

# PLANT & PEST ADVISORY

A RUTGERS COOPERATIVE EXTENSION PUBLICATION

## Fungicide Resistance Management for Ornamentals

*Ann B. Gould, Ph.D., Specialist in Plant Pathology*



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Infectious fungi sometimes develop resistance to particular fungicides, especially when a product is used repeatedly without alternating with chemically unrelated fungicides. Fungicide resistance becomes evident when fungicides don't work as well, or at all, on populations of fungi that have become less sensitive to them. When this occurs, there is no value in increasing rates, shortening intervals between sprays, or using other fungicides with similar modes of action.

Development of resistance is tied to the fungicide mode of action depending on whether the fungicide acts on a single site or at multiple sites within the fungus. In general, fungi are less prone to develop resistance to contact fungicides, which inhibit several vital functions in the fungal cell, than to many penetrant fungicides, which may inhibit only one vital function in the fungal cell. A single fungus needs to mutate only once to overcome the action of a single-site fungicide but must mutate more often to overcome the action of a multi-site fungicide, and the likelihood of this is rare.

In general, several strategies are recommended to minimize the risk of fungicide resistance. First, don't rely on fungicides alone for disease control. Follow good management practices and use resistant host plant material as it becomes available. Second, avoid repeated use of the same fungicide or materials with closely related modes of action. Third, alternate or tank mix fungicides with different modes of action (see FRAC coding\*). Refer to product labels before tank-mixing products to ensure compatibility and to avoid phytotoxicity. In some cases, several premix fungicides that contain products with differing modes of action are available. Finally, use recommended rates and proper management techniques. Although these general principles can help to reduce risk of fungicide resistance, they do not eliminate it. Pathogen populations resistant to a particular fungicide can still develop, even when good management practices are employed, but the changes of this happening are generally greatly reduced. The risk of fungicide resistance for many compounds labeled for turf and ornamental diseases is found in Table 1.

\*FRAC stands for Fungicide Resistance Action Committee (FRAC). The purpose of this group is to "provide fungicide resistance management guidelines to prolong the effectiveness of these "at risk" fungicides and to limit crop losses should resistance occur." Chemistries with

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different modes of action have different FRAC coding. Do not tank mix or alternate fungicides with the same FRAC number in a pesticide application program. Compounds labeled “M” act upon multiple sites and resistance risk is low.

For more information on FRAC, visit the following web site: <http://www.frac.info/frac/index.htm>.

<b>Chemical class</b>	<b>Motility</b>	<b>Role in protection</b>	<b>Mode of action</b>	<b>Activity</b>	<b>FRAC</b>	<b>Risk of fungicide resistance</b>
<b>aromatic hydrocarbons</b> (chloroneb, dicloran, etridiazole, PCNB)	contact	preventive	interferes with lipids and membrane synthesis	multi-site	14	low to moderate
<b>carbamates</b> (propamocarb-HCl)	contact	preventive	inhibits enzyme activity, membrane function, or fatty acid metabolism	multi-site	28	moderate
<b>chloronitriles (phthalonitriles)</b> (chlorothalonil)	contact	preventive	stops energy production in fungus and is toxic to cell membranes	multi-site	M5	low
<b>DMI fungicides (demethylation inhibitors) (imidazoles, piperazines, pyrimidines, triazoles)</b> (fenarimol, myclobutanil, propiconazole, tebuconazole, triflumizole, triadimefon, triforine)	acropetal penetrant	preventive, curative (affects fungal growth and sporulation)	interferes with cell membrane by inhibiting ergosterol	single	3	moderate to high
<b>dicarboximides</b> (iprodione)	localized penetrant	preventive	interferes with lipids and membrane synthesis	multi-site	2	moderate to high
<b>dithiocarbamates</b> (ferbam, mancozeb, maneb, ziram)	contact	preventive (some compounds in this class affect different sites)	inhibits enzyme activity, membrane function, or fatty acid metabolism	multi-site	M3	low to moderate
<b>glucopyranosal antibiotic</b> (streptomycin)	acropetal penetrant	bactericide	inhibits amino acid and protein synthesis	single-site	25	high
<b>hydroxylanilides</b> (fenhexamid)	contact	preventive	inhibits sterol biosynthesis in membranes	multi-site	17	low
<b>inorganics (copper, sulfur)</b>	contact	preventive	inhibits energy production (sulfur) or denatures proteins and enzymes (copper)	multi-site	M1/ M2	low
<b>MBC fungicides (methyl benzimidazole carbamates benzimidazoles and thiophanates (thiophanate-methyl))</b>	acropetal penetrant	preventive, curative	inhibits DNA synthesis and interferes with cell division (mitosis)	single	1	very high
<b>morphilines (piperidines) (piperalin)</b>	contact	eradicator	inhibits sterol biosynthesis in membranes	single	5	low to moderate
<b>PA fungicides (phenylamides) (acylalanines) (mefenoxam, metalaxyl)</b>	acropetal penetrant	preventive	interferes with ribosomal RNA	single	4	high
<b>phenylpyrroles (fludioxonil)</b>	contact	preventive	cell lysis and inhibits amino acid uptake	multi-site	12	low to moderate
<b>phosphonates (fosetyl-Al, phosphorous acid and salts)</b>	phimobile penetrant	curative	unknown	single	33	low to moderate

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# Diseases of Turfgrass

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

## Pink Snow Mold/Fusarium Patch

**Pink snow mold**, caused by the fungus *Microdochium nivale*, is apparent on golf course greens, tees and fairways in the tri-state area. Current outbreaks can be controlled with Banner, Chipco 26GT, chlorothalonil, Compass, ConSyst, Curalan, Disarm, Eagle, Headway, Heritage, Insignia, Instrata, Medallion, Spectro, Tartan, thiophanate-methyl (e.g., 3336), Trinity or vinclozolin. For best results next fall, apply any of these fungicides (or PCNB) on a preventive basis in early to mid-November and then repeat in late-January if the snow cover recedes. Do not reapply PCNB after January 15 due to the long residual activity (> three months) and the possibility of phytotoxicity during warm weather.

## New Fungicides

Heritage G, Disarm G, Disarm C and Triton fungicides have just received EPA registration in the United States for the control of turfgrass diseases. The first two products are broad-spectrum, granular formulations of the strobilurins fungicides azoxystrobin (Heritage G) and fluoxastrobin (Disarm G) that may be applied to either golf or residential turf by a certified pest control operator. Disarm C is a premix of fluoxastrobin and chlorothalonil that can be used on golf but not home lawns. Triton (triticonazole) is a DMI fungicide which is similar in activity to propiconazole and triadimefon. All of these products control a wide-range of diseases that affect turf in New Jersey. See respective labels for restrictions and specific diseases controlled.

## Yellow Patch

This disease, often referred to as **cool season brown patch**, is apparent on some greens and tees at this time. Unlike brown patch which occurs in the summer, **yellow patch** (*Rhizoctonia cerealis*) thrives during cool, wet weather between October and May. Patches are chlorotic and typically range from several inches to three feet in diameter. Patch centers are frequently green, resulting in a "frog-eye" or yellowish ring effect. Banner, chlorothalonil, Endorse, Heritage, Insignia, Medallion, ProStar or thiophanate-methyl are most effective when used on a preventive basis in late-October, but can also provide curative control when used at label rates. Even without the use of fungicides, however, symptoms generally disappear with a return to regular mowing and warm weather.

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## Turf Field Day

Mark your calendars now for this year's Rutgers Turfgrass Research Field Days which will be held on August 4, 2009 (Golf and Fine Turf Research Field Day at Horticultural Farm II, New Brunswick, NJ) and August 5, 2009 (Landscape Turf Research Field Day at Adelphia Research Farm, Freehold, NJ). Additional information and directions to each location will appear in future issues of this newsletter. □

## Brown Patch Turfgrass Samples Needed

**D**r. Ning Zhang's lab at Rutgers University studies brown patch disease of turfgrasses. If you have infected grass samples with brown patch or large patch symptoms (caused by *Rhizoctonia* species), please contact Ning at 732-932-9711 ext. 162 or send your samples to the following address.

Ning Zhang  
Dept. of Plant Biology and Pathology  
Rutgers, The State University of New Jersey  
59 Dudley Road, Foran Hall 201  
New Brunswick, NJ 08901  
phone: 732-932-9711 x162  
[zhang@aesop.rutgers.edu](mailto:zhang@aesop.rutgers.edu)  
<http://aesop.rutgers.edu/~plantbiopath/faculty/zhang/zhang.htm>

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phthalimides (captan)	contact	preventive	interferes with respiration and glycolysis	multi-site	M4	low
SDHI (succinate dehydrogenase inhibitors) phenyl-benzamides (flutolanil)	acropetal penetrant	preventive	blocks activity of respiratory enzymes	single	7	moderate
Qil fungicides (quinone inside inhibitors) cyanoimidazole (cyazofamid)	contact	preventive	inhibits respiration	single	21	moderate to high
QoI fungicides (quinone outside inhibitors) strobilurins (azoxystrobin, fenamidone, kresoxim-methyl, trifloxystrobin)	acropetal penetrant	preventive (inhibits spore germination)	interferes with respiration	single	11	high
tetracycline antibiotic (oxytetracycline)	systemic	bactericide	inhibits protein synthesis	single	41	high

# Plant Diagnostic Laboratory Highlights

*Richard J. Buckley, Laboratory Coordinator*

## General Interest

Before we rush into spring, and believe me I am ready to rush, a brief recap of last season is in order. Last year was a down year for samples submitted to the Plant Diagnostic Laboratory. Our totals were down by about 15% last year and were the lowest since 1999. We assume most of the declines are related to the economy. The golf sector is particularly troublesome. As you all well know, plant health care costs are in the disposable income category (golf too) and we all have a little (a lot) less money to burn. In this economy, it is particularly important to make your pesticide or management strategy count. It might be tempting to forgo sampling and diagnosis to save a buck. That saved dollar; however, just might be the best investment you can make. A proper diagnosis of your plant health problem is always the first step in an effective control program. Remember, we are here to help you.

## Turf

Samples from golf courses have decreased slowly since 2005. In 2005 we had 940 samples of golf turf and we had 628 last year. In my time at the Plant Diagnostic Laboratory, bad years for turfgrass stand out and 2005 was one of the worst. The hot, dry summer caused a surge in dead grass that was clearly reflected in our sample totals. At the time, cost was not the primary issue we considered before submitting a sample for diagnosis. The current economic situation is surely partly to blame for the decline in samples from golf turf. We also see more competition in my business and some of you have tasted the fruit of other diagnosticians. A large part of the decline in samples from golf course putting greens; however, is due to the advances in **anthracnose** management. Samples of anthracnose continue to decline in the laboratory. In 2000 26% of the turf samples were diagnosed with anthracnose. Last year about 8% of our turf samples had the disease. It appears that widespread adoption of Rutgers recommendations turned a significant problem for many turf managers into a completely manageable issue. It is safe to say that I am a victim of our own success here at Rutgers.

Last year **summer patch** got some press as a resurgent problem. If you look at our records, however, we find that summer patch samples fluctuate yearly from just above 90 to just fewer than 120. Last year's total was right in the typical range, so why do we think the disease was so bad? I believe that as the focus shifts away from anthracnose, the problems that we all always had – **brown patch, pythium blight, dollar spot, summer patch** – are more apparent. I am quite sure that the destructive potential of anthracnose overwhelmed the

other diseases and as we clean up the anthracnose mess the other stuff remains and returns to our focus.

There is not much happening on the turf front yet. Surely some of you had **snow mold**? The recent spurt of snowy and rainy days made for perfect **pink snow mold** conditions! Expect to see the disease moving forward during cool, wet periods into May.

## Ornamentals

A number of conifers – most notably spruce and Douglas fir – have been submitted to the laboratory this winter with evidence of **winter injury**. Local spruce trees, in fact, took a beating during the dry heat of August and September last year and have been submitted to the laboratory in great numbers since mid-October. I expect the trend to continue due to the warm period we had in January. Many plants deacclimatize during the warm periods in winter and subsequently suffer during the bitter cold periods that follow. One can expect that trees damaged during the cold snaps will exhibit discoloration and dieback as we progress into summer. Odd patterns of burn may emerge on branches with damaged (previously frozen) xylem tissue. In some cases, sub acute levels of winter stress do not manifest until later in the season as premature senescence and drop of leaves and needles as well as branch dieback and even total plant failure (frozen roots).. ☐

# Marketing in Tough Times

Steve Bogash, Commercial Horticulture Agent,  
Penn State Cooperative Extension

Reprinted from *The Vegetable & Small Fruit Gazette*,  
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Anyone facing the sales climate going into this spring and summer that is not at the very least apprehensive could reliably be considered crazy. For many of us the last real downturn that we experienced was the Dotcom bubble pop of the 90's and that is nothing compared to today's economic climate. With so many of our customers out of work, worried about being out of work soon, or having had their financial nest egg greatly shrunken, selling things this growing season will be very different. There are some things that you can do to help your bottom line. Doing something is far preferable to hiding under your office desk and praying.

- Be sure your advertising is targeted, but keep advertising even when things are tight. First and foremost, you need your customers to know that you are alive and kicking. Secondly, numerous studies (they may have been done by advertising related businesses, but I have not had the time to do that deep research) show that businesses that keep advertising and do so in an organized manner following a coordinated plan do much better in both the short and long run. Rather than run scattered ads in newspapers with discounts and the usual stuff you run every year, try a new approach; take control of where your ads are located. If you are selling greenhouse ornamentals, make sure that your ads run with associated news articles or in garden inserts. For produce, require that your ads be connected with food articles. Wasting money on teaser ads may work in fat times, but now is the time to take control. Develop a budget, stick to that budget and keep records of how your new campaign works to better refine it later. I've always liked coupons that must be presented to measure how an ad works.

- Be sure your place looks maintained. This is not the time to let your signs fade, shingles fall off and your parking lot stripes vanish. If your customers question whether you are in business to stay, they will migrate elsewhere. Few people like doing business with failing companies unless they are giving things away.

- Submit articles to local newspapers, church newsletters, garden clubs....If there was ever a time to clearly demonstrate your expertise and how wonderful your business is, this is the time. If you've got meeting room space, invite local garden clubs to use the space for meetings, give them tours, maybe provide part of their refreshments, use your imagination....

- Sample (how would that work with plants?): While staying within state Dept. of Agriculture rules and regulations, provide samples of ready to eat (RTE)

produce. This can be soup, salsa, dips or simply cut produce. People buy more readily when they know what they are getting. Be sure to provide recipes for whatever RTE products you offer along with the main ingredients. If you've got a chef connection, take advantage of that and provide some well marketed edutainment. People love to watch others cook.

- Network, network, network.....Talk to your colleagues and competitors, you never know when mutual connections can be developed.

- Use your customer base to drag in new people, reward them for referrals: Word of mouth is still the most effective form of marketing. It costs you little and your good customers often bring in people a lot like themselves. Develop a simple straightforward method to reward people for dragging their friends in. Ask them to introduce their friend to the manager on duty for a gift. Keep the gift simple, but reasonably valuable.

- Train your staff - be sure they know your products inside out. While we are on the subject of staff, weak staff will stay that way, fear of job loss is seldom the motivator to change a lifetime of bad habits. When you hear business consultants say cut the fat, this is the first and easiest fat to go. I hate bad employees. They tend to bring even the most positive, professional people down like a bad case of the flu.

- Go after your present customer base, don't let them get away. Make sure that everything about how you do business makes it clear that you like what you do, appreciate your customers and intend to keep things that way regardless of the rockiness of our present road. Start with your warrantee, if they bring back a plant, replace it, if they say the sweet corn they got last week was wormy or mealy or off-flavor - give them a dozen. These things cost little in the larger scheme of things, but make it clear that you appreciate their business. Everyone should greet your customers - help your shy staffers with scripted lines until they get a clue. Even the shyest staffer can say "Welcome to Bogash Farms, our strawberries are awesome today." Or "We just brought in a new load of begonias, they're in the front of greenhouse #2, you've got to check them out." Everybody smiles for the customers, I know some surgeons that can help. If you have employees that cannot put down their cell phone or iPod, recommend a new line of work.

- Negotiate, yes, bargain with advertisers. These are tough economic times. Don't be afraid to ask for a price break. This is more than just saying I want a discount, bargaining takes time and patience and the willingness to say "NO" until you get the deal you want.

- Weekend weather will still be the single greatest factor. While somewhat self-explanatory, we all know that cool, wet, weekends dampen green product sales. Make your place as weather neutral as possible, so customers know that they will not suffer unnecessarily. Have

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# Southern NJ 2009 Plastic Pesticide Container Collection Schedule

*(It's FREE and one core credit will be issued to participants with a NJDEP Pesticide license)*

*NEW FOR 2009: Only one core credit will be issued per calendar year to those who participate.*

## Atlantic County

LOCATION: Helena Chemical  
66 Route 206 (North of the Route  
30/206 intersection)  
Hammonton, New Jersey

TIME: 9:00 a.m. to 3:00 p.m.

DATES: Friday, April 3; Thursday, May 7; Friday, June 5;  
Thursday, July 2; Thursday, August 7; Thursday, September 3; Friday, October 2

## Cumberland County

LOCATION: Cumberland County Solid Waste Complex  
169 Jesse Bridge Road (located off  
Route 55, Exit 29)  
Deerfield, New Jersey  
(Open trucks or trailers must be tarped  
before entering Complex)

TIME: 9:00 a.m. to 12 Noon

DATES: Friday, May 15; Friday, June 19; Friday, July 17;  
Friday, August 21; Friday, September 18; Friday, October 16; Friday, November 20

## Salem County

LOCATION: Helena Chemical  
440 N. Main St.  
Woodstown, New Jersey

TIME: 9:00 a.m. to 3:00 p.m.

DATES: Thursday, April 9; Friday, May 8; Friday, June 12;  
Friday, July 10; Friday, August 14; Friday, September 4;  
Friday, October 9

This program is offered to agricultural, professional and commercial pesticide applicators who hold a NJDEP pesticide license. State, county and municipal government agencies may also participate. A representative from the New Jersey Department of Agriculture will be on-site to inspect the containers and issue one core credit to pesticide license holders who follow all of the required processing steps. To receive credit, participants must bring their pesticide license to the collection site and must follow all of the processing steps. Core credits will not be issued to participants who fail to follow all of the pesticide container processing steps.

*NEW FOR 2009: Only one core credit will be issued per calendar year to those who participate.*

Plastic Pesticide Container Processing Steps & Size Limits:

1. All pesticide containers must be either triple rinsed or pressure rinsed, drained and dry inside;
2. All pesticide containers must be free of residue (other than stains);
3. The booklet must be removed (it is not necessary to remove the paper labels glued to the container);

4. Foil seal must be removed;
5. Only non-refillable pesticide containers will be accepted – you must drill a ¼-inch hole in the bottom of the container or with a utility knife make a 6-inch slit in the bottom of the container so the container will not hold liquids;
6. Only pesticide containers embossed with HDPE or the recycling #2 will be accepted;
7. Pesticide containers up to 55-gallons in capacity will be accepted. 5-gallon pails must be cut in half; 30-gallon containers into at least 4 pieces; and 55-gallon containers into at least 8 pieces. This can be accomplished using a sawsall, chainsaw, circular saw, or reciprocating saw. It is not necessary to cut up containers less than 5-gallons; and
8. Pesticide containers must have originally held an EPA registered pesticide. □

## Gypsy Moth Suppression Program

*Lynne Richmond, NJ Department of Agriculture*

The gypsy moth is the most destructive forest insect pest to infest New Jersey's forests. Repeated defoliation by the gypsy moth represents a serious threat to New Jersey woodland and shade tree resources.

The New Jersey Department of Agriculture promotes an integrated pest management approach, which encourages natural controls to reduce gypsy moth feeding and subsequent tree loss. However, when gypsy moth cycles are at a peak, natural controls have difficulty in preventing severe defoliation. In these special cases, the Department recommends aerial spray treatments on residential and recreational areas using the selective, non-chemical insecticide, *Bacillus thuringiensis*.

The Department's Gypsy Moth Suppression Program is a voluntary cooperative program involving New Jersey municipalities, county agencies, state agencies, and the USDA Forest Service.

In order to protect New Jersey's valuable forest resources, the Department conducts aerial defoliation and ground egg mass surveys, monitors the application and evaluates the efficacy of the spray material.

A total of 64 municipalities and 10 agencies have tentatively opted in to the 2009 aerial gypsy moth suppression program, with 45,425 acres in 16 counties. The Department conducted egg mass surveys in 139 municipalities in 19 counties. Of those, 86 towns, nine

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umbrellas handy, help people load their cars, provide liners for under pots and flats and build overhead coverings to keep people out of the weather.

● Luxury items will probably be in low demand. Fortunately, most of you reading this article don't sell much in the way of true luxury goods. Perhaps some buyers will look at the price of raspberries and blackberries and reconsider, but most of what we sell at worst falls under the category of little luxuries and thus may be spared. I've seen color bowls getting pretty pricey in recent years.

● Things could get really tight before they get better. Your individual situation could be very different from even 10 miles away if a factory or trucker or warehouse closes that makes up a lot of your drive-past business. Keep on top of the news and keep your inventory under control.

● Price point will matter a lot. People react to price point. That is why Wal-Mart spends so much time playing with and advertising their supposedly 'falling' prices. Try to keep as much of your product priced according to perceived value. Ask friends that shop to keep an eye over your shoulder. Everyone appreciates a deal, but finding the right price is an art form. Product that appears too cheap makes one wonder what's wrong with it. Overpriced stuff simply means product that sits. This entire article should be devoted to this issue alone, but even that would help little as each business must find price points that keep sales rolling while making a profit.

● Vegetable gardening will help, but only a little unless things get really bad. I keep reading that vegetable gardening is a growing trend and that may be so, but I cannot imagine enough people tearing themselves away from their big screen television and air conditioning to make much of a difference in our businesses yet. Make sure you have good quality vegetable plants on hand in varieties that people want. This is a minor investment and who knows what will happen as electricity prices climb and jobs vanish, maybe everyone will be growing veggies again. I'm betting hard on the big screen.

● Make your place a destination. Let's face it, people can buy produce at large grocers and do without flowers in a pinch. We are solidly in the entertainment business, so make your place worthy of your customer's time. Demonstration gardens, cooking classes, How-to classes, snack bars, things for kids to do.....all help to create an inexpensive opportunity for people to get their plants, produce, or baked goods and keep you in business.

● Don't get despondent. Gardening is still a relatively cheap hobby and people need to eat and want locally grown products. You can make it through, but not using a business model from 2007, 1997 or before that relied on lots of money floating about. Based on my reading of the economic news, that money never really existed. Those of us that can become lean and mean will still be standing next year and beyond. □

agencies in 17 counties on 61,016 acres qualified for this year's spray program. Thirteen municipalities opted not to participate in the program due to financial constraints. Participating municipalities must notify residents, adjoining municipalities and school districts of the program. The Department has requested \$1.5 million from the USDA Forest Service in cost-share dollars to assist participating municipalities with treatment costs. The USDA has not yet committed to federal funding for this year's spray program. Gypsy moth suppression activities are expected to begin in early May in South Jersey and in mid-May in the northern counties. □

