Maximizing Turfgrass Cultural Practices to Minimize Pesticide Use

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TurfFiles

Welcome | TurfTips | Maint. Calendars | Turfgrasses | Diseases | Insects | Other Pests | Weeds

WELCOME TO TURFFILES

Spring is finally here! TurfFiles has a new look and many new features:

- Trying to find an extension publication. Select 'Official Publications' under the menu item 'Extension' or click **here**.
- Check out the **Disease ID Decision Aid** for help in diagnosing disease problems.
- Have a question about a particular disease, insect, or weed? New information sheets contain pictures, descriptions, and management recommendations.
- Don't know what a cool-season grass is? The new **glossary** may help.
- Want more information about drought? Use the keyword search box on the top right of the screen, or look at the **keyword index**.

Alerts | News | Presentations | Careers | Internships

NEW FEATURE!!!
Sign up for Turf ALERTS

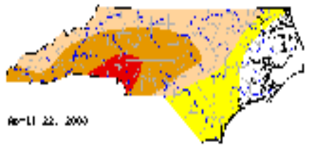
Large Patch Attacks Again	**Apr 24, 2008**
Pythium Root Dysfunction Outbreak across North Carolina	**Apr 16, 2008**
Treat Your Rings in Spring	**Mar 27, 2008**

Disease Aids | Turf/Weed Aids | Water Aids

Turf Irrigation Management System (TIMS) NEW!
The TIMS Water Management Program is available to North Carolinians to calculate and track irrigation use. Using the NC Climate Office current weather data, TIMS can tell you in number of minutes how long to water your lawn.

TIMS
TURF IRRIGATION MANAGEMENT SYSTEM

NC DROUGHT!



US Drought Monitor of North Carolina

North Carolina Drought Advisory Council

NC Division of Water Resources, DENR

N.C. Division of Forest Resources, Keetch-Byram Drought Index

Guides

The following comprehensive guides provide information on turf maintenance as well as pest identification and management.

Carolina Lawns

Lawns are smooth, living carpets that add beauty and recreational space to you home. The benefits of a healthy lawn go beyond the obvious. As your grass grows, it is working to help the environment by stabilizing soil and reducing air pollution, noise, heat, dust, and glare. Surveys show that an attractive, well-landscaped lawn can even add to the value of your home. To reap the rewards of a handsome lawn, take great care in the selection, establishment,

Internet 100%

start | Microsoft PowerPoint ... | TurfFiles - Windows I... | Search Desktop | 2:38 PM

Fred Yelverton, PhD
Professor, North Carolina State U.

- Weed Science in Turfgrasses
- Turfgrass Management
- Teach GCSAA
  - Advanced Weed Management
  - Event Management and Golf Course Preparation

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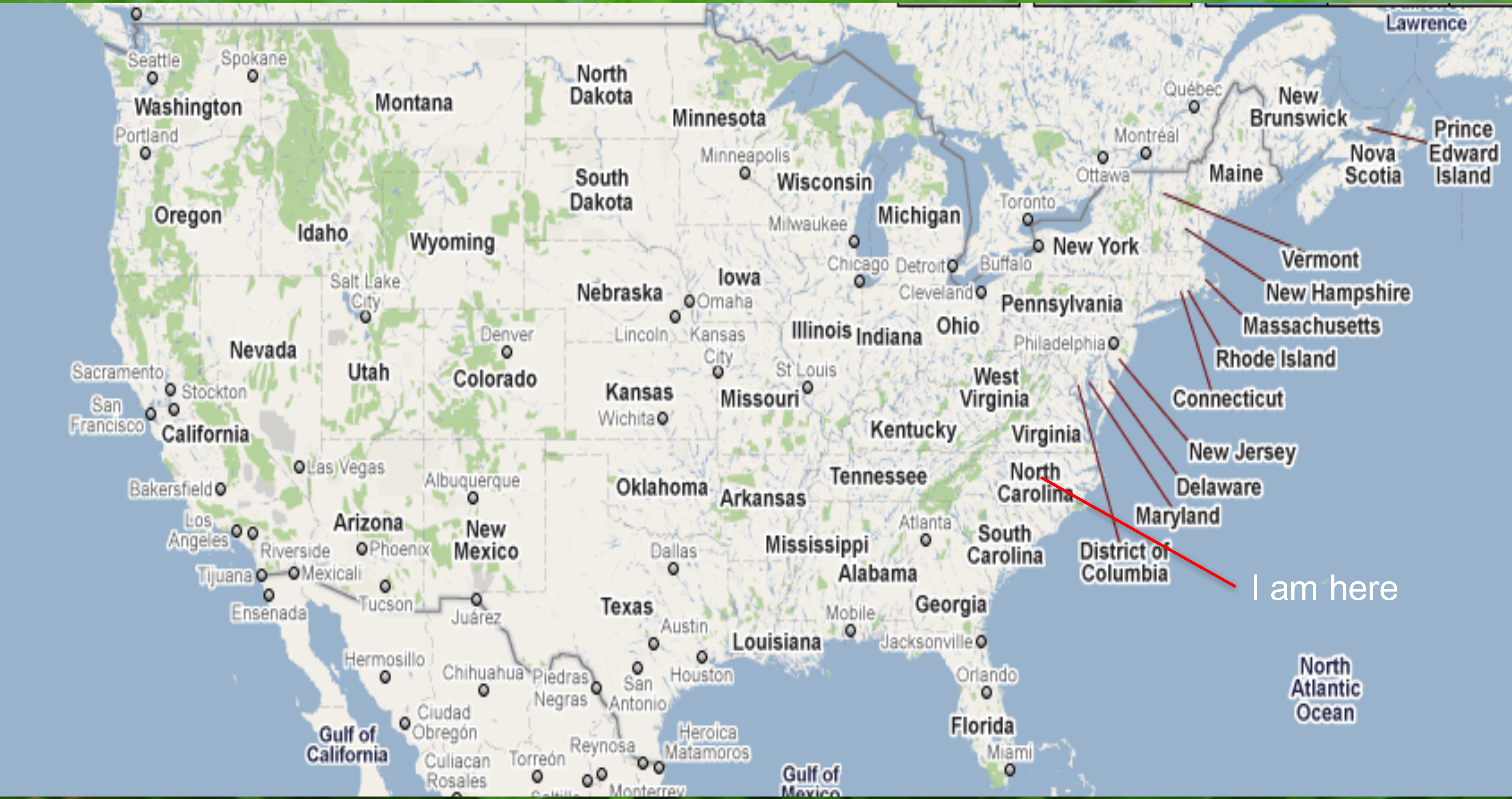
Turfgrass Management in the United States




8 28 '97


Pinehurst #2


Shinnecock Hills GC


Augusta National GC

Club de Sotogrande, Spain

Le Golf Nationale

Question for Spain Golf Courses

Conversion of Putting Greens from Creeping Bentgrass to Ultradwarf Bermudagrass??

Ultradwarf Bermudagrass vs Creeping Bentgrass

- **Ultradwarf bermudagrass cultivars far superior to older putting green bermudas**
- **There are 600 golf courses in North Carolina. 15 years ago, NC was approximately 80% bentgrass: 20% bermudagrass.**
- **In 2018, NC is approximately 50% bentgrass: 50% ultradwarf bermuda.**

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The Ultradwarf Option

- Less summer stress on the grass and superintendent (true)
- Fewer inputs required (not true)
- Aggressive aeration in summer is available (true)
- Less water, easier irrigation scheduling (true)
- Fewer employees (not true – labor requirements different. Trade summer labor for winter labor)
- Tolerates poorer water quality vs. creeping bentgrass (true)
- Ability to perform in a less-than-desirable rootzone (maybe true but not recommended)
- Can meet and exceed golfer expectations (true)

Ultradwarf Bermudagrass Potential Negatives

- Growth slows ~15C,
- Starts loosing chlorophyll ~10F,
- Completely brown with frost, thus, need for winter color,
- Higher N rates needed vs. bentgrass,
- Poor shade tolerance (big difference vs bentgrass)
- Winter-kill potential (we have had big problems)
- Grain development,
- Quicker organic layering buildup,
- Golfer preconceived discrimination against bermudagrass.
- Typically, ultradwarf greens need renovating more frequently.

Ultradwarf Bermudagrass vs Creeping Bentgrass

- **The average age until regrassing of ultradwarf bermudagrass in NC has been about 10 years. This compares to about 25-30 years for creeping bentgrass.**

- **Regrassing is almost always caused by off-type bermudagrass. Contamination, mutation, etc.**

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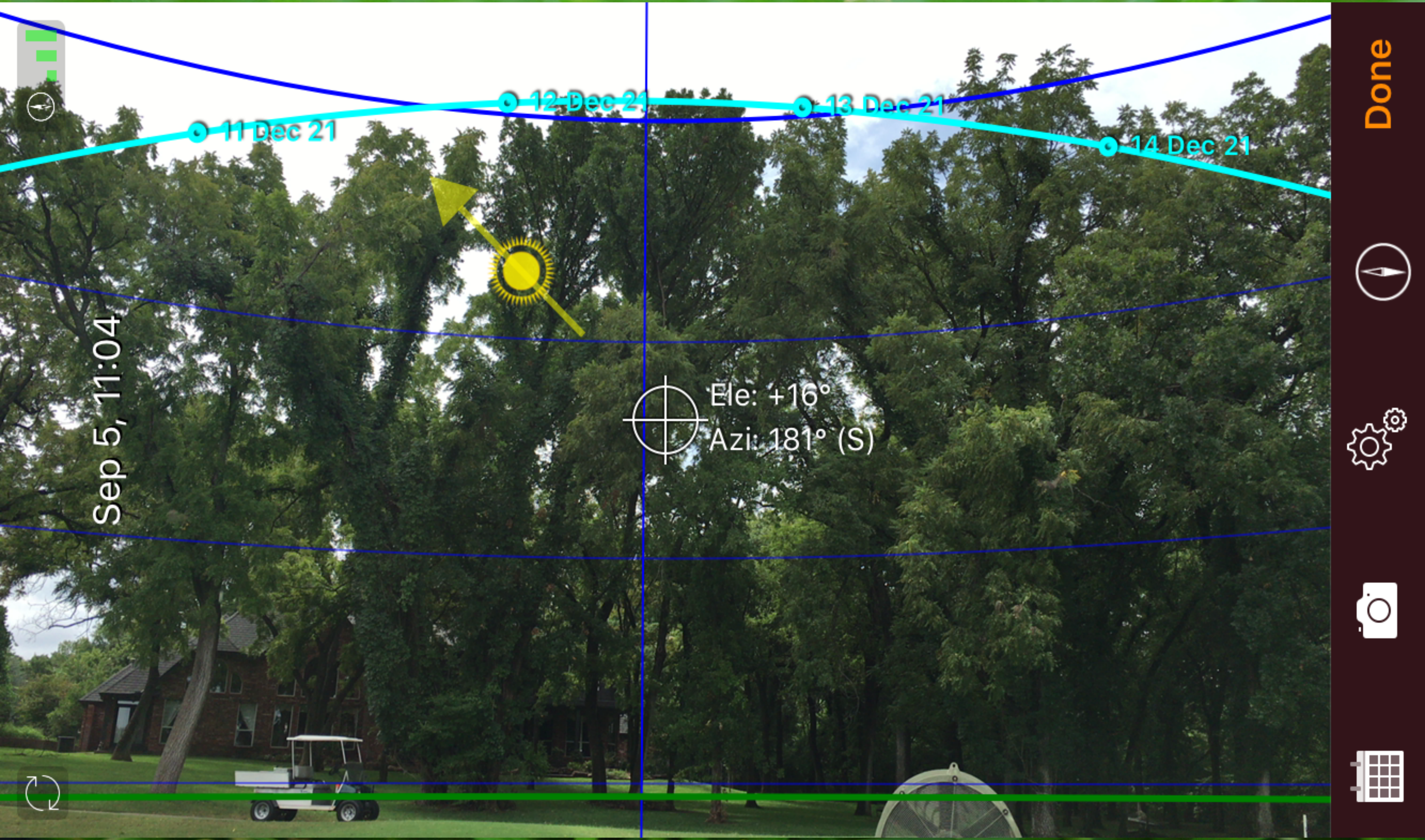
Sunseeker Application for phone



Freezing Protection Strategies

Freezing Tolerance (°F) of Bermudagrasses

Putting Green		Fairway		Seeded	
Champion	23.4 a	GN-1	21.3 a	AZ Common	21.9 a
Floradwarf	23.2 a	Baby	19.9 ab	Mirage	21.0 ab
MS-Supreme	22.6 ab	Tifway	19.9 ab	Jackpot	20.7 abc
MiniVerde	21.6 bc	Tifsport	19.0 bc	Guymon	18.7 bc
TifEagle	21.2 cd	Quickstand	17.6 cd	Yukon	18.3 c
Tifdwarf	20.3 d	Midlawn	16.9 d		
Tifgreen	20.3 d				

These are tissue temperatures in the laboratory, not air temperatures.

Source: Anderson, Taliaferro, & Martin. HortScience 28:955.

Low Temperature Tolerance

TifSport

Midiron


Varietal Differences
Tifway (419)
TifGrand & Celebration

Northern movement of ultradwarf greens

Richardson, et al., 2017

Bermudagrass and Cool Temperatures

Currently, for fairways, most cold tolerance cultivars include:

- Riviera, Latitude 36, Yukon, Patriot, and NorthBridge

For greens:

Tifdwarf > Champion > MiniVerde > TifEagle

- However, covers can essentially equalize this.

Close Mowing Height + Shade and Winter Kill

Winter Damage Situations

Traffic on Frozen Green

Shade & Compaction (Triplex Ring)

Scalping, Compaction

Shade

Desiccation

Preparing Bermudagrass Greens for Winter

- Remove shade sources,
- Aerify in late summer to reduce soil compact
- Raise mowing heights in late fall, do not scalp at this time,
- Maintain adequate/sufficient soil K levels,
- Allow greens to go dormant, use pigments for green color,
- Monitor soil moisture, especially low RH, windy days. Desiccation is a leading contributor to “winter” damage,
- Use wetting agents for uniform soil moisture,
- Cover greens when temps. are expected to dip to 23 to 25F. Insert porous layer via pine straw, swimming noodles, vapor barrier, thick cardboard, erosion tubes, bubble wrap or using double covers.

Covering Bermudagrass Greens to Prevent Winterkill

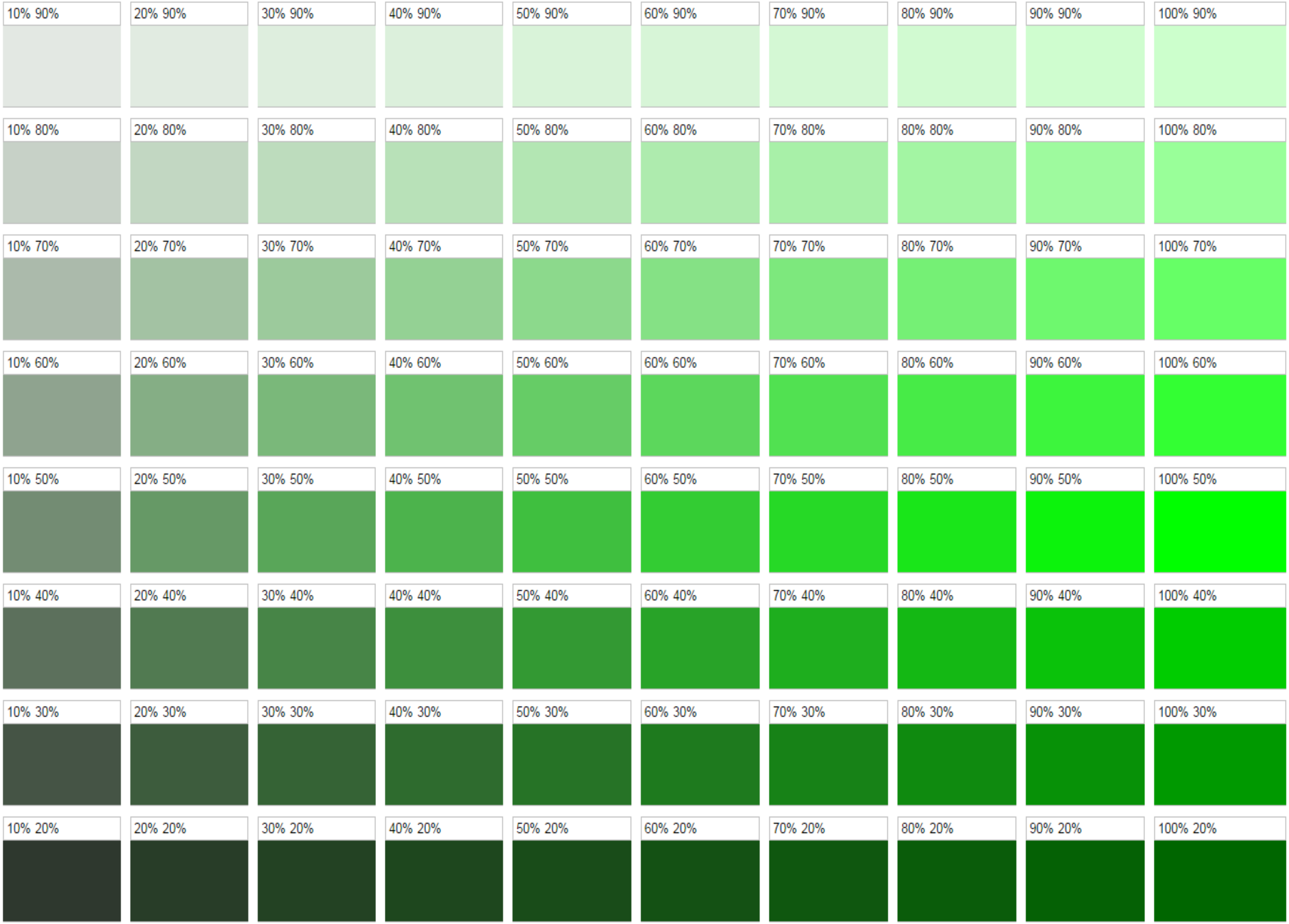

Oversize Your
Cover


Pinestraw or Bubble Wrap Under a Cover For Protection to $\leq 0^{o}$F (-18^{o}C)

Cover Protection

Saturation, Lightness

HUE = 120°



Colorant Considerations

- Desired turfgrass color
  - Cost
  - Shade of green
  - Longevity of color
  - Color re-application
- Application timing
  - Level of turfgrass dormancy
- Desired coverage
  - Dilution
  - Application rate
  - Application method

Fall/Winter Painting

Pros

- Able to provide a aesthetically pleasing green color to dormant turf.
- Affordable
- No decrease in playability
- No competition once spring “green-up” rolls around

Cons

- Multiple applications may be needed to maintain winter long green color
- Tendency for paint to turn bluish/gray color
- Little information regarding products
- Not a wearable surface
- Appropriate spray equipment needed

Overseeding Issues

- Seed Cost
- Preparation of area (more prep, better growth)
- Additional water, little more fertilizer
- Transition back to warm-season turfgrass
- Alteration of herbicide programs

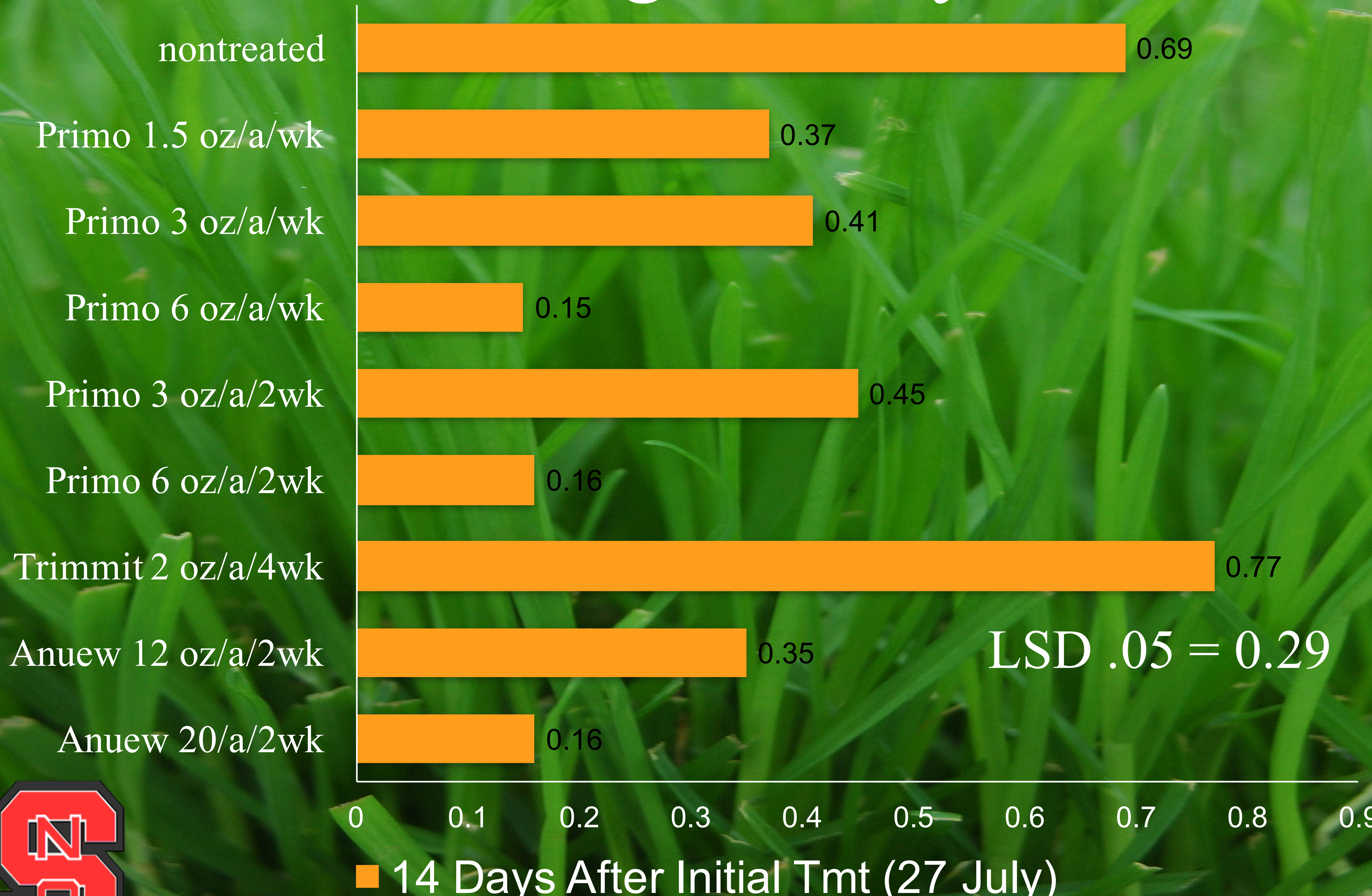

Miniverde Bermudagrass
3 Days After Application
Untreated Control
SprayMax
Solarogen
Enviroseal Go Green
Endurant
Super Cover
Bermuda
Lineman
Ultradwarf Super
Southwestern
Southwest Green
LESCO Green
Green Lawnger
Regreen
Titan Green Turf
Turf Cote
Green Turf Dye
Sugar Hill Turf
Mtp Turfgreen
Blue
Original
Ultradwarf Plus
Graphics
Bermudagrass
Evergreen
Wintergreen Plus


HD300
JOHN DEERE

Dual nozzles

Research with Plant Growth Regulators on Ultradwarf Bermudagrass Putting

PGR Effects on ‘Champion’ Bermudagrass Dry Wt



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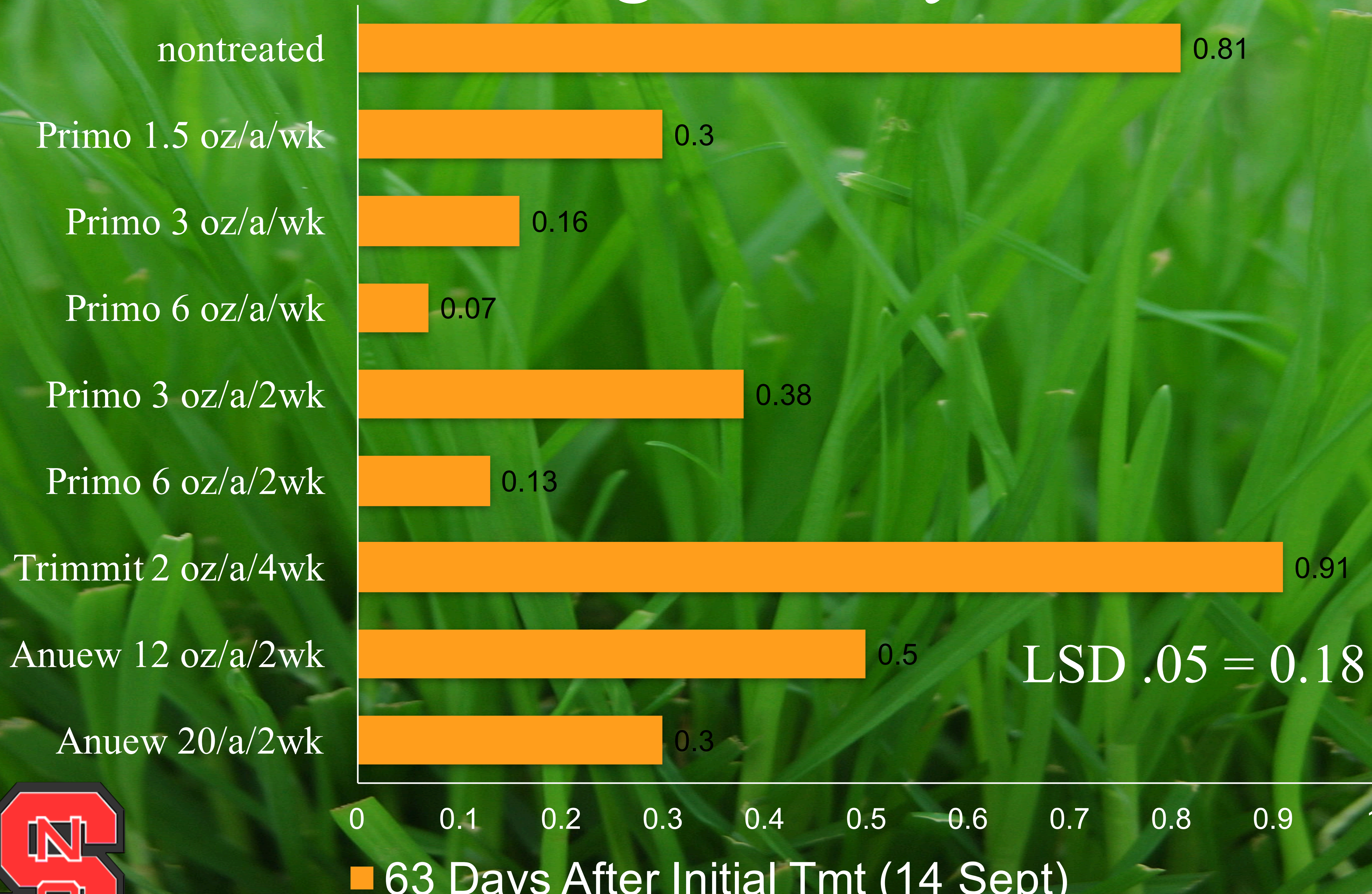
Application: 14 July, 2017

PGR Effects on 'Champion' Bermudagrass Dry Wt.



Initial Application: 14 July, 2017

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Ultradwarf Bermudagrass vs Creeping Bentgrass Summary

- **Ultradwarf bermudagrasses are excellent for putting greens**
- **Ultradwarf bermudagrasses are not lower maintenance than creeping bentgrass**
- **Management is vastly different but basically you are trading one set of management issues for another set of management issues.**

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Ultradwarf Bermudagrass vs Creeping Bentgrass Summary

- **Ultradwarf bermudagrasses (so far) have to be regressed more often than creeping bentgrass.**

- **Poa annua is more easily managed in bermudagrass greens but herbicide resistance is a major issue.**

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Ultradwarf Bermudagrass vs Creeping Bentgrass Summary

- **Ultradwarf bermudagrasses require significantly more sunlight than bentgrass.**
- **Recognize the maintenance calendar is significantly different and see how that matches with your golf course golf rounds by month.**

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Best Defense Against Pests

- **Dense competitive turf!!**
- **Any agronomic practice that promotes dense turf is the best defense against pests.**

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Prevention of one turfgrass species from encroaching on another

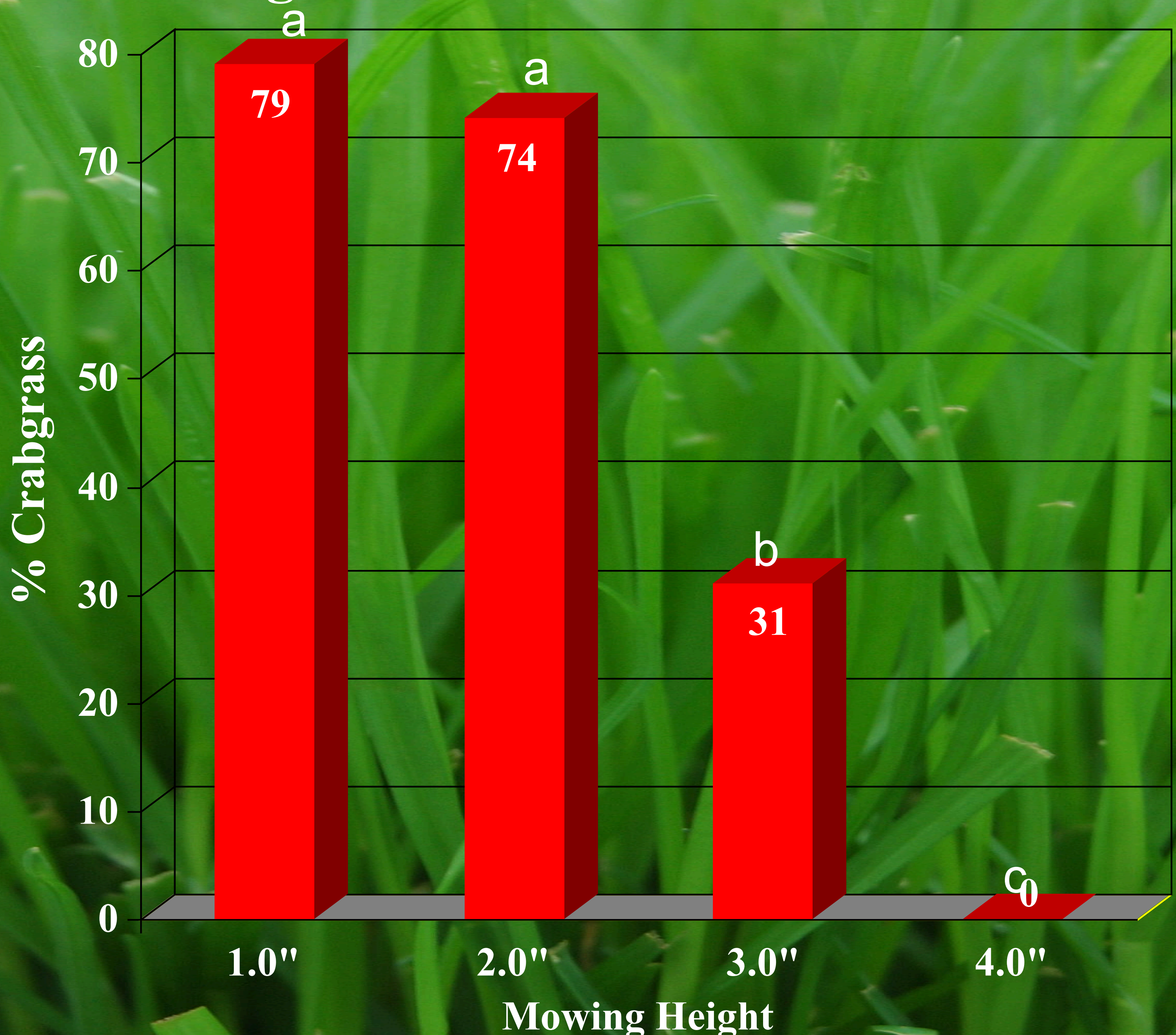
Mechanical edging is very effective

Power edge to cut roots and rhizomes

Blowing debris off the green


After cleanup

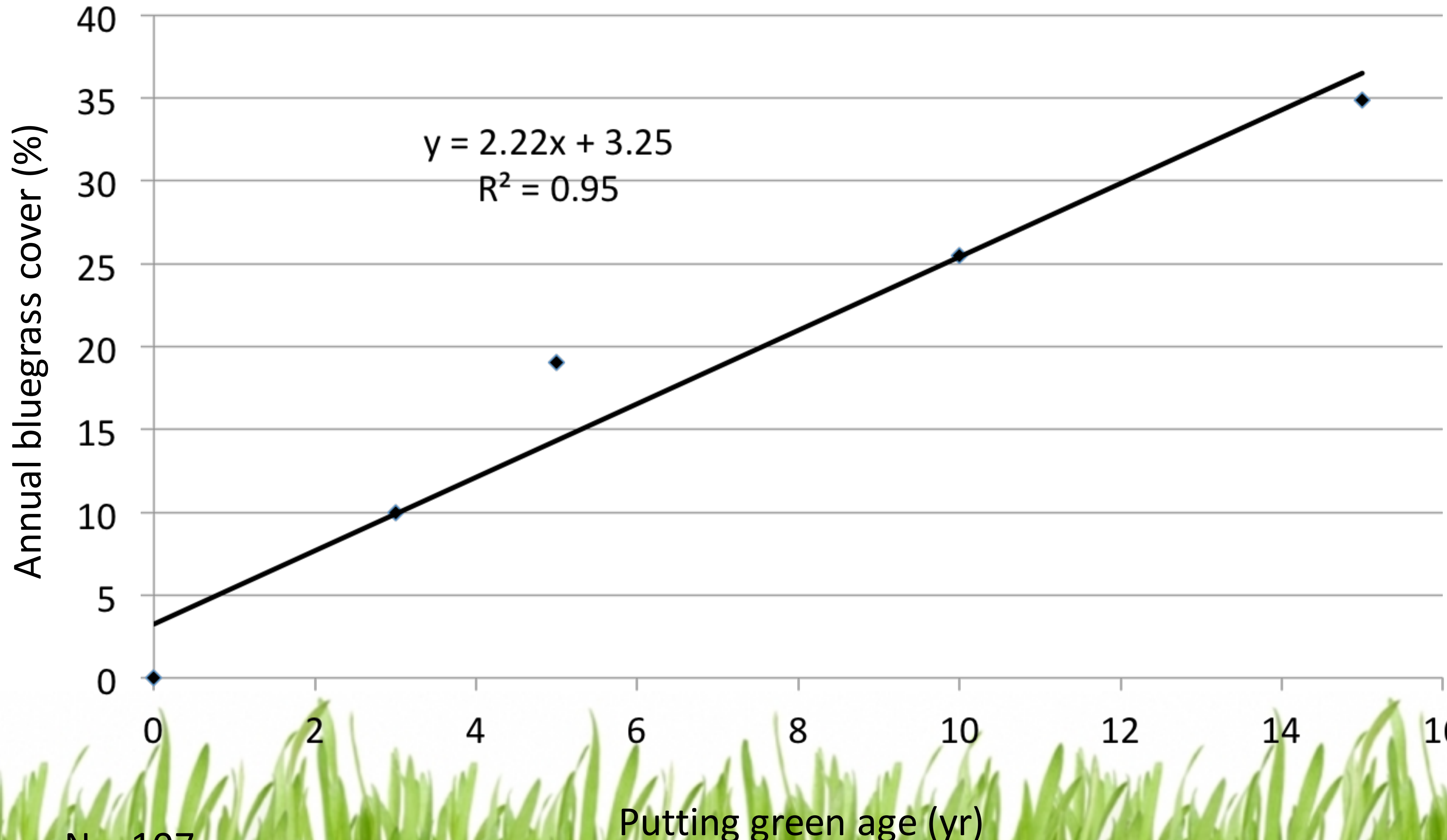
Effect of Mowing Height on Crabgrass Incidence in Tall fescue



Data Collected: 09-13-07, LSD (P=0.05), Sandhills Research Station, Sodman 90/10 (mixture w/ bluegrass)

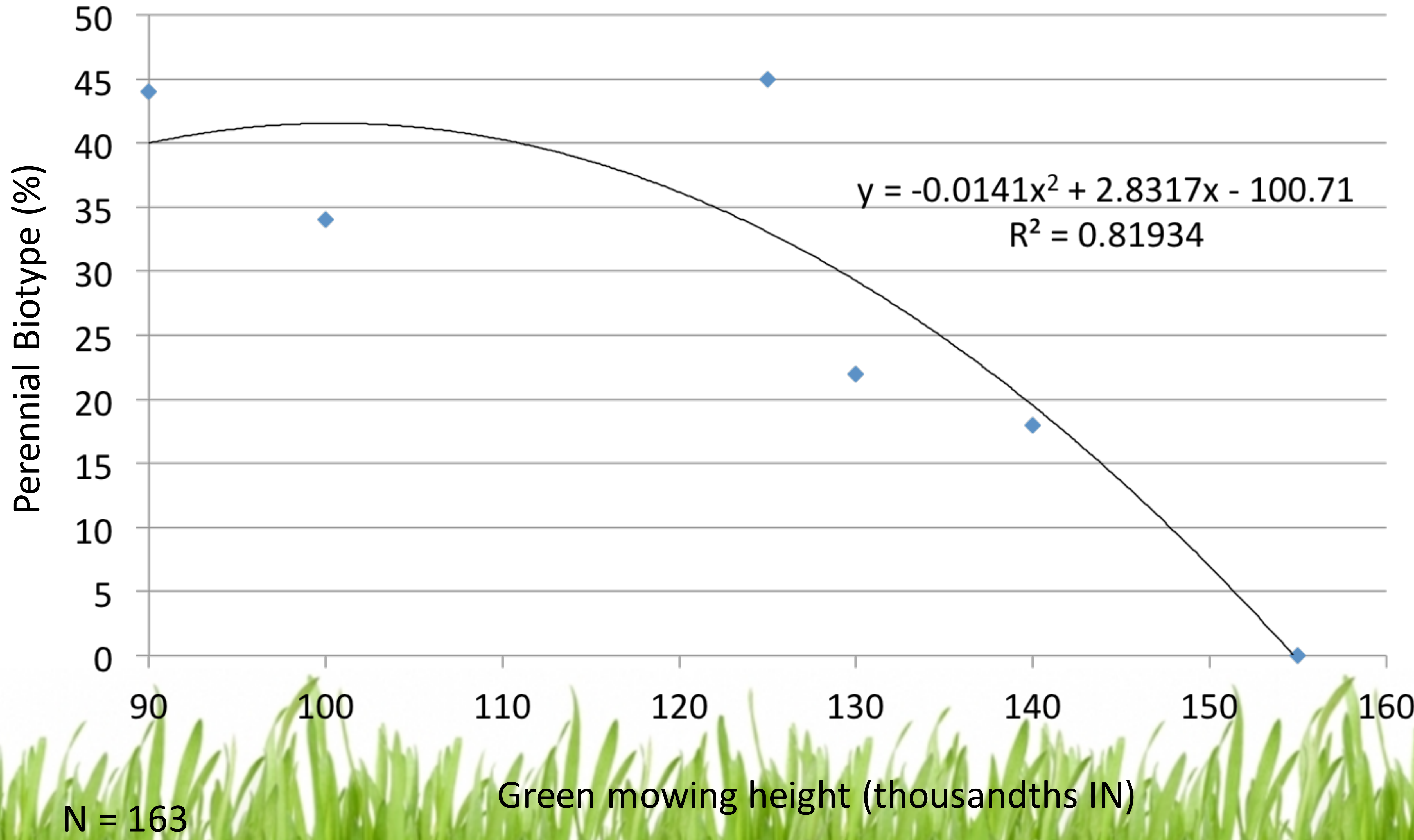

2.5 cm
5 cm
7.5 cm
10 cm

Effect of Putting Green Age on Annual Bluegrass Cover (First 15 Years)



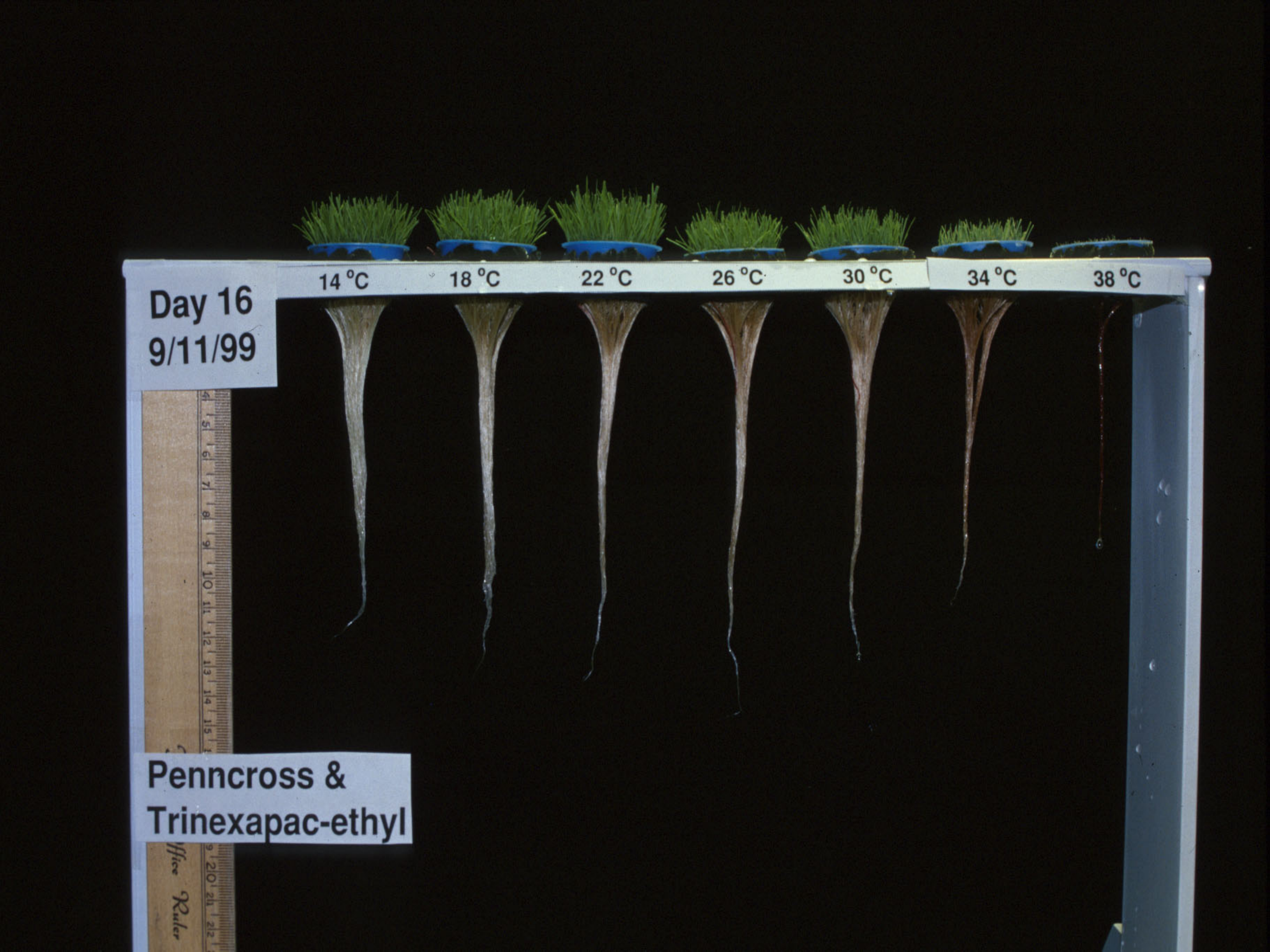
N = 107

Effect of Putting Green Mowing Height on Percentage of Poa that is Perennial



Conditions That Promote *Poa annua* ssp. and Bentgrass

	Poa annua	Bentgrass
Moisture	Wet	Moderate
Soil Conditions	Compacted	Uncompacted
Core Cultivation	Decreases comp.	Increases comp.
N Fertilization	High	Moderate
Clipping Removal	Decreases comp.	Increases comp.
pH	6.0 – 7.0	5.5 – 6.0


Day 16
9/11/99
14 °C
18 °C
22 °C
26 °C
30 °C
34 °C
38 °C
Penncross &
Trinexapac-ethyl


Day 16
9/2/98
Flexible Office

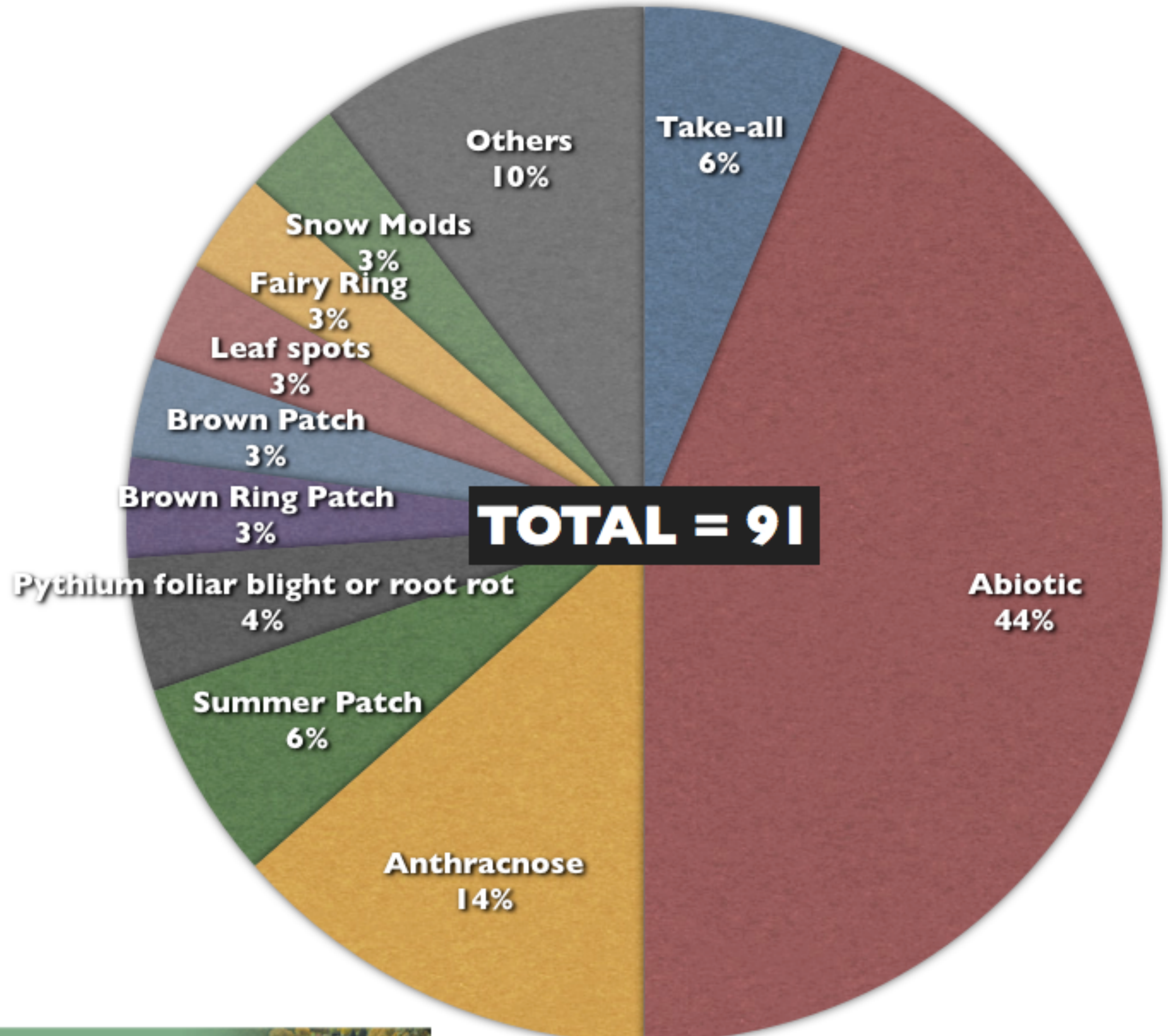
Creeping bentgrass vs Poa annua

- Creeping bentgrass is more drought tolerant and heat tolerant than Poa annua.
- *Poa annua* is more susceptible to winter injury than bentgrass

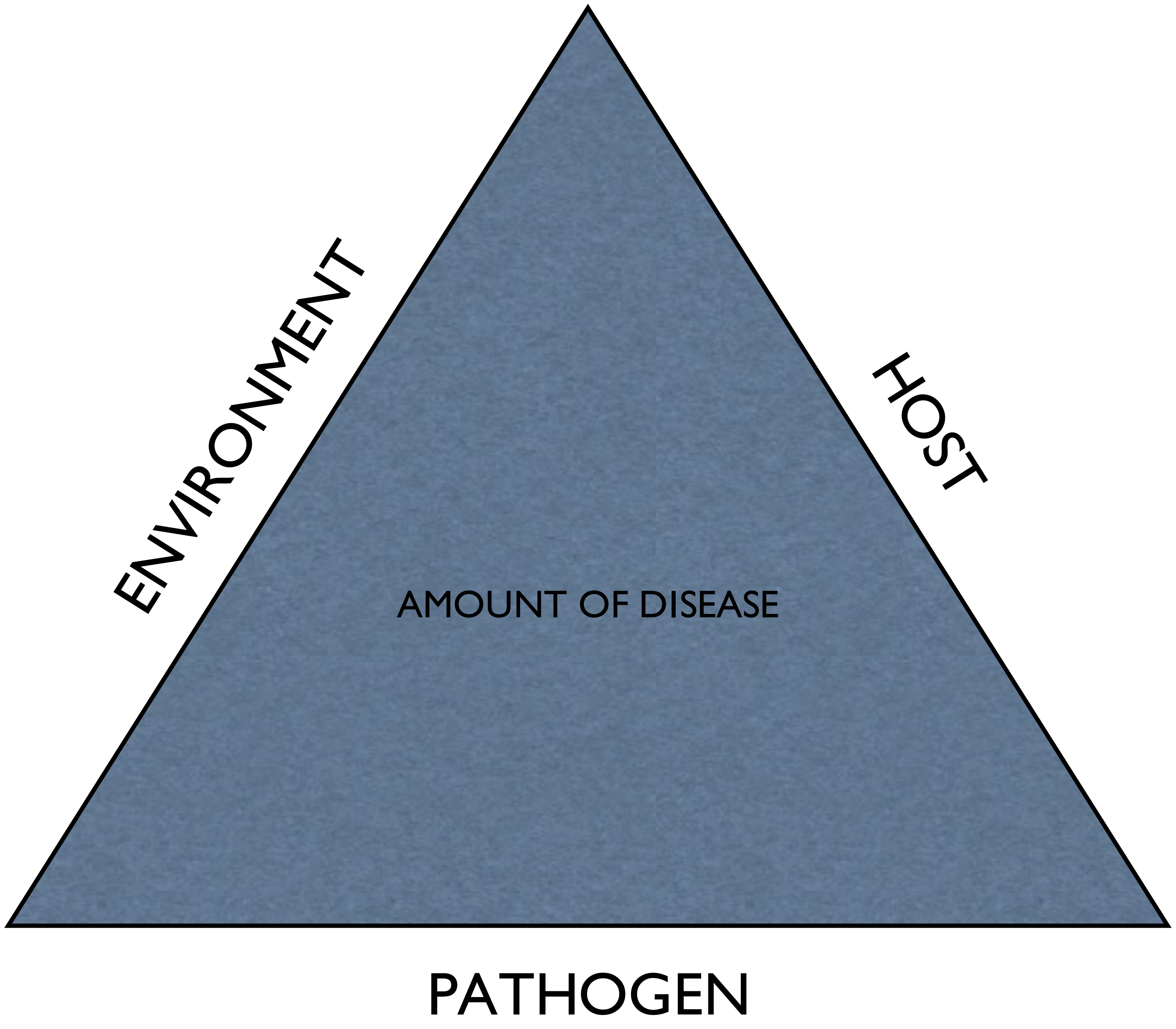
Managing Summer Stress and Summer Diseases in Cool-Season Grasses

Jim Kerns, Ph.D.
Assistant Professor and Extension Specialist
NC State University
Department of Plant Pathology

2011 TDL Professional Diagnoses



Disease Triangle




No mow
NO
mow

Four factors contribute to summer turf stress/loss

1. Heat - most difficult to control often associated w/ drought stress (non-irrigated conditions)

2. Wear

3. Desiccation

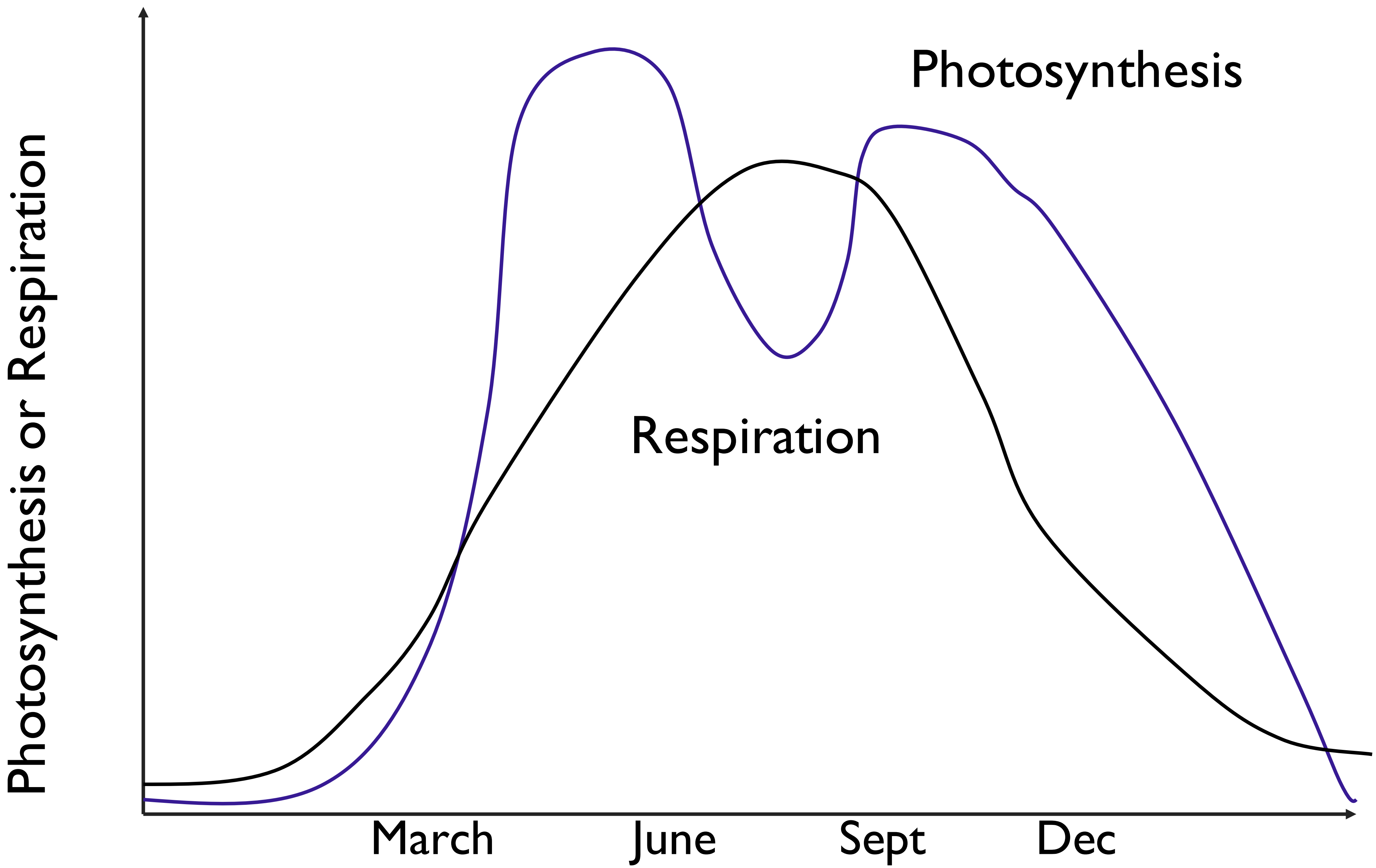
4. Disease: anthracnose, leaf spots, bacterial diseases, Pythium, summer patch

Reasons for Root Loss

Above ground

- photosynthesis declines, photorespiration increases
- plant consumes more energy than it produces
- carbohydrate reserves depleted, leading to loss of root mass

Time of Year Effects

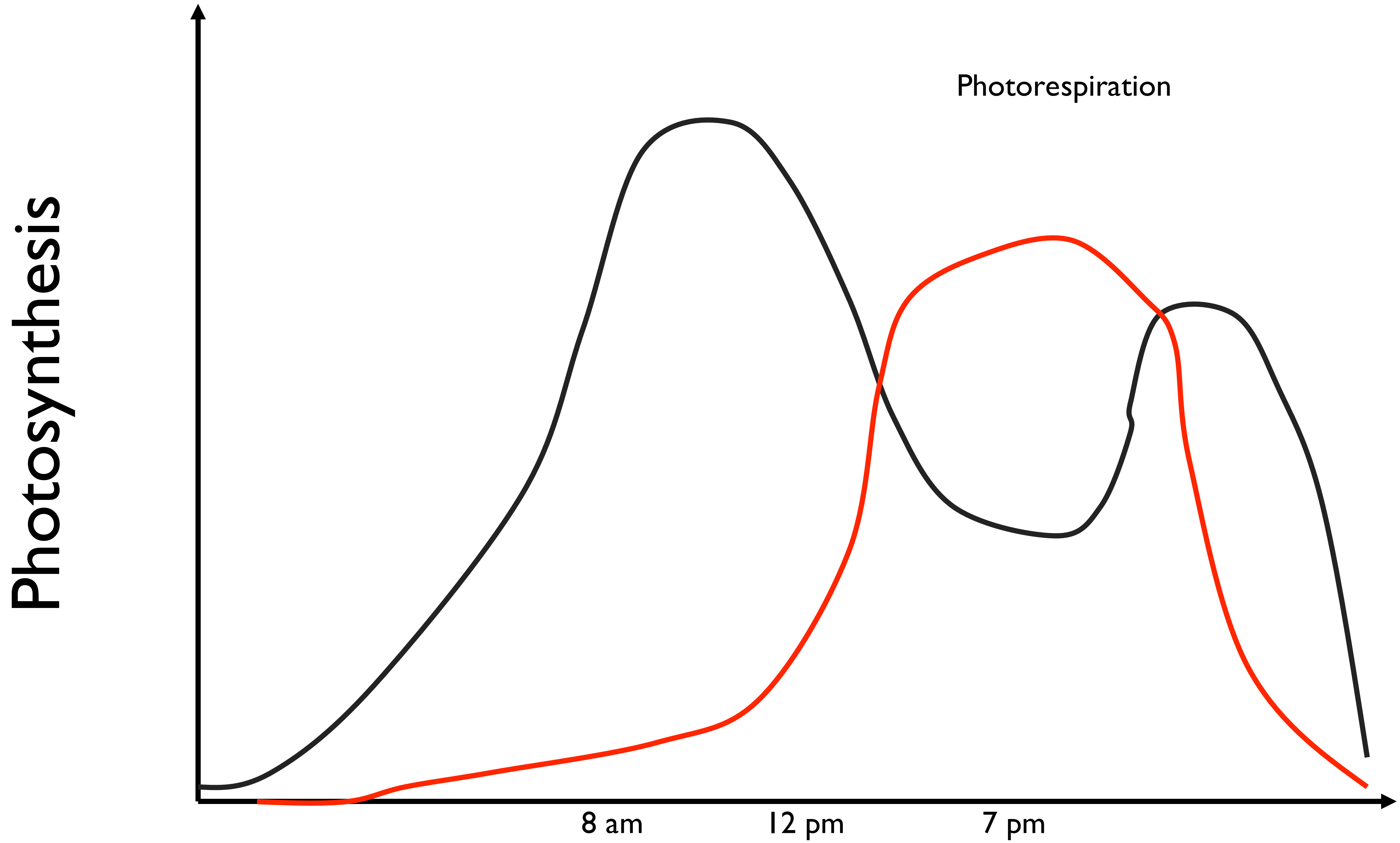


Slide Courtesy of Dr. Brian Horgan

Photorespiration

- High Temps (> 24° C)
- $CO_2 + H_2O$ = Less Sugars ($C_6H_{12}O_6$)
- On hot dry days, turfgrass plants (C3) are forced to close stomates to prevent water loss. PR occurs when CO_2 levels inside leaf becomes low. CO_2 levels drop relative to O_2 levels in plant. When CO_2 levels drop below 50ppm, O_2 starts to combine with Rubisco instead of CO_2. Photosynethetic output drops by about 25%.

Photorespiration



Slide Courtesy of Dr. Brian Horgan

Types of Heat Stress

- Indirect
  - Long periods of temps above optimal
  - Not immediately fatal
  - Negative effect on physiological processes
- Direct
  - Rapid increase in temp, last for a short time
  - Denature proteins
  - Cell membrane rupture
  - More of a problem in roots
  - Rarer than indirect stress

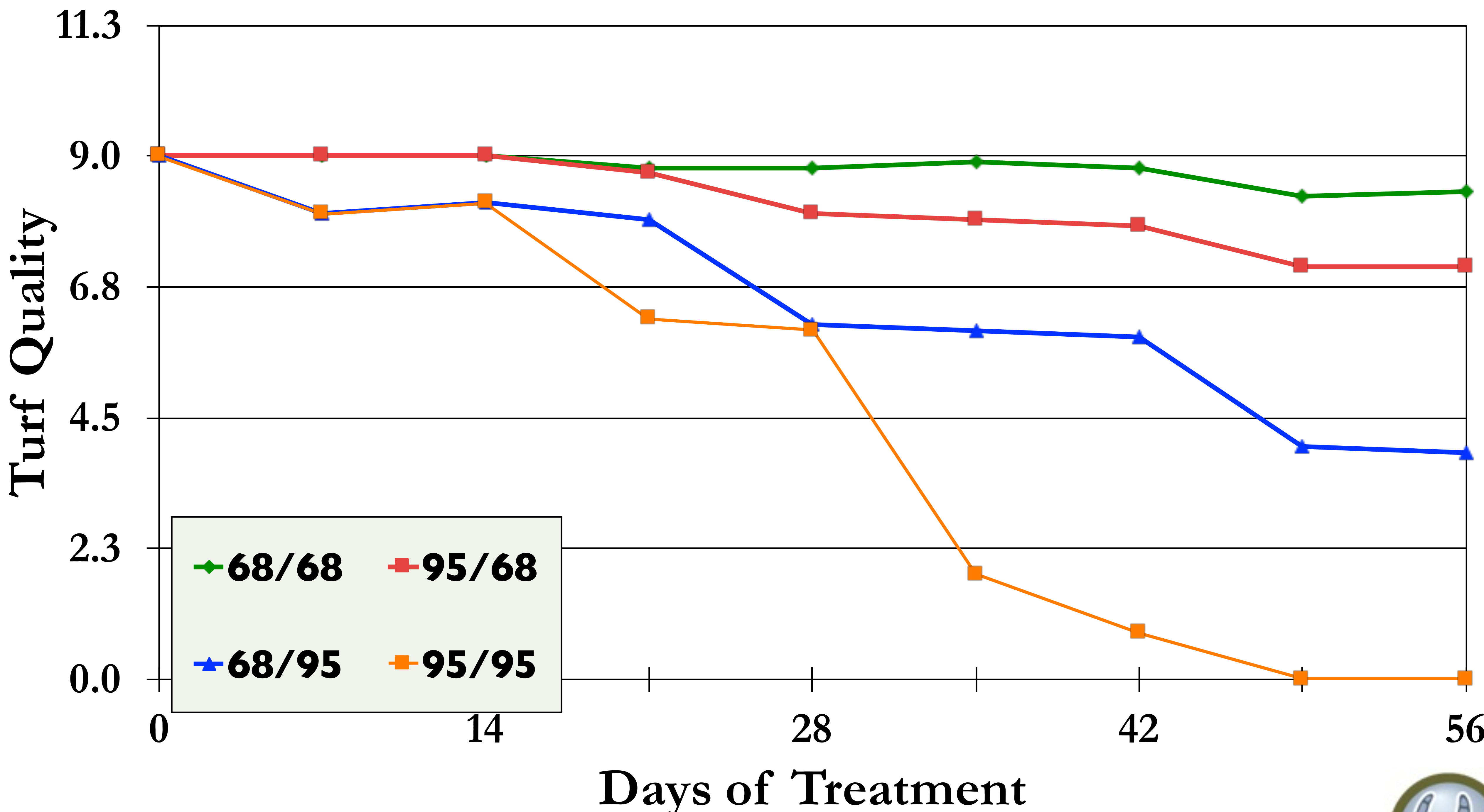
Morphological Effects

- Chlorosis
- Reduced shoot growth
- Reduced root growth (length, viability)
- Tillering
- Leaf size
- Turf density

Effects of Heat Stress

1. Increase in rate of root maturation; no new roots
2. Death of root system
3. Decline in shoot growth (reduced leaf width, length, and rate of appearance)

‘Penncross’ response to Day/Night Temperatures



- After Xu & Huang, 2000

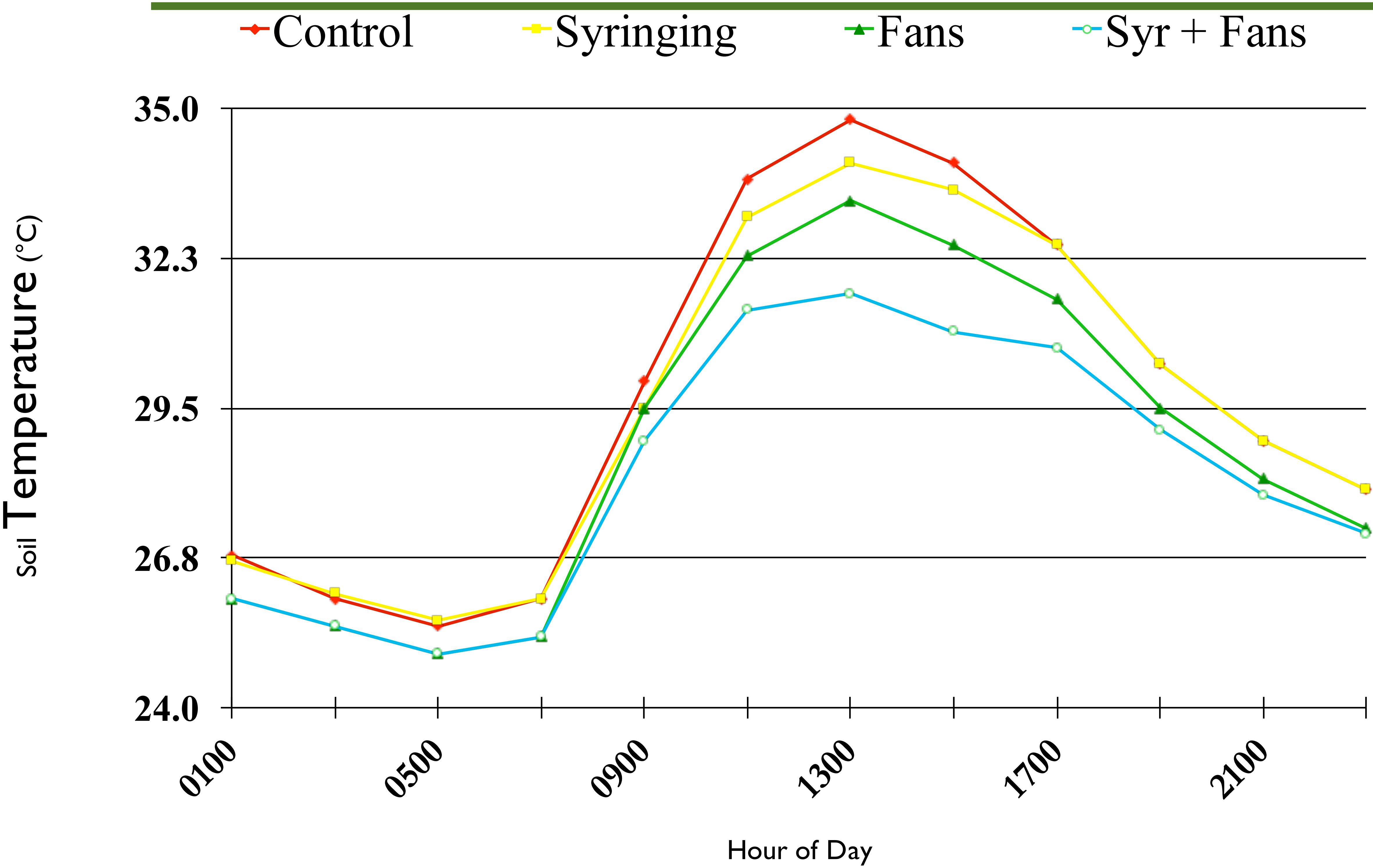
Creeping bentgrass root influenced by temperature

Slide Courtesy of Dr. Brian Horgan

Huang, 2001

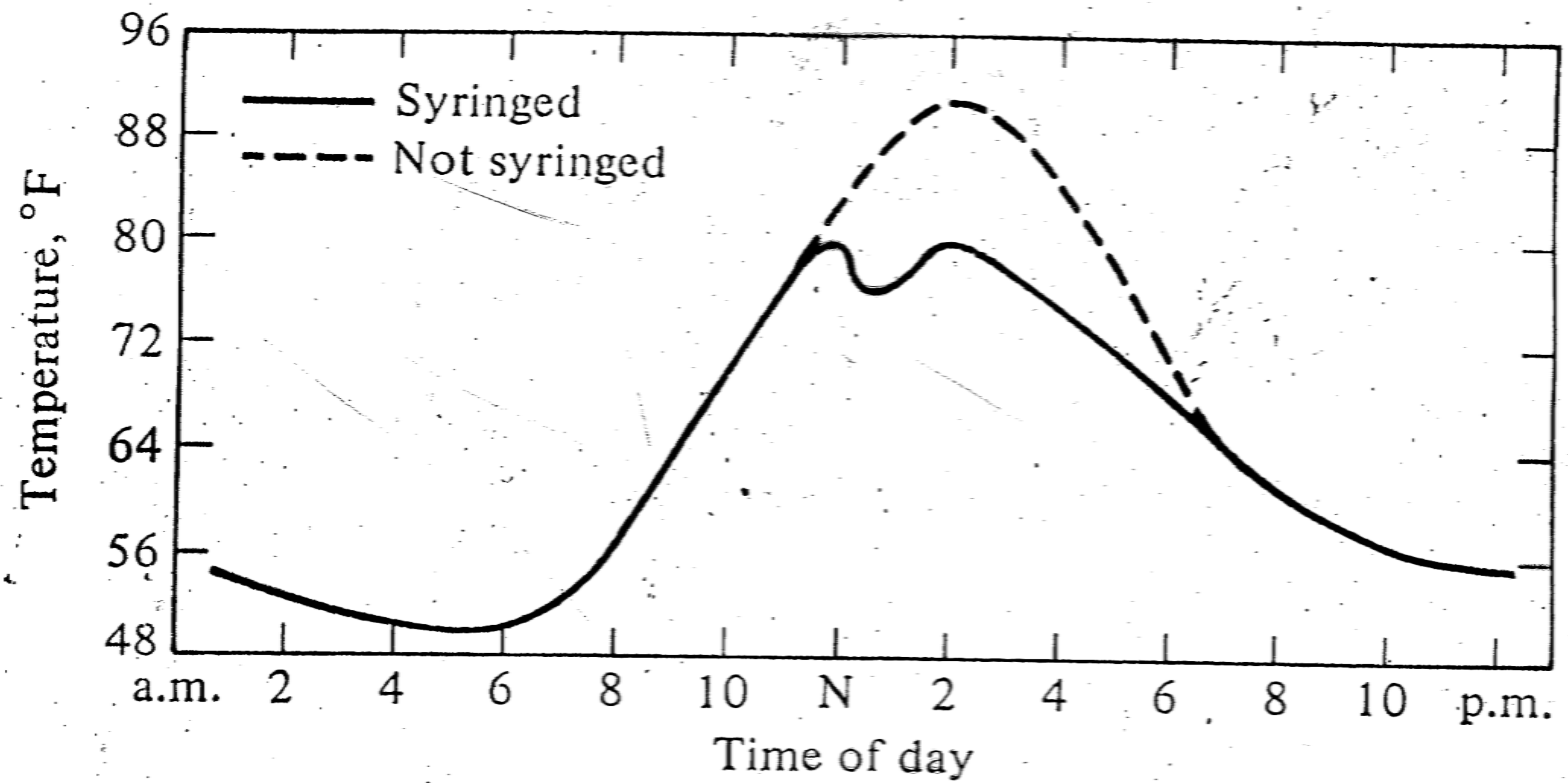
Cooling with Fans and Syringing

LSD0.05 = 0.7
18 Aug. 2000
Max air temp. = 39



Guertal et al., Crop Sci. 45:245-250, 2005

Cooling Effects of Syringing



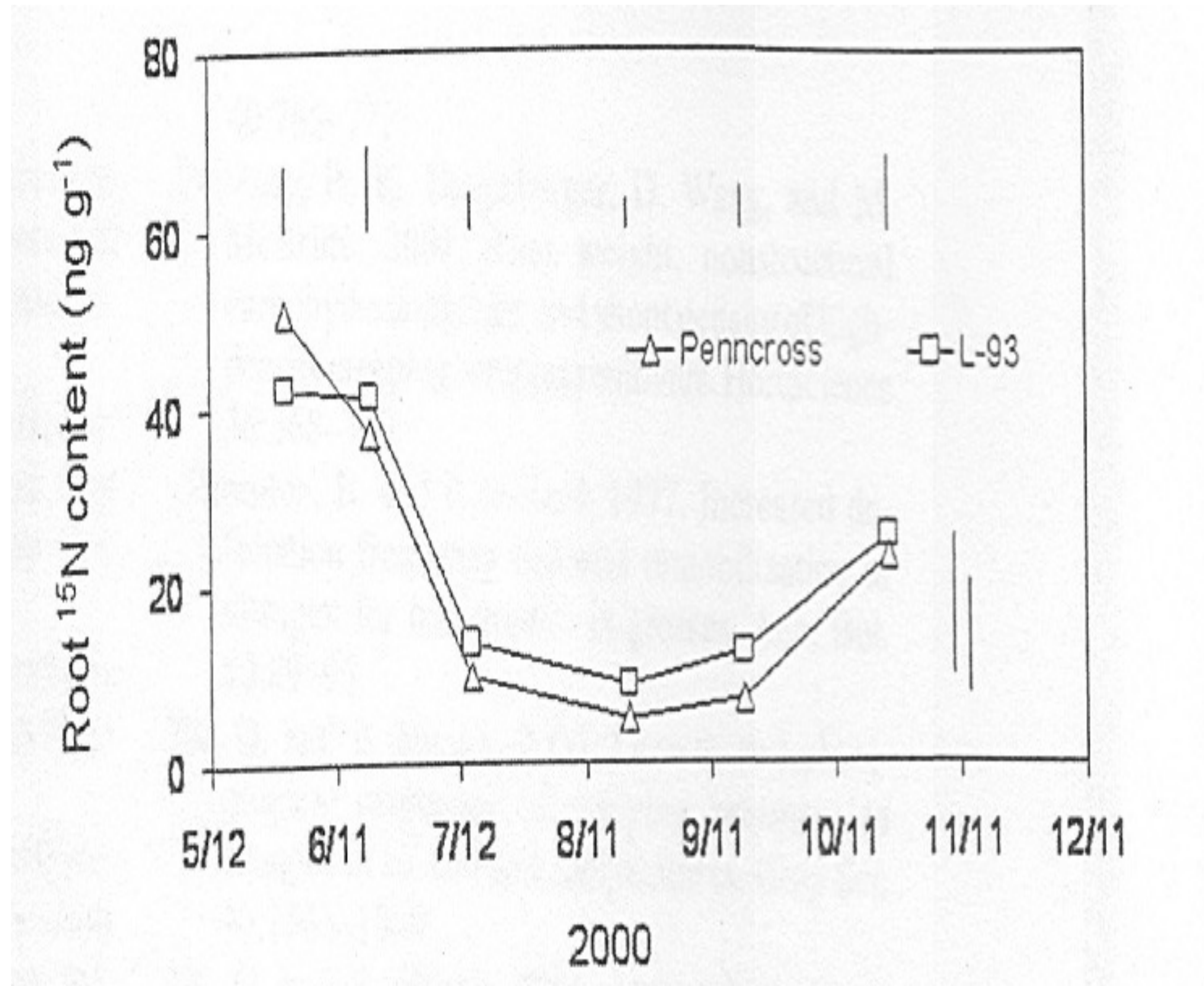
Source: Beard, 1973

Syringing

- In general, in areas where cool season turf is grown
  - Syringing causes a 1 to 2°C decrease in canopy temp. for up to 2 hours

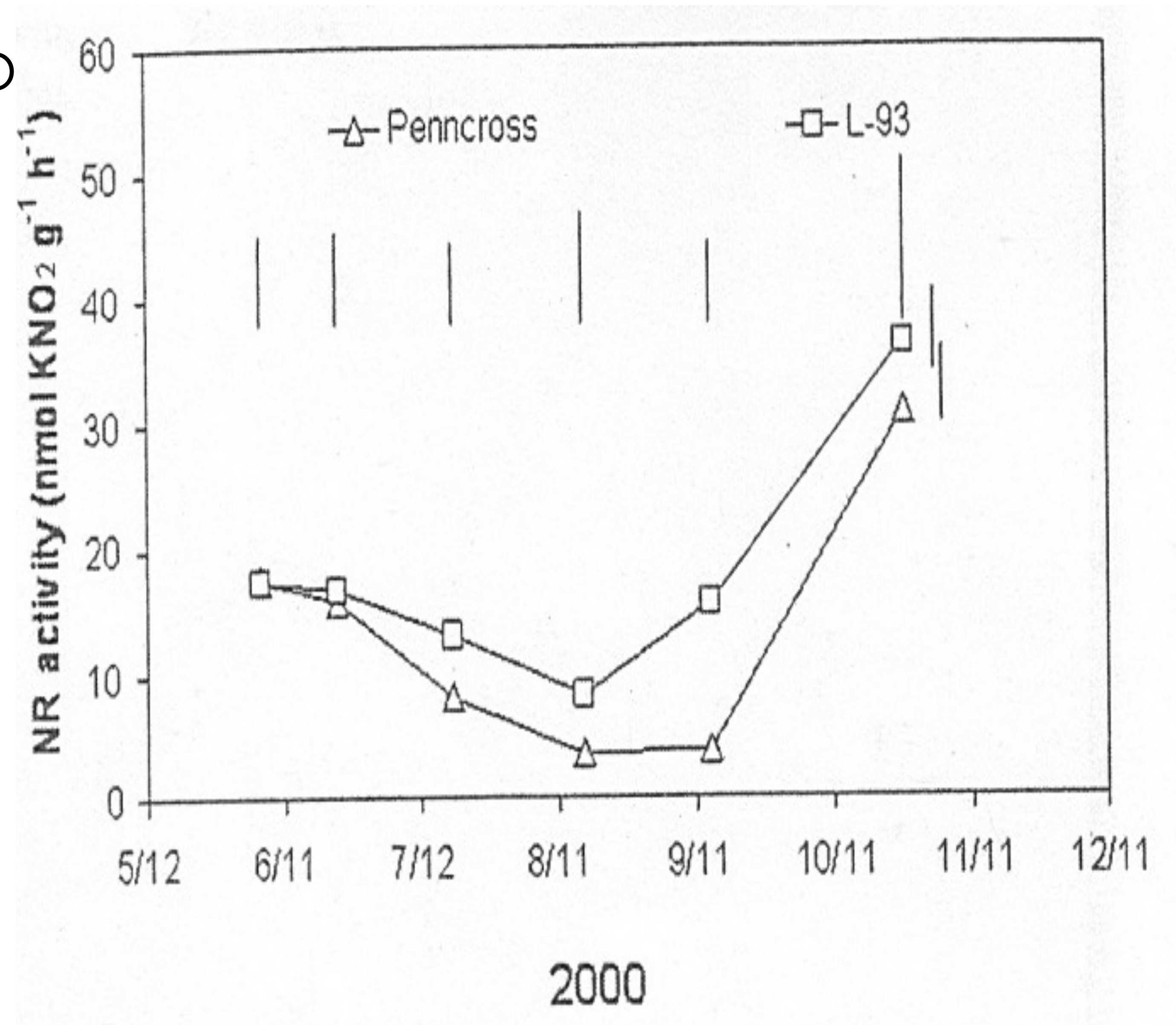
15N root uptake

- N uptake indication of amino acid production
- 15N highest in May, lowest in August



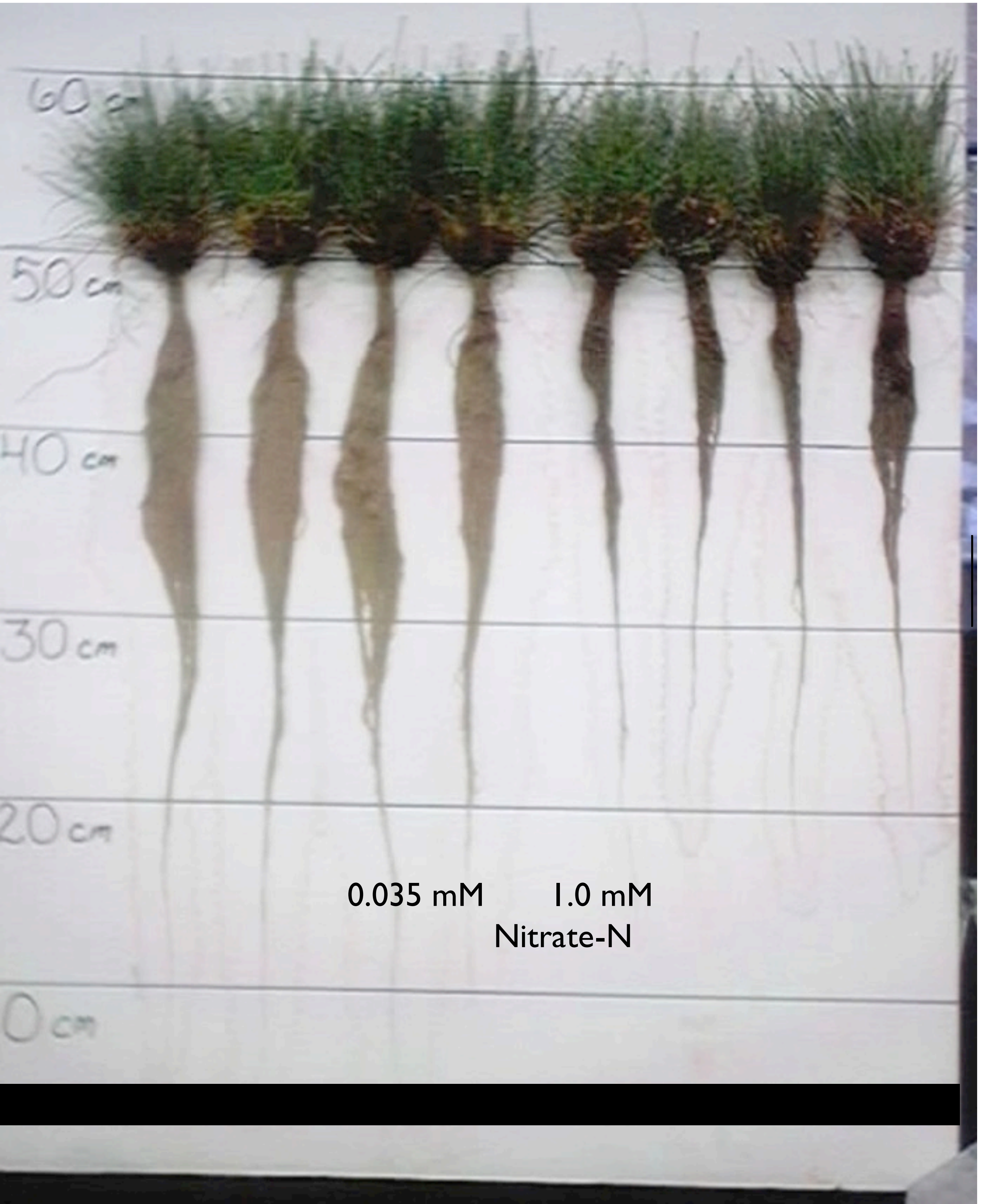
Nitrate Reductase Enzyme

- NR key enzyme in NO3 assimilation (sensitive to high temps)
- NR lowest in summer
- Nutrient uptake inhibited when temps high



Slide Courtesy of Dr. Brian Horgan

IMPACT OF NITRATE CONCENTRATION ON ROOT AND SHOOT GROWTH



Elevated nitrate (1.0 mM) dramatically reduced root growth with only modest increase in shoot growth.

Nitrate delivered via the xylem to shoots diverted fixed C from transport to roots to amino acid synthesis in leaves and greater shoot growth.

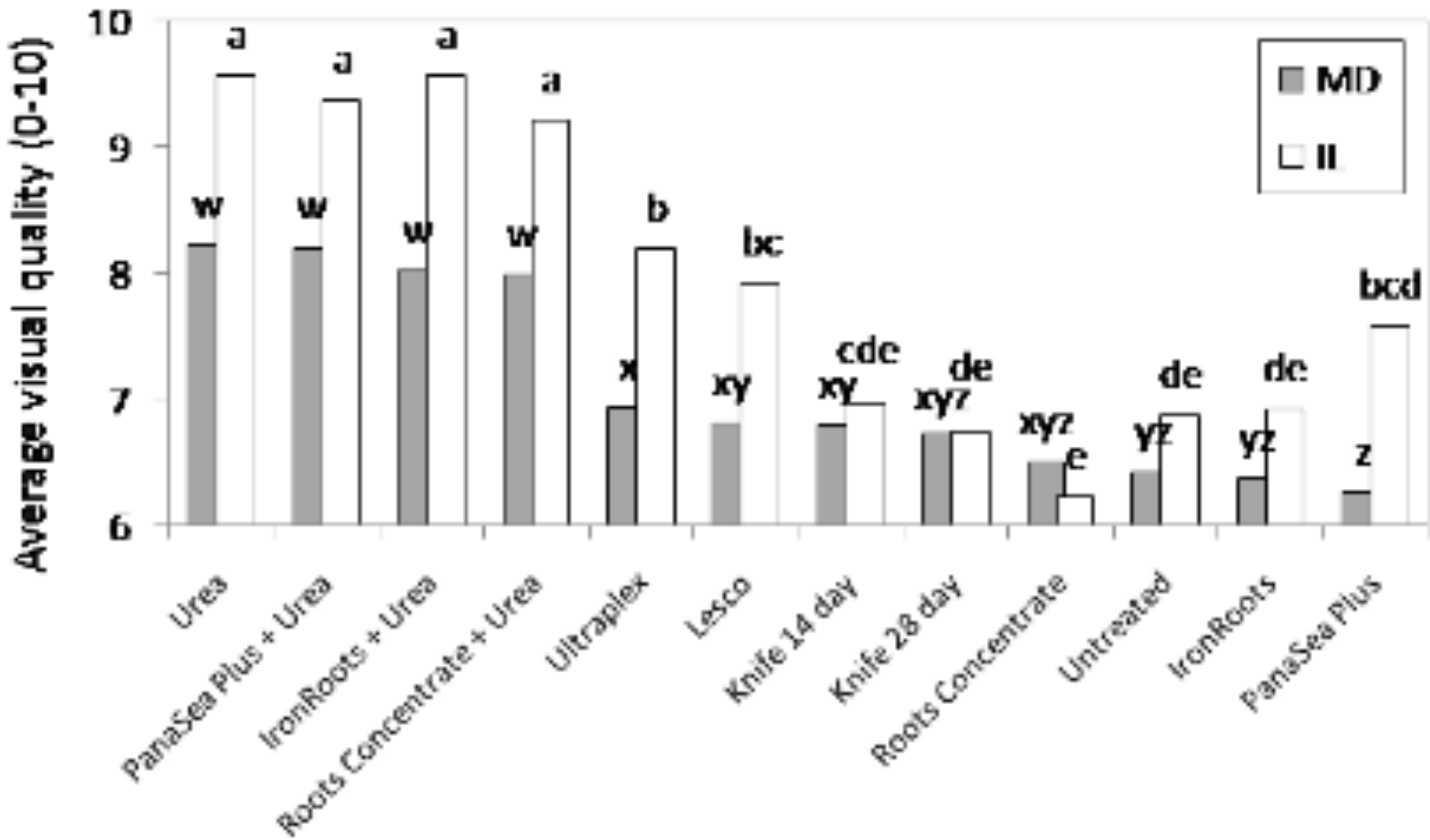
Slide Courtesy of Dr. Brian Horgan

Replacing nitrate with ammonium promoted shoot growth without inhibiting growth of roots.

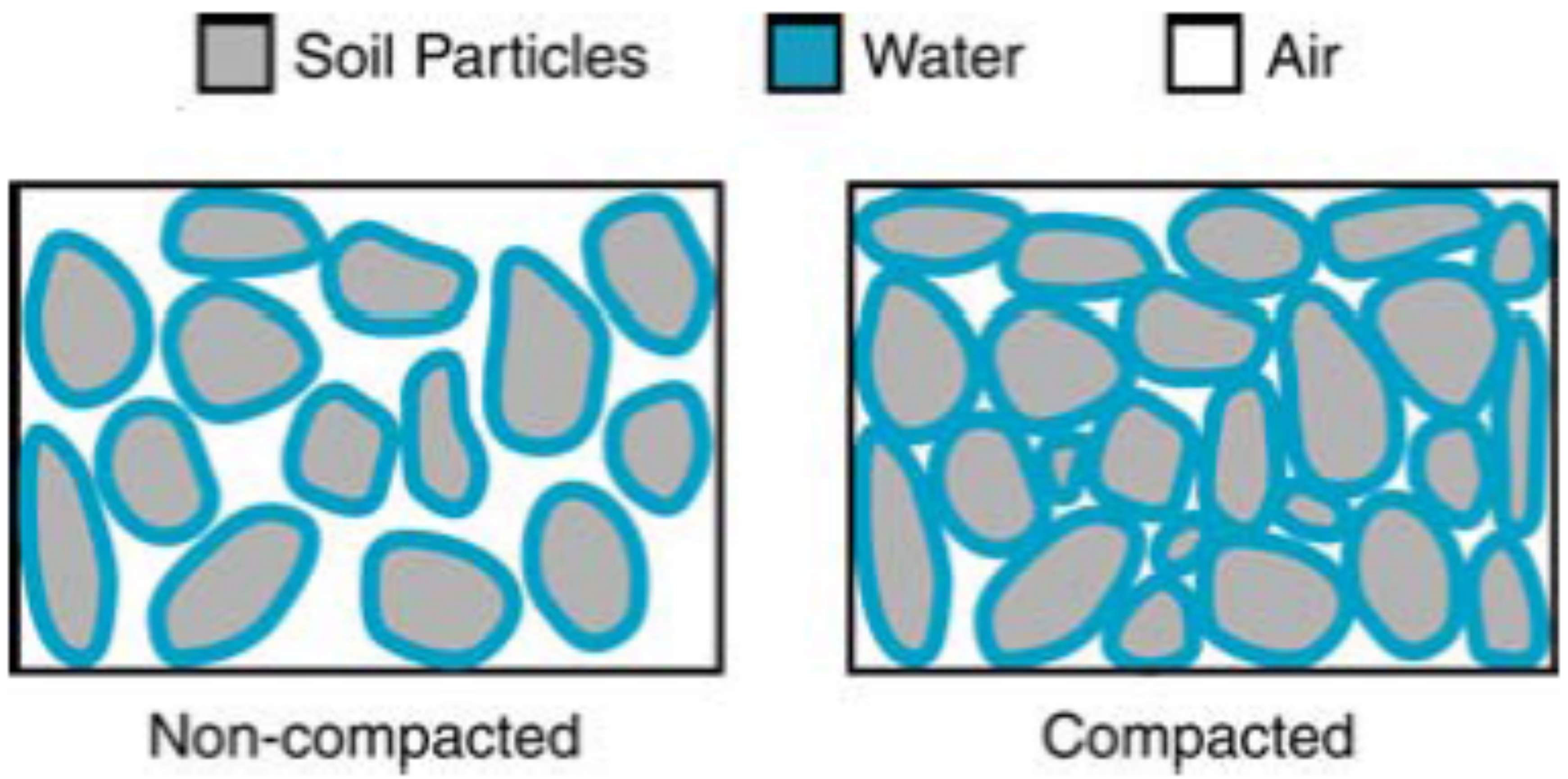
Here there was no nitrate present to inhibit transport of sugars from leaves to roots.

Slide Courtesy of Dr. Brian Horgan

NC STATE UNIVERSITY TURF PATHOLOGY



Compaction Increases Heat Capacity

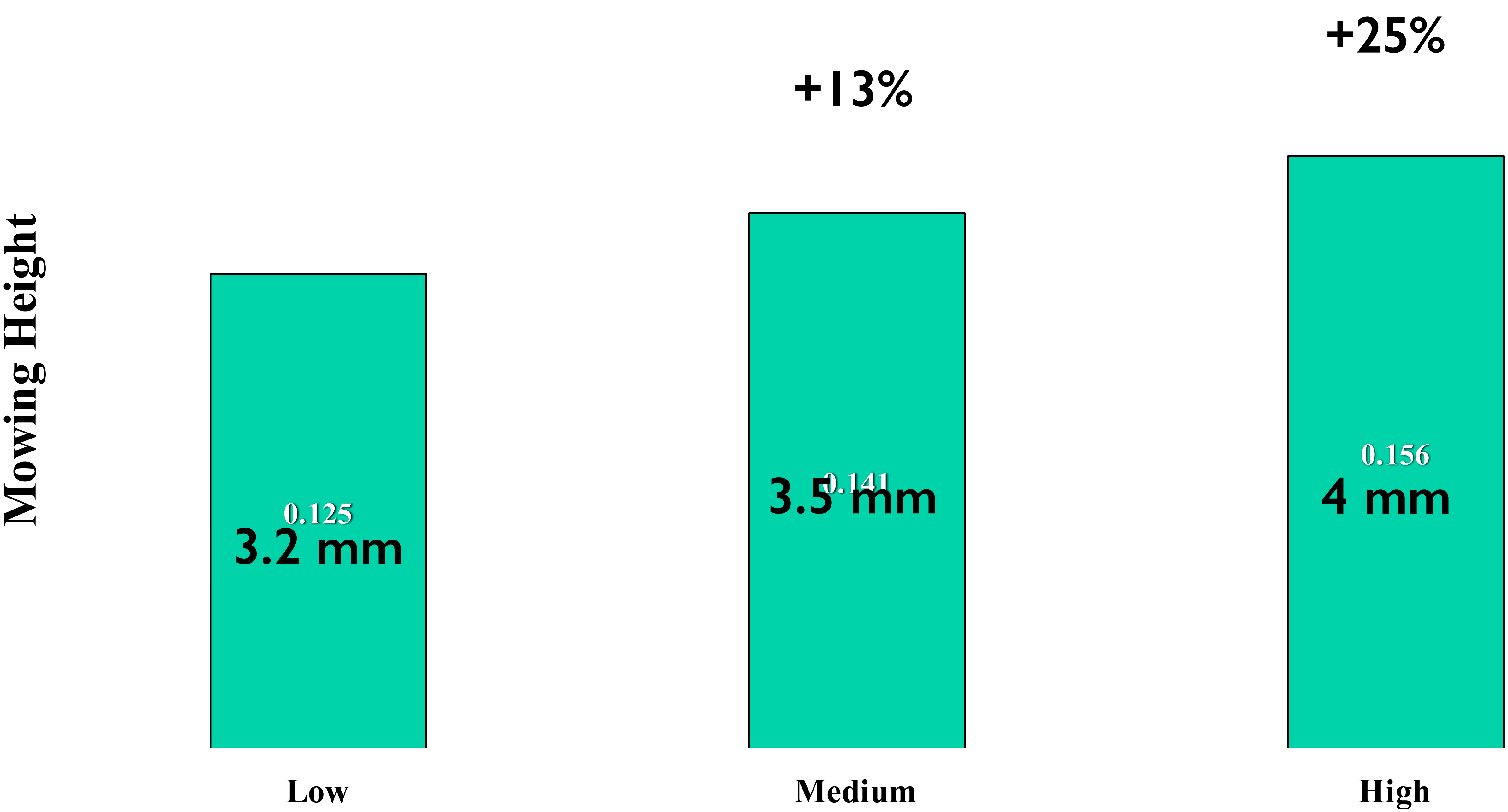


Venting and Aerification

- Golf Course Greens: Poke holes every three weeks
  - Increase surface gas exchange and drainage
    - Temperature moderation

- **Do not neglect annual aerification and/or topdressing**

Increasing Photosynthetic Potential



Courtesy Dr. Greg Bell, Ok State

Turfgrass quality on a creeping bentgrass putting green during summer heat stress, June – August, 2004.

	2004		
Treatment	June	July	August
Mowing	8.00AB	7.67AB	7.00CD
Mowing w/ rolling	8.00AB	7.5BC	6.67D
Alternating mowing w/ rolling	8.33A	8.17AB	8.00AB

Interaction means followed by the same letter are not significantly different according to LSD(0.05).

Slide Courtesy of Dr. John Sorochan

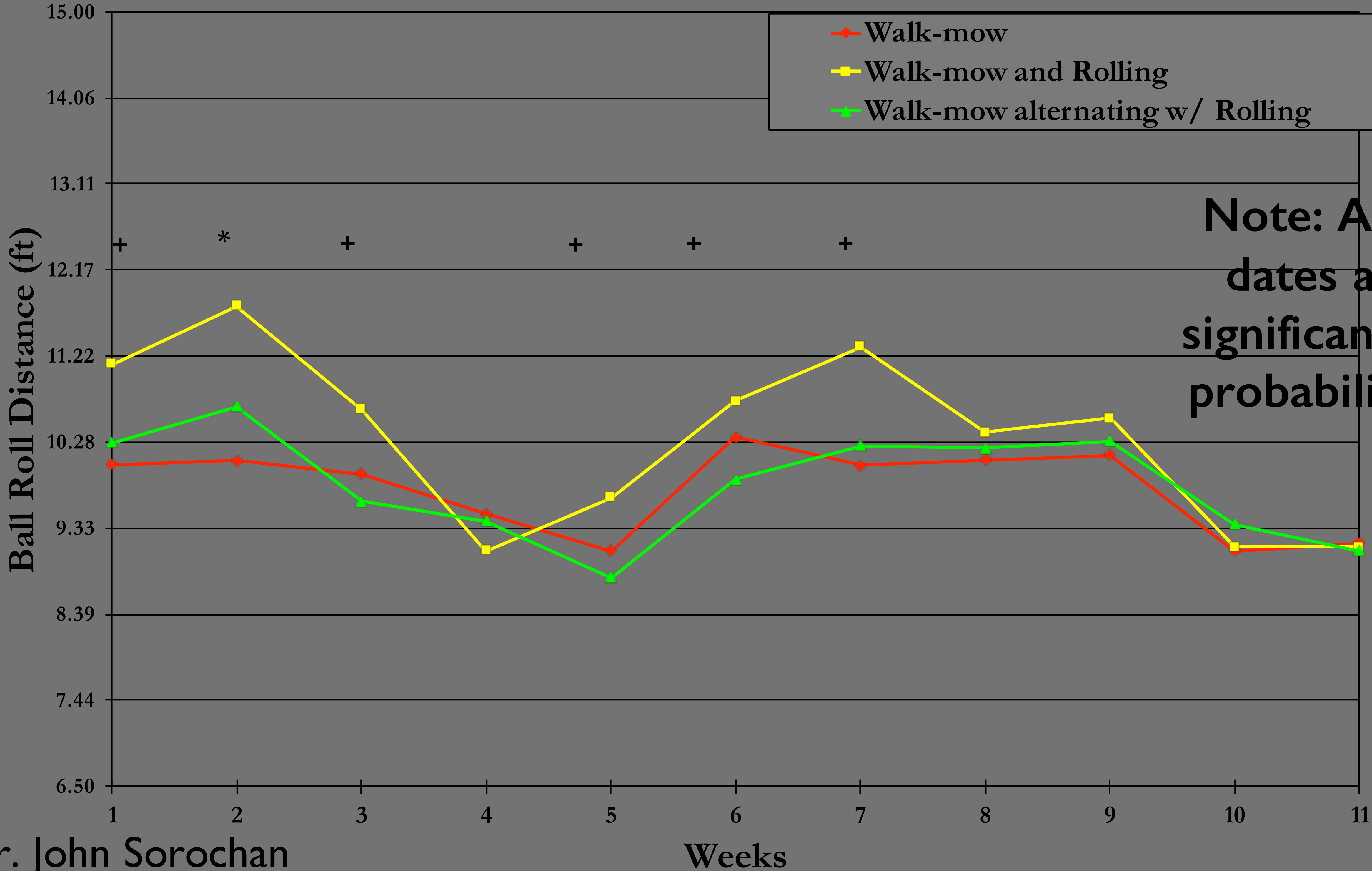
Turfgrass quality on a creeping bentgrass putting green during summer heat stress, June – August, 2005.

	2005		
Treatment	June	July	August
Mowing	7.00A	7.00A	6.00B
Mowing w/ rolling	7.00A	6.23B	5.43C
Alternating mowing w/ rolling	7.00A	7.00A	6.87A

Interaction means followed by the same letter are not significantly different according to LSD(0.05).

Slide Courtesy of Dr. John Sorochan

Treatment Effects for Green Speed: Knoxville, TN (1 June – 1 September 2006)



Note: All other dates are not significant at 0.05 probability level.

Dr. John Sorochan

Conclusions

Statistical differences are not realistic for ball roll distance.

Differences of 15 CM are not noticeable by the average golfer (Karcher et al., 2001).

Speed differences for treatments greater than 15 CM

- 4 of 37 collection dates for AMR compared to MOW

Slide Courtesy of Dr. John Sorochan

Conclusions

Superintendents should consider:

- Alternating mowing with rolling during periods of heat stress
    - Improve turfgrass quality
    - Maintain reasonable green speeds
- Potentially reduce costs?

Slide Courtesy of Dr. John Sorochan

Summary of Summer Stress Management

- Maximize carbohydrate reserves
  - Moderation of N (ammonium based)
  - Raise mowing height
  - Reduce mowing frequency
  - Syringing
  - Venting
  - Topdressing
  - Potentially fans

- Chemical applications

Research with Plant Growth Regulators

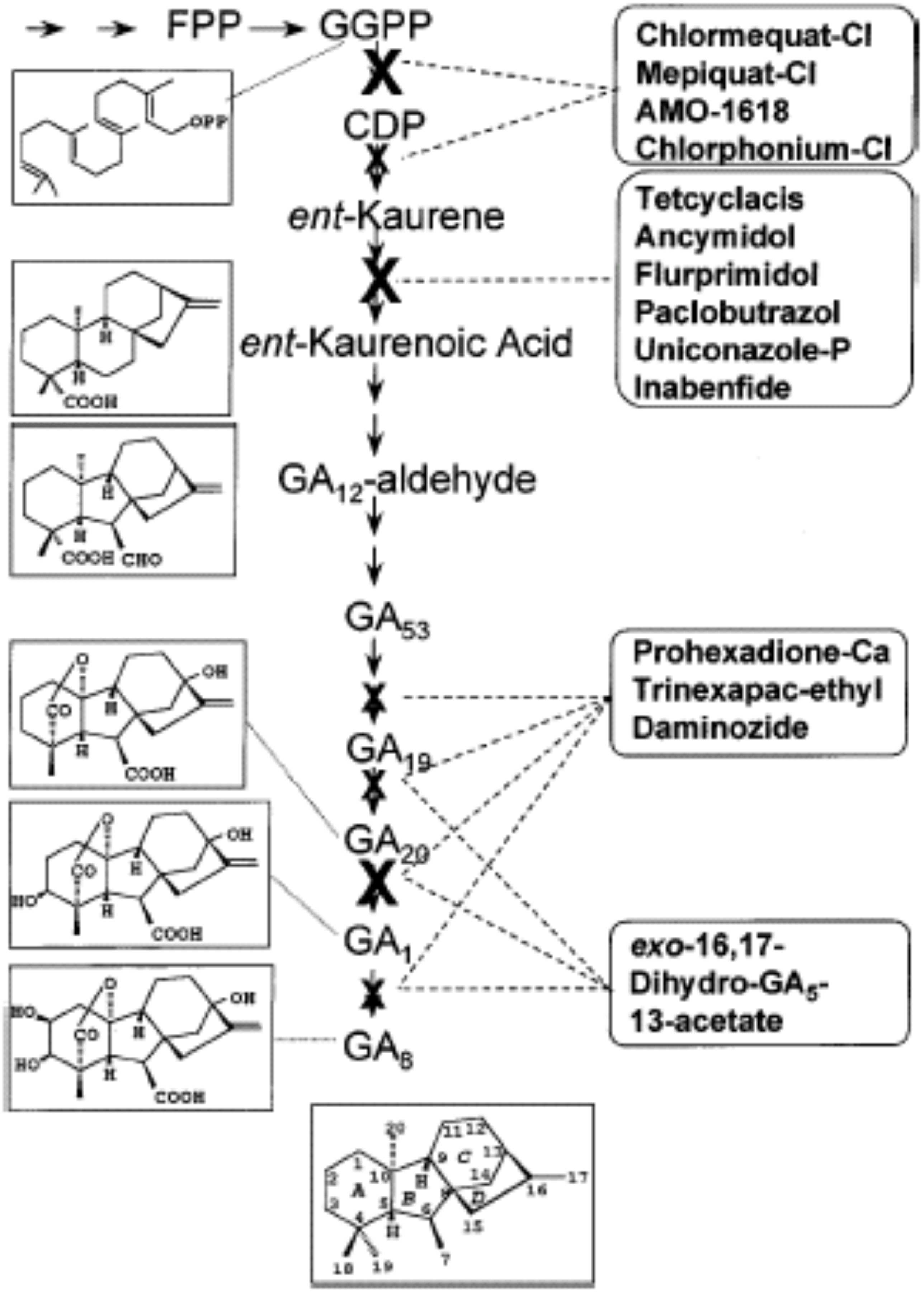


Figure 1 Simplified scheme of biosynthetic steps involved in GA biosynthesis and points of inhibition by plant growth retardants (**X**, **x** = major and minor activity, respectively). (See text for abbreviations.)


NON-TREATED
PRIMO 0.094
Primo 0.063
12 4 96


Primo Maxx 1EC
(0.125 oz/M)
Primo Maxx 1EC
(3 oz/a)
Application A: June12
Application E: July 12
Nontreated
Trimmit 2SC
(16 oz/a)
Application A: June12
Application E: July 12
Nontreated
Photo taken 8-7-07


Trimmit 2SC
(8 oz/a)
Primo Maxx 1EC
(0.125 oz/M)
Primo Maxx 1EC
(0.125 oz/M)
Primo Maxx 1EC
(0.125 oz/M)
Primo Maxx 0.06 kg ai/ha
every 4 wks
Photo taken 8-7-07, 56


Trimmit 2SC
(8 oz/a)
Primo Maxx 1EC
(0.125 oz/M)
Primo Maxx 1EC
(0.125 oz/M)
Primo Maxx 0.06 kg ai/ha
every 2 wks
Photo taken 8-7-07, 56


Proxy 21.7 SC
(5 fl oz/M)
Primo Maxx 1EC
(0.125 oz/M)
Primo Maxx 1EC
(3 oz/a)
Primo Maxx 0.06 kg ai/ha
every week
Photo taken 8-7-07, 56


PNC PARK
BUD LIGHT
PNC
GIANT EAGLE