Snow Mold Control on Putting Greens in the Intermountain West

IEGCSA 2007 Pesticide Short Course
Nov. 9, 2007
Hayden Lake Country Club, Hayden Lake, ID

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Pullman, WA
Outline

- Status of PCNB
- 3 snow molds
- Cultural control
- Chemical control
- Biological control
PCNB or not PCNB?

• Put on the market in 1964. Standard for snow mold control in turf

• PCNB (a.k.a.):
  • Terraclor 75WP
  • Turfcide 400
  • Revere 4000
  • Par-Flo
  • FFII 14-3-3

• 1988 and 2003 amendments to FIFRA bring databases of older chemicals up to modern standards
PCNB or not PCNB?

• Fall 2006 Reregistration Eligibility Decision (RED) designated PCNB as “ineligible for reregistration” for use on turf and many other crops

• Public comment ended Jan. 2007

• EPA is crafting a response to comments and may come out with an amended RED by the end of the year, at the earliest

• Decision can still be challenged
Reregistration Eligibility Decision (RED) for PCNB

- **High Risk factors**
  - Hazardous air pollutant
    - Significant volatilization
      - Increase exposure
      - Long range transport
  - Soil breakdown 0.5 to 3 years
    - Immobile (low leaching)
    - Increase potential for surface water contamination (long-range transport)
  - Bioaccumulation
    - Very high in fish (>1100X)
    - Aquatic plants (>3100X)
Reregistration Eligibility Decision (RED) for PCNB

- **Risk/Benefit - High/Low**
  - Numerous highly effective, economically feasible alternatives with lesser environmental risk

- **EPA's decision:** PCNB is “Ineligible for reregistration” for use on turf and many other crops

- **Website:**
  http://www.epa.gov/oppsrrd1/reregistration/pcnb/
Snow molds

- **Pink snow mold**
  - *Microdochium nivale*

- **Gray snow molds**
  - *Typhula incarnata*
  - *Typhula ishikariensis*
Pink Snow Mold
(*Microdochium nivale*)

- Cool moist conditions 30-60 °F
- Does not require snow cover
- Circular patches up to 20” diameter
- Reddish bronze to light gray
- Likes annual bluegrass
Microdochium nivale

Reddish bronze fringe (active)

Interior recovers as disease spreads outward
Gray Snow Molds
Apply Fungicides

Gray Snow mold
Disease cycle

Spring

Summer

Sclerotia

Germination of sclerotia

Sclerotia in dead foliage

Infection of snow-covered plant

Mycelium with clamp connections

Basidiospores germinating

Sporocarps that bear basidiocarps

Clavula, bearing basidia on its surface

Stipe
Typhula incarnata

- >60 days continuous snow cover
- Temperatures 34-36 °F
- Variable patches of gray/white matted turf
- Sclerotia: up to 5 mm diameter red/brown embedded in dead leaf tissue (spring)
- Sporocarps: pinkish gelatinous looking upright structures 20 mm tall (fall only)
- Less destructive
Typhula incarnata
T. incarnata sporocarps in low cut turf in the fall
Typhula ishikariensis

- >100 days continuous snow cover
- Temperatures 34-36 °F
- Bleached crust of mycelium after drying
- Sclerotia: <2 mm dark brown/black visible on crust ('Speckled' snow mold) (spring)
- Sporocarps: silvery-white; very small <15 mm tall (very rare) (fall only)
- Destructive
Typhula ishikariensis
McCall, ID

167 days snow cover
95% *T. ishikariensis*
5% *T. incarnata*

CHECK

*Typhula Blight = New Job*
Gray snow mold

Pink snow mold
• Cultural control
• Chemical control
• Biological control
Cultural control

- Control thatch
  - Aerify/topdress
  - Verticut/topdress

- Avoid excess nitrogen late in the fall

- High K fertilizer in the fall (2-3 lbs/M)

- Mow as long as possible

- Surface drainage

- Clear debris

- Trim or remove trees

- Extreme case remove snow
Chemical Control

Late fall application of fungicides before permanent snow cover
Fungicide Timing

- Pink snow mold control
- Trial fungicide application

Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sept  Oct  Nov  Dec
DMI Fungicides

- **Banner MAXX, Spectator Ultra**
  - Propiconazole

- **Trinity**
  - Triticonazole

- **Lynx**
  - Tebuconazole

- **Bayleton**
  - Triadimefon
Strobilurin Fungicides

• Heritage
  - Azoxystrobin

• Compass
  - Trifluoxyystrobin

• Insignia
  - Pyraclostrobin
Fungicides

- **Daconil, Manicure**
  - Chlorothalonil

- **Medallion**
  - Fludioxonil

- **26GT, 18 Plus**
  - Iprodione

- **Cleary's 3336**
  - Thiophanate-methyl

- **Terraclor, Turfcide 400, Revere 4000**
  - PCNB, Quintozene
Single formulations with 2 to 3 fungicides

- **Instrata** (Propiconazole + Fludioxonil + Chlorothalonil)
- **Headway** (Propiconazole + Azoxystrobin)
- **Concert** (Propiconazole + Chlorothalonil)
- **Tartan** (Trifloxystrobin + Triadimefon + StressGard)
- **TBZ + TFS Green** (Trifloxystrobin + Tebuconazole + StressGard)
- **Reserve** (Tebuconazole + Chlorothalonil + StressGard)
- **Spectro 90** (Chlorothalonil + thiophanate-methyl)
<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate (prod/M)</th>
<th>Disease (% area infected)</th>
<th>Turf quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrata 3.61SE</td>
<td>11 fl oz</td>
<td>0.0 a</td>
<td>5.3 a</td>
</tr>
<tr>
<td>Instrata 3.61SE</td>
<td>9 fl oz</td>
<td>0.3 a</td>
<td>5.0 ab</td>
</tr>
<tr>
<td>Banner MAXX (Propiconazole) +</td>
<td>2 fl oz</td>
<td>4.3 a</td>
<td>4.3 abc</td>
</tr>
<tr>
<td>Turfcide 400 (40% PCNB)</td>
<td>6 fl oz</td>
<td>4.3 a</td>
<td>3.3 c</td>
</tr>
<tr>
<td>Turfcide 400 (40% PCNB)</td>
<td>12 fl oz</td>
<td>4.3 a</td>
<td>3.3 c</td>
</tr>
<tr>
<td>Instrata 3.61SE</td>
<td>5 fl oz</td>
<td>8.3 a</td>
<td>4.0 abc</td>
</tr>
<tr>
<td>Banner MAXX (Propiconazole) +</td>
<td>4 fl oz</td>
<td>13.0 a</td>
<td>3.7 bc</td>
</tr>
<tr>
<td>Medallion 50WP (Fludioxonil)</td>
<td>0.33 oz</td>
<td>87.3 b</td>
<td>1.0 d</td>
</tr>
<tr>
<td>CHECK</td>
<td>0</td>
<td>87.3 b</td>
<td>1.0 d</td>
</tr>
</tbody>
</table>
Instrata 9.3 fl oz  
Instrata 6 fl oz  
Instrata 11 fl oz  
CHECK

165 days snow cover
25% Gray
75% Pink

Syngenta Snow Mold Study 2005-2006  City of McCall Golf Course. McCall, ID
<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate prod/M</th>
<th>Disease % area infected</th>
<th>Turf quality**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tartan (Trifloxystrobin + Triadimefon + SG) +</td>
<td>2 fl oz</td>
<td>0.0 a*</td>
<td>5.0 a</td>
</tr>
<tr>
<td>Chipco 26GT (Iprodione)</td>
<td>4 fl oz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compass 50WG (Trifloxystrobin) +</td>
<td>0.25 oz</td>
<td>0.0 a</td>
<td>4.0 b</td>
</tr>
<tr>
<td>Chipco 26GT (Iprodione)</td>
<td>4 fl oz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TBZ + TFS Green (Trifloxystrobin + Tebuconazole + SG) +</td>
<td>2 fl oz</td>
<td>0.3 a</td>
<td>5.0 a</td>
</tr>
<tr>
<td>Chipco 26GT (Iprodione)</td>
<td>4 fl oz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TBZ + TFS Green (Trifloxystrobin + Tebuconazole + SG) +</td>
<td>2 fl oz</td>
<td>0.3 a</td>
<td>5.0 a</td>
</tr>
<tr>
<td>Daconil Ultrex 82.5WDG (Chlorothalonil)</td>
<td>5 oz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tartan (Trifloxystrobin + Triadimefon + SG) +</td>
<td>2 fl oz</td>
<td>0.3 a</td>
<td>4.7 ab</td>
</tr>
<tr>
<td>Terraclor 75WP (PCNB)</td>
<td>4 oz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instrata 3.61SE (Propiconazole + Fludioxonil + Daconil)</td>
<td>9 fl oz</td>
<td>0.3 a</td>
<td>3.0 c</td>
</tr>
<tr>
<td>Tartan (Trifloxystrobin + Triadimefon + SG)</td>
<td>2 fl oz</td>
<td>0.7 a</td>
<td>5.3 a</td>
</tr>
<tr>
<td>TBZ + TFS Green (Trifloxystrobin + Tebuconazole + SG)</td>
<td>2 fl oz</td>
<td>0.7 a</td>
<td>5.0 a</td>
</tr>
<tr>
<td>CHECK</td>
<td>0</td>
<td>18.0 b</td>
<td>2.7 c</td>
</tr>
</tbody>
</table>
Pink Snow Mold Control with Products from Bayer 2006-07.
WSU TARC. Pullman, WA.

<50 days snow cover
100% Pink SM

Instrata 9 fl oz
CHECK

Compass 0.25 oz +
26GT 4 fl oz

TBZ + TFS Green w/StressGard 2 fl oz
<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate prod/M</th>
<th>App. date</th>
<th>Disease (% area infected)</th>
<th>Turf quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insignia 20WG +</td>
<td>0.7 oz</td>
<td>early</td>
<td>0.0 a</td>
<td>5.3 bc</td>
</tr>
<tr>
<td>Manicure Ultra +</td>
<td>5.0 oz</td>
<td>late</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revere 4000</td>
<td>8.0 fl oz</td>
<td>late</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insignia 20WG +</td>
<td>0.7 oz</td>
<td>early</td>
<td>0.3 a</td>
<td>7.0 a</td>
</tr>
<tr>
<td>18 PLUS +</td>
<td>4.0 fl oz</td>
<td>late</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manicure Ultra</td>
<td>5.0 oz</td>
<td>late</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 PLUS +</td>
<td>4.0 fl oz</td>
<td>late</td>
<td>1.0 a</td>
<td>5.7 b</td>
</tr>
<tr>
<td>Manicure Ultra +</td>
<td>5.0 oz</td>
<td>late</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revere 4000</td>
<td>8.0 fl oz</td>
<td>late</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spectator Ultra +</td>
<td>4.0 fl oz</td>
<td>early</td>
<td>2.0 a</td>
<td>6.3 ab</td>
</tr>
<tr>
<td>Insignia 20WG +</td>
<td>0.7 oz</td>
<td>early</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manicure Ultra</td>
<td>5.0 oz</td>
<td>late</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FFII 14-3-3 (PCNB) Granular +</td>
<td>6.36 lbs</td>
<td>late</td>
<td>14.7 c</td>
<td>4.0 d</td>
</tr>
<tr>
<td>Fungicide V (Chloroneb) Granular</td>
<td>5.95 lbs</td>
<td>late</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHECK</td>
<td>0.0</td>
<td></td>
<td>73.3 d</td>
<td>1.0 e</td>
</tr>
<tr>
<td>Snow Cover</td>
<td>Treatment 1</td>
<td>Treatment 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>------------</td>
<td>-------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>165 days</td>
<td>Insignia 0.7 oz (early) + 18 Plus 4 fl oz (late) + Manicure Ultra 5 oz (late)</td>
<td>18 Plus 4 fl oz (early) + Manicure Ultra 5 oz (early) + Revere 4000 8 fl oz (late)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25% Gray</td>
<td>CHECK</td>
<td>Par-Flo 12 fl oz (late)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75% Pink</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**LESCO 2005-06. City of McCall Golf Course. McCall, ID.**
BioControl

• *Typhula phacorrhiza*
  - Antagonistic to *T. incarnata* and *T. ishikariensis*

• *Pseudomonas aureofaciens (Tx-1)*
  - Pink snow mold suppression
  - Applied daily in summer

• *Trichoderma atroviride (Plant Helper)*
  - Parasitize gray snow mold sclerotia
  - Summer apply

• Seed meal
  - Mustard, radish, and rapeseed

• Earth Worm castings (Black Gold)
  - May suppress *Microdochium nivale*
Whitefish Lake Golf Course
4/10/02

Check

Plant Helper (Fungus Helper?)

FFII w/14-3-3
(2x rate)
Summary

- PCNB?
- Cultural methods to minimize impact
- Instrata at 9 to 11 fl oz with >60 days snow cover. Pink only 5 to 7 fl oz.
- StressGard in Tartan and TBZ + TFS Green increases turf quality. Use with Daconil with >60 days snow cover.
- Insignia + 26GT + Manicure Ultra very good control and turf quality with >60 days snow cover without a DMI fungicide
- Minimize resistance rotate your fungicides (especially strobilurins)
- Biocontrol agents: some degree of suppression
WSU Disclaimer

“Some of the pesticides discussed in this presentation were tested under an experimental use permit granted by WSDA. Application of a pesticide to a crop or site that is not on the label is a violation of pesticide law and may subject the applicator to civil penalties up to $7,500. In addition, such an application may also result in illegal residues that could subject the crop to seizure or embargo action by WSDA and/or the U.S. Food and Drug Administration. It is your responsibility to check the label before using the product to ensure lawful use and obtain all necessary permits in advance.”
Questions?