



Great Lakes Fruit, Vegetable & Farm Market EXPO Michigan Greenhouse Growers EXPO

December 4-6, 2012

DeVos Place Convention Center, Grand Rapids, MI



Greenhouse: Controlling Other Greenhouse Plant Diseases

Where: Grand Gallery (main level) Room D

Sponsored by [Syngenta Flowers](#).

MI Recertification credits: 1 (COMM CORE, PRIV CORE)

Moderator: Chris Lufkin, Syngenta Flowers

- 3:00 pm Controlling Other Greenhouse Plant Diseases: *Botrytis*, *Pythium*, Powdery Mildew, *Rhizoctonia*, and *Thielaviopsis*
- Blair Harlan, Plant, Soil and Microbial Sciences Dept., MSU
- 3:50 pm Session Ends

Controlling Other Greenhouse Plant Diseases: *Botrytis*, *Pythium*, Powdery Mildew, *Rhizoctonia*, and *Thielaviopsis*

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Botrytis Blight. The fungus *Botrytis cinerea* causes disease on greenhouse ornamental and vegetable crops including leaf spots, blighting, stem cankers, and damping-off. *Botrytis* produces large masses of gray conidia or spores (hence the name “gray mold”) that are carried on air currents to healthy plants where blight can become established. Infection can start as a small leaf spot that can quickly coalesce into a large necrotic area or infect the cut stem surface of stock plants and progress downward, causing a dieback of the entire plant. On bedding and stock plants, *Botrytis* typically becomes established and produces conidia on older lower leaves that are near the moist soil surface and under the plant canopy. *Botrytis* can also infect dead plant tissue in the pot or on the greenhouse bench or floor, which can be a source of future infections.

When the weather is moist and humid, susceptible plants may need to be protected from *Botrytis* infection. Plants may also be susceptible if they become wet from water dripping from overhead, dew, or condensation. Water allows the *Botrytis* conidia to germinate and penetrate the plant. Watering in the morning so that the foliage can dry rapidly is one way to minimize *Botrytis*. Reducing relative humidity by spacing plants further apart and providing good air circulation can be helpful. Reduce the relative humidity for a minimum of 24 hours immediately following the harvesting of cuttings to help “dry” the wounded stems and thereby limit stem blight. Finding the beginnings of brown/gray fuzziness on lower leaves can signal the need for disease control measures. Sanitation is an important first step to reduce *Botrytis* in your greenhouse. If you have dead plant tissue on your greenhouse bench, it is likely supporting sporulating *Botrytis*! The table below shows that even the best treatments do not completely prevent infection, however, they are often necessary partners in a successful management program that includes environmental control and sanitation.

This table shows the results of a trial conducted on poinsettia plants inoculated with *Botrytis*.

Fungicides were applied and allowed to dry prior to introducing *Botrytis*. The fungicides containing chlorothalonil (Daconil is an example) and iprodione consistently provide effective control. The biopesticide Veranda O has been shown to be effective in several studies. Newer products Pageant and Palladium make excellent rotational products in a spray program. Fungicides must be applied as a foliar spray to be effective in controlling this disease.

Treatment and rate/100 gal	% of leaves with sporulating <i>B. cinerea</i>	Health rating 1=healthy, 10=dead
Untreated control	65.4 e	7.0 e
Daconil Weather Stik 6SC 1.4 pt	7.0 a	2.0 ab
Veranda O 11.3WDG 8 oz	12.3 ab	3.0 ab d
Pageant 38WG 18 oz	5.2 a	1.8 ab
Palladium 62.5WDG 6 oz	13.0 ab	2.3 abc
Decree 50DF 1.5 lb	19.1 abc	3.3 bcd
Medallion 50WP 4 oz	0.5 a	1.3 a
Chipco 50WP 2 lb	6.0 a	1.8 ab
Heritage 50WG 8 oz	35.8 bcd	4.0 cd
GANTEC Green E 8 fl oz	58.5 e	7.3 e
Disarm O SC 4 fl oz	37.7 cd	4.5 d
OHP 6672 F 20 fl oz	69.4 e	6.8 e

Botrytis ‘A’ Team

Daconil Weatherstik SC	chlorothalonil
Decree 50DF	fenhexamid
Chipco 26019 WDG, 26GT F	iprodione
Pageant 38WG	pyraclostrobin + boscalid
Veranda O WDG	polyoxin D zinc salt

Botrytis ‘B’ Team

Compass O WDG	trifloxystrobin
Dithane DF	mancozeb
Heritage WDG	azoxystrobin
Insignia WG	pyraclostrobin
Palladium WDG	cyprodinil + fludioxonil

Pythium Root Rot. *Pythium* crown and root rot is a common and persistent disease in the greenhouse industry. *Pythium* is a water mold that can “nibble” the feeding roots of plants, resulting in stunted growth. *Pythium* can also cause severe symptoms, such as crown rot, that can result in plant death. *Pythium* favors wet, saturated soil conditions, such as overwatered media. The persistence of this pathogen can be traced to its ability to ‘hibernate’ on dirty plant containers, benches, hoses, and greenhouse walkways, ready to become activated by the right crop and weather conditions. Although *Pythium* can be a problem on almost any greenhouse crop, plants like geranium, poinsettia, and snapdragons are often the most affected. Sanitation is especially important in limiting root rot. Conditions that favor good plant growth and minimize stress make the plant less vulnerable to attack by a root rot. Use a pressure washer with soap and water when cleaning walkways, benches, etc. You can follow this with a disinfectant to remove any remaining *Pythium*. If you’ve done everything right and still find yourself with a *Pythium* problem, choosing the right fungicide tools can minimize your losses.

Scouting is an important first step in controlling *Pythium* root rot. If *Pythium* has a significant head start, the root system of some plants will be too rotted and the fungicides will not be able to rescue them. If Subdue MAXX has been the only or primary fungicide used over the years, and *Pythium* continues to be an issue in your greenhouse, it is possible that the *Pythium* has become resistant and is no longer affected by this fungicide. To know for sure, the *Pythium* present in your greenhouse must be tested in a diagnostic lab. To avoid the development of resistance, rotate among the different active ingredients available among fungicide products.

If *Pythium* has not been a major issue in your greenhouse, a fungicide such as Banrot 40WP is a mixture of two different active ingredients and targets all three common root rots. If *Pythium* is diagnosed as the problem, choosing a fungicide that is specific for *Pythium* is important and include Subdue MAXX (also available as Mefenoxam 2), Truban, Terrazole, Aliette, and FenStop. If you have *Pythium* resistant to Subdue MAXX in your greenhouse it is recommended that Truban or Terrazole be used as they have been shown to be the most effective products in our greenhouse trials. Since Truban and Terrazole have the same active ingredient, rotating between these two fungicides is not recommended. Aliette and FenStop are tools for *Pythium* control that can be helpful if used early and if the disease is not severe. For the best control, the time between fungicide applications should not be stretched beyond the minimum interval listed on the label. Only drench applications, not spray applications, are effective in controlling *Pythium* root rot.

Pythium ‘A’ Team

Truban WP/Terrazole WP	etr Diazole
Subdue MAXX EC	mefenoxam

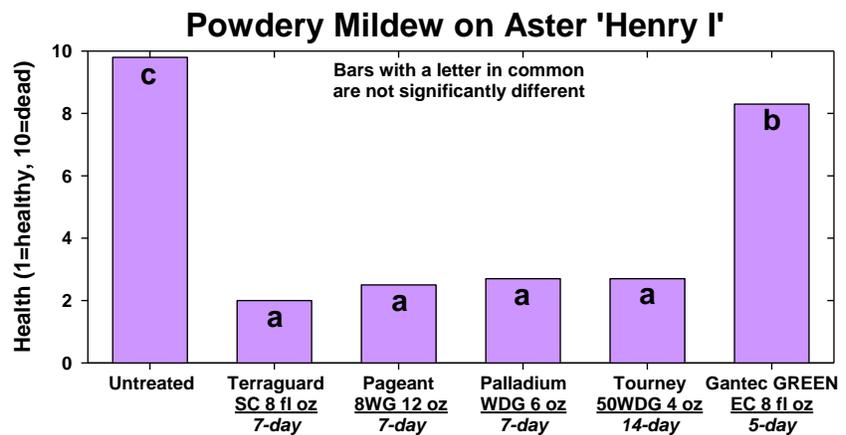
Pythium ‘B/B-’ Team

Adorn SC	fluopicolide
Aliette WDG	fosetyl-al
Captan WDG	captan
Heritage WDG	azoxystrobin
FenStop SC	fenamidone
Segway SC	cyazofamid

Powdery Mildew. The white talcum-like colonies of powdery mildew can start small but can rapidly blight the leaves, stems, and flowers of susceptible crops. Some powdery mildews can be specific to one type of plant while other powdery mildews, such as *Erysiphe cichoracearum*, can infect many different annual and perennial flowers and vegetables. The abundant conidia (spores) give a white, powdery or fluffy appearance. There are times when identifying the disease can be difficult as infection sometimes can only cause yellowing and withering of leaves and stunted plant growth. High relative humidity can prompt epidemics. Some plant species such as gerbera daisy, calibrachoa, asters, and verbenas are very susceptible and should be sprayed more frequently with the most effective fungicides. Other plant species may not need frequent applications but should be scouted regularly for signs of the disease. It should be noted that certain varieties of a plant species are more susceptible than others.

Growing susceptible crops can be a challenge, and fungicides have typically played a key role.

Powdery mildews are tricky and have been known to genetically adapt to overcome some of the most effective fungicides. You may want to start out with the most effective products, such as Eagle and Terraguard if you are growing an especially susceptible crop. Currently there are several excellent products available (Insignia, Pageant, Tourney, etc.) to rotate with your best fungicides in a comprehensive spray program.



Powdery Mildew 'A' Team

Eagle EW/WP	myclobutanil
Terraguard SC	triflumizole

Powdery Mildew 'A-/B' Team

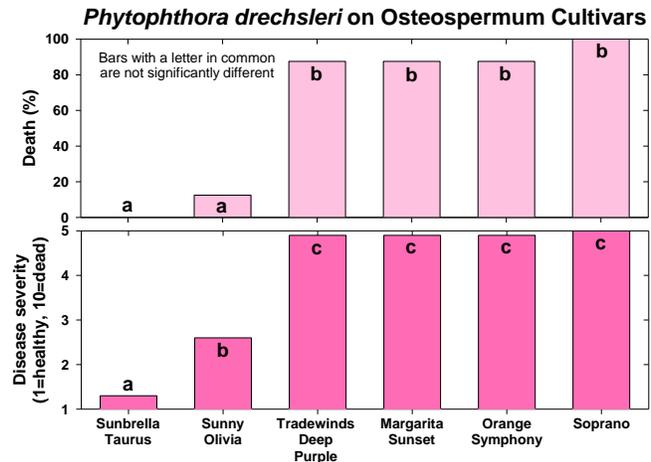
Compass O WDG	trifloxystrobin
Heritage WDG	azoxystrobin
Insignia WG	pyraclostrobin
Pageant WG	pyraclostrobin + boscalid
Strike WDG	triadimefon
Tourney WDG	metconazole
Zyban WSP	t-methyl + mancozeb

Phytophthora Root Rot. *Phytophthora* is a water mold (like *Pythium*) and can be a particularly devastating and difficult-to-control problem. It can spread quickly in a greenhouse, especially in flood floor and hydroponic systems. Two types of *Phytophthora* (*Phytophthora nicotianae* and *Phytophthora drechsleri*) are usually found in floriculture crops and can cause root, crown, and foliar blights. *Phytophthora nicotianae* can infect snapdragon, fuchsia, verbenas, bacopa, vinca, African violet, and dusty miller to name a few. *Phytophthora drechsleri* may infect poinsettias. Losses can be especially severe where ample water and warm temperatures favor disease epidemics. Symptoms include brown-black cankers at the soil line and diseased roots. Infected foliage will have a water-soaked, dark necrotic area. In some cases, the crowns will be the first plant part to become infected, after which the infection will move up the stem into the foliage near the petiole. This type of symptom is especially noticeable on English ivy and African violets.

Controlling the spread of *Phytophthora* spp. can be difficult. First, *Phytophthora* must be kept out of the production site. This is particularly difficult with floriculture crops because of the widespread distribution of prefinished plants. Also, plants may not exhibit obvious symptoms until the infection is

well established or the plant becomes stressed (e.g., over- or underwatering). Infected plants treated with fungicides may appear healthy until the fungicides wear off and *Phytophthora* increases. The second challenge is eradicating *Phytophthora* once it has been introduced. Sanitation can limit disease and includes removing plant debris and disinfesting production surfaces. Power washing benches and replacing floor mats are important steps to take to reduce inoculum for future crops.

The graph on this page shows the wide range of susceptibility among osteospermum cultivars to *Phytophthora drechsleri*. ‘Sunbrella Taurus’ and ‘Sunny Olivia’ showed resistance to infection from *Phytophthora* while the remaining cultivars in the study had >80% plant death.



If fungicides, such as the standard Subdue MAXX, are used to control *Phytophthora*, rotate it with other effective products. The newly registered fungicide Micora SC (mandipropamid) has been effective in greenhouse studies. Also, Adorn has controlled disease on pansy, poinsettia and snapdragon. The phosphorous acid products, such as Alude and Vital, may also limit disease. Other fungicides such as FenStop, Insignia, Heritage, Terrazole/Truban, Stature, Segway, and Aliette, may offer help if the disease pressure is not too severe. Some products have performed well on one crop but failed on another, so care must be taken to use a fungicide program that effectively rotates products to maintain disease control and minimizes the chance of fungicide resistance developing in *Phytophthora*.

Phytophthora ‘A’ Team

Adorn SC	fluopicolide
Alude L	phosphorous acid salts
FenStop SC	fenamidone
Micora SC	mandipropamid
Stature DM WP	dimethomorph
Subdue MAXX EC	mefenoxam
Terrazole WP	etr Diazole

Phytophthora ‘B’ Team

Aliette WDG	fosetyl-al
Captan WDG	captan
Insignia WG	pyraclostrobin
Segway SC	cyazofamid

Rhizoctonia Root Rot. The *Rhizoctonia solani* fungus typically causes a dull brown to dark brown rot on lower plant stems. In severe cases it can also destroy the root system of an infected plant. This pathogen can thrive in wet/dry or warm/cool conditions. Sanitation is an important method of limiting the pathogen as it is most likely to spread with contaminated soil, flats, or pots. Terraclor, Terraguard, Cleary’s 3336/OHP 6672, and Medallion applied as a drench have been important tools in preventing *Rhizoctonia* and halting its spread. Repeated studies with the biopesticide Veranda O have shown it to be a very effective product against *Rhizoctonia*. Biocontrol agents are becoming more widely available for use in controlling damping-off fungi such as *Rhizoctonia*.

Growing mixes that are naturally suppressive to damping-off soilborne fungi are also available to growers. A “suppressive” medium is one that represses, restrains, or checks the growth of damping-off fungi. Initially, interested growers may want to test the usefulness of suppressive media in their growing system by planting a small portion of their crop in suppressive media. Communication with sales representatives and extension personnel may be helpful to evaluate and perhaps modify growing systems using suppressive medium to achieve the best results.

Rhizoctonia ‘A’ Team

Medallion WG	fludioxonil
Terraclor WP	PCNB
Terraguard SC	triflumizole
Veranda O WDG	polyoxin D zinc salt

Rhizoctonia ‘B+’ Team

Cleary’s 3336 WP/OHP 6672 FL	t-methyl
Captan WDG	captan
Heritage WDG	azoxystrobin

Black Root Rot. Black root rot, caused by the fungus *Thielaviopsis basicola*, is a serious threat to pansies, petunias, and vinca. It may also infect cyclamen, calibrachoa, poinsettia, primula, impatiens, snapdragon, verbena, phlox, begonia, and nicotiana. Symptoms of black root rot are often mistaken for nutrient deficiencies. Leaves may turn yellow and the youngest leaves become stunted and tinged with red. In mild infections, older leaves are yellow-green with the veins retaining their green color.

Sanitation is the best preventive measure against black root rot. This pathogen produces a spore that can persist on floor mats, greenhouse benches, or flats/pots. It is not recommend to reuse plug trays for crops that are susceptible to *Thielaviopsis*. University studies have shown that fungus gnats and shore flies can move this pathogen around a greenhouse by eating the spores and excreting them into nearby pots. If you have a *Thielaviopsis* problem and a fungus gnat problem then you will have a quickly spreading epidemic! Based on MSU studies, fungicides that have thiophanate-methyl as the primary active ingredient (Cleary’s 3336 F is an example) should be used frequently. Good rotational products include Terraguard and Medallion since they have a different mode of action and were shown to be effective in MSU studies against black root rot. Choosing an effective fungicide to control black root rot is critical because a misstep early in the disease epidemic may result in an unsalable crop. It is recommended to use the highest labeled rate of each treatment with close reapplication intervals.

Thielaviopsis ‘A’ Team

Cleary’s 3336 WP/OHP 6672 FL	t-methyl
Medallion WG	fludioxonil
Terraguard SC	triflumizole

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