What’s New in Moss Control?

Wendy Gelernter Ph.D.
Moss is the number one problem on many poa and bent greens

WHY?
Moss is increasingly difficult to control due to:

- lower mowing heights
- loss of mercury-based fungicides
- decreased use of chlorothalonil
- unique biology of moss
Moss Biology

- About 1100 species of mosses
- Almost all golf courses deal with *Bryum argenteum*
Silvery thread moss

*Bryum argenteum*
Moss Biology

- Small, primitive, slow-growing perennial plants with chlorophyll
- No vascular system
- No roots – rhizoids to anchor plants (do not absorb water or nutrients)
- Spread by spores, or by fragments of plants (vegetative); wind, water, equipment
- Waxy coating on leaves, dense growth habit
- Different control strategies must be employed because of these differences
Moss plant and sporophyte

0.3” – 0.8 “ long
Cultural practices

- Keep turf healthy!
- **Manage wet spots**
- Scout for early infestations
- Raise mowing heights
- Regular verticutting, brushing, sanding
- Physical removal
Cultural practices

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- Improve drainage
- Aerify, sand topdress
- Irrigation distribution
- Hand watering
- Infiltration aids: Aqueduct, Dispatch etc. to move water
Chemical control considerations

- Spot vs. broadcast applications
- Phytotoxicity
- Volume of application
- Temperature
- Labeled vs. unlabeled approaches
- Role of non-ionic surfactants
Spot applications

- Most techniques are effective, but labor intensiveness, injury to nearby turf is an issue
- Drenching the area is essential
- Backpack sprayer, hand sprayers
  - UltraDawn dishwashing liquid: 4 oz/ga
  - UltraDawn/vinegar/warm water: 3/2/20 (Glenn Kramer)
  - Baking soda: 3 oz/2 ga
Ultra Dawn dishwashing liquid*
100% control for >8 weeks @ 4 oz/gal

40 ga/1000 80 ga/1000 160 ga/1000

*Not registered on turf
Broadcast Applications are the Focus

PHYTOTOXICITY

• Must use products that attack foliage
• Must have excellent coverage
• Most materials that kill moss can also injure turfgrass
• Moss invasion will increase as a result of phyto
• Products with potential for phytotoxicity
  – Iron-based products (ferrous sulfate)
  – Copper hydroxide (Junction)
  – Terracyte (sodium carbonate per oxyhydrate)
Terracyte activity 28 days after last treatment: average of 66% control

Mark M. Mahady and Associates
Turf injury from Terracyte on Poa annua 14 days after 3 sequential treatments

Mark M. Mahady and Associates
Reducing phyto potential with Terracyte

- Use a calibrated drop spreader
- Spread plate or dispersion plate to avoid deposition in lines
- Apply 4.0 lb/1000 in two directions
- Irrigate before and after application
- Use when air temperatures are <70F
- Bentgrass was less sensitive than Poa to phyto
Granular Iron treatments
Reducing phyto potential with iron sulfate

- Apply during cool weather (<70F)
- Apply in higher application volumes (minimum of 5 gallons/1000 sq ft)
- Avoid use on Poa greens
- Use 8 – 16 oz/1000 high quality ferrous sulfate
- Phyto is still possible, but risks are decreased
Reducing phyto potential by using non-phytotoxic products!

- Chlorothalonil (Concorde, Daconil, Echo, Manicure)
- Carfentrazone (QuickSilver)
Moss control at Friendly Hills CC
David Michael, superintendent

Products applied 5/26/98: PACE Turfgrass Research Institute
Daconil Weather Stik
North Carolina State

Percent Moss Control

Daconil WS 4 oz: 2 app
Daconil WS 4 oz: 1 app

Daconil WeatherStik 4 oz/1000 (2 apps)

Daconil WeatherStik 4 oz/1000 (1 app)

43 DAT NC State
Chlorothalonil

• Least risk of phytoxicity
• Up to 90% control BUT
• Warm weather required (>80F optimal)
• Minimum of 3 applications, every 1-2 weeks
• Higher application volumes improve control
• Must keep an eye on chlorothalonil limits
QuickSilver (carfentrazone)

Contact herbicide: disrupts foliar cell membranes:
- Also in mixes: SpeedZone, PowerZone
- Introduced 1992: Buttonweed, burweed, clover, dandelion, henbit, pigweed, speedwell, etc.
- Activity on moss/safety to cool-season greens identified 2002/2003 by Yelverton

Labeled on newly seeded and established turf:
- Kentucky bluegrass
- perennial rye
- tall and fine leaf fescue
- creeping bentgrass
- common bermuda, bahia, zoysia, St. Augustine, centipede
QuickSilver (carfentrazone)
Regulatory issues

• Labeled for use on golf courses but excluding greens and tees
• May damage hybrid bermudagrass
• Labeled at only low rates (2.1 oz/acre) and 3 applications/year
• Special local need 24 (c) labels in SC, NC, GA, IN for greens, higher rates
• Currently not legal for use on greens in CA

Federal label for use on greens approved last week!
QuickSilver (carfentrazone)

- Improved activity with 0.25% (v/v) non-ionic surfactant
  - 0.25% = 0.0025 X spray volume
    - = 0.25 gallons/100 gallons
  - Silwet L-77, Activator 90, AdWet, Pen-A-Trate, Monterey Super 7
  - To avoid foaming, add surfactant to tank when almost filled

- Improved activity is likely with higher application volumes (>2 ga/1000 sq ft)
- Temperature does not affect activity
2003 trials: North Carolina State
Products applied once: 7/24/03

Percent Moss Control

- Quicksilver 6.7oz + NIS: 1 app
- QuickSilver 6.7 oz: 1 app
- Daconil WS 4 oz: 1 app
2003 trials: North Carolina State
Products applied twice: 7/24, 8/6/03
## Moss control options for broadcast applications

<table>
<thead>
<tr>
<th></th>
<th>Efficacy</th>
<th>Turf Safety</th>
<th>Temp tolerance</th>
<th>Signal Word</th>
<th>Score</th>
<th>CA Label</th>
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<tbody>
<tr>
<td>Chlorothalonil</td>
<td>+++</td>
<td>+++</td>
<td>++</td>
<td>+ ½ W/D</td>
<td>10 ½</td>
<td>+</td>
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<tr>
<td>Quick Silver</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++ C</td>
<td>14</td>
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<tr>
<td>Ferrous sulfate</td>
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<td>++</td>
<td>++</td>
<td>+++ C</td>
<td>9</td>
<td>+</td>
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<tr>
<td>Terracyte</td>
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<td>+ D</td>
<td>7</td>
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<tr>
<td>Junction</td>
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<td>+ D</td>
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<td>Application</td>
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<tr>
<td>Chlorothalonil</td>
<td>3 weekly apps @ high rate for moss</td>
<td>Best &gt;80F</td>
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<tr>
<td>QuickSilver</td>
<td>2 apps @ 6.7 oz/A plus 0.25% NIS</td>
<td>No greens label; SR 1020 sensitivity</td>
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<tr>
<td>Ferrous sulfate</td>
<td>8-16 oz/1000 every 7-10 days</td>
<td>Best &lt;70F; phyto possible</td>
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<tr>
<td>Terracyte</td>
<td>3 weekly apps @ 4 lb/1000 in 2 directions</td>
<td>Best &lt;70 F; phyto possible</td>
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<td>Junction</td>
<td>2-4oz/1000, every 2 wks during winter</td>
<td>Best at very cool temps; phyto likely</td>
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Application and beyond

• Higher application volumes (>2 ga/1000) for improved efficacy
• Once the moss is gone, there is a bare patch! Moss will re-grow unless turf growth is stimulated