

The background of the slide features a large, faint, circular watermark of the Rutgers University seal. The seal contains the text "RUTGERS UNIVERSITY" and "1823" around a central emblem.

RUTGERS

New Jersey Agricultural
Experiment Station

What We've Learned from 18 Years of Anthracnose Research:

**Bruce Clarke, Jim Murphy, James Hempfling,
Chas Schmid, John Inguagiato, Joseph
Roberts, and Wrennie Wang**

Rutgers University

www.turf.rutgers.edu

Management of Putting Greens Changed Dramatically from the 1980's to 2000's

- Reduced annual rates of N :
 - 245 to 343 kg ha⁻¹ yr⁻¹ (5 to 7 lbs N/1000 ft²/ yr) 1980's
 - 49 to 147 kg ha⁻¹ yr⁻¹ (1 to 3 lbs N/1000 ft²/ yr) 2000's
- Reduced mowing heights:
 - 6.4 mm (0.250 in) 1950 - 70's
 - 4.1 mm (0.160 in) 1980's
 - <2.3 mm (0.100 in) 1990's - 2000's
- Lower soil moisture
 - 100% ET replacement 1980's
 - 40-60% ET replacement 1990 - 2000



Photo: J. Inguagiato

From 1980's to 2000, Saw a Dramatic Increase in the Incidence & Severity of Anthracnose on Putting Greens

- Hypothesis in 2000 When we Started Res.:
 - Certain cultural practices are intensifying anthracnose on annual bluegrass putting greens,
and that
 - Utilizing sound agronomic practices (BMPs) can significantly reduce disease severity, improve turf quality, and reduce fungicide inputs

James A. Murphy, Ph.D.
Bruce B. Clarke, Ph.D.
John A. Inguagiato, Ph.D.

Update on BMPs for anthracnose on annual bluegrass turf

In many cases, a combination of cultural practices can effectively suppress anthracnose, eliminating the need for fungicides.



Hort Farm 2 at Rutgers University in New Brunswick, N.J., was the site of the anthracnose research trials. Photos by James Hempfling

Anthracnose Disease of Turfgrass

Causal Agent: *Colletotrichum cereale* Manns sensu lato
Crouch, Clarke, and Hillman (Crouch et al. 2006)



Can Develop as a Foliar Blight

Anthracnose Symptomology

Chlorotic Leaves

Acervuli on Infected *Poa annua* Tillers



Photo: Landschoot, APS Press



Cultural Strategies for Anthracnose



Impact of Mowing Practices on Anthracnose Severity

- **Mowing Height**
 - 2.8 mm (0.110 in.)
 - 3.2 mm (0.125 in.)
 - 3.6 mm (0.141 in.)
- **Mowing Frequency**
 - Single cut each day (7x / wk)
 - Double cut each day (14x / wk)



Jo

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; 3.2 mm)

AND either

(2) increasing mowing frequency, **and/or**

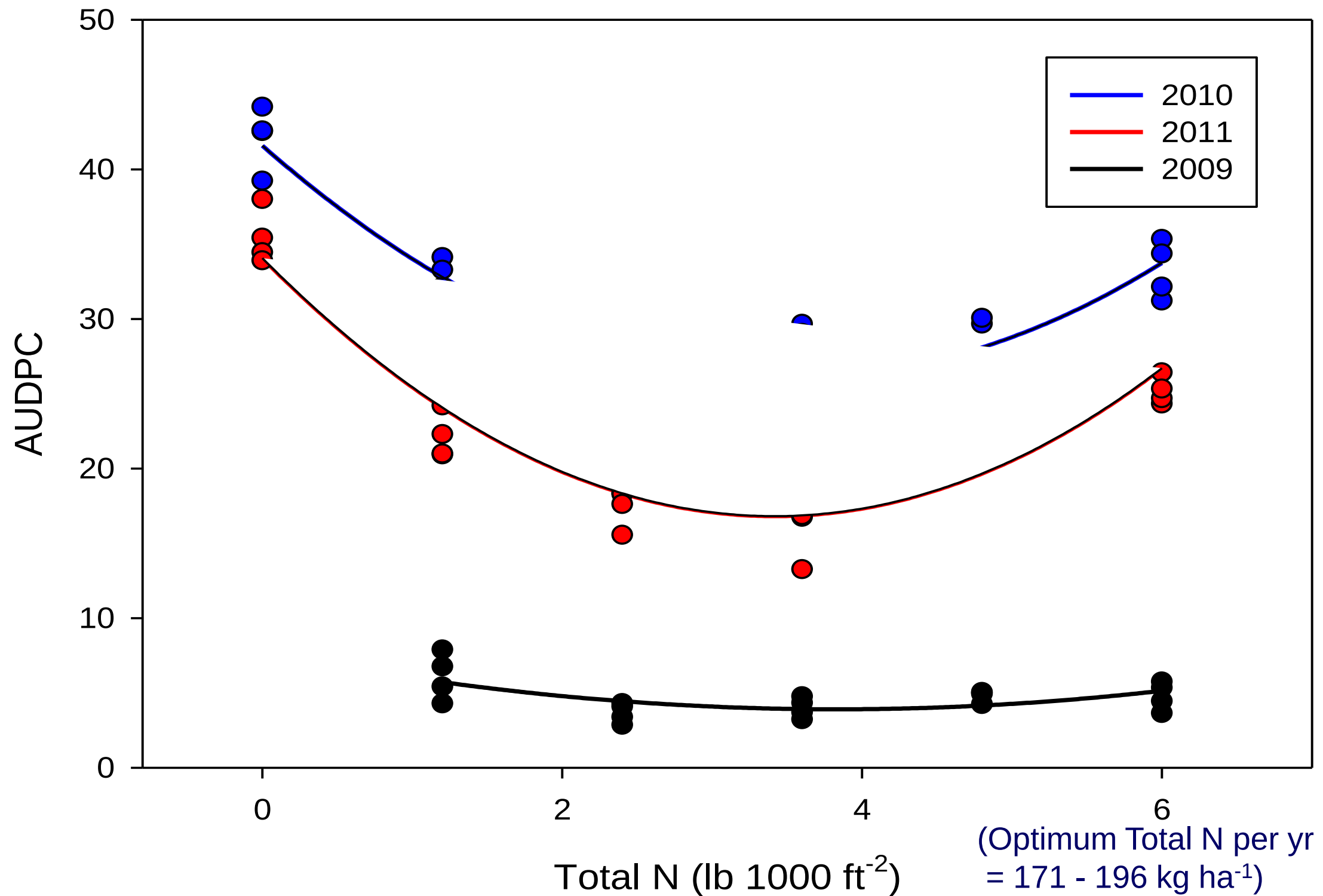
(3) initiating frequent lightweight rolling

Nitrogen (N) Fertility

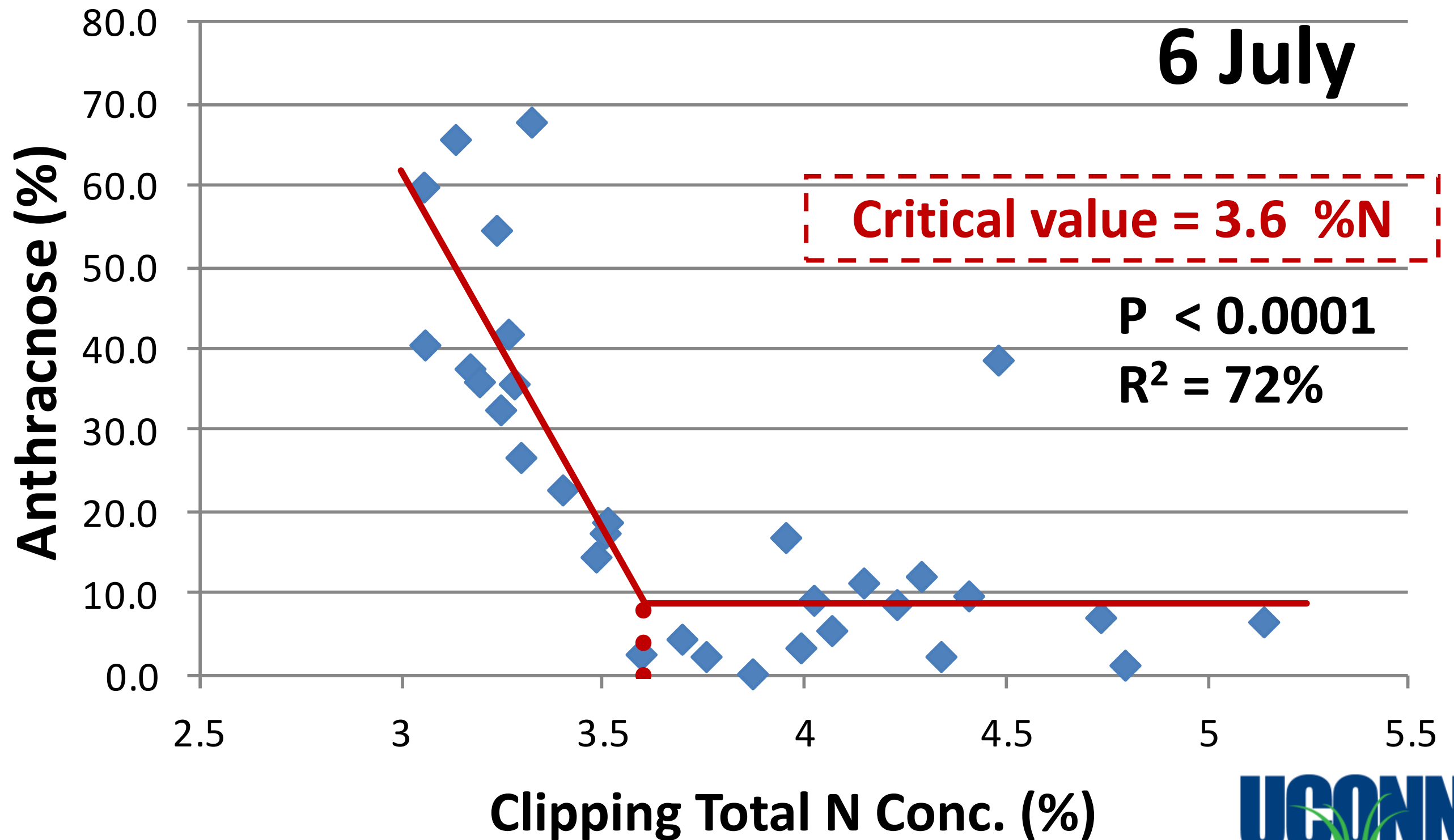
- Summer timing highly effective
- Light & frequent ideal (0.1 lbs. / 1,000-ft² / week)
- 0.2 lbs. / 1,000-ft² / week more effective
 - useful short-term for curative (up to ½ lbs.)
 - PGR to avoid surge growth



What's the Optimum Rate of N applied to ABG in a Season w/ respect to Anthracnose?



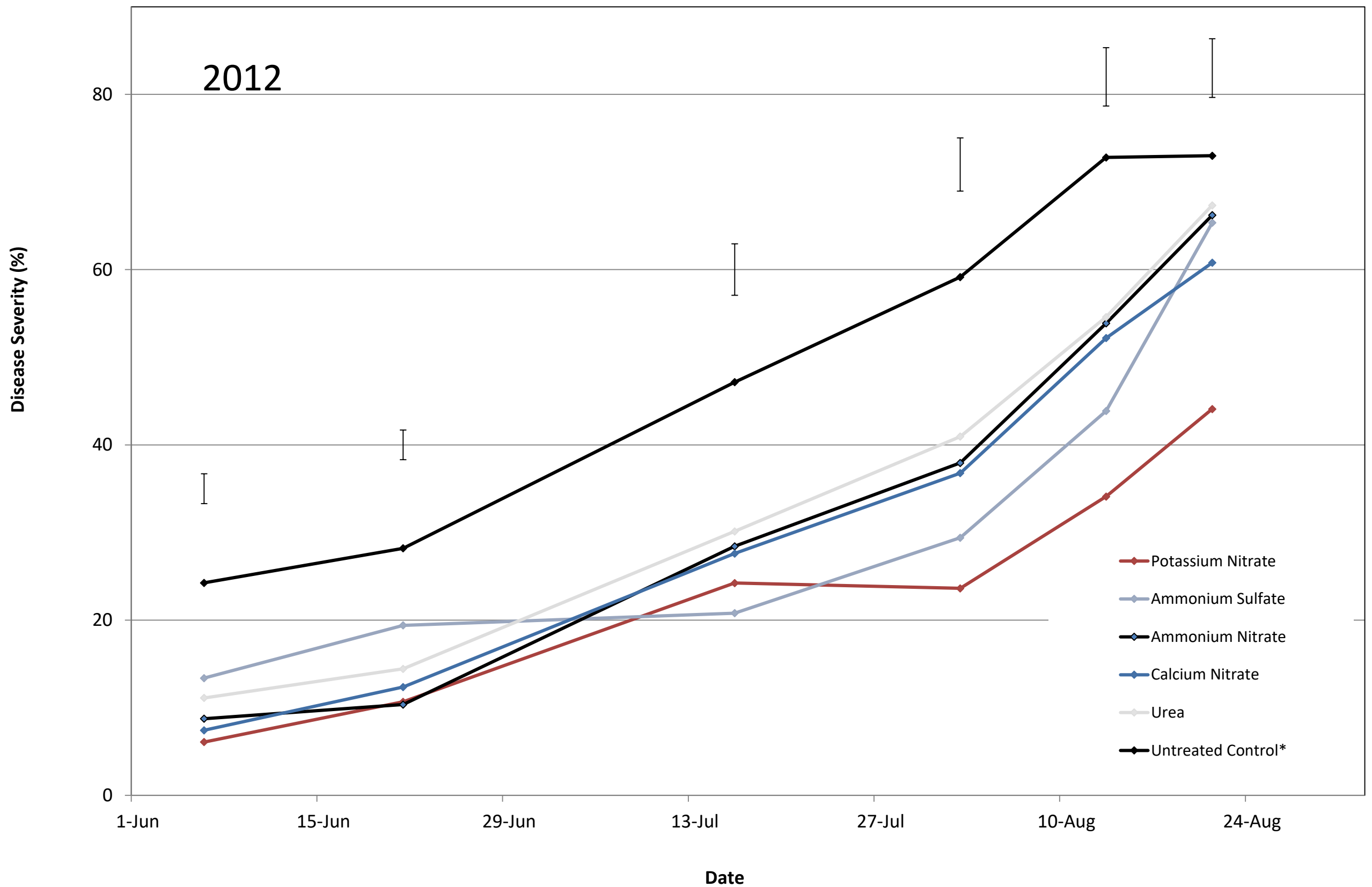
Foliar N relative to anthracnose in ABG turf—2012



Nitrogen Source

- ♦ Preliminary studies indicated that N source affects anthracnose severity

EFFECT OF NITROGEN FORM ON DISEASE SEVERITY

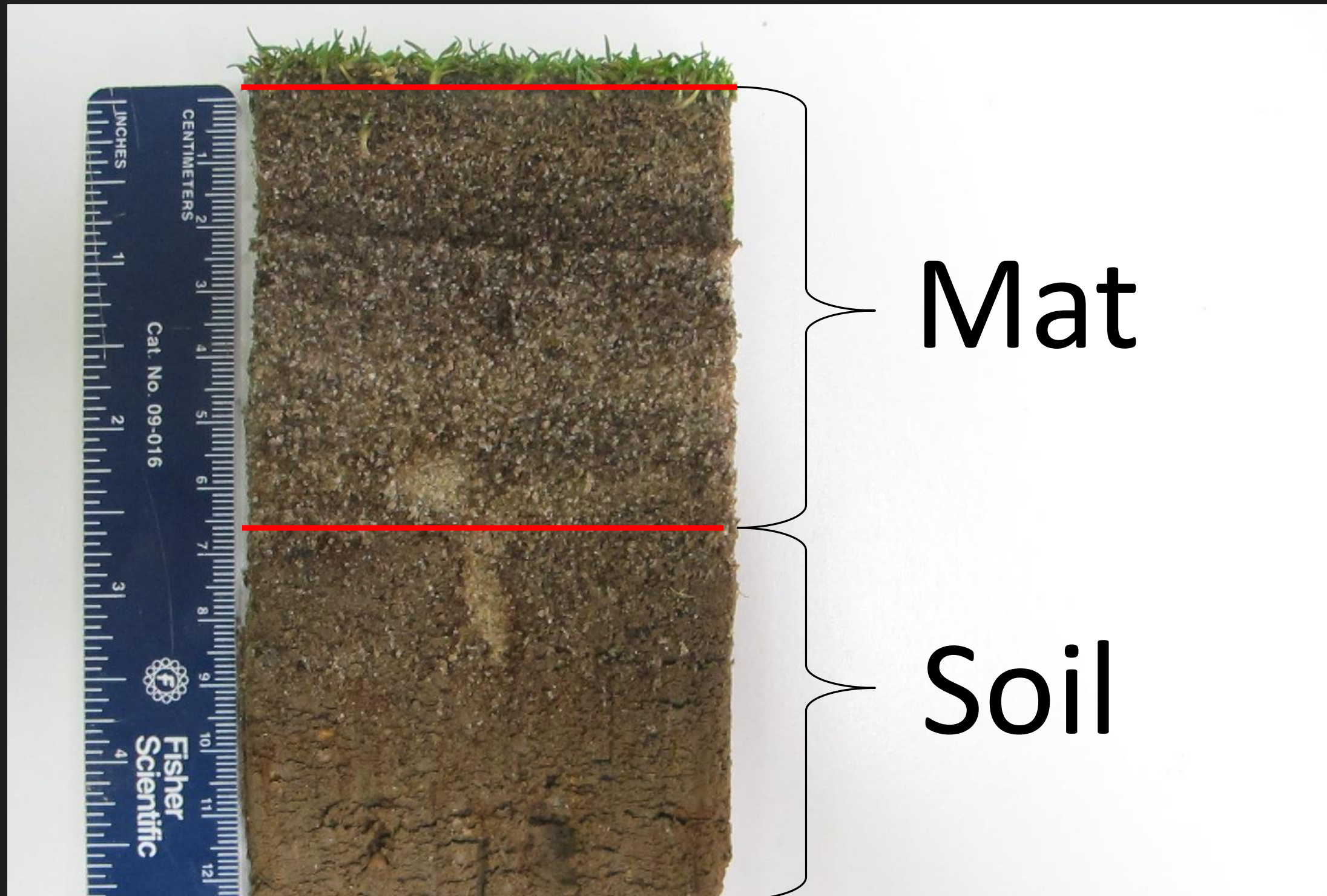


* Untreated control not included in statistical analysis

Why Does Nitrogen Source Affect Anthracnose Disease?

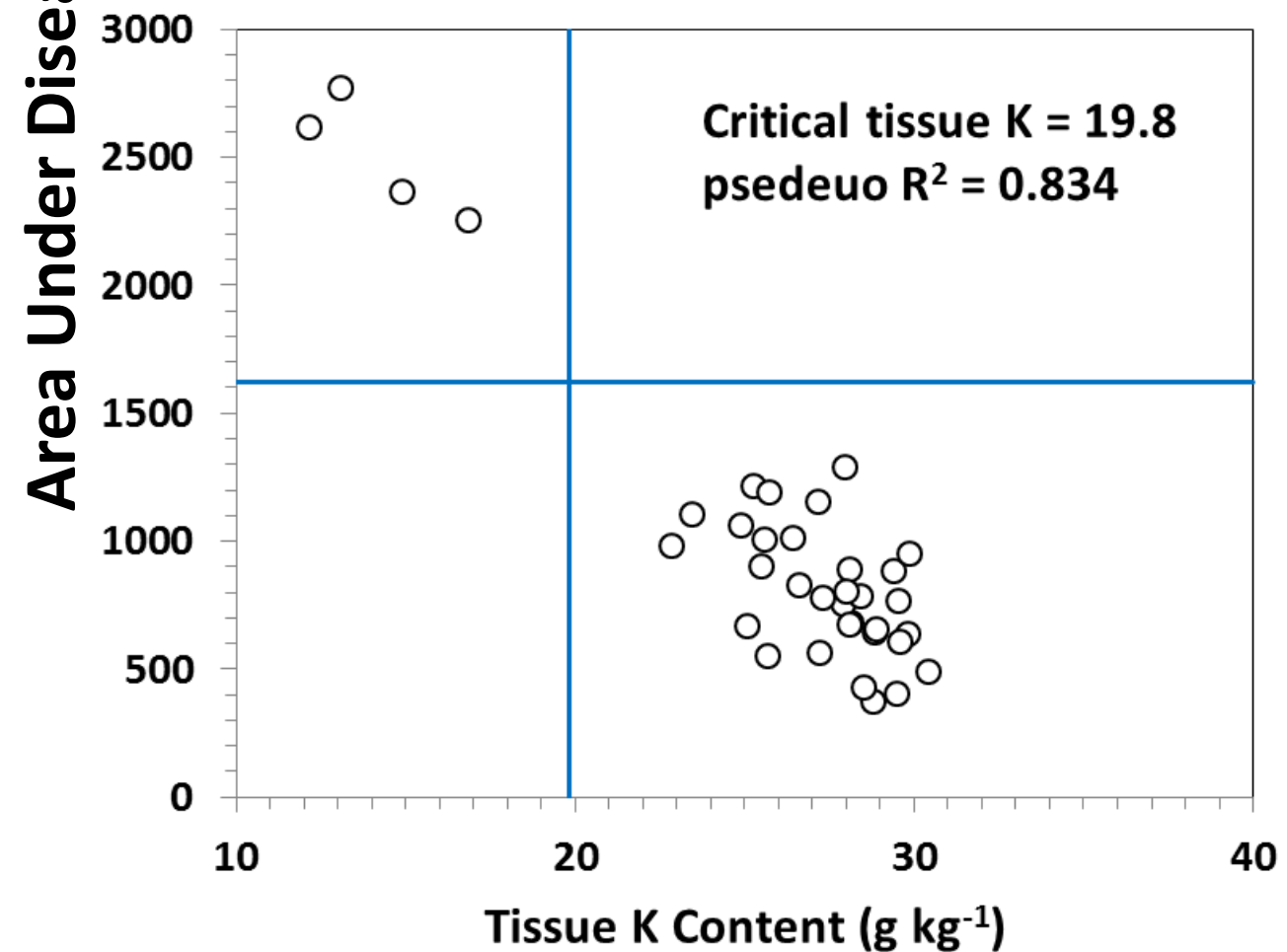
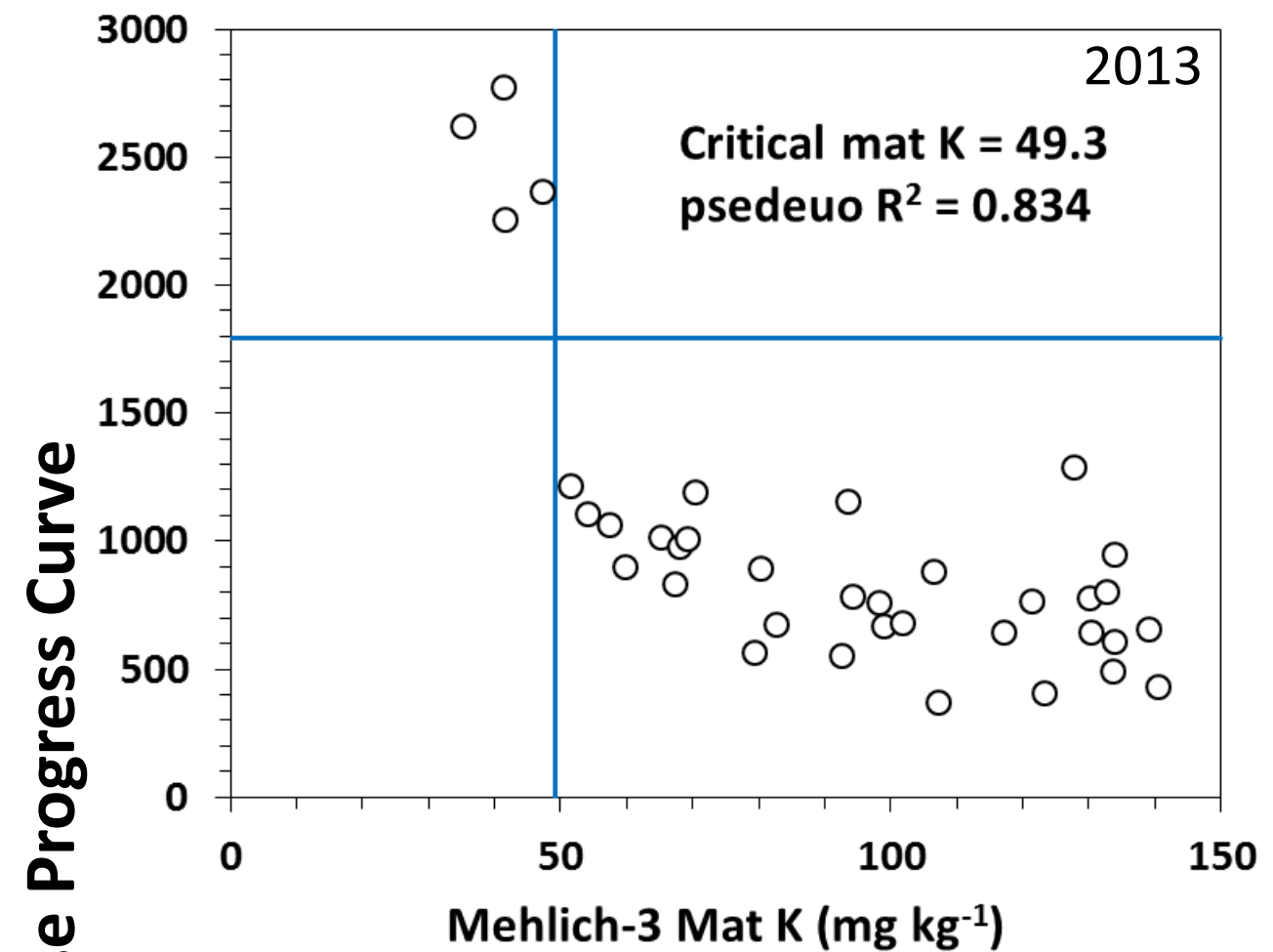
- N form
 - Ammoniacal vs. Nitrate - not solely responsible
- Soil pH
 - Ammonium sources acidify soil
- Potassium
 - May help uptake of N and reduce plant stress
- Calcium
 - Improve cell wall structure or increase N-use efficiency

SOIL SAMPLING PROCEDURES



Sufficiency for anthracnose:
Mat K > 50 ppm (Mehlich 3)

Tissue K > 20 g kg⁻¹ (2%)
max. 3% at 100 ppm
soil



Soil pH Trial

Study Factors

Limestone (CaCO_3)

- 5 rates
- soil pH from 5.8 to 7.8

Sulfur (S)

- 2 rates - soil pH < 5.0

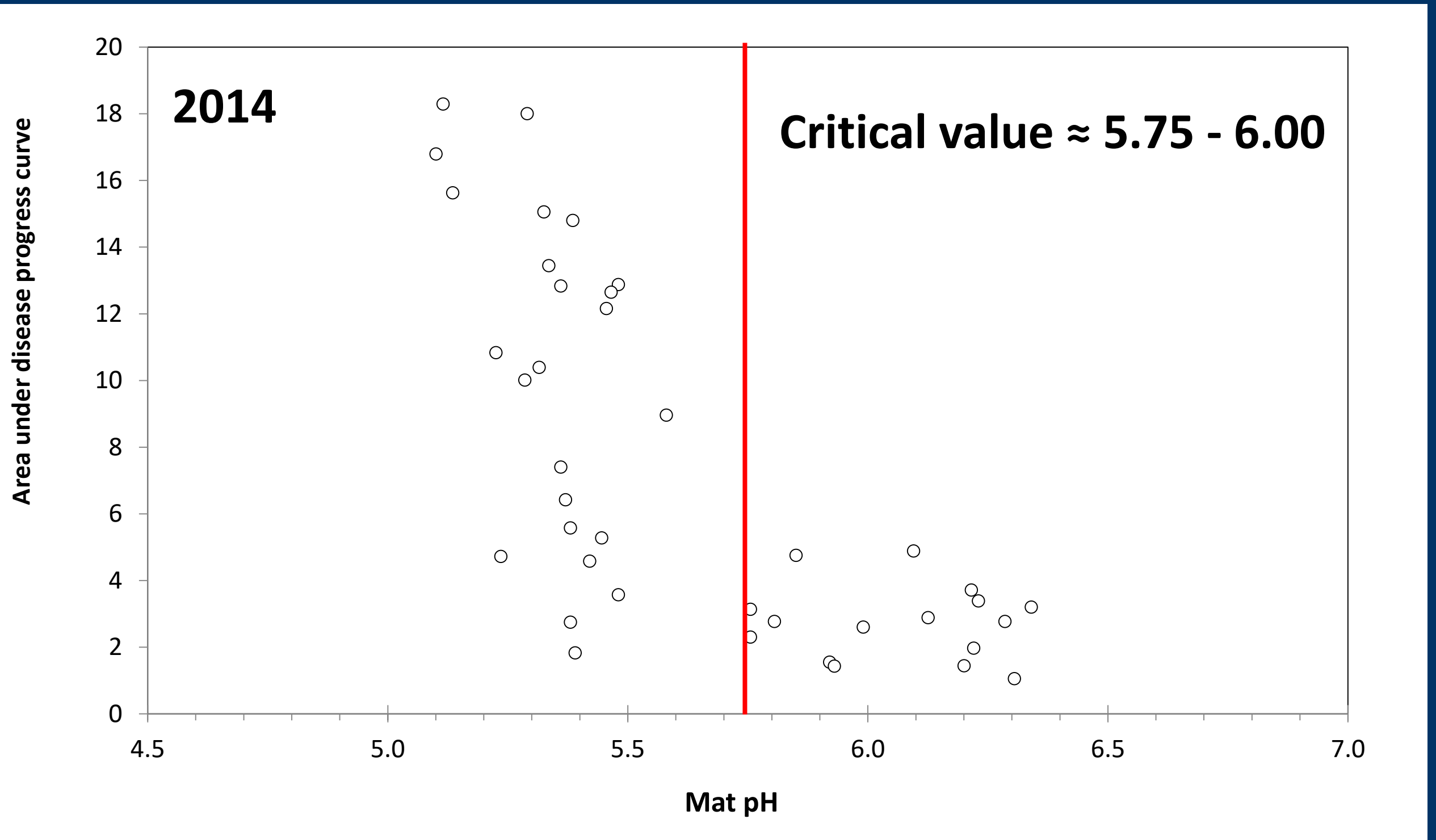
Gypsum (Ca)

- 2 rates to match Ca in limestone



Treatments applied on 2011 - 2018

Anthracnose response to soil pH



Plots with pH = 6.4

Oct.
2014

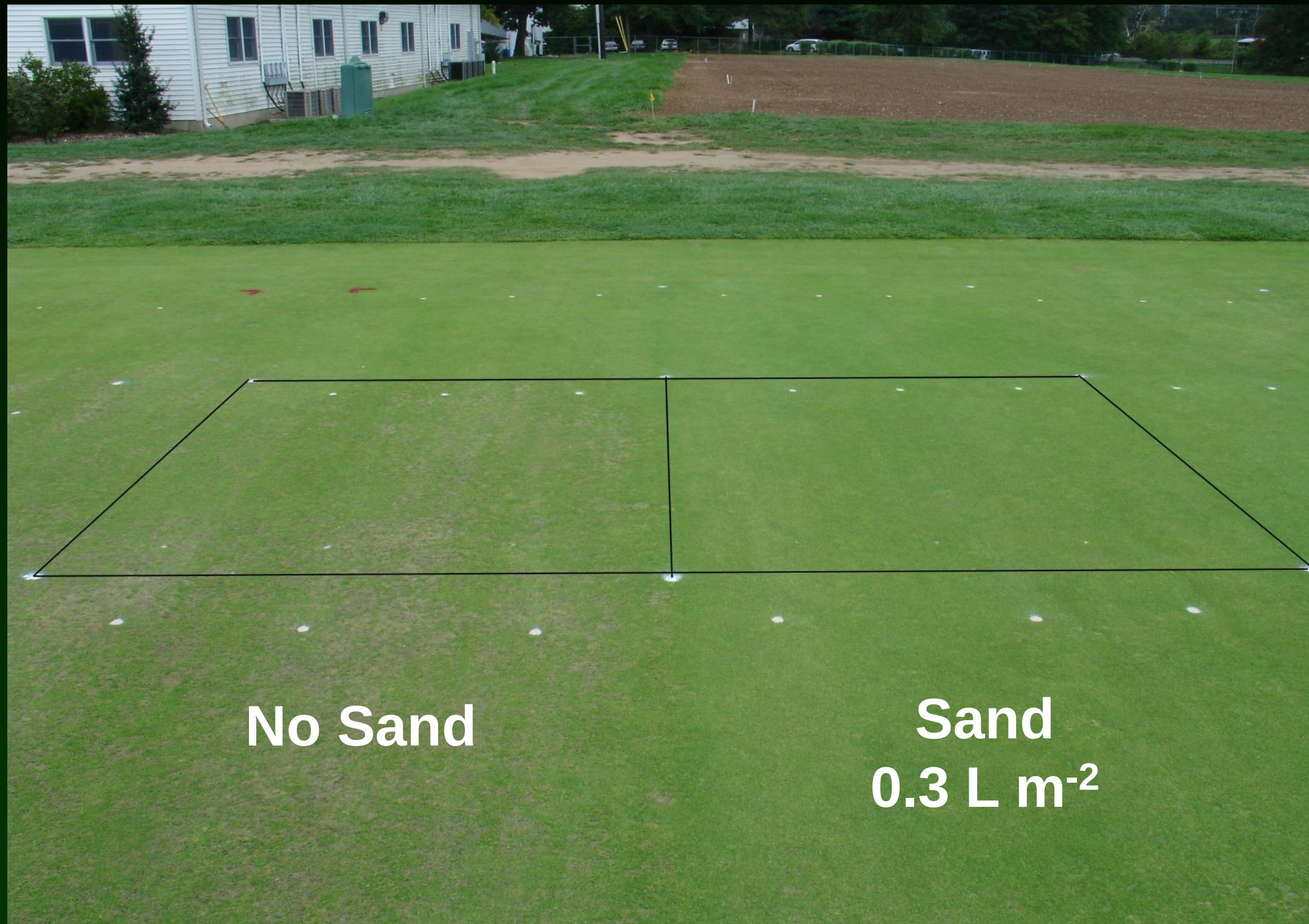


Limestone applied at 46 and 54 lbs. / 1,000-ft²

Sand Topdressing

- Frequent, topdressing reduces anthracnose
100 lbs. / 1,000-ft² every 7 to 14 d
- Also true under foot traffic





No Sand

Sand
0.3 L m⁻²

No Sand

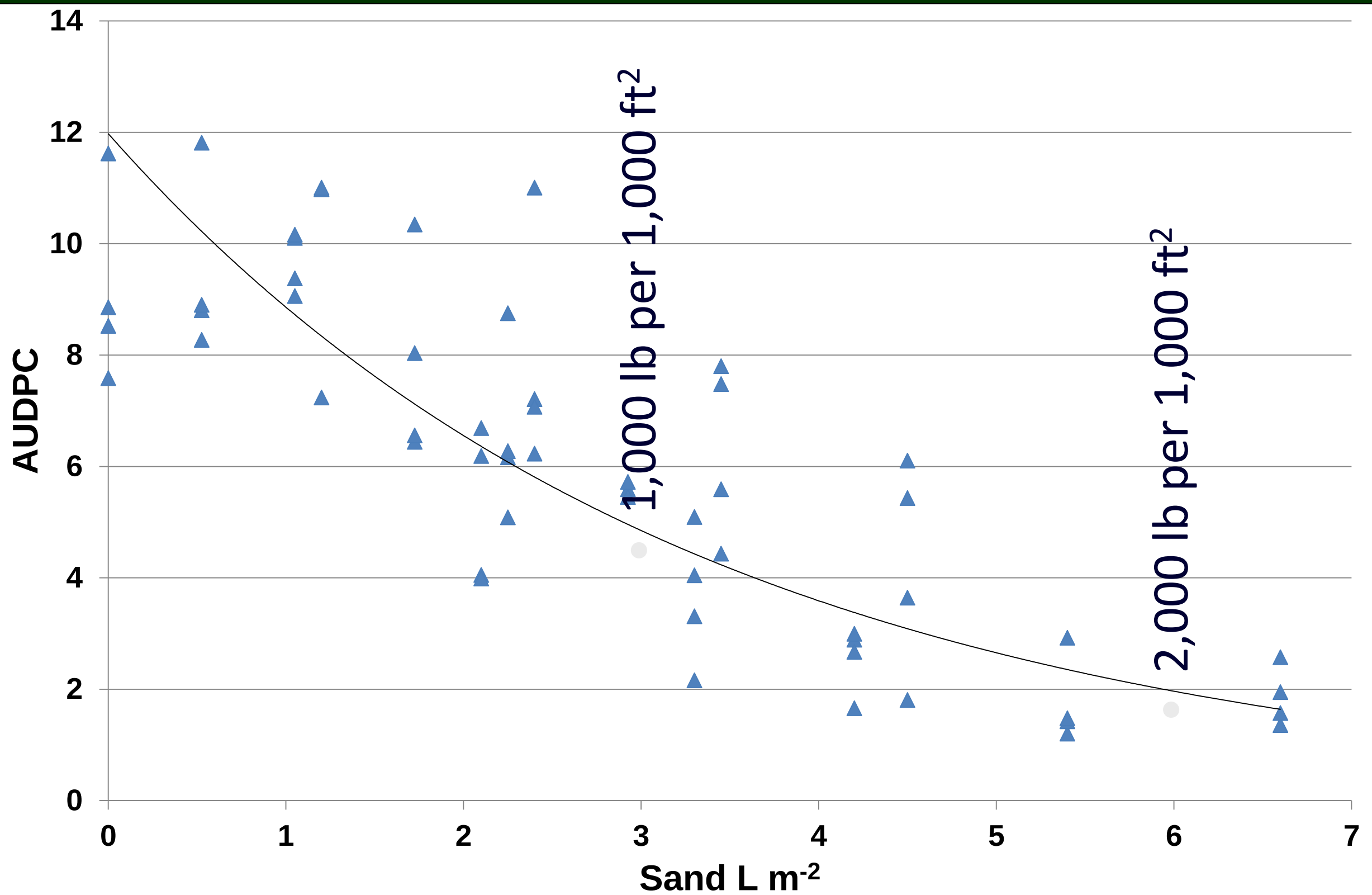
1.0 ft³/1000-ft²

2.0 ft³/1000-ft²

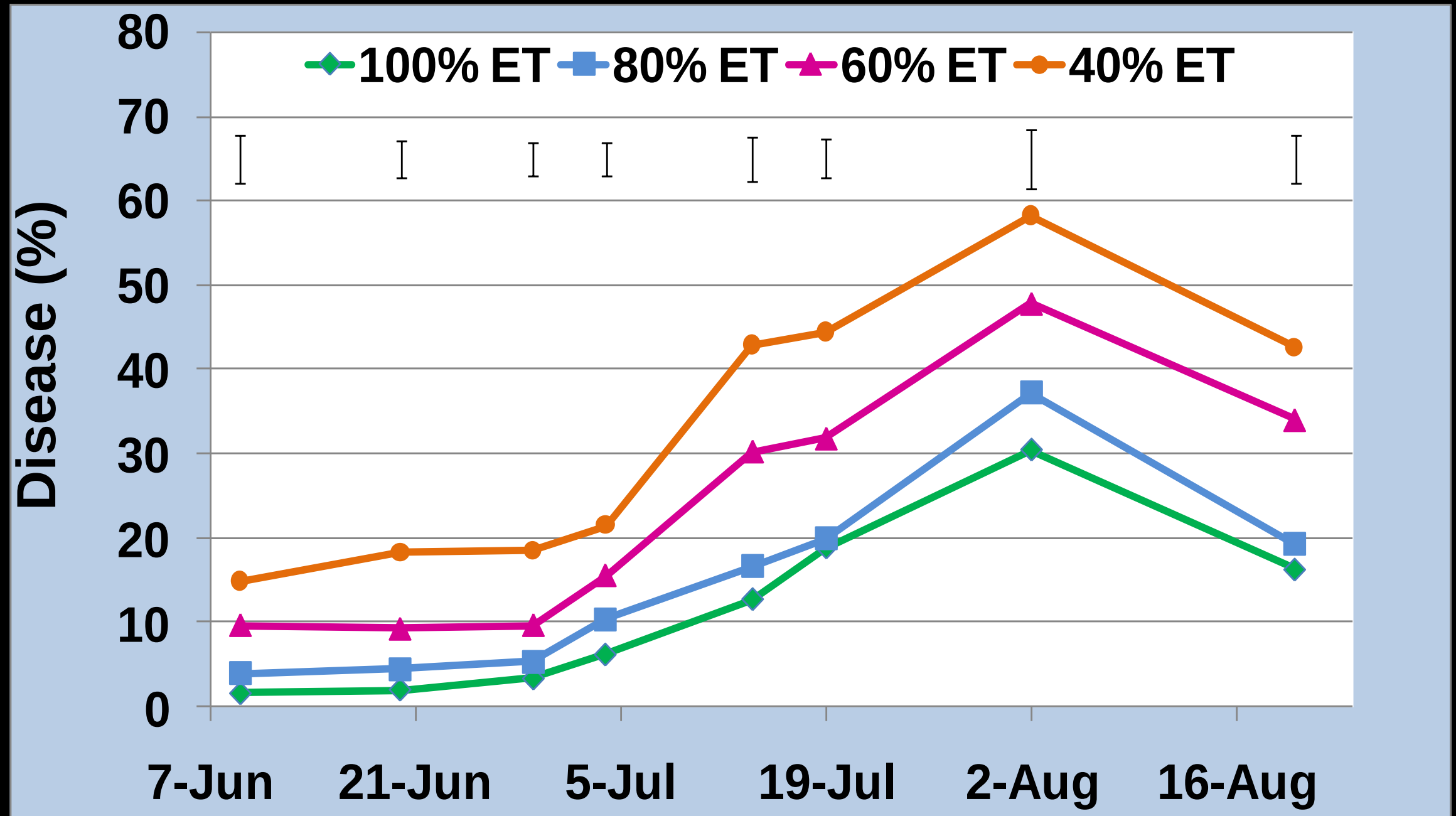


- Topdressing improves surface characteristics
- Firmer surface raises effective height of cut
 - Deeper crowns reducing stress

Anthracnose severity response (AUDPC) to
total amount of sand applied (L m^{-2}) during 2009



Irrigation Quantity Effects on Anthracnose Severity - 2007



Verti-cutting

- Detailed studies of mechanical injury indicates that wounding of leaves, crowns, or stolons does not affect anthracnose



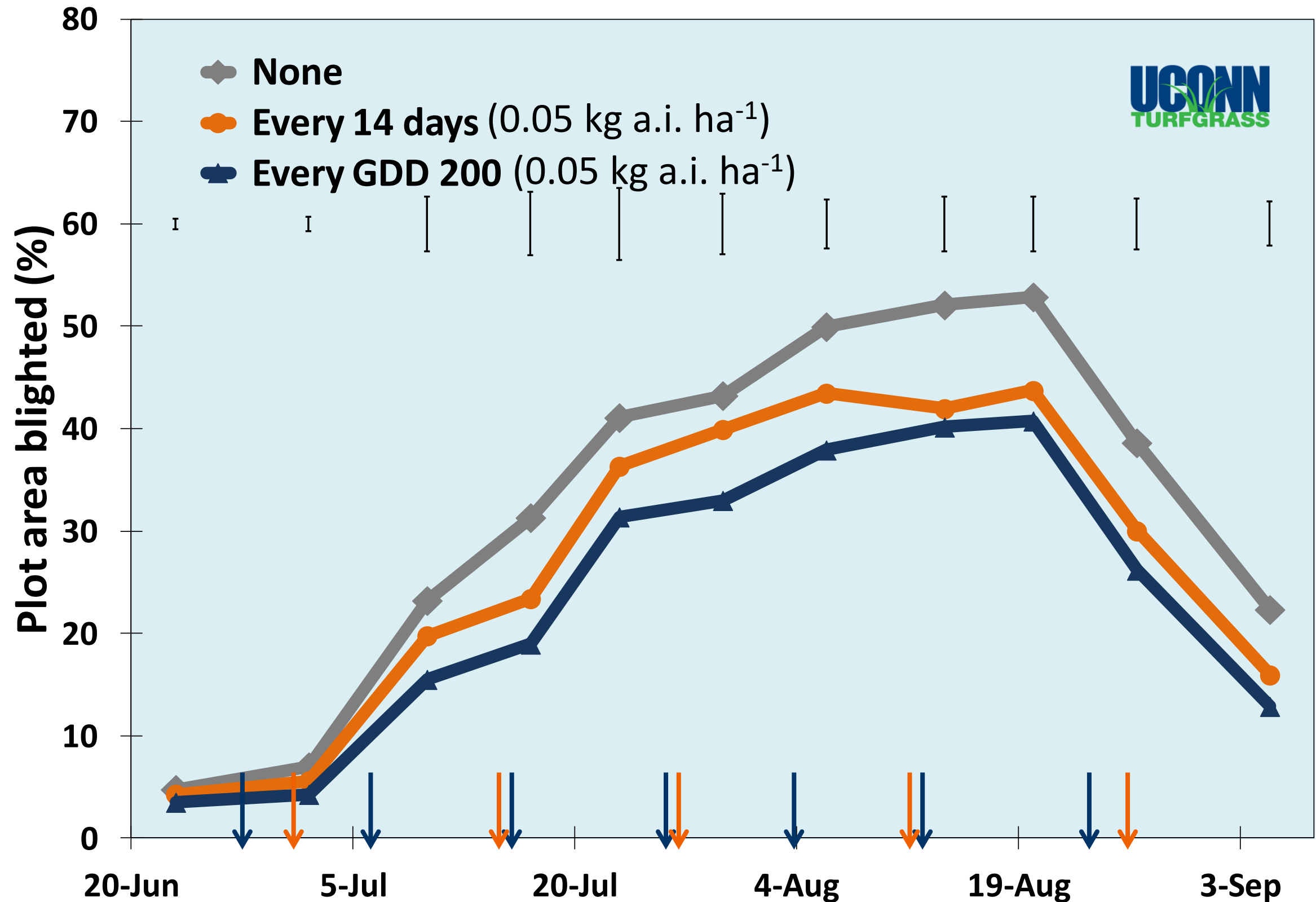
Plant Growth Regulators

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



Combining Best Management Practices (BMP)

Factors:

Mowing Height

0.090 vs. 0.125 inch



N Fertility

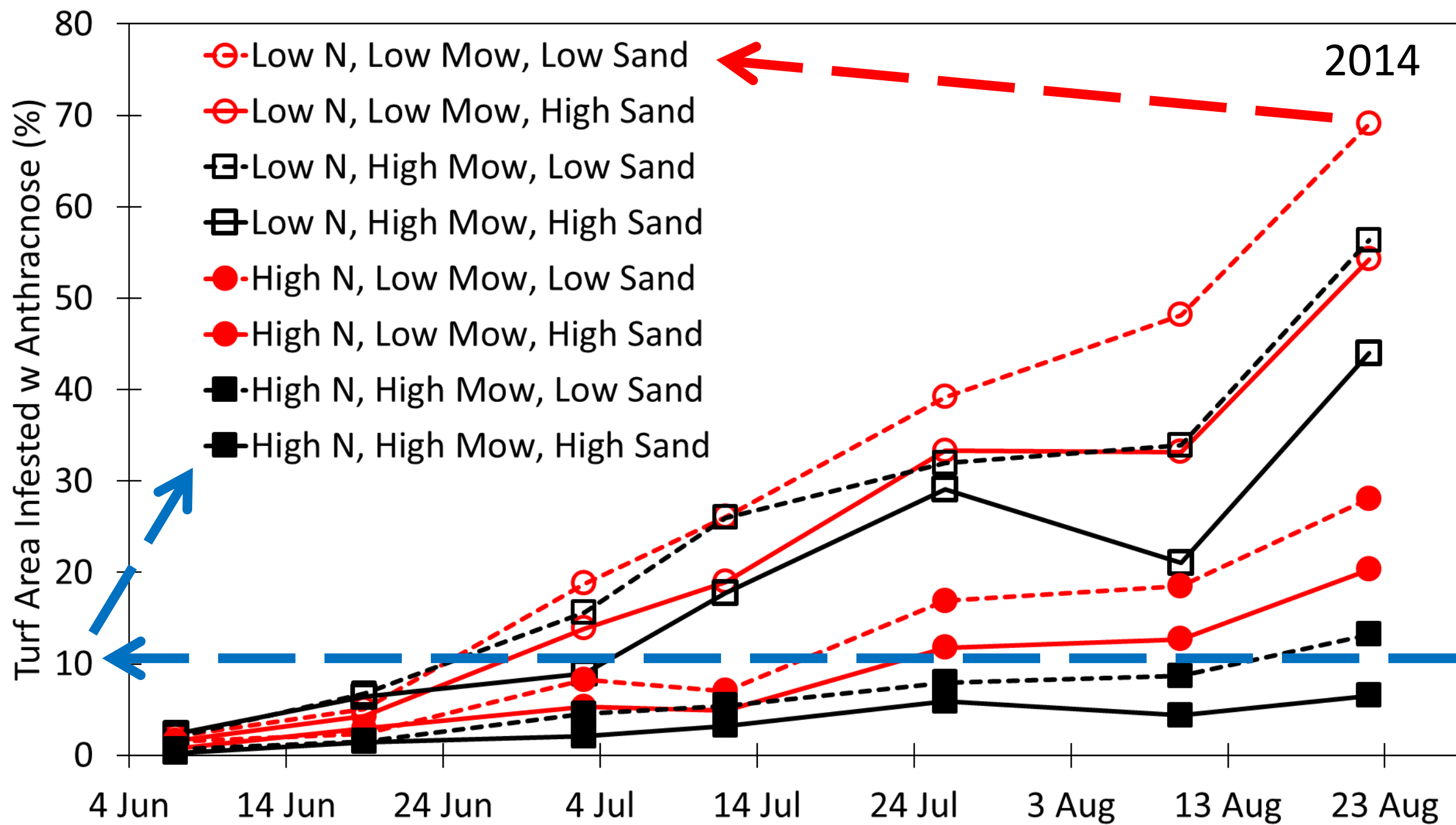
2.05 vs. 4.1 lbs N / 1,000-ft² / yr

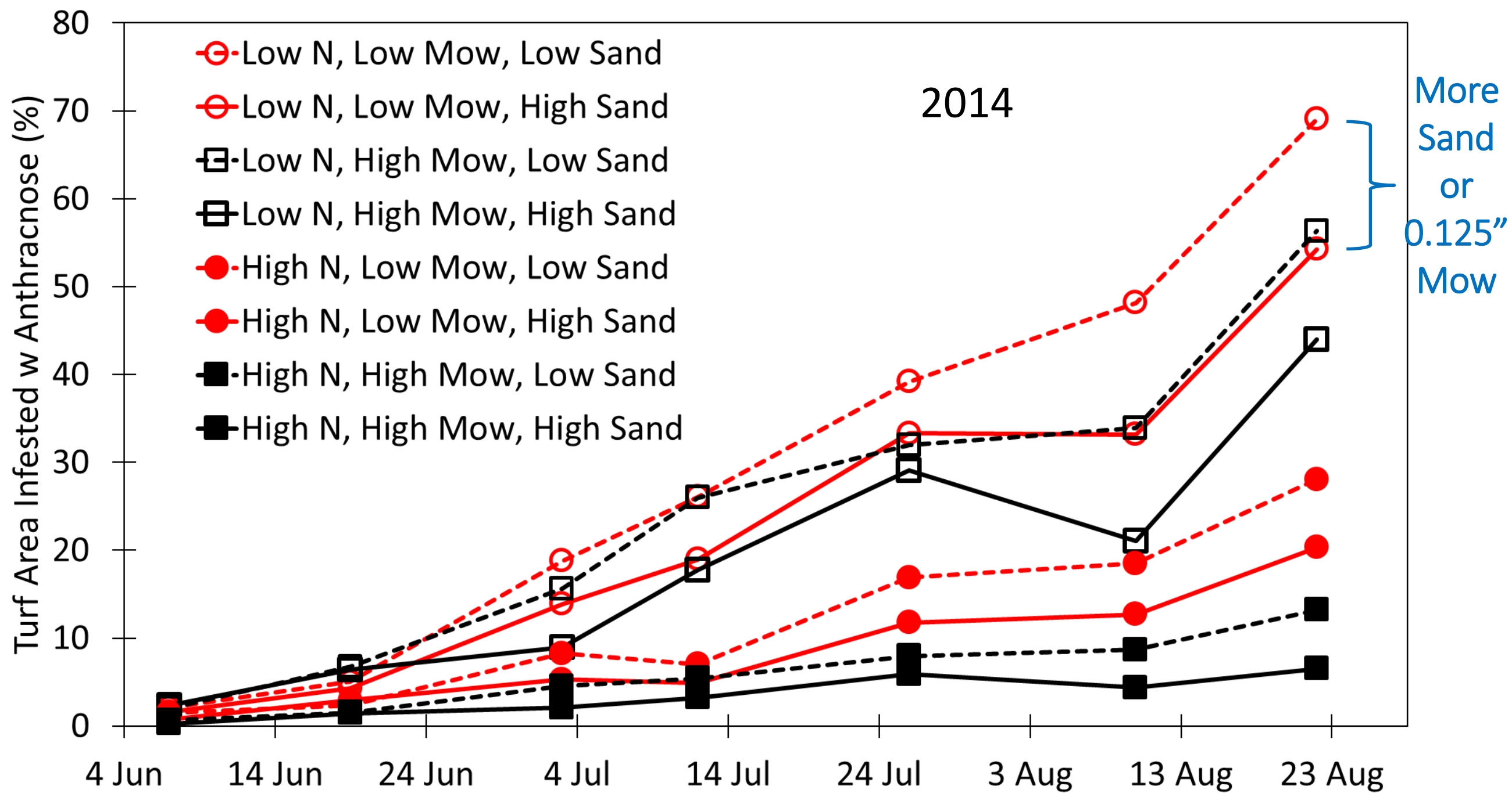


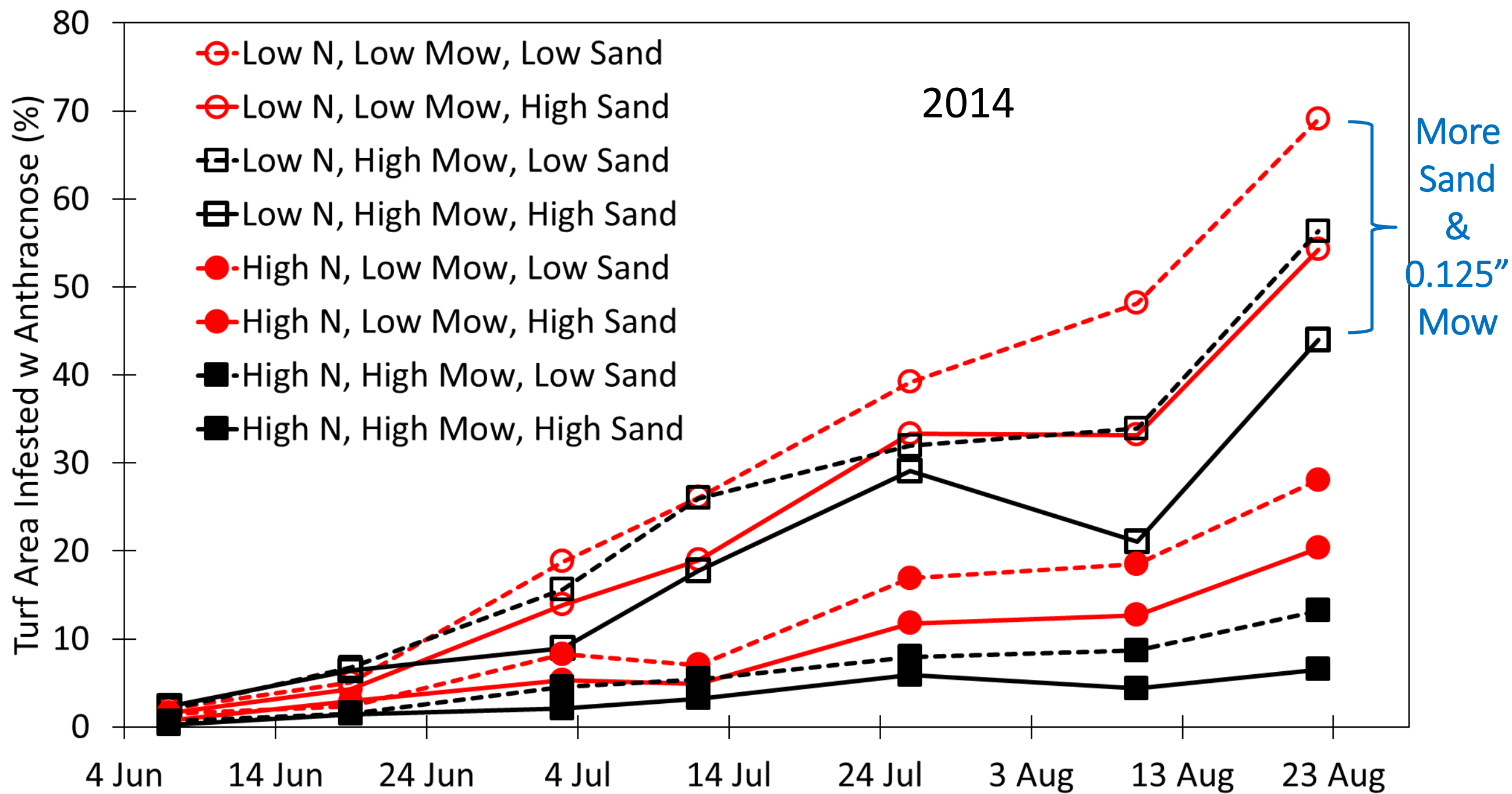
Topdressing Sand

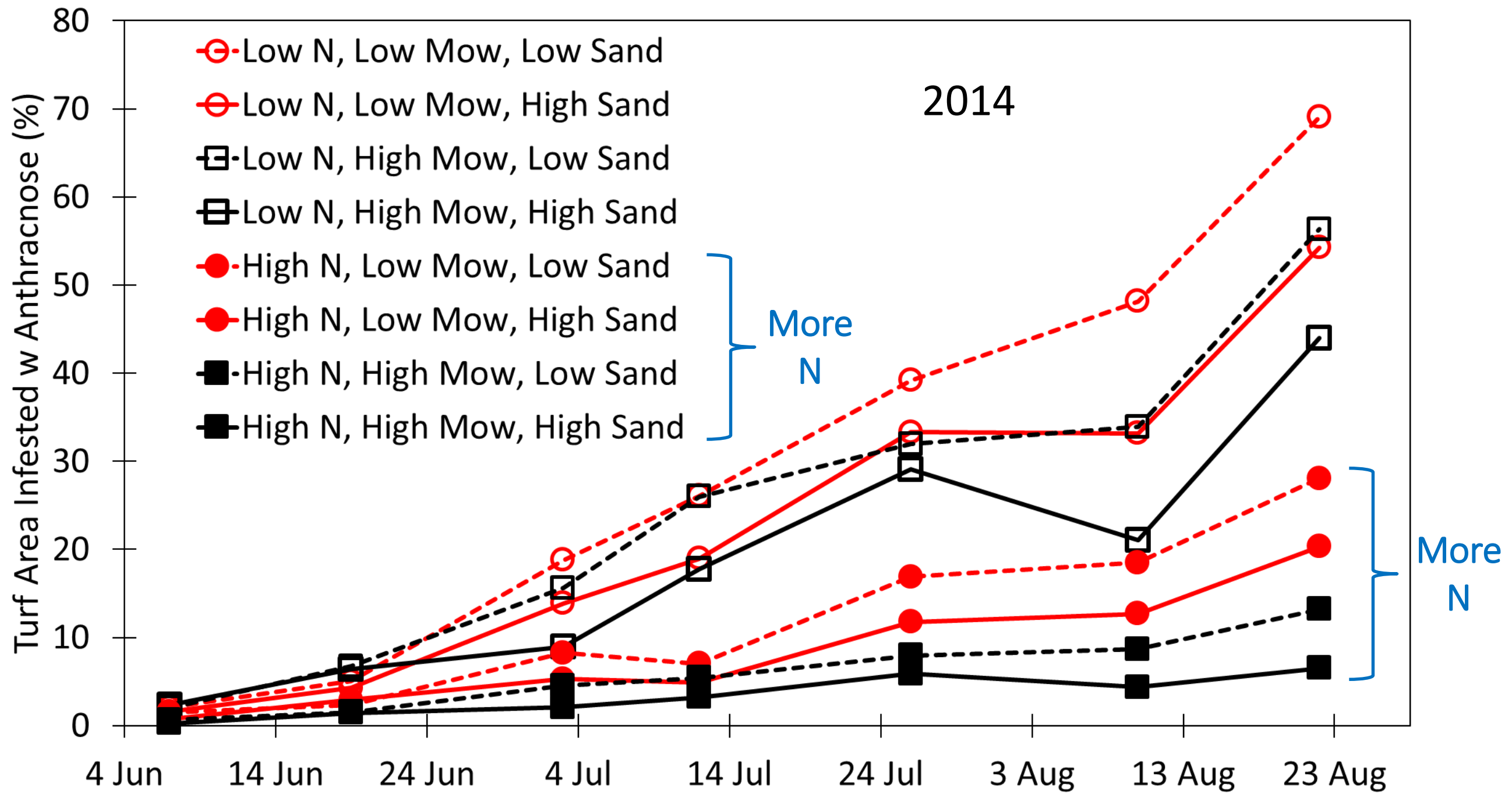
760 vs. 1,660 lbs. / 1,000-ft² / yr











Controlling Anthracnose Basal Rot with a Sound Fungicide Program

PPA-1

Chemical Control of Turfgrass Diseases 2020

Bruce B. Clarke, Department of Plant Biology, Rutgers University; Paul Vincelli, Department of Plant Pathology, University of Kentucky; Paul Koch, Department of Plant Pathology, University of Wisconsin-Madison; Gregg Munshaw, Department of Plant and Soil Sciences, University of Kentucky

Turfgrasses under intensive management are often subject to outbreaks of infectious diseases. Diseases usually are most damaging when weather or cultural conditions favor the disease-causing agent but not plant growth and vigor. Cultural



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Google: PPA-1: Chemical Control of Turfgrass Diseases

Chemical Control of Anthracnose

I. Demethylation Inhibitors

(Sterol Inhibitors)

- Banner, Bayleton, Eagle, Torque, Tourney, Trinity, Triton, **Maxtima**

II. Strobilurins

- Heritage, **Heritage Action**, Insignia, Disarm

VI. Antibiotic

- Endorse, Affirm

III. Benzimidazoles

- Fungo, 3336

IV. Nitriles

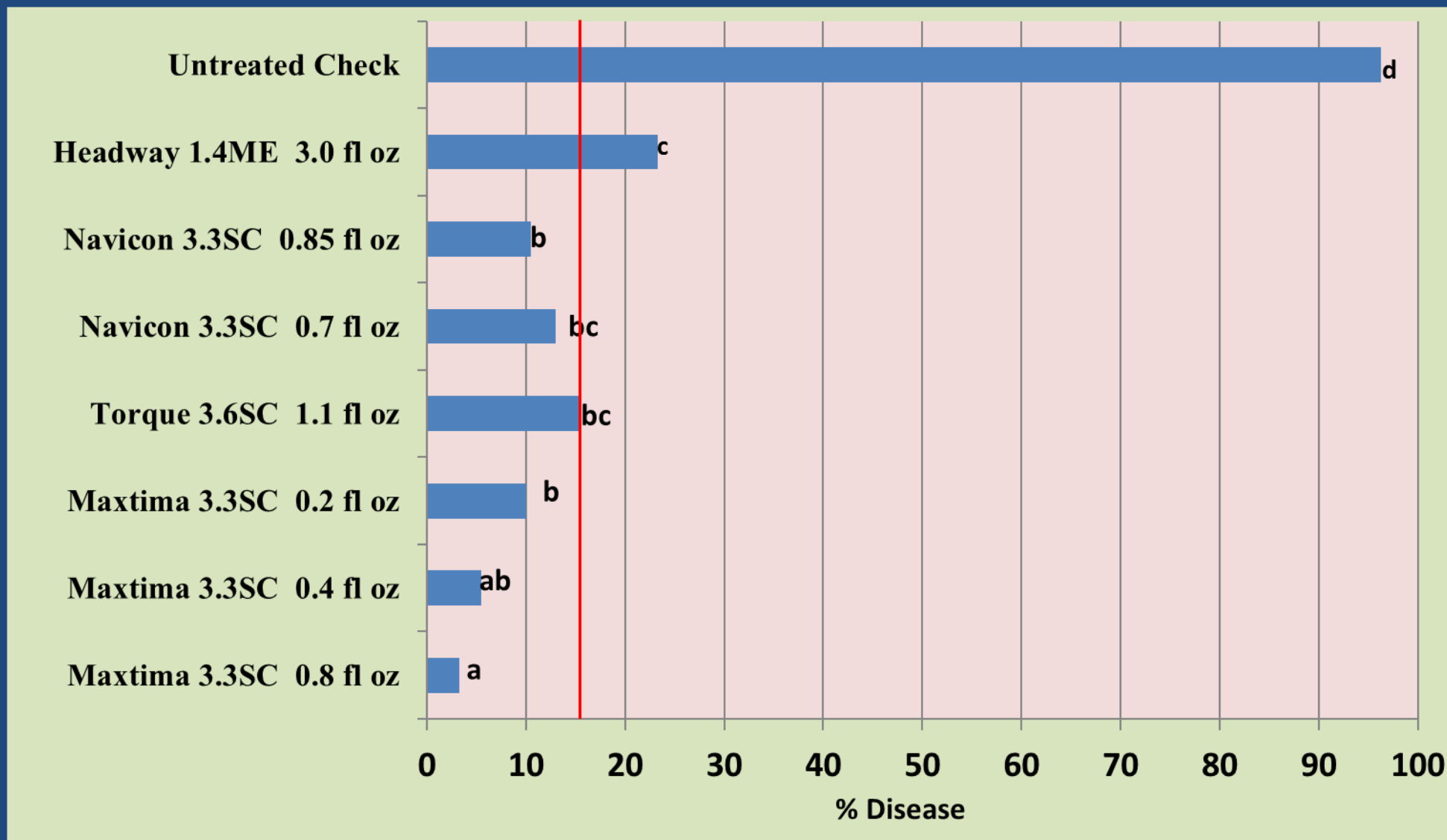
- Daconil, **Daconil Action**, Echo, Concorde

V. Combinations (III/IV, I/II, & I/ IV)

- ConSyst, Spectro, Headway, Tartan , Renown, Interface, Concert, Lexicon, **Navicon**

Anthracnose Control - ABG Green : Rutgers

28 August, 2015 (14 d)¹



¹ Applied 15 May – 7 Aug 14 d interval; 2 gal water, 40psi

Good Control of ABR Chemistries

- ◆ Phosphonates – fosetyl-Al and Phosphites
 - Chipco Signature 80WG, **Signature Xtra Stressgard**
 - **Appear, Fiata**
- ◆ DMI – myclobutanil
 - **Eagle 40W**
- ◆ Dicarboximide – iprodione
 - **Chipco 26GT 2SC**
- ◆ Phenylpyrrole – fludioxonil
 - **Medallion 50W**
- ◆ Carboximides
 - **Velista**
- ◆ Mineral Oil – **Civitas**
- ◆ PCNB – **Autilus**
- ◆ Pyridinamine
 - **Secure**
(limited activity)

100% ET

60% ET

Untreated Control



Signature Xtra Stressgard
4 oz @ 14 days

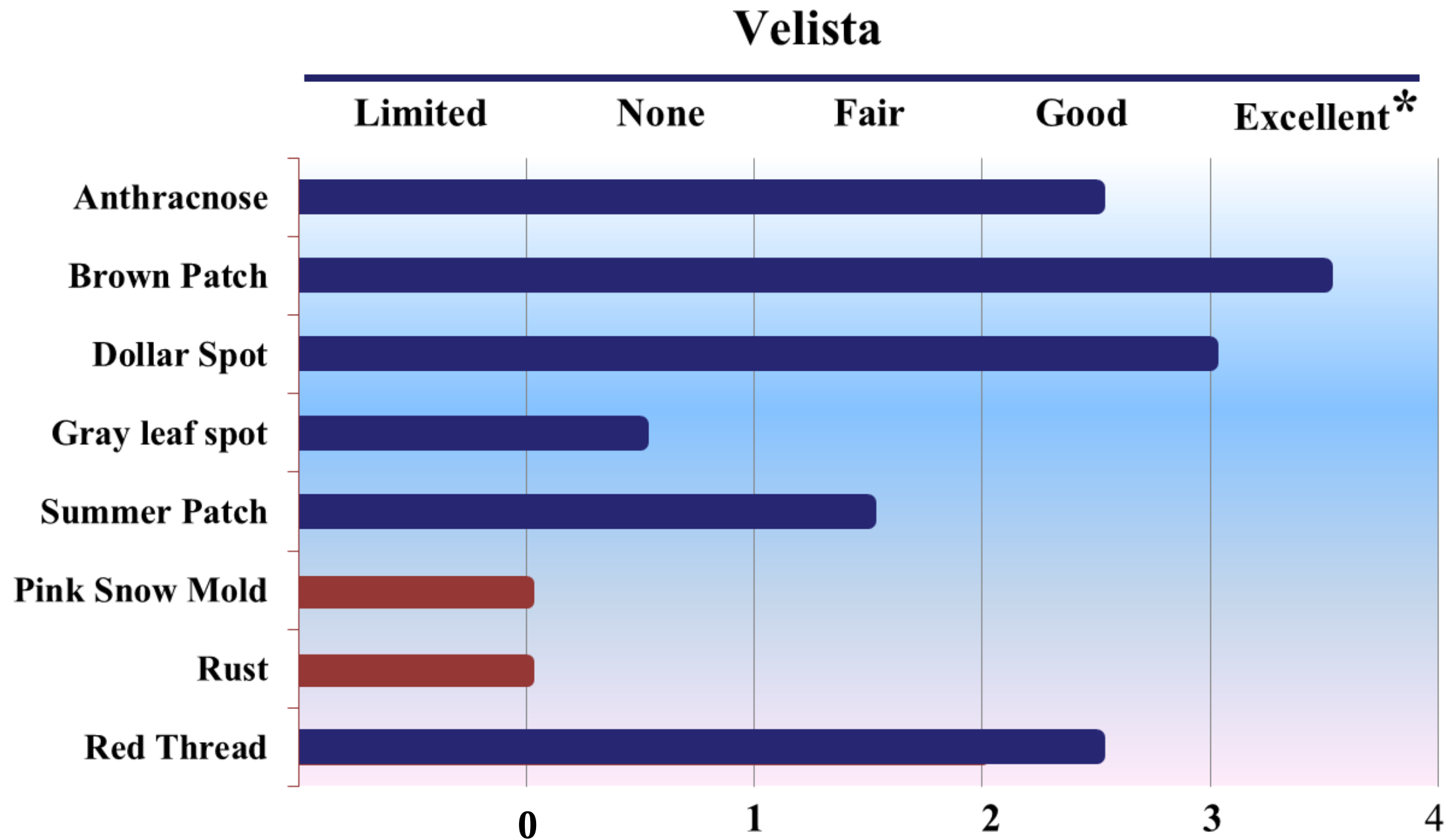


Signature Xtra Stressgard
2 oz @ 7 days



August 21, 2015

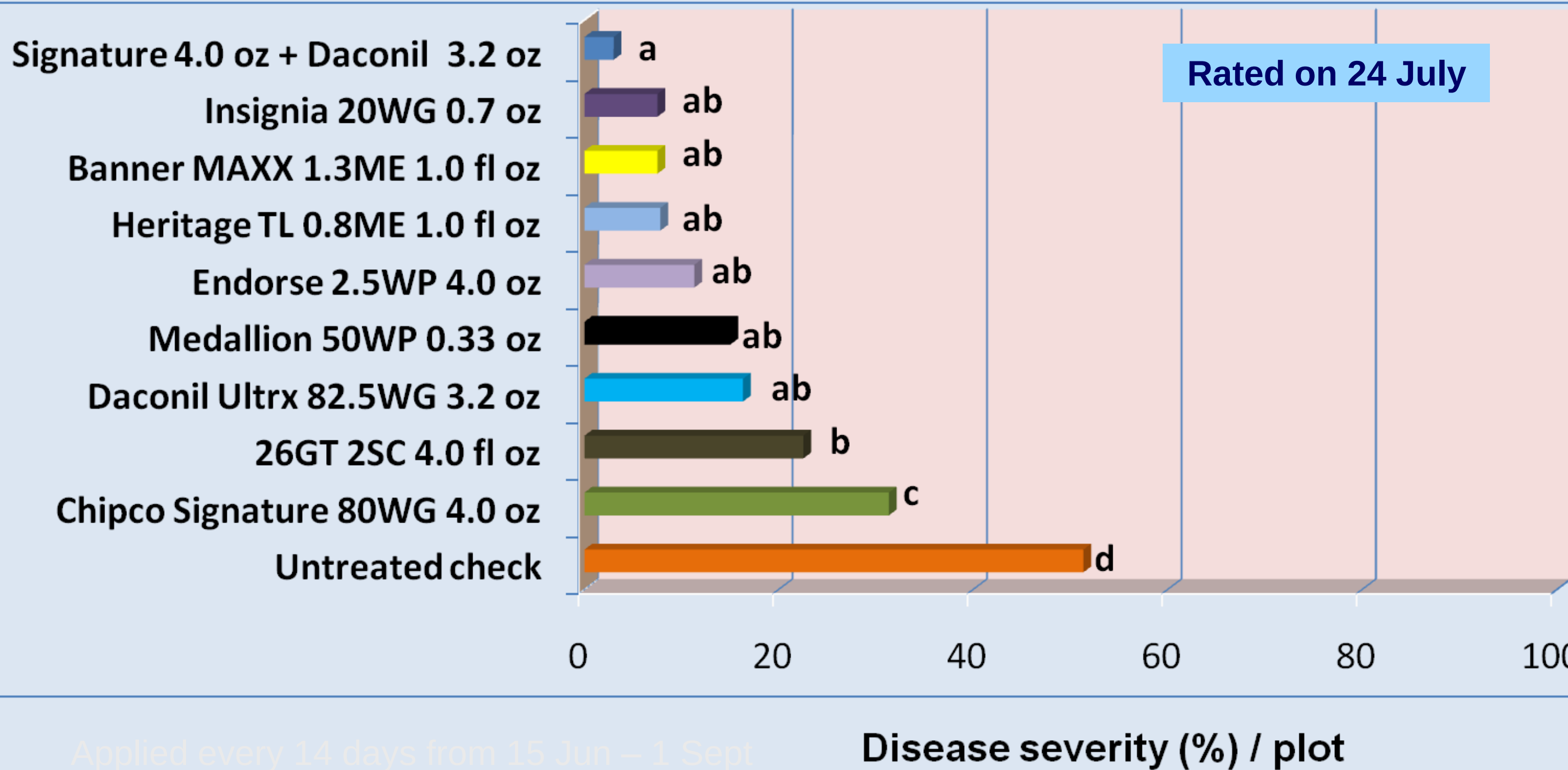
Relative Efficacy of New Fungicides for Cool - Season Turf Diseases : 2005- 2011 (Golf)



* 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



A wide-angle photograph of a golf course green. In the background, a large, multi-story clubhouse with a stone facade and a balcony with green umbrellas is visible. A line of white golf carts is parked along a path to the left of the green. The green itself is well-maintained with several yellow flagsticks and white tee markers. The text "Putting It All Together: Using BMPs to Reduce Fungicide Inputs" is overlaid in red on the lower half of the image.

Putting It All Together: Using BMPs to Reduce Fungicide Inputs

BMP Effect on Fungicide Efficacy: 2012-14

Objective: Use Inputs While Maintaining Excellent Turf Quality & PBMPs to Reduce Fungicide performance

Factors:

Mowing Height: 0.090 vs. 0.125 inch

N Fertility: 2.05 vs. 4.1 lb N per 1,000-sq-ft per year

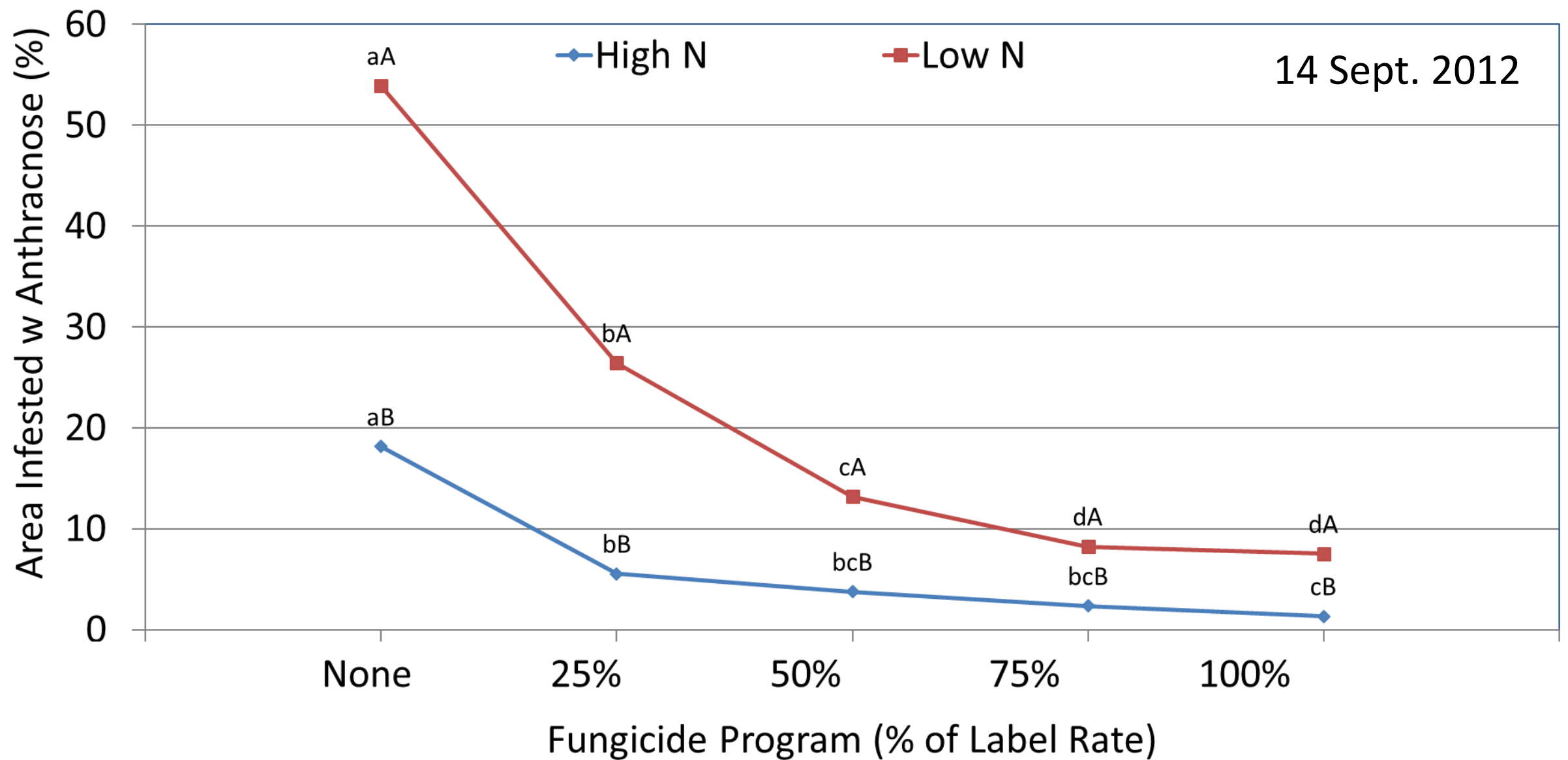
Fungicide Program:

Calendar-based 14-day interval of fungicides at label rates of

- 100% (3.2 oz/M Dac Ultrex + 4 oz/M Signature)
- 75%
- 50%
- 25%
- 0%

Threshold-based at 100% rate of fungicides (sprayed at 5% disease)

Anthracnose Response to Fungicide Rates Influenced by N Fertility



**TOTAL # OF FUNGICIDE APPLICATIONS (MAY- SEPT 2012):
COMPARISON OF THRESHOLD APPLICATIONS TO COMBINATIONS
OF NITROGEN PROGRAMS AND MOWING HEIGHTS**

	Low Mow (0.090 in)	High Mow (0.125 in)
Low N (2.05 lbs N 1000 ft ⁻² yr ⁻¹)	9	9
High N (4.1 lbs N 1000 ft ⁻² yr ⁻¹)	5	2

80% less fungicide than calendar-based schedule

Acknowledgments



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