

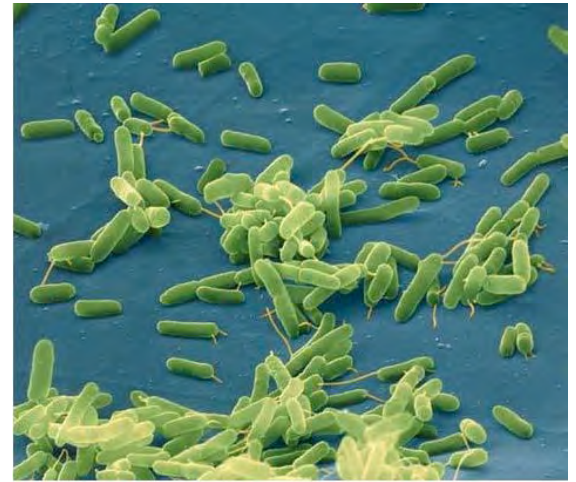
Bacterial Decline on Creeping Bentgrass—North & South Perspectives

Rick Latin, Ph.D., Professor of Plant
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Entomology, Soil and Plant Science,
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Characteristics of the bacterial decline of creeping bentgrass

“Not much is known about the association of bacteria with turf.”



To date, the search for a solution to the bacterial problem has produced...

- **lots of anecdotal information**
- **few plausible explanations**
- **no real solutions**

**R. Latin
Professor of Plant Pathology,
Purdue University**

Bacterial decline facts

- ✓ The new disease on creeping bentgrass caused by *Acidovorax* is different from the bacterial wilt of annual bluegrass caused by *Xanthomonas*.
- ✓ The *Acidovorax* disease occurs on creeping bentgrass – stressed CBG!
- ✓ Only a few turf pathology labs are prepared to readily identify the nature of bacterial pathogens on turf.
(NCSU, Clemson, URI, MSU, Purdue)
- ✓ No one has been able to isolate the pathogen **AND** inoculate CBG **AND** replicate **ALL** symptoms in the field.

Historical record of bacterial disease on turf

Disease and <i>Pathogen</i>	Turf host	Conditions associated with outbreak	Reference
Bacteria (associated)	CBG cv Toronto	Spring/Fall... Precip + cool nights	Roberts, et al., 1981
Bacterial Wilt <i>Xcg</i>	ABG	Not described	Roberts, et al., 1985
Bacterial Wilt <i>Xcampestris</i>	ABG	May/June... severity reduced w/dry conditions	Dernoeden, et al., 2003
Bacterial Wilt <i>Xtranslucens</i>	ABG	Warm/Wet for spread...heat drought for damage	Mitkowski, 2005
Bacterial Brown Stripe <i>Acidovorax</i>	CBG	Not described	Furuya., et al., 2009
Bacterial "Disease" <i>Acidovorax</i>	CBG	Hot, droughty conditions	Giordano, et al., 2010
Bacterial "Disease" <i>Acidovorax</i>	CBG	Summer stress conditions	2010-2012 Numerous observations
<i>Xcg</i> = <i>Xanthomonas campestris</i> subsp. <i>graminis</i>			

Bacterial decline of creeping bentgrass

Recent history

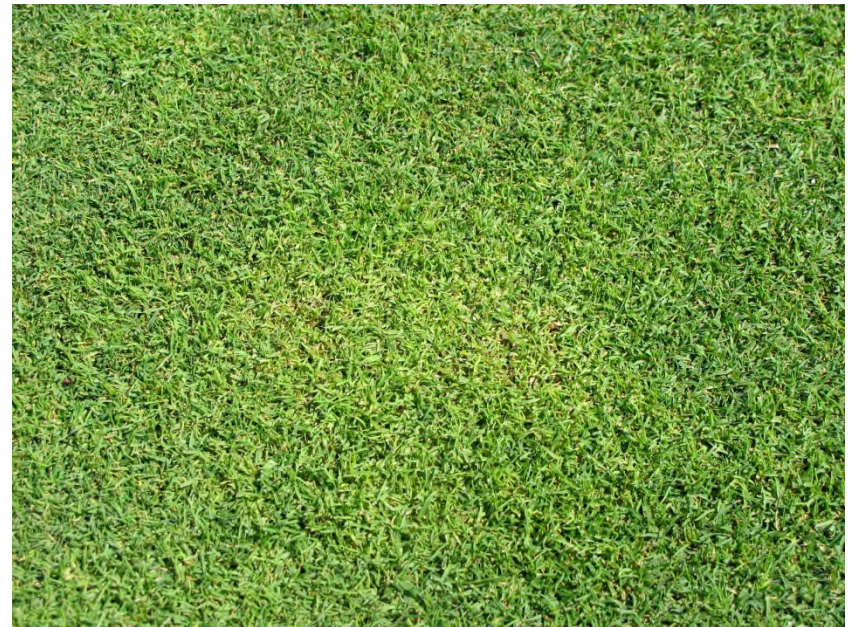
2009 - 2010

- damage observed at Quail Hollow CC in Charlotte, NC.
- fungal pathogens and abiotic factors eliminated
- Michigan State group isolates several bacteria

2011

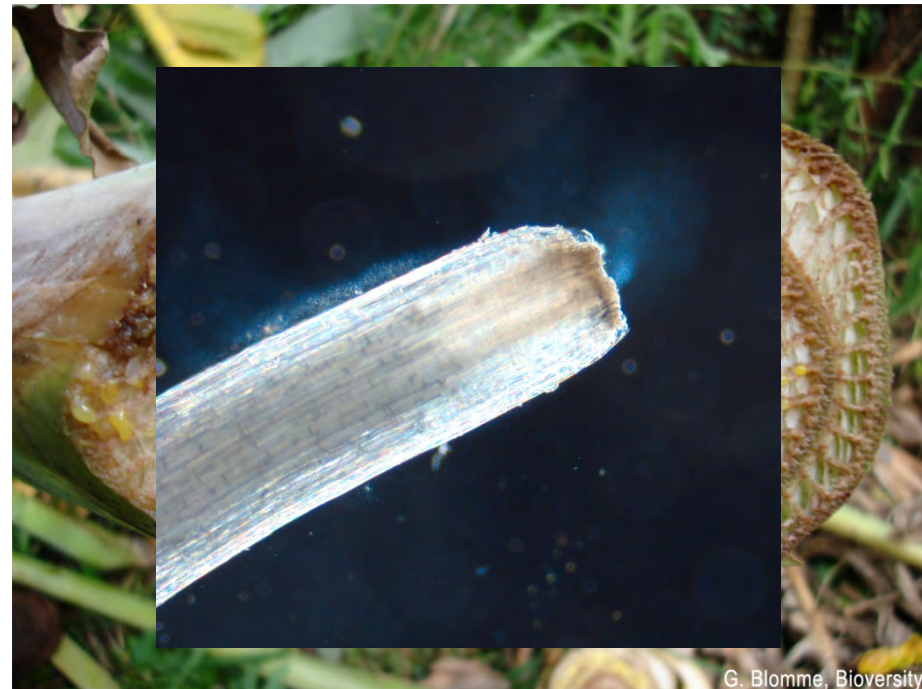
- although only a few cases were confirmed, there were 100's of “diagnoses” of a bacterial disease on CBG





D. Settle, CDGA

- **Chlorosis** is the only consistent symptom from field reports. Sometimes it progresses to **necrosis**. Sometimes it is associated with **etiolated tillers**. Sometimes there is a wilt symptom. Often, **bacterial streaming** can be observed.



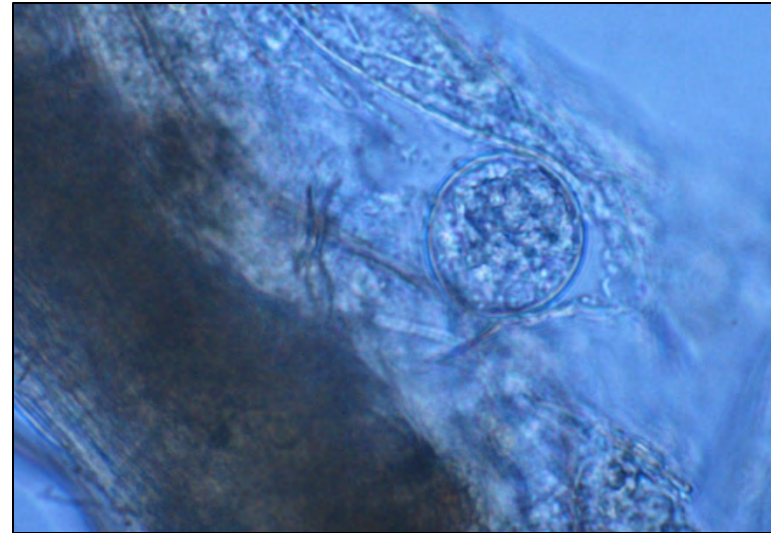
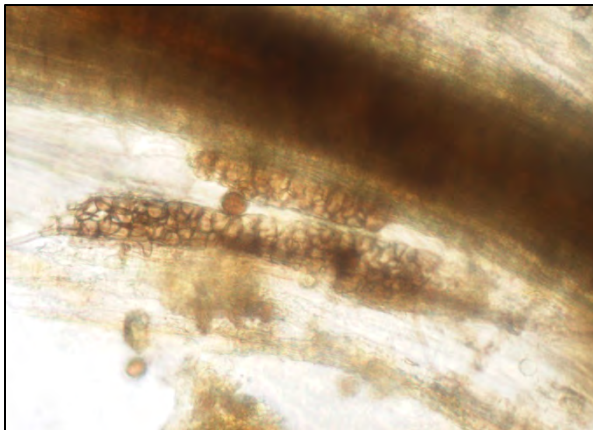
G. Blomme, Bioversity

Reports are almost exclusively from intensively maintained turf—very high profile golf courses. Maintenance of those putting greens is most aggressive. Tolerance to damage—even cosmetic changes in color—is extremely low.

Environmental stress is a significant component in all of the reports. 2010-2012 have been either hot or dry or both.

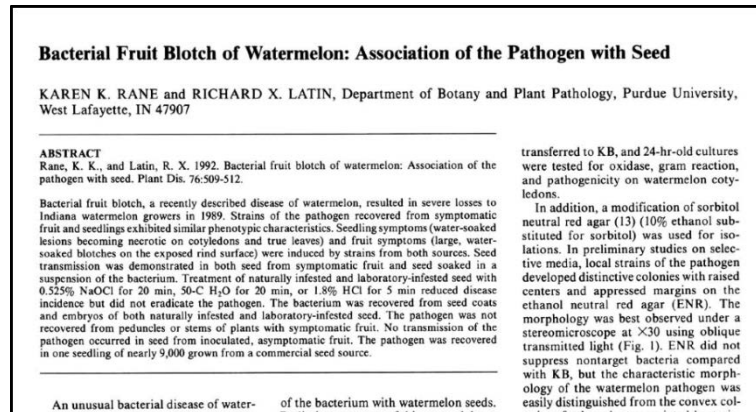


Suspicious samples often exhibit signs and symptoms of other disease problems.



How did Acidovorax come to reside on my putting green?

- a) Airborne bacteria were introduced with storms?
- b) Mechanical introductions...equipment, golfers shoes?
- c) Infested seed?
- d) It was always there?



Bacterial Fruit Blotch of Watermelon: Association of the Pathogen with Seed

KAREN K. RANE and RICHARD X. LATIN, Department of Botany and Plant Pathology, Purdue University, West Lafayette, IN 47907

ABSTRACT

Rane, K. K., and Latin, R. X. 1992. Bacterial fruit blotch of watermelon: Association of the pathogen with seed. Plant Dis. 76:509-512.

Bacterial fruit blotch, a recently described disease of watermelon, resulted in severe losses to Indiana watermelon growers in 1989. Strains of the pathogen recovered from symptomatic fruit and seedlings exhibited similar phenotypic characteristics. Seedling symptoms (water-soaked lesions becoming necrotic on cotyledons and true leaves) and fruit symptoms (large, water-soaked blotches on the exposed rind surface) were induced by strains from both sources. Seed transmission was demonstrated in both seed from symptomatic fruit and seed soaked in a suspension of the bacterium. Treatment of naturally infested and laboratory-infested seed with 0.525% NaOCl for 20 min, 50-C H₂O for 20 min, or 1.8% HCl for 5 min reduced disease incidence but did not eradicate the pathogen. The bacterium was recovered from seed coats and embryos of both naturally infested and laboratory-infested seed. The pathogen was not recovered from peduncles or stems of plants with symptomatic fruit. No transmission of the pathogen occurred in seed from inoculated, asymptomatic fruit. The pathogen was recovered in one seedling of nearly 9,000 grown from a commercial seed source.

transferred to KB, and 24-hr-old cultures were tested for oxidase, gram reaction, and pathogenicity on watermelon cotyledons.

In addition, a modification of sorbitol neutral red agar (13) (10% ethanol substituted for sorbitol) was used for isolations. In preliminary studies on selective media, local strains of the pathogen developed distinctive colonies with raised centers and appressed margins on the ethanol neutral red agar (ENR). The morphology was best observed under a stereomicroscope at $\times 30$ using oblique transmitted light (Fig. 1). ENR did not suppress *Rhizoglyphus* bacteria compared with KB, but the characteristic morphology of the watermelon pathogen was easily distinguished from the convex colonies of the plant-associated bacteria.

An unusual bacterial disease of watermelon was associated with the bacterium with watermelon seeds.

If the bacteria were always there, then why have I not seen it before 2010?

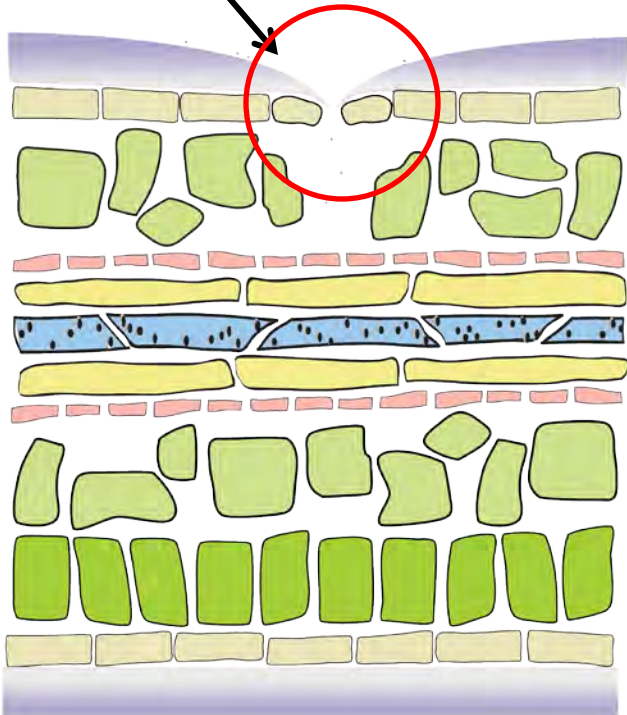
- **Other problems seemed to mask the presence of Acidovorax.**
- **Periodic changes in management practices made turf more vulnerable.**
- **Weather during the last three summers was unusual.**



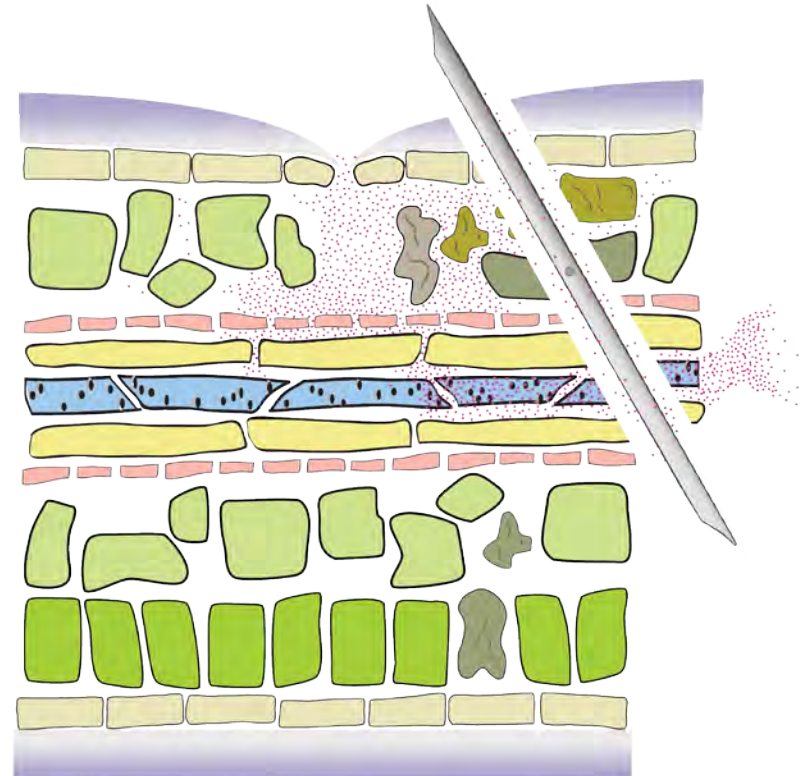
Bacteria behave differently than fungi

In most cases, bacteria and turf plants live in relative harmony...even when bacteria find their way into plant tissues through natural openings in leaf surfaces.

stomate



Bacteria may be spread by mowing...and by other mechanical operations that result in wounded leaf tissues.



There is no pattern (seed lot / cultivar) among cultivars to suggest seed transmission.

The presumption is that the pathogen is part of the natural environment.

There is only anecdotal evidence suggesting that the disease (or at least symptoms) occurred in the past -- (unreliable).

Disease is reported more frequently on a few modern cultivars. However, reports exist where more traditional cultivars are involved.

Disease is reported almost exclusively on turf maintained at greens height. However, we recently isolated Acidovorax from fairway height CBG.

Pre-disposing factors

Heat

Drought

Aggressive grooming

Mowing

Traffic

PGR?

N-stress

Root diseases

Other predisposing factors?



Bacteria Decline in Bentgrass – Southeast Perspectives

Bruce Martin, Ph.D.
Clemson University

Realities of Diagnostics

- Finding any particular pathogen does not necessarily show cause and effect
- Biology is complex, but remember the disease triangle: host, pathogen, and environment interactions result in disease
- In golf turf, environment effects... both man-made and natural, are extremely important to recognize
- Acidovorax and other bacteria pathogens require years of focused research before their role in bentgrass decline is elucidated

Realities of Diagnostics and Bentgrass Management

- Recent problems with decline associated with bacteria have occurred in years of RECORD BREAKING heat
- Problems have been mostly associated with high-budget courses with high demands
- Besides the environmental stress, we have reduced cutting heights, increased PGRs, reduced fertility, etc.
- ‘More’ in the case of inputs does not necessarily equate to ‘Better’

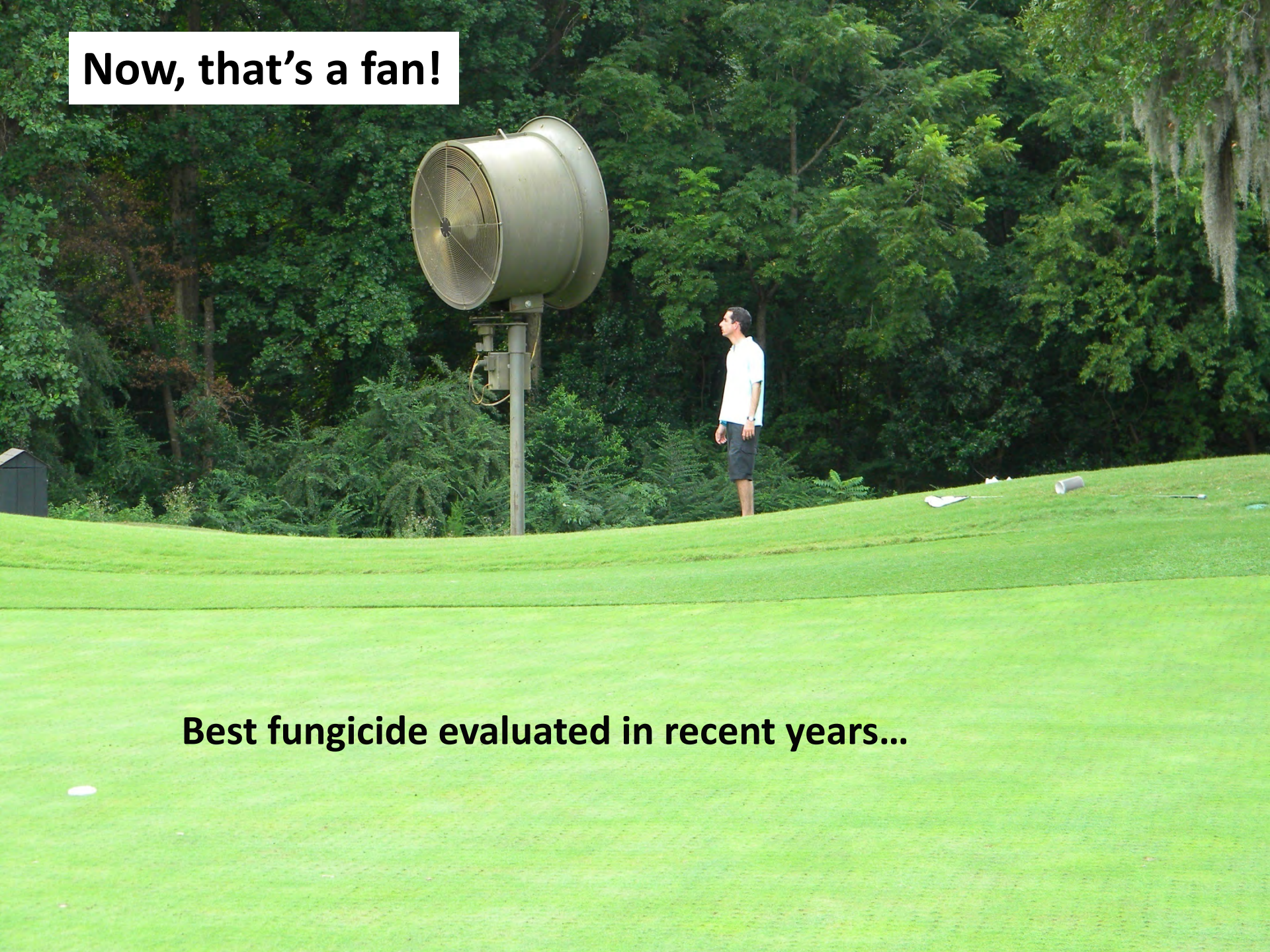
So, what do we do?

- Try to stop the bleeding – evaluate practices and products that may help
- Continue to attempt to reproduce the symptoms in the field
- Avoid throwing \$ at the problem as a ‘management’ practice
- Remember the fundamentals of bentgrass plant physiology in heat stress environments

Not much of a fan....

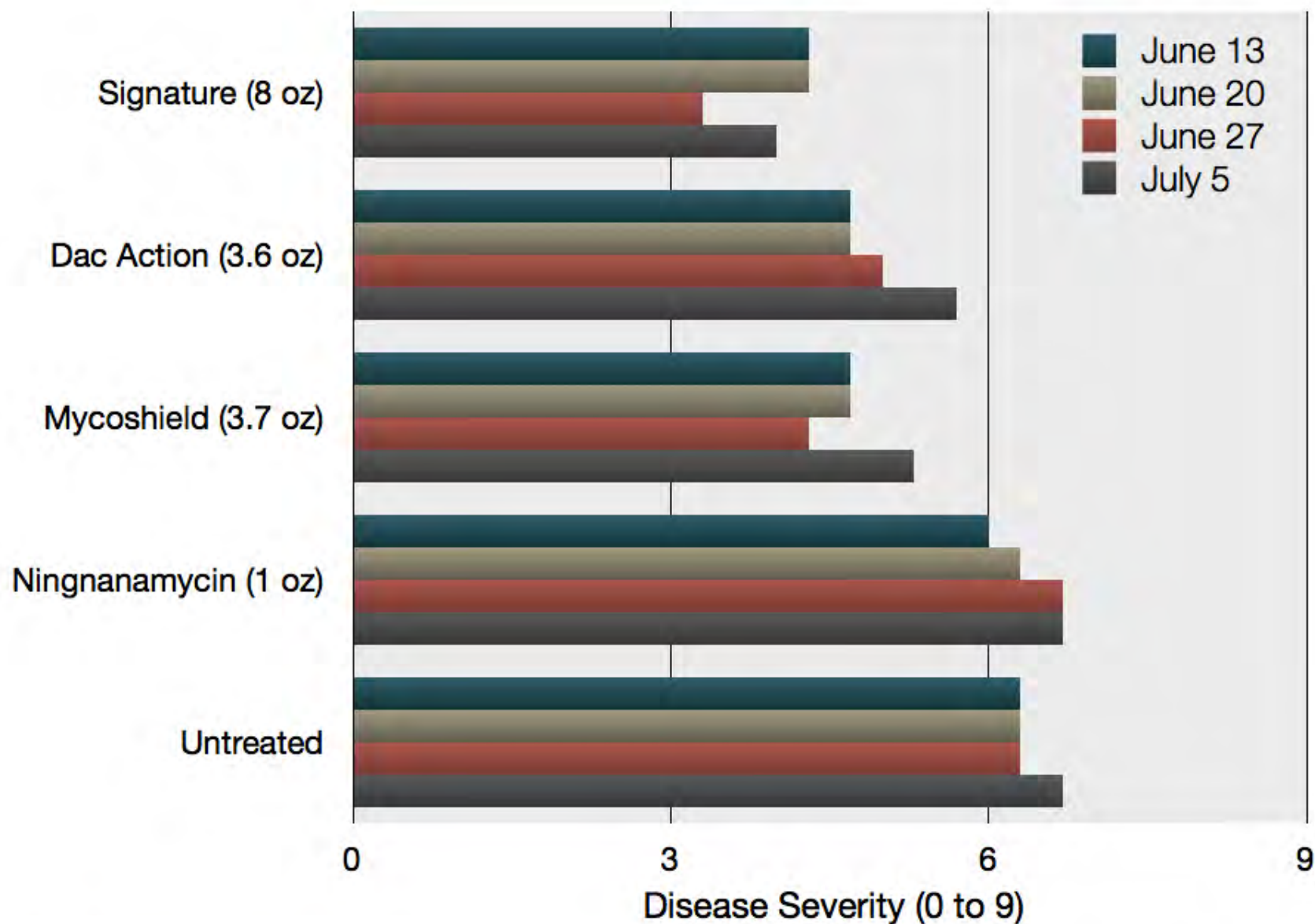


Now, that's a fan!



Best fungicide evaluated in recent years...

ATTEMPTS TO STOP THE BLEEDING



Treatments applied June 13, June 20, and June 27

Summary of Management Research

- sanitation of turfgrass leaves prior to aerification, topdressing, or other abrasive practices warrants further investigation
- besides being illegal, antibiotics are phytotoxic to bentgrass and should not be used
- no products tested in field trials have provided effective or consistent control of bentgrass etiolation
- Signature, Daconil Action, and copper products have helped to reduce turf thinning and decline
- biostimulants did not enhance and Primo applications suppressed etiolation symptoms

2012 Field Research from Clemson and Univ. Rhode Island

3 locations in southeast (Clemson):

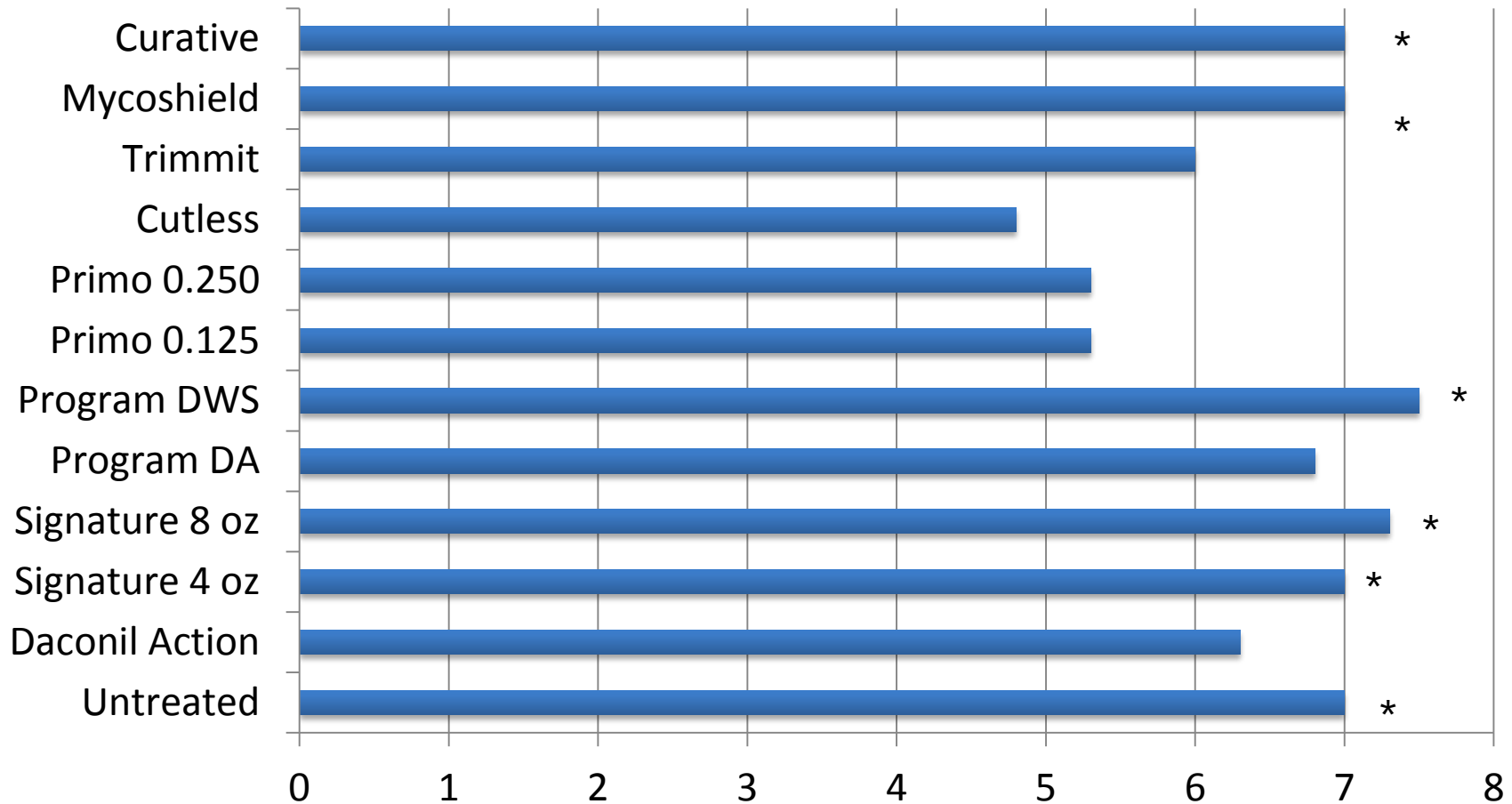
Quail Hollow, Eagle Point, Belfair

3 locations in Northeast (URI)

Treatments – 2 week intervals

Treatments	Rates/1000 sq ft.
1. Untreated (26GT or Daconil + Pythium)	
2.Daconil Action	3.5 fl oz
3. Chipco Signature	4 oz
4. Chipco Signature	8 oz
5. Program with Daconil Weatherstik	Various, but 4 apps of Dac WS
6. Program with Daconil Action	Same as '5', but 4 apps of DacAction
7. Primo	0.125 fl oz
8. Primo	0.250 fl oz
9. Trimmit	0.19 fl oz
10. Cutless 50WP	0.2 oz
11. Mycoshield	10 lb/acre
12. Curative (26 GT or Dac + Pythium)	

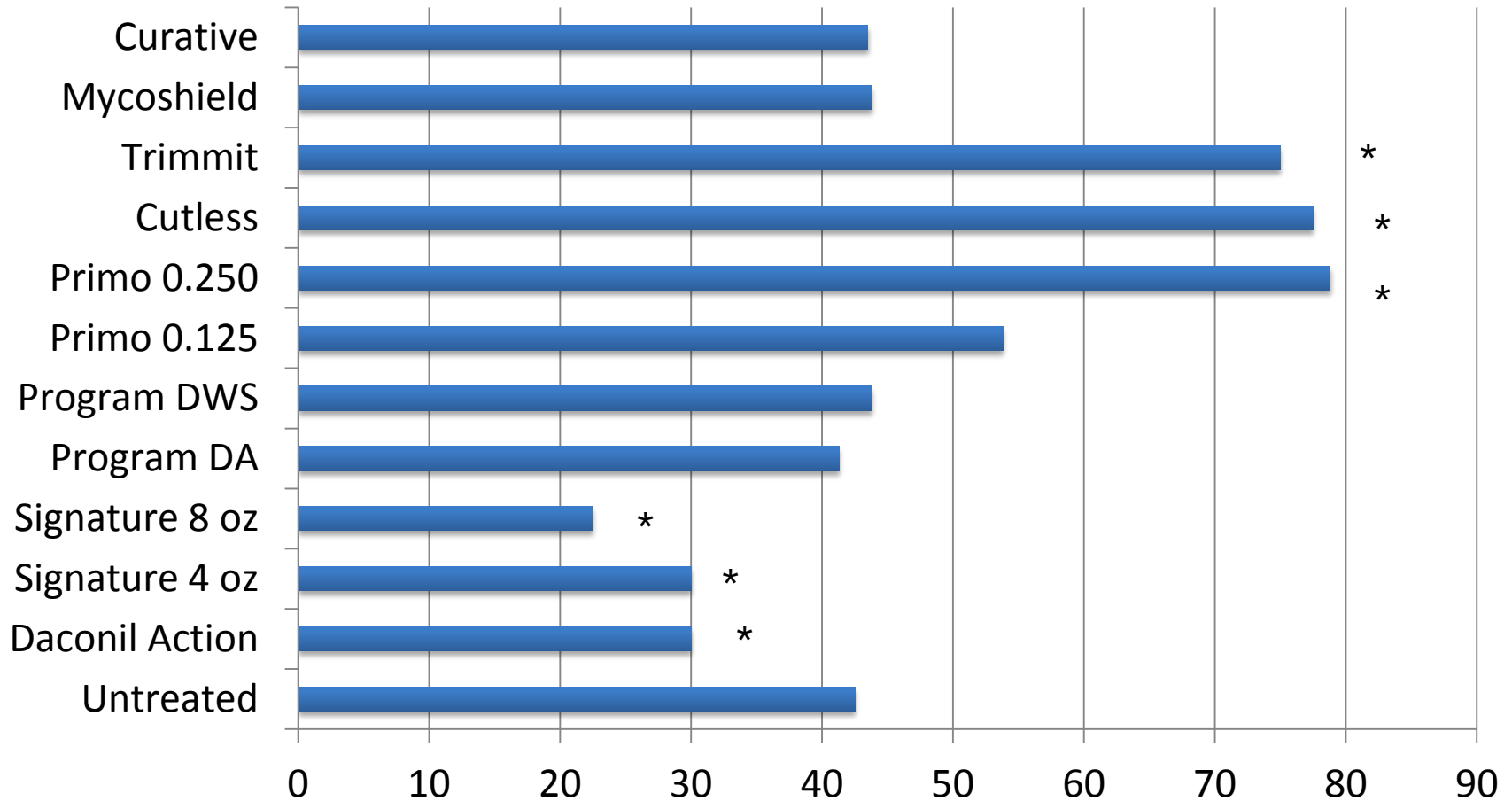
Turf Quality, Quail Hollow, before Tournament



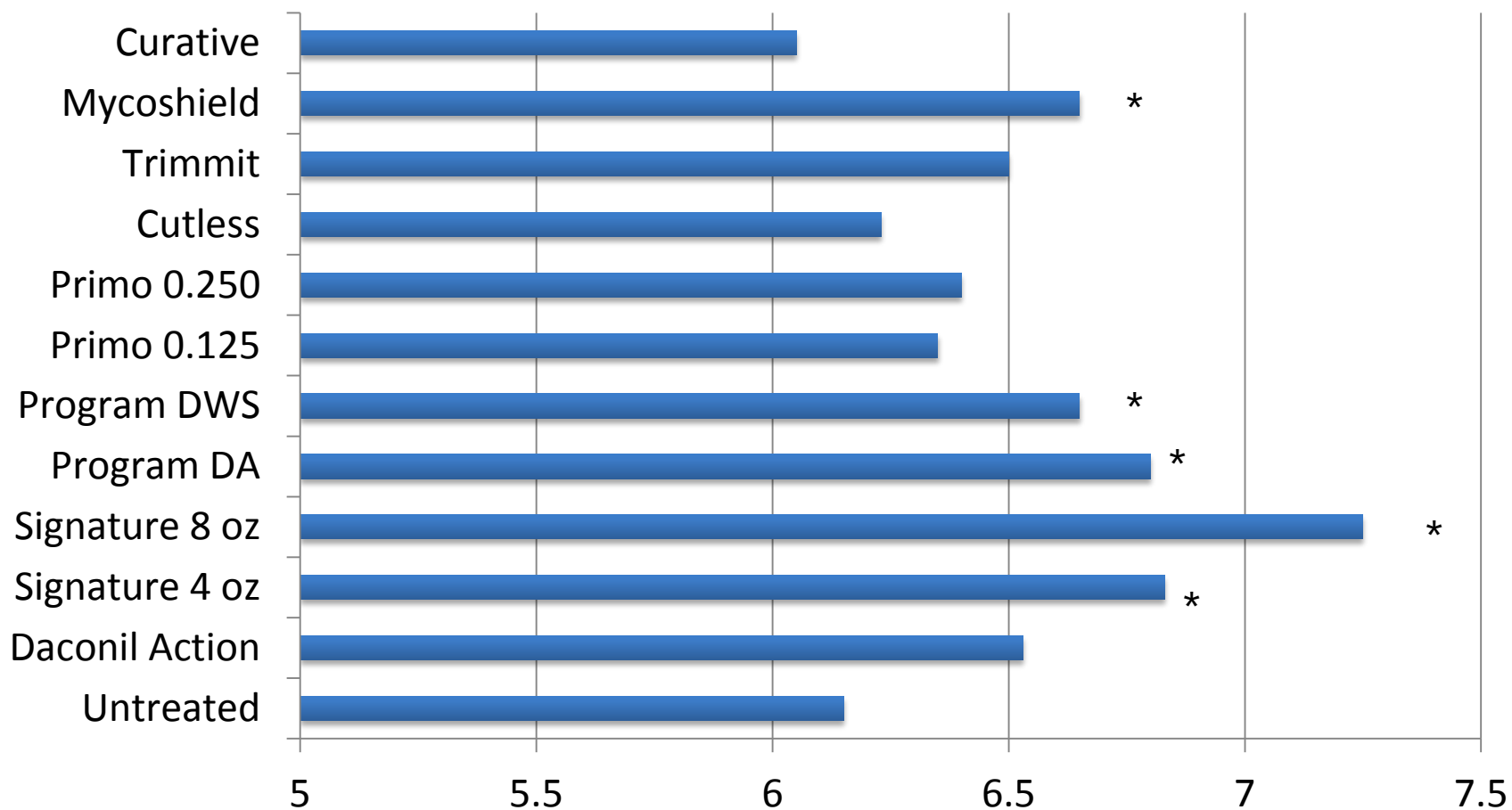
* Non fungicide treatments getting 4 oz 26GT or DacWS + Pythium control

April 23, 2012

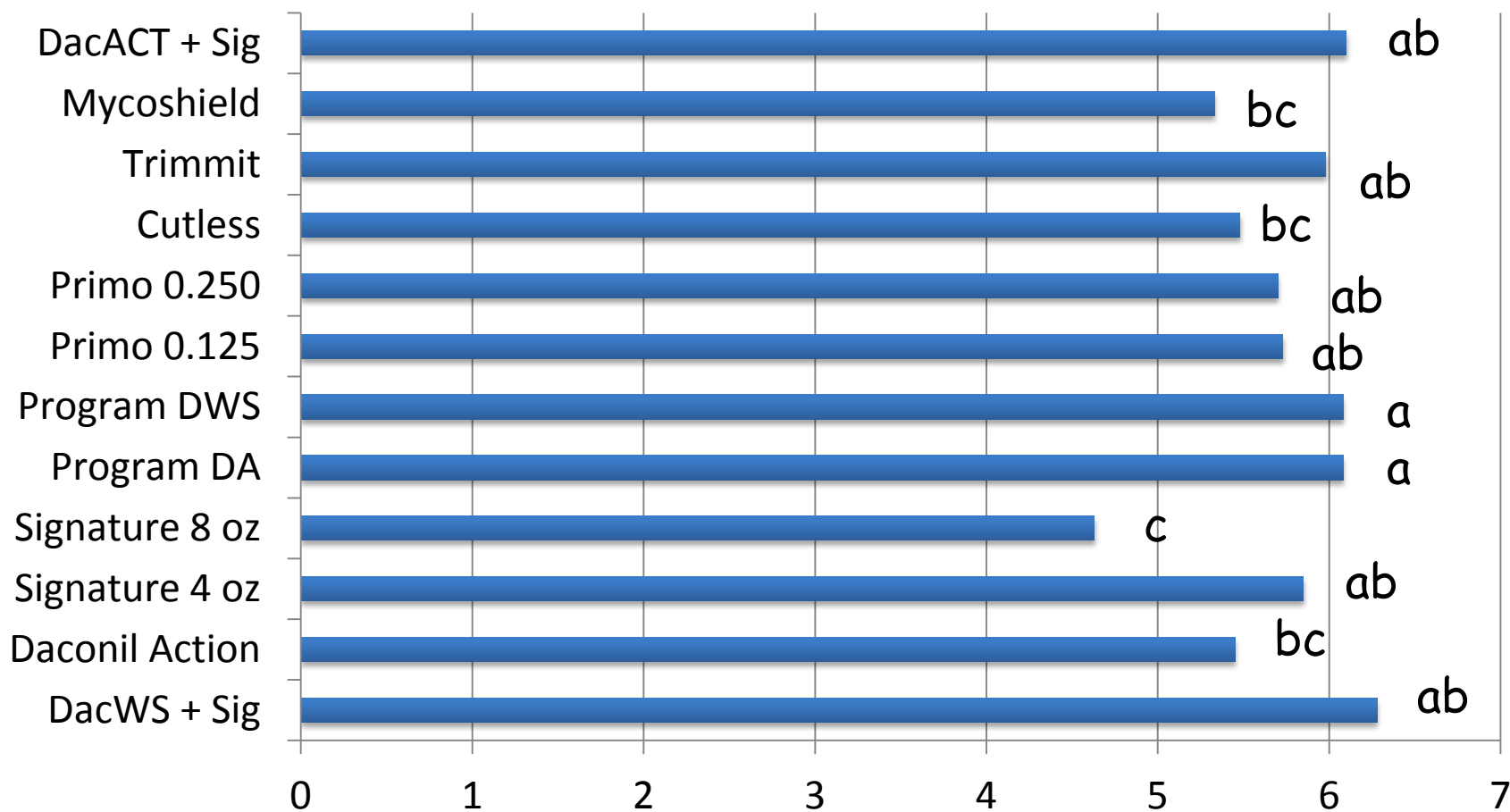
% Decline, after Tournament, Quail Hollow



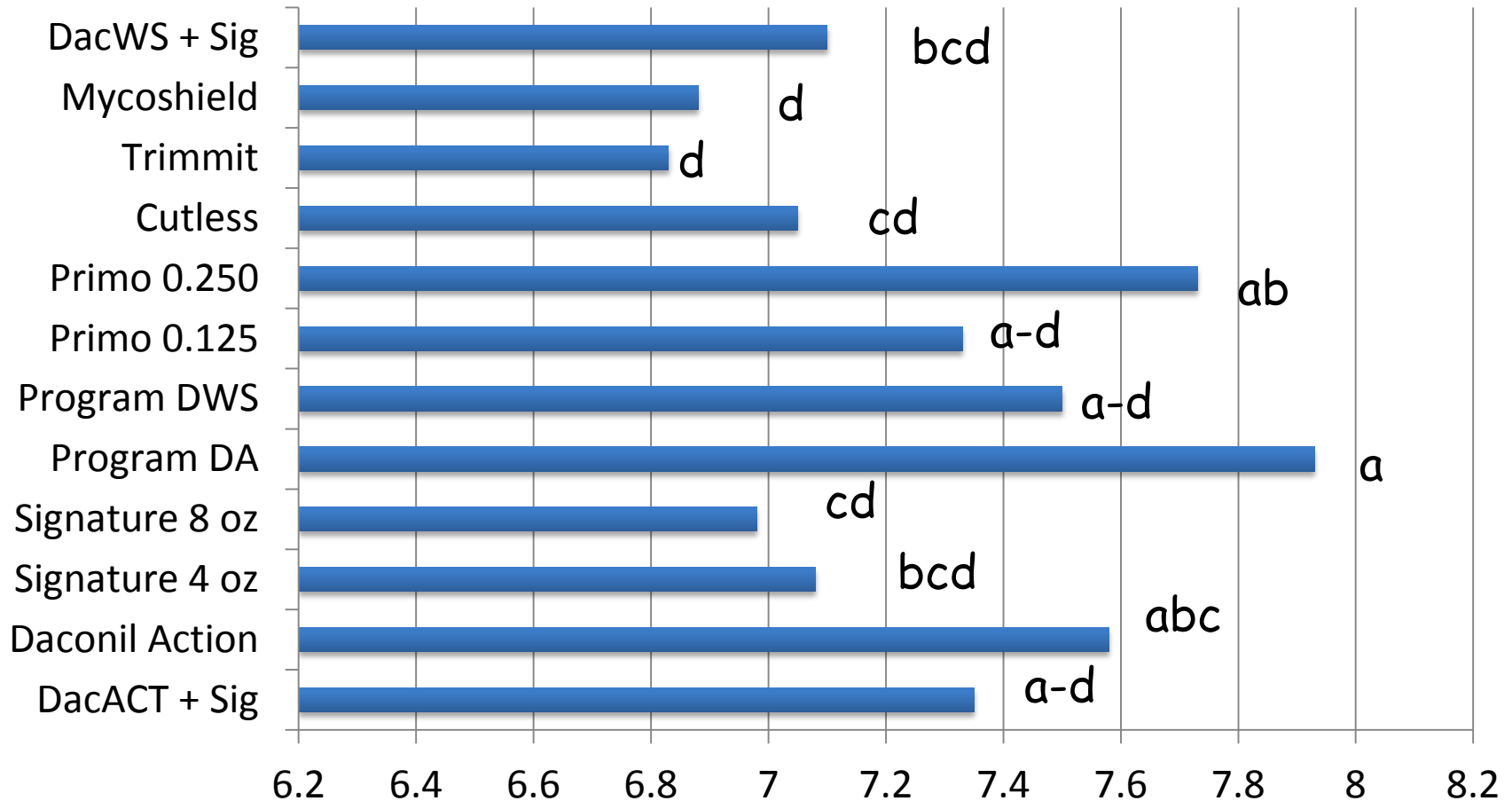
Turf Quality, Quail Hollow



Turf Quality, Quail Hollow



Turf Quality, Eagle Point



Suggestions

- Stick to the fundamentals and consider simplifying concerning inputs
- Among the inputs, don't forget fertility
- Design a reasonable disease control program
- Don't apply illegal pesticides – any benefits (not proven) do not offset the risks
- Ultradwarf bermudagrass can provide an excellent putting surface