# Getting to the Root of the Problem: Biology and Management of Patch Diseases

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# ROOT DISEASES

## Caused by Ectotrophic Root-Infecting (ETRI) Fungi

# PATCH DISEASES / ROOT PATHOGENS

Bermudagrass Decline

Kikuyugrass Decline

Necrotic Ring Spot

Spring Dead Spot

Summer Patch

Take-All Patch

# Summer Patch

**Causal Organism :**

*Magnaporthe poae*

**Susceptible Hosts :**

| | |
|---|---|
| Annual Bluegrass | *Poa annua* |
| Kentucky Bluegrass | *Poa pretensis* |
| Fine Fescue | *Festuca* spp. |
| Bentgrass | *Agrostis* spp. |

# IDENTIFICATION

# AND

# BIOLOGY OF THE FUNGUS

# Conditions Favoring Summer Patch

- Hot, Humid Weather
- Excessive Soil Moisture
- Low Mowing Height
- Soil Compaction / Poor Drainage

# Impact of Cultural Practices on Summer Patch Development

- Compaction
- Nitrogen fertility
- Soil and rhizosphere pH

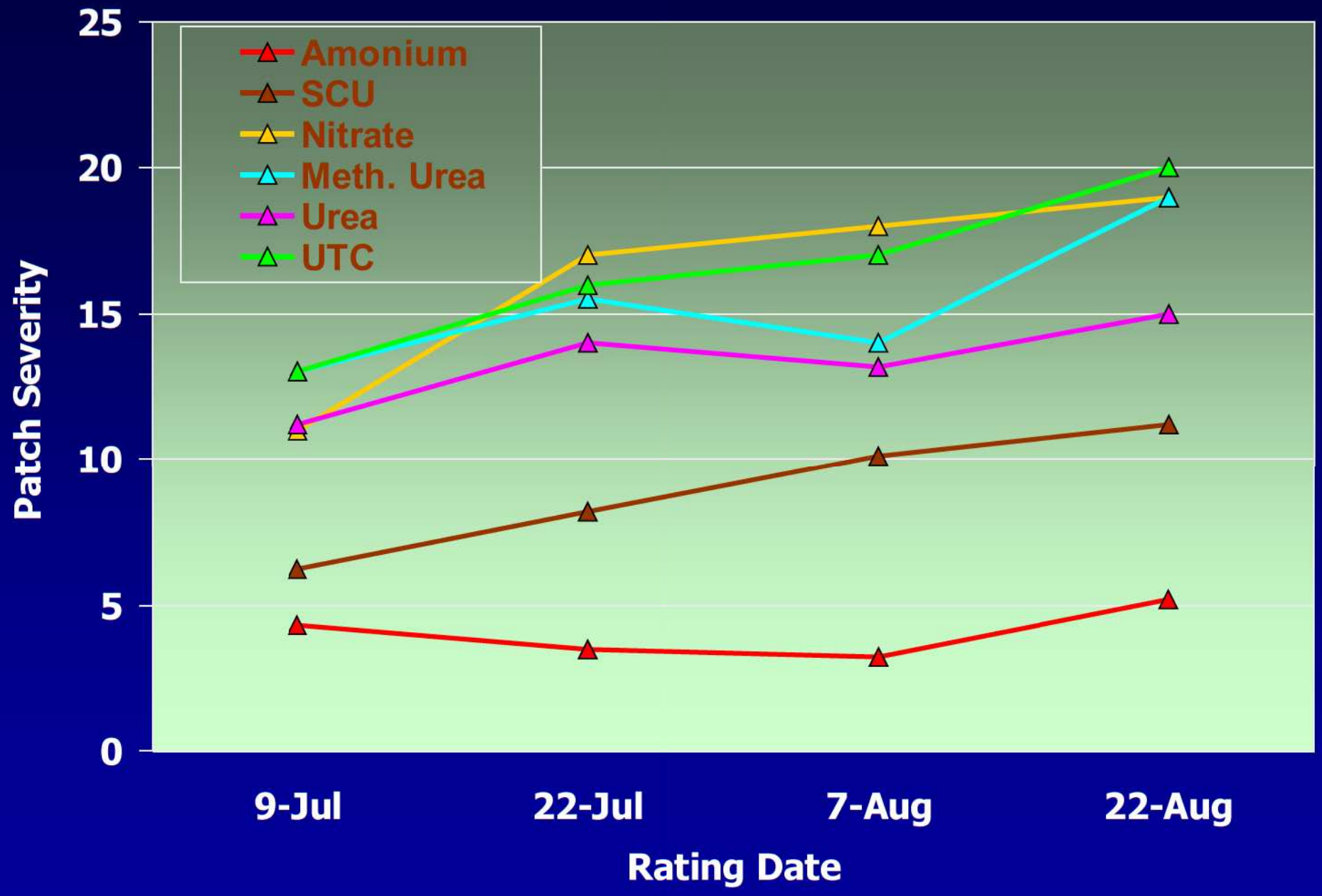
# Effect of Compaction/Aerification on Summer Patch Severity

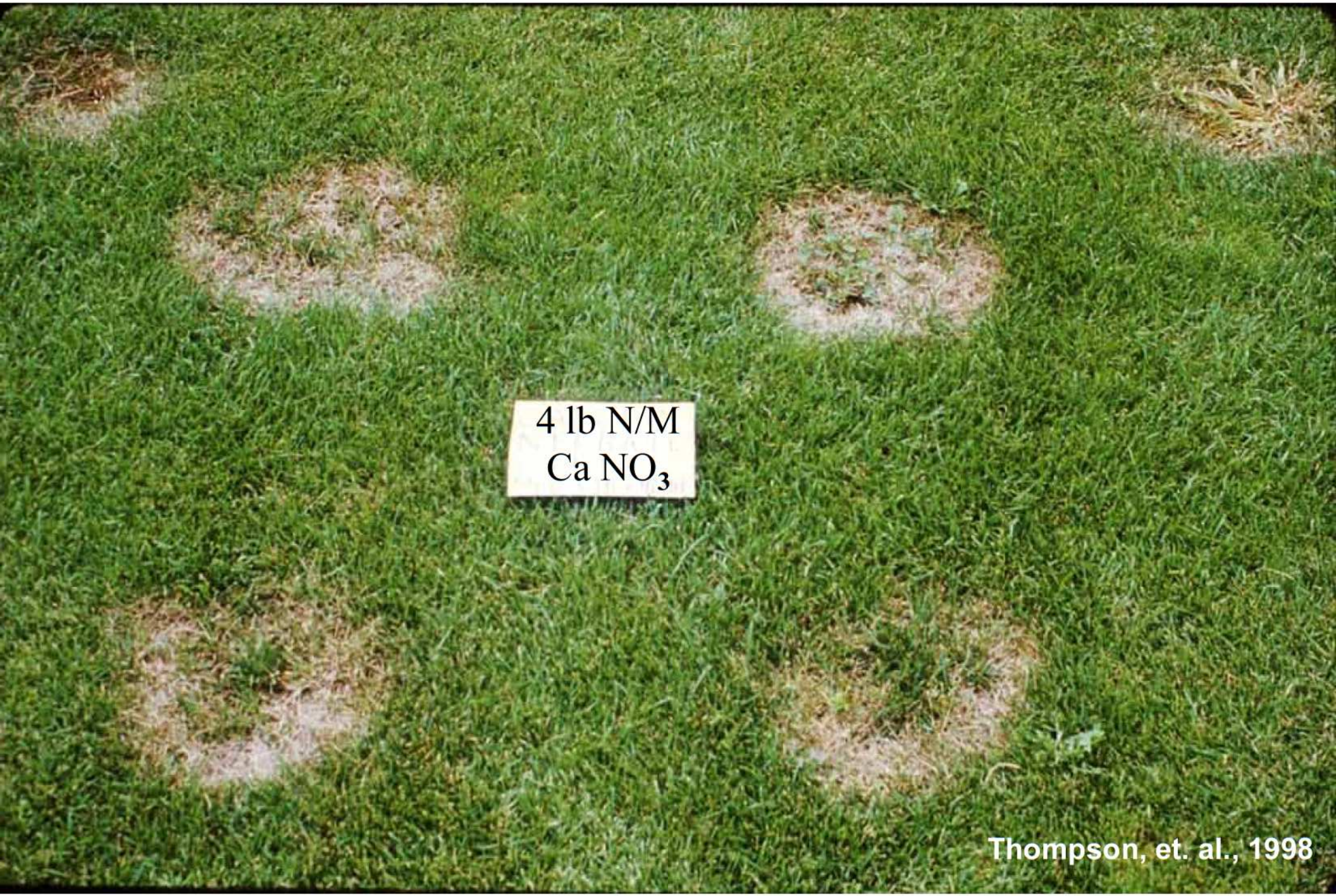
| | Compaction | | | | |
|---|---|---|---|---|---|
| Aerification | HVY (4X) | HVY (2X) | MOD (4X) | MOD (2X) | Non Comp |
| Dp: S | 3.5 | 4.3 | 3.8 | 3.5 | 2.0 |
| Dp: S & F | 4.8 | 4.3 | 3.5 | 3.5 | 2.8 |
| Dp: F | 5.0 | 5.5 | 4.5 | 4.8 | 3.3 |
| Sh: S | 7.3 | 5.5 | 6.0 | 3.0 | 2.8 |
| Sh: S & F | 6.3 | 5.8 | 5.8 | 3.8 | 3.3 |
| Sh: F | 9.4 | 10.4 | 9.5 | 6.8 | 4.3 |
| None | 17.5 | 15.0 | 13.7 | 10.7 | 7.1 |

Mean Significant Difference = 1.2 cm

# Sources of Nitrogen

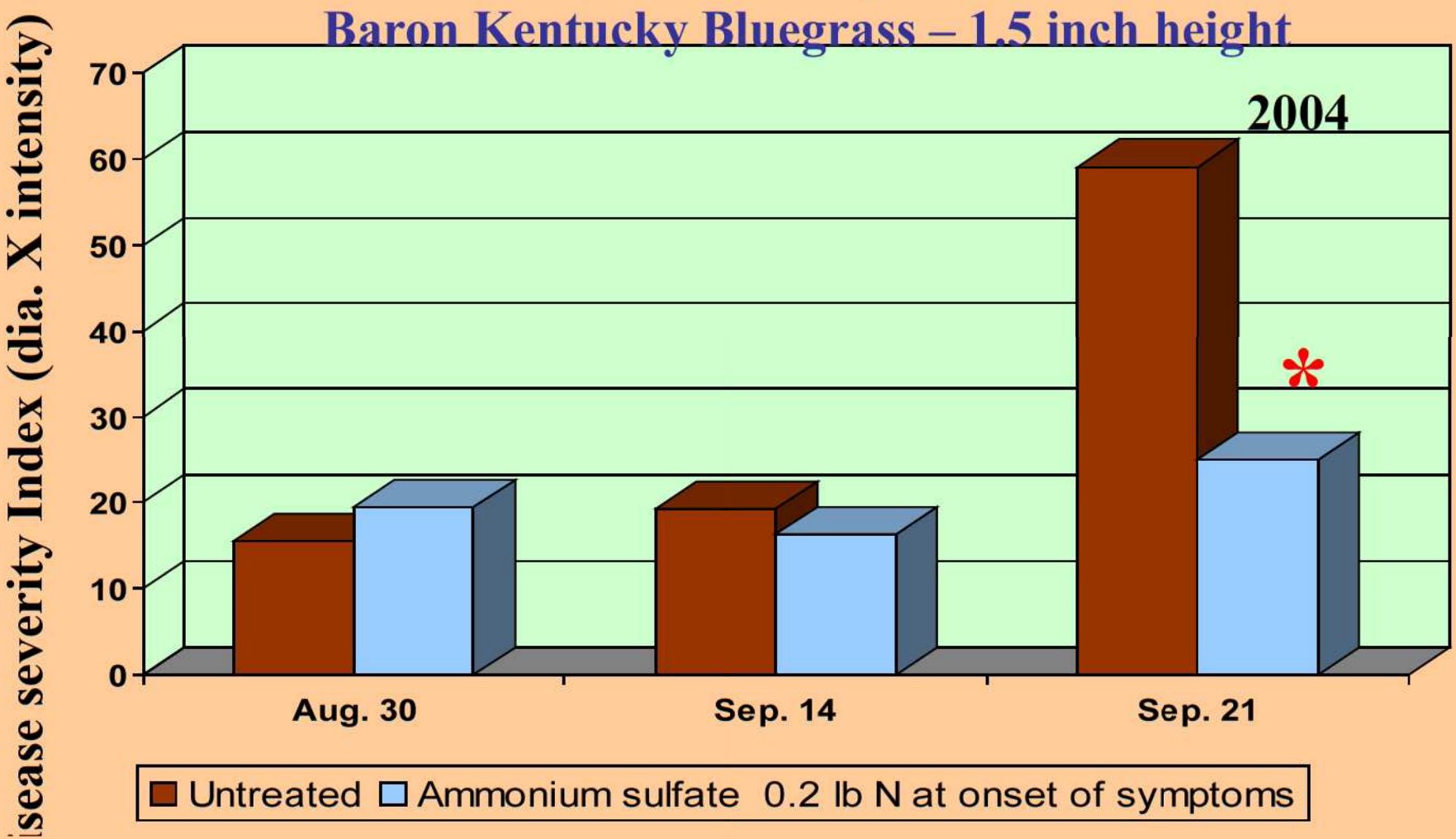
- Urea
- Sulfur - Coated Urea
- Ammonium Sulfate
- Ammonium Chloride
- Calcium Nitrate
- Potassium Nitrate
- Nutralene
- Nitroform


Amonium
SCU
Nitrate
Meth. Urea
Urea
UTC
Patch Severity
25
20
15
10
5
0
9-Jul
22-Jul
7-Aug
22-Aug
Rating Date


4 lb N/M
Ca $NO_3$
Thompson, et. al., 1998

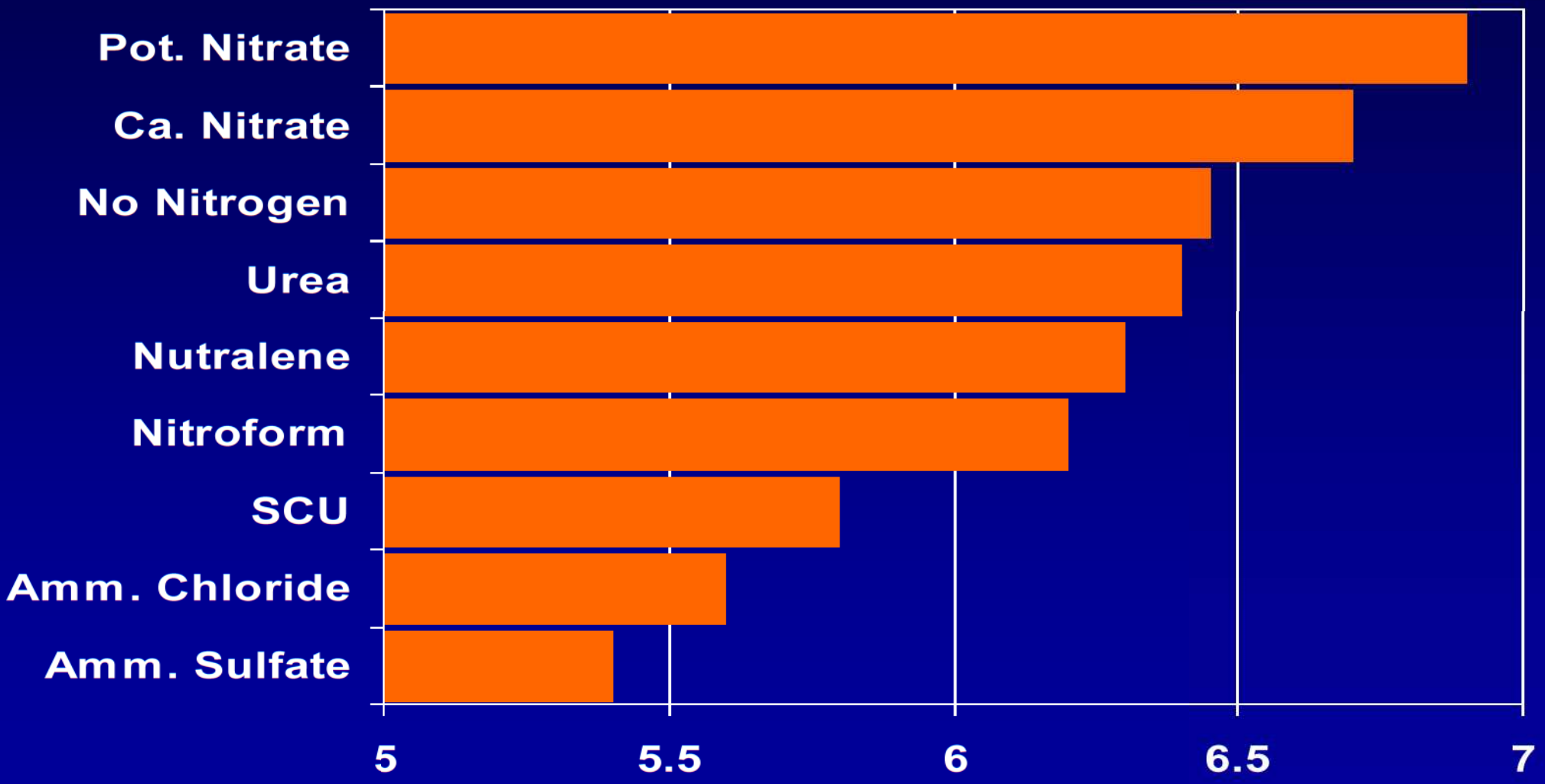

4 lb N/M
AS
Thompson et. al, 1998

# Suppression of summer patch symptoms with Ammonium Sulfate - Rutgers University




* = Means are significantly different according to the Waller-Duncan k-ratio t-test (k=100).

# Acidification of Soil by Nitrogen Source
# 4 lb N/1000 sq. ft / year



# Summer Patch Management

- Aerify and Improve Drainage
- Raise Mowing Height during Heat Stress
- Overseed with Perennial Ryegrass, Tall Fescue, or Bentgrass
- Fertilize with Ammonium Sources, SCU; Avoid using Nitrate Source
- Maintain pH at or Below 6.0
- Apply Systemic Fungicides (4 gal water)

# Evaluation of Fungicides for the Control of Summer Patch

# Control of Summer Patch

I DMIs :

- Banner, Bayleton, Eagle, Rubigan, Trinity

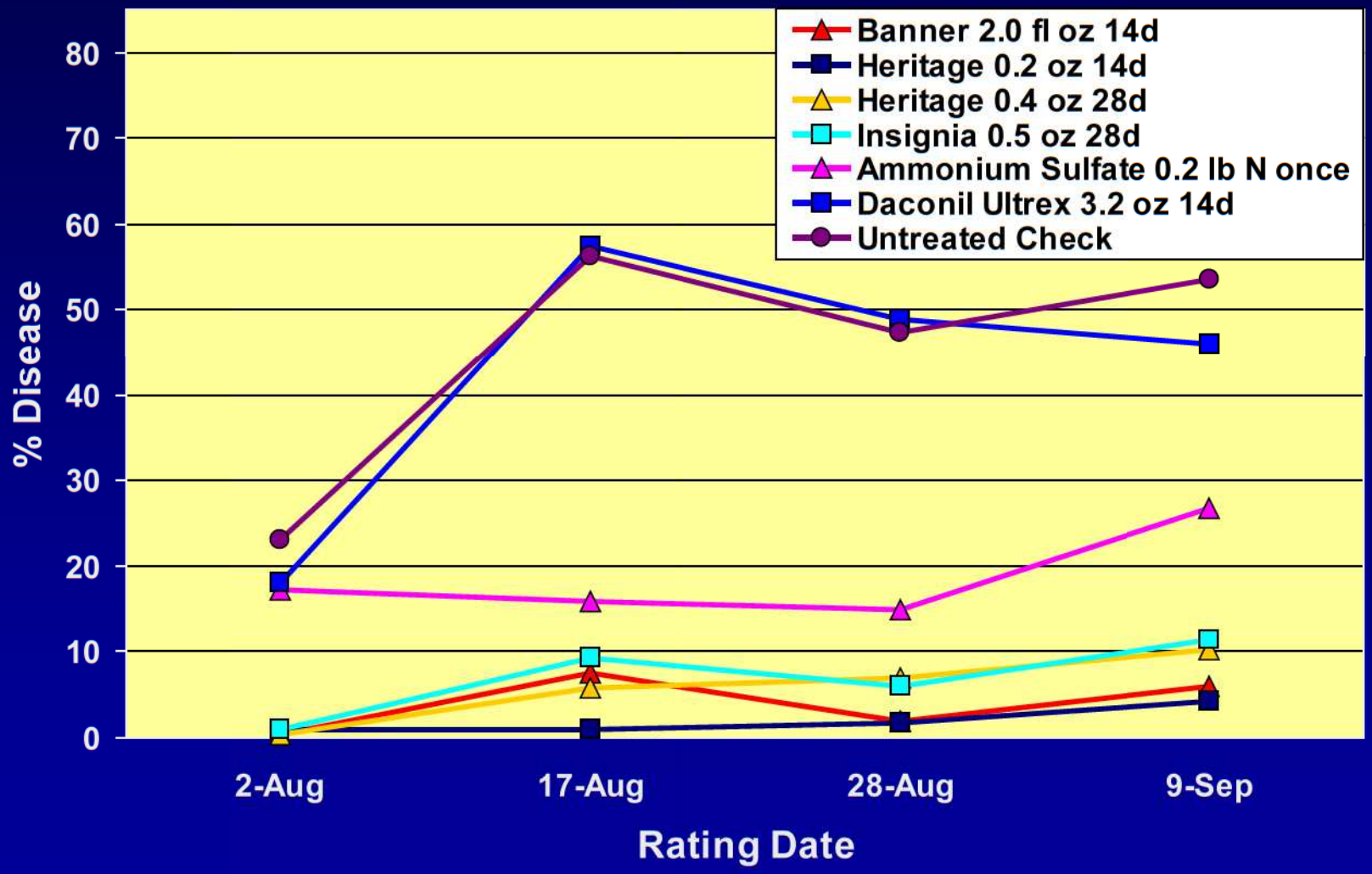
II Benzimidazoles :

- Cleary 3336

III Strobilurins :

- Compass, Disarm, Heritage, Insignia
- Headway and Armada

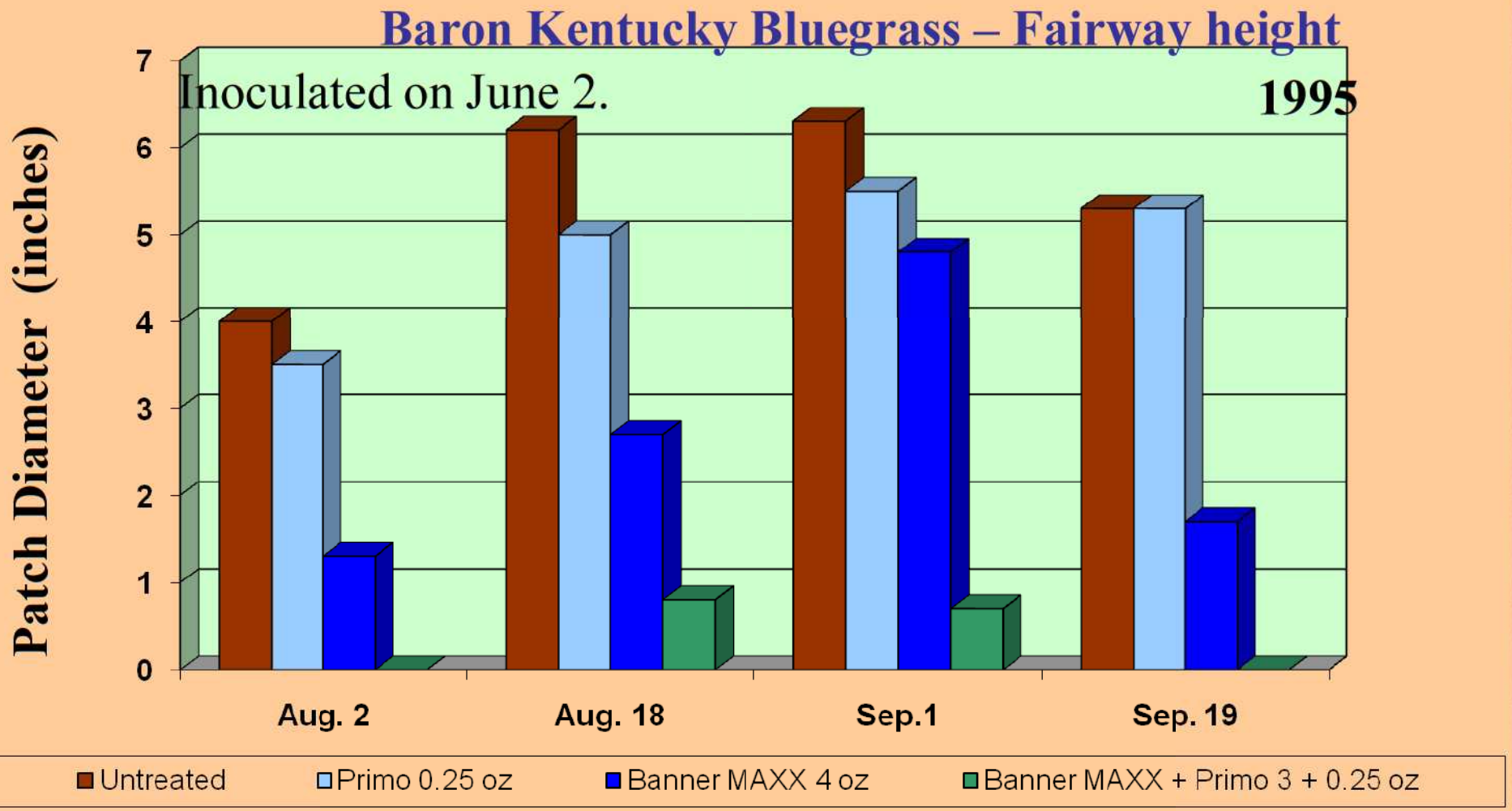
# Control of Summer Patch on Kentucky Bluegrass




Rutgers 2002


Summer Patch Control: (Heratage left & Untreated Check right)
on Kentucky bluegrass

# Impact of Primo on Summer Patch Severity on KBG
# Rutgers University



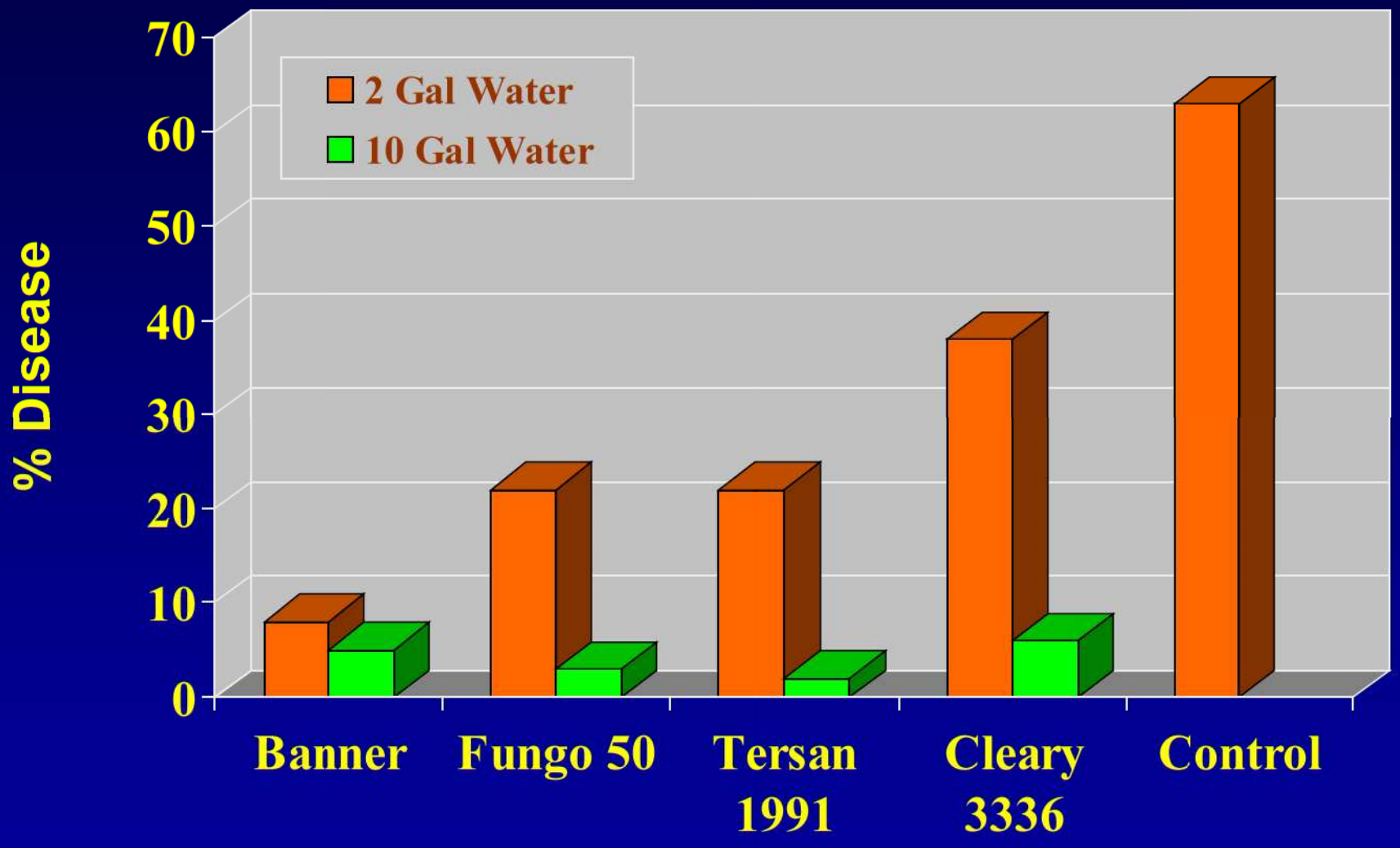

→ All products applied on a 28 day interval.

# Summer Patch Gallonage Study

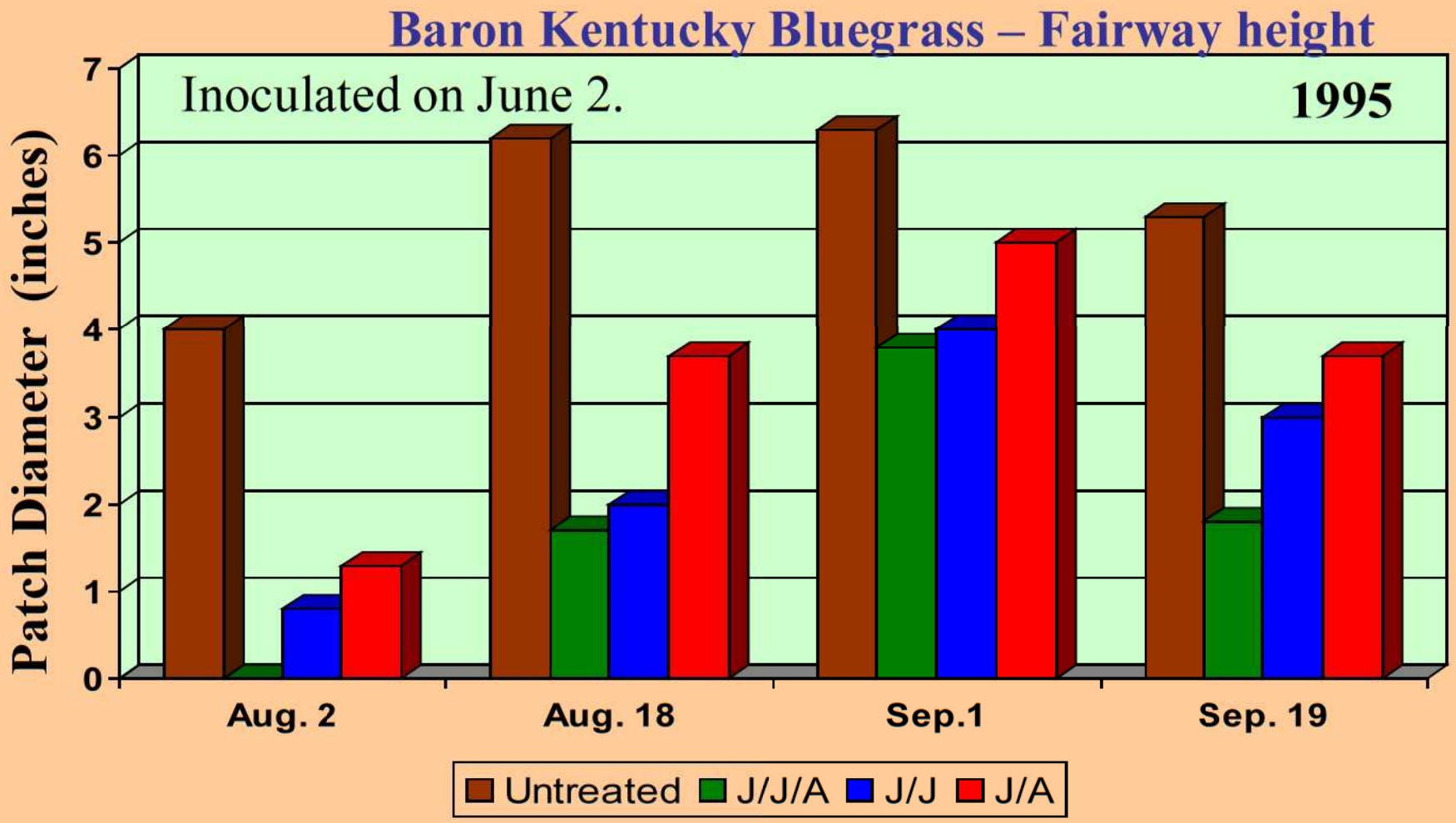
- 2 gallons water / 1000 sq ft
- 5 gallons water / 1000 sq ft
- 10 gallons water / 1000 sq ft

Fairway Study – 3 yrs

# Summer Patch Control



# Application Timing and Summer Patch
# Rutger's University




→ Banner applied at 127 ml/m² on a 28 day interval.

# Summer Patch Chemical Control

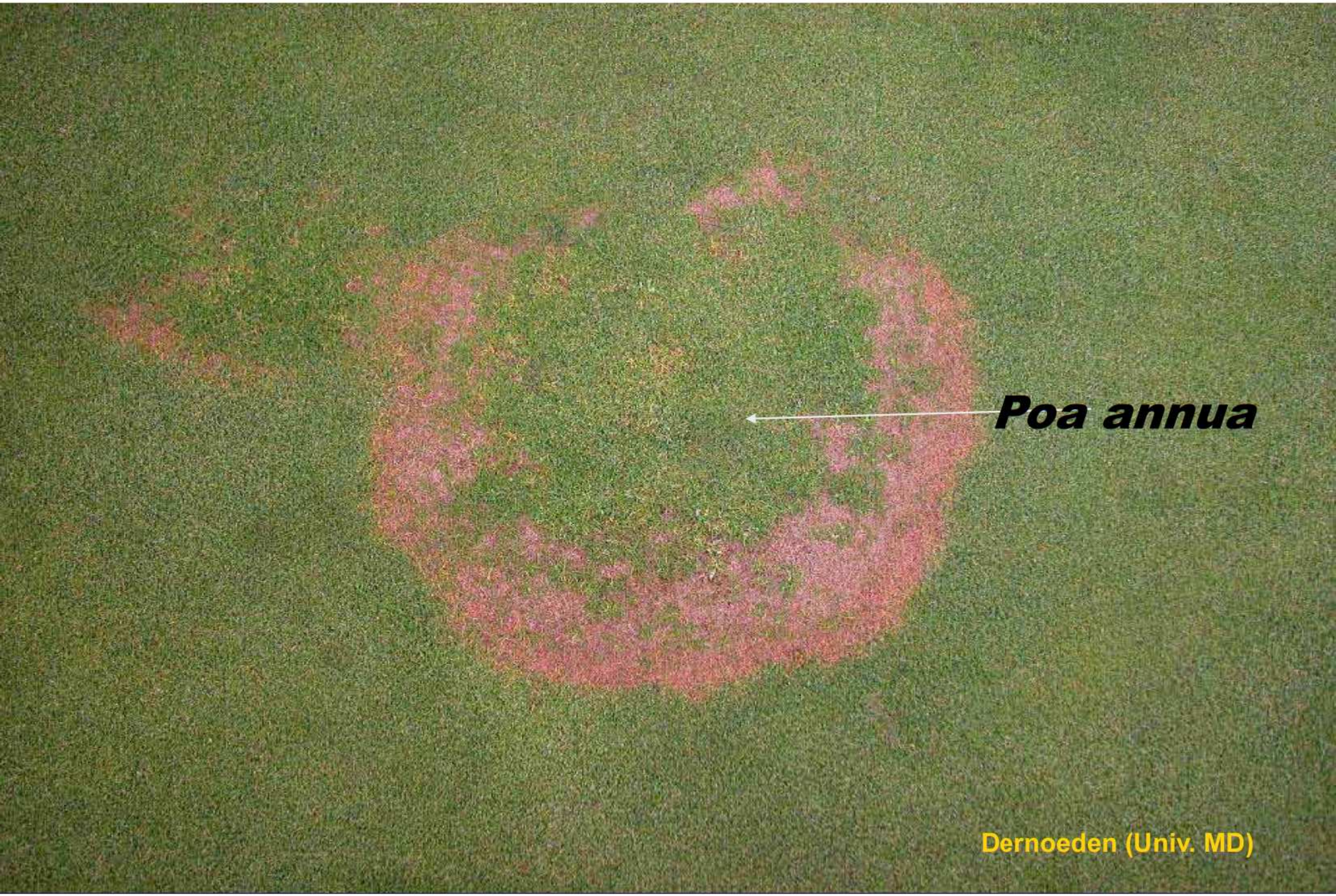
- DMIs, Benzimidazoles, Strobilurins
- Use full label rates – 3 times / season in areas with a history of summer patch
- Apply in 4 gal water / 1000 $ft^2$ or Irrigate immediately after spraying
- Timing – Soil temp. 65° F @ 2" depth for 5 to 7 consecutive days

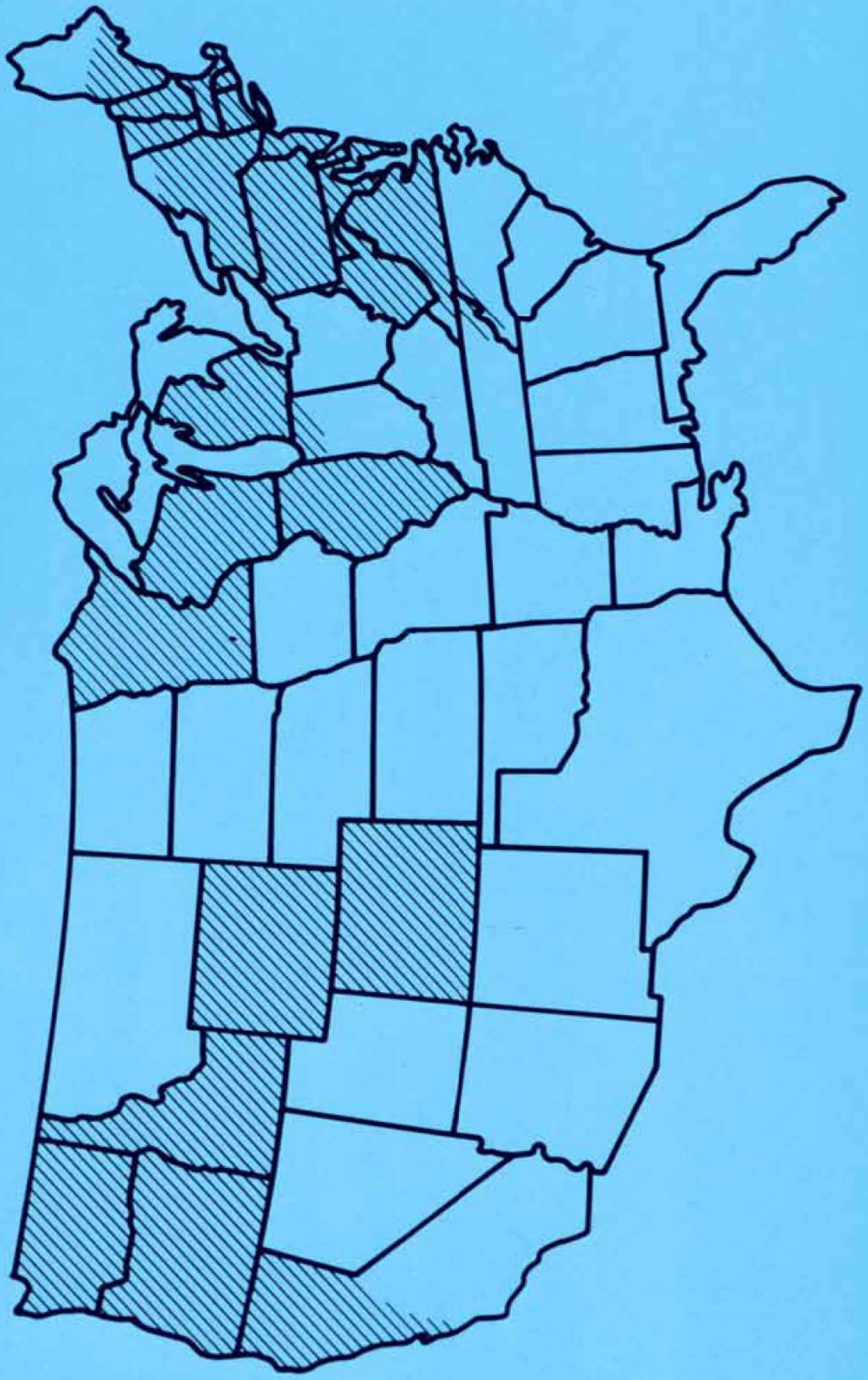
# TAKE-ALL PATCH

**Causal Agent:** *Gaeumannomyces graminis* var. *avenae*

**Hosts:** Agrostis stolonifera (creeping bentgrass)
A. tenuis (colonial bentgrass)
A. canina (velvet bentgrass)


Dernoeden (Univ. MD)


Poa annua
Dernoeden (Univ. MD)



# IDENTIFICATION

# AND

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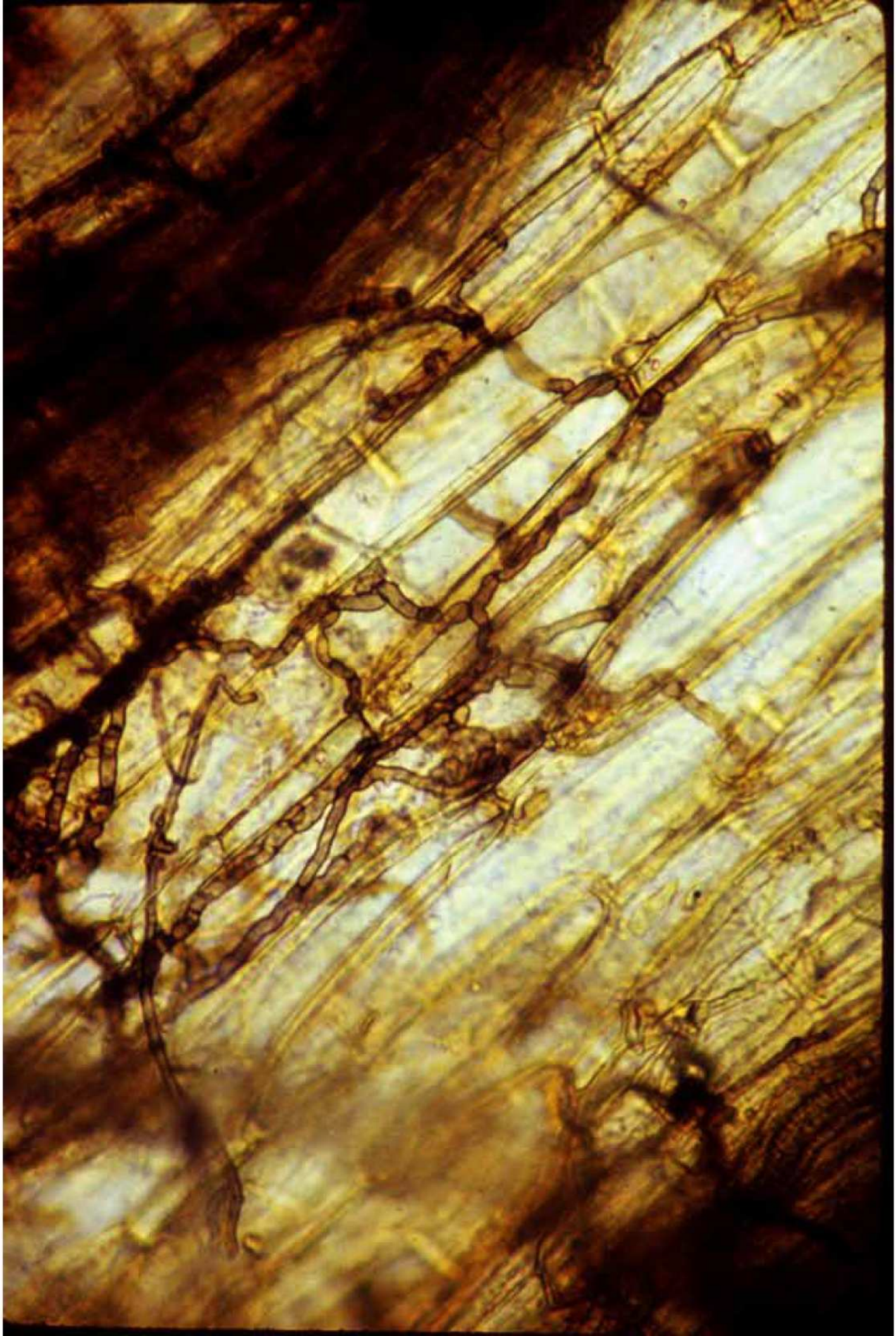


# Factors Believed to Enhance Take-All Patch

- Cool Temperatures (40 - 60 $^{0}$ F)
- Ample Soil Moisture
- High Soil or Rhizosphere pH (>6.5)
- Sandy, Light-Textured Soils
- Fumigated or Recently Cleared Land

# Take-all Decline of Bentgrass

- Generally, Take-All Decline (TAD) starts within 3-5 Years after the disease first appears
- In wheat, TAD has been linked to a buildup of producing fluorescent *Pseudomonas* spp. and other Bacteria
- Root colonizing bacteria inhibit growth of the pathogen on root surfaces (i.e. antagonism) and eventually brings about TAD

**Dernoeden (Univ. MD)**

# Effect of N-Sources on Take-all Patch in Colonial Bentgrass

| N-Source* | Rate | | % Diseased Area | | |
|---|---|---|---|---|---|
| | lb/M | kg/ha | 12 Jul | 12 Oct. | 22 Nov |
| Ammonium Phos. | 0.4 | 20 | 27 | 3 | 1 |
| Ammonium Sulfate | 0.7 | 35 | 26 | 6 | 3 |
| Untreated | -- | -- | 39 | 33 | 28 |

*Applied 12 July and 8 August

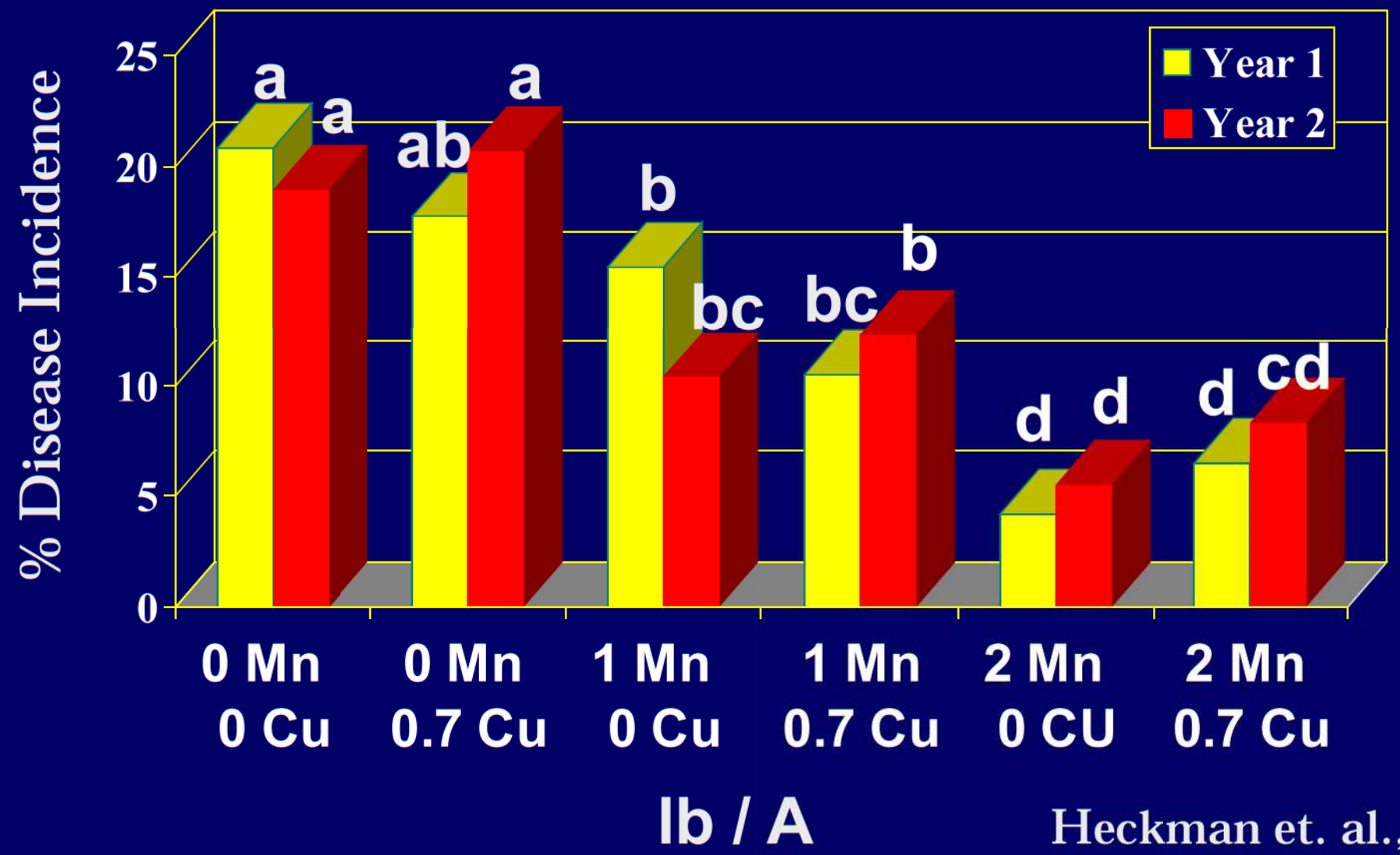
SMITH, 1956

# Roles of Mn in Take-all

## Manganese

- *G. graminis* oxidizes $Mn^{2+}$ to $Mn^{3+}$ or $Mn^{4+}$, rendering it unavailable to the plant
- Results in a localized deficiency of Mn
- Weakens plant's resistance
- Mn applications reduces take-all severity

# Influence of Mn and Cu on Take-all Patch on a Bentgrass Fairway




Heckman et. al., 2003,

# REDUCING PLANT STRESS

# Take-All Management For Greens

- Increase mowing height and reduce the mowing frequency in the summer  symptoms are apparent
- Use acidifying fertilizers during cool weather to reduce burn potential
- Apply foliar applications of Mn (2 lb Mn/A)
- Syringe frequently / hand water and suspend core aeration when symptoms are present

# Integrated Management of Take-all Patch

## Resistant Species / Cultivars

- Fescues, bluegrasses, and ryegrasses are not affected by take-all patch
- Little known about relative susceptibility of bentgrass species and cultivars

# Susceptibility of Bentgrass Cultivars to Take-all Patch Madison, WI, 2001 (Fairway Ht)*

| CULTIVAR | MEANS (1-9 RATING) |
|---|---|
| Backspin | 6.2a |
| Princeville | 6.0ab |
| Penn G-6 | 5.7ab |
| Brighton | 5.2ab |
| Century | 4.7ab |
| SR 7100 | 4.7ab |
| Penncross | 4.3ab |
| Penneagle | 4.2ab |
| L93 | 4.0b |
| Seaside II | 4.0b |
| Providence | 3.7b |

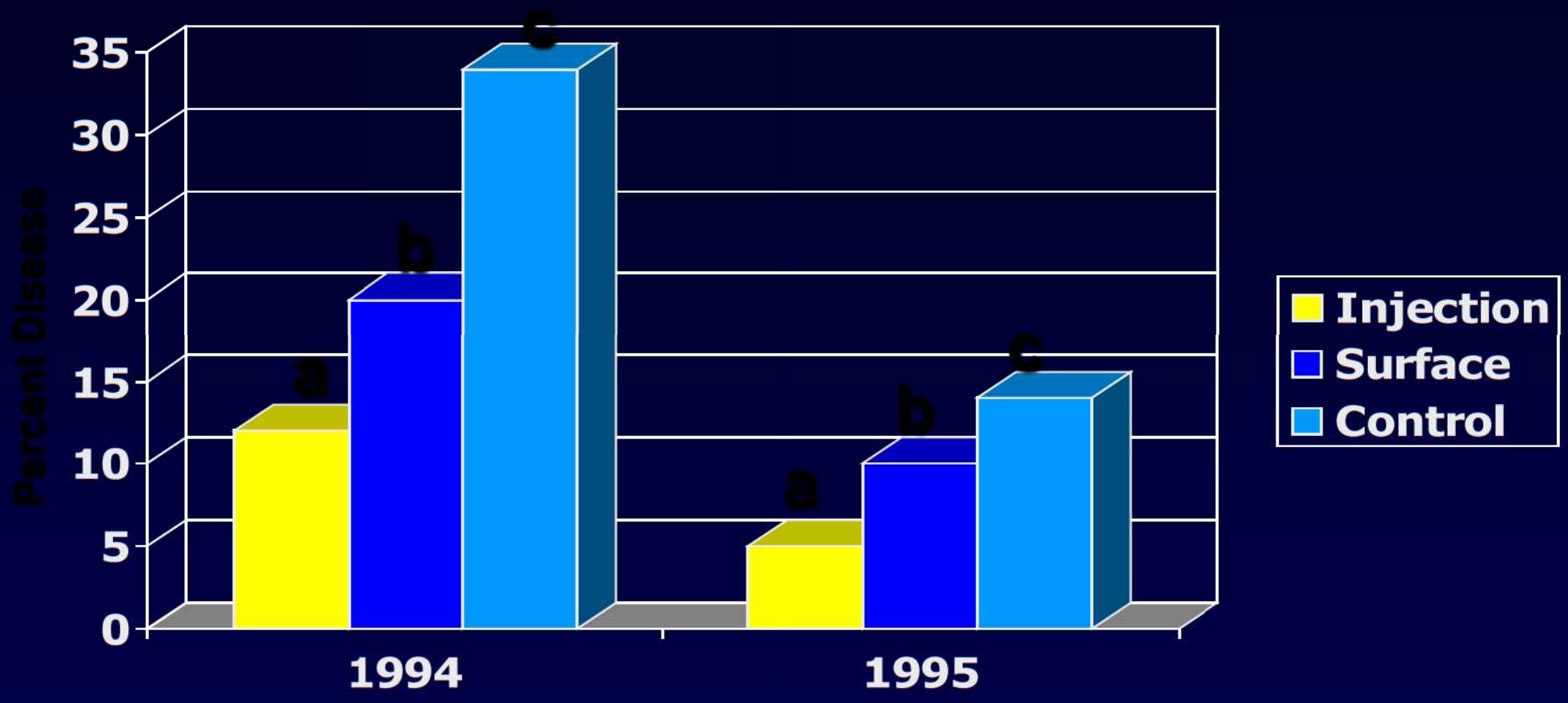
*NTEP Trials, where 9= least disease

# Management of Take-All Patch with Fungicides

- Fungicides reduce TA but do not eliminate it
- Preventive Treatments are best
  - Timing: Oct. + Nov. + Apr. + May
- Products*
  - azoxystrobin (Heritage)
  - pyraclostrobin (Insignia)
  - fluoxastrobin (Disarm)
  - propiconazole (Banner MAXX)
  - fenarimol (Rubigan)
  - triadimefon (Bayleton)

*Apply in 4 GPA with flat fan nozzles and high pressure

# Subsurface Injection vs. Surface Application




***Rubigan 1AS applied at 4 oz/1000 $ft^2$ in Sept., Oct., Apr., and May

B.B. Clarke, unpublished data