Getting to the Root of the Problem: Biology and Management of Patch Diseases

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ROOT 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
Summer Patch

Causal Organism:

*Magnaporthe poae*

Susceptible Hosts:

- Annual Bluegrass
- Kentucky Bluegrass
- Fine Fescue
- Bentgrass
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
## Effect of Compaction/Aerification on Summer Patch Severity

<table>
<thead>
<tr>
<th>Aerification</th>
<th>Compaction</th>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HVY (4X)</td>
<td>HVY (2X)</td>
<td>MOD (4X)</td>
<td>MOD (2X)</td>
<td>Non Comp</td>
</tr>
<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 = 1.2 cm
Sources of Nitrogen

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

Thompson et. al, 1998
Suppression of summer patch symptoms with Ammonium Sulfate - Rutgers University

Baron Kentucky Bluegrass – 1.5 inch height

Disease severity Index (dia. X intensity)

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

Values range from 5 to 7 (5.5, 6, 6.5, 7)
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 Systemic Fungicides (4 gal water)
Evaluation of Fungicides for the Control of Summer Patch
Control of Summer Patch

I DMIs:
- Banner, Bayleton, Eagle, Rubigan, Trinity

II Benzimidazoles:
- Cleary 3336

III Strobilurins:
- Compass, Disarm, Heritage, Insignia
- Headway and Armada
Control of Summer Patch on Kentucky Bluegrass

![Graph showing the control of Summer Patch on Kentucky Bluegrass with various treatments like Banner 2.0 fl oz 14d, Heritage 0.2 oz 14d, Heritage 0.4 oz 28d, Insignia 0.5 oz 28d, Ammonium Sulfate 0.2 lb N once, Daconil Ultrex 3.2 oz 14d, and Untreated Check. The graph tracks the percentage of disease from 2-Aug to 9-Sep.]

Rutgers 2002
Summer Patch Control: (Heratage left & Untreated Check right) on Kentucky bluegrass
Impact of Primo on Summer Patch Severity on KBG Rutgers University

**Baron Kentucky Bluegrass – Fairway height**

Inoculated on June 2.

<table>
<thead>
<tr>
<th>Date</th>
<th>Untreated</th>
<th>Primo 0.25 oz</th>
<th>Banner MAXX 4 oz</th>
<th>Banner MAXX + Primo 3 + 0.25 oz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 2</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Aug. 18</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Sep. 1</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Sep. 19</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

† All products applied on a 28 day interval.
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
Baron Kentucky Bluegrass – Fairway height

Inoculated on June 2. 1995

Patch Diameter (inches)

Aug. 2  Aug. 18  Sep. 1  Sep. 19

- Untreated
- J/J/A
- J/J
- J/A

† Banner applied at 127 ml/m² on a 28 day interval.
Summer Patch Chemical Control

- DMIs, Benzimidazoles, Strobilurins

- Use full label rates – 3 times / season in areas with a history of summer patch

- Apply in 4 gal water / 1000 ft² or Irrigate immediately after spraying

- Timing – Soil temp. 65º 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
IDENTIFICATION
AND
BIOLOGY OF THE FUNGUS
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
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)
## 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>Ib/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

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**SMITH, 1956**
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
REDUCE
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
# Susceptibility of Bentgrass Cultivars to Take-all Patch

**Madison, WI, 2001 (Fairway Ht)**

<table>
<thead>
<tr>
<th>CULTIVAR</th>
<th>MEANS (1-9 RATING)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backspin</td>
<td>6.2a</td>
</tr>
<tr>
<td>Princeville</td>
<td>6.0ab</td>
</tr>
<tr>
<td>Penn G-6</td>
<td>5.7ab</td>
</tr>
<tr>
<td>Brighton</td>
<td>5.2ab</td>
</tr>
<tr>
<td>Century</td>
<td>4.7ab</td>
</tr>
<tr>
<td>SR 7100</td>
<td>4.7ab</td>
</tr>
<tr>
<td>Penncross</td>
<td>4.3ab</td>
</tr>
<tr>
<td>Penneagle</td>
<td>4.2ab</td>
</tr>
<tr>
<td>L93</td>
<td>4.0b</td>
</tr>
<tr>
<td>Seaside II</td>
<td>4.0b</td>
</tr>
<tr>
<td>Providence</td>
<td>3.7b</td>
</tr>
</tbody>
</table>

*NTEP Trials, where 9 = least disease*
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
Subsurface Injection vs. Surface Application

***Rubigan 1AS applied at 4 oz/1000 ft² in Sept., Oct., Apr., and May

B.B. Clarke, unpublished data