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National Turfgrass Evaluation Program
www.ntep.org

Ultimate Turfgrass Links Page
www.msu.edu/user/karcherd/turflinks

Industry Trade Shows

Can West Show
www.canadanursery.com

Canada's International Horticultural Trade Show & Conference
www.locongress.com

"CENTS" Show
www.onla.org/cents.html

Florida Nursery & Allied Trades Show
www.fnats.org

Green Industry Expo (PLCAA, ALCA, PGMS)
www.gieonline.com

Gulf States Horticultural Expo
www.growit.com/gshe/index.htm

Hawaii Mid-Pacific Horticultural Expo
www.hena.org

International Construction and Utility Equipment Exposition
www.icuee.com

International Irrigation Show
www.irrigation.org

International Lawn, Garden and Power Equipment Expo
expo.mow.org

Mid-America Horticultural Trade Show
www.midam.org

Mid-Atlantic Nursery Trade Show
www.mants.com

New England Grows Trade Show
www.negrows.org

Ontario Turfgrass Symposium
www.open.uoguelph.ca

Southwest Horticultural Trade Show & Conference
www.azna.org/tradeshow/index.html

The Farwest Show
www.farwestshow.com

Western Nursery & Garden Expo
www.westernexpo.com

Work Truck Show
www.ntea.com

Government Agencies

Environmental Protection Agency (EPA)
www.epa.gov

Occupational Safety and Health Administration (OSHA)
www.osha.gov

U.S. Dept. of Agriculture (USDA)
www.usda.gov

U.S. Small Business Administration (SBA)
www.sba.gov

USDA Animal and Plant Health Inspection Agency (APHIS)
www.aphis.usda.gov

USDA APHIS National Agricultural Pest Information System (NAPIS)
www.ceris.purdue.edu:80/napis/

USDA APHIS National Plant Board
www.aphis.usda.gov/npb/index.html

Diagnostic Labs

Auburn U Plant Diagnostic Lab
www.aces.edu/department/ipm/plantlab.htm

Cornell U Plant Disease Diagnostic Clinic
plantclinic.cornell.edu/

Iowa State U Extension Plant Disease Clinic
www.exnet.iastate.edu/Pages/plantpath/pdcintro.html

Montana State U Plant Sciences & Plant Pathology
plantsciences.montana.edu

North Carolina State U Plant Disease and Insect Clinic
www.ces.ncsu.edu/depts/ent/clinic/index.html

Ohio State U Plant & Pest Diagnostic Clinic
www.ag.ohio-state.edu/~plantdoc/cweppdc/index.php

Oklahoma State U Plant Disease and Insect Diagnostic Lab
plants.okstate.edu/Pddl/index.htm

Oregon State U Plant Clinic
www.bcc.orst.edu/bpp/clinic.html

Purdue U Plant & Pest Diagnostic Lab
www.ppdl.purdue.edu/ppdl/

Rutgers Plant Diagnostic & Soil Testing Lab
aesop.rutgers.edu/~floriculture/diagnostic/diagnost.htm

Texas A&M Plant Pathology & Microbiology Diagnostics Lab
plantpathology.tamu.edu/index4.html

U of Florida Plant Disease Clinic
128.227.207.24/pdc/

U of Georgia Extension Plant Pathology
www.ces.uga.edu/Agriculture/plantpath/epphomep.html

U of Maryland Plant Diagnostic Laboratory
pest.umd.edu/PlantDiagnostic/intro.html

U of Mass Disease Diagnostics
www.umassturf.org/diagnostics/diseases.htm

U of Wisconsin Turfgrass Disease Diagnostic Lab
www.plantpath.wisc.edu/tddl/

Virginia Tech Plant Disease Clinic and Nematode Assay Lab
www.ppws.vt.edu/~clinic/

Manufacturer Associations

Equipment & Engine Training Council
www.eetc.org

Irrigation Association
www.irrigation.org

National Bark and Soil Producers
www.nbspa.org

National Truck Equipment Association
www.ntea.com

Outdoor Power Equipment Institute (OPEI)
opei.mow.org

Responsible Industry for a Sound Environment (RISE)
www.pestfacts.org

Turfgrass Producers International (TPI)
www.turfgrasssod.org

Professional Associations

American Nursery & Landscape Association (ANLA)
www.anla.org

American Society of Irrigation Consultants (ASIC)
www.asic.org

Associate Landscape Contractors Association (ALCA)
www.alca.org

Canadian Nursery Landscape Association (CNLA)
canadanursery.com

Golf Course Superintendents Association of America (GCSAA)
www.gcsaa.org

National Arborist Association (NAA)
www.natlarb.com

North American Weed Management Association (NAWMA)
www.nawma.org

Professional Grounds Maintenance Society (PGMS)
www.pgms.org

Professional Lawn Care Association of America (PLCAA)
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Contact vs. systemic fungicides

▶ Contact fungicides are an older type of fungicide also known as protectants that intercept a fungus and prevent it from attacking or getting inside a grass plant. They don't penetrate plant tissues but inhibit fungi by interfering with the growth and development of fungi in a number of ways, i.e., multiple site inhibitors. This creates a very low risk that fungal resistance will develop.

▶ For a fungus to develop resistance, it needs to change its DNA. But contact fungicides are toxic to many different fungi, including many non-target fungi that are beneficial to your turf, and they must be applied frequently.

▶ Systemic fungicides "move" once applied to the turf and redistribute inside the plant. Some fungicides are locally systemic; meaning they only move a few cells away from the point of entry. A carrier is a material upon which the active ingredient is loaded, for the application and the carrier itself can have fungicidal activity and can greatly affect how the active ingredient reacts and enters a plant.

▶ Generally systemic fungicides require 3 to 5 days to become fully effective. To be effective, the disease severity at the time of application must be low, so it is important to scout your turf and look for the start of disease. — *Hank Wilkinson*

CONTACT FUNGICIDES[a]

Common name	Trade name	Chemical class
captan	Captan	carboximide
chloronebb	Terraneb SP	chlorinated aromatic
chlorothalonil	Daconil	nitrile
etridiazole (ethazole)[b]	Terrazole, Koban	triadiazole
mancozeb	Fore, Manzate	ethylene bis-dithiocarbamate
PCNB (quintozene)[b]	Turfcide, Terraclor	chlorinated aromatic
thiram	Spotrete	dithiocarbamate

a Also known as "protectant" fungicides. Contact fungicides remain on plant surfaces and don't penetrate into tissues. All are multi-site inhibitors and have low risk for supporting fungal resistance development.

b Purported to have some systemic activity.

COURTESY OF R.T. KANE AND H.T. WILKINSON

Why fungicides fail in ornamentals

By Bal Rao, Ph.D

Generally, fungicides fail because of the conditions to which they're exposed. Unreasonable expectations can also cause someone to call a fungicide application a failure. By following label specifications and using the process of elimination, you should be able to narrow down or identify the cause(s) of disease management failures. This will help you develop effective disease management strategies and correct or improve future failures.

Some of the following factors may be responsible for poor disease management on ornamentals.

- Not following label specifications
- Not knowing the disease or plants well through improper identification or not understanding resistance, plant sensitivity, disease characteristics or pathogen life cycle.
- Product failure due to improper selection, slow activity, low concentration, failure to penetrate surface, solvent causing phytotoxicity, product age or photodegradation or other breakdown, incompatibility of products, limited activity, short residual effect, label limitations or heavy disease pressure.
- Misunderstanding treatment methods by miscalculating active ingredient, improper or faulty mixing/cleaning, failure to add surfactant or other agents, failure on application, failure to water in, improper equipment or calibration, no follow-up applications, poor plant uptake, rain wash-off, wind drift, soil conditions, improper storage.
- Poor timing in application related to pathogen's life cycle, degree days, extended cool and moist periods favoring disease developments, activity after residual is gone or multiple flushes of pathogen growth.

— The author is Manager of Research and Technical Development at The Davey Tree Expert Co., Kent, OH.

SYSTEMIC FUNGICIDES GROUPED BY CHEMISTRY AND MODE OF ACTION [a]

Common name	Trade name	Mode of action	Resistance risk
(benzimidazoles):			
benomyl	Tersan 1991*	mitotic poison (SSI)	high
thiophanates	Fungo, Cleary 3336	mitotic poison (SSI)	high
(phenylamide):			
metalaxyl	Subdue, Apron	RNA synthesis inhibitor	high
mefanoxam	Subdue MAXX	RNA synthesis inhibitor	high
(1,2,4-triazoles):			
cyproconazole	Sentinel*	demethylase inhibitor	moderate
myclobutanil	Eagle	DMI	moderate
propiconazole	Banner	DMI	moderate
tebuconazole	Lynx	DMI	(expmtl)
triadimefon	Bayleton	DMI	moderate
triticonazole	Triton	DMI	(expmtl)
(pyrimidinemethanol):			
fenarimol	Rubigan	DMI	moderate
(strobilurins):			
azoxystrobin	Heritage	respiration inhibitor	moderate
kresoxim-methyl	Experimental	cytochrome bc complex	moderate
trifloxystrobin	Compass	in mitochondria	moderate
(dicarboximides):			
iprodione	Chipco 26019, GT	not well known	moderate
vinclozolin	Vorlan, Curalan	not well known	moderate
(benzamide):			
flutolanil	Prostar	multi-site	low
(carbamate):			
propamocarb	Banol	membrane disruption MSI	low
(phosphonate):			
fosetyl-aluminum	Aliette	indirect plant activity	low

(a) Some are single-site inhibitors (SSI), and a few are multi-site inhibitors (MSI). SSIs have a moderate to high risk of developing fungicide resistance.

(*) Systemic fungicides marked with an asterisk are no longer available.

COURTESY OF R.T. KANE AND H.T. WILKINSON

KEY LANDSCAPE PLANTS AND THEIR DISEASES

Ash (Fraxinus)
* Anthracnose

Ivy, Boston (Parthenocissus)
* Black rot

Azalea (Rhododendron)
* Botrytis blight
* Leaf gall
* Nematodes
* Ovulinia flower blight
* Powdery mildew
* Root rots

Ivy, English (Hedera)
* Colletotrichum leaf spot
* Bacterial leaf spot

Cherry (Prunus)
* Bacterial leaf spot
* Black knot
* Coccomyces leaf spot

Juniper (Juniperus)
* Cedar-apple and cedar-quince rusts
* Kabatina twig blight
* Phomopsis twig blight
* Root rot

Crabapple (Malus)
* Cedar-apple rust
* Fire blight
* Powdery mildew
* Scab

Lilac (Syringa)
* Bacterial leaf blight
* Powdery mildew
* Witches' broom

Dogwood (Cornus)
* Anthracnose\ Decline
* Septoria leaf spot

Oak (Quercus)
* Anthracnose
* Decline
* Leaf blister

Elm (Ulmus)
* Botryodiplidia canker
* Dutch elm disease
* Black leaf spot
* Phloem necrosis (yellows)
* Wetwood

Pachysandra (Pachysandra)
* Volutella blight

Hawthorn (Crataegus)
* Fire blight
* Leaf spot
* Rust

Pine (Pinus)
* Sphaeropsis (Diplodia) tip blight
* Needle blights
* Cyclaneusma Needlecast
* Lophodermium Needlecast
* Ploioderma (Hypoderma) Needlecast
* Root rots
* Gall and cankering rusts

Rhododendron (Rhododendron)
* Botryosphaeria dieback
* Cercospora leaf spot
* Ovulinia flower blight
* Phytophthora die-back and root rot

Spruce (Picea)
* Cytospora canker
* Rhizosphaera Needlecast

Rose (Rosa)
* Black spot
* Cankers
* Powdery mildew
* Rust

Sycamore (Platanus)
* Anthracnose
* Powdery mildew

SOURCE: PENN STATE UNIVERSITY COOPERATIVE EXTENSION

HOW TO MANAGE WOODY ORNAMENTALS AND THEIR DISEASES

	Dormant	Bud break	Summer	Autumn
Arborvitae (Thuja)				
Kabatina twig blight	P	BSp		BSp
Phomopsis twig blight	P	BSp		BSp
Root rot			D	
Ash (Fraxinus)				
Anthracnose				R
Azalea (Rhododendron)				
Botrytis blight		BSp		
Leaf gall		P-BSp*		
Leaf spots		BSp		R
Nematodes				F
Ovulinia flower blight		BSp		
Phytophthora dieback	P	BSp	CSp	CSp-P
Powdery mildew			BSp	CSp
Root rots		D	D	F
Boxwood (Buxus)				
Canker	P	BSp		BSp
Macrophoma leaf spot	P		I	
Nematodes				F
Root rot				F
Catalpa (Catalpa)				
Leaf spots				R
Powdery mildew				NT
Verticillium wilt				NT
Cherry (Prunus)				
Bacterial leaf spot		BSp	CSp	
Black knot	P-X*	BSp		
Coccomyces leaf spot			BSp	

	Dormant	Bud break	Summer	Autumn
Chestnut (Castanea)				
Blight	P-X*			
Leaf spot				R
Cotoneaster (Cotoneaster)				
Fire blight	P-BSp*	CSp	CSp	
Scab		BSp	CSp	
Crabapple (Malus)				
Cedar-apple rust			NT	
Fire blight	P-BSp*	CSp*	CSp*	
Powdery mildew			NT	
Scab		BSp	CSp	R
Dogwood (Cornus)				
Anthracnose	P	BSp	CSp	
Decline	P-X*	BSp	CSp-I	I
Septoria leaf spot		BSp	CSp	

ABBREVIATIONS of suggested control techniques to employ at each key management time:

*	Only if the disease had been severe
BSp	Begin spray schedule-discontinue when weather dries
CSp	Continue spraying if wet-discontinue when weather dries
D	Apply soil drench fungicides
F	Fumigate before planting
I	Irrigate to prevent drought stress
NT	No treatment required
P	Prune
R	Rake and destroy fallen leaves
X	Remove infected plant

Visit our Web site's "This Month's Features" page (www.landscapemanagement.net) to see a more comprehensive list of woody ornamentals and their diseases.

SOURCE: PENN STATE UNIVERSITY COOPERATIVE EXTENSION