Turf Diseases in the Rocky Mountain Region
Ned Tisserat
Bioagricultural Sciences and Pest Management
Colorado State University

Disease Publications
- Available online as PDF
  - [http://extension.missouri.edu/explore/agguides/ipm1029.htm](http://extension.missouri.edu/explore/agguides/ipm1029.htm)
  - Hard copies $3.00 through U. Missouri
- Chemical Control of Turfgrass Diseases
  - [http://www.uky.edu/Ag/ukturf/DiseasePubs.htm](http://www.uky.edu/Ag/ukturf/DiseasePubs.htm)

Turfgrass Problem Identification
- Diagnostic labs
  - CSU, Ft. Collins
  - Jefferson County Extension
  - Tri-River Area, Grand Junction
- Please submit a representative sample and complete description of problem

Snow Molds in Colorado
- Pink snow mold
  - *Microdochium nivale*
- Typhula blight
  - Gray snow mold
    - *T. Incarnata*
  - Speckled snow mold
    - *Typhula ishikariensis*

Pink Snow Mold
- Pink snow mold (*Microdochium nivale*)
  - Development during cool-cold weather (32-50 F)
  - Pink margin is characteristic
  - Snow cover may enhance disease but is not necessary
  - Often found with other snow molds
  - Patch margins have distinct pink (salmon) color
**Speckled and Gray Snow Mold**
- *Typhula blight* species difficult to tell apart in the field
- Development in winter under snow cover
  - Temperatures just above freezing
  - Usually requires 30+ days under snow for development
- Attacks foliage and shoots; not a root pathogen

**Typhula Blight**
- Fungi survive summer as resting structures of fungal mycelium called *sclerotia*

**Snow mold management myth #1**
Fungicide residues diminish quickly after application
- Fungicide concentrations diminish slowly or not at all during the winter

**Snow mold management myth #2**
Longer periods of snow coverage (greater than 3-4 months) always enhances Typhula blight damage
- In fact, snow mold damage may reach high levels after just a few months snow coverage

**Snow mold management myth #3**
Spring snow removal suppresses Typhula blight development
- Spring snow removal had no influence on Typhula blight severity in plots that were treated with a fungicide
- Snow removal may help prevent ice damage
Snow mold management myth #4
Compacting snow makes Typhula blight worse

Snow mold management myth #5
Two or more fall fungicide applications are better than a single application just before snow cover

- Of the nineteen paired comparisons from two golf courses over a 7 year period, there was only one case in which two fungicide applications provided better Typhula blight control than a single application.

Snow mold control
- Not necessary in Kentucky bluegrass lawns; only on annual bluegrass or creeping bentgrass fairways/greens
- Make a single application just before permanent snow cover
- Use a combination of fungicide chemistries

Fungicides for Snow Molds
- Usually combinations used
  - Cholorthalonil
  - Fludioxonil
  - Propiconazole
  - Tebuconazole (Torque)
  - triticonazole
  - Iprodione
  - Thiophanate methyl
  - trifloxystrobin
- Combinations include Spectro, Instrata, Reserve, many, many others

Ascochyta Leaf Blight
- Uniform or patchy areas of bleached turf
- Symptoms
  - Often develops in spring following wet weather
  - May follow periods of temperature extremes
- Diseased leaves are bleached and may have pinched appearance
- Symptoms occur rapidly

Management of Ascochyta Leaf blight
- Turf normally will recover; not a killing disease
- Balanced fertility
- Mow at 2 ½ - 3 inches
- Sharpen blades on mower
- Fungicides not necessary?
  - [http://www.ext.colostate.edu/pubs/pubs.html#garden](http://www.ext.colostate.edu/pubs/pubs.html#garden)
Don’t confuse Ascochyta with heat and drought damage

**Slime Molds**
- Not true fungi
- Slimy plasmodium feeds on organic matter but doesn’t damage turf
- Fungicides not necessary

**Drechslera Leaf Spot** and melting out
- *Drechslera poae*
  - Symptoms common in spring and fall during cool weather
  - Disease development favored by extended periods of leaf wetness
  - Individual plants killed; resulting in thin, off-color stand (melting-out)
  - Purple leaf spots surrounded by yellow zone

**Control of Leaf Spot**
- Overseed or renovate with resistant cultivars
  - ‘common’ types of bluegrass
    - South Dakota, Kenblue, Park, others
- Increase mowing height
- Irrigation?
- Decrease thatch
- Avoid excessive nitrogen fertilization in spring
- Fungicide applications?
  - If the disease is bad enough for fungicides, consider renovation instead
Necrotic Ring Spot of Kentucky Bluegrass
*Ophiostoma korrae*
- Symptoms develop in mid summer to fall, may be apparent into spring
- Rings or frogeyes
- Perennial disease
- Often develops 2-3 years after sodding, but may be latent for a number of years

Necrotic Ring Spot
- Fungus colonizes roots when soil temperatures are between 60-75F.
- Fungal growth relatively slow
- Diseased roots killed during periods of stress
  - Drought
  - Heat?

Management of NRS
- Proper site preparation
- Use resistant varieties
- Follow guidelines for growing bluegrass
  - Maintain proper height
  - Reduce thatch
- Don’t expect to control NRS in a single season!
  - Requires patience and adjustments in cultural practices
  - Fungicides aren’t a silver bullet

Avoid Excessive Irrigation!
- Irrigation audit
- Modify irrigation frequency, amount during growing season

Manage Fertilizer Applications
- Avoid excessive rates of Nitrogen
  - Don’t use more than 4 lb N/1000 sq feet per year
- Timing of applications very important!
  - Apply most N in late summer, fall (follow CSU guidelines)
    - Late summer applications help turf recover from damage
  - Avoid applying more than 1 lb N/1000 sq feet (fast release) at any one application
  - Avoid heavy spring N applications
    - If fertilizing in spring use slow-release formulations

Acidify Root Zone to Suppress NRS
- Mechanism still unclear
- Use acidifying sources of N fertilizer
  - Sulfur-coated urea
  - Ammonium sulfate
- Use sulfur to reduce pH
  - 1-3 lb/1000 sq feet/year applied in the fall and/or spring
  - Monitor soil pH
Overseeding?

- Overseeding with ryegrass an option
- Overseeding with resistant bluegrass varieties?
- No consistency from location to location

<table>
<thead>
<tr>
<th>Most Resistant</th>
<th>Least-resistant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adelphi, NuBlue, Alpine, Apache, Apex, Award, Princeton104, Bristol, Eclipse, Joy, Kelly, Miranda, Mystic, NE 80-88, NuStar,Telegram, TFE104, Tourney</td>
<td>Amazon, Limousine, Optima, Opal, Sydsport, BA 68-82, (&gt;Fairfax), BA 70-131, Barsweet, Chen, HV-97, (&gt;Cocktail), J 335, Julia</td>
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</tbody>
</table>

NRS severity increased from 10% severity August 18 to 20% September 28, suggesting that fungicide effects 'pooped out' late in season

Fungicides for NRS

- Timing is critical
- Make first application in mid- to late- May
- Don’t apply too early in the spring!
- Don’t apply too late in the fall!
- Make Multiple applications
  - Two monthly applications good but three are better
  - Fungicide effects generally last 2-4 weeks at most

<table>
<thead>
<tr>
<th>Fungicide Product Name</th>
<th>Efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>azoxystrobin Heritage</td>
<td>Fair to good</td>
</tr>
<tr>
<td>azoxystrobin +propiconazole Headway</td>
<td>Fair to good</td>
</tr>
<tr>
<td>iprodione Chipco 26GT, Raven, Lesco 18 Plus, Ipodione Pro</td>
<td>Unknown (doubtful)</td>
</tr>
<tr>
<td>metconazole Tourney</td>
<td>Good? (1 year data)</td>
</tr>
<tr>
<td>myclobutanil Eagle</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

Necrotic Ring Spot Information

- [http://www.ext.colostate.edu/pubs/pubs.html #garden](http://www.ext.colostate.edu/pubs/pubs.html #garden)
- Or go to Colorado State University Website, then go to Extension, then to publications.
Summer Patch

- *Magnaporthe poae*
  - soil borne, root rotting fungus, movement on sod
- Kentucky bluegrass, annual bluegrass, fine fescues (not tall fescue)
- Perennial disease
- Confirmed in Colorado
  - Grand Junction 2005
  - Greeley 2006

Summer Patch of *Poa annua*

Management of Summer Patch

- Resistance in Kentucky bluegrass
  - Avoid common types of bluegrass
    - Park, Kenblue, South-Dakota Certified, Ginger, Alene, Greenley
- Differences in regions?

Management of Summer Patch

- Reduce compaction
- Raise mowing heights
- Thatch reduction
- Soil acidification (pH <6.0)
  - Ammonium sulfate
  - Sulfur coated urea
  - sulfur
- Manganese applications (manganese sulfate at 2 lb/acre per year)
  - Increased synthesis of phenolic and ligneous compounds
- Irrigation schedules

Don’t confuse summer patch with anthracnose on putting greens

Anthracnose (Basal Crown)

- *Colletotrichum cereale*
- Creeping bentgrass, annual bluegrass
- Development often during hot, humid weather, but symptoms may also appear in late spring and fall
- Often associated with adverse growing conditions
  - 'bentgrass decline'.
Management of Anthracnose

- Avoid fertility excesses or deficiencies
  - Light, frequent nitrogen applications may help grass recover from injury
  - 3 lb/year
- Low, frequent mowing may enhance disease
  - Raise mowing height
  - Don’t mow cleanup every day
  - Don’t mow wet greens if anthracnose present
- Anthracnose is stress but not wound related
  - Topdressing is good in general, but may temporarily increase disease

Management of Anthracnose

- Improve soil drainage
  - Deep tine, aerate (vent) in fall
  - Spike, hydroject, or slice compacted greens during summer, but avoid doing this if anthracnose present
- Don’t over-irrigate
- Avoid using Embark, Dimension, ProStar on greens with history of anthracnose
- Primo applications are not associated with anthracnose development
Fungicides for Anthracnose

- Work best as preventive treatments
  - Applications in this region may need to be started before Memorial Day and continued through August.
  - DMI plus protectant as an example
  - Applications every 2-4 weeks depending on conditions
  - Anthracnose strains vary in sensitivity to fungicides

- Systemic products (subject to resistance problems) Avoid sequential applications
  - Heritage, Insignia, Compass
  - Propiconazole, Eagle, Trinity, Triton, Tourney
  - Thiophanate-methyl
  - Protectants (tank mix with systemics)
    - Chlorothalonil, Endorse, Medallion,
  - Mix systemic with contact

Dollar Spot

- Pathogen
  - *Sclerotinia homoeocarpa*

- Hosts
  - creeping bentgrass, perennial ryegrass, Kentucky bluegrass, fine fescues, zoysiagrass, bermudagrass

- Time of year
  - may occur throughout summer, but more severe in spring and early summer and again in late summer, early fall

  - Most economically important turf disease in world!

Environmental Conditions

- Survives as dormant mycelium in infected tissues
- Optimal temps for infection between 21 and 28 C
- Extended periods of leaf wetness favor infection
  - Dew
  - Guttation droplets
- Low nitrogen fertility favors infection
Management of Dollar Spot

- Resistant species?
  - All species except tall fescue susceptible to some extent, although there are differences among varieties
  - There are some varieties of bentgrass that are highly susceptible. These should be avoided in certain areas such as golf course fairways

Cultural Management of Dollar Spot

- Minimize leaf wetness duration (dew and guttation droplets)
  - poling, syringing, mowing
  - Pruning of trees and air circulation
  - Irrigation scheduling (no evening watering)
- Avoid drought stress
  - Core cultivation to reduce thatch
- Fertility management
  - Increasing nitrogen fertility may reduce disease severity

Management of Dollar Spot

- Preventive and curative fungicide applications
  - More fungicides used to control this disease than any other!
- Disease forecasting
- Fungicide resistance
  - Don’t use the same class of fungicide continuously during the growing season. Fungus may become insensitive to fungicide!

Fairy Rings

- Formation of ring or arc shaped areas of discolored or dead turf
- look for fungal growth in thatch-soil interface
- Diameter can vary, but may be extremely large
- Rings seldom overlap
Many Fungi Cause Fairy Rings

Fairy Ring Precursor? *Lycoperdon pusillum*

Fairy Ring Fungicide Trials

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate</th>
<th>7/25</th>
<th>8/7</th>
<th>8/13</th>
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<tbody>
<tr>
<td>Untreated</td>
<td>-</td>
<td>40a</td>
<td>46a</td>
<td>51a</td>
</tr>
<tr>
<td>Raly II</td>
<td>3 fl oz</td>
<td>53a</td>
<td>46.3</td>
<td>49a</td>
</tr>
<tr>
<td>Bayleton + Raly II</td>
<td>1 oz</td>
<td>3 fl oz</td>
<td>41a</td>
<td>16c</td>
</tr>
<tr>
<td>Heritage TL + Raly II</td>
<td>4 fl oz</td>
<td>3 fl oz</td>
<td>61a</td>
<td>33ab</td>
</tr>
<tr>
<td>Heritage TL + Raly II</td>
<td>2 fl oz</td>
<td>3 fl oz</td>
<td>54a</td>
<td>21bc</td>
</tr>
<tr>
<td>ProStar + Raly II</td>
<td>2.2 oz</td>
<td>3 fl oz</td>
<td>56a</td>
<td>35ab</td>
</tr>
<tr>
<td>ProStar + Raly II</td>
<td>4.5 oz</td>
<td>3 fl oz</td>
<td>39a</td>
<td>29bc</td>
</tr>
</tbody>
</table>

Fungicide Management of Fairy Ring

Suppressing Fairy Rings

- Spike greens before fungicide application
- Apply fungicides with wetting agent and water greens immediately after application
  - Apply in large volume of water >4 gallons/1000
- Make application before onset of rings or just as they appear (late June early July?)
  - additional applications may be necessary
- Fungicides
  - Bayleton, Tourney have worked well in several recent trials
  - ProStar and Heritage

Patch Diseases Caused by *Rhizoctonia*

- *R. solani* (various groups)
  - brown patch on bentgrass, other grasses
  - Large patch on zoysiagrass
- *R. cerealis*
  - Yellow patch or cool-season brown patch
- *R. zeae var. circinata* (*Waitea circinata*)
- *R. oryzae*
**Yellow Patch**

- *Rhizoctonia cerealis*
- **Hosts**
  - annual bluegrass, bent
- **Development** fall to early spring; symptoms do not have to develop under snow cover.

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**Yellow Patch Control**

- Damage often superficial
- Improve surface drainage
- Preventive fungicide applications in early November
  - Heritage, ProStar, Bayleton
- Curative treatments less effective
  - Chlorothalonil, iprodione, Medallion, Endorse

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**Brown Ring Patch or Waitea Patch**

*Rhizoctonia circinata*

- **Hosts**: *Poa annua*
- **Development** in May, early June
  - Likes it warm but not hot; won’t see this in mid-summer.
- Very similar in appearance to yellow patch, fairy ring

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**Brown Ring Patch or Waitea Patch**

- Symptoms somewhat superficial – turf may recover on its own.
- Water management –
  - Don’t overwater
- **Fertility?**
  - Maintain even fertilization
- Preventive and curative fungicide treatments
  - Many of the DMI fungicides appear effective alone or in combo with other products

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**Take-all Patch of Bentgrass**

*Gaeumannomyces graminis var avenae*

- **Host**
  - bentgrasses
- Most common on new putting surfaces or renovated greens, Symptoms start in spring, may continue through summer

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**Take-All**

- Fungal colonization of roots begins in fall or spring at temperatures near 65 F.
- Symptoms may be apparent during cool weather, or occasionally in mid-summer
Control of Take-All

- Soil acidification (ammonium sulfate)
  - pH 5.5 and 6.0
  - difficult on sand based greens
- Balanced nitrogen and phosphorus fertilization
- Manganese treatments?
  - Apply 2.2 manganese (5.5 lb manganese sulfate) in spring or fall

Control of Take-All

- Fungicide applications
  - in fall similar to snow mold treatments if symptoms are most apparent in spring
  - In spring if symptoms apparent in summer
- Types of fungicides
  - DMI fungicides (Rubigan, Bayleton, Banner MAXX, Eagle)
  - QoI fungicides (Heritage)

Take All Decline

- Gradual decline in severity with time (3-4 years); often don’t see disease on old, established turfgrass
- Development of suppressive soils; accumulation of antagonistic microorganisms
  - Bacteria (fluorescent Pseudomonads)
  - production of antibiotics
- Decline phenomenon also occurs with spring dead spot, necrotic ringspot, summer patch diseases

Rapid Blight in Colorado

Rapid Blight of Bentgrass
*Labyrinthula terrestris*
Associated with high salinity

*Agrostis stolonifera*
Rapid Blight

- Caused by a marine organism called *Labyrinthula*

Rapid Blight of Bluegrass and Bentgrass

- Found at two golf courses in Brighton, Colorado, February 2009
  - Time of development unusual
- Usually associated with high salinity (reclaimed water or poor wells)

Rapid Blight

- Rapid blight is frequently associated with high soil salinity (>2.5 dS/m total dissolved salts) and sodium levels above 110 mg/kg. Soil salinity levels from the site affected by the disease were below this guideline. However, sodium levels were high (184 mg/kg).
Management of Rapid Blight

- Manage salinity and sodium levels
  - [http://www.paceturf.org/PTRI/Documents/0303ref.pdf](http://www.paceturf.org/PTRI/Documents/0303ref.pdf)
- Insignia (0.9 oz/1000 sqft)
- This might also occur in parks, sports turf and maybe home lawns if there are issues with high salinity/sodium
- Please send suspect samples to us

Strobiluron Fungicides For Turfgrass

- Azoxystrobin – Heritage
  - Mixed with propiconazole -Headway
- Pyraclostrobin -Insignia
  - Mixtures: Pillar (with trifloxystrobin); Honor (with bosalid)
- Trifloxystrobin - Compass
  - Mixed with triadimefon - Armada, Tartan
- Fluoxastrobin - Disarm

DMI (Triazole) Fungicides
Sterol Inhibiting Fungicides

- Fenarimol – Rubigan
- Myclobutanil – Eagle
  - Mixed with mancozeb – ManHandle
- Propiconazole – Banner MAXX, Propiconazole Pro, Spectator, Strider
  - Mixed with azoxystrobin - Headway
  - Mixed with fludioxonil, chlorothalonil – Intrata
- Triadimefon – Bayleton
  - Mixed with trifloxystrobin – Armada, Tartan

DMI (Triazole) Fungicides
Sterol Inhibiting Fungicides

- Triticonazole – Trinity (BASF), Triton (Bayer) for NRS, Reserve (mixed with chlorothalonil)
- Metconazole – Tourney (Valent)
  - Summer Patch, NRS
- Tebuconazole – Torque (Cleary’s)
  - NRS, Snow molds

Fungicide Resistance

- High risk with strobilurons, moderate with DMI
- Limit the number of applications per year
- Tank mixtures
- Combine applications with cultural practices
- Don’t use low rates

Biocontrol Products for Turfgrass

- *Bacillus licheniformis* – EcoGuard
- *Bacillus subtilis* - Rhapsody
- *Trichoderma harzianum* - Biotrek, Turfshield, Turfmate