Pythium Root Dysfunction

[*Pythium volutum*]

SYMPTOMS

Pythium root dysfunction is a disease of creeping bentgrass putting greens, and is most damaging to greens that were constructed within the last 10 years. The pathogen infects bentgrass roots during the fall and spring and reduces their ability to absorb water and nutrients from the soil. Symptoms may appear at any time of year, but are most severe during periods of hot and/or dry weather. *Pythium* root dysfunction appears in circles or irregular patches up to 2 feet in diameter that initially show signs of wilt or nutrient deficiency. As the disease progresses, affected areas turn orange and decline, eventually collapsing to the ground. Infected roots are tan in color and lack root hairs, which causes the sand to fall easily from the roots when examining a soil probe sample. Reductions in root depth may not be evident during the fall and spring, but roots infested with *Pythium volutum* die back rapidly when soil temperatures are above 85ºF.

Pythium root dysfunction soil cores

Characteristic	Description
Host Grass Species	creeping bentgrass
Month(s) with symptoms	all
Stand Symptoms	patches (4 inches to greater than 3 feet)
Foliar Symptoms - Location/Shape	dieback from leaf tip
Foliar Symptoms - Color	orange, yellow
Root/Crown Symptoms	roots tan and lacking root hairs
Fungal Signs	none

Note: Still not sure if this is the right disease? The Turfgrass Disease Identification program may be helpful. Or consult the experts at the Turf Diagnostics Lab. Check the TurfFiles glossary for definitions of unfamiliar terms.

FACTORS AFFECTING DISEASE DEVELOPMENT

Pythium root dysfunction infects creeping bentgrass roots in the fall, winter, and spring when mean daily soil temperatures are between 50ºF and 75ºF. Disease activity reduces the turf's ability to absorb water and nutrition from the soil, and also leads to rapid root dieback when soil temperatures exceed 85ºF. Therefore, the appearance of *Pythium* root dysfunction symptoms are enhanced by low fertility, drought stress, and low soil oxygen levels. Symptoms are most common during hot weather in summer but may also appear during warm, dry conditions in fall, winter, or spring.

CULTURAL CONTROL

Creeping bentgrass greens should be constructed with at least 15% organic matter by volume to provide adequate water and nutrient holding capacity. After establishment, creeping bentgrass should be fertilized with 4 to 6 lbs N per 1000 ft^2 annually. Use regular soil and tissue testing to ensure that all other nutrients

are present in adequate amounts. Raise mowing heights above 0.125 in. during summer to increase photosynthesis and alleviate stress. Avoid severe drought stress by irrigating before symptoms of wilt become widespread, and supplement with syringing and hand-watering of areas that dry out more quickly. Soil surfactants increase the uniformity of soil moisture across putting greens and will assist with water management. Frequent cultivation and topdressing are needed to maximize oxygen levels in the soil. In general, 15% to 20% of the putting green surface area should be impacted by hollow-tine aerification annually, and 5000 lbs of topdressing should be applied per 1000 ft^2 each year. Biweekly solid-tine aeration during summer will increase root survival by creating temporary channels for air and water movement through the soil profile.

CHEMICAL CONTROL

Standard *Pythium* fungicides, such as mefanoxam (Subdue Maxx), propamocarb (Banol), and fosetyl-Al (Signature) have provided poor to moderate control of *Pythium* root dysfunction when applied alone. The most effective fungicides have been those belonging to the QoI (azoxystrobin, fluoxastrobin, pyraclostrobin, and trifloxystrobin) and QiI (cyazofamid) chemical classes. Applications watered in with 1/8" of irrigation immediately have been slightly more effective than standard foliar applications. The same result may also be obtained by making the applications in larger volumes of water (4 to 6 gallons per 1000 ft^2) to drive the fungicide deeper into the canopy. Tank-mixtures of Signature + Banol (4 + 2 oz/1000 ft^2) or Signature + Subdue Maxx (4 + 1 oz/1000 ft^2) also have provided good disease suppression. These tank-mixtures are most effective when applied to the foliage in 2 gallons of water per 1000 ft^2.

Fungicides may be used on either a curative or preventative basis for *Pythium* root dysfunction control. Both strategies employ the same fungicide rotation:

1. QoI Fungicide (high label rate, watered-in with 1/8" of irrigation)

2. Segway (0.9 fl oz/1000 ft^2, watered-in with 1/8" of irrigation)

3. Signature + Banol (4 + 2 oz/1000 ft^2) or Signature + Subdue Maxx (4 + 1 oz/1000 ft^2) applied in 2 gal/1000 ft^2 and left on the foliage.

For preventative control, one of these treatments should be applied every 21 to 28 days in the fall and spring when mean daily soil temperatures are between 50ºF and 75ºF. Curative applications should be made every 14 to 28 days based on the appearance of symptoms. For curative applications, Insignia has been significantly more effective than the other QoI fungicides. Segway (cyazofamid) is also an effective curative treatment. Regardless of which fungicide is applied, effective curative control also requires increased mowing heights and nitrogen inputs to relieve stress and allow the affected plants to heal.

Because QoI and QiI fungicides are prone to fungicide resistance, it is very important to follow the fungicide rotation outlined above. Superintendents who apply one fungicide repeatedly are likely to experience control failure as the fungal population becomes resistant.

Fungicide	Efficacy[1]	Resistance Risk [2]	Class [3]	Products [4]
pyraclostrobin + boscalid**	+++	6	carboxamide + QoI	Honor
cyazofamid**	+++	9	QiI	Segway
pyraclostrobin	+++	9	QoI	Insignia
propamocarb	++	4	carbamate	Proplant, Banol
mefenoxam	++	9	phenylamide	Subdue, Fenox, Mefenoxam 2, Mefenoxam 2 AQ, Quell
metalaxyl	++	6	phenylamide	Vireo

Fungicide	Efficacy[1]	Resistance Risk [2]	Class [3]	Products [4]
fosetyl-Al**	++	3	phosphonate	Autograph, Fosetyl-Al, Prodigy Signature, Signature
azoxystrobin	++	9	QoI	Heritage
trifloxystrobin	++	9	QoI	Compass
ethazole**	+	3	aromatic hydrocarbon	Koban, Terrazole
phosphorous acid**	+	3	phosphonate	Alude, Magellan, Resyst, Vital, Vital Sign
fluoxastrobin + myclobutanil	?	6	DMI + QoI	Disarm M
fluoxastrobin	?	9	QoI	Disarm, Disarm G

** Not for application to residential lawns.

Footnotes:

(1) ***Efficacy Codes:***

++++	excellent control when conditions are highly favorable for disease development
+++	good control when disease pressure is high, or excellent control when disease pressure is moderate
++	good control when disease pressure is moderate, excellent control when disease pressure is low
+	good control when disease pressure is low
0	does not provide adequate control under any conditions
?	cannot be rated due to insufficient data

(2) ***Resistance Risk:***

1	Rotating and tank-mixing not necessary, but recommended to avoid potential side effects from continuous use of same chemical class.
2	Rotate to different chemical class after 3-4 applications; tank-mixing not necessary.
3	Rotate to different chemical class after 2-3 applications; tank-mixing not necessary.
4	Rotate to different chemical class after 1-2 applications; tank-mixing not necessary.
6	Rotate to different chemical class after 1-2 applications; tank-mixing with low or moderate risk product recommended.
9	Rotate to different chemical class after EVERY application; tank-mix with low or moderate risk product for EVERY application.

(3) Continual use of fungicides with similar control mechanisms (modes of action) can result in fungi that are resistant to some chemicals. Poor or ineffective disease control can be expected when this occurs. Managers can reduce the chances of this happening by mixing or alternating fungicides belonging to different chemical classes.

(4) Recommendations of specific chemicals are based upon information on the manufacturer's label and performance in a limited number of trials. Because environmental conditions and methods of application may vary widely, performance of the chemical will not always conform to the safety and pest control standards indicated by experimental data. When more than one brand name exists for an agricultural chemical, the name of brand that first came onto the market is listed first. Otherwise, brand names are listed in alphabetical order. The order in which brand names are given is not an indication of a recommendation or criticism.

Recommendations for the use of agricultural chemicals are included in this publication as a convenience to the reader. The use of brand names and any mention or listing of commercial products or services does not imply endorsement by North Carolina State University or discrimination against similar products or services not mentioned. Other brand names may be labeled for use on turfgrasses. Individuals who use agricultural chemicals are responsible for ensuring that the intended use complies with current regulations and conforms to the product label. Be sure to obtain current information about usage regulations and examine a current product label before applying any chemical. For assistance, contact your county's Cooperative Extension agent.

Useful links:

Glossary: http://www.turffiles.ncsu.edu/Glossary.aspx

Turf Diagnostics Lab: http://ncstateturfdiagnostics.com/TDL/Home.html

Turfgrass Disease Identification Program: http://www.turffiles.ncsu.edu/diseaseID/

Turfgrass Disease Management Program: http://www.turffiles.ncsu.edu/diseasemgmt/

Turf Irrigation Management System: http://www.turffiles.ncsu.edu/tims/

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