BMPs for the Control of Summer Patch on Annual Bluegrass Turf

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Summer Patch

Causal Organism:

*Magnaporthe poae*

Susceptible Hosts:

- Annual Bluegrass: *Poa annua*
- Kentucky Bluegrass: *Poa pretensis*
- Fine Fescue: *Festuca spp.*
- Bentgrass: *Agrostis spp.*
PATCH DISEASES

Caused by Ectotrophic Root-Infecting (ETRI) Fungi
PATCH DISEASES / ROOT PATHOGENS

- Bermudagrass Decline
- Kikuyugrass Decline
- Necrotic Ring Spot
- Spring Dead Spot
- Summer Patch
- Take-All Patch
IDENTIFICATION AND BIOLOGY OF THE FUNGUS
Conditions Favoring Summer Patch

- Hot, Humid Weather
- Excessive Soil Moisture
- Low Mowing Height
- Soil Compaction / Poor Drainage
Impact of Cultural Practices on Summer Patch Development

- Compaction
- Nitrogen fertility
- Soil and rhizosphere pH
COMPACTION
# Effect of Compaction/Aerification on Summer Patch Severity

<table>
<thead>
<tr>
<th>Aerification</th>
<th>HVY (4X)</th>
<th>HVY (2X)</th>
<th>MOD (4X)</th>
<th>MOD (2X)</th>
<th>Non Comp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dp: S</td>
<td>3.5</td>
<td>4.3</td>
<td>3.8</td>
<td>3.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Dp: S &amp; F</td>
<td>4.8</td>
<td>4.3</td>
<td>3.5</td>
<td>3.5</td>
<td>2.8</td>
</tr>
<tr>
<td>Dp: F</td>
<td>5.0</td>
<td>5.5</td>
<td>4.5</td>
<td>4.8</td>
<td>3.3</td>
</tr>
<tr>
<td>Sh: S</td>
<td>7.3</td>
<td>5.5</td>
<td>6.0</td>
<td>3.0</td>
<td>2.8</td>
</tr>
<tr>
<td>Sh: S &amp; F</td>
<td>6.3</td>
<td>5.8</td>
<td>5.8</td>
<td>3.8</td>
<td>3.3</td>
</tr>
<tr>
<td>Sh: F</td>
<td>9.4</td>
<td>10.4</td>
<td>9.5</td>
<td>6.8</td>
<td>4.3</td>
</tr>
<tr>
<td>None</td>
<td>17.5</td>
<td>15.0</td>
<td>13.7</td>
<td>10.7</td>
<td>7.1</td>
</tr>
</tbody>
</table>

Mean Significant Difference = 3 inches
Sources of Nitrogen

- Urea
- Sulfur - Coated Urea
- Ammonium Sulfate
- Ammonium Chloride
- Calcium Nitrate
- Potassium Nitrate
- Nutralene
- Nitroform
4 lb N/M
Ca NO₃

Thompson, et. al., 1998
Acidification of Soil by Nitrogen Source
4 lb N/1000 sq. ft / year

Pot. Nitrate
Ca. Nitrate
No Nitrogen
Urea
Nutralene
Nitroform
SCU
Amm. Chloride
Amm. Sulfate

5 5.5 6 6.5 7
Suppression of summer patch symptoms with Ammonium Sulfate - Rutgers University

Baron Kentucky Bluegrass – 1.5 inch height

Disease severity Index (dia. X intensity)

Aug. 30  Sep. 14  Sep. 21
Untreated  Ammonium sulfate  0.2 lb N at onset of symptoms

2004

* = Means are significantly different according to the Waller-Duncan k-ratio t-test (k=100).
Summer Patch Management

- Aerify and Improve Drainage
- Raise Mowing Height during Heat Stress
- Overseed with Perennial Ryegrass, Tall Fescue, or Bentgrass
- Fertilize with Ammonium Sources, SCU; Avoid using Nitrate Source
- Maintain pH at or Below 6.0
- Apply Pentrant Fungicides (2 - 4 gal water)
Question:
Can acidifying nitrogen fertilizers reduce fungicide rate?

Answer:
Yes. It may, however, can take two to three years to occur.
Influence of N Form and Fungicide Rate on Summer Patch Severity

Lynx 25DF 1.32/0.66; Banner 1.1E 4/2 fl oz; Sentinel 40WG 0.25/0.12 oz.
Bent/Poa Green, Little Mill, CC, Marlton, NJ.
Evaluation of Fungicides for the Control of Summer Patch
Control of Summer Patch

I DMIs:
- Banner, Bayleton, Eagle, Trinity, Triton, Tourney, Torque

II Benzimidazoles:
- Cleary 3336

III Strobilurins (QoI):
- Compass, Disarm, Heritage, Insignia
- Headway and Tartan

IV Carboximides: Xzemplar (fluxapyroxad)
Summer Patch Control: (QoI left & Check right)
Kentucky bluegrass
Control of Summer Patch on Kentucky Bluegrass

<table>
<thead>
<tr>
<th>Control Method</th>
<th>Rating Date</th>
<th>% Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banner 2.0 fl oz 14d</td>
<td>2-Aug</td>
<td>0</td>
</tr>
<tr>
<td>Heritage 0.2 oz 14d</td>
<td>17-Aug</td>
<td>10</td>
</tr>
<tr>
<td>Heritage 0.4 oz 28d</td>
<td>28-Aug</td>
<td>20</td>
</tr>
<tr>
<td>Insignia 0.5 oz 28d</td>
<td>9-Sep</td>
<td>30</td>
</tr>
<tr>
<td>Ammonium Sulfate 0.2 lb N once</td>
<td></td>
<td>40</td>
</tr>
<tr>
<td>Daconil Ultrex 3.2 oz 14d</td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>Untreated Check</td>
<td></td>
<td>60</td>
</tr>
</tbody>
</table>

Rutgers 2002
Effect of Fungicides on Summer Patch – Kentucky Bluegrass: Rutgers, 2011*

*Fungicides applied from May 27 to August 15 (Pillar = (Insignia + Trinity)
Suppressing Summer Patch with Selected fungicides on Kentucky Bluegrass: Rutgers University: 2011

Lexicon Intrinsic 4.17SC = Insignia + fluxapyroxad, Xzemplar 2.5SC = fluxapyroxad; Interval = 28 day
Suppression of Summer Patch by the Biological Control Product Companion on Kentucky Bluegrass Turf

Companion microbial inoculant contains *Bacillus subtilis* GB03 (> $1.5 \times 10^{10}$ CFU/L); Heritage 50WG (azoxystrobin) @ 0.4 oz / 1,000 sq ft every 14-d; 3.9 cm cutting ht
Summer Patch Gallonage Study

- 2 gallons water / 1000 sq ft
- 5 gallons water / 1000 sq ft
- 10 gallons water / 1000 sq ft

Fairway Study – 3 yrs
Summer Patch Control

- 2 Gal Water
- 10 Gal Water

% Disease

- Banner
- Fungo 50
- Tersan 1991
- Cleary 3336
- Control
Impact of Irrigation on Fungicide Effectiveness
<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Amount of Water Carrier</th>
<th>Amount of Irrigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bayleton</td>
<td>2 gal/1000</td>
<td>0</td>
</tr>
<tr>
<td>Banner</td>
<td>5 gal/1000</td>
<td>¼ inch</td>
</tr>
<tr>
<td>Sentinel</td>
<td>10 gal/1000</td>
<td>½ inch</td>
</tr>
<tr>
<td>Rubigan</td>
<td></td>
<td>1 inch</td>
</tr>
<tr>
<td>Tersan 1991</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
IMPACT OF POST-TREATMENT IRRIGATION ON SUMMER PATCH DEVELOPMENT IN KENTUCKY BLUEGRASS

- **Banner 1.1E**
- **Sentinel 40WG**

**CHECK** = 25.2 IN.

<table>
<thead>
<tr>
<th>Post-Treatment Irrigation (inches)</th>
<th>Patch Diameter (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 in.</td>
<td>4.0</td>
</tr>
<tr>
<td>0.25 in.</td>
<td>3.5</td>
</tr>
<tr>
<td>0.5 in.</td>
<td>3.0</td>
</tr>
<tr>
<td>1.0 in.</td>
<td>5.0</td>
</tr>
</tbody>
</table>
Summer Patch Chemical Control

- DMIs, Benzimidazoles, Strobilurins, and certain Carboximides
- Use full label rates – 3 times / season in areas with a history of summer patch
- Apply in 2 - 4 gal water / 1000 ft² or Irrigate immediately after spraying
- Timing – Soil temp. 65°F @ 2” depth for 5 to 7 consecutive days
TAKE-ALL PATCH

Causal Agent: *Gaeumannomyces graminis var. avenae*

Hosts: *Agrostis stolonifera* (creeping bentgrass)
       *A. tenuis* (colonial bentgrass)
       *A. canina* (velvet bentgrass)
Poa annua
Take-all Decline of Bentgrass

- Generally, Take-All Decline (TAD) starts within 3-5 Years after the disease first appears.
- In wheat, TAD has been linked to a buildup of producing fluorescent *Pseudomonas* spp. and other Bacteria.
- Root colonizing bacteria inhibit growth of the pathogen on root surfaces (i.e. antagonism) and eventually brings about TAD.

Dernoeden (Univ. MD)
Factors Believed to Enhance Take-All Patch

- Cool Temperatures (40 - 60 °F)
- Ample Soil Moisture
- High Soil or Rhizosphere pH (>6.5)
- Sandy, Light-Textured Soils
- Fumigated or Recently Cleared Land
Question: What is the impact of soil pH and nitrogen source on disease severity?
Relationship Between Take-all Severity and Soil pH

- Positive correlation between rhizosphere pH and take-all severity in wheat and bentgrass.
- Suppressive effect of NH$_4$ fertilizers related to reduction in rhizosphere pH.

Effect of N-Sources on Take-all Patch in Colonial Bentgrass

<table>
<thead>
<tr>
<th>N-Source*</th>
<th>Rate</th>
<th>% Diseased Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lb/M</td>
<td>kg/ha</td>
</tr>
<tr>
<td>Ammonium Phos.</td>
<td>0.4</td>
<td>20</td>
</tr>
<tr>
<td>Ammonium Sulfate</td>
<td>0.7</td>
<td>35</td>
</tr>
<tr>
<td>Untreated</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

*Applied 12 July and 8 August

SMITH, 1956
Impact of N Source on Take-All Severity and Soil pH on a Bentgrass Fairway (1993-95)
Roles of Mn in Take-all

Manganese

- *G. graminis* oxidizes Mn$^{2+}$ to Mn$^{3+}$ or Mn$^{4+}$, rendering it unavailable to the plant
- Results in a localized deficiency of Mn
- Weakens plant’s resistance
- Mn applications reduces take-all severity
Influence of Mn and Cu on Take-all Patch on a Bentgrass Fairway

Heckman et. al., 2003, 2004
REDUCING PLANT STRESS
Take-All Management For Greens

- Increase mowing height and reduce the mowing frequency in the summer symptoms are apparent
- Use acidifying fertilizers during cool weather to reduce burn potential
- Apply foliar applications of Mn (2 lb Mn/A)
- Syringe frequently / hand water and suspend core aeration when symptoms are present
Integrated Management of Take-all Patch

Resistant Species / Cultivars

- Fescues, bluegrasses, and ryegrasses are not affected by take-all patch

- Little known about relative susceptibility of bentgrass species and cultivars
Take-all Patch Resistance: Rutgers University

Percent Disease

20°C, GgaMat5
## Take-All Control: Past Research

<table>
<thead>
<tr>
<th>Year</th>
<th>Author(s)</th>
<th>Control Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1956</td>
<td>J. D. Smith</td>
<td>Limestone application enhances disease.</td>
</tr>
<tr>
<td>1958</td>
<td>Jackson</td>
<td>Organo-mercury fungicides effective.</td>
</tr>
<tr>
<td>1981</td>
<td>Dernoeden</td>
<td>PMAS (1 fl oz) Bayleton 25DF (4 oz). (green)</td>
</tr>
<tr>
<td>1989</td>
<td>Chastagner &amp; Staley</td>
<td>Fall applications of Rubigan, Bayleton, and Banner most effective.</td>
</tr>
</tbody>
</table>
Effect of Fungicide Injection Depth on Take-all Patch Severity*--YR1

* Heritage 0.4 oz / M sq ft

% Disease

0.7"  1.5"  3.0"  Surface  Check

0  5  10  15  20  25  30
Management of Take-All Patch with Fungicides

- Fungicides reduce TA but do not eliminate it
- Preventive Treatments are best
- Products*
  - azoxystrobin (Heritage)
  - pyraclostrobin (Insignia)
  - fluoxastrobin (Disarm)
  - propiconazole (Banner MAXX)
  - fenarimol (Rubigan)
  - triadimefon (Bayleton)

*Apply in 4 GPA with flat fan nozzles and high pressure
Any Questions?