperss	sulfur	Scholar	fludioxonil
Chloronil	chlorothalonil	Moncoat MZ	flutolanil + mancozeb	Sectagon 42	sodium methyl dithiocarbamate (metam sodium)
Chlorothalonil	chlorothalonil	Monsoon	tebuconazole	Sovran	kresoxim-methyl
Cupro 5000	copper hydroxide	Nevado	iprodione	Stratego	propiconazole + trifloxystrobin
Cuprofix Disperss	basic copper sulfate	Nimitz	fluensulfone	Switch	cyprodinil + fludioxonil
Cuproxat	basic copper sulfate	Nu-Cop	copper hydroxide	Tanos	famoxadone + cymoxanil
Curzate	cymoxanil	Omega	fluazinam	Tebuconazole	tebuconazole
Decree	fenhexamid	Onset	tebuconazole	Tebusha	tebuconazole

## Chemical Control Products for Diseases, *Continued*

Trade Name	Common Name	Trade Name	Common Name	Trade Name	Common Name
Dithane DF Rainshield	mancozeb	Orius	tebuconazole	Tebuzol	tebuconazole
Dithane F45	mancozeb	Paladin	dimethyl disulfide	Telone C-17	1,3-dichloropropene + chloropicrin
Dithane M45	mancozeb	Penncozeb	mancozeb	Telone C-35	1,3-dichloropropene + chloropicrin
Dominus	ally isothiocyanate	Penncozeb 4FL	mancozeb	Telone II	1,3-dichloropropene
Drexel Sulfur	sulfur	Penncozeb DF	mancozeb	Terr-O-Gas 50	methyl bromide + chloropicrin
Echo	chlorothalonil	Ph-D	polyoxin D zinc salt	Terr-O-Gas 67	methyl bromide + chloropicrin
Endura	boscalid	Phostrol	phosphorous acid	Thiolux	sulfur
Equation	azoxystrobin	Pic-Chlor 60	1,3-dichloropropene + chloropicrin	Thiophanate Methyl	thiophanate-methyl
Equus	chlorothalonil	Polyram	metiram	Tilt	propiconazole
Evito 480SC	fluoxastrobin	Presidio	fluopicolide	T-Methyl	thiophanate-methyl
Firewall	streptomycin sulfate	Previcur Flex	propamocarb	Toledo	tebuconazole
Flint	trifloxystrobin	Priaxor	fluxapyroxad + pyraclostrobin	Top Cop with Sulfur	copper-sulfur
Flouronil	mefenoxam + chlorothalonil	Pristine	pyraclostrobin + boscalid	Topsin-M	thiophanate-methyl
Fontelis	penthiopyrad	Procure	triflumizole	Torino	cyflufenamid
Forum	dimethomorph	Proline	prothioconazole	Trevo	azoxystrobin
Fosphite	phosphorous acid	ProPhyt	phosphorous acid	Ultra Flourish	mefenoxam
Gem	trifloxystrobin	Propiconazole	propiconazole	Uniform	mefenoxam + azoxystrobin
Headline	pyraclostrobin	PropiMax	propiconazole	Vanguard	cyprodinil
Incognito	thiophanate-methyl	Quadris	azoxystrobin	Vapam	sodium methyl dithiocarbamate (metam sodium)
Initiate	chlorothalonil	Quadris Opti	azoxystrobin + chlorothalonil	Veranda O	polyoxin D zinc salt
Inspire Super	difenoconazole + cyprodinil	Quadris Top	azoxystrobin + difenoconazole	Vertisan	phosphorous acid
Iprodione	iprodione	Quash	metconazole	Viathon	phosphorous acid + tebuconazole
Kocide	copper hydroxide	Quilt	azoxystrobin + propiconazole	Vydate L	oxamyl
Koverall	mancozeb	Quintec	quinoxifen	Zampro	ametoctradin + dimethomorph
K-Pam HL	potassium methyl dithiocarbamate	Rally (formerly Nova)	myclobutanil	Zonix	ramnolipid biosurfactant
Kumulus	sulfur				

## Appendix 2

### Resistance Management

Most modern fungicides and bactericides are subject to losing effectiveness due to resistance development and must be involved in a resistance management program. The essence of such programs is to minimize the use of the product, which includes rotating it with non-related products that are effective against the target disease. A "non-related" product is one that belongs to a different resistance management group. These groups are defined and separated by their mode of action, i.e., how they attack the fungus. The Fungicide Resistance Action Committee (FRAC) has established the following table to classify disease-control products. Groups that are at medium to high risk of resistance development must be alternated or tank-mixed with members of other groups.

**Table 1. Resistance management groups for disease control products for vegetables.**

Group Number	Group Name and Examples
Medium- to High-Risk Groups (resistance management needed)	
1	benzimidazoles (ex. Mertect, Topsin M)
2	dicarboximides (ex. Iprodione, Rovral)
3	demethylation inhibitors (DMI's), includes the <i>imidazoles</i> (ex. Procure) and the <i>triazoles</i> (ex. Rally, Tilt)
4	phenylamides (ex. Ridomil Gold, Ultra Flourish)
7	carboxamides (ex. Endura, Fontelis, Luna, Priaxor)
9	anilinopyrimidines (ex. Vanguard, Scala)
11	quinone outside inhibitors (Qoi's) (ex. Quadris, Headline, Cabrio, Flint)
12	phenylpyrroles (ex. Maxim)
13	quinolines, (ex. Quintec)
14	aromatic hydrocarbons (ex. Botran; Terraclor)
17	hydroxyanilids (ex. Decree)
21	quinone inside Inhibitors (Qii's) (ex. Ranman)
22	benzamides (ex. Gavel)
25	glucopyranosyl antibiotic (ex. Agri-mycin 17, Ag Streptomycin, Firewall)
27	cyanoacetamideoximes (ex. Curzate)
28	carbamates (ex. Previcur Flex)
40	carboxylic acid amides (ex. Forum, Revus)
43	acylpicolides (ex. Presidio)
45	quinone x inhibitors (ex. Zampro)
U6	phenyl acetamides (ex. Torino)
Low-Risk Groups (resistance management not needed)	
29	2,6-dinitroanilines (ex. Omega)
30	organo-tin compounds (ex. Super Tin)
33	ethyl phosphonates (ex. Aliette), and phosphorous acid (ex. ProPhyt, Phostrol, AgriFos)
M1	inorganics - copper - Resistance management recommended for bacterial diseases (medium risk)
M2	inorganics - sulfur
M3	dithiocarbamates (ex. mancozeb, metiram, thiram, ziram)
M4	phthalimides (ex. captan)
M5	chloronitriles (ex. chlorothalonil)
P1	benzo-thiadiazole (ex. Actigard)
NC	oils, bicarbonates, biologicals (ex. neem oil, Armicarb, Contans, Serenade, AgriPhage)

M = multi-site activity, P = plant defense induction, NC = not classified

## Appendix 3

### Cucurbit Spray Program

**Table 1. Suggested spray program for disease control in cucurbit crops.**

<p><b>Early season:</b>            Use a primary fungicide (chlorothalonil or mancozeb) every 7 to 14 days (more frequently in wet weather, less frequently in dry weather). Begin the program at vine tip-over to early bloom (3 to 4 weeks after seeding). Inspect the field for disease symptoms beginning at seedling emergence so that the spray program can be started sooner than planned, if needed. If plectosporium blight appears in pumpkin or squash, Flint or Cabrio should be alternated with the primary fungicide. Otherwise, there is little need to rotate the primary fungicides with other fungicides in the early season. (Chlorothalonil and mancozeb are not subject to the development of resistance, so continued use is not a problem.)</p> <p><b>Mid-Late Season:</b>            Scout for powdery mildew when this disease becomes a threat, around midsummer. When the first powdery mildew colonies (circular, white patches) are seen, add sulfur, Torino, Fontelis or Quintec (if labeled) to the tank with the primary fungicide (preferably chlorothalonil, when powdery mildew is present). This tank mix can be alternated with Pristine, if desired. Do <b>not</b> depend on Flint, Cabrio or Quadris for powdery mildew control, since resistance to the strobilurins is widespread in this fungus. Various diseases can occur in mid-late season, and the choice of fungicides should be determined by which diseases appear in the current year, or have occurred in the field in previous years. Air blast sprayers are needed when canopies become thick. Apply sprays every 7 to 14 days, depending on rainfall. Add copper to the tank mix if angular leaf spot or bacterial leaf spot appear.</p>
---

Table 2, on the following page, provides efficacy ratings for disease-control products labeled for cucurbit crops. It will assist in selecting the most appropriate fungicide for the diseases encountered in a field.

Example spray program for PUMPKIN:

Application no.	Timing <sup>a</sup>	Product
1	Begin vine running	MSF <sup>b</sup>
2		MSF
3		MSF
4	1 <sup>st</sup> appearance of powdery mildew <sup>c</sup>	MSF + PMF <sup>d</sup> 1
5	d owny mildew warning issued <sup>c</sup>	MSF + PMF2 + Ranman
6		MSF + PMF1 + Zampro
7		MSF + PMF2 + Ranman

<sup>a</sup> Applications every 7 to 14 days, depending on rainfall, except where noted.

<sup>b</sup> MSF: Multi-site fungicide = chlorothalonil or mancozeb. For organic production, copper.

<sup>c</sup> Hypothetical situation; these triggers could occur at any time. Downy mildew tracking and forecasts available at <http://cdm.ipmpipe.org/>

<sup>d</sup> PMF: Powdery mildew fungicide. Choose two of these and alternate them: Quintec, sulfur, Torino, Fontelis. For organic production, sulfur. Sulfur does not require alternation.

**Table 2. Relative effectiveness of disease-control products in cucurbit crops (0 to 5 scale).**

Product <sup>a</sup>	Alternaria Leaf Spot	Anthraco nose	Downy Mildew	Gummy Stem Blight	Phytophthora Blight	Plectosporium (Microdochium) Blight	Powdery Mildew
Aliette, Linebacker	0	0	1	0	0	0	0
Cabrio	4	4	0 <sup>c</sup>	4	1	4	0 <sup>c</sup>
chlorothalonil	3	4	3	4	0	3	2
copper, fixed	0	1	3	1	1	2	2
Curzate	0	0	2	0	2	0	0
Flint	4	4	0 <sup>c</sup>	4	0	4	0 <sup>c</sup>
Fontelis	5	1	0	5	0	0	4
Forum	0	0	1	0	1	0	0
Gavel	3	2	3	2	1	2	1
Inspire Super	--	2	0	3	0	3	2
Luna Experience (watermelon only)	5	2	0	5	0	--	5
mancozeb	3	3	3	3	1	3	1
mefenoxam	0	0	0	0	V <sup>b</sup>	0	0
phosphorous acid	0	0	1	0	2	0	0
Previcur Flex	0	0	3	0	1	0	0
Presidio	0	0	3	0	2	0	0
Pristine	4	4	0 <sup>c</sup>	5	1	3	3
Procure	0	0	0	0	0	0	2
Quadris	4	4	0 <sup>c</sup>	4	0	2	0 <sup>c</sup>
Quintec	0	0	0	0	0	0	5
Rally	0	0	0	0	0	0	2
Ranman	0	0	4	0	2	0	0
Reason	2	0	3	0	--	0	0
Revus	0	0	2	0	3	0	0
sulfur	0	0	0	0	0	0	4
Sovran	--	--	0 <sup>c</sup>	4	--	--	0 <sup>c</sup>
Switch	0	0	0	5	0	2	2
Tanos	–	–	2	0	–	0	0
Torino	0	0	0	0	0	0	5
tebuconazole	0	0	0	3	0	0	2
thiophanate methyl	0	2	0	2	0	2	0 <sup>c</sup>
Zampro	0	0	3	0	0	0	0

– = unknown, 0= not effective, 1= slight control, 2= fair control (adequate only when conditions are unfavorable for the disease), 3= moderate control (adequate in most seasons), 4= very good control, 5= excellent control. All of these ratings apply to the use of these materials on a regular, preventive schedule begun before the onset of disease.

<sup>a</sup> Please refer to Appendix 1 for trade names.

<sup>b</sup> Variable. The occurrence of resistance to this material in pathogen populations results in unpredictable control.

<sup>c</sup> Product is no longer effective because of widespread resistance to it in the pathogen population.

## Appendix 4

### Tomato Spray Program

A tomato spray program should focus on materials that protect against early blight while also providing some protection against other diseases. A broad-spectrum material should be included each application and add specialized products, listed in this publication, as needed for other unexpected diseases that may occur, such as late blight, gray mold or Sclerotinia.

**If problems with bacterial spot or speck are expected**, apply mancozeb+Actigard the first week after transplanting. Use mancozeb+copper the following spray and alternate that with Fontelis+Actigard and Inspire Super+Actigard until the allowed number of applications has been reached (three each, for Fontelis and Inspire Super). If bacterial disease control is still needed at that time, use copper or Agri-Phage in each application. The 5-day PHI for mancozeb may not be compatible with a harvest schedule. If so, substitute chlorothalonil for mancozeb during harvest. Likewise, Actigard should be discontinued during harvest because of its 14-day PHI. **Note:** It is recommended that strobilurin fungicides (Cabrio, Quadris) no longer be used for early blight control because of the prevalence of resistant strains. Effective early blight fungicides are needed in each application. If late blight occurs, appropriate fungicides must be added. Fontelis and Inspire Super do not have any late blight activity.

**Table 1. Suggested spray program for disease control in tomato crops.**

Week	Products
1	mancozeb + Actigard
2	mancozeb + copper
3	Fontelis + Actigard
4	mancozeb + copper
5	Inspire Super + Actigard
6	mancozeb + copper
7	Fontelis + Actigard.
8	mancozeb + copper
9	Inspire Super + Actigard
10	chlorothalonil + copper

Week	Products
11 -begin harvest	Fontelis + copper
12	chlorothalonil + copper
13	Inspire Super + copper
14	chlorothalonil + copper
15	chlorothalonil + copper

Agri-Phage can be used instead of copper.

**In areas in which bacterial spot or speck problems are not expected**, omit Actigard, copper and Agri-Phage. Copper and Agri-Phage can be added if bacterial diseases appear.

Table 2, on the following page, provides efficacy ratings for disease-control products labeled for tomato. It will assist in selecting the most appropriate fungicide for the diseases encountered in a field.



**Table 2. Relative effectiveness of disease-control products in tomato (0 to 5 scale).**

Product <sup>a</sup>	Early Blight	Late Blight	Septoria Leafspot	Gray Mold	Bacterial Spot, Speck
Actigard	0	0	0	0	3
AgriPhage	0	0	0	0	2
Cabrio	0 <sup>b</sup>	3	4	0	0
chlorothalonil	3	4	4	2	0
copper, fixed	2	2	2	0	3
Curzate	0	3	0	0	0
Endura	4	0	--	3	0
Flint	0 <sup>b</sup>	2	--	0	0
Forum	0	3	0	0	0
Fontelis	5	0	4	3	0
Gavel	3	2	3	0	0
Inspire Super	5	0	3	0	0
mancozeb	3	2	4	0	0
mefenoxam	0	0 <sup>b</sup>	0	0	0
Ph-D	2	1	--	2	--
Previcur Flex	0	3	0	0	0
Presidio	0	4	0	0	0
Priaxor	4	0	--	3	0
Quadris	0 <sup>b</sup>	3	4	0	0
Ranman	0	3	0	0	0
Reason	3	3	1	0	0
Revus	0	4	0	0	0
Revus Top	3	4	--	0	0
Scala	2	0	0	3	0
Switch	3	--	--	4	0
Tanos	0 <sup>b</sup>	3	3	0	1
Zampro	0	4	0	0	0

-- = unknown, 0= not effective, 1= slight control, 2= fair control (adequate only when conditions are unfavorable for the disease), 3= moderate control (adequate in most seasons), 4= very good control, 5= excellent control. All of these ratings apply to the use of these materials on a regular, preventive schedule begun before the onset of disease. These ratings apply to commonly used rates of the products, applied so that the plants are adequately covered.

<sup>a</sup> Please refer to Appendix 1 for trade names.

<sup>b</sup> Resistance to this product has been detected and is believed to be widespread.

**Disclaimer**

This publication contains pesticide recommendations that are subject to change at any time. The recommendations in this publication are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. The label always takes precedence over the recommendations found in this publication.

Use of trade or brand names in this publication is for clarity and information; it does not imply approval of the product to the exclusion of others that may be of similar, suitable composition, nor does it guarantee or warrant the standard of the product. The author(s), the University of Tennessee Institute of Agriculture and University of Tennessee Extension assume no liability resulting from the use of these recommendations.



[AG.TENNESSEE.EDU](http://AG.TENNESSEE.EDU)

Real. Life. Solutions.

W 141 (Rev.) 02/15 15-0127

Programs in agriculture and natural resources, 4-H youth development, family and consumer sciences, and resource development. University of Tennessee Institute of Agriculture, U.S. Department of Agriculture and county governments cooperating. UT Extension provides equal opportunities in programs and employment.