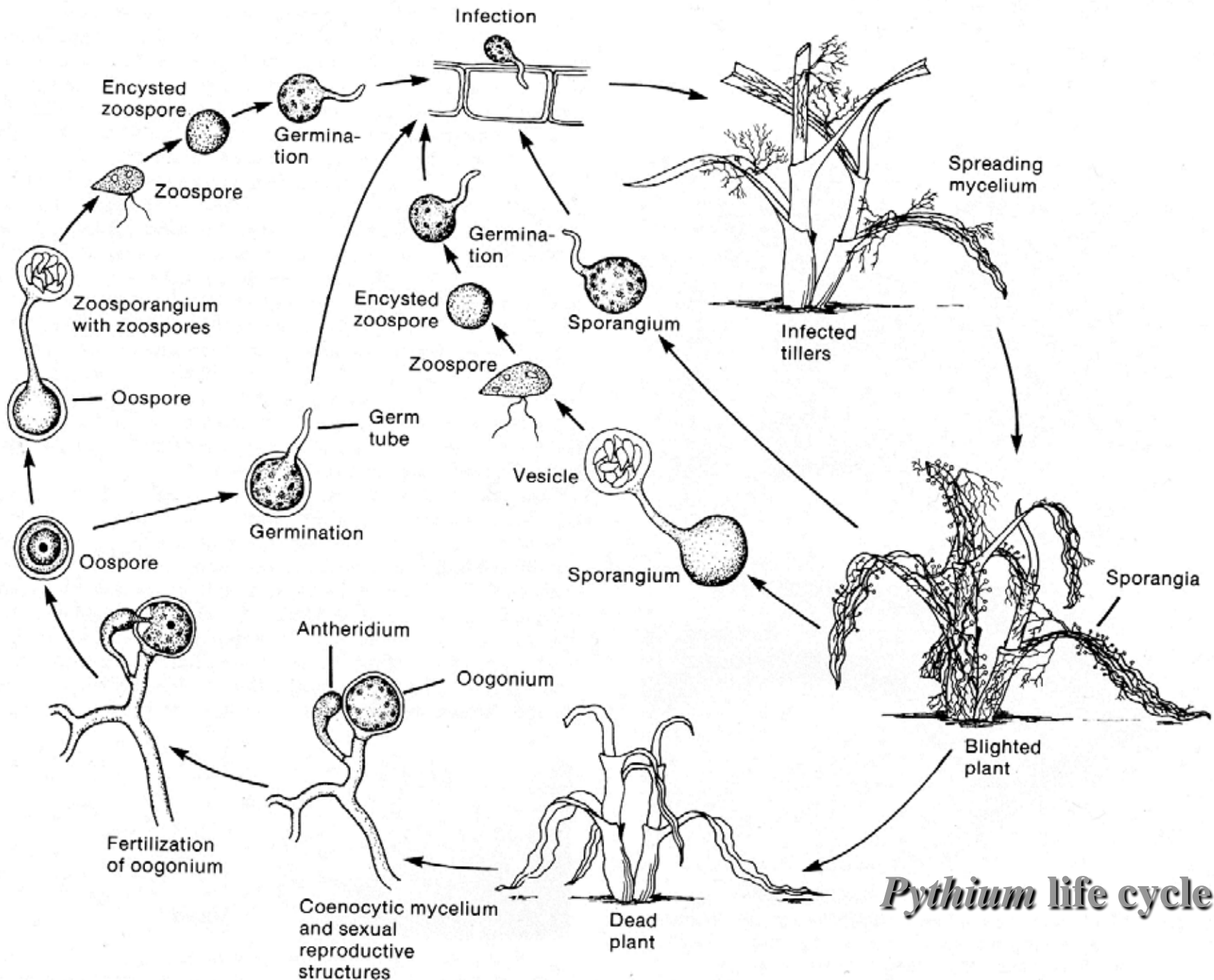


Diseases of Bentgrass Caused by *Pythium*

- Ø Damping-off of seedlings
- Ø Pythium blight of foliage
- Ø Pythium root rot, dysfunction

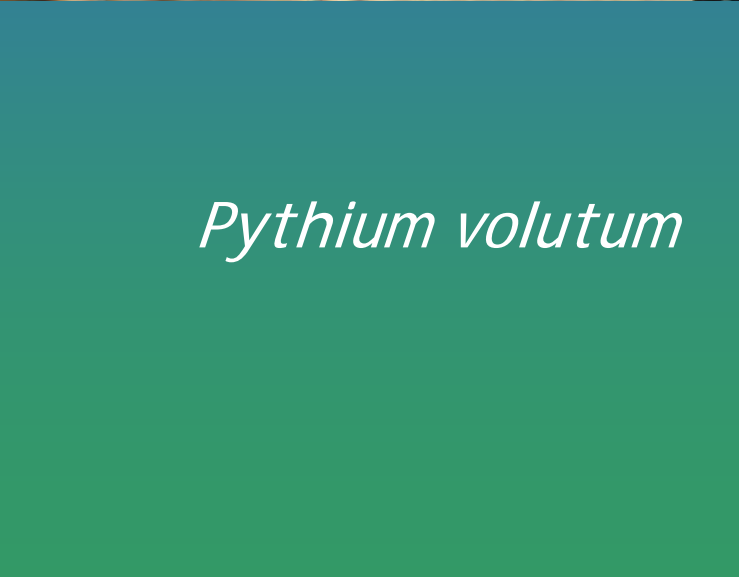


Pythium life cycle





*Pythium
aphanidermatum*

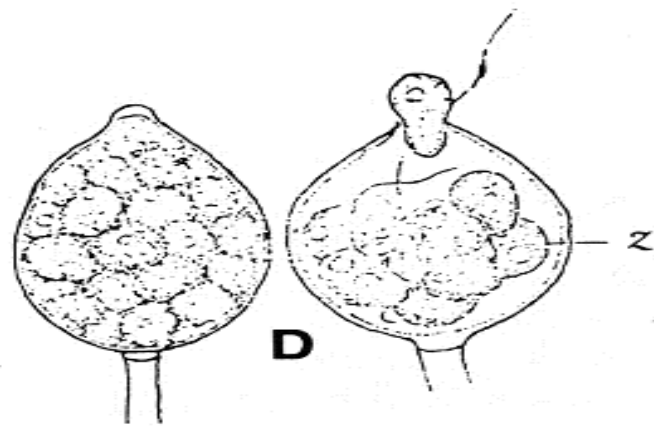
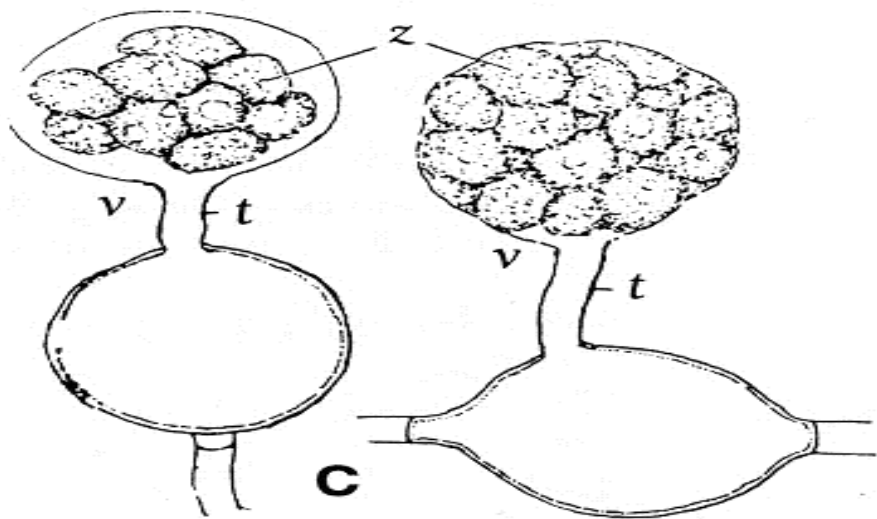
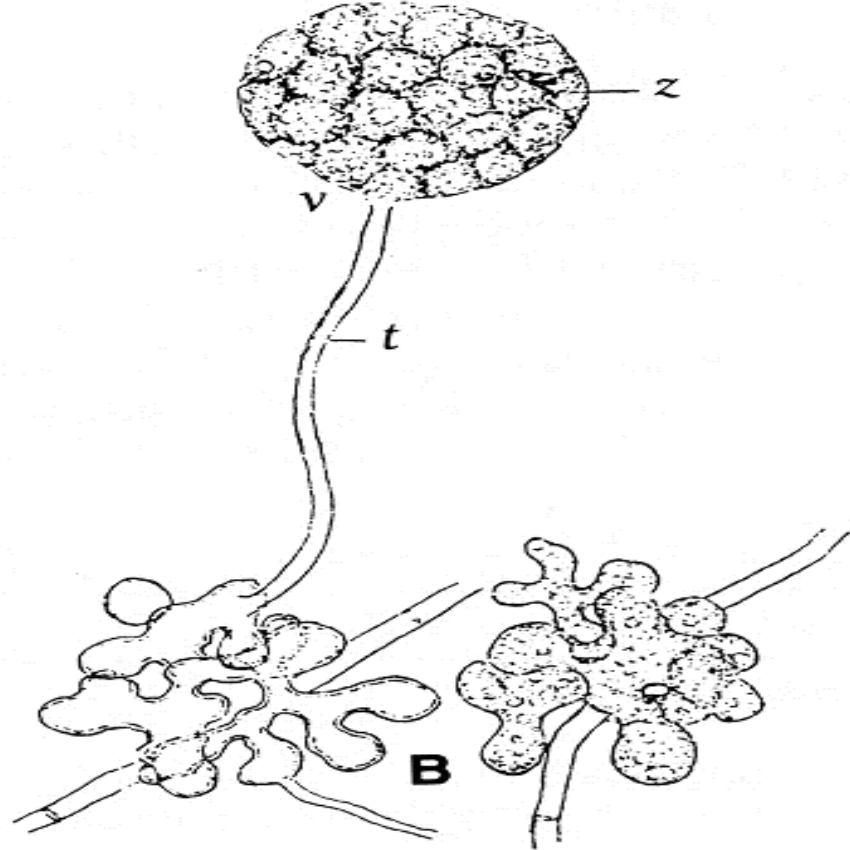
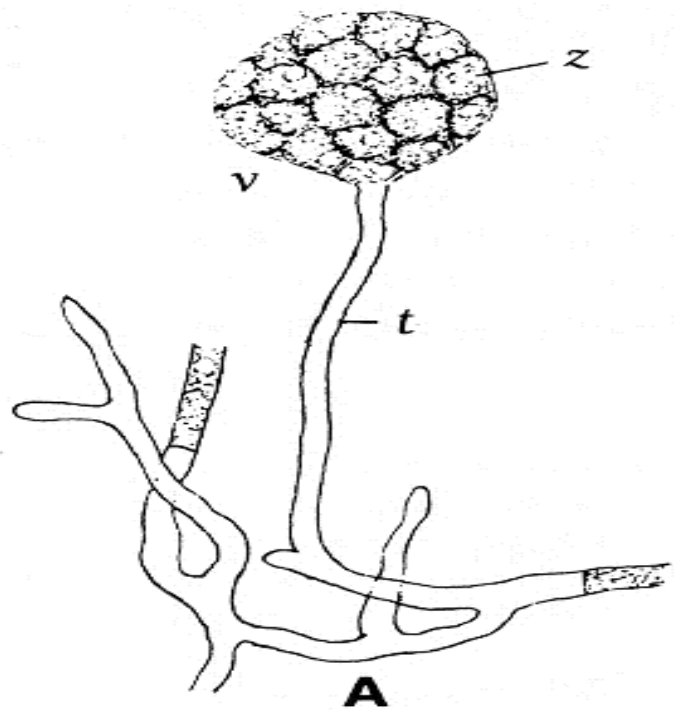


Pythium volutum



Hyphae , sporangia and oospores of *P. ultimum*







Seedling Diseases / Damping-Off

- F Causal Agent(s): *Pythium* spp., *Bipolaris sorokiniana*, *Rhizoctonia* species, *Drechslera* spp., *Fusarium* spp.
- F Hosts/ Occurrence: All grasses may be affected in the seedling stage or may be affected by seed rot. Seed of poor quality or vigor is especially prone to problems. Poor seedbed preparation and seed that is planted too deep or is planted in soils that are too cold or too wet are prone to problems. Excessive nitrogen in the seed bed and excessive seeding rates also increase disease potential.

Seedling Diseases / Damping-Off

- Ø **Symptoms/ Signs:** No emergence of seedlings, or a sparse stand. Seedlings may emerge, but turn yellow, reddish brown, wilt and collapse.
- Ø **Control:** Plant Apron treated seed (mefanoxam) or seed treated with ethazole (Terrazole). Follow label directions for treating seed with ethazole. After seedlings emerge and the “stand” has been achieved, spray with mefenoxam, or propamocarb at the low label rate in 1 to 2 gallons per 1000 sq.ft.

Pythium Blight

- F Causal Agent(s): *Pythium aphanidermatum* (Edson) Fitzpatrick and other *Pythium* species such as *P. myriotylum* Drechs., *P. graminicola* Subrum., *P. arrhenomanes* Drechs., and *P. ultimum*
- F Hosts / Occurrence: All turfgrasses are susceptible with the cool-season grasses - creeping bentgrass, annual bluegrass and Kentucky bluegrass - being the most.

We are seeing Pythium blight on bermudagrass more and it can be an important disease of cool-season turfgrasses used for overseeding bermudagrass putting greens.

It is most likely to occur when day and night temperatures exceed 85 F and 68 F, respectively, and when the relative humidity is high. Pythium blight can be a highly destructive disease.

Pythium Diseases - Symptoms on Leaves

- Ø small (2.5-10 cm), purplish water-soaked patches, with slippery or slimy feeling when rubbed between the fingers
- Ø white-gray “cobwebby” mycelium may be present with humidity is high
- Ø leaves become light brown, dry and shriveled
- Ø symptoms may occur in streaks, sometimes with water draining channels









Pythium and Brown Patch together -
time to purchase sod

Pythium blight in *Poa trivialis* overseeding





Pythium Blight epidemic in overseeding





Pythium Blight in Bermudagrass



Pythium Blight in Bermudagrass
(not overseeded)



Pythium Blight

F Most likely to occur when **day and night** temperatures exceed **85 F and 68 F**, respectively, and when the relative humidity is high.

F Typically occurs between June and September

Pythium Blight

150 Rule :

Historically, *Pythium* blight was predicted when Min. air temp + Max. relative humidity > 150 (over predicts)

Pythium Blight

Hall et al - 1985 (over predicts)

Based on air temp during 24 hr period only

Min temp $> 70^{\circ}$ F < 18 hr = No risk

Min temp $> 68^{\circ}$ F > 18 hr < 24 hr = Mod
risk

Min temp $> 68^{\circ}$ F > 24 hr = Severe risk

Conditions Favoring Pythium Blight

- | **High soil salinity** favors increased susceptibility
- | **High fertility generally** favors increased disease
- | **Low soil moisture** preceding abundant rainfall and high temperatures favor disease outbreaks

Pythium Blight Cultural Control

- Maintain adequate soil moisture
- Reduce seed rates (spring and summer)
- Soil pH in a more acid range
- Balanced fertility
- Leach salts if they accumulate to high levels
- Reduce leaf wetness

Chemical Control of Pythium Blight

I Aromatic Hydrocarbons :

Koban, Terraneb, Terrazole

II Dithiocarbamates :

Banol, Mancozeb,

III Phenylamides :

Quell, Subdue Maxx, Apron (seed treatment)

IV Phosphonates :

Signature, Prodigy and the phosphites

V Strobilurins (QoI):

Heritage, Insignia, Disarm

VI QII

cyazofamid: Segway

VII Premixture: Stellar (Valent/fluopicolide +propamocarb)

Control of Pythium Blight on PRG : Rutgers 2005

Trt and rate / 1000 ft ²	Sch.	% turf area infested		
		13 Jun	30 Jun	25 Jul
Subdue MAXX 2MC 0.5 fl oz	14 day	7.3 a	3.0 a	0.0 a
Banol 6SC 1.0 fl oz	14 day	0.0 a	1.0 a	0.0 a
Chipco Signature 80WG 4.0 oz	14 day	0.8 a	0.0 a	3.8 ab
Alude 46L 5.5 fl oz	14 day	0.3 a	0.7 a	7.0 b-d
Insignia 20WG 0.9 oz	14 day	0.0 a	0.0 a	0.0 a
Heritage 50WG 0.2 oz	14 day	0.0 a	0.0 a	0.3 a
Heritage 50WG 0.4 oz	21 day	0.0 a	1.3 a	11.3 d
Heritage TL 0.8ME 2.0 fl oz	21 day	0.0 a	10.0 b	4.5 a-c
Untreated check	-	7.8 b	32.7 c	24.3 e
	INT	DAT	DAT	DAT
	14	7	9	7
	21	7	21	7

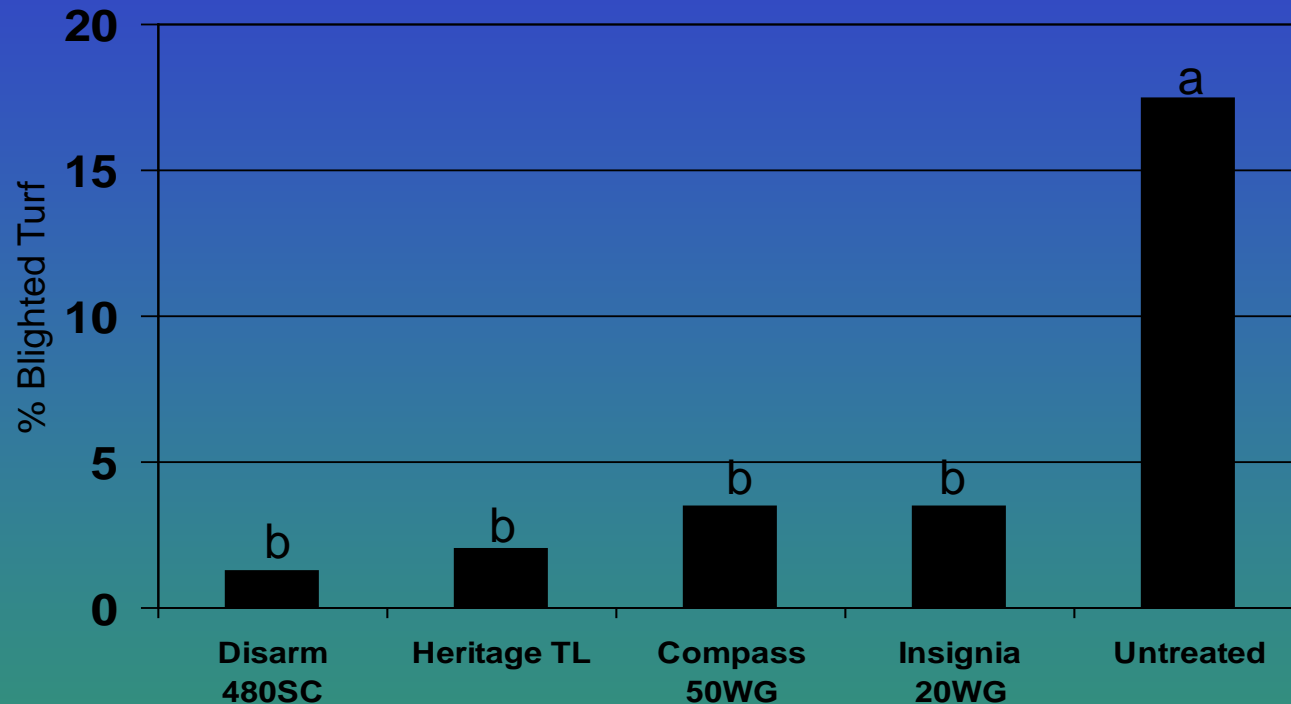
Pythium Blight Control.

*** 2007 Field Trial ***

Treatments and Product Appl. Rate / 1000 sq. ft.

Disarm 480S	0.36 fl oz
Heritage TL	2.0 fl oz
Compass 50WG	0.2 oz
Insignia 20WG	0.9 oz
Banol 6L	1.3 fl oz
Subdue MAXX 1MEC 0.5	fl oz
Signature 80WDG	4.0 oz
Untreated	--- ---

Percent Pythium blight – Aug. 24, 2007 (21 DAT).



- Creeping bentgrass 'PennTrio' (~fairway, 0.450 inch height), Bellewood Golf Course, North Coventry, PA.
- Treatments applied on July 20 and Aug. 3, 2007 (14-day int.), in 1 gal water per 1000 sq ft.
- Treatments arranged as a randomized complete block design, 4 reps, plot size was 2.5 x 2.5 ft.
- Plots inoculated with *Pythium aphanidermatum* infested rye grain (20 g per plot) on Aug. 13, 2007.
- Fisher's Protected Least Significant Different Test at $P < 0.10$.

Mike Fidanza

Pythium Root Disease/ Dysfunction

F Pathogen: *Pythium aristosporum*, *P. arrhenomanes*, *P. graminicola*, *P. volutum*; others

F Grasses affected: All turfgrasses, but primarily creeping bentgrass and annual bluegrass

Two Root Diseases Caused by Pythium species

F Pythium Root Rot

- Caused by an large number of Pythium species
- Occurs in poorly drained greens or during wet weather
- May develop at any time of year
- Symptoms usually in irregular patterns, sometimes in spots or patches
- Responds well to standard Pythium fungicides (ethazole, mefanoxam)

F Pythium Root Dysfunction

- *P. volutum*, *P. arrhenomanes*, or *P. aristosporum*
- Most severe in well-drained greens
- Disease development occurs in fall and spring, symptoms appear in summer
- Symptoms appear in distinct circular patches
- Standard Pythium fungicides not highly effective
- QoI and Qii fungicides most effective

Pythium Root Disease/ Dysfunction

- F **Symptoms and Signs:** Nonspecific; sometimes yellow patches or reddish-brown discolored turf, thinning in irregular areas. *No foliar mycelium*. Discolored sometimes water-soaked roots and crown tissues. Oospores, mycelium and/or sporangia may be readily evident in root/crown tissues
- F **Conditions:** late spring to early winter, particularly during or following prolonged wet, overcast weather. Drought or other stresses can initiate visible symptoms.

Pythium Root Disease/ Dysfunction

- F Utilize cultural practices to improve drainage, improve sunlight penetration to greens, air movement (fans); improve soil conditions; deep tine aerify if layering is a problem; core-aerification; hydraulic aerification
- F Chemicals: Aliette + Fore, ethazole or chloroneb drenches (avoid in high heat...), followed by Subdue Maxx... Insignia, cyazofamid (experimental from FMC).

Pythium Species from roots and crowns of bentgrass

Highly aggressive *Mod. Aggressive* *Low Aggressive* *Not Aggressive*

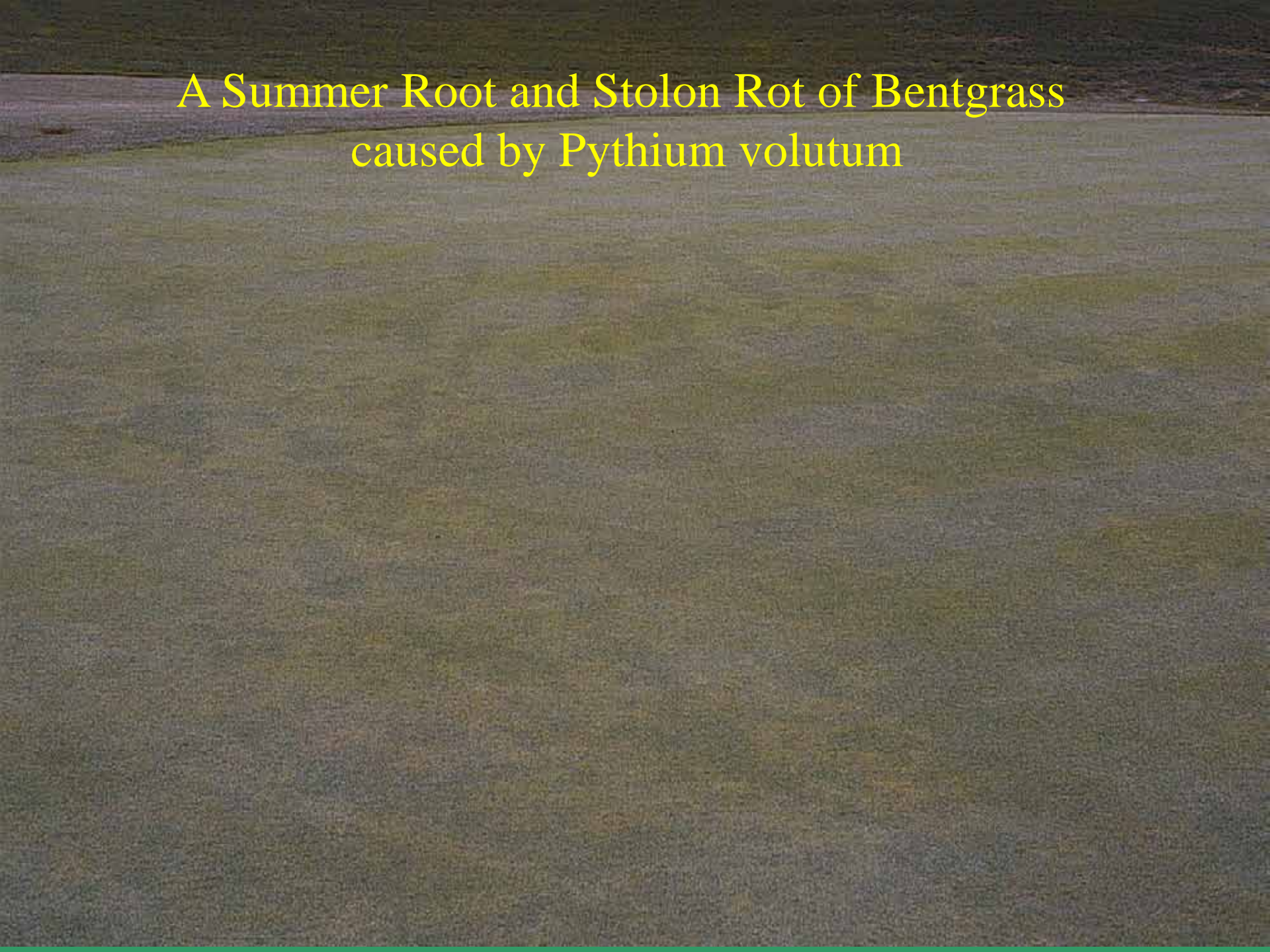
	P. arrhenomanes	P. distocum	P. oligandrum	P. perillum
	P. aristosporum	P. irregulare	P. multisporum	P. catenulatum **
*	P. aphanidermatum	P. multisporum	P. rostratum	P. torulosum **
	P. graminicola	P. paroecandrum	P. zingiberis	P. intermedium
*	P. myriotylum	P. splendens	P. violae	P. plurispodium
	P. tardiocrescens	P. sylvaticum	P. afertile	P. carolinianum
*	P. vanderpoolii	P. ultimum var.	P. pulchrum	P. dissimile
	P. volutum	spongiferum	P. iwayamai	
		P. violae	P. sylvaticum	
			P. pyrilobum	
			P. polycarpum	
			P. distocum	
			P. salpingophorum	

**most frequently isolated

* cause cottony blight

Abad, et al. Phytopathology
1994.

A Summer Root and Stolon Rot of Bentgrass
caused by *Pythium volutum*







Pythium Crown and Root Rot

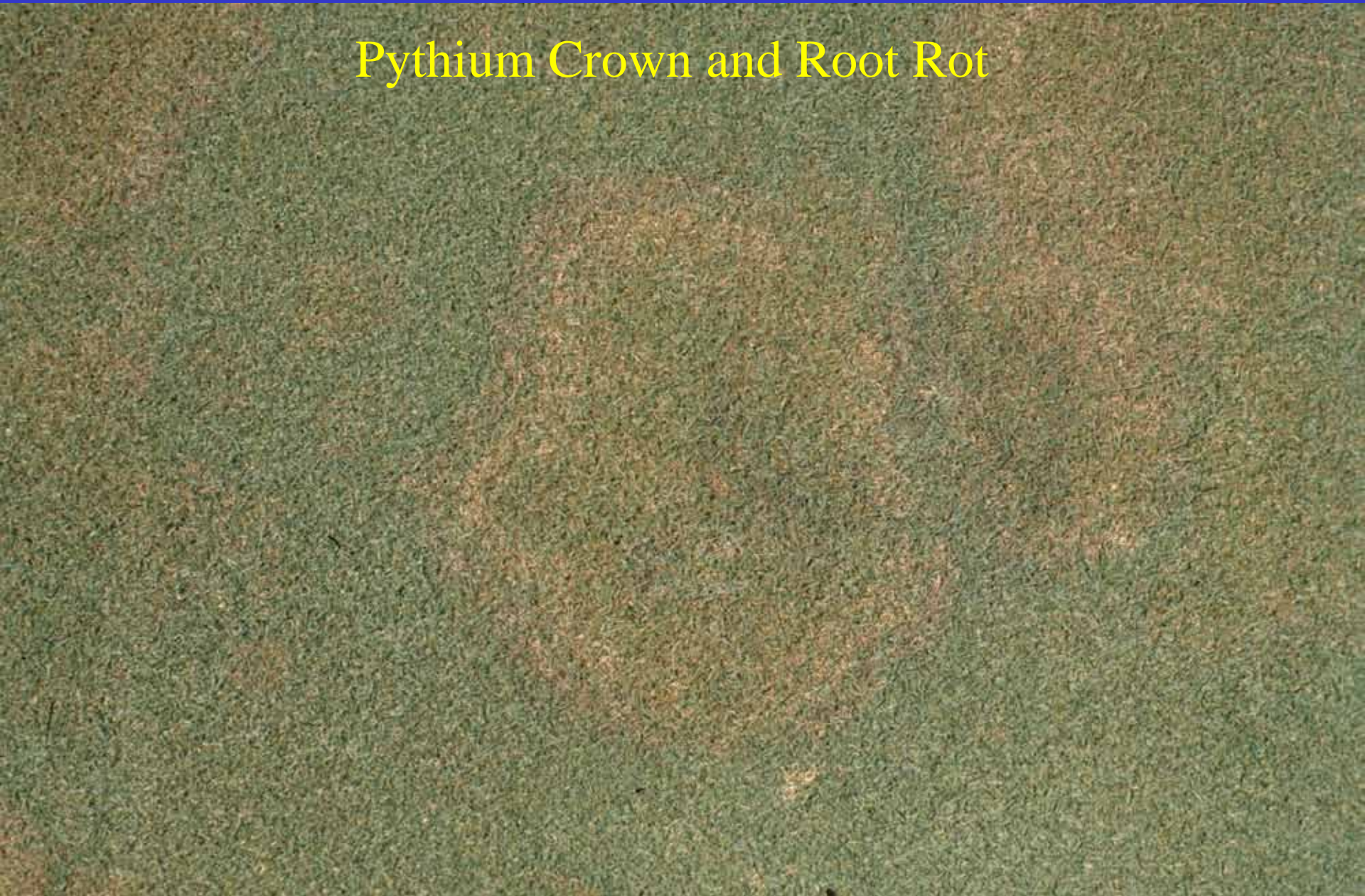


Pythium Crown and Root Rot



Martin, 1996

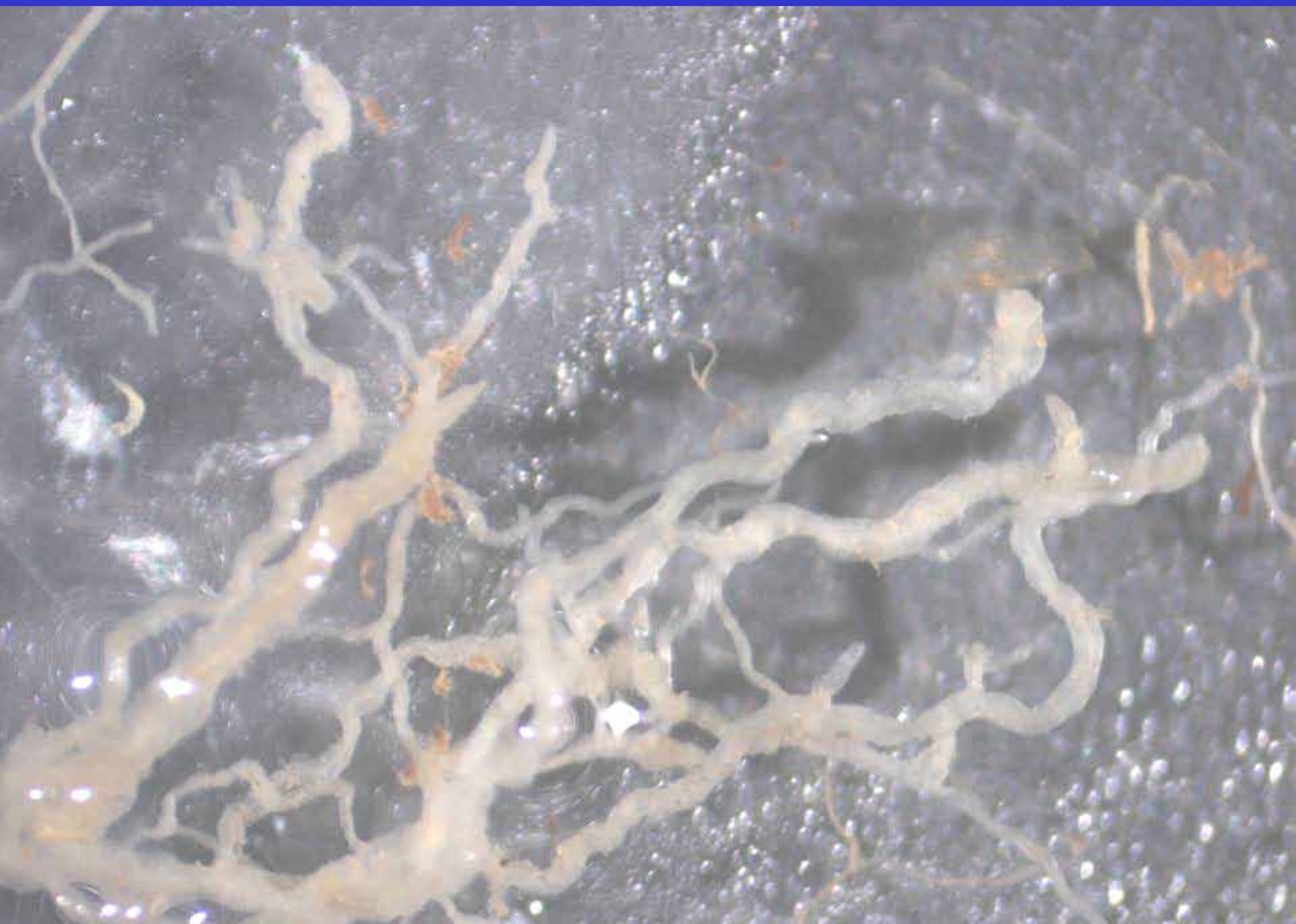
Pythium Crown and Root Rot





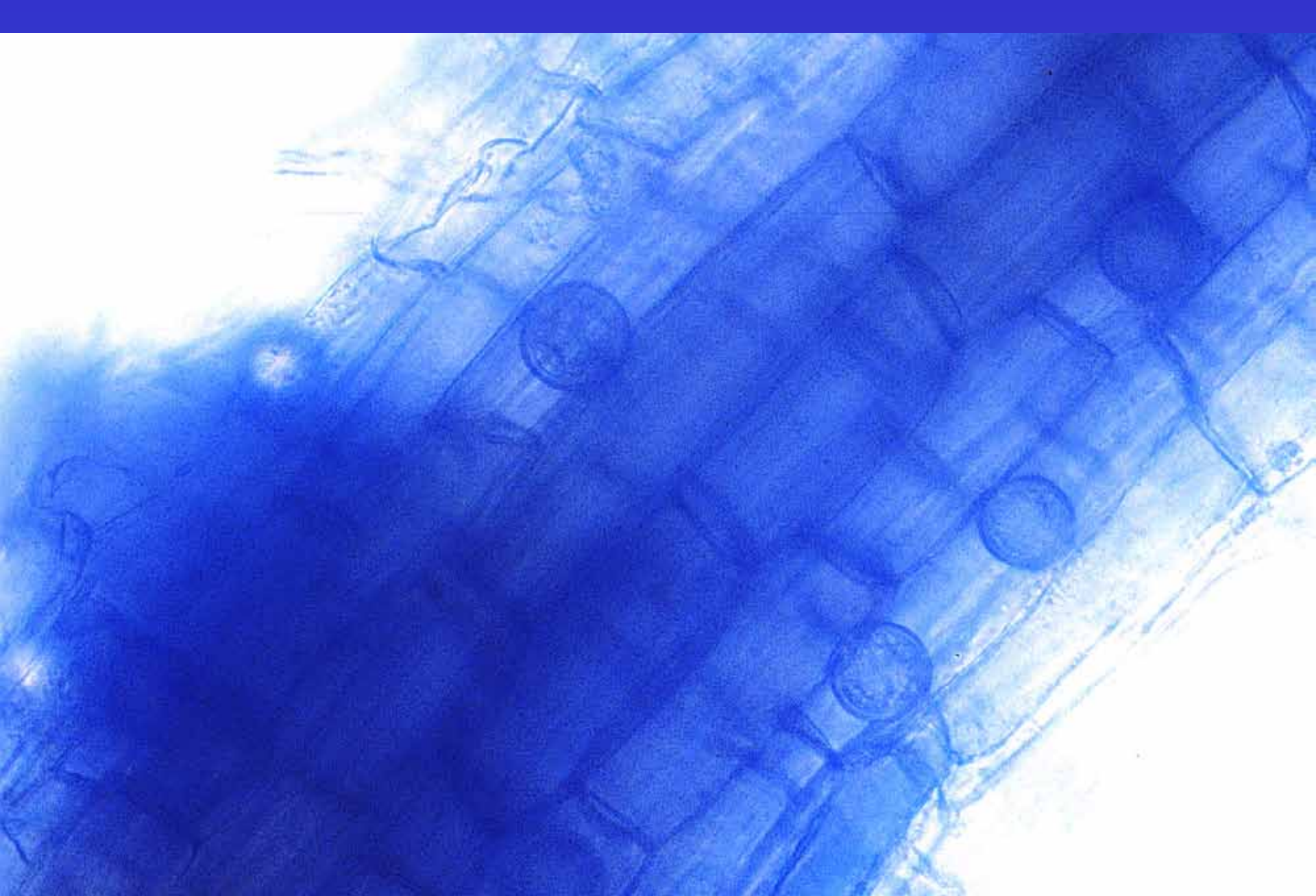




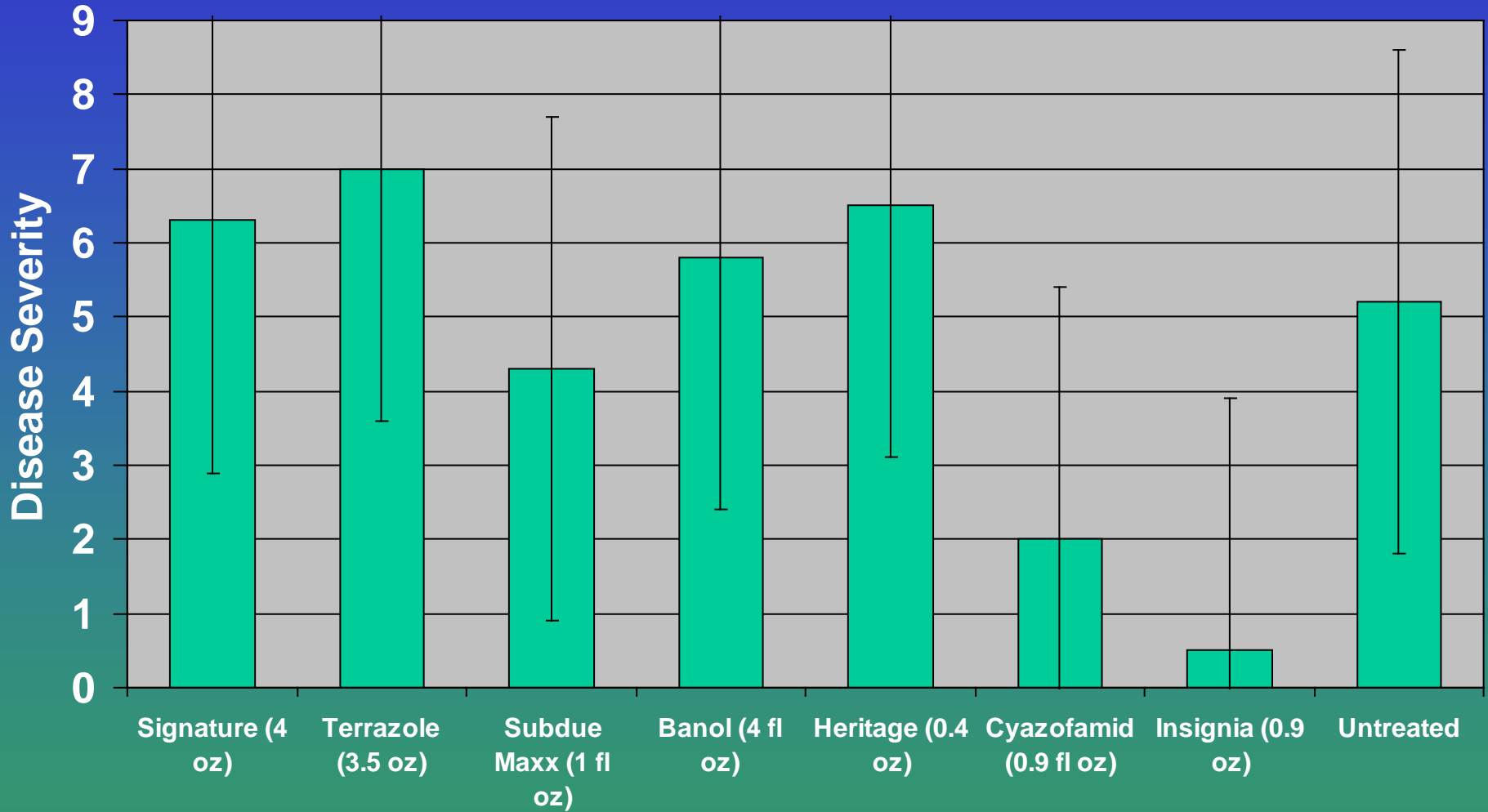




Oospores in crown and roots
of bentgrass



Preventative Control of PRD - 2004



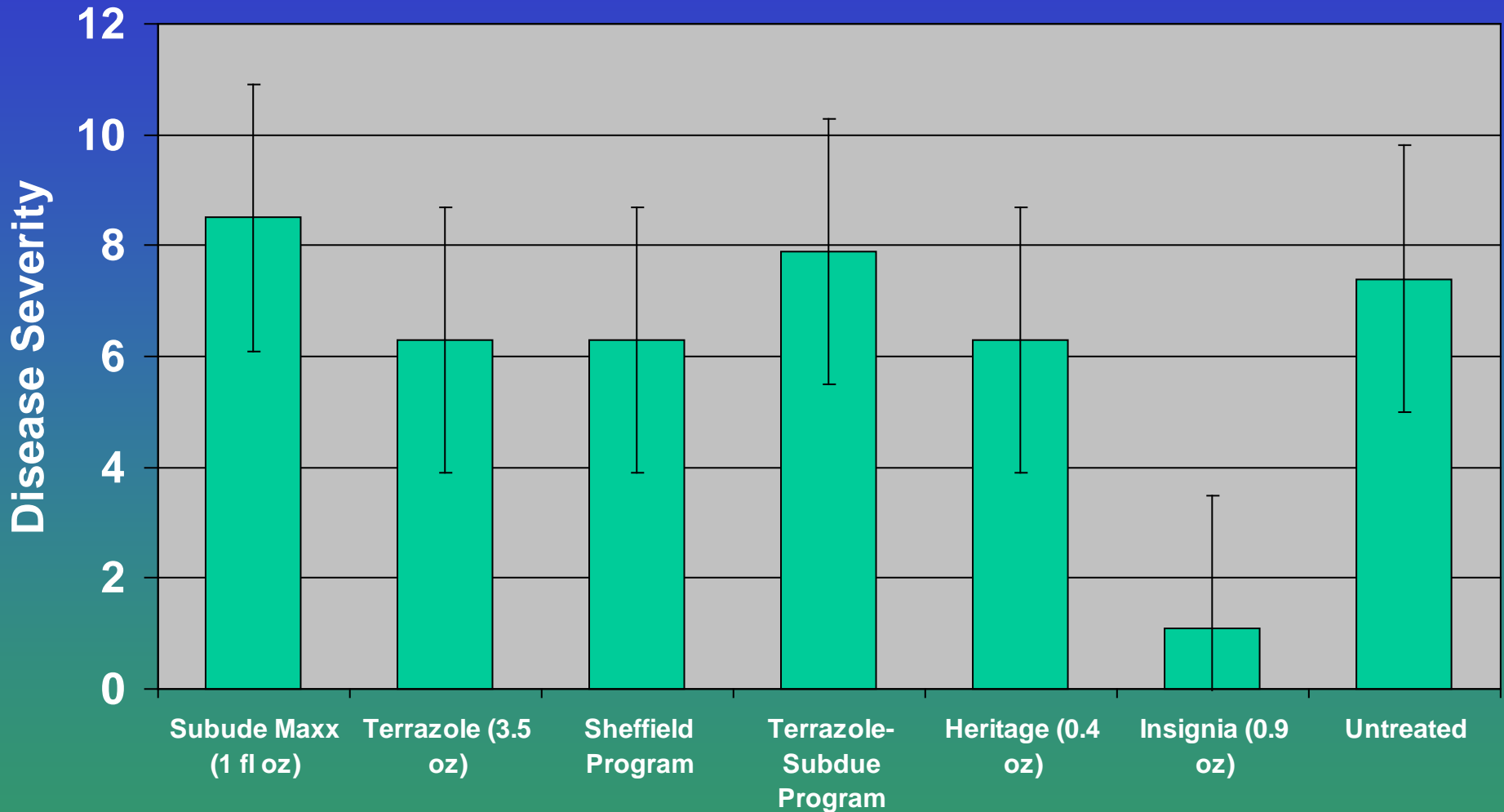
Treatments applied 4/21, 5/6, 5/20, and 6/2

Data collected 7/15

Error bars indicate MSD according to Waller-Duncan

Tredway, NC State Univ.

Curative Control of Unknown Bentgrass Disease



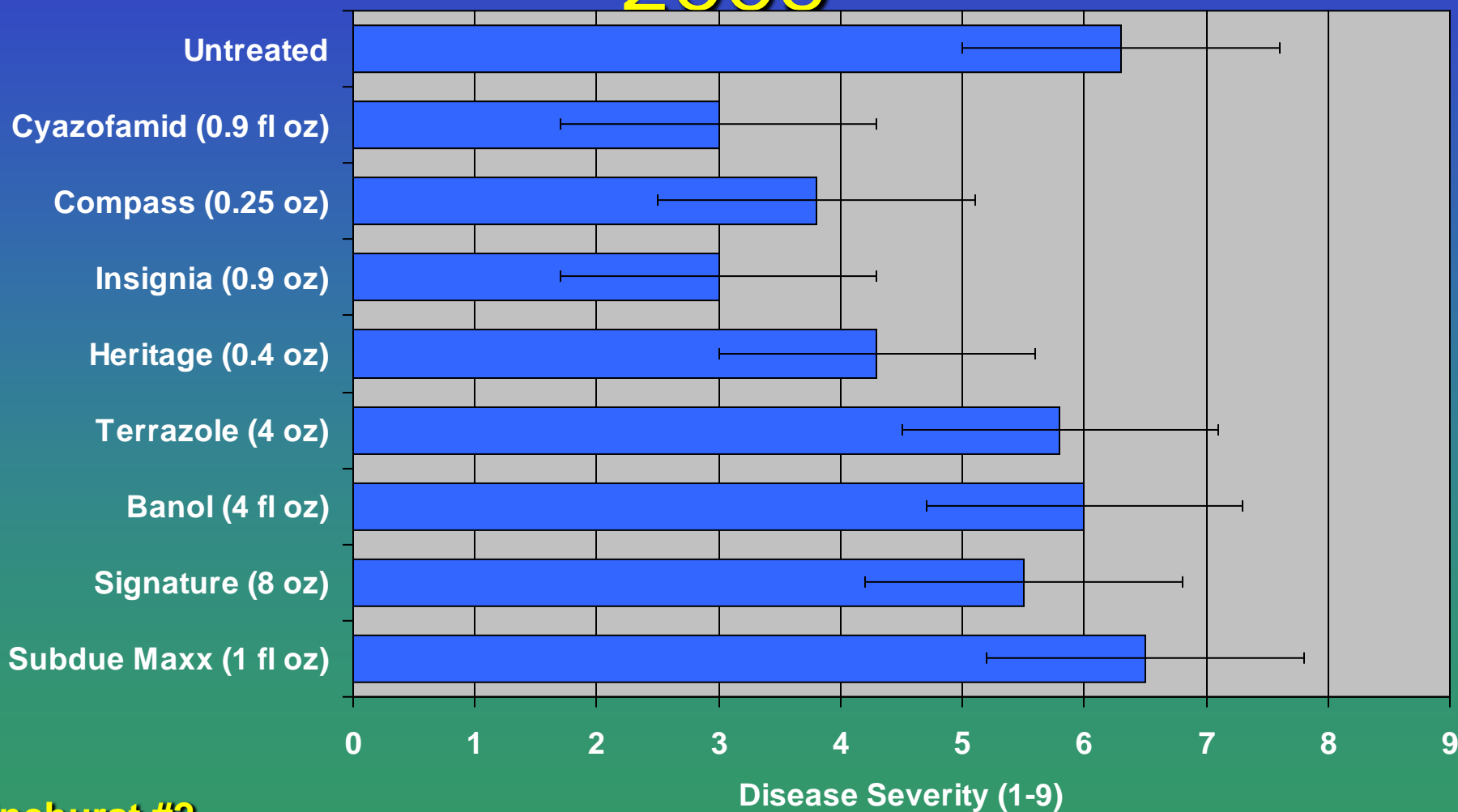
Treatments applied 7/20 and 8/3

Data collected 8/5

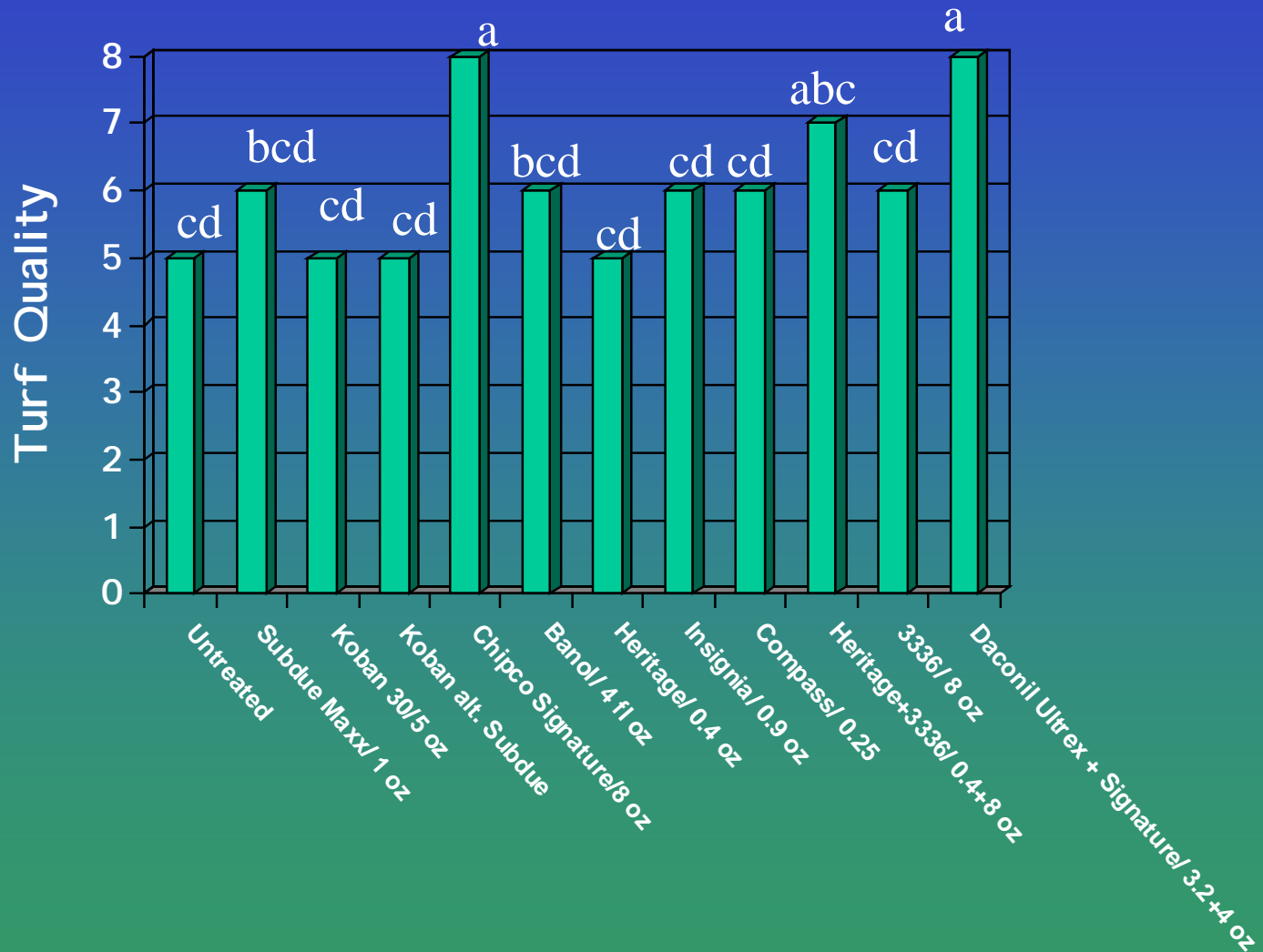
Error bars indicate MSD according to Waller-Duncan

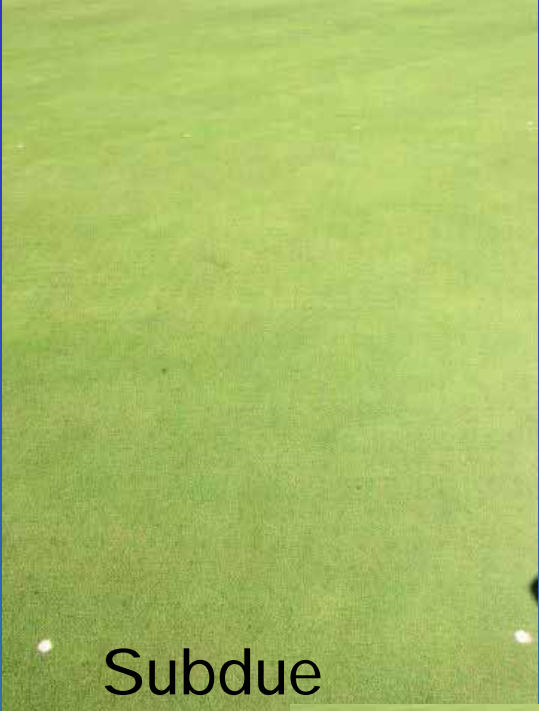
Tredway, 2004

Preventative Control of PRD, 2005



Fungicides for Curative Control of Pythium Root Rot - Aiken SC





Subdue



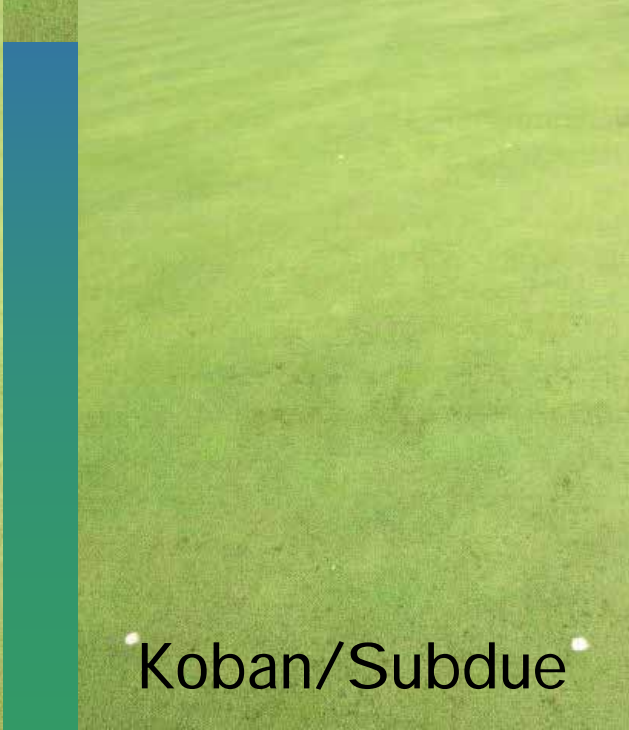
Chipco Signature



Signature + Daconil



Insignia



Koban/Subdue



Preventive Control of Pythium Root Rot 2005

F Sprays applied May 27, June 17, and July 8 (21 day schedule).

1 Check

2 Heritage TL 0.8ME +/- K₂SO₄ 2fl oz

3 Heritage TL 0.8ME +/- K₂NO₃ 2fl oz

4 Heritage TL 0.8ME +/- Earthworks 20-8-15 2fl oz

5 Heritage 50WG +/- Earthworks 20-8-15 0.4 oz

6 Insignia 20WG +/- K₂SO₄ 0.9 oz

7 Insignia 20WG +/- K₂NO₃ 0.9 oz

8 Insignia 20WG +/- Earthworks 20-8-15 0.9 oz

9 Chipco Signature 80WG +/- Earthworks 20-8-15 8 oz

10 Daconil Ultrex 3.2oz +Chipco Signature 80WG 4oz
+/- Earthworks 20-8-15

11 Koban 30 4oz alt. Subdue Maxx 21.3ME 1fl oz +/- Earthworks 20-8-15

12 Subdue Maxx 21.3ME 1fl oz

13 Terraneb 65WP 4oz +/- Earthworks 20-8-15

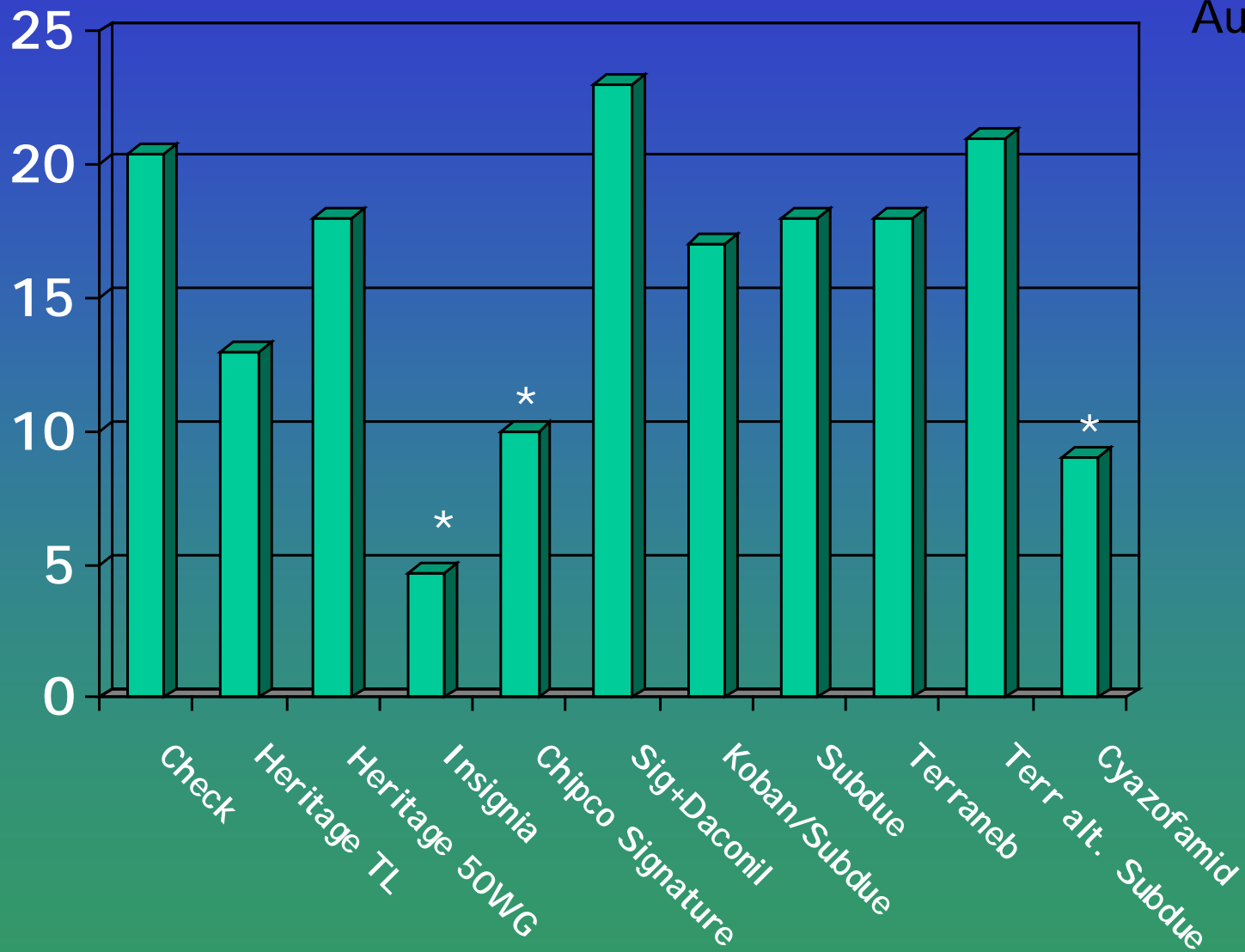
14 Terraneb 65WP 4oz alt. Subdue Maxx 21.3ME 1fl +/- Earthworks 20-8-15

15 Cyazofamid 40L 0.9 fl oz

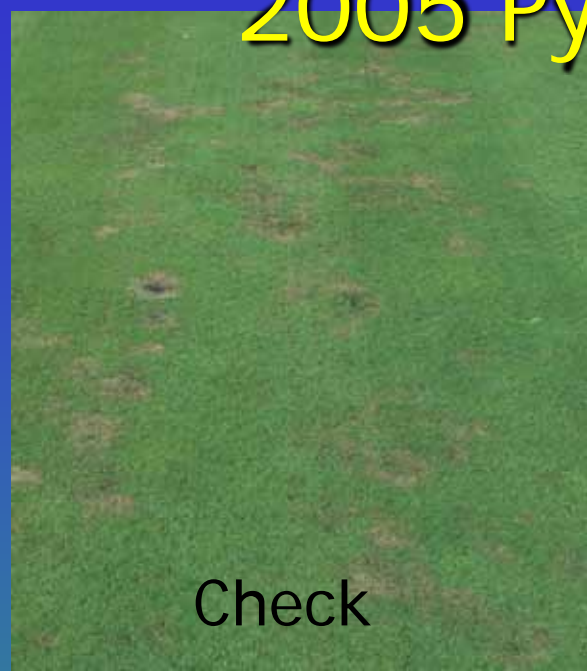
Pythium Root Rot 2005

Sprays applied May 27, June 17, and July 8

Aug. 26 rating



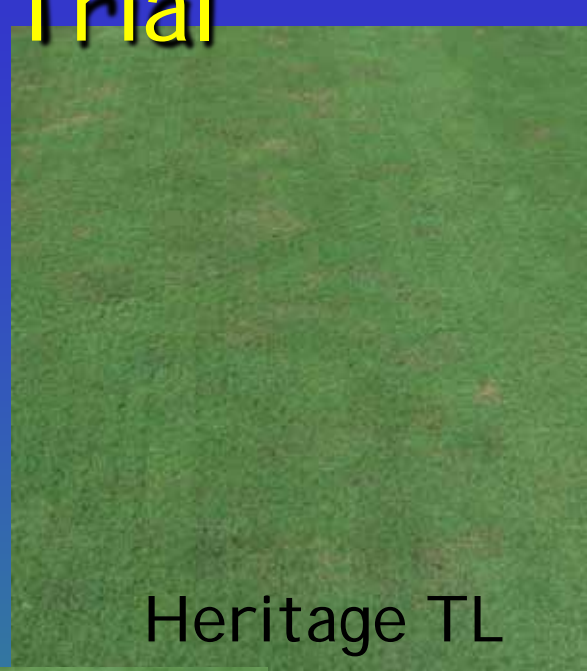
2005 Pythium Root Rot Trial



Check



Insignia



Heritage TL



Signature



Cyazofamid

New Products for Turfgrass Disease Control

F Segway

F cyazofamid

F Qil , new class of chemistry to the turf market

F developed by ISK, but marketed by FMC

F 0.45 to 0.9 fl oz per 1000 ft² application rate

F released in spring 2007



SEGWAY™

FUNGICIDE

EPA Reg. No. 71512-13-279 EPA Est. No. 279-NY-1

Active Ingredient:.....34.5%
 Cyazofamid*.....
Other Ingredients:.....65.5%
 100.0%

*4-chloro-2-cyano-N,N-dimethyl-5-(4-methylphenyl)-1H-imidazole-1-sulfonamide (CA)
 Contains 3.33 pounds Cyazofamid Per Gallon (800 grams per liter)

KEEP OUT OF REACH OF CHILDREN CAUTION

See side panel for additional precautionary statements.

Read entire label carefully and use only as directed.

MANUFACTURED IN FRANCE.

Manufactured for:



FMC Corporation
 Agricultural Products Group
 Philadelphia PA 19103

Net Contents:

FIRST AID

If on skin	<ul style="list-style-type: none"> Take off contaminated clothing. Rinse skin immediately with plenty of soap and water for 15-20 minutes. Call a poison control center or doctor for treatment advice.
If in eyes	<ul style="list-style-type: none"> Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing. Call a poison control center or doctor for treatment advice.
If swallowed	<ul style="list-style-type: none"> Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Do not give anything by mouth to an unconscious person.
If inhaled	<ul style="list-style-type: none"> Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible. Call a poison control center or doctor for further treatment advice.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment.

HOTLINE NUMBER

For 24-Hour Medical Emergency Assistance (Human or Animal)
 Call 1-800-331-3148.
 For Chemical Emergency, Spill, Leak, Fire or Accident,
 Call 1-800-331-3148.

PRECAUTIONARY STATEMENTS

Hazards to Humans (and Domestic Animals)

CAUTION

Harmful if absorbed through skin. Avoid contact with skin, eyes or clothing. Avoid breathing spray mist. DO NOT take internally.

Personal Protective Equipment (PPE)

Applicators and other handlers must wear long-sleeved shirt and long pants, socks, shoes, and chemical resistant gloves made of any water-proof material.

Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing. Do not allow contact of contaminated clothing with unprotected skin. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

Engineering Control Statements

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides (40 CFR 170.240 (d) (4-6)), the handler PPE requirements may be reduced or modified as specified in the WPS.

Disarm™ 480 SC

Fungicide

GROUP 11 FUNGICIDE

For Turf Uses

Ingredients	By wt.
Active Ingredient	
*Fluoxastrobin	40.3 %
Inert Ingredients	59.7 %
Total	100.0 %

This product contains 4 pounds of Fluoxastrobin per gallon (480 g per liter)

*[(1E)-2-[[6-(2-Chlorophenoxy)-5-fluoro-4-pyrimidinyl]oxy]phenyl] 5,6-dihydro-1,4,2-dioxazin-3-yl) methanone-O-methylloxime]

**KEEP OUT OF REACH OF CHILDREN
CAUTION**

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle.
(If you do not understand the label find someone to explain it to you in detail.)

For PRODUCT USE Information Call 1-866-761-9397

Produced for:

**ARYSTA LIFESCIENCE
NORTH AMERICA CORPORATION**
15401 Weston Parkway, Suite 150
Cary, NC 27513

EPA Est. No. 62171-MS-001
EPA Registration No. 66330-64
Label Number 20630-B



Arysta LifeScience

NET WEIGHT: 16 FLUID OUNCES



GROUP 28 43 FUNGICIDE

STELLAR™ Fungicide

**Turf and Ornamental Fungicide
For Control of Pythium and Phytophthora Diseases**

Active Ingredient	By Wt.
*Fluopicolide	5.54%
**Propamocarb Hydrochloride	55.40%
Other Ingredients	<u>39.06%</u>
Total	100.00%

*2,6-dichloro-N-[[3-chloro-5-(trifluoromethyl)-2-pyridinyl]methyl]benzamide
**propyl[3-(dimethylamino)propyl]carbamate hydrochloride

STELLAR™ FUNGICIDE is a suspendable concentrate fungicide containing 0.52 lb fluopicolide per gallon and 5.2 lbs of propamocarb hydrochloride per gallon.

KEEP OUT OF REACH OF CHILDREN

CAUTION

SEE NEXT PAGE FOR ADDITIONAL PRECAUTIONARY STATEMENTS.

NET CONTENTS ____

**SHAKE WELL BEFORE USING
AGITASE BIEN ANTE USO**