Anthracnose Symptomology

Chlorotic Leaves

Acervuli on Infected *Poa annua* Tillers

Photo: Landschoot, APS Press
Management Practices can have a Major Effect on Anthracnose Severity
Mowing Frequency Effect on Anthracnose Severity

0 20 40 60 80 100
30-Jul 13-Aug 27-Aug 10-Sep 24-Sep 8-Oct
% Disease

14 / wk

7 / wk
Lightweight Rolling Practices Effecting Anthracnose

Rolled every other day

No rolling
The Take-Home message is …

… you can significantly reduce anthracnose and maintain green speed (ball roll distance) by:

(1) increasing heights of cut (≥ 0.125 in.)

AND either

(2) increasing mowing frequency, and/or

(3) initiating frequent lightweight rolling
**Best Management Practices**

**Nitrogen Fertility** – maintain turf vigor by

- Emphasize Spring N - 1 to 2 lb per 1000-ft² (at higher rates, include slow release nitrogen)

- Begin light-frequent N early in the year (April) at 0.1 to 0.2 lb of N per 1000 ft² per wk

- Total N per yr 3.5 – 4 lb per 1000-ft²
What’s the Optimum Rate of N applied to ABG in a Season w/ respect to Anthracnose?
Foliar N relative to anthracnose in ABG turf—2012

6 July

Critical value = 3.6 %N

P < 0.0001

R² = 72%
N SOURCE STUDY

Objective
- Determine if N source effects anthracnose severity

Treatments
Five N sources
- calcium nitrate, ammonium nitrate, ammonium sulfate, potassium nitrate, and urea

Two Frequencies
- weekly and biweekly (May-Sept)

All treatments applied at 0.1 lbs N per 1000 ft²
EFFECT OF NITROGEN FORM ON DISEASE SEVERITY

Disease Severity (%)

<table>
<thead>
<tr>
<th>Date</th>
<th>1-Jun</th>
<th>15-Jun</th>
<th>29-Jun</th>
<th>13-Jul</th>
<th>27-Jul</th>
<th>10-Aug</th>
<th>24-Aug</th>
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<tbody>
<tr>
<td>Potassium Nitrate</td>
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<td>Ammonium Sulfate</td>
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<tr>
<td>Ammonium Nitrate</td>
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<tr>
<td>Calcium Nitrate</td>
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<td>Urea</td>
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<tr>
<td>Untreated Control*</td>
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* Untreated control not included in statistical analysis
Why Does Nitrogen Source Affect Anthracnose Disease?

- N form
  - Ammoniacal vs. Nitrate
- Soil pH
  - Ammonium sources acidify soil
- Potassium
  - May help uptake of N and reduce plant stress
- Calcium
  - Improve cell wall structure or increase N-use efficiency
ANTHRACNOSE POTASSIUM STUDY
10 SEPT. 2012

No Potassium

$K_2SO_4 \ (1:1)$
SOIL SAMPLING PROCEDURES
POTASSIUM TRIAL

• 2 x 4 factorial - 2 potassium sources at 4 rates
  • Potassium sulfate (K$_2$SO$_4$) and potassium chloride (KCl)
  • 0, 1.3, 2.7, and 5.4 lbs K 1000-ft$^{-2}$ annually
• Potassium nitrate (KNO$_3$) and potassium carbonate (K$_2$CO$_3$) applied at 5.4 lbs K 1000-ft$^{-2}$ annually
• Treatments applied biweekly after urea application from May through November.
Soil Potassium

Critical values for soil test K ranged from 85 to 98 lbs/acre.

Lower limit for potassium sufficiency range is 100 lbs/acre (or 50 ppm)
**Tissue Potassium**

Critical values for tissue K content ranged from **1.9 – 2 %**

Lower limit for tissue potassium sufficiency range is **2.0 %**
SOIL pH TRIAL

Treatment factors

Five **limestone** (CaCO$_3$) rates to **increase** soil pH
  • Range from **5.8** to **7.8**

Two **sulfur** (S) treatments to **decrease** soil pH
  • pH < **5.0**

Two **gypsum** (Ca) treatments as **calcium checks**

• All treatments applied on 12 Dec 2011 and 1 April 2014
**Anthracnose Response to Soil pH**

Critical value for soil pH ≈ 5.75 - 6.00

2014

Area under disease progress curve vs. Mat pH
Turfgrass quality

Critical values for turf quality ranged from pH 5.8 – 5.9 %
pH STUDY 1 Oct 2014

pH = 6.4

(limestone applied at 46 and 54 lbs CaCO$_3$ 1,000-ft$^{-2}$)
pH = 5.2

(Elemental sulfur applied at 0.5 and 0.25 lbs S 1,000-ft²)
Best Management Practices

**Topdressing**

- Topdressing in **spring** very beneficial at 400 to 800 lb per 1,000-ft² (more effective than fall)
- Summer topdressing very beneficial weekly - up to 100 lb per 1,000 ft² bi-weekly - up to 200 lb per 1,000 ft²
Anthracnose severity response (AUDPC) to total amount of sand applied (L m$^{-2}$) during 2009

- 1,000 lb per 1,000 ft$^2$
- 2,000 lb per 1,000 ft$^2$
- Topdressing improves surface characteristics
- Firmer surface raises effective height of cut
- Deeper crowns reducing stress
Best Management Practices

Irrigation

- Avoid excessively wet or wilt stress conditions to reduce anthracnose
- Irrigate at 80% of ET₀ (Kₖ = 0.8) or 60% of ET₀ (Kₖ = 0.6) and timely hand watering to avoid wilt stress
Irrigation Practices Influence on Anthracnose of an Poa annua Green

Disease (%)

- 100% ET
- 80% ET
- 60% ET
- 40% ET

7-Jun, 21-Jun, 5-Jul, 19-Jul, 2-Aug, 16-Aug
Best Management Practices

Verti-cutting and other cultivation

- Wounding from these practices DOES NOT increase anthracnose disease

- Do not avoid the use of verti-cutting or other cultivation practices if needed
Best Management Practices

Plant Growth Regulators

Use for better turf and playing quality

Will not increase anthracnose severity; may reduce

1) **Proxy** (ethephon) or **Embark** (melfluidide) at label rates during March/April for seedhead control

2) **Primo MAXX** (trinexapac-ethyl) every 7 to 14 days at 0.1 to 0.2 fl oz per 1000-ft² during growing season
Trinexapac-ethyl Application Interval Effect on Anthracnose

- None
- Every 14 days (0.05 kg a.i. ha\(^{-1}\))
- Every GDD 200 (0.05 kg a.i. ha\(^{-1}\))

Plot area blighted (%)

- 20-Jun
- 5-Jul
- 20-Jul
- 4-Aug
- 19-Aug
- 3-Sep

UCONN TURFGRASS
Controlling Anthracnose Basal Rot with a Sound Fungicide Program
Chemical Control of Anthracnose

I. Demethylation Inhibitors (Sterol Inhibitors)
   - Banner, Bayleton, Eagle, Torque, Tourney, Trinity, Triton

II. Strobilurins
   - Heritage, Heritage Action, Insignia, Disarm

III. Antibiotic
   - Endorse, Affirm

III. Benzimidazoles
   - Fungo, 3336

IV. Nitriles
   - Daconil, Daconil Action, Echo, Concorde

V. Combinations (III/IV, I/II, & I/IV)
   - ConSyst, Spectro, Headway, Tartan, Renown, Interface, Concert, Lexicon
Good Control of ABR Chemistries

- **Phosphonates** – fosetyl-Al and Phosphites
  - Chipco Signature 80WG (4.0 oz)
  - **Appear (6 fl oz)**
- **DMI** – myclobutanil
  - Eagle 40W (1.0 oz)
- **Dicarboximide** – iprodione
  - Chipco 26GT 2SC (4 fl oz)
- **Phenylpyrrole** – fludioxonil
  - Medallion 50W (0.25 oz)
- **Carboximides**
  - **Velista (0.3-0.5 oz)**
  - Mineral Oil – **Civitas**
Relative Efficacy of New Fungicides for Cool - Season Turf Diseases

* Efficacy on a 1-4 Scale, where 1 = not effective, 2 = fair – good control, 3 = good – excellent control, and 4 = excellent control. Limited = insufficient data.
Control of Anthracnose Basal Rot with Civitas 98AS on an Annual Bluegrass (Poa annua L.) Green in North Brunswick, NJ - 2010

Relatively poor disease control obtained with a 6% solution of Civitas + Harmonizer pigment applied every 14-d from 18 May – 17 August 2010 – Note thinning and sealing off of the soil surface on Civitas treated turf
AUTILUS® Flowable Turf Fungicide

- Active ingredient: PCNB Labeled for golf course greens, tees and fairways
- Good efficacy against anthracnose (Chlorosis in hot weather)
- Application Windows: May – mid-June; September – October (water-based formulation in future – reduce burn)
- Unique mode of action – FRAC Group 14 (aromatic hydro)
  - Tank-mix option for resistance management
Anthracnose Control in Annual Bluegrass Putting Green Turf: Rutgers University - 2015

Treatments Applied on a 14 Day Interval

Rate/1,000 SQFT:
6 fl.oz. 6 fl.oz. 8 fl.oz. 1.1 fl.oz. 0.5 oz. 4 fl.oz. 4 fl.oz.

Untreated Plot Ratings
29 July: 66.0%
8 August: 91.5%
18 August: 93.8%

* Treatment included the pigment product Par at 1 pint/A
Daconil Action

- Daconil Action contains acibenzolar, a systemic compound which induces the plant’s natural resistance to disease.

- This is a unique mode of action which mimics natural systemic acquired resistance (SAR) found in most plants.

- It has no direct effect on the pathogen.
Control of Anthracnose with chlorothalonil + acibenzolar (Daconil Action®) on an Annual Bluegrass Green - RU

**2008 Anthracnose Trial**

<table>
<thead>
<tr>
<th>Date</th>
<th>Untreated</th>
<th>Daconil Action 2.0 fl oz</th>
<th>Daconil WeatherStik 2.0 fl oz</th>
<th>Daconil Ultrex 1.8 oz</th>
</tr>
</thead>
<tbody>
<tr>
<td>25-Jul</td>
<td></td>
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<tr>
<td>1-Aug</td>
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<tr>
<td>15-Aug</td>
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<tr>
<td>22-Aug</td>
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Treatments applied every 14 days (15 May – 15 Aug 2008) *sign. 0.05
Appear™ Fungicide

Anthracnose
Pythium

Basic Application Guidelines
Rate: 3 to 8 fl oz per 1000 ft², Application interval: 7 to 14 days
Used in programs to provide disease control and reduce plant stress
Anthracnose Trial 2011: Rutgers University
Annual Bluegrass (Greens Height)

Applications: May 17, 31; June 14, 28; Jul 12, 26; Aug 9, 23.

*Rate per 1,000 ft².
Signature Xtra Stressgard

- Pythium, yellow tuft, anthracnose (tank mixed)
- Fosetyl-Al rate lowered, now 60 WDG vs. 80 WDG
- Reduction allows for inclusion of additional components to optimize plant health
- Alleviates biotic and abiotic stress
- Enhanced formulation for improved tank-mix compatibility
Anthracnose Control with Signature Xtra Stressgard 60WG on Annual Bentgrass Putting Green: Rutgers University 2015 (Anth-1-15)

Fungicides applied on 15 May – 7 August 14d & 21d, 14 August 7d
Untreated Control

Signature Xtra Stressgard
4 oz @ 14 days

Signature Xtra Stressgard
2 oz @ 7 days

August 21, 2015
Velista

- Active ingredient: penthiopyrad
- SDHI fungicide: acropetal penetrant
- Fungicide class: carboximide
- FRAC group: 7
- Formulation: 50WDG
- Application rate: 0.3 - 0.5 oz 1000-ft\(^{-2}\)
- Pending registration in the US: Spring 2014
Relative Efficacy of New Fungicides for Cool - Season Turf Diseases : 2005- 2011 (Golf)

* Efficacy on a 1-4 Scale, where 1 = not effective, 2 = fair – good control, 3 = good – excellent control, and 4 = excellent control. Limited = insufficient data.
Evaluating Tank Mixtures for the Control of Anthracnose
Curative Control of Anthracnose Basal Rot on an Annual Bluegrass Green – Univ. Riverside, CA

Applied every 14 days from 15 Jun – 1 Sept

Disease severity (%) / plot

Signature 4.0 oz + Daconil 3.2 oz
Insignia 20WG 0.7 oz
Banner MAXX 1.3ME 1.0 fl oz
Heritage TL 0.8ME 1.0 fl oz
Endorse 2.5WP 4.0 oz
Medallion 50WP 0.33 oz
Daconil Ultrx 82.5WG 3.2 oz
26GT 2SC 4.0 fl oz
Chipco Signature 80WG 4.0 oz
Untreated check

Rated on 24 July
A Programmatic Approach to Controlling Anthracnose Basal Rot
Excellent Control of ABR: Programs (Alt/R)

Rutgers Alternation Program for NE and Mid-Atlantic States

- Mid-May – DMI
- Early-June – Nitrile (chlorothalonil)
- Mid-June – Phosphonate (fosetyl-Al) + Nitrile
- Early-July – Dicarboximide (iprodione)
- Mid-July – Phenylpyrrole (fludioxonil) + DMI (reduced rate)
- Early-August – Phosphonate + Nitrile
- Mid-August – Polyoxin-D + DMI (reduced rate)
- Late-August (if weather is still hot) - Nitrile

14 – d interval
Putting It All Together: Using BMPs to Reduce Fungicide Inputs
Objective: Use BMPs to Reduce Fungicide Inputs While Maintaining Excellent Turf Quality & Performance

Factors:

Mowing Height
0.090 vs. 0.125 inch

N Fertility
2.05 vs. 4.1 lb N per 1000 ft² per yr

Fungicide Program
- Calendar-based 14-day interval at 100%, 75%, 50% and 25% rates of fungicides (3.2 oz/M Dac Ultrex + 4 oz/M Signature)
- Threshold schedule at 100% rate of fungicides
Anthracnose severity response to fungicide Rate as influenced by N fertility - 14 Sept 2012
Total # of Fungicide Applications (May-Sept 2012): Comparison of Threshold applications to combinations of Nitrogen programs and mowing heights

<table>
<thead>
<tr>
<th>Low N</th>
<th>Low Mow (0.090 in)</th>
<th>High Mow (0.125 in)</th>
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</thead>
<tbody>
<tr>
<td>Low N</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>High N</td>
<td>5</td>
<td>2</td>
</tr>
</tbody>
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80% less fungicide than calendar-based schedule