

# TIMELY INFORMATION

## Agriculture & Natural Resources

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### CONTROL OF ROOT, CROWN AND FOLIAR DISEASES OF BEDDING PLANTS AND FLOWERS IN THE GREENHOUSE AND LANDSCAPE

Austin Hagan

Professor and Extension Plant Pathologist  
Dept. Entomology and Plant Pathology  
Auburn University

#### Disease Control Strategies for Greenhouse Bedding and Floral Crops

Prevention is the key to minimizing disease-related plant and income losses during the production, shipping, and sales of greenhouse bedding and floral crops. Disease prevention strategies include the production of disease-resistant cultivars or selections, cultural practices, crop sanitation, greenhouse design, and chemical control. In the near future, biological control practices may also become an integral part of a disease management program for bedding and floral crops. Generally, no single control strategy will insure complete control from damaging diseases, particularly root rots. Rather, several strategies are usually combined to prevent costly disease outbreaks in greenhouse crops.

#### Disease Resistance

Production and establishment of disease resistant cultivars or selections is an inexpensive and often effective means of reducing the risk of damaging disease as well as lowering production costs. Disease resistance is, however, rarely included among the criteria used to identify new bedding plant or floral crop selections. In particular, many popular bedding and floral crops are highly sensitive to one or more root rot diseases. Some differences in the reaction of cultivars or lines of selected bedding or floral crops to certain diseases have been noted and every effort should be made to exploit available sources of resistance.

**Cultural Practices:** Cultural practices utilized to minimize the risk of disease outbreaks in bedding and floral crops include greenhouse design, sanitation, potting media components, watering patterns, as well as media fertility and pH.

**Greenhouse Design:** Preferably, bedding and floral crops should be grown on raised benches covered with heavy gauge wire or similar open material. Cedar slats benches should be avoided. Where bedding plants are produced on porous concrete or gravel floors, beds should be slightly crowned to speed drainage of excess water and prevent ponding around flats or pot-grown stock. Avoid growing greenhouse crops on flat beds on plastic or fiber-covered native soil, which is a source for root rot causing fungi.

In poorly ventilated greenhouses, selected floral and foliar diseases are quite common on certain bedding and floral crops. Moisture condenses on plant foliage as damp, humid air cools at or shortly after sundown. Heavy dews can form anytime in late fall through spring especially during a day or more of mild, rainy, overcast weather [typically a warm front accompanied by heavy cloud cover and lots of rain]. Only a few hours of dampness or free water on leaves or stems is sufficient for infection by some disease-causing bacteria and powdery mildew fungi. Overnight wetting of the foliage is extremely conducive to outbreaks of diseases such as Botrytis blight, downy mildew, and Rhizoctonia web blight.

Timely ventilation and heating is the most effective means of managing moisture in a greenhouse, particularly in the fall, winter and spring. By venting the humid, warm ambient air in the late afternoon or early evening hours and slightly heating [and thereby drying] the incoming air, humidity in the greenhouse can often be held below the threshold for disease development [85% for Botrytis blight]. Greenhouse moisture management can be particularly tricky during mild, wet winter weather. Also, sufficient fans or similar ventilation equipment should be installed to prevent isolated pockets of damp air from settling around greenhouse crops and to facilitate air circulation. During humid, summer months, a combination of evaporative cooling pads and fans will also help remove excess moisture. Finally, space out pot-grown crops on benches to allow air to circulate around the foliage.

**Potting Media:** Occurrence and severity of soilborne diseases is often tied to the accidental contamination of potting media by plant pathogenic fungi during propagation or production. Soilless media used by nearly all greenhouse operations typically is relatively pathogen-free. Contamination of selected peat-containing mixes by *Thielaviopsis basicola*, which is the fungus that causes black root rot on pansy, vinca (periwinkle), and other floral crops, is not uncommon.

Crops grown in poorly-drained or compacted potting media are at greatest risk from root rot diseases. To drain quickly, potting media must have about 20 to 30 percent air space. Addition of fine amendments, such as peat moss or fine clay, slow water percolation and will lead to a waterlogged, poorly aerated media. Peat moss and composed bark materials will decay and often become compacted; thereby slowing the movement of water through potting media. Finally, never add raw soil to potting media.

**Watering Practices:** Moisture is a critical component in the development of both soil, foliar, and floral diseases of greenhouse crops. While all greenhouse crops require a good bit of water for optimum growth, excessive moisture levels in the media and on the foliage will increase the incidence and severity of most diseases. To avoid over or under watering, pot and flat-grown stock should be segregated according to water needs, especially when using an ebb & flow or similar automated watering system. When scheduling overhead irrigation, water at mid-day but not late enough in afternoon or early evening so that the leaves remain wet all night. Wetting of the foliage can also be minimized by installing a drip, ebb & flow, or similar irrigation system. Never recycle greenhouse or nursery run-off unless a chlorination or similar water treatment system has been installed.

**Soil Fertility:** The impact of soil fertility has been demonstrated for only a handful of diseases of greenhouse crops. Nitrogen form, i.e. ammoniac vs. nitrate nitrogen, has been shown to influence the development of *Thielaviopsis* black root rot on pansy. A deficiency of calcium may greatly increase the sensitivity of floral crops to the Botrytis blight. Excessive rates of nitrogen fertilizers raise salt levels in potting

media, which may ultimately predispose the roots attack by root rot fungi like *Pythium* or *Phytophthora*. Salt damage on greenhouse crops can be avoided by monitoring nitrogen fertility levels with a salt meter.

**Sanitation:** Spent blooms and other debris from previous greenhouse crops as well as discarded potting media are important sources of foliar and soilborne plant pathogenic fungi and bacteria. During the production cycle, remove and discard unsalable or dead plants as well as other crop debris from production areas. Between crops, clear loose potting media and debris from propagation benches and production areas. If a root rot disease has caused serious loss, wash down benches and other work areas with a greenhouse disinfectant. Periodically, treat (paint) cedar benches or other wooden surfaces with copper based preservatives.

Plug trays, flats, and pots should not be reused unless they are carefully rinsed of loose trash, sanitized with a surface disinfectant, and air dried. Water breakers, hoses, and tools should also be kept off of the greenhouse floor and occasionally cleaned. Knives and other pruning tools, particularly those used to take cutting from stock plants, must be cleaned with surfaces disinfectant, such as rubbing alcohol, after each cut.

Plugs, cuttings, and other propagative plant material are sources of damaging diseases, particularly those caused by viruses and root rot fungi. Shipments of propagation stock should be inspected immediately upon arrival for damaged caused by diseases and insect pests. If a serious disease problem is found, contact the shipper. Diseased or otherwise damage should be discarded.

Potting media bags or bulk components should be stored on raised and if possible covered concrete or asphalt pads. Periodic steam cleaning of bulk mixers, hoppers, and other media handling equipment may also help minimize losses due to root and crown-rot diseases.

## CHEMICAL CONTROL

In the bedding and floral crop market, quality sells. There is no tolerance in the market for poor quality bedding and floral crops. As a result, fungicides and bactericides often must be used in order to insure the uniformity and marketability of bedding plant and pot-grown floral crops as well as to avoid damage caused by plant pathogenic fungi and bacteria. Annually, disease such as crown and root rots caused by the fungi *Phytophthora*, *Pythium*, *Thielaviopsis*, *Myrothecium* and *Rhizoctonia*, along with a blossom and foliar blight caused by *Botrytis* are significant threats to the appearance and marketability of many widely grown bedding plants and potted flowers. Depending on the crop and target disease, one or multiple applications of a selected fungicide and/or bactericide may be needed to prevent damaging disease outbreaks.

Effective selection and use of preventative fungicide and bactericide treatment demands that greenhouse managers be familiar with the damaging diseases of the crops in their production mix as well as on the influence of environmental conditions on their development and spread. It's also critical that managers be able to recognize and monitor outbreaks of damaging diseases and the effectiveness of their disease control program. Preventative treatment programs should be targeted at those diseases, such as *Phytophthora* root rot on petunia or *Botrytis* blight on poinsettia, that can and often do cause severe losses. Applications should be continued at interval specified on the product label until the crop is no longer vulnerable to attack, environmental conditions are unfavorable for the disease, or the crop is sold. Typically,

preventative fungicide and bactericide treatments are most effective when combined with recommended sanitation and crop management practices.

Curative treatment programs begun after disease symptoms are recognized are generally much less effective in controlling both foliar and soilborne diseases especially root and crown rot, than a preventative treatment regime. Many of the damaging diseases of the bedding and floral crops widely grown in Alabama are listed in the Table (1) below.

### Major Diseases of Bedding and Floral Crops in Alabama.

<b>CROP</b>	<b>DISEASE</b>	<b>COMMENTS</b>
Ageratum	Botrytis Blight	Develops during several days of humid, rainy, cloudy weather.
Begonia	Bacterial Blight Botrytis Blight Powdery Mildew Pythium Root Rot Root-Knot Nematode	Sanitation critical.
Chrysanthemum	Ascochyta Ray Blight	On blooms.
Coleus	Downy Mildew	Develops during several days of humid, rainy, cloudy weather.
Cyclamen	Fusarium Crown Rot	Inspect incoming stock.
Dianthus	Heterosporium Leaf Spot Rhizoctonia Crown and Stem Rot	
Geranium	Alternaria Leaf Spot Bacterial Leaf Spot Botrytis Blight Pythium Root Rot Rust	Clean cuttings.
Impatiens	Alternaria Leaf Spot Bacterial Leaf Spot Botrytis Blight Phytophthora Root Rot Rhizoctonia Crown Rot Tomato Spotted Wilt	Watch overhead watering.
Latana	Foliar Nematode	Healthy cuttings.

Marigold	Alternaria Leaf Spot Cercospora Leaf Spot	Seen on all marigold cultivars.
Pansy	Anthrachnose Black Root Rot Botrytis Blight Cercospora Leaf Spot Myrothecium Crown Rot Phytophthora Root Rot Pythium Root Rot	Clean plugs critical.
Petunia	Botrytis Blight Phytophthora Shoot and Root Rot	Sanitation critical.
Poinsettia	Botrytis Blight Pythium Root Rot Rhizoctonia Root Rot	Watch watering and fertilization practices.
Rose (Miniature)	Powdery Mildew Cylindrocladium root and crown rot	
Rose (Mother's Day)	Downy Mildew	Particularly destructive in closed greenhouses during extended periods of heavy clouds and rain.
Snapdragon	Botrytis Blight Rhizoctonia Collar Rot Root-knot Nematode Rust	Serious disease problems in ground beds.
Verbena	Foliar Nematode Powdery Mildew	Sanitation critical.
Vinca	Phytophthora Shoot Blight and Root Rot Rhizoctonia Crown Rot	Disease resistant lines. Sanitation critical as are protective fungicide sprays.
Zinnia	Alternaria Leaf Spot Bacterial Leaf Spot Botrytis Blight Powdery Mildew	Healthy plugs or seedlings.

On bedding and floral crops, root and crown rot diseases often cause the greatest loss and are most difficult to control. Best results can generally be obtained by mixing a fungicide into the potting medium before transplanting plugs, rooted cuttings, or liners; then following with a fungicide drench after 1 to 3 months as needed. Just applying a fungicide drench immediately after transplanting may be a somewhat less effective but more practical alternative to mixing a fungicide into the potting medium. Given the long residual activity of many soil fungicides (see Table 2), only a single fungicide treatment is usually required prior to finishing many bedding and some floral crops. Drenches should always be applied when the crop needs water.

Due in part to continued plant growth and weathering of fungicide deposits, applications of fungicides

and bactericides for the control of foliar diseases must be made more often than drench treatments. For best results, start preventative sprays when the windows for infection opens and continue treating until the plants are not vulnerable to attack or the crop is sold. Again, the total number of sprays required for the control of foliar diseases on bedding and floral may not exceed 3 or 4. Timing of those sprays is, however, quite critical. Uniform coverage of the target area is also crucial for obtaining effective disease control with foliar-applied fungicides and bactericides. Typically, spray until the leaves are wet or until run-off.

To avoid any nasty surprises just before shipping, flat and pot-grown crops must be routinely inspected during the production cycle for symptoms of damaging diseases. This advice holds true for treated and untreated crops. From a distance, uneven or yellowed top growth as well as open cells in flats is an indicator of a foliar or soilborne disease outbreak. Should symptomatic plants [consider insect, disease or nutritional/environmental disorders], be seen, immediately identify the cause. If a disease is diagnosed, dump any unmarketable stock and apply, when appropriate a recommended fungicide or bactericide at the highest rate and shortest treatment interval on the label.

### Pythium and Phytophthora Root Rot

Development of Pythium and Phytophthora root rot is often linked with the poor greenhouse sanitation, use of pathogen contaminated or poorly drained media, repeated overwatering, high soluble salt levels due to over fertilization, and planting diseased plugs, liners, or cuttings.

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#### Potting and Transplanting

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Fungicide	Rate/ cu yd media	Interval	Comments
etr Diazole + thiophanate-methyl Banrot 8G	16 oz.	1-3 mo.	<b>Dry Media Mix</b> -Thoroughly mix into media. Apply drench or foliar spray 1-3 mo. after potting.
etr Diazole Truban 30W Truban 5G Terrazole 35W	1.5-3 oz. 10 oz. 1.5-3 oz.	1-3 mo.	<b>Dry Media Mix</b> -Thoroughly mix into media. Apply drench or foliar spray 1-3 mo. after potting.
fluidioxonil + mefenoxam Hurricane	6.25 oz.	3-4 wk.	<b>Dry Media Mix</b> -Thoroughly mix in potting media and then plant. Follow with drench treatments at needed to prevent disease. Also controls Rhizoctonia root rot.
fosetyl-AL Aliette T/O Prodigy 80DG	8-12 oz.	1 mo.	<b>Dry Media Mix</b> -Use on well rooted plants. Thoroughly mix into media before stepping up liners or potted plants. Apply drench or foliar spray 1 mo. after potting.

<i>Gliocladium virens</i> Soilgard 12G	2-4 oz.	1-4 wk.	<b>Preplant Media Drench</b> -Apply in 50 to 100 gallons per 400 to 800 square foot of bench area or flats. Allow 24 hours between treatment and seeding or transplanting cuttings without true leaves. Cuttings with true leaves may be transplanted immediately.
mefexomen Subdue GR	1.6-8 oz.	1-2 mo.	<b>Dry Media Mix</b> -Mix thoroughly. Follow with media drench or foliar spray as needed.
potassium salts of phosphorus acid Alude	1-2 pt	1 mo.	<b>Dry Media Mix</b> -Mix 2 qt. of solution per cu. yd. of media. Follow with drench or foliar spray after 1 mo.
<i>Trichoderma harzianum</i> Root Shield Granular	1-1.5 lb		<b>Dry Media Mix</b> - Thoroughly mix into potting media. Mix into landscape beds with a rake or tiller at 1-1.5 lb per 1000 ft. sq.

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### Container Production and Landscape

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Fungicide	Rate	Interval	Comments
dimethomorph Stature DM	6.5-12.8 oz.	10-14 d.	<b>Media Drench</b> -Apply when roots are established or at first sign of disease. Reapply as needed through production cycle at specified interval. Apply sufficient water to wet the root zone.
	6.4-12.8 oz.	10-14 d.	<b>Foliar Spray</b> -Apply sufficient water to wet foliage and stems. Repeat through production cycle.
etridiazole Truban 30W Terrazole 35W Terrazole 2L Truban 25W	3-10 oz. 3-10 oz. 2-7 fl. oz. 3-4 fl. oz.	1-3 mo.	<b>Media Drench</b> -Apply sufficient volume to wet media in container. The 100 gallon drench volume will treat 400 sq. ft. of bed area. Irrigate immediately after application. Repeat at specified intervals. Do not apply with other pesticides. See label for plant list.
etridiazole + thiophanate-methyl Banrot 40W	6-12 oz.	1-3 mo	<b>Media Drench</b> -Apply sufficient volume to wet media in container. The 100 gallon drench volume will treat 400 sq. ft. of bed area. Irrigate immediately after application. Repeat at specified intervals. Do not apply with other pesticides. Also controls <i>Rhizoctonia</i> , <i>Fusarium</i> , and <i>Thielaviopsis</i> -incited root rot diseases.
etridiazole + thiophanate-methyl Banrot 8G	8-12 lb.	1-3 mo.	<b>Post-Plant Broadcast</b> -Covers 1000 sq. ft. of bed area. Apply with drop or cyclone spreader. See label for spreader settings. After application, rake-in or lightly cultivate. Also controls <i>Rhizoctonia</i> , <i>Fusarium</i> , and <i>Thielaviopsis</i> -incited root rot diseases.

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	8-12 lb.	1 mo.	<b>Pre-Plant Broadcast</b> -Evenly distribute over 1000 sq. ft. of bed area with a cyclone or drop spreader. See label for spreader settings. Harrow or till upper 2 to 6 inches of soil. Also controls <i>Rhizoctonia</i> , <i>Fusarium</i> , and <i>Thielaviopsis</i> -incited root rot diseases.
fenamidone Fenstop	7-14 fl. oz.	1 mo.	<b>Media Drench</b> -Apply 50 to 100 gal. water per 400 sq. ft. of bench or bed area. Do not make more than four applications per crop per season. <b>Greenhouse use only.</b>
fluidioxonil + mefenoxam Hurricane	1.5 oz.	3-4 wk.	<b>Drench on Transplants or Cuttings</b> -Use enough water to thoroughly wet the root zone and crown area. Reapply as needed.
fosetyl-AL Aliette T/O Prodigy 80DG	6.4-12.8 oz.	1 mo.	<b>Media Drench</b> -Apply 2 qt. of fungicide solution per sq. ft. Repeat as needed but do not exceed one treatment every 30 days.
	2.5-5 lb.	1 mo.	<b>Foliar Spray</b> -Apply as needed to do not exceed one spray every 30 days. Do not mix with sticker or other surfactants.
<i>Gliocladium virens</i> Soilgard 12G	2-8 oz.	1-4 wk.	<b>Post Plant Drench to Established Plants</b> -Depending on container volume, apply 4 to 16 fluid ounces of finished drench at 1- to 4-week intervals.
mefexomen Subdue MAXX Mefenoxam 2	0.13-0.25 fl. oz.	1-2 mo.	<b>Media Drench at Seeding</b> -Use 1 ½ to 2 pt of drench solution per sq. ft. See label for plant list and use restrictions.
	0.5-2 fl oz	1-2 mo.	<b>Media Drench at Transplanting</b> -Use 1 ½ to 2 pt of drench solution per sq. ft.
	1.25-2.5 fl. oz./ 1000 sq. ft.	2-4 mo.	<b>Soil Surface Spray</b> -Broadcast or band on soil surface to obtain thorough coverage of plant root zone. After an application, irrigate with at least a half inch of water if rain does not occur within 7 days.
potassium salts of phosphorus acid Alude	6.3-12.7 fl. oz.	1 mo.	<b>Media Drench</b> -Apply 25 gal. of water to 100 sq. ft. of bed area and repeat as needed.
	1-2 qt.	14-21 d.	<b>Foliar Spray</b> -Apply to thoroughly wet foliage and repeat as needed.

propamocarb Banol 67S Proplant	25 fl. oz.	3-4 mo.	<b>Media Drench</b> -Irrigate immediately after application. The 100 gallon volume drench solution will treat 400 sq. ft. of bed or bench area.
pyraclostrobin Insignia	8-16 oz.	7-21 d.	<b>Media Drench</b> -Apply in enough water to wet root zone, crown, and base of plant and repeat as needed.
<i>Trichoderma harzianum</i> Root Shield WP	3-5 oz.	1 mo.	<b>Media Drench for Pythium root rot control</b> -Apply in enough water to wet root zone, crown, and base of plant and repeat as needed. Refer to label for list of prohibited tank mix partners. OMRI listed organic fungicide.

**Root and Collar Rot Diseases caused by *Rhizoctonia*, *Fusarium*, *Sclerotium*, *Cylindrocladium*, and *Thielaviopsis***

Root and collar rot disease development is often linked with the poor greenhouse sanitation, use of pathogen contaminated or poorly drained media, repeated overwatering, and planting diseased plugs, liners, or cuttings.

<b>Fungicide</b>	<b>Rate per 100 gal.</b>	<b>Interval</b>	<b>Comments</b>
azoxystrobin Heritage 50W	1-4 oz.	2-4 wk.	<b>Heavy Foliar Spray/Drench</b> -Apply when conditions favor disease and repeat as needed. Controls root and crown rots caused by <i>Fusarium</i> , <i>Rhizoctonia</i> , and <i>Sclerotium</i> .
etrifiazole + thiophanate-methyl Banrot 40W	6-12 oz.	1-3 mo.	<b>Media Drench</b> -Controls <i>Rhizoctonia</i> , <i>Fusarium</i> , and <i>Thielaviopsis</i> as well as <i>Phytophthora</i> and <i>Pythium</i> -incited root rot diseases. Apply sufficient volume to wet media in container. The 100 gallon drench volume will treat 400 sq. ft. of bed area. Irrigate immediately after application. Repeat at specified intervals. Do not apply with other pesticides.
Banrot 8G	16 oz.	1 mo.	<b>Dry Media Mix</b> - Controls <i>Rhizoctonia</i> , <i>Fusarium</i> , and <i>Thielaviopsis</i> as well as <i>Phytophthora</i> and <i>Pythium</i> -incited root rot diseases. Thoroughly incorporate into medium before planting. Use on well-rooted plants. Begin drenches no earlier than 1 month after potting. See product label for list of approved plants.
	8-12 lb.	1-3 mo.	<b>Post-Plant Broadcast in Landscape Beds</b> -Covers

			1000 sq. ft. of bed area. Apply with drop or cyclone spreader. See label for spreader settings. After application, rake-in or lightly cultivate.
	8-12 lb.	1 mo.	<b>Pre-Plant Broadcast-</b> Evenly distribute over 1000 sq. ft. of bed area with a cyclone or drop spreader. See label for spreader settings. Harrow or till upper 2 to 6 inches of soil.
fluidioxonil + mefenoxam Hurricane	6.25 oz.	3-4 wk.	<b>Pre-Plant Dry Media Mix-</b> To control <i>Rhizoctonia</i> diseases in bedding and floral crops, thoroughly mix in potting media and then plant. Follow with drench treatments at needed to prevent disease. Also controls Phytophthora and Pythium root rot. See label for plant list.
	0.75 oz.	---	<b>Media Drench to Seedlings-</b> Apply at rate of 1 to 2 pints of fungicide suspension per square foot of bench area. Make one drench before transplanting to larger container. See label for plant list.
	1.5 oz.	3-4 wk.	<b>Media Drench to Transplants and Cuttings-</b> Apply at rate of 1 to 2 pints of fungicide suspension per square foot of bench area. Repeat as needed to prevent disease. See label for plant list.
fluoxastrobin Disarm O	2-4 fl. oz.	7-21 d.	<b>Heavy Crown Spray-</b> Directed application to base of plant, lower stems, and media surface. See label for plant list, treatment intervals for specific diseases, and further instructions. Make no more than 2 consecutive applications of Disarm O before alternating with a non-strobilurin fungicide.
	0.15-0.6 fl. oz.	14-28 d.	<b>Media Drench-</b> Apply 1 to 2 pt solution per sq. ft. of bed or bench area or sufficient volume of solution to wet media. See label for plant list, treatment intervals for specific diseases, and further instructions.

flutolanil		3-4 wk.	<b>Media Drench</b> -To control <i>Rhizoctonia</i> and <i>Sclerotium</i> -incited (white mold or stem rot) diseases on wood ornamentals, apply at rate of 1 to 2 pints of fungicide suspension per square foot of bed or bench area. Make no more than four (4) drench treatments per year.
Contrast 70WSP	3-6 oz.		
Prostar 70WP	3-6 oz.		
iprodione		2 wk.	<b>Media Drench</b> -Controls <i>Rhizoctonia</i> root and crown rot on cuttings, liners, and container stock. Apply 1-2 pints of drench solution per square foot of bench area.
Chipco 26019 N/G	6.5 oz.		
Sextant 2F	13 fl. oz.		
26GT-O	13 fl. oz.		
PCNB		4-6 wk.	<b>Media Drench</b> - Apply 100 gals. To 400 to 800 sq. ft. of bed or bench area for control of <i>Rhizoctonia</i> and <i>Sclerotium</i> cutting, root, and collar rot diseases on woody ornamentals.
Terraclor 75W	4-8 oz.		
PCNB 75W	4-8 oz.		
Defend 75W	4-8 oz.		
Defend 10G	15-20 lb	4-6 wk.	<b>Pre-Plant Broadcast</b> -Apply to 1000 sq. ft. of bed area. Incorporate to depth of 2 to 3 inches.
polyoxin D			<b>Heavy Foliar Spray:</b> To control <i>Rhizoctonia</i> root rot, apply to drip before disease appears and when conditions favor disease. Repeat as needed to control disease. Rotate with fungicides with other modes of action to prevent resistance-related control failures.
Veranda O	4-8 oz.	7-10 d.	
Veranda T	4-8 oz.		
Affrim	4-8 oz.		
pyraclostrobin + boscalid			<b>Media Drench:</b> To control <i>Fusarium</i> , <i>Rhizoctonia</i> , and <i>Sclerotinia</i> in plug trays, liners and container stock. Begin applications when conditions favor disease and prior to symptom development. Thorough wetting of the root zone, root collar, and surrounding medium is required. Avoid water prior to application to allow for movement of fungicide through medium. See label for plant list and use restrictions.
Pageant	12-18 oz.	7-21 d.	
thiophanate-methyl			<b>Media Drench/Heavy Foliar Spray:</b> To control <i>Fusarium</i> , <i>Rhizoctonia</i> , <i>Thielaviopsis</i> and <i>Cylindrocladium</i> root rots on all woody ornamentals. Covers approx. 800 sq. ft. of bed or bench area. For larger containers, apply ¼ -2 pt. of drench solution per sq. ft. depending on media type and depth.
3336 4.5 F	16-20 fl. oz.	3-4 wk.	
6672 4.5 F	16-20 fl. oz.		

3336 WP	12-16 oz.	3-4 wk.	<b>Media Drench:</b> To control <i>Fusarium</i> , <i>Rhizoctonia</i> , <i>Thielaviopsis</i> and <i>Cylindrocladium</i> root rot on all woody ornamentals, apply 2-3 pts. Solution per sq. ft. depending on media type and depth to thoroughly soak media.
6672 50W	12-16 oz.		
<i>Trichoderma harzianum</i> Root Shield WP	3-5 oz.	1 mo.	<b>Media Drench-</b> To control <i>Fusarium</i> , <i>Rhizoctonia</i> , <i>Thielaviopsis</i> and <i>Cylindrocladium</i> root rot, apply in enough water to wet root zone, crown, and base of plant and repeat as needed. Refer to label for list of prohibited tank mix partners. OMRI listed organic fungicide.
triflumizole Terraguard 50W	4-8 oz.	3-4 wk.	<b>Media Drench-</b> To control <i>Rhizoctonia</i> and <i>Thielaviopsis</i> root rot Apply at 3-to 4-week intervals. From two to four applications may be needed.

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### Botrytis Blight

Development of Botrytis blight in floral greenhouse crops is favored by a relative humidity above 85%. Disease usually appears on greenhouse crops in late fall through the winter months when outdoor weather patterns are wet, mild, and cloudy for several consecutive days. Floral crops in bloom are most vulnerable to Botrytis blight. Venting moisture saturated air followed by heating of the incoming air will help slow disease development. Protective fungicide treatments are needed on vulnerable floral crops like poinsettia to protect from this disease.

Fungicide	Rate per 100 gal.	Interval	Comments
azoxystrobin Heritage 50W	2-4 oz.	1-3 wk.	Apply to drip when conditions favor disease and repeat as needed. Use higher rate at shorter interval when disease is active on target plants. See label for plant list. Make no more than 2 consecutive applications of Heritage 50W before alternating with a non-strobilurin fungicide.
chlorothalonil Daconil Ultrex Daconil Weather Stik Echo 720 6F	1.4 lb. 1.5 pt. 1.5 pt.	7-14 d.	Apply to drip when conditions favor disease and repeat as needed. Use higher rate at shorter interval when disease is active on target plants. See label for plant list. May spot the blooms of some floral crops, particularly impatiens.
chlorothalonil + thiophanate-methyl Specto 90 DF Tee-1-Up Consys WDG	1-2 lb. 0.75-1.5 lb. 1.2 lb.	7-14 d.	Apply to drip when conditions favor disease and repeat as needed. Use higher rate at shorter interval when disease is active on target plants. See label of each product for plant list and diseases controlled.
copper sulfate pentahydrate Phyton 27	10-25 fl. oz.	7-10 d.	Use sufficient volume of water to thoroughly cover the leaves and stems. Repeat applications as needed to control disease. May be applied as often as 3 to 5 days when disease is severe. Refer to label for specific application rates and plant list. <b>Note: some floral crops may be sensitive to copper.</b>
fenhexamid Decree 50WDG	1-1.5 lb.	7-14 d.	Apply at to all above-ground plant surfaces. See label for plant list.
fluidioxonil Medallion	2-4 oz.	7-14 d.	Apply to point of run-off when conditions favor disease. See label for plant list and further application instructions.
fluoxastrobin Disarm O	4-8 oz.	7-21 d.	Apply to point of run-off when conditions favor disease and before infection occurs. See label for plant list and further application instructions. Make no more than 2 consecutive applications of Disarm O before alternating with a non-strobilurin fungicide.

iprodisone		7-14 d.	Apply to drip when conditions favor disease and repeat as needed. Use higher rate at shorter interval when disease is active on target plants. See label for plant list. <b>NOT FOR RESIDENTIAL USE.</b>
Chipco 26GT	1-2.5 qt./A		
Sextant	1-2.5 qt./A		
26GT-O	1-2.5 qt./A		
Iprodione Pro SE	1-2.5 qt.		
Chipco 26019 50W	1-2 lb.		
Chipco 26019 N/G	1-2 lb.		
polyoxin D		7-10 d.	Apply to drip before disease develops or conditions favor disease and repeat as needed. Rotate with fungicides with other modes of action to prevent resistance-related control failures.
Veranda O	4-8 oz.		
Veranda T	4-8 oz.		
Affirm	4-8 oz.		
pyraclostrobin		7-21 d.	Apply to point of drip before disease appears and when conditions favor development. Repeat as needed. <b>DO NOT</b> use an organosilicone adjuvant as phytotoxicity may occur. See label for plant list. See label for plant list. Make no more than 2 consecutive applications of Insignia before alternating with a non-strobilurin fungicide.
Insignia	8-16 oz.		
pyraclostrobin + boscalid		7-14 d.	Begin applications when conditions favor disease and prior to symptom development. Apply enough spray solution to thoroughly cover crown, stems, and media surface. See label for plant list.
Pageant	12-18 oz.		
thiophanate-methyl		7-14 d.	Apply to drip when conditions favor disease and repeat as needed. Use higher rate at shorter interval when disease is active on target plants.
3336 50W	12-16 oz.		
3336 4.5F	10-20 fl. oz.		
6672 50W	12-16 oz.		
6672 4.5F	10-20 fl. oz.		
Systec 1998 4.5F	10-20 fl. oz.		
AllBan Flo	10-14.5 fl. oz.		
AllBan 50W	12-16 oz.		
thiophanate methyl + flutolanil	4-8 oz.	10-14 d.	Apply to point of drip when conditions favor disease and repeat as needed.
Sys Star WDG			
thiophanate-methyl + iprodione		7-14 d.	Use sufficient volume of water to thoroughly cover the leaves and stems. Repeat applications at 7- to 14-day intervals as needed. Use higher rate at shorter interval when disease is present. <b>NOT FOR RESIDENTIAL USE.</b>
26/36 Fungicide	33-84 fl. oz./A		

trifloxystrobin Compass 50W Compass O	2-4 oz. 2-4 oz.	7-14 d.	Apply before disease is detected and when conditions favor disease. When disease is active, use higher rate at shorter intervals. See label for plant list. Make no more than 2 consecutive applications of Compass before alternating with a non-strobilurin fungicide. Compass O is labeled for greenhouse use.
triflumizole Terraguard SC	4-8 fl. oz.	7-14 d.	Apply at first sign of disease and repeat as needed to control disease. Refer to label for application rates and instructions.

### Leaf Spot Diseases caused by Bacteria

<b>Bactericides</b>	<b>Rate per 100 gal.</b>	<b>Interval</b>	<b>Comments</b>
copper hydroxide Cupro 2005 T/N/O	0.75-2 lb.	7-10 d.	<b>Foliar Spray:</b> Apply when conditions favor disease or symptoms first appear. Apply as needed as long as conditions are favorable and plants produce vulnerable growth. <b>Note: some floral crops may be damaged by repeated applications of copper pesticides. Check crop sensitivity by treated a few plants before applying to an entire block of plants. Also refer to the label for plant list, application rates, and cautionary statements.</b>
copper hydroxide pentahydrate Phyton 27	13-50 fl. oz.	5-7 d.	
streptomycin sulfate Agri-Mycin 17	0.5 lb.	5-7 d.	

### Leaf Spot Diseases caused by Fungi

<b>Fungicide</b>	<b>Rate per 100 gal.</b>	<b>Interval</b>	<b>Comments</b>
azoxystrobin Heritage 50W	2-4 oz.	1-3 wk.	Apply to drip when conditions favor disease and repeat as needed. Use higher rate at shorter interval when disease is active on target plants. See label for plant list. Make no more than 2 consecutive applications of Heritage 50W before alternating with a non-strobilurin fungicide.
chlorothalonil Daconil Ultrex Daconil Weather Stik Echo 720 6F	1.4 lb. 1.5 pt. 1.5 pt.	7-14 d.	Apply to drip when conditions favor disease and repeat as needed. Use higher rate at shorter interval when disease is active on target plants. See label for plant list. May spot the blooms of some floral crops, particularly impatiens.

chlorothalonil + thiophanate-methyl Specto 90 DF Tee-1-Up Consyst WDG	1-2 lb. 0.75-1.5 lb. 1.2 lb.	7-14 d.	When applied when symptoms appear, controls leaf spots and blights caused by <i>Alternaria</i> , <i>Cercospora</i> , <i>Colletotrichum</i> , <i>Corynespora</i> , <i>Didymella</i> , <i>Diplodia</i> , <i>Mycosphaerella</i> , <i>Ramularia</i> , and <i>Septoria</i> along anthracnose, downy mildew, powdery mildew, scab, and Phytophthora blight. See label of each product for plant list and diseases controlled.
copper hydroxide Cupro 2005 T/N/O	0.75-2 lb.	7-10 d.	Apply at first sign of disease and repeat as needed to control disease. Controls <i>Alternaria</i> leaf spot, anthracnose, <i>Cercospora</i> leaf spot, Phytophthora blight, and powdery mildew. See label for plant list. <b>Note: some floral crops may be sensitive to copper.</b>
copper sulfate pentahydrate Phyton 27	10-35 fl. oz.	7-10 d.	Use sufficient volume of water to thoroughly cover the leaves and stems. Repeat applications as needed to control disease. May be applied as often as 3 to 5 days when disease is severe. Refer to label for specific application rates and plant list. <b>Note: some floral crops may be sensitive to copper.</b>
fluxastrobin Disarm O	1-8 oz.	7-28 d.	Apply to point of run-off when conditions favor disease and before infection occurs. Controls leaf spots and blights caused by <i>Alternaria</i> , <i>Ascochyta</i> , <i>Cercospora</i> , <i>Colletotrichum</i> , <i>Myrothecium</i> , and <i>Septoria</i> along anthracnose, downy mildew, powdery mildew, rust diseases, and Phytophthora shoot blight. See label for plant list, treatment intervals for specific diseases, and further instructions. Make no more than 2 consecutive applications of Disarm O before alternating with a non-strobilurin fungicide.
iprodione Chipco 26GT Sextant 26GT-O Iprodione Pro SE Chipco 26019 50W Chipco 26019 50W N/G	1-2.5 qt./A 1-2.5 qt./A 1-2.5 qt./A 1-2.5 qt. 1-2 lb. 1-2 lb.	7-14 d.	Apply to drip when conditions favor <i>Alternaria</i> leaf spot or anthracnose and repeat as needed. Use higher rate at shorter interval when disease is active on target plants. See label for plant list. <b>NOT FOR RESIDENTIAL USE.</b>

myclobutanil Eagle 20EW	6-12 fl. oz.	10-14 d.	Controls anthracnose, <i>Cercospora</i> leaf spot, powdery mildew, and rust diseases. See label for plant list.
propiconazole Banner MAXX Propensity 1.3 MEC	5-8 fl. oz. 5-8 fl. oz.		See label for application rates for specific diseases. Controls leaf spots and blights caused by <i>Alternaria</i> , <i>Cercospora</i> , <i>Colletotrichum</i> , <i>Septoria</i> , and by other fungi. Also active against rust diseases. See label for plant list.
pyraclostrobin Insignia	4-16 oz.	7-14 d.	Controls leaf spots and blights caused by <i>Alternaria</i> , <i>Cercospora</i> , <i>Colletotrichum</i> , <i>Didymella</i> , <i>Entomosporium</i> , <i>Septoria</i> , <i>Sclerotinia</i> and other fungi. Also controls powdery mildew, rust diseases, as well as black spot and downy mildew. DO NOT use an organosilicone adjuvant as phytotoxicity may occur. See label for use rates for controlling specific diseases.
pyraclostrobin + boscalid Pageant	8-16 oz.	7-14 d.	Controls leaf spots and blights caused by <i>Alternaria</i> , <i>Cercospora</i> , <i>Colletotrichum</i> , <i>Didymella</i> , <i>Myrothecium</i> , <i>Phomopsis</i> , and other fungi. Also controls powdery mildew, rust diseases and downy mildew. Begin applications when conditions favor disease and prior to symptom development. Do not use an organosilicate surfactant as phytotoxicity may occur. Refer to the label for application rate, list of diseases controlled, and plant list.
thiophanate-methyl + iprodione Sys Star WDG	4-8 oz.	10-14 d.	Apply to drip and repeat as needed to control disease.
thiophanate-methyl + mancozeb Zyban 75W	1.5 lb.	7-14 d.	Apply to drip before disease appears and when conditions favor disease. Refer to the label for list of diseases controlled, and plant list.

triadimefon Bayleton 50 T/O Bayleton 50 4.1F Strike 50W	1-8 oz. 1-8 fl. oz. 1-8 oz.	7-21 d.	Systemic fungicide controls leaf spots and blights caused by <i>Cercospora</i> , <i>Colletotrichum</i> , as well as powdery mildew, rust and flower blight diseases. Refer to label for rates and spray schedules as well as plant list. Some PGR activity may be seen with extended use. <b>Use Bayleton 50 T/O and Bayleton 50 4.1F outdoors and Strike 50W in the greenhouse.</b>
trifloxystrobin Compass 50W Compass O	2-4 oz. 2-4 oz.	7-14 d.	Apply before disease is detected and when conditions favor disease and repeat as needed. When disease is active, use higher rate at shorter intervals. See label for plant list. Compass O is labeled for greenhouse use only.
triflumizole Terraguard SC	2-16 fl. oz.	7-14 d.	Controls leaf spots and blights caused by <i>Alternaria</i> , <i>Exserohilum</i> , and <i>Myrothecium</i> , as well as powdery mildew, scab and rust diseases on all woody ornamentals. Refer to label for application rates and instructions.

## Powdery Mildew

Fungicide	Rate per 100 gal.	Interval	Comments
azoxystrobin Heritage 50WDG	1-4 oz.	14-28 d.	Apply when conditions favor disease and repeat if needed. Make no more than two consecutive applications.
<i>B. subtilis</i> QST 713 Rhapsody Cease	2-8 oz. 2-8 qt.	3-10 d.	Begin applications when conditions favor disease development prior to the onset of disease. Repeat as needed. OMRI listed organic product.
chlorothalonil + thiophanate-methyl Specto 90 DF Tee-1-Up Consyst WDG	1-2 lb. 0.75-1.5 lb. 1.2 lb.	7-14 d.	Apply when applied when symptoms appear. See label of each product for plant list.
copper hydroxide Cupro 2005 T/N/O	0.75-2 lb.	7-10 d.	Apply at first sign of disease and repeat as needed to control disease. See label for plant list. Some woody ornamentals may be damaged by copper fungicides.
copper sulfate pentahydrate Phyton 27	15-25 fl. oz.	7-14 d.	Apply at first sign of disease and repeat as needed to control disease. Refer to label for plant list and use rates. Some woody ornamentals may be damaged by copper fungicides.

fluoxastrobin Disarm O	1-4 oz.	7-28 d.	Apply to point of run-off when conditions favor disease and before infection occurs. See label for plant list, treatment intervals for specific diseases, and further instructions. Make no more than 2 consecutive applications of Disarm O before alternating to a non-strobilurin fungicide.
myclobutanil Eagle 20EW	6-12 fl. oz.	10-14 d.	Apply at first sign of disease and repeat as needed to control disease. See label for plant list.
potassium bicarbonate MilStop	2-5 lb./A	7-14 d.	Apply at first sign of disease and repeat as needed. Use higher rate at shorter interval when disease pressure is high. Refer to label for plant list and site usage.
propiconazole Banner MAXX Propensity 1.3 MEC	5-8 fl. oz. 5-8 fl. oz.	7-14 d.	Apply at first sign of disease and repeat as needed to control disease. See label for plant list.
pyraclostrobin Insignia	4-16 oz.	7-14 d.	Apply at first sign of disease and repeat as needed to control disease. DO NOT use an organosilicone adjuvant as phytotoxicity may occur.
pyraclostrobin + boscalid Pageant	6-11 oz.	7-14 d.	Begin applications when conditions favor disease and prior to symptom development. Do not use an organosilicate surfactant as phytotoxicity may occur.
thiophanate-methyl 3336 4.5F 3336 50W 6672 4.5F 6672 50W Systec 1998 4.5F Tee Off 4.5F	20 fl. oz. 12-16 oz. 10-20 fl. oz. 12-16 oz. 10-20 fl. oz. 7-20 fl. oz.	7-14 d.	Apply at first sign of disease and repeat as needed to control disease. Refer to label for application rate and plant list.
triadimefon Bayleton 50 T/O Bayleton 50 4.1F	1-8 oz. 1-8 fl. oz.	7-21 d.	Apply at first sign of disease and repeat as needed to control disease. Refer to label for rates, spray schedules as well as plant list. Some PGR activity may be seen with extended use. Use Bayleton 50 T/O and Bayleton 50 4.1F outdoors <b>only</b> .
thiophanate-methyl + mancozeb Zyban 75W	1.5 lb.	7-14 d.	Apply to drip before disease appears and when conditions favor disease. Refer to the label for list of diseases controlled, and plant list.
trifloxystrobin Compass 50WP Compass O 50WDG	1-4 oz. 1-4 oz.	7-14 d.	Apply at first sign of disease and repeat as needed to control disease. Refer to label for plant list and application instructions as well as site use restrictions for each product.

triflumizole Terraguard SC	2-16 fl. oz.	7-14 d.	Apply at first sign of disease and repeat as needed to control disease. Refer to label for application rates and instructions.
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## BIOLOGICAL CONTROL

For the past two decades, considerable resources to developing disease control strategies that do not involve the use of synthetic pesticides. Due to tighter worker protection standards, concerns of pesticide exposure, and impending loss of the fumigant methyl bromide, the pace of biofungicide development has accelerated. A number of beneficial soil-inhabiting microbes have been identified that either produce antibiotics or other compounds which suppress disease-causing fungi, are parasites of those fungi, or stimulate host defenses. Several have been registered for use on greenhouse or nursery crops as biofungicides. In research trials, some biopesticides have performed as well as recommended soil fungicides but corroborating field data often is not available.

Like many synthetic soil fungicides, biopesticides are most effective only when used as a preventative treatment. Biopesticides will, however, have little or no effect on existing leaf or root infections. Best results have been obtained when products are incorporated into media prior to seedling or transplanting. If additional disease protection is needed, follow the media incorporated biopesticide with an application of a recommended fungicide or biofungicide. Some of these products are also formulated for use as a seed treatment to control seed rot, pre- and post-emergence damping off as well as foliar diseases.

Since biopesticides are so new, no one has a great deal of experience using these products. To avoid a catastrophic crop failure, test one or more of these products on a small portion of a greenhouse crop. If possible, compare their performance with that of the fungicide treatment regime usually employed. Once an individual is confident that these products will work, then they can be used with no further restrictions. The biopesticides (biofungicides) registered for use on greenhouse crops are listed in the table below.

### Biopesticides Registered For Use On Greenhouse Crops.

#### Root and Crown Rot Diseases Caused by Fungi

PRODUCT	RATE	Interval	COMMENTS
<i>B. subtilis</i> QST 713		21-28 d.	<b>Media Drench-</b> Suspend in 100 gallons of water with agitation and apply as a soil drench to greenhouse planting mixes for suppressing root and crown rot diseases caused by <i>Rhizoctonia</i> , <i>Fusarium</i> , <i>Phytophthora</i> , and <i>Pythium</i> . Begin applications after seeding, transplanting into flats, pots, or containers. Repeat as needed to control disease.
Rhapsody	1-2 gal.		
Cease	1-2 gal.		
<i>Gliocladium virens</i> Soilgard 12G	2-8 oz.	1-4 wk.	<b>Post Plant Drench to Established Plants-</b> For control of pathogens such as <i>Pythium</i> , <i>Rhizoctonia</i> , and <i>Fusarium</i> . Depending on container volume, apply 4 to 16 fluid ounces of finished drench at 1- to 4-week intervals.

	1 to 1.5 lb. /cu. yd.		<b>Dry Media Mix</b> -Thoroughly incorporate during mixing of media or pot filling. For control of pathogens such as <i>Pythium</i> , <i>Rhizoctonia</i> , and <i>Fusarium</i> . Follow with Media Spray or Drench treatments as needed to prevent disease. Allow at least 24 hours before planting seeds or cuttings into treated media.
	1 to 1.5 lb. /cu. yd.		<b>Pre-plant Incorporated in Outdoor Beds</b> -Thoroughly incorporate to desired depth. Refer to label for additional instructions. Treatment rate will vary with tillage depth.
<i>Streptomyces griseoviridis</i> Strain K61) Mycostop	0.04-0.07 oz. /cu. yd.	2-6 wk.	<b>Dry Media Mix</b> - Apply as concentrated spray when media is being blended. Thoroughly mix into potting media. Follow with Media Spray or Drench treatments as needed to prevent disease.
	1.4-14 oz./100 gal.	2-6 wk.	<b>Media Drench</b> -For control of <i>Fusarium</i> , <i>Phytophthora</i> , and <i>Pythium</i> root and crown rot, thoroughly wet medium and repeat as needed.
	0.35-0.7 oz. /1000 sq. ft.	2-6 wk.	<b>Soil or Media Spray</b> -Covers 1000 sq. ft. of bed or bench area. Water within 6 hr to move product through root zone.
	1.4-14 oz./100 gal	--	<b>Transplant Dip</b> -Dip roots before transplanting. Follow with foliar spray or drench treatment as needed to control disease. Follow with Media Spray or Drench treatments as needed to prevent disease.
	1-1.5 lb	1 mo.	<b>Preplant Dry Media Mix</b> for control of root and crown rot pathogens such as <i>Pythium</i> , <i>Rhizoctonia</i> , and <i>Fusarium</i> . Thoroughly mix into potting media. Mix into landscape beds with a rake or tiller at 1-1.5 lb per 1000 ft. sq.

<i>Trichoderma harzianum</i> Root Shield Granular	3-5 oz.	1 mo.	<b>Media Drench</b> -Suspend in 100 gallons of water with agitation and apply as a soil drench to greenhouse planting mixes. For seeding flats or shallow (up to 4-inch depth) beds or pots, apply at a rate of 50 - 100 gallons per 800 square feet. For deeper beds or pots, apply at a rate of 100 gallons per 400 square feet, or at the rate of ½ - 1 cup (4 – 8 fl. ounces) per 3” – 6” pots respectively. Apply RootShield® WP Biological Fungicide through low pressure watering nozzles such as fan nozzles or other drench watering systems applied directly to the medium.
Root Shield WP	2-4 oz.	1-4 wk.	<b>Preplant Media Drench:</b> Apply in 50 to 100 gallons per 400 to 800 square foot of bench area or flats. Allow 24 hours between treatment and seeding or transplanting cuttings without true leaves. Cuttings with true leaves may be transplanted immediately.

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### Leaf Spot and Blight Diseases Caused by Fungi

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PRODUCT	RATE	Interval	COMMENTS
<i>B. subtilis</i> QST 713		3-10 d.	Begin applications when conditions favor disease development prior to the onset of disease. Repeat as needed. OMRI listed organic product. See label for list of diseases controlled and plant list.
Rhapsody	2-8 oz.		
Cease	2-8 qt.		

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### APPENDIX

#### Reaction of Selected Annuals to Diseases

##### REACTION OF BEE BALM (MONARDA) TO POWDERY MILDEW

**Resistant**-Blue Stocking, Marshall’s, Delight, Violet Queen. Moderately Susceptible: Gardenview Scarlet, Kardinal, Mrs. Perry, Ohio Glow, Red Stocking, Stone’s Throw Pink.

**Susceptible**-Mahogany, Prairie Night, Snow White, Adam, Cambridge Scarlet, Croftway Pink, Purple Crown, Souris.

##### SENSITIVITY OF MARIGOLDS TO FLOWER BLIGHT (*Choanephora cucurbitarum*)

**Moderately Susceptible**-American Indian Orange, Papaya Crush, Pineapple Crush, Inca Orange, Cortez Yellow, Excel Primrose.

**Susceptible**- Inca Gold, Excel Yellow, Pumpkin Crush, Perfection Gold, Perfection Orange, Excel Orange, Perfection Yellow, Antiqua Gold, Marvel Orange.

**Highly Susceptible**-Discovery Orange, Antiqua Orange, Marvel Yellow, Inca Yellow, Marvel Gold.

#### **ALTERNARIA PETAL SPOT on Annual Salvia**

**Very Highly Resistant (Little or no petal spot)**-Carabiniere Red, Covergirl, Empire Burgundy, Salmon Lilac, Salmon Purple, Salmon Red, Firecracker Blue, Firecracker Burgundy, Firecracker Cherry, Firecracker Lilac, Firecracker Red, Firecracker Rose, Hotline Red, Hotline Violet, Hot Stuff Red, Hot Stuff, Rose, Maestro, Primco Red, Rambo Scarlet, Red Hot Sally, Red Vista, Salsa Burgundy, Salsa Scarlet, Sizzler Burgundy, Salsa Bicolor, Sizzler Lavender.

**Highly Resistant**-Hotline Salmon, Empire Light Salmon, Firecracker Orange, Firecracker Salmon, Hot Stuff Salmon, Salsa Salmon, Salsa Salmon Bicolor.

**Resistant**-Hotline White.

**Highly Susceptible**-Empire White, Firecracker White, Salsa White, Sizzler White.

#### **ANTHRACNOSE (*Colletotrichum gloeosporioides*) on Basil**

**Highly Resistant to Immune**-Purple Ruffles, Green Bouquet, Dark Opal, Greek Ruffles, Aussie Sweet, Lemon, Genovese, Thai, Large Green, Mexican Spice, Sweet Basil, Mrs. Burns Lemon.

**Moderately Resistant**-Variegated Spicy Globe, Lettuce Leaved, Bush Green.