

CONTROL OF FUSARIUM DISEASES ON ORNAMENTALS

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How many times have you looked at a sick plant and wondered what was wrong with it? If you then sought advice from an expert chances are good that you had to send a sample away to a lab and the diagnosis took at least a week. Why the experts can't just look at the plant and tell what's wrong? Diseases caused by very different pathogens can look the same. We are used to this idea when we think of a root rot that could be caused by *Fusarium*, *Phytophthora*, *Pythium*, or *Rhizoctonia*. On the other hand, a pathogen like *Fusarium* can cause very different symptoms on different plants or under different environmental conditions.



Fusarium stem rot on Aster



Fusarium root rot on Coleonema



Fusarium stem rot on Dianthus

Fusarium stem rot on Christmas Cacti

Fusarium rot of cacti and succulents is usually caused by *Fusarium oxysporum* and includes dieback, root and stem. Most species of cacti and succulents are susceptible with stem infections generally tan and may be dry at times and appear sunken. The orange-colored spores of the pathogen form in the spots. One of the easiest ways to distinguish between *Fusarium* and *Drechslera* rots is to observe the color of the spores since those of *Fusarium* are tan while those of *Drechslera* are black. The possibility of both diseases occurring concurrently should be kept in mind when choosing control procedures. Thiophanate methyl is effective in controlling *Fusarium* diseases but will not control

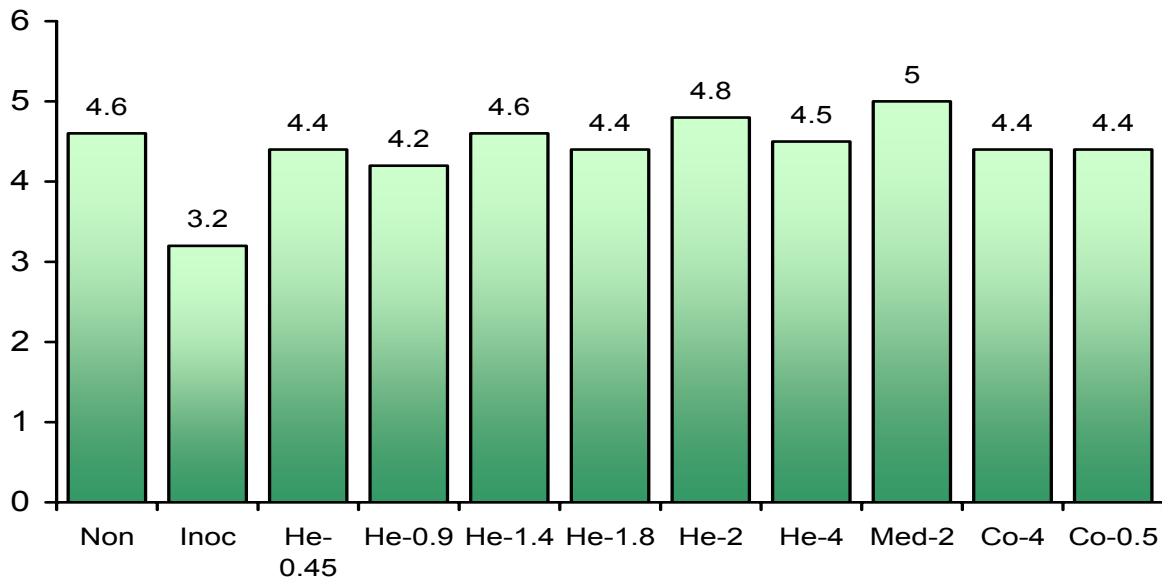
Drechslera stem rot.



Treatment	Rate/100 gal	Disease Severity
Water-noninoculated	-----	1.4 a
Water-inoculated	-----	3.0 de
Medallion	4 oz	2.2 b
Heritage	4 oz	2.5 bcd
Terraguard	4 oz	2.8 bcd
3336	16 oz	3.1 e
Terraclor 75WP	8 oz	2.7 bcde
Heritage/Medallion	2 oz each	2.3 bc
Chipco 26109	16 oz	2.4 bc
Compass O	4 oz	2.5 bcd

Fusarium crown rot on Lisianthus

A relatively new disease of lisianthus (*Eustoma grandiflora*) has become a serious problem throughout the United States over the past six years. This disease, caused by *F. avenacearum*, causes plants to develop poor color, wilting and eventually kills them. Stem decay sometimes extends 5 or 6 inches above the potting medium. In some cases, leaves on affected stems develop dead streaks with lower leaves appearing unaffected. The fruiting bodies of this Fusarium form on stems close to the potting medium when conditions are humid. They are pale-orange or off white and usually easy to distinguish from the gray spores of Botrytis which causes very similar disease symptoms and can occur simultaneously. Work from Florida has shown best control with fludioxinil (Medallion 50 WP from Novartis) and a combination of thiophanate methyl and iprodione. A grant from the American Floral Endowment has allowed further testing.



Fusarium leaf spot on Dracaenas

Fusarium leaf spot and stem rot of dracaenas is caused by *Fusarium moniliforme*. Fusarium leaf spot symptoms occur initially on the newest leaves of the plant when this whorl is very wet and spores are present. Spots are irregularly shaped, tan to reddish brown and many times have a yellow border. On Sansevieria, the disease is called red leaf spot and indeed on many dracaenas the spots are reddish too. Stem rot often occurs on cuttings during mist propagation. Symptoms are identical to those caused by Erwinia and culture of the pathogen is required to differentiate the two diseases. If plants are treated with fungicides and the foliage kept dry the leaf spot can be controlled. Chlorothalonil and mancozeb provide excellent control of Fusarium leaf spot of dracaenas. Soil

drenches of thiophanate methyl may decrease the stem rot phase on these plants.



All of the testing that I had completed in Florida indicated that chlorothalonil (like Daconil 2787) and mancozeb (like Dithane) gave the best control. Results of two trials conducted in 2000 are given in Table. It was interesting to find that Daconil remains the best overall fungicide for this disease. Newer fungicides that are also very effective include Heritage, Compass and Phyton 27. Heritage was most effective when used at 2 oz every 14 days. Compass also gave very good to excellent control when used at 4 oz every 21 days but was found to be phytotoxic to Janet Craig while being safe on Red-edge (*marginata*). The symptoms on Janet Craig unfortunately look similar to those caused by *Fusarium* and could lead to an inaccurate conclusion that the fungicide had not controlled the disease on this plant. Always trial new products on a small number of your crops under your special conditions to insure crop safety.

Table. Efficacy of some fungicides for control of *Fusarium* leaf spot on *Dracaenas*.

Treatment	Rate/100 gal (interval)	Disease severity on Janet Craig	Disease severity on Red-edge (<i>marginata</i>)
Water - noninoculated	---	0 a	0 a
Water-inoculated	---	10.9 b	2.7 b
Phyton 27	15 oz (7 day)	2.6 a	Not tested
Daconil Ultrex	1.4 lb (14 day)	0 a	0 a
Heritage 50WDG	1 oz (7 day)	0.9 a	Not tested
Heritage 50WDG	2 oz (7 day)	Not tested	0.6 ab
Heritage 50WDG	2 oz (14 day)	0.1 a	0.7 ab
Heritage 50WDG	2 oz (21 day)	Not tested	1.2 ab
Heritage 50WDG	4 oz (21 day)	0.5 a	Not tested
Compass 50DG	4 oz (21 day)	0 a (phytotoxic)	0.9 ab

Fusarium wilt on Cyclamen

In contrast, all of the work I have completed on Fusarium wilt on cyclamen has been done since I left Florida. This disease was first described in Germany in 1930 and later in the U.S. in 1949. The pathogen is *F. oxysporum* f.sp. *cyclaminis* and causes yellowing of lower leaves, wilting, root rot, browning or purpling of the vascular tissue in the corms and sometimes corm rot. Once plants become infected, they nearly always die despite fungicide applications. All ages of plants can get the disease, but those that are flowering near the end of the production cycle are often the ones that show the most dramatic symptoms. Indeed, symptoms may not appear until the plants are ready for sale. During warm weather the disease advances most quickly and drought stress can quickly turn a healthy appearing crop into one that is devastated with Fusarium wilt. The spores that spread disease are easily moved by irrigation water. When the disease was first discovered researchers found that although the seeds were not contaminated, the debris in the package sometimes was contaminated.



Management of Fusarium wilt on cyclamen by using resistant cultivars is not an option since they are all susceptible. Keep the medium pH above 6.0 by additions of dolomitic lime to reduce disease severity. It is critical that cyclamen plugs or seedlings are pathogen-free when purchased since even the best fungicides cannot eradicate this disease. Frequent scouting to remove symptomatic plants is a must. Never allow a crop to wilt because drought stress can rapidly bring on severe symptoms of Fusarium wilt. Plants may die as quickly as 2 weeks after symptoms appear. We did a test in 1999 with irrigation frequency and this disease. One set of plants was irrigated with clear water every day, the second was irrigated normally and the third was allowed to wilt before irrigation (drought). Our test confirmed that exposing cyclamen to drought increases severity of Fusarium wilt on Cyclamen. It was also interesting that watering the plants every day kept symptoms from developing compared to what I called normal irrigation. This test was conducted during the summer when the cyclamen apparently appreciated more water than I would normally give them.

Chemical control of this disease is not particularly successful. However, our research has shown that the best fungicides for Fusarium wilt on cyclamen are Medallion 50WP (fludioxonil from Syngenta), Heritage 50WDG (azoxystrobin from Syngenta) and Terraguard 50WP (triflumizole

from UniRoyal). Each of these fungicides must be used at 4-oz/100 gal to obtain even passable control of the disease. This year we used some lower rates of Heritage in a trial with the result that no disease control was seen at all.

Treatment	Rate/100 gal	Disease Severity
Water-noninoculated	-----	1.0 a
Water-inoculated	----	3.4 b
Insignia	8 oz	1.9 ab
Insignia	16 oz	2.0 ab
Medallion	2 oz	1.8 ab
Heritage	0.9 oz	2.1 ab
Compass O	2 oz	1.7 ab
3336	16 oz	2.2 ab
Heritage/3336	0.9 and 16 oz	1.8 ab
Fungo	20 oz	2.9 ab
Heritage/Fungo	0.9 and 20 oz	1.8 ab

Table. Summary of Tests for Fusarium wilt control on Cyclamen -1994 to 2005.

Product	Rate	Degree of control
Heritage 50WDG	4-16 oz	Good to very good
Medallion 50WP	1-4 oz	Good to very good
Terraguard 50WP	2-8 oz	Some to good
Compass 50WG	2-8 oz	Some
Fungo	20 oz	Some
Decree 50WDG	32 oz	Some
Insignia	8-16 oz	Some
Chipco 26019	16 oz	Poor to none
Phyton 27	10-20 oz	Poor to none
RootShield	8 oz	Poor to none
Rubigan	4 oz	None
Sythane 2E	8 oz	Poor
3336	16-24 oz	None

Conclusions

Fusarium diseases on ornamentals remain some of the most difficult to control. Prevention is still the best approach, even when fungicides must be used. The most effective fungicides generally work best when the plants are produced with minimal stress and all cultural control steps are taken to reduce disease pressure. Remember that many species of Fusarium are selective and do not attack a wide range of plants. This is especially true of those causing wilt diseases. Get an accurate diagnosis since Fusarium stem and root rot can look very similar to diseases caused by *Pythium*, *Botrytis*, *Cylindrocladium* and *Rhizoctonia*. Finally, mixed

infections with other soil-borne fungi are common and a partial diagnosis with lead to partial control at best.

Ornamental Fusarium Hosts

Compiled by Sue Harris

Scientific Name	Common Name	Fungal Species
<i>Abelmoschus</i>	Silk Flower	<i>F. oxysporum</i> <i>F. oxysporum sp. vasinfectum</i>
<i>Ajuga</i>	Carpet Bugle	<i>F. oxysporum</i>
<i>Callistephus</i>	China Aster	<i>F. culmorum</i> <i>F. oxysporum sp. callistephi</i> <i>F. oxysporum sp. conglutinans</i>
<i>Capisicum</i>	Ornamental Pepper	<i>F. annuum</i> <i>F. oxysporum</i>
<i>Centaurea</i>	Bachelor's Button	<i>F. oxysporum sp. callistephi</i>
<i>Chrysanthemum</i>	Mum	<i>F. moniliforme</i> <i>F. oxysporum</i> <i>F. oxysporum sp. callistephi</i> <i>F. oxysporum sp. chrysanthemi</i> <i>F. oxysporum sp. conglutinans</i> <i>F. oxysporum sp. tracheiphilum</i> <i>F. poae</i> <i>F. roseum</i>
<i>Dahlia</i>	Dahlia	<i>F. oxysporum</i>
<i>Delphinium</i>	Larkspur	<i>F. oxysporum sp. delphinii</i>
<i>Dianthus</i>	Carnation, pink	<i>F. acuminatum</i> <i>F. avenaceum</i> <i>F. culmorum</i> <i>F. equiseti</i> <i>F. oxysporum sp. dianthi</i> <i>F. poae</i> <i>F. roseum</i>
<i>Digitaria</i>	Foxglove	<i>F. acuminatum</i>
<i>Euphorbia</i>	Poinsettia	<i>F. moniliforme</i> <i>F. oxysporum</i> <i>F. solani</i>
<i>Gerbera</i>	Gerbera Daisy	<i>F. oxysporum</i> <i>F. solani</i>
<i>Gladiolus</i>	Gladiolus	<i>F. oxysporum sp. gladioli</i>
<i>Hedera</i>	English Ivy	<i>F. oxysporum</i>

		<i>F. solani</i>
<i>Helianthus</i>	Sunflower	<i>F. chlamyosporum</i>
		<i>F. concolor</i>
		<i>F. equiseti</i>
		<i>F. lateritium</i>
		<i>F. moniliforme</i>
		<i>F. oxysporum</i>
		<i>F. pallidoroseum</i>
		<i>F. poae</i>
		<i>F. solani</i>
		<i>F. sporotrichiodes</i>
		<i>F. subglutinans</i>
		<i>F. ventricosum</i>
<i>Hibiscus</i>	Hibiscus	<i>F. javanicum</i>
		<i>F. lateritium</i>
		<i>F. oxysporum</i>
<i>Iris</i>	Iris	<i>F. oxysporum</i>
<i>Lathyrus</i>	Sweet Pea	<i>F. oxysporum sp. vasinfectum</i>
		<i>F. solani</i>
<i>Lilium</i>	Lily	<i>F. oxysporum sp. lili</i>
<i>Lupinus</i>	Lupin	<i>F. moniliforme</i>
		<i>F. oxysporum sp. radici-lupini</i>
		<i>F. solani sp. lupini</i>
<i>Matthiola</i>	Stock	<i>F. avenaceum</i>
		<i>F. oxysporum sp. Mathioli</i>
<i>Mentha</i>	Mint	<i>F. roseum</i>
<i>Narcissus</i>	Daffodil	<i>F. moniliforme</i>
		<i>F. oxysporum sp. narcissi</i>
<i>Nicotinia</i>	Flowering Tobacco	<i>F. oxysporum sp. nicotianae</i>
<i>Rhododendron</i>	Rhododendron, azalea	<i>F. moniliforme</i>
		<i>F. oxysporum</i>
		<i>F. solani</i>
<i>Rosa</i>	Rose	<i>F. oxysporum</i>
<i>Tagetes</i>	Marigold	<i>F. oxysporum</i>
<i>Viola</i>	Pansy	<i>F. oxysporum</i>
<i>Zinnia</i>	Zinnia	<i>F. oxysporum</i>