**Disease Management for Turfgrasses**

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**UPDATE ON NEW FUNGICIDES FOR TURFGRASS DISEASE CONTROL**

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### Fungicide Chemical Families

- **Aromatic Hydrocarbons** - ethazole, PCNB, chloranb
- Benimidazoles - benzimidazole, thiophanate methyl
- Carbamates - flutolanil, carboxin, oxycarboxin, boscalid, penthiopyrad, flusilazole
- Demethylation Inhibitors (DMI) Fungicides - difenoconazole, triadimefon, propiconazole, cyproconazole, myclobutanil, tebuconazole, metconazole, fenarimol
- Disulfotonicides - propiconazole, vinclozolin
- Dicarboximides - iprodione, vinclozolin
- Dithiocarbamates and Carbamates - captan, maneb, mancozeb, propamocarb, thiram
- Nitriles - chlorothalonil
- Phenylamides - metalaxyl, mefenoxam
- Phenyl pyridinamine - fluzinon
- Phenyl pyridazone - Medallion
- Phosphonates - Fusaric Acid, generic phosphite fungicides
- Strobilurins (QoI methoxyacrylates) - azoxystrobin, triazoletriben, pyraclostrobin, fluxystrobin
- Qii - cyazofamid (Segway) - new PBI Gordon
- Carboxylate amide - flupyradoc (with propamocarb in Stellar)
- Benothiadazole - acibenzolar-S-methyl (Daconil Action)
New Syngenta Fungicides

✦ "Appear" - 53.3% potassium phosphite; a 4.1 lb/gal formulation - 3-8 fl oz/1000 sq.ft.; Pythium diseases -
✦ "Secure" - 40% fluazinam as a 4.17 lb/gal FRAC group 29; 0.5 fl oz/1000 sq.ft. broad spectrum - golf courses only
✦ "Briskway" - 1.67 lb azoxystrobin + 1.05 lb difenoconazole/gal = 2.72 lb/gal broad spectrum premixture (rates 0.3-0.73 fl oz/1000 sq.ft.) - golf course turf only

Curative Control of Dollar Spot in Crenshaw Bent 2012

![Graph showing infection centers]

New Fungicides - SDHI mode of Action

✦ SDHI = succinate dehydrogenase inhibitors. "Carboxamide" class
✦ Subgroupings are:
  - phenyl-benzamides (e.g. flutolanil)
  - phenyl-carboxamides (e.g. boscalid)
  - pyrazole-carboxamides (2 new ones)
SDHI Fungicides - FRAC code 7, medium resistance risk

- penthiopyrad - "Velista" from DuPont, now being developed by Syngenta, marketing anticipated 2015
- fluxapyroxad - "Xzemplar" from BASF (tested as BAS 700) - full use sites
- BASF has developed a pre-mix of fluxapyroxad + pyraclostrobin (BAS 703) called "Lexicon" - full use sites

**Xzemplar 0.262 oz/M**

May 30

June 13

- Velista, 0.5 oz/M

May 30

June 13
Know the Key Diseases on the Grass in Question -

- Centipedegrass - large patch, nematode infestations, fairy ring, ‘centipede decline’
- St. Augustinegrass - large patch, gray leaf spot, take-all root rot
- Zoysiagrass - large patch, dollar spot, yellow patch, leaf spots
- Bermudagrass - dollar spot, spring dead spot, leaf spots
- Tall fescue - brown patch, Pythium blight, gray leaf spot, net blotch

Brown Patch in Tall Fescue
Brown Patch in Cool-season Turfgrasses - Management

- balanced fertility at pH optimum for the grass itself (based on soil test)
- improve air movement, sunlight penetration
- decrease leaf wetness by irrigation adjustments
- correct subsurface drainage problems if they exist
- avoid high N fertility during periods of heat stress
- improved cultivars for heat stress areas
- use of fungicides

Brown Patch in Cool-season Turfgrasses - fungicides

- triadimefon - Bayleton
- propiconazole - Baner
- myclobutanil - Eagle
- vinclozolin - Caralon, etc
- iprodione - Chipco 26019
- thiophanate methyl - Cleary 3336 (only in formulation can be used by homeowners)
- fluxapyroxad - Xzemplar
- fluazinam - Secure
- mancozeb - Fore, Dithane
- azoxystrobin - Heritage, Heritage G, Headway, Briskway, Strebe
- trifloxystrobin - Compass
- trifloxystrobin + triadimefon - Arnedo, Tartan
- Pyraclostrobin - Insignia
- Pyraclostrobin + boscalid - Honor
- Pyraclostrobin + fluxapyroxad - Lexicon

Pythium Blight
Pythium Blight Control
- Maintain soil moisture in adequate range for plant growth and soil pH in a more acid range; balanced adequate fertility
- Reduce leaf wetness by late night irrigations
- Use of fungicides:
  * Subdue Maxx
  * Insignia
  * Banol (sod, golf onl)
  * DisArm
  * Phosphites
  * Segway
  * Heritage
  * Stellar

Note: mixtures of strobilurins also registered for Pythium although use sites vary.

Large Patch
✦ St. Augustinegrass  Most susceptible
✦ Zoysiagrass
✦ Centipedegrass
✦ Bermudagrass  Least susceptible

Sheath Rot Symptom of brown patch (Large Patch) in St. Augustine
R. solani AG 2,2 "LP"
Infections occur in the lower basal leaf sheath area, not on leaf lamina
Large Patch in Zoysia

Causal agent: R. solani AG 2,2 ‘LP’

Relative Growth of a Host/Pathogen System
**Large Patch (Brown Patch) of Warm-season Turfgrasses - Management**

- provide good surface and subsurface soil drainage
- alter irrigation to limit leaf and thatch moisture
- balanced N fertility, avoid excess N in late summer/early fall
- fungicide applications:
  - apply in fall before initial outbreak, repeat in severe cases after 28-30 days
  - a single application to follow up in spring as grasses come out of dormancy may also improve control
  - Prostar, Heritage, Insignia are very good fungicides for this disease; other fungicides may provide good control

**Fungicides Labeled for Large Patch**

- Heritage (Azoxystrobin)
- Insignia (pyraclostrobin)
- DisArm (fluxastrolbin)
- Prostar (flutolanil)
- Terremec SP (chloroneb)
- 26 GT. (prodione) *not home lawns
- Bayleton (triadimefon) (supp. label req'd for home lawns)
- Secure (fluazinam) - GC only
- Xzemplar (fluxapyroxad)

Granular formulations of Heritage, Insignia, Disarm are available

**Fungicides Labeled for Large Patch - Combinations**

- Headway (azoxystrobin + propiconazole) - 1.5-3 fl oz
- Briskway (azoxystrobin + difenoconazole) - 0.3-0.725 oz
- DisArm C (chlorothalonil + fluxastrolbin) - 3 to 6 fl oz
- DisArm M (chlorothalonil + myclobutanil) -
- Consyst 67WG (chlorothalonil + thiophanate methyl) - 2 to 8 oz *** others available
- 26/36 3.8F - Iprodione + thiophanate methyl - 2 to 4 fl oz **not home lawns
- Systar 80WG (thiophanate methyl + flutolanil) - 2 to 3 oz **not home lawns
- Honor 28WG - (boscalid + pyraclostrobin) - 11 oz
- Lexicon (fluxapyroxad + pyraclostrobin) - 0.34 oz
- Pillar G (triticonazole + pyraclostrobin) - 3 lb/1000 sq.ft.
Gray Leaf Spot

- **Pathogen:** *Pyricularia grisea*
- **Hosts:** St. Augustinegrass, tall fescue, ryegrasses, some weedy grasses (e.g. crabgrass).
- **Disease Profile:** A very common disease in St. Augustine wherever it is grown. The disease occurs in very hot, humid weather and is generally more severe in newly established lawns, in shady locations or locations with poor air movement.
Spores of the gray leaf spot fungus, *Pyricularia grisea*

**Gray Leaf Spot**

- *Cultural control*: improve air movement and light penetration in areas prone to chronic infections. Irrigate in very early morning to promote maximum drying conditions during the day. Avoid excessive rates of nitrogen fertilizers. Mow on a suggested schedule appropriate to growth rate of the turf.
Fungicides for Gray Leaf Spot

- Armada 50WP - 0.6 to 1.2 oz, 14-28 day
- Briskway 2.72 SC - 0.3-0.725 oz (no more than 2 seq. apps) GC only
- Heritage 50WDG - 0.2 to 0.4 oz, 14-28 day
- Headway - 1.5-3 fl oz, 14-28 day
- Compass 50WDG - 0.15 to 0.25 oz, 14-21 day
- Insignia 20WDG - 0.5-0.9 oz/14-28 day
- Honor - 0.5-1.1 oz/14-28 day (GC only)
- Lexicon - 0.34-0.47 oz/14-28 day
- Pillar G (triticonazole + pyraclostrobin) - 3 lb/1000 sq ft/14-28 day
- Mancab Formulations - see labels for rates
- Banner Maxx - 1 to 2 fl oz, 14 day
- Tourney - 0.37 oz, 14 day
- Endorse - 4 oz/14 day
- thiophanate methyl formulations (Cleary 3336, Fungo, Cavalier) - 4 to 8 fl oz
- combinations of chlorothalonil + thiophanate methyl (e.g. Spectro 90, Consyst)

St. Augustingrass Root Growth Increases with Lexicon and Insignia Intrinsic brand fungicides

Application made 14-days prior to cutting sod for transplanting. Roots cores were taken 4 months after treatment. Treatments are statistically different from untreated. Dr. Bruce Martin, Clemson University, 2012.

St. Augustingrass Root Growth Increases with Pillar and Lexicon Intrinsic brand fungicides

Application made after sod was transplanted. Root cores taken 4 months after treatment. Treatments are statistically different from untreated. Dr. Bruce Martin, Clemson University, 2012.
Spring Dead Spot

- Causal Agent(s): Ophiostomata herpotricha, O. korrae and O. narmari
- Hosts: bermudagrass, bermudagrass hybrids, zoysia (rare) and buffalograss
- Symptoms generally present
  - Early-Spring
  - Concurrent with breaking dormancy
Cultural Practices to Reduce Spring Dead Spot Disease Severity

- Plant root rhizosphere acidification, ammonium ($\text{NH}_4$) based N-Sources (e.g., $(\text{NH}_4)_2\text{SO}_4$ or $\text{NH}_4\text{Cl}$) 1.0 lb N/M per growing month
- Monitor soil nutrient status, especially Potassium, ($\text{KCl}$) 1.0 lb K/M per growing month
- Core Aerification and Verticutting
- More SDS tolerant varieties (e.g., Patriot, Midlawn, Vamont)

Spring Dead Spot Management with Fungicides

<table>
<thead>
<tr>
<th>Products Labeled</th>
<th>Rate (oz/1,000 ft²)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubigan 1A.S.</td>
<td>4.0 to 6.0 fl. oz</td>
<td>1 app at 4 oz or 1 app at 6 oz</td>
</tr>
<tr>
<td>(no longer available)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banner Maxx 1.24MC</td>
<td>4.0 fl. oz</td>
<td>1 to 3 apps. beginning in August</td>
</tr>
<tr>
<td>Torque 3.6 SC</td>
<td>0.6 fl oz</td>
<td>28 day interval; 68 F in fall and spring</td>
</tr>
<tr>
<td>Heritage 50WG TL formulation</td>
<td>0.4 oz or 2 fl oz</td>
<td>1 to 2 apps. beginning in late-Fall</td>
</tr>
<tr>
<td>Eagle 20 EW</td>
<td>2.4 fl oz</td>
<td>1 to 2 apps. beginning in August</td>
</tr>
<tr>
<td>Cleary 3336</td>
<td>4-6 oz</td>
<td>Fall and spring applications</td>
</tr>
<tr>
<td>DisArm 480SC</td>
<td>0.36 fl oz</td>
<td>1-2 applications/ 28 days apart</td>
</tr>
<tr>
<td>DisArm 0.25G</td>
<td>2.3-4.6 lb</td>
<td></td>
</tr>
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</table>
Spring Dead Spot 2010 results

Approaching acceptable efficacy

SPRING DEAD SPOT TRIAL 2014 - TIFEAGLE BERMUDAGRASS

Untreated
A20744 50WG (aka Velista), 0.7 oz, 2 x @ 28 days

Briskway (0.725 oz) alt. Headway (3 oz)

Headway alt. Headway
Ring (Criconemella) nematode damage in a centipedegrass lawn.

Yellow bermudagrass damaged from Sting nematodes (Belonolaimus longicaudatus).
Galls on roots

Galls on each root tip, now necrotic
Survey of Plant-parasitic Nematodes in Carolina Turfgrass
by Weimin Ye¹, Yongsan Zeng², Lane Tredway², Samuel Martin¹ and Matt Martin²

Biological and ‘biorational’ nematicides

- Ditera (a fungus, Myrothecium roseum) – 20 lb/A application rate
- Sesame extracts (e.g. Neo-Tec)
- Neem extracts (Agroneem EC; azadirachtin)
- Mustard plant by-products (glucosinolate metabolites are nematicidal)
- Pasteuria penetrans, *P. busae*
- Avid 0.15 EC (abamectin)
- Others: chitin and chitosan products, thyme oil, ‘biosafe nematicide: peroxyacetic acid; VA mycorrhizae

BACTERIA

- *Pasteuria penetrans, P. usgae*
**Bacillus firmus – Nortica (Bayer)**

“BioNem WP is effective against phytopathogenic nematodes, and is registered in Israel for the control of root knot nematodes in vegetable crops (cucumber, tomatoes, pepper, eggplant and herbs) and in perennial crops (peaches, olives, ornamentals). Long term suppression of nematode population was observed following single application of BioNem WP, either pre or post-planting.”

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**Rooting data, July 22**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Rate (lb/A)</th>
<th>Timing</th>
<th>Depth of Rooting (in)</th>
<th>Root biomass (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated</td>
<td>15.79</td>
<td>ab</td>
<td>0.136362522 c</td>
<td></td>
</tr>
<tr>
<td>2. Nortica 5% WP</td>
<td>35</td>
<td>April 19, May 14</td>
<td>16.95 a</td>
<td>0.179112998 abc</td>
</tr>
<tr>
<td>3. Nortica 5% WP</td>
<td>70</td>
<td>April 30</td>
<td>16.79 ab</td>
<td>0.140212520 bc</td>
</tr>
<tr>
<td>4. Nortica 5% WP</td>
<td>17.5</td>
<td>April 30, May 28</td>
<td>14.28 ab</td>
<td>0.160475017 abc</td>
</tr>
<tr>
<td>5. Nortica 5% WP</td>
<td>70</td>
<td>May 14, June 18</td>
<td>16.73 a</td>
<td>0.1737502 a bc</td>
</tr>
<tr>
<td>6. Nemacur 20G</td>
<td>2.3 lb/1000 sq.ft.</td>
<td>April 19</td>
<td>16.38 a</td>
<td>0.160425030 abc</td>
</tr>
<tr>
<td>7. Nortica 5% WP</td>
<td>35</td>
<td>May 14, June 18</td>
<td>16.73 a</td>
<td>0.170525912 ab</td>
</tr>
<tr>
<td>8. Nortica 5% WP</td>
<td>70</td>
<td>June 18</td>
<td>17.10 a</td>
<td>0.160205012 ab</td>
</tr>
</tbody>
</table>
**Spring Applications of MultiGuard Protect to Bermudagrass Greens**

- **% turfgrass green cover**
  - **Un treated**
  - **Multi Guard**

Crow, GCM July 2014

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**MultiGuard + Heritage**

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**Nontreated**

Martin, 2014

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**Fluensulfone MCW-2 480 EC; A new systemic non-fumigant nematicide for the control of nematodes in Agricultural and Horticultural crops.**

C.T. Schiller, R.C. Everich & J.R. Whitehead
Makhteshim Agan of North America (MANA)

To be labeled in turf as 'Nimitz' in 2016 anticipated
Impressive efficacy from a new experimental nematicide.
Fluopyram vs. Sting nematode

Sting nematode counts/100 cc soil
Single app or 2 wk intervals

Martin, 2014
Sting nematode counts/100 cc soil
4 wk intervals

- Untransed
- 0.1963 2@4wk
- 0.1963 4@4wk
- 0.3927 4@4wk
- 0.157 (500) 4@4 wk

Martin, 2014