AN INDEPENDENT NEWSLETTER FOR COOL SEASON TURF MANAGERS

Turf Grass TRENDS

Premier Issue

Pythium root rot

A growing problem on high maintenance turf

by Dr. Eric B. Nelson

IN RECENT YEARS, Pythium-related root and crown rot damage to highly managed turfgrasses has become increasingly recognized as a major, nationwide problem. The contributing causes are easier to identify than to actually correct, because:

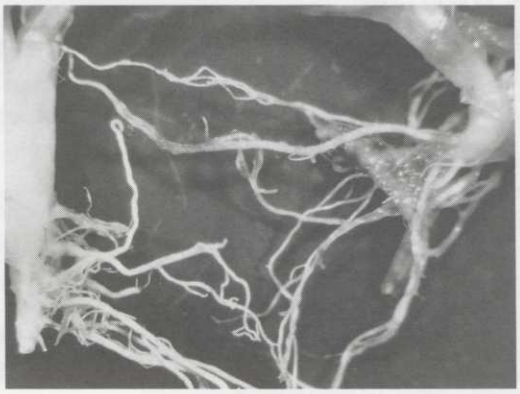
- PYTHIUM-CAUSED DISEASE is difficult to diagnose on the basis of simple field observations.
- OUR PRESENT KNOWLEDGE about specific Pythium species is still quite limited.
- THERE ARE SEASONAL, weather-related conditions and site-specific variables that must be sorted through.

However, even given these difficulties and limitations, there are a number of corrective actions that turf managers can take today, and promising additional remedies are under development. The first step is to get a clearer understanding of the disease.

Disease effects and affected grasses

CHARACTERIZED by both root and crown decay, this disease complex leads to a substantial thinning, and the possible loss of, established turfgrass stands. Although most frequently associated with established highly maintained bentgrass/annual bluegrass putting greens on golf courses, it is also widespread on highly managed home lawns and newly seeded areas as well.

At eye level, damage caused by Pythiums can be obvious and extensive, but the problem has grown because of a host of complexities that affect both the diagnosis of the disease and effective treatment of it.



Pythium damaged root and crown. At first, Pythium damage may be evident in the crown, but not in the roots. In severe cases, however, the root systems are greatly reduced in volume and vigor. They may also appear discolored. The crowns of infected plants may also appear water-soaked and discolored.

Although most turfgrass species are susceptible to Pythium root rot damage, they vary in their tolerance to infection. Bluegrasses *(Poa annua* and *P. pratensis),* ryegrasses, and bentgrasses are species that are particularly susceptible to infection.

Conditions and symptoms vary

EARLY SYMPTOMS OF PYTHIUM ROT may be visible immediately after snow melt, but are more common in the spring (March–May). Symptoms, however, may be evident at any time throughout the growing season, and disease activity may continue into late autumn. Observations of the disease in the Northeast indicate that particular sites are more prone to Pythium root rot damage in early spring and late autumn, while other areas experience the problem primarily in warmer parts of the season—with little or no damage at other

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Microscopic photo of Pythium infected root tip. It is difficult to diagnose Pythium root rot on the basis of field observations with the naked eye, but the difficulty doesn't end there. Pythium spores abound on this root tip, and many scientists still base their diagnosis of the disease on the presence of these oospores; however, Pythium growth inside the plant, in the absence of oospore production, can cause extensive root and crown damage—and many Pythium infections go undiagnosed.

times of the year. For instance, poorly drained areas may be subject to damage in the spring and fall, while areas with shade or poor air circulation may be susceptible to warm weather damage. These patterns of damage also may be related to variations in the native complex of pathogenic *Pythium* species associated with different sites, and also to the management practices unique to particular areas. These management practices may limit the activity of certain species and favor the activity of others.

Under the cool wet conditions typical of early spring (March–May) and late autumn (October–November), symptoms may first appear as small diffuse yellow or reddish brown patches of turf approximately two to three inches in diameter. Symptoms often closely resemble the early stages of Pink Snow Mold *(Microdochium nivale)* or Necrotic Ring Spot damage. In the spring, plants may be slow to come out of dormancy, and growth may be less vigorous than in uninfected plants. Under severe conditions, patches of infected turf may coalesce, and large areas may appear yellow and in a general weakened condition. Commonly, infected turf responds poorly to the application of fertilizers. As the season progresses and temperatures rise, large areas of previously infected turf may wilt, turn yellow to brown, and die.

Under warm wet conditions in mid-summer (June–August), initial symptoms appear as small tan to brown or bronze patches of turf—very similar in appearance to Dollar Spot patches. Again, these patches may converge on one another and affect large areas of turf. Extensive stands of plants can rapidly wilt and die. With severe infections, plants may wilt rapidly under heat stress, and thinning may be so extensive that large areas may become devoid of plants. Recovery of severely affected areas may take an entire season.

Diagnostic difficulties

PYTHIUM DAMAGED PLANT ROOTS often remain infected throughout the entire year, making it difficult to eradicate from problem sites. The frequency of root infections increases in the early spring during cool, wet periods. The infection rate reaches maximum levels in early summer. From studies on golf course putting greens, these periods of peak root infection typically coincide with Pythium root rot outbreaks. Following heavy infection periods, roots and crowns may contain abundant oospores of several of the pathogenic Pythium species, providing sufficient inoculum for the infection of newly developing roots in the fall and spring. These spores allow the fungus to survive unfavorable environmental conditions in a dormant state, and are insensitive to many fungicidal treatments.

Unlike Pythium (cottony) Blight, no foliar mycelium is evident during periods favorable for infection. Without observable evidence of the actual fungus itself, one can rarely diagnose Pythium root rot from field symptoms alone. Compounding the problem, Necrotic Ring Spot and Summer Patch can produce visual symptoms that are very similar to those produced by Pythium root rot. Thus, only upon microscopic examination of roots and crowns can one effectively determine whether the damage is from Pythium species.

Ideally, a qualified diagnostician should examine turfgrasses suspected of being affected by Pythium root rot, but, for one reason or another, many turf managers presently do not have ready access to such a resource.

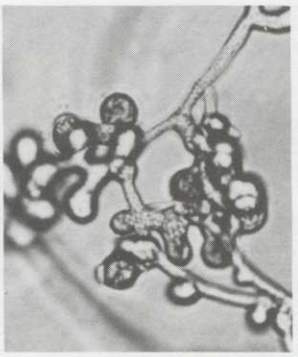
Typically, damage is first evident in the crown—with the roots largely unaffected. However, as the infection progresses on severely infected plants, the root systems may be extensively discolored, and are greatly reduced in volume and vigor. Crown areas may also appear water-soaked and greatly discolored. If root systems are not well developed prior to infection by Pythiums, the level of damage that a root system can sustain, and still function, becomes dramatically reduced. Under conditions of root system restriction, severe plant decline can occur.

On the basis of laboratory and field observations of Pythium root rot, the above-ground symptoms are clearly not a suitable basis for an accurate diagnosis of this disease. The microscopic observation of oospores in root tips, the root cortex and crowns has been the most accurate method of positively identifying Pythium root rot.

One problem with this technique is that much of the root and crown damage can occur as a result of Pythium growth inside the plant—in the absence of large numbers of oospores. Therefore, diagnoses based strictly on observations of oospore quantities are likely to overlook a number of Pythium root rot occurrences. Ideally, a qualified diagnostician should examine turfgrasses suspected of being affected by Pythium root rot, but, for one reason or another, many turf managers presently do not have ready access to such a resource.

Treatment

WE CAN REDUCE the severity of Pythium root rot damage by adjusting cultural practices to minimize plant stress. Maintaining an extensive and vigorous plant root system, as well as the effective management of water, are key elements in minimizing environmental stresses conducive to Pythium root rot.



Microscopic photo of Pythium sporangia. All species of Pythium produce sporangia that give rise to spores that "swim" in free water. That, in fact, is why Pythiums need prolonged wet periods to induce severe disease development. Sporangia are not long-lived and are sensitive to fungicides. Pythium oospores, on the other hand, can survive adverse environmental conditions in a dormant state. This ability helps to make them impervious to many fungicidal treatments.

Biological control of Pythium root rot also appears promising. Recent studies have shown that the application of topdressings—amended with certain composts and organic fertilizers—will reduce the symptoms of Pythium root rot on golf course putting greens. Unlike fungicide applications, application of composts and organic fertilizers may also reduce populations of Pythium species in soil.

If conditions warrant the application of fungicides, the recommended approach is to carefully choose—and thoroughly water in—a currently-labeled fungicide. Although turfgrasses affected with Pythium root rot respond to drenches with Pythium-selective fungicides, symptoms may frequently recur—particularly as temperature and precipitation change. This recurrence happens because pathogen inoculum levels in the soil are rarely suppressed following fungicide applications.

The currently available Pythium fungicides and application recommendations are listed in the table on page 4. Of the systemic fungicides, Banol® or Aliette® have been most effective in controlling Pythium root rot in the Northeast. Subdue® has been effective in some locations, but has failed in others. The granular formulations of Subdue® have been more effective than the liquid formulation. Koban® and Terrazole® are contact fungicides that also have been effective in some locations for the control of Pythium root rot. They are the only fungicides that have been shown to be effective in reducing soil inoculum of *Pythium*.

For sites with a history of early spring Pythium root rot problems, a fall application (mid-October–mid-November) of an appropriate Pythium fungicide (usually Banol®) is most effective in suppressing disease development early in the following spring. This should be followed-up with another application in the spring. In order for control to be effective at any time during the season, the fungicide must reach the root zone. We therefore recommend that all fungicides be thoroughly watered-in at the time of application. We also advise avoiding continuous application of any one fungicide on the same site, since this practice may enhance the development of fungicide-resistant Pythium populations—a phenomenon that researchers have already observed among some strains of root-rotting Pythium species.

Researchers have observed that applications of high rates of several of the newer non-Pythium specific broad-spectrum systemic fungicides actually increased damage from Pythium root rot. That is why we currently recommend that these types of fungicides be used sparingly on sites with a history of Pythium root rot and during periods favorable for Pythium infection. ■

DIGGING DEEPER

Which Pythium makes a difference

PYTHIUM GRAMINICOLA appears to be the principal culprit involved in Pythium root and crown rot disease in the Northeastern U.S. The evidence includes how frequently this particular species has been isolated from creeping bentgrass and perennial ryegrass and the strength of its ability to produce root and crown rot in these grasses.

Not all species of Pythium produce disease. In healthy, as well as diseased, turfgrass stands, researchers can readily isolate pathogenic, as well as non-pathogenic, species.

Little is currently known about the biology and ecology of the major species of *Pythium* that cause Pythium root rot. The most thorough understanding of any of these species on turfgrasses has come from studies of the soil ecology of *P. aphanidermatum,* the primary cause of cottony blight, and, to a limited extent, *P. graminicola.* However, the extrapolation of this information to other root-rotting *Pythium* species is uncertain. We certainly do not know much of the biology of *P. torulosum* and *P. vanterpoolii.* The limited information available on *P. graminicola* and *P. aristosporum* has come from annual crops such as wheat, corn and barley. Research is just beginning to address the biology, ecology and epidemiology of root-infecting Pythium species in established turfgrasses. ■

Pythium species that are generally more damaging under cooler (45°–60° F) conditions include:

- *Pythium graminicola*
- *P. vanterpoolii*
- *P. torulosum*
- *P. aphanidermatum*
- *P. aristosporum*

Species that can damage turfgrass roots under warm (75°–85° F) conditions include:

- *Pythium aphanidermatum*
- *P. graminicola*
- *P. myriotylum*
- *P. aristosporum*
- *P. periplocum*
- *P. vanterpoolii*
- *P. arrhenomanes*

Fungicides for the Control of Root-Rotting Pythium Diseases of Turfgrasses

Fungicide	Trade Name	Formulation	Application Rates (per 1000 ft²)*	Cost Range (per 1000 ft²)
Chloroneb	Teremec SP®	65W	Not Recommended for Pythium Root Rot	
	Tersan SP®	65W	Not Recommended for Pythium Root Rot	
	Scott's ProTurf Fungicide II®	6.3G	Not Recommended for Pythium Root Rot	
Ethazole	Koban®	30W	7 oz.	$8.24–$11.75
			9 oz.	$10.60 –$13.83
		1.3G	8 lb.	$13.87–$18.80
	Terrazole®	35W	8 oz.	$ not available
Mancozeb	Fore®	80W	Not Recommended for Pythium Root Rot	
	Lesco 4®	80W	Not Recommended for Pythium Root Rot	
	Lesco Mancozeb DG®		Not Recommended for Pythium Root Rot	
	Manzate 200®	37F	Not Recommended for Pythium Root Rot	
		75DF	Not Recommended for Pythium Root Rot	
	Tersan LSR®	80W	Not Recommended for Pythium Root Rot	
Metalaxyl	Subdue®	2E	2 oz.	$2.73–$3.48
		2G	1.5 lb.	$3.08–$3.90
		5G	10 oz.	not commercially available
	Scott's Pythium Control®	1.2G	2.5 lb.	$4.74–$6.34
(+triadimefon)	Scott's Fluid Fungicide II®	16AS	Not Recommended for Pythium Root Rot	
(+mancozeb)	Pace®	7+14S	Not Recommended for Pythium Root Rot	
Fosetyl-Al	Aliette®	80W	4 oz.	$.85–$1.06
			8 oz.	$1.70–$2.12.
Propamocarb	Banol®	6S	2 oz.	$3.57–$4.38
			4 oz.	$7.14–$8.76

* All fungicides must be thoroughly watered-in to get effective Pythium root rot control. Only Aliette® can be applied as a spray and still maintain control of Pythium root rot.

Under formulations: W=wettable powder; G=granular; F=flowable; AS=aqueous solution; S=solution; E=emulsifiable

TERMS TO KNOW

contact fungicides ..... Chemical agents that attack various forms of fungi on contact.
systemic fungicides ..... Chemical agents that enter and spread through plants attacking fungi throughout the plants.
crown rot ..... Decay of the crown of a plant, where the above ground portion of the plant joins the roots.
dormancy ..... A state of reduced or suspended activity.
epidemiology ..... The study of the spread of diseases in host populations.
foliar mycelium ..... Masses of filaments that represent the active growth stage of a fungus and is usually visible on the surface of leaves of infected plants only during the growth stage.
infection period ..... The time span during which a disease agent is active and able to spread the disease.
inoculum ..... The structures of a disease-causing agent that spread the disease during infection periods. Also used in "pathogen or soil inoculum" to refer either to the disease-causing agent or its presence in the soil.
oospores ..... Microscopic reproductive cells of Pythium fungi, which are able to survive adverse environmental conditions.
pathogen ..... A disease-causing agent.
pathogenic ..... An adjective used to describe the disease-causing potential of an agent.
root cortex ..... The major internal portion of a plant root.
sporangia ..... Microscopic reproductive cells of Pythium fungi from which swimming spores are produced.
symptoms ..... The observable effects of diseases.