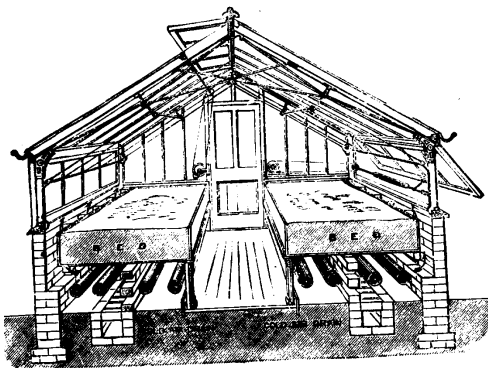


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Fungicides for Disease Control of Ornamentals in the Greenhouse

Ann B. Gould, Ph.D., Plant Pathology

There are a variety of chemical and biorational pesticides on the market these days for use in ornamental greenhouse crops. Some of the more recently registered chemical fungicides, as well as several biorational products, are described below. As always, be sure to read labels carefully prior to application of any pesticide.

Newer Chemical Pesticides or Changes in Registration

• **Compass 50WDG** (trifloxystrobin) is a strobilurin fungicide manufactured by Novartis. Strobilurins are broad-spectrum, acropetal systemics that affect the energy-generating process of fungal cells. Compass 50WDG is labeled for control of certain foliar, stem, and root diseases of a number of ornamentals grown in greenhouses, interiorscapes, and nurseries. Diseases listed on the label include **black spot** of rose, **Botrytis blight**¹, **downy mildew**, **leaf spots**, **powdery mildew**, **damping off** due to *Rhizoctonia*, **rusts**, and **scab**. For foliar disease control, Compass 50WDG is applied at 1 to 4 oz/100 gal rates at 7- to 14-day intervals. For damping off due to *Rhizoctonia*, the product is applied at a rate of 0.5 oz/100 gal at 21- to 28-day intervals. See label for specific hosts.

• **Contrast 70WSP** (flutolanil) is a systemic fungicide soon to be distributed by Scotts-Sierra Crop Protection Company. Flutolanil is a benzanilide fungicide that blocks the action of certain respiratory enzymes in Basidiomycete fungi. Contrast 70WSP is labeled for management of **rust diseases** and **foliar, cutting, and bulb diseases** caused by *Rhizoctonia* and *Sclerotium rolfsii*, and can be used in greenhouses, shade houses, outdoor container, and field grown ornamental nursery stock. In the greenhouse, Contrast 70WSP is normally applied at a rate of 3 to 6 oz/100 gal water.

• **Cygnus 50W** (kresoxim-methyl) is another strobilurin fungicide that has protective, curative, and eradicant activity against **powdery mildew** of ornamentals. Cygnus 50W, manufactured by BASF, can be applied to bedding plants, poinsettias, cut flowers, roses, and trees grown in the greenhouse (see label for specific hosts). In most cases, 1.6 oz of product/100 gal of water is applied at 7- to 10-day intervals.

• **Decree 50WDG**, distributed by SePro, is a fenhexamid fungicide labeled for control of *Botrytis*¹. This non-systemic compound belongs to a new class of chemistry known as the hydroxylanilides and has a single

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mode of action that works by inhibiting the hyphal growth and germ tube elongation of the pathogen. Application rates range from 1.0 to 1.5 lb product/A.

- **Heritage 50W** (azoxystrobin), manufactured by Zeneca, is a strobilurin fungicide that has a new supplemental label for control of certain foliar and root diseases of ornamentals grown in greenhouses, shade-houses, outdoor nurseries, retail nurseries, and landscapes. Diseases of greenhouse crops labeled for control include **downy mildew** and **black spot** of rose, **powdery mildew**, **rust**, **Botrytis blight**¹, **Phytophthora shoot blight**, and **Rhizoctonia**, **Sclerotium**, and **Fusarium root rots**. Heritage is usually applied at 1 to 4 oz rates/100 gal of water every 7 to 28 days (see label for exact rates and timing).

- **Medallion 50W** (fludioxonil) is a fungicide labeled for use on ornamentals grown in greenhouses and other enclosed structures. The compound targets certain **foliar diseases** caused by *Rhizoctonia* and *Botrytis*¹, as well as **stem and root diseases** caused by *Rhizoctonia*, *Fusarium*, *Cylindrocladium*, *Sclerotium*, and *Thielaviopsis*. Medallion 50W belongs to a class of compounds known as the phenylpyrroles. These protectant chemicals affect the plasma membrane of the fungal pathogen. The compound is packaged in 1 oz water soluble packets; application rates range from 1 to 2 oz product/100 gal of water when applied as a drench or foliar spray. Medallion is manufactured by Novartis.

- **Vorlan DF** (vinclozolin), distributed by Scotts-Sierra Crop Protection Company, has added ornamentals to the label. Vinclozolin is a preventive, contact fungicide in the dicarboximide class that is effective against **Botrytis blight**¹ when applied as a spray or dip. Other vinclozolin products labeled for greenhouse use include Ornalin FL (another Scotts product) and Curalan DF (BASF Corp.).

¹Control of *Botrytis* in ornamental plantings:

Although compounds that contain thiophanate-methyl, iprodione, and vinclozolin are registered for control of **Botrytis blight** or **gray mold**, isolates of *Botrytis* that are resistant to these compounds may be present. If a treatment applied as per label recommendations is not effective, shortening the interval or increasing the rate will not improve disease control; as a result, another fungicide should be used. To reduce the possibility of fungal resistance in the future, avoid the sole use of any fungicide, especially those that have a single mode of action (such as strobilurins), for extended periods of time when other reliable products are available.

Biorational Products

Biorational products are considered “environmentally friendly” because they can suppress pest populations while having the least harmful effects on other non-target organisms and the environment. Biorational products available for disease control include horticultural

oil sprays (JMS Stylet-Oil, Sunspray Ultra-Fine Spray Oil, and Triact 70), potassium bicarbonate (Kaligreen), and biological control products such as AQ10, Mycostop, RootShield™, and SoilGard 12G. In general, these products are worth consideration in preventive programs where disease pressure is low, and they are good candidates for use in IPM programs.

Horticultural oil sprays

- **JMS Stylet-Oil** (paraffinic oil, marketed by JMS Flower Farms, Inc.) is labeled for control of **black spot** and **powdery mildew** in roses. Application rates for this product range from 1 to 2 oz/gal of water.

- **SunSpray Ultra-Fine Spray Oil** (paraffinic oil) is labeled for control of **powdery mildew** in greenhouse crops as well as outdoor zinnia, lilac, azalea, phlox, and aster. The usual rate of application for greenhouse plants ranges from 0.5 gal oil/100 gal water for cut roses to 1.0 gal oil/100 gal of water for most other greenhouse crops.

- **Triact 70** (neem oil, marketed by Thermo Trilogy Corp.) is registered in the greenhouse for control of **powdery mildew**, **downy mildew**, **leaf spot**, **Botrytis blight**, and **black spot** of roses. In a preventive program, Triact should be applied at the 0.5 gal/100 gal water rate and increased to 1.0 gal/100 gal water when disease pressure is higher. Greenhouse roses should be sprayed in a rotation program that includes neem oil only once every 4 weeks. Do not apply neem oil to wilted or stressed plants or to newly transplanted materials prior to root establishment.

Note: when plant canopies are extremely dense, these oil sprays may not be effective because thorough coverage is difficult to attain. Since phytotoxicity to these products may be a problem, it is sound practice to conduct a phytotoxicity test on a few plants before spraying an entire crop, especially if plants are in bloom. Be sure to check individual labels for specific information on problems with plant sensitivity or incompatibility with other fungicides.

Potassium bicarbonate

Kaligreen, manufactured by Toagosei Co., Ltd., contains microencapsulated potassium bicarbonate (82%). It works by disrupting the potassium ion balance in the fungus cell, causing the cell walls to collapse. Kaligreen is registered for control of **powdery mildew** in roses and in field and greenhouse ornamentals such as bare root, container, bedding, and flowering stock, field grown cut flowers, vegetable transplants, nursery and landscape, potted flowering shade and flowering trees, and woody ornamentals. It is normally applied at rates of 1 to 3 lb product/100 gal water.

Biological control products

- **AQ10** consists of fungal spores of *Ampelomyces quisqualis* isolate M-10 as the active agent. AQ10 spores germinate and hyperparasitize **powdery mildew** fungi. Since AQ10 spores require a relative humidity of 60% in

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Diseases of Turfgrass

Bruce B. Clarke, Ph.D., Turfgrass Pathology

New Fungicide

Novartis Crop Protection, Inc. recently received a turf label for Compass (trifloxystrobin), a new strobilurin fungicide. Compass has been particularly effective against **brown patch** in tests at Rutgers, but is also labeled for the control of **leaf spot, anthracnose, summer patch, gray leaf spot, red thread, pink patch, rust** and **pink snow mold/Fusarium patch**. Although Compass is a strobilurin like Heritage, it is in a different subclass called oximinooacetates. Since this product is not translocated in the vascular tissue, it functions much like a localized penetrant. The fungicide, however, is distributed locally within the leaf (translaminar activity) and does appear to be redistributed through a vapor phase short distances (2-3 inches) within the turf canopy.

Stem and Crown Rust

These diseases are prevalent on susceptible Kentucky bluegrass and perennial ryegrass cultivars, respectively, at this time. As **rust** intensifies, the turf prematurely yellows and orange pustules called uredia (reproductive structures) appear on affected blades. To control both **stem** and **crown rust**, maintain adequate fertility and apply Banner, Bayleton, Daconil, Eagle, mancozeb, Manicure, Sentinel, or Thalonil per manufacturer's recommendations.

Pink Snow Mold

This disease, caused by the fungus *Microdochium nivale* (Fusarium nivale), should develop soon on greens and tees. Apply Banner, Chipco 26GT, Cleary 3336, Curalan, Daconil, Fungo, Heritage, Manicure, Thalonil, Touche, or Vorlan to stop current infections. For best results, apply any of these fungicides (or PCNB) in early to mid-October and then repeat in late-January if the snow cover recedes. Do not reapply PCNB after January 15 due to the possibility of phytotoxicity during warm weather next spring.

Stripe Smut

This disease, caused by the fungus *Ustilago striiformis*, is apparent on sensitive Kentucky bluegrass varieties. Symptoms typically appear as long black streaks (striations) between the veins of infected blades. When these areas rupture, abundant black smut spores are released. Research at Rutgers has shown that one well-timed application of a systemic fungicide in early to mid-October offers excellent control and is, therefore, better than multiple applications in the spring (mid-May). For best results, apply Banner, Bayleton, Cleary 3336, Eagle, Fungo, Rubigan or Sentinel, now per manufacturer's recommendations.

Turf Expo

The New Jersey Turfgrass Expo is one of the largest educational turfgrass conferences and trade shows in the Northeast. Established more than 25 years ago, the Turfgrass Expo provides a forum for the dissemination of information and the exchange of ideas concerning all aspects of the turfgrass and landscape industries. The Expo is co-sponsored by the Center for Turfgrass Science/Rutgers Cooperative Extension and the New Jersey Turfgrass Association and represents an educational highlight for more than 1400 participants from throughout the country. A conference proceeding is published each year summarizing information on a wide range of technical and popular topics.

This year's Turf Expo will be held at the Trump Taj Mahal Casino in Atlantic City on **December 7-9, 1999**. This is an excellent opportunity to receive the latest turf management information from nationally renowned speakers. For additional information please contact Bea Devine at (732) 821-7134. □

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the microenvironment to germinate, it is best to apply this product in the early morning or late evening hours when humidity is at its highest. Repeat applications should be every 7 to 14 days, and there should be a minimum of 2 sequential applications to maintain populations of the AQ10 organism. AQ10 is labeled for commercial ornamentals, including bare root and container stock, bedding and flowering plants (greenhouse and outdoors), field grown cut flowers, nursery and landscape plants, potted flowering plants, roses, shade and flowering trees, and woody ornamentals.

- **Mycostop** consists of dried spores and mycelium of the fungus *Streptomyces griseovirides* strain K-61. This product is used for control of **seed rot, root and stem rot, and wilt** caused by *Fusarium*, *Alternaria*, and *Phomopsis* in ornamentals and vegetables. In addition, Mycostop is labeled for suppression of **Botrytis blight** and *Pythium*, *Phytophthora* and *Rhizoctonia* **root rots** in the greenhouse. Mycostop, manufactured by Kemira Agro Oy, can be used as a seed treatment, soil spray or soil drench, and can be incorporated into potting media.

- The active ingredient in **RootShield™**, *Trichoderma harzianum* Rifai strain KRL-AG2 (T-22), is a soil fungus that grows in the root zone and colonizes the root system. The fungus protects roots by parasitizing or competing with soil pathogens such as *Pythium*, *Rhizoctonia*, or *Fusarium*. RootShield™, distributed by BioWorks, Inc., is available in granular or wettable powder formulations.

- **SoilGard 12G** is labeled for control of **damping-off** and **root rot** pathogens grown in greenhouses, nurseries, and interiorscapes. The active agent is the naturally occurring, nonphytotoxic soil fungus *Gliocladium virens* GL-21. This fungus is antagonistic to root pathogens such as *Pythium* and *Rhizoctonia*. SoilGard is manufactured by Thermo Trilogy, Corp. and comes in a granular formulation.

Note: since biological control products often consist of viable organisms, soil pH, storage and application temperatures, and mixing with other fungicides must be considered for optimal results. Consult the label for specific recommendations before storage and use. □

Pest Notes

Deborah Smith-Fiola, Ocean County Agricultural Agent, and Steven Rettke, Program Associate in IPM

✓ **BAGWORMS** : **Bagworm** caterpillars have tied their bags closed and pupated. By this time, several hundred eggs have been laid within the female bag, where they overwinter before hatching late next spring. Removing and destroying the bags any time during the next 7 to 8 months is a valuable cultural method that eliminates the overwintering eggs.

The female bags containing eggs can usually be felt when slightly squeezed between two fingers (the vacated male bags will feel hollow or empty when squeezed). Females often carry their bags to the tops of trees before pupating to allow for wind dispersal of some of the newly hatched larvae to other nearby plant hosts. Therefore, concentrate your removal efforts on these higher locations.

Unless the infested trees are small, do not expect to physically remove all of the female bags. Make note of the location of this problem and be sure to monitor the area for **bagworms** next spring. If you catch them when they are small in June, you can achieve good control with *Bacillus thuringiensis*.

✓ **SPIDER MITES**: **Spruce mites** and **Southern red mites** are the common cool season mites which increase their activity during the fall months. Their peak populations occur during October and November, even though damage is not obvious until next spring. Generally by December, all overwintering eggs have been laid on leaves, needles and twigs. With magnification, the clear or reddish-orange bubble shaped eggs can be observed tucked into branch and bark crevices. Horticultural oils can be very effective at suppressing both eggs and active adults. (Remember, oils cause "blue" conifers to turn green.)

Spruce mites are not yet resistant to any miticides. Avid, Conserve, Soaps, Hexygon and Kelthane can be used if necessary.

✓ **SOFT SCALES**: Tuliptree, Magnolia, Fletcher, Calico, Lecanium, Cottony Maple and Cottony Camellia are all examples of **soft scales** which overwinter as nymphs on twigs or branches of trees and shrubs. Before leaves drop in the fall, scale crawlers move back from the leaves to the bark where they spend the remaining part of their life cycles.

Late winter dormant oils are particularly effective against immature **soft scales**. Monitor for their presence by investigating black sooty mold on needles, twigs or branches. Close inspection is often required since many overwintering soft scales are difficult to see (translucent nymphs).

Avoid cover sprays in order to conserve beneficials. Predators and parasitoids can often effectively control **soft scale** populations when not destroyed by unnecessary sprays (the late winter sprays have the least impact on beneficials).

✓ **GALL ADELGIDS**: The **Eastern spruce gall** and **Cooley spruce gall adelgids** all overwinter as immature females and are vulnerable to control treatments during the late months of the year. Remember to target sprays onto only the most recent growth or terminal twigs and buds. It is only on these locations where the **adelgids** mentioned above will overwinter.

✓ **DEFOLIATORS**: **Gypsy moths**, **Eastern tent caterpillars** and **Fall cankerworms** all have overwintering egg masses that are found on twigs, branches, and/or trunks. Learn to recognize the appearance of these egg clusters. Mechanically remove eggs or prune out twigs with attached egg masses.

✓ **NEEDLE YELLOWING OF CONIFERS**: The older, inner needles of many conifers, especially white pine, will begin to yellow and drop during the weeks of autumn. This normal event may be magnified by the summer drought and is often a concern to unknowing homeowners.

✓ **APHIDS**: Cooler temperatures and rain may lead to an increase in **aphid** populations. Keep in mind that many insect predators and parasitoids remain active through the fall, and can effectively suppress **aphids**. For example, syrphid flies (also known as hover flies) prefer cooler fall temperatures and continue activity after lady beetles and lacewings have entered dormancy. □

Briefs

❖ The Horticultural Engineering newsletter from Cook College is available on the Web at: www.cook.rutgers.edu/~roberts/

❖ Landscaping for the '90's - IPM Symposium, sponsored by Rutgers Cooperative Extension, will be held at 2 locations: Thursday, December 2, 1999 at the Ramada Inn, Toms River and Wednesday, December 1, 1999, at a North Jersey location (see below).

Contact: Deborah Smith Fiola, Agricultural Agent, RCE of Ocean County, (732)-349-1250, e-mail: smithfiola@aesop.rutgers.edu.

Call Joel Flagler, Agricultural Agent, RCE of Bergen County for N. Jersey location, (201) 599-6162.

Rutgers Cooperative Extension - NJAES
U.S. DEPARTMENT OF AGRICULTURE
Rutgers - The State University of New Jersey

Plant & Pest Advisory
18 College Farm Road
Cook College
New Brunswick, N.J. 08901-8551

PLANT & PEST ADVISORY LANDSCAPE NURSERY & TURF EDITION CONTRIBUTORS

RCE Specialists and Staff

Raul I. Cabrera, Ph.D., Nursery Management
Bruce B. Clarke, Ph.D., Turf Pathology
Ann B. Gould, Ph.D., Ornamentals Plant Pathology
Steven Hart, Ph.D., Weed Science
Joseph R. Heckman, Ph.D., Soil Fertility
James A. Murphy, Ph.D., Turf Management
George J. Wulster, Ph.D., Floriculture
Richard J. Buckley, Coordinator, Plant Diagnostic Laboratory
RCE County Agricultural Agents and Program Associates
Atlantic, Charlene H. Costaris (609-625-0056)
Bergen, Joel Flagler (201-599-6162)
Burlington, Raymond J. Samulis (609-265-5050)
Camden, James Willmott (609-566-2900)
Cumberland, James R. Johnson (609-451-2800)
Essex, Jonathan H. Forsell (973-678-7988)
Gloucester, Jerome L. Frecon (609-863-0110)
Hunterdon, Winfred P. Cowgill, Jr. (908-788-1338)
Middlesex, William T. Hlubik (732-745-3443)
Monmouth, Richard G. Obal (732-431-7261)
Ocean, Deborah Smith-Fiola (732-349-1246)
Steven Rettke, Program Associate IPM
Passaic, Stanley Kamara (973-305-5742)
Somerset, Nick Polanin (908-526-6293)
Union, Madeline A. Flahive, Prog. Assoc. (908-654-9854)
Warren, William H. Tietjen (908-475-6505)

Newsletter Production

Jack Rabin, Assistant Director, NJAES
Cindy Rovins, Editor and Designer
Mary Ann Hughes, Assistant Editor

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Pesticide User Responsibility: Use pesticides safely and follow instructions on labels. The user is responsible for the proper use of pesticides, residues on crops, storage and disposal, as well as damages caused by drift. For specific labels, special local-needs label 24(c) registration, or section 18 exemption, contact Rutgers Cooperative Extension in your County.

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