



Turfgrass Diseases: Rust Diseases (Causal fungi: *Puccinia* spp.)

Rust is the name given to a group of foliar diseases of turfgrasses that can occur on golf courses, athletic fields, home lawns, parks, and institutional grounds.



Puccinia sp., fruiting bodies, Telium, vertical section, in turf.
Bruce Watt, University of Maine, Bugwood.org

Rust diseases are caused by fungi in the genus *Puccinia*. A few of the common rusts that occur on cool-season turfgrasses include stem, stripe, crown, and leaf rust. Although there are differences among these diseases with respect to the symptoms and portion of the plant affected, they generally occur under the same environmental and cultural conditions.

Symptoms and signs

Initial symptoms of rust diseases appear as pale-yellow speckling of leaves or stems. As the disease progresses, the yellow areas become larger and tend to align in rows parallel with the veins of the leaves. Eventually, the leaf surface ruptures and the yellow spots develop into reddish-brown spore masses called uredinia (more commonly referred to as pustules). Severely diseased plants have an appearance similar to rusty iron, hence the name rust. When infected leaves are rubbed between fingers or walked upon, an orange powder collects on fingers or shoes. This powder is composed of millions of tiny spores (urediniospores) of the causal fungus. Rust is normally a late summer or early fall problem and does not occur at other times of the year in Pennsylvania.



Figure 1. Rust symptoms and signs on a perennial ryegrass lawn on the Penn State University Park campus. Photos: Peter Landschoot, Penn State



Figure 2. Orange pustules (spore masses) of *Puccinia* spp. on individual Kentucky bluegrass leaves. Photo: Peter Landschoot, Penn State



Figure 3. Orange-tinted urediniospores of *Puccinia* spp. on a shoe after the wearer walked through a rust-infested lawn. Photo: Peter Landschoot, Penn State

Disease cycle

The cycle of development for rust diseases is quite complex. Of the dozen or so species of rust fungi that affect turfgrasses, all but three go through five distinct spore production stages. Some of these stages, which are necessary for the completion of the entire life cycle, must occur on plants that are unrelated to turfgrasses. For a specific rust species, completion of the rust life cycle may require grasses and woody shrubs or grasses and herbaceous ornamental plants. In general, rust diseases do not kill turfgrasses but may weaken them to the point that they become more susceptible to stress-related problems, such as drought and heat.

Cultural control

Adequate nitrogen and irrigation to maintain growth through late summer will minimize rust infections. In most years, the disease does not become severe enough to thin stands, although infected turf may take on a yellow-orange color. Although most cool-season turfgrass species are susceptible to infection by at least one species of *Puccinia*, perennial ryegrass and Kentucky bluegrass tend to be more commonly and severely affected than other species. Turfgrass cultivars vary in susceptibility to rust diseases; thus, turfgrass managers should select rust-resistant cultivars of perennial ryegrass and Kentucky bluegrass whenever possible.

Chemical control

Fungicides are rarely used to control rust diseases in lawns or sports turf. However, when newly seeded turfgrasses begin to show symptoms in high visibility settings, one or two fungicide applications usually will control rust infestations.

Some penetrant fungicides labeled for control of rust diseases.

Active ingredient according to class	Fungicide class, FRAC code*, and plant mobility classification**	Product name(s)***
Demethylation inhibitors (DMI)		
flutriafol	DMI, 3, acropetal penetrant	Rayora
metconazole	DMI, 3, acropetal penetrant	Tourney
myclobutanil	DMI, 3, acropetal penetrant	Andersons Golden Eagle DG, Eagle 20EW, Myclobutanil 20EW
propiconazole	DMI, 3, acropetal penetrant	Andersons Prophecy DG, Banner Maxx II, Dorado, Lesco Spectator, Propiconazole 14.3, Savvi
tebuconazole	DMI, 3, acropetal penetrant	ArmorTech TEB 360 XL, Mirage Stressgard, Sipcam Clearscape ETQ, Tebuconazole 3.6, Torque
triadimefon	DMI, 3, acropetal penetrant	Andersons Fungicide VII, Bayleton FLO
triticonazol	DMI, 3, acropetal penetrant	Trinity
Methyl benzimidazole carbamates (MBC)		
thiophanate-methyl	MBC, 1, acropetal penetrant	3336 EG, 3336 DG, Cavalier F, Fungo Flo, Lesco T-Storm, SysTec 1998, TM 4.5, TM 85 WDG, T-Methyl, Transom 4.5F
Quinone outside inhibitors (QoI)		
azoxystrobin	QoI, 11, acropetal penetrant	Heritage, Heritage TL, Strobe 50WG, Strobe 2L, Strobe Pro

fluoxastrobin	QoI, 11, acropetal penetrant	Disarm G, Disarm 480 SC, Fame Granular, Fame SC
mandestrobin	QoI, 11, acropetal penetrant	Pinpoint
pyraclostrobin	QoI, 11, local penetrant	Insignia SC Intrinsic
trifloxystrobin	QoI, 11, local penetrant	Compass
Succinate dehydrogenase inhibitors (SDHI)		
penthiopyrad	SDHI, 7, acropetal penetrant	Velista

Some multisite contact fungicides labeled for control of rust diseases.

Active ingredient	Fungicide class, FRAC code*, and plant mobility classification**	Product name(s)***
chlorothalonil	Chloronitrile, M5, contact	Chlorostar DF, Chlorothalonil 5G, Chlorothalonil 720 SFT, Chlorothalonil DF, Daconil Ultrex, Daconil Weatherstik, Daconil ZN, Echo 720, Pegasus 6L, Previa
fluazinam	Oxidative phosphorylation uncoupler, 29, contact	Flex-Guard, Rotator, Secure, Soteria
mancozeb	Dithiocarbamate, M3, contact	Dithane 75DF Rainshield, Fore 80WP Rainshield, Lesco 4 Flowable Mancozeb, Manzate Max T&O, Manzate Pro-Stick T&O, Protect T/O

Some combination product fungicides labeled for control of rust diseases.

Active ingredient	Fungicide class, FRAC code*, and plant mobility classification**	Product name(s)***
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azoxystrobin + acibenzolar-S-methyl	QoI, 11, acropetal penetrant + Host defense induction, P1, systemic penetrant	Heritage Action
azoxystrobin + chlorothalonil	QoI, 11, acropetal penetrant + Chloronitrile, M5, contact	Renown
azoxystrobin + difenoconazole	QoI, 11, acropetal penetrant + DMI, 3, acropetal penetrant	Briskway
azoxystrobin + propiconazole	QoI, 11, acropetal penetrant + DMI, 3, acropetal penetrant	Goliath XP, Headway, Headway G, Contend B
azoxystrobin + propiconazole + pydiflumetofen	QoI, 11, acropetal penetrant + DMI, 3, acropetal penetrant + SDHI, 7, acropetal penetrant	Posterity XT
azoxystrobin + tebuconazole	QoI, 11, acropetal penetrant + DMI, 3, acropetal penetrant	ArmorTech Zoxy-T, Oximus
benzovindiflupyr + difenoconazole	SDHI, 7, acropetal penetrant + DMI, 3, acropetal penetrant	Ascernity, Contend A
boscalid + pyraclostrobin	SDHI, 7, acropetal penetrant + QoI, 11, local penetrant	Honor Intrinsic
chlorothalonil + acibenzolar-S-methyl	Chloronitrile, M5, contact + Host defense induction, P1, systemic penetrant	Daconil Action
chlorothalonil + iprodione	Chloronitrile, M5, contact + Dicarboximide, 2, local penetrant	E-Pro ETQ,
chlorothalonil + propiconazole	Chloronitrile, M5, contact + DMI, 3, acropetal penetrant	Concert II

chlorothalonil + propiconazole + fludioxonil	Chloronitrile, M5, contact + DMI, 3, acropetal penetrant + Signal transduction, 12, local penetrant	Instrata, Versagard Fungicide G
chlorothalonil + tebuconazole	Chloronitrile, M5, contact + DMI, 3, acropetal penetrant	E-Scape ETQ
chlorothalonil + thiophanate-methyl	Chloronitrile, M5, contact + MBC, 1, acropetal penetrant	ConSyst, Peregrine, Spectro 90WDG, Tee-1-Up, TM/C
copper hydroxide + mancozeb	Multi-site inorganic, M1, contact + Dithiocarbamate, M3, contact	Junction WSP
fluazinam + acibenzolar-S-methyl	Oxidative phosphorylation uncoupler, 29, contact + Host defense induction, P1, systemic penetrant	Secure Action
fluazinam + tebuconazole	Oxidative phosphorylation uncoupler, 29, contact + DMI, 3, acropetal penetrant	Traction
fluopyram + trifloxystrobin	SDHI, 7, acropetal penetrant + QoI, 11, acropetal penetrant	Exteris Stressgard
fluoxastrobin + chlorothalonil	QoI, 11, acropetal penetrant + Chloronitrile, M5, contact	Disarm C, Fame+C
fluoxastrobin + myclobutanil	QoI, 11, acropetal penetrant + DMI, 3, acropetal penetrant	Disarm M
fluoxastrobin + tebuconazole	QoI, 11, acropetal penetrant + DMI, 3, acropetal penetrant	Fame+T
iprodione + trifloxystrobin	Dicarboximide, 2, local penetrant + QoI, 11, acropetal penetrant	Interface Stressgard

isofetamid + tebuconazole	SDHI, 7, acropetal penetrant + DMI, 3, acropetal penetrant	Tekken
mefentrifluconazole + pyraclostrobin	DMI, 3, acropetal penetrant + QoI, 11, local penetrant	Navicon
PCNB + tebuconazole	Aromatic hydrocarbon, 14, contact + DMI, 3, acropetal penetrant	Premion
pyraclostrobin + fluxapyroxad	QoI, 11, local penetrant + SDHI, 7, acropetal penetrant	Lexicon Intrinsic
pyraclostrobin + triticonazole	QoI, 11, local penetrant + DMI, 3, acropetal penetrant	Pillar G
thiophanate-methyl + flutolanil	MBC, 1, acropetal penetrant + SDHI, 7, acropetal penetrant	SysStar WDG
trifloxystrobin + triadimefon	QoI, 11, acropetal penetrant + DMI, 3, acropetal penetrant	Armada 50WG, Tartan Stressgard

*FRAC is an abbreviation for Fungicide Resistance Action Committee. The FRAC code/resistance group system consists of numbers indicating classes or groups of fungicides based on the mode of action, and letters that refer to broad classifications of fungicides (P = host plant defense inducers; M = multi-site fungicides; and U = unknown mode of action and unknown resistance risk). Due to the risk of fungicide resistance, turf managers should avoid excessive use of fungicides within the same FRAC code/resistance group and alternate products among different FRAC codes/resistance groups.

**Plant mobility classification refers to a fungicide's ability to penetrate plant surfaces or remain on plant leaf or stem surfaces without penetration. Fungicides that penetrate plant surfaces and are translocated mostly upwards through plant xylem tissues are called acropetal penetrants (acropetal = toward the apex). Fungicides that enter plant cuticles or move limited distances in internal plant spaces, but do not translocate through vascular tissues (xylem and/or phloem) are called local penetrants. Contact fungicides do not penetrate plant surfaces and only inhibit fungal pathogens residing on leaf and stem surfaces.

***Follow label precautionary statements, restrictions, and directions regarding tolerant turfgrass species, rates, and timing of applications.

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