

# Rolling and Dollar Spot

Understanding the Mechanisms  
Behind Decreased Disease  
Incidence and Lightweight  
Rolling on Putting Greens

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# Outline

- ▶ Introduction
- ▶ History
- ▶ Research Hypotheses
- ▶ Project background information
- ▶ Field research results
- ▶ Lab Experiment details
- ▶ Lab experiment results
- ▶ Conclusions

# Rollin', Rollin', Rollin'

- ▶ “From May until October each green should be rolled daily with a light roller”

Golf course architect, Journalist, and 3-time U.S. Amateur Champion, Walter Travis, (1901). *Practical Golf*

- ▶ “I can not conceive how a perfect putting surface can be developed or maintained without rolling.”

Former Vice President of the USGA, Dr. W.S. Harban, (1922).

# History

- ▶ Historically, rolling has been used to:
  - ▶ Improve surface uniformity
  - ▶ Increase ball roll distance (green speed)



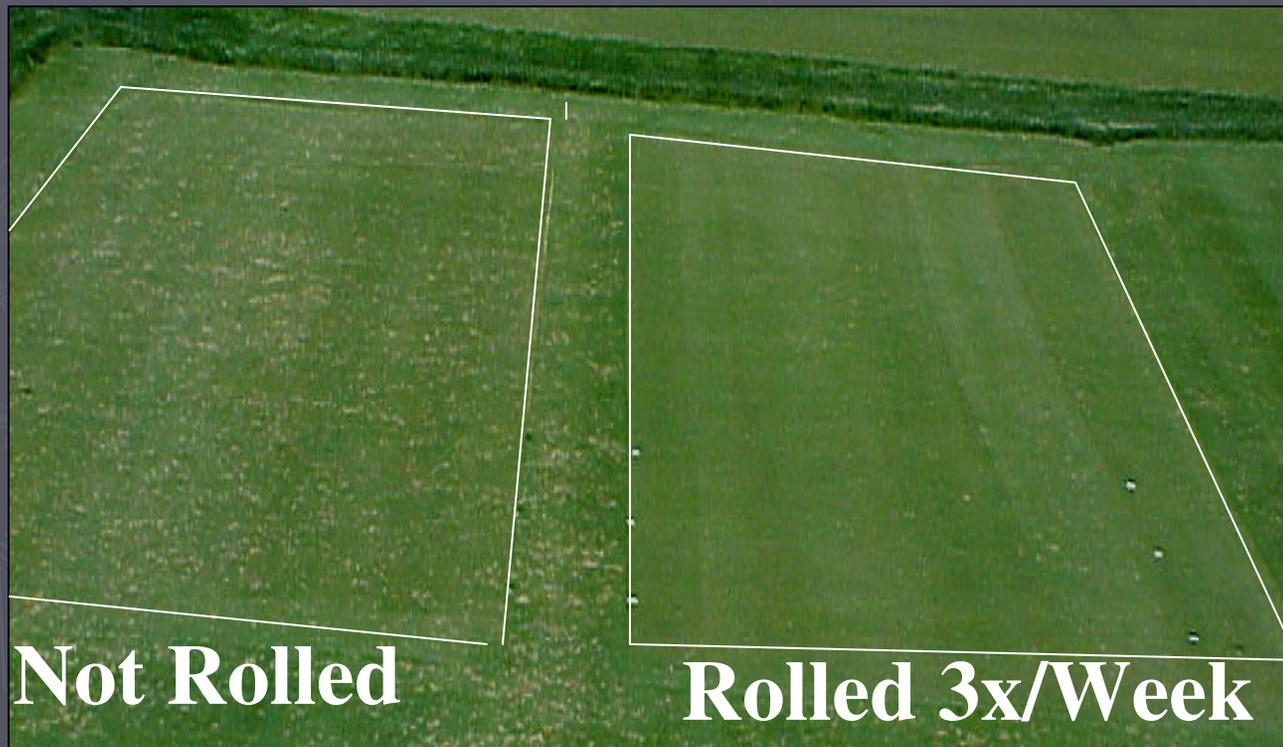
# Problems...

“So we also need to investigate the potential for **aboveground problems associated with continual season-long turf rolling**. For example, does regular rolling have any direct negative effect on turfgrass plants? Does the repeated pressure subtly crush tissues? **Will pathogens invade crushed tissues, leading to diseased turf?**”

Dr. J.B. Beard, (1994)

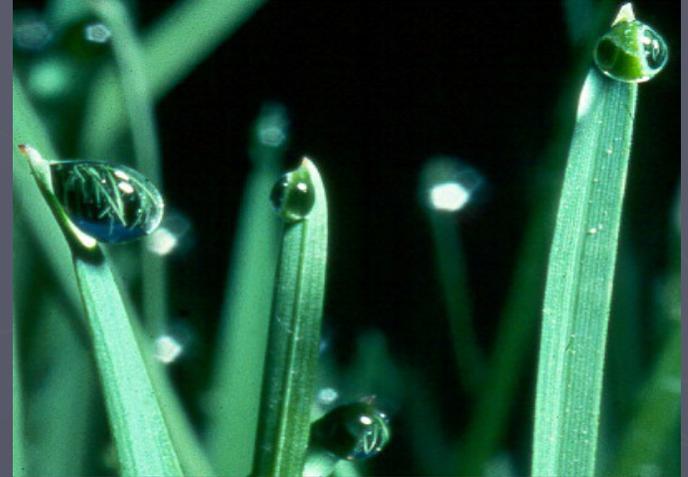
# More Recently...

- ▶ Nikolai *et al.* found that rolling 3x per week significantly decreased dollar spot incidence



# Hypotheses

- ▶ Rolling plays a part in Dew/Guttation removal
- ▶ Rolling is having an effect on microbial activities



# Background

- ▶ USGA Green Mix
- ▶ “*Independence*” creeping bentgrass/~20% annual bluegrass
- ▶ Rolled with Tru-Turf R52-11T greens roller
- ▶ Hand mowed 6 days/wk @ 0.156” (3.96mm)
- ▶ NO FUNGICIDES
- ▶ All other inputs kept constant among treatments



# Treatments

- ▶ Control (not rolled)
- ▶ Rolled once in the A.M.\*
- ▶ Rolled once in the P.M.\*
- ▶ Rolled twice in the A.M.\*

\* 5 days/wk for duration of study, set up in a randomized block design with 3 replications

# Rolling

- ▶ June – October in 2008 and 2009
- ▶ Dollar spot ratings were taken on a regular basis when disease symptoms were present
- ▶ Quality ratings, % VWC, and clipping/soil samples were taken as needed

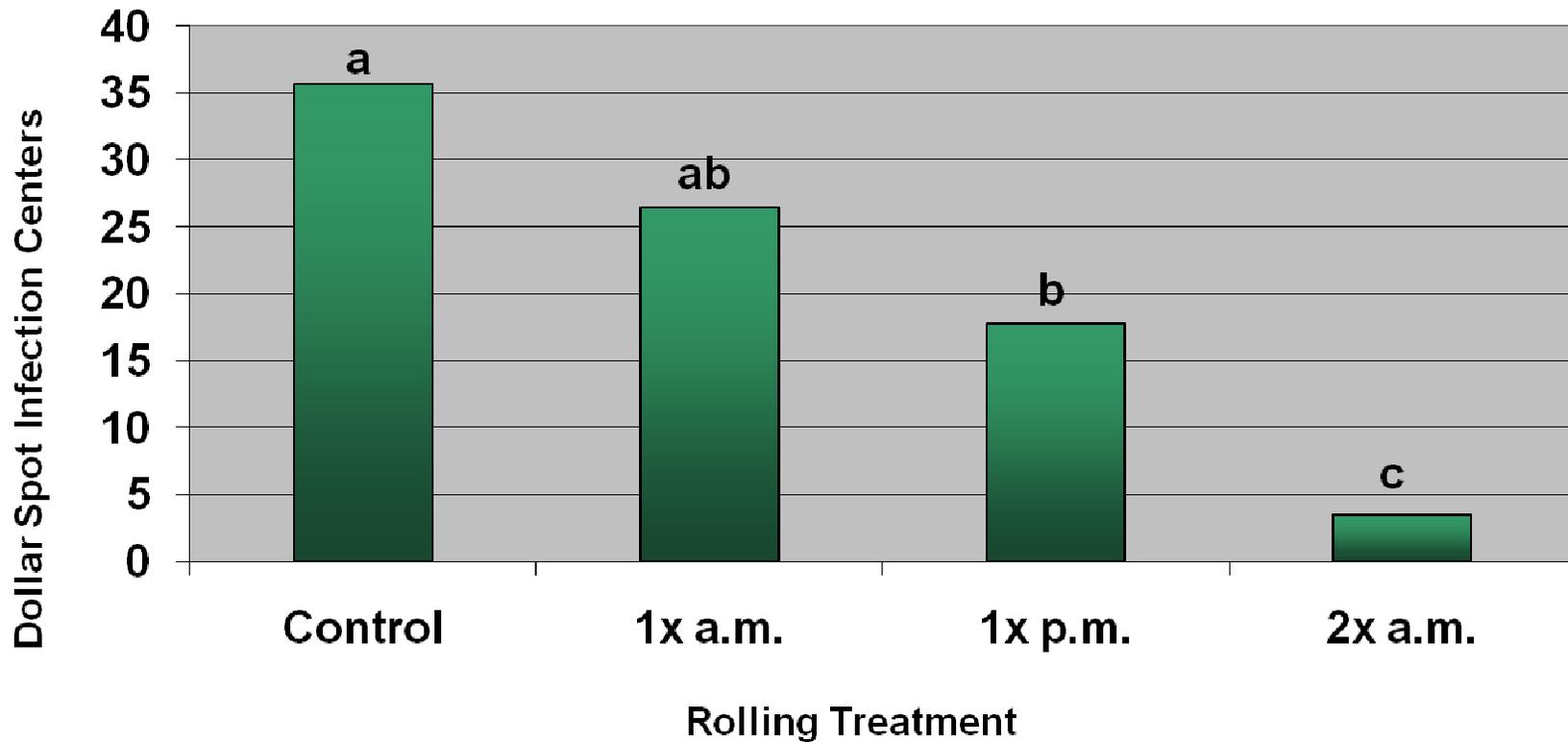
# Hypothesis I

- ▶ Dew and guttation fluid provide nutrient rich food source for the dollar spot fungus.
- ▶ Rolling (typically in the morning) removes excess dew and guttation fluid.
- ▶ Removal/dispersal of this fluid limits the pathogen's proliferation.

# To test this hypothesis...

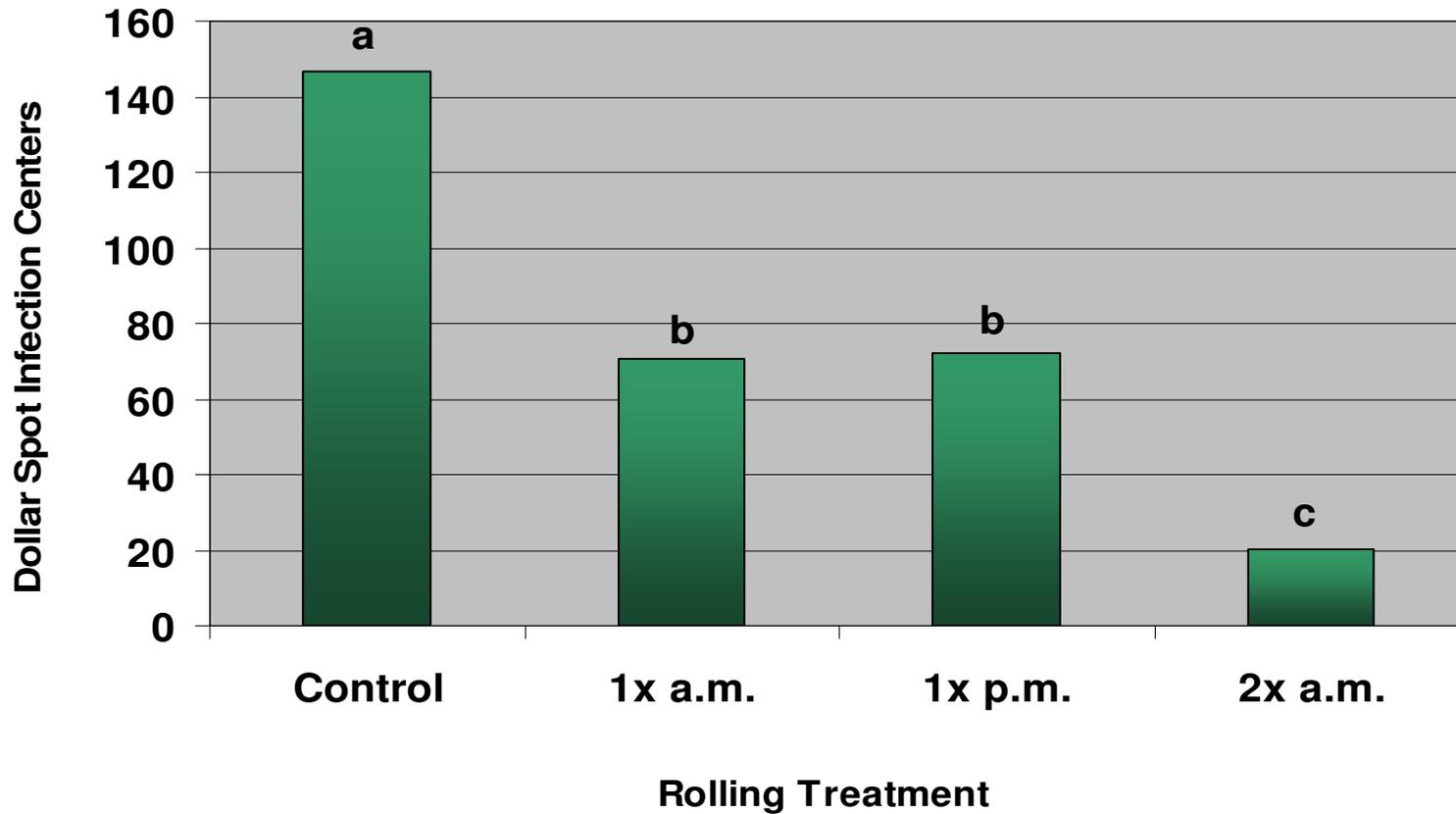
- Rolled in the morning while dew was present
- Rolled in the afternoon, after dew dissipated

# Dollar Spot 2008



Treatment means followed by the same letter are not significantly different according to Fischer's LSD ( $p < 0.05$ ).

# Dollar Spot 2009



Treatment means followed by the same letter are not significantly different according to Fischer's LSD ( $p < 0.05$ ).

**Slide 14**

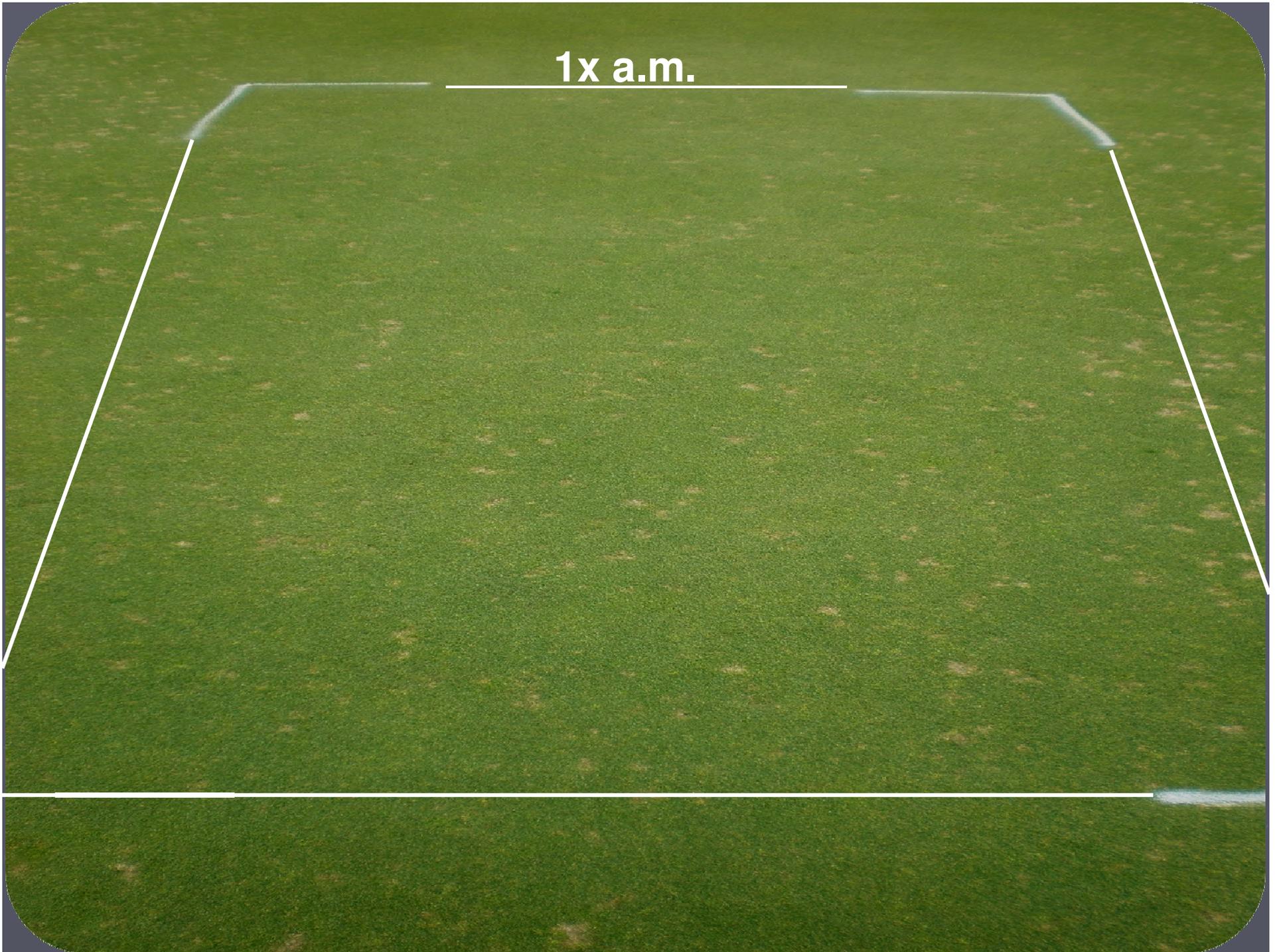
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**v1**

Greater differences between the control and rolling treatments.

vargaslabpaul, 12/22/2009

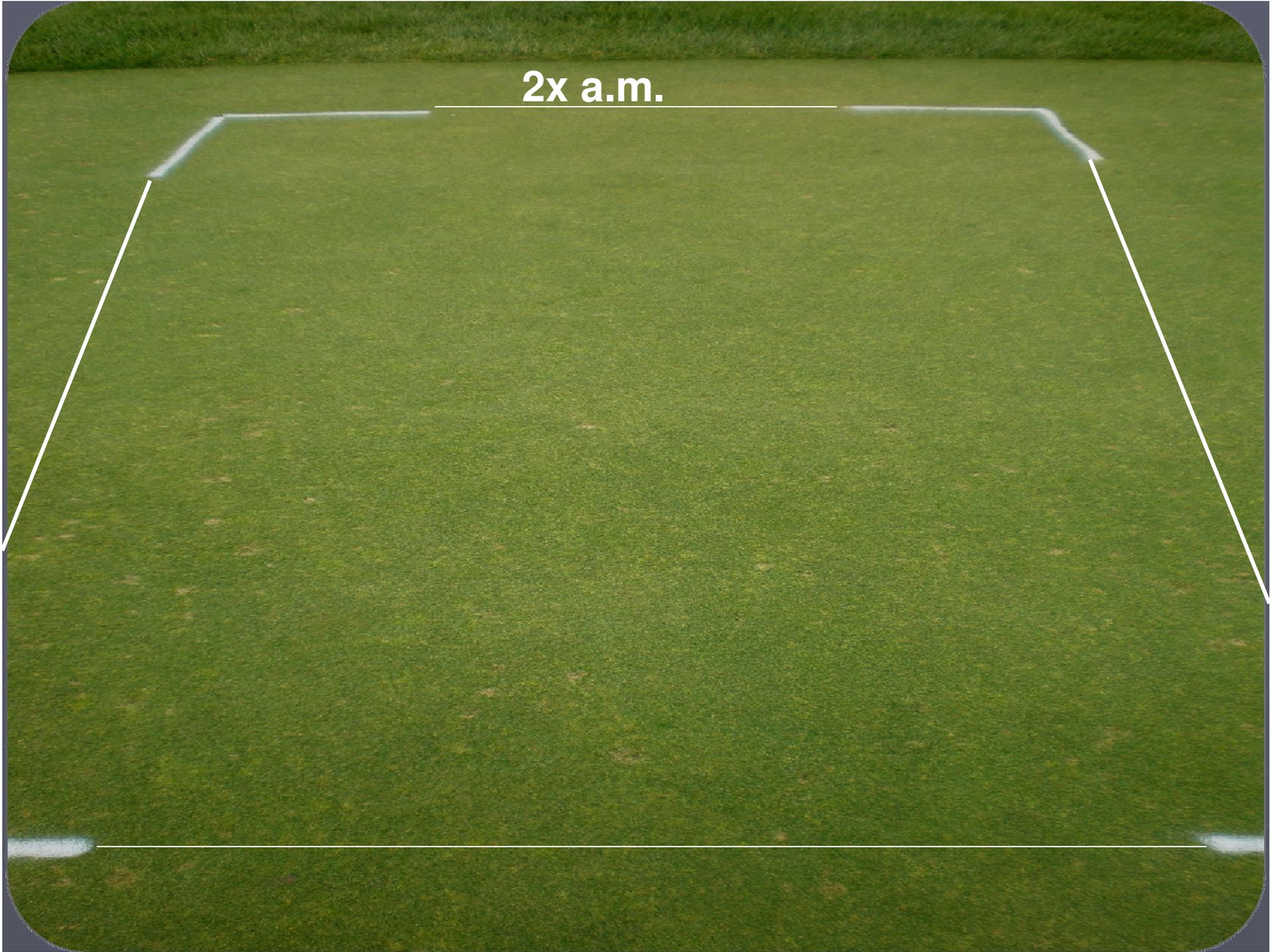
1x a.m.



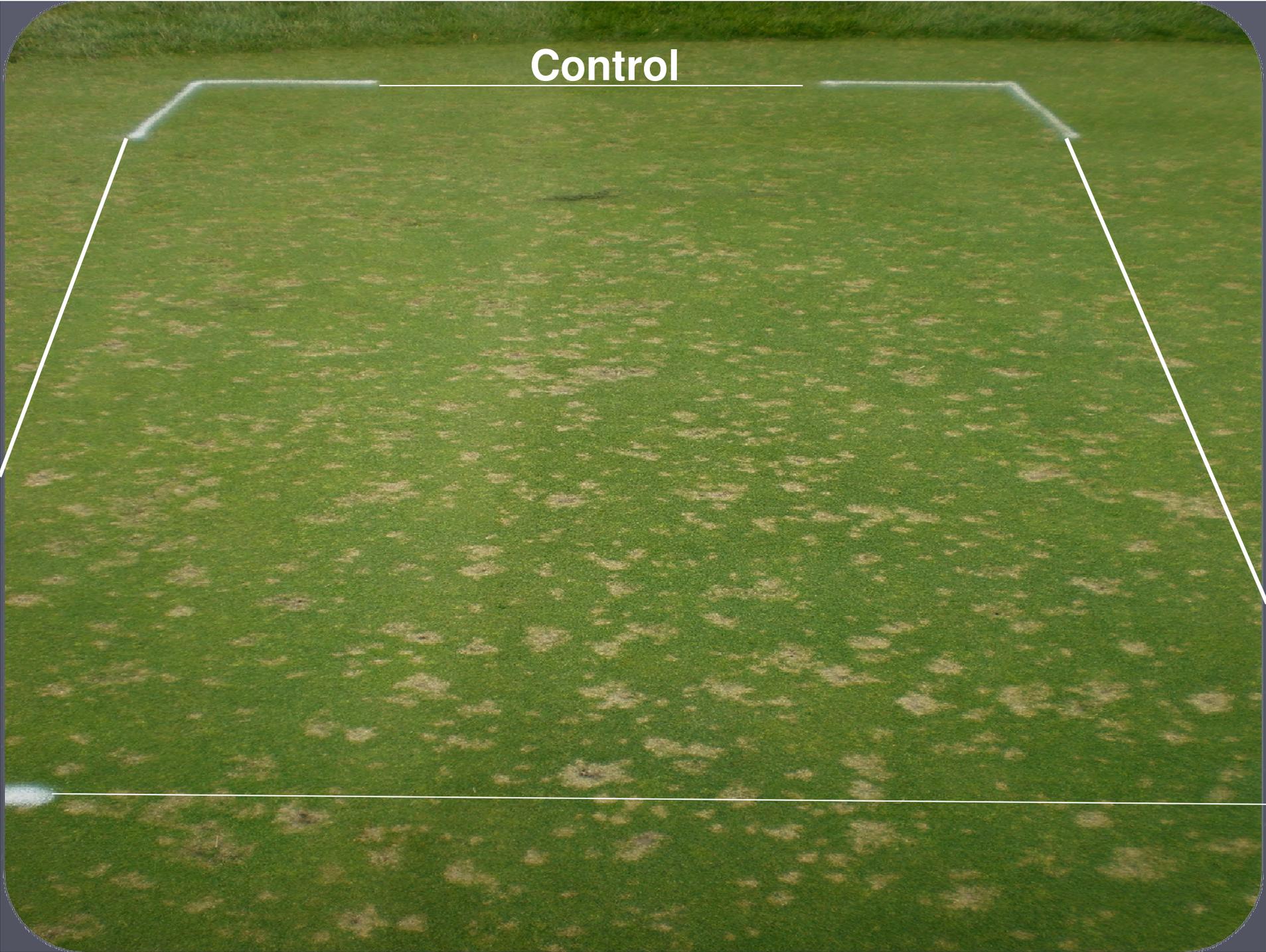
1x p.m.

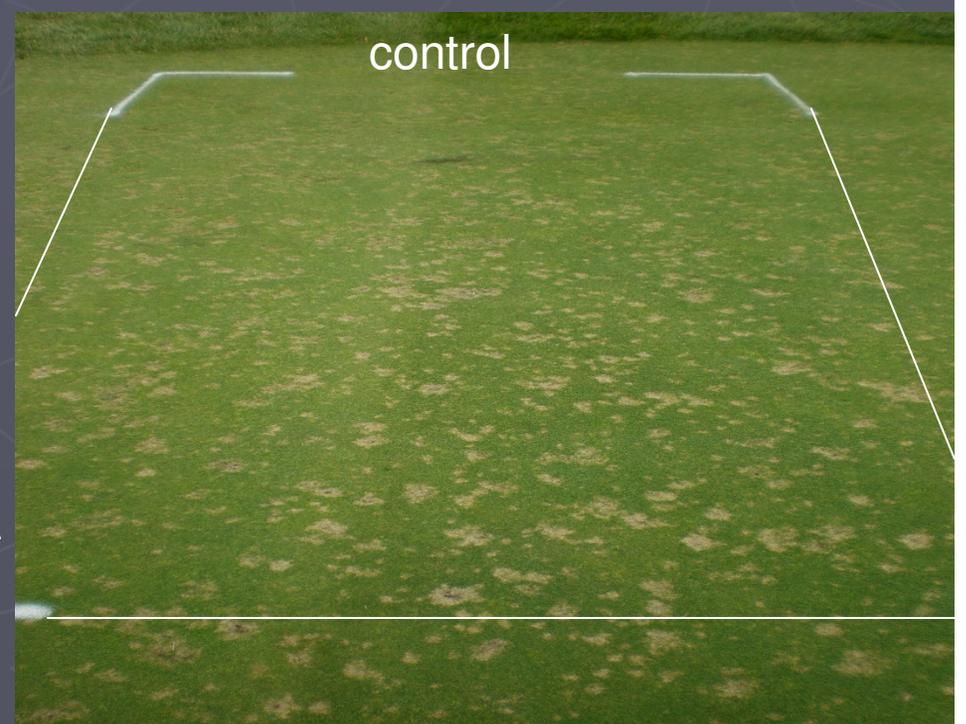
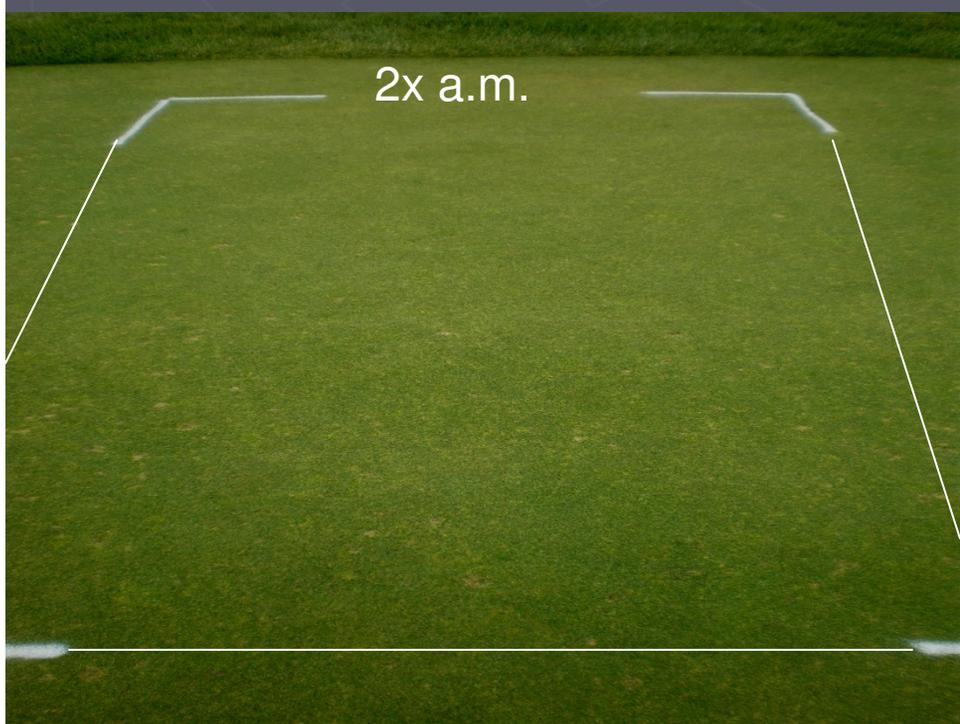
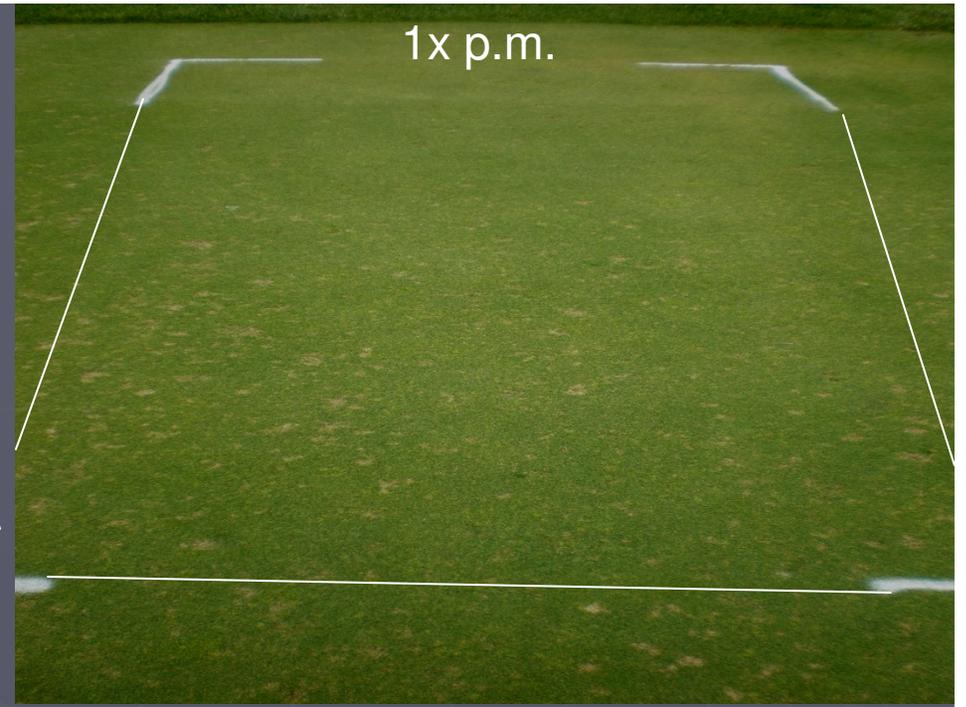
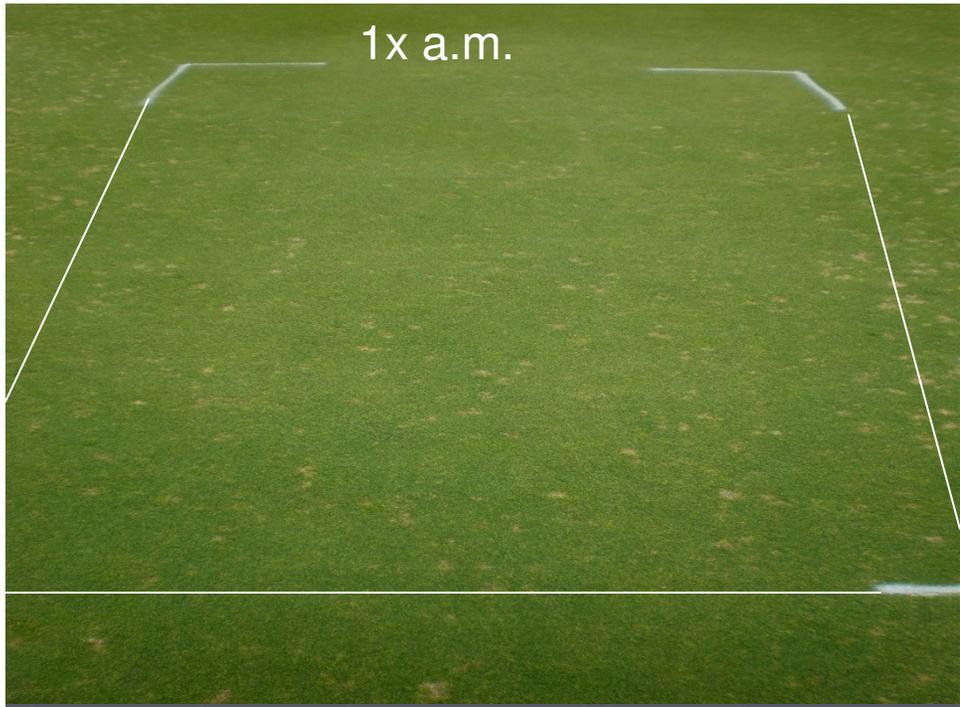


2x a.m.

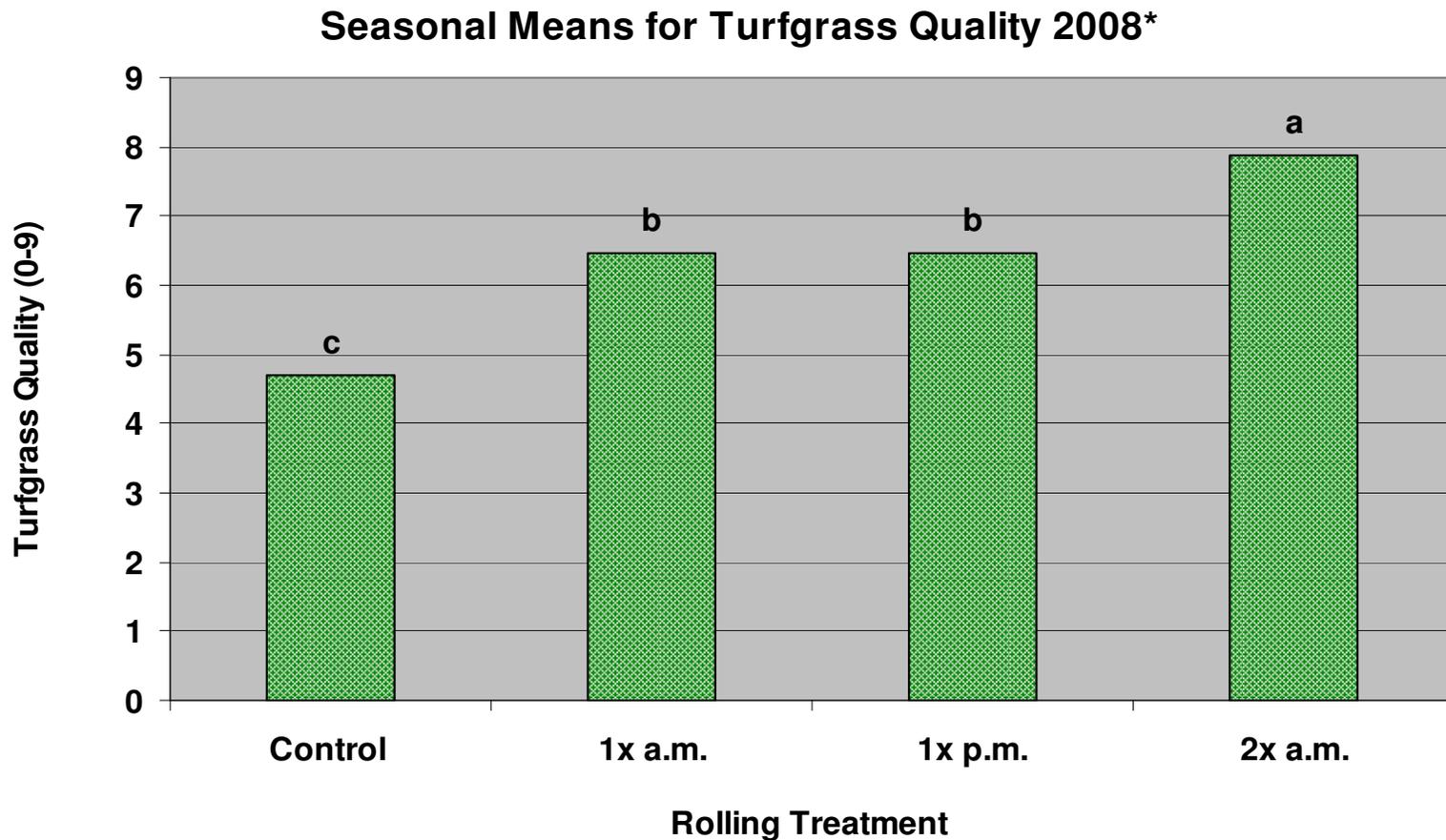


**Control**



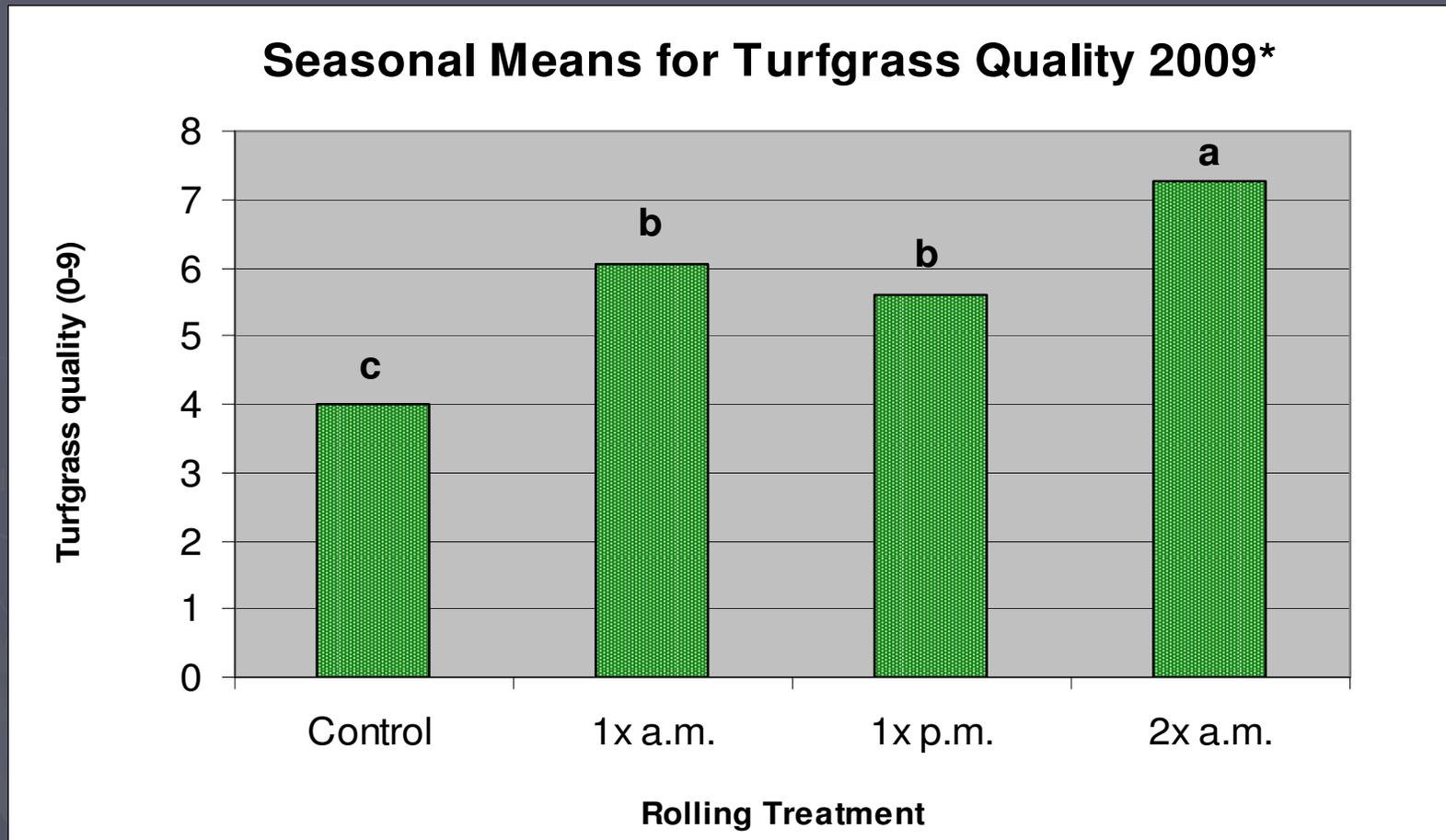


# Turfgrass Quality 2008



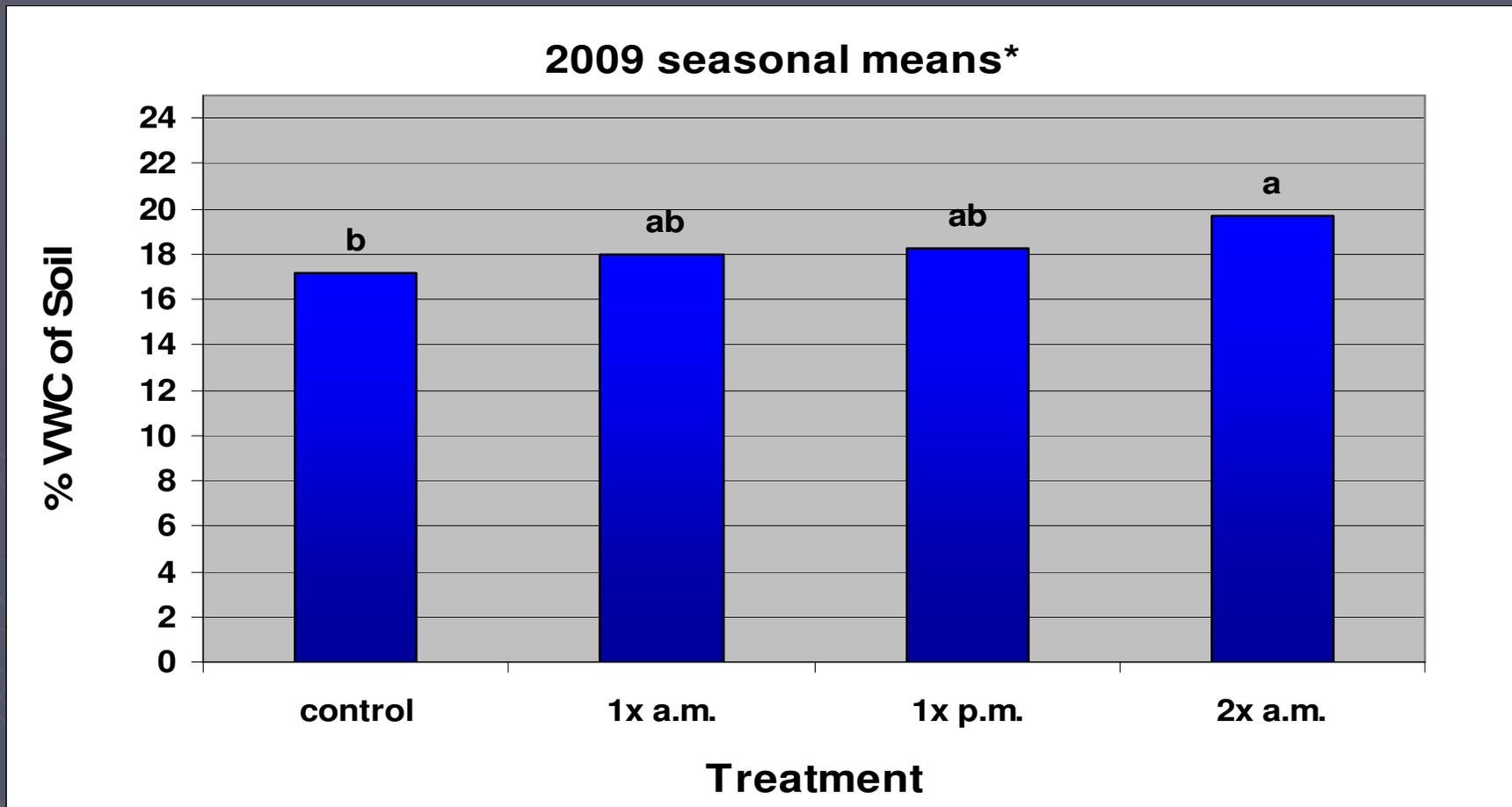
\*Based on a 0-9 rating scale, 0=dead turf, 9=excellent turf. A rating of 6 or higher indicates acceptable putting green quality. Means followed by the same letter are not significant according to LSD ( $p < 0.05$ ).

# Turfgrass Quality 2009



\*Based on a 0-9 rating scale, 0=dead turf, 9=excellent turf. A rating of 6 or higher indicates acceptable putting green quality. Means followed by the same letter are not significant according to LSD ( $p < 0.05$ ).

# Volumetric Water Content



\*Means of 4 ratings from 2009. Each plot %VWC was an average of 20 random readings taken on each plot at a depth of 1/2". Differences according to Fisher's LSD ( $p < 0.05$ )

# Results and Conclusions

- ▶ p.m. Rolling (after dew/guttation has dissipated), resulted in significant dollar spot reductions compared to control.
- ▶ 1x a.m. treatment was NOT different from 1x p.m.
- ▶ This suggests dew/guttation removal may not be the underlying mechanism in dollar spot reduction.

# Results and Conclusions

- ▶ Rolling (2x/day) resulted in an increase in % VWC in top ½” of soil compared to the control.
- ▶ Rolling 2x/day resulted in lower seasonal dollar spot incidence than all other treatments.
- ▶ Rolling 5 days/week regardless of the treatment, decreased seasonal dollar spot and increased turfgrass quality ratings compared to the control.

# Hypothesis II

- ▶ Regular lightweight rolling is having an affect on soil %VWC as well as microbial population dynamics in the upper root zone.
- ▶ Many soil bacteria contain known antifungal activity.
- ▶ Rolling ultimately could be having an effect on pathogen populations by promoting...
  - Competition
  - Antagonism
  - Direct inhibition (parasitism)
  - Induced resistance

# Bacterial Biological Control

## Bacterial Species

### Pseudomonas spp.

- P. aerofaciens*
- P. aeruginosa*
- P. fluorescens*
- P. lambergii*
- P. putida-fluorescens*
- Other *Pseudomonas* spp.

- Dollar spot
- Take all patch
- Pythium spp.
- Summer patch
- Brown patch
- Fusarium spp.
- Leaf spot

- Enterobacter cloacae*

- Dollar spot
- Pythium
- Summer patch

- Xanthomonas maltophilia*
- X. campestris*

- Summer patch
- Leaf blight

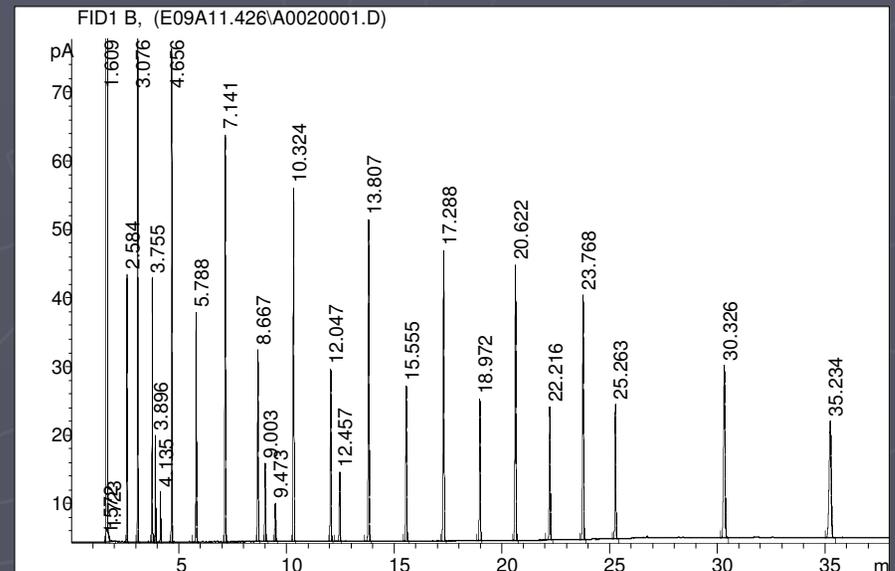
- Serratia marcescens*
- Serratia* spp.
- Streptomyces* spp.
- Bacillus* spp.
- PGPR

- Dollar spot
- Spring leaf spot
- Brown patch
- Pythium
- Summer patch

## Diseases Controlled

# Microbial Analysis

- ▶ Soil cores (20 cores) taken at a depth of 1” from each plot were homogenized to get a representative root zone sample for each plot.
- ▶ Cores were prepped and sent for phospholipid fatty acid (PLFA) analysis.

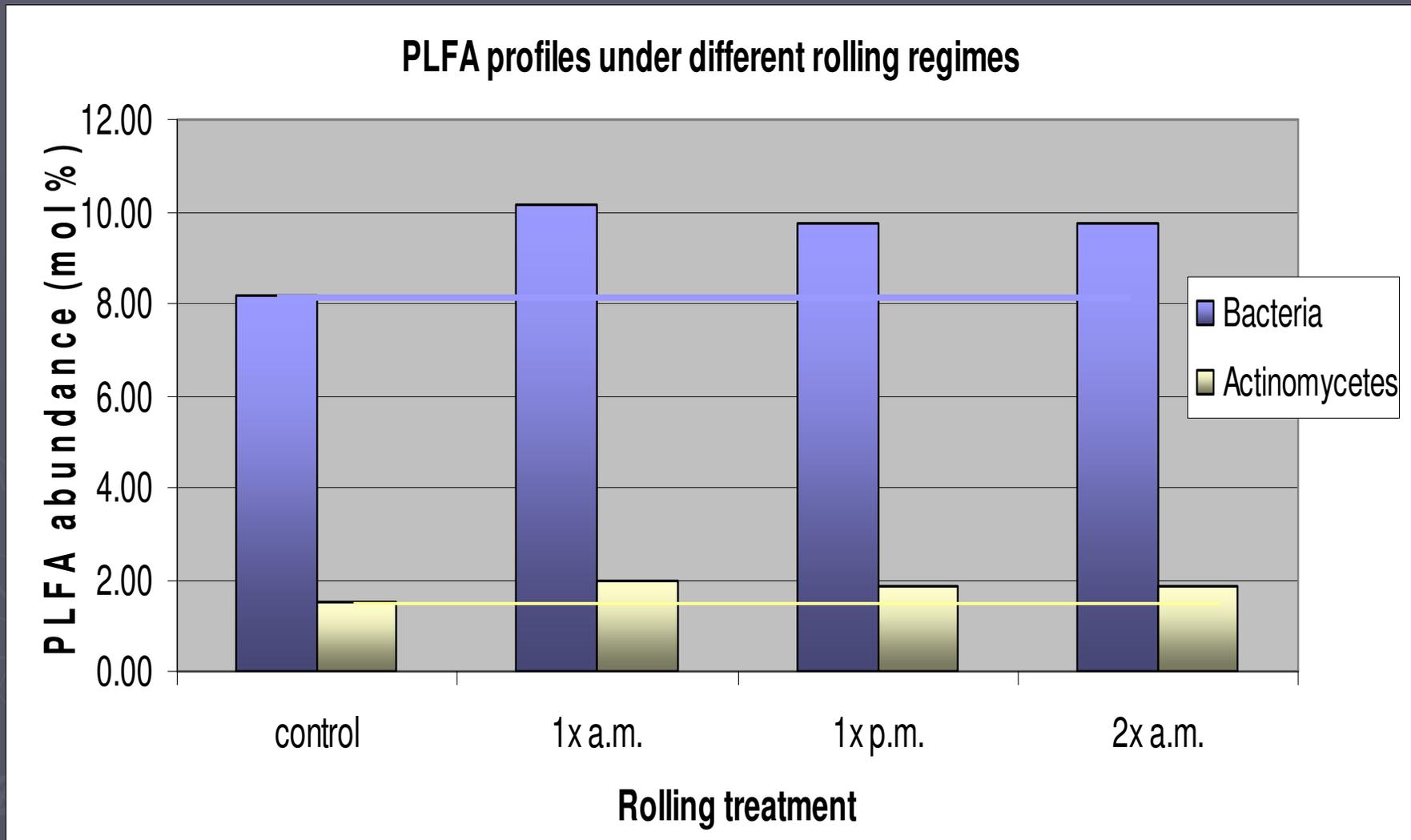


# PLFA analysis

- ▶ Extracts key fatty acids from soil samples
- ▶ Can separate bacteria, fungi, actinomycetes etc.
- ▶ By measuring the relative abundance in soil samples, a general “fingerprint” of microbial activity can be obtained.

v2

# PLFA Groups



Groupings according to Bossio et al; Myers et al; Vestal and White; and Turpeinen et al.

## Slide 29

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v2

based on results, the lipid abundance indicates a trend towards more bacteria in rolled plots than the control  
vargaslabpaul, 12/22/2009

# Conclusions

- ▶ PLFA groupings show a trend towards higher bacterial proportions in rolled plots.

# Discussion

- ▶ Higher bacterial proportions in the rolled soil may be contributing to lower disease incidence.
- ▶ Further investigation of long term rolling effects on soil microbial activity must be done.
- ▶ This initial study has shown promising results regarding rolling and microbial populations.

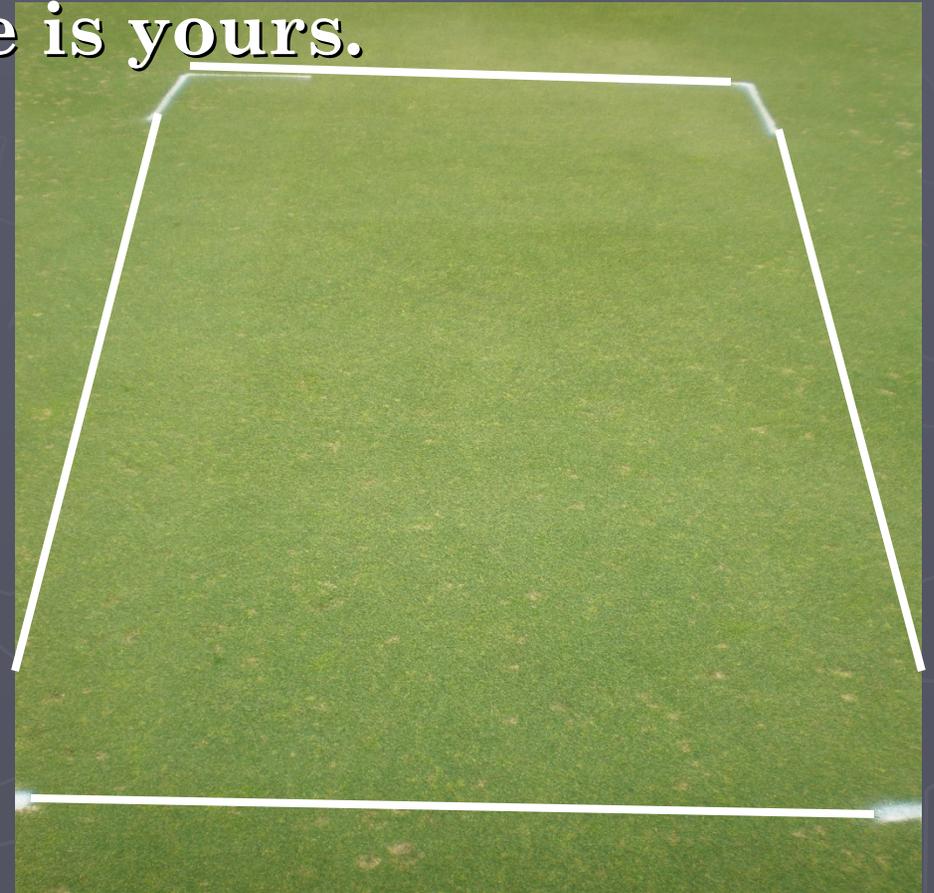
# Final Conclusions

- ▶ Dew/guttation removal is not the underlying factor in dollar spot reduction (1x p.m. treatment).
- ▶ Trends towards higher bacterial proportions in the rolled soils may be contributing to dollar spot reduction.

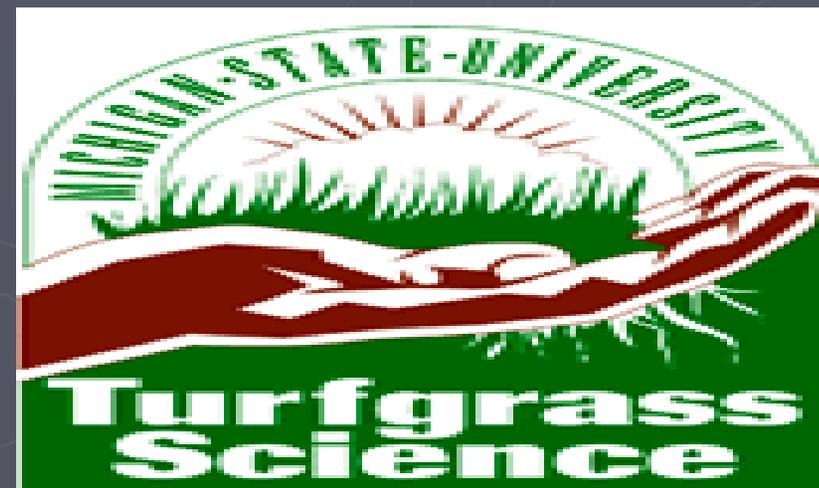
# Final Thought

- ▶ Rolling is a beneficial way of reducing dollar spot incidence on putting greens...

**The choice is yours.**



# Special Thanks



# Questions?

