2020 OGCSA Pest Management Webinar Series

Thank you for joining us.

We will begin at the top of the hour.

Presented By

Simplot PARTNERS

Oregon Chapter GCSAA

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Research Updates

Best Management Practices

December 2020 OGCSA

Jen Browning PCA

BASF Senior Technical Specialist

The Course

Front 9

- Maxtima & Navicon Intrinsic Research Updates
- Fairy Ring
- Anthracnose
- Summer Patch

The Course

Back 9

- Programs and cultural management of summer patch
- General BMPs
- Choosing and deploying **effective** chemistry
- Curative (just kidding) and preventative chemistries

Maxtima® Fungicide:
Controls the Toughest Diseases

- **Maxtima** fungicide delivers broad spectrum control over the tough diseases you care about most
- Tough Cool Season Diseases don't stand a chance:
  - Dollar Spot
  - Anthracnose
  - Fairy Ring
  - Summer Patch
  - Brown Ring Patch (formerly Waitea Patch)
  - Take-All Patch
- Warm Season:
  - Take All Root Rot
  - Spring Dead Spot
  - Fairy Ring

Controls Toughest Diseases

Superior control of Dollar Spot, Spring Dead Spot, Anthracnose, Fairy Ring and Summer Patch

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Navicon® Intrinsic® Brand Fungicide:
Controls the Toughest Diseases

- **Navicon Intrinsic** brand fungicide delivers broad spectrum control over 20 diseases
  - Dollar Spot
  - Anthracnose
  - Fairy Ring
  - Summer Patch
  - Brown Ring Patch
  - Take-all Patch
  - Take All Root Rot
  - Spring Dead Spot
  - Fairy Ring
  - Gray Leaf Spot
  - Leaf Spots
  - Melting Out
  - Pink Patch
  - Powdery Mildew
  - Fusarium Patch
  - Rapid Blight
  - Red Thread
  - Yellow Tuft (Downey Mildew)
  - Necrotic Ringspot
  - Pythium Blight
  - Pythium Root Dysfunction & Root Rot
  - Large Patch
  - Gray & Pink Snow Mold

Controls Toughest Diseases

Superior control of dollar spot, spring dead spot, anthracnose, fairy ring and summer patch

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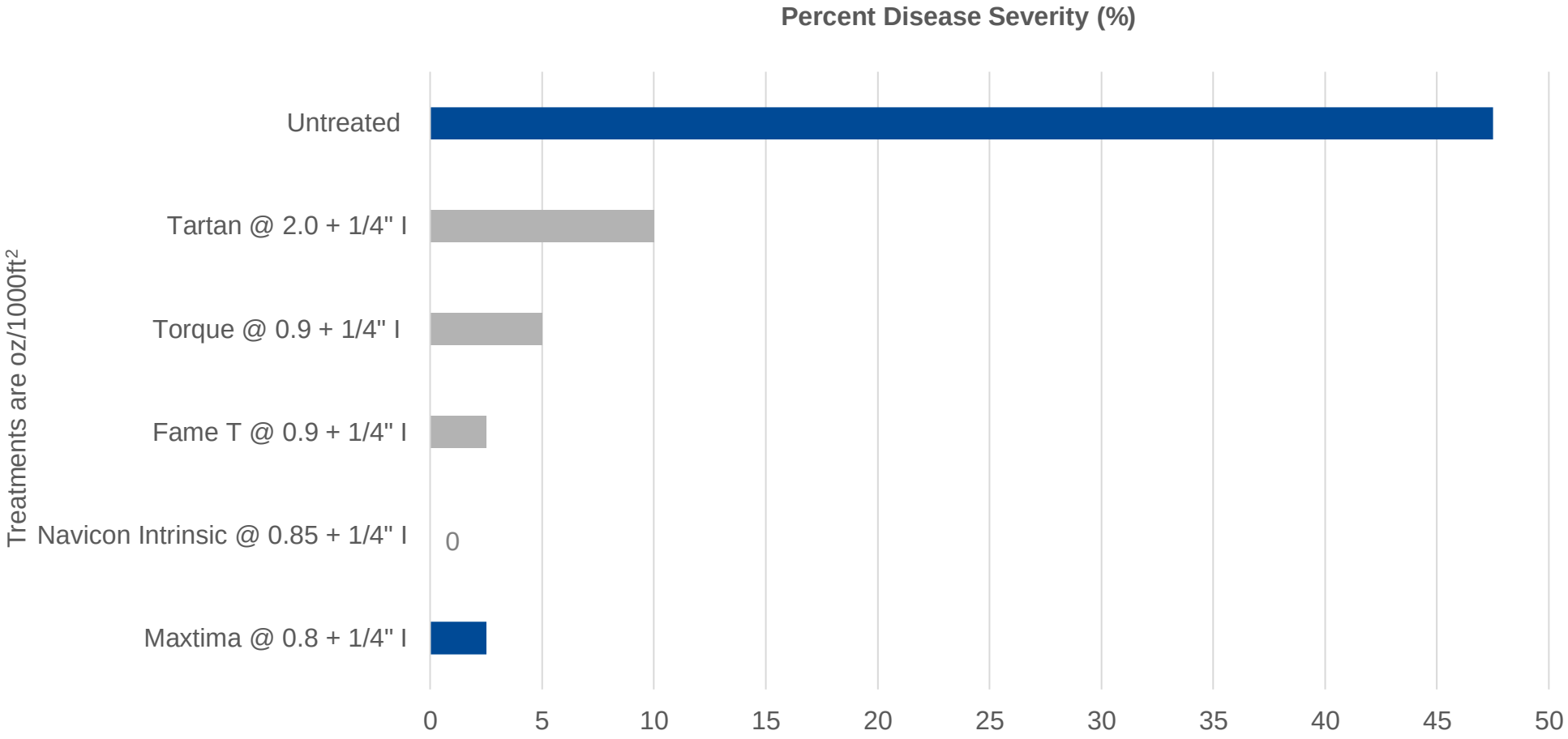
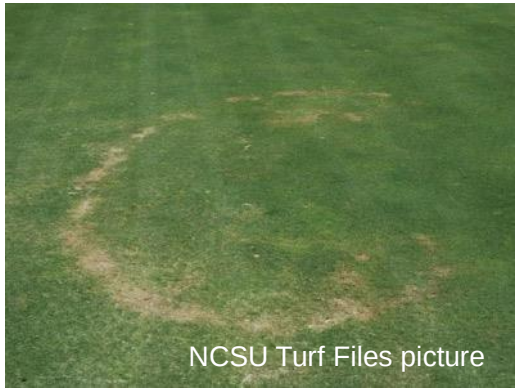
Curative Fairy Ring Control at Trial Conclusion

Kerns, NCSU, 2018





Pest:
Fairy ring fungi (Various)

Applications:
Apr 12, May 10, Jun 7, July 7, 2016
All treatments contained wetting agent at initiation
Plots were irrigated with 0.25" water following application.

Percent Infected:
Trial begun as curative with 45% fairy ring infection in untreated plots.

Final rating shown Jul 27, 2016

Maxtima® fungicide and Navicon® Intrinsic® brand fungicide provide excellent curative control of fairy ring

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Fairy Ring Support Program

A preventative golf spray program for fairy ring control

At BASF, we know keeping your turf healthy is critical to your success. With your needs in mind, this program is designed specifically for fairy ring. This support program is structured for at least 90% control of the treated area offering 6 months of protection after first application. If the course has followed the recommended spray program and within 6 months of the first application at least 90% control is not achieved, BASF will provide a product of its choice for a curative application.

Qualifying Fungicides

Product	Package
Honor® Intrinsic® brand fungicide	6 x 3 lbs
Honor® Intrinsic brand fungicide	1 x 38 lbs
Insignia® SC Intrinsic brand fungicide	2 x 2.5 gal
Insignia SC Intrinsic brand fungicide	4 x 30.5 fl oz
Lexicon® Intrinsic brand fungicide	4 x 21 fl oz
Maxtima® fungicide	4 x 28 fl oz
Maxtima fungicide	2 x 2.5 gal
Navicon® Intrinsic brand fungicide	4 x 37 fl oz
Navicon Intrinsic brand fungicide	2 x 2.5 gal
Xzemplar® fungicide	2 x 114 fl oz
Xzemplar fungicide	4 x 11.4 fl oz

Application Details

- Make 1st application at 55-60°F average soil temperature
- Rates per 1,000ft²
- Application spray volume is 2-4 gallons/1000ft²
- Provide ¼" irrigation post application
- Applications to be made in conjunction with a soil wetting agent program

Golf Fairy Ring Spray Support Program

A preventative golf spray program for fairy ring control

We understand the struggles that come with disease-stricken turf. Our portfolio of fungicides has proven performance controlling this disease. We have put together a support program to help you take back control and rest easy knowing you have our support.

Required Spray Program By Zone

Zone 1: Cool Season, Greens

Application	Timing	Product	Rate
1	Spring	**Xzemplar® fungicide**	0.26 fl oz
2	Memorial Day	**Navicon® Intrinsic® brand fungicide**	0.85 fl oz
3	Fourth of July	**Lexicon® Intrinsic brand fungicide**	0.47 fl oz
4	Mid-August	**Maxtima® fungicide**	0.8 fl oz

Zone 1: Cool Season, Fairways

Application	Timing	Product	Rate
1	Spring	**Honor® Intrinsic brand fungicide** OR **Insignia® SC Intrinsic brand fungicide**	1.1 oz OR 0.7 fl oz
2	28 Days after first application	**Maxtima fungicide** OR **Xzemplar fungicide**	0.8 fl oz OR 0.26 fl oz
3	28 Days after 2nd application	**Lexicon Intrinsic brand fungicide** OR **Maxtima fungicide**	0.47 fl oz OR 0.8 fl oz

Program Process:

- BASF Representative to visit golf course and check all required documentation of treatments, rates, watering, etc.
- BASF Representative to make judgement in its sole discretion of whether control of fairy ring is less than 90% of the total treated acres. All judgement by the BASF Representative will be final.
- If applicable, BASF will determine the curative product to be provided.
- If applicable, golf course will receive product for curative application between five (5) and ten (10) business days after visit by BASF Representative. No labor cost is covered.

QUALIFICATIONS:
Follow regional spray program contained in this document is based on timing, rates, approved products, and application details. Follow watering instructions and other specific measures to ensure penetration of the fungicide into the fairy ring zone in the soil. Claims must be filed within thirty (30) days of seeing fairy ring breakthrough to your local BASF Sales Representative. All spray records showing rates, date of application, watering amounts, etc. will be required upon visit to your course by BASF. No claims will be processed without full spray records. The golf course must have purchased product used from a BASF Authorized Agent after January 1, 2019. **The T&O Golf Fairy Ring Spray Support Program does NOT apply to purchases from other sub distributors and dealers and/or resellers.**

This program is only available to BASF Golf Course Qualified End-Users. This program runs from August 1, 2020 to July 31, 2021.

For more information and full program details, visit **betterturf.basf.us.**

Always read and follow label directions. BASF reserves the right to cancel or modify this program at any time.

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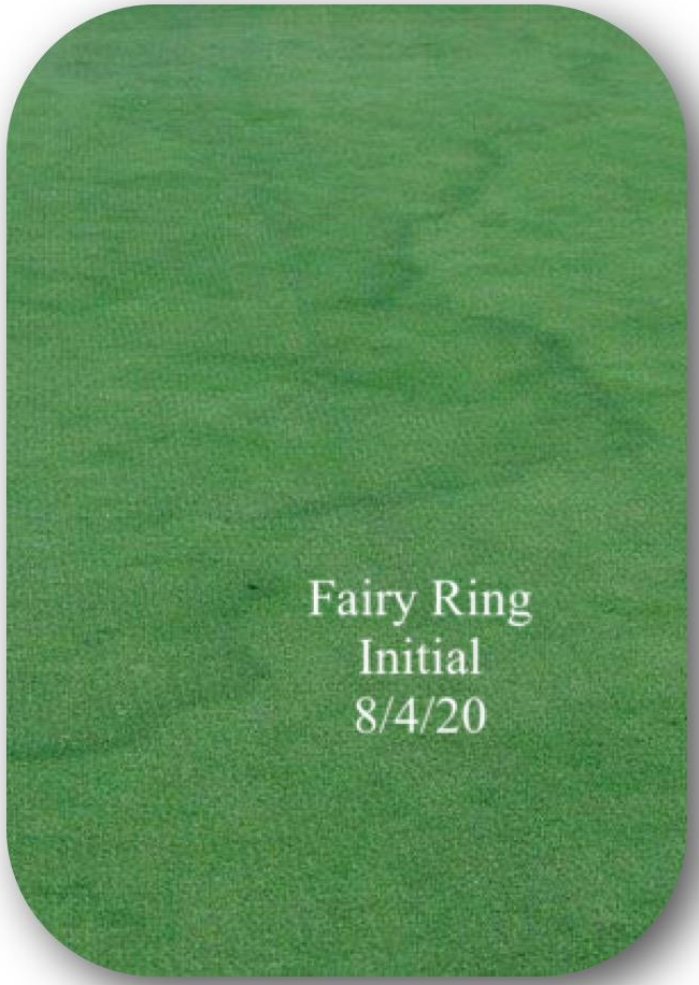
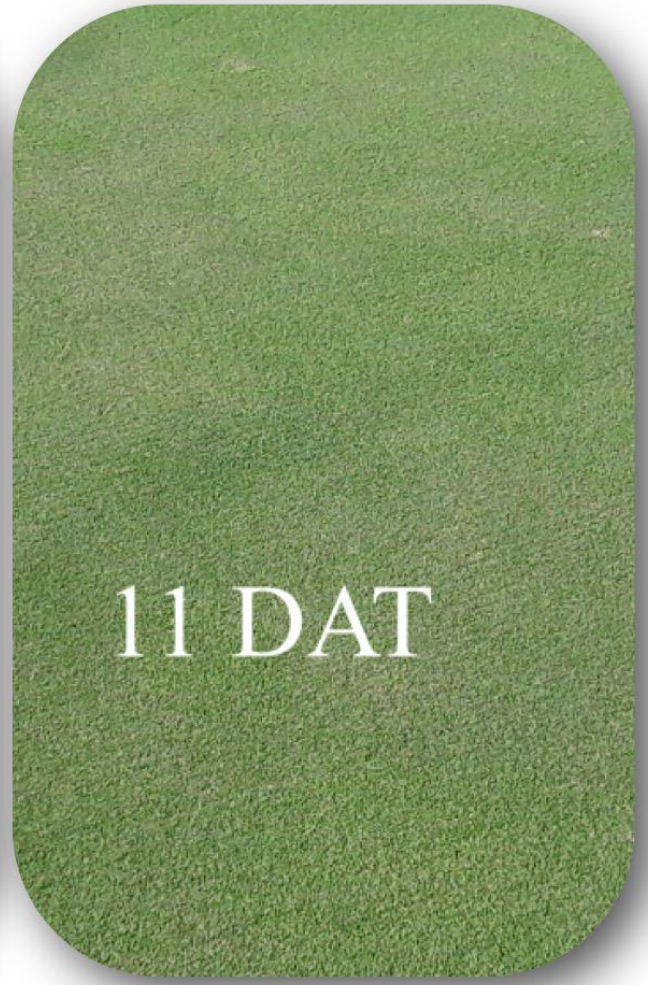
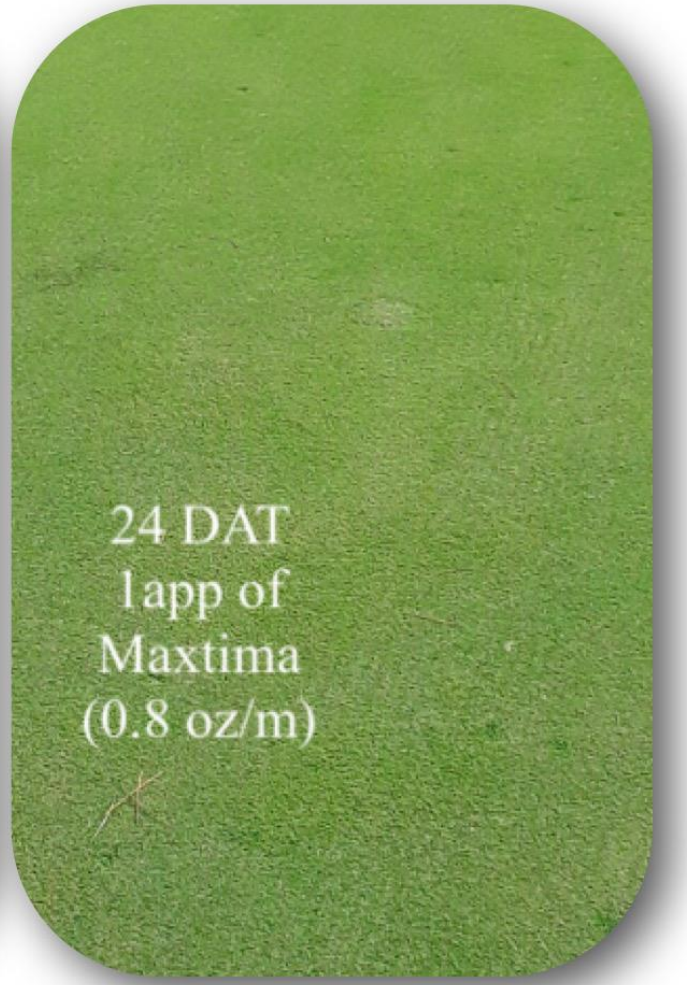
Maxtima Curative Treatment







Navicon Intrinsic Curative Treatment

July 9, 2020

August 5, 2020

Anthracnose Summer Patch Programs

2020 Baird, UC Riverside

BASF 1	BASF 2	Bayer 1	Bayer 2	Bayer 3	Syngenta
Fairway Program	**Greens Program**				
Maxtima (A-H)	Primo Maxx (A-H)	Primo Maxx (A-H)	Primo Maxx (A-H)	Primo Maxx (A-H)	Primo Maxx (A-H)
Insignia Intrinsic (BDFH)	Navicon Intrinsic (ACEG)	Mirage Stressgard (ACEG)	Mirage Stressgard (ACEG)	Mirage Stressgard (ACEG)	Heritage Action (ADG)
Encartis (BDFH)	Lexicon Intrinsic (BDFH)	Daconil WS (BDFH)	Daconil WS (BDFH)	Daconil WS (BDFH)	Daconil Action (BEH)
Civitas (CEG)	Signature Xtra Stressgard (BDFH)	Signature Xtra Stressgard (BDFH)	Signature Xtra Stressgard (BDFH)	Signature Xtra Stressgard (BDFH)	Velista (CF)
Affirm WDG (CEG)	Affirm WDG (BDFH)	Insignia Intrinsic (CE)	Tartan Stressgard (BDFH)	Exteris Stressgard (BDFH)	
					(ABCDEFG) are spray timings

Foliar and basal rot anthracnose + summer patch preventative programs on annual bluegrass putting greens in Riverside, CA – initiated 5/22 sprayed on 2 week interval

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Anthracnose Summer Patch Programs

2020 Baird, UC Riverside

	BASF 1	BASF 2	Bayer 1	Bayer 2	Bayer 3	Syngenta
	Maxtima (A-H)	Primo Maxx (A-H)	Primo Maxx (A-H)	Primo Maxx (A-H)	Primo Maxx (A-H)	Primo Maxx (A-H)
	Insignia Intrinsic (BDFH)	Navicon Intrinsic (ACEG)	Mirage Stressgard (ACEG)	Mirage Stressgard (ACEG)	Mirage Stressgard (ACEG)	Heritage Action (ADG)
	Encartis (BDFH)	Lexicon Intrinsic (BDFH)	Daconil WS (BDFH)	Daconil WS (BDFH)	Daconil WS (BDFH)	Daconil Action (BEH)
	Civitas (CEG)	Signature Xtra Stressgard (BDFH)	Signature Xtra Stressgard (BDFH)	Signature Xtra Stressgard (BDFH)	Signature Xtra Stressgard (BDFH)	Velista (CF)
	Affirm WDG (CEG)	Affirm WDG (BDFH)	Insignia Intrinsic (CE)	Tartan Stressgard (BDFH)	Exteris Stressgard (BDFH)	
Mean Quality Rating (1-10)	7.1	**7.4**	7.5	7.3	7.3	7.3
Mean Injury Rating (1-10)	0.0	0.0	1.3	1.5	1.1	0.0
Mean Disease Cover (1-10)	2.7	3.0	3.0	4.1	3.9	4.7
Mean Percent Green Cover	**98.3**	97.1	97.5	97.3	98.0	97.2

Means are averages of all ratings taken over the trial period, May – August 2020

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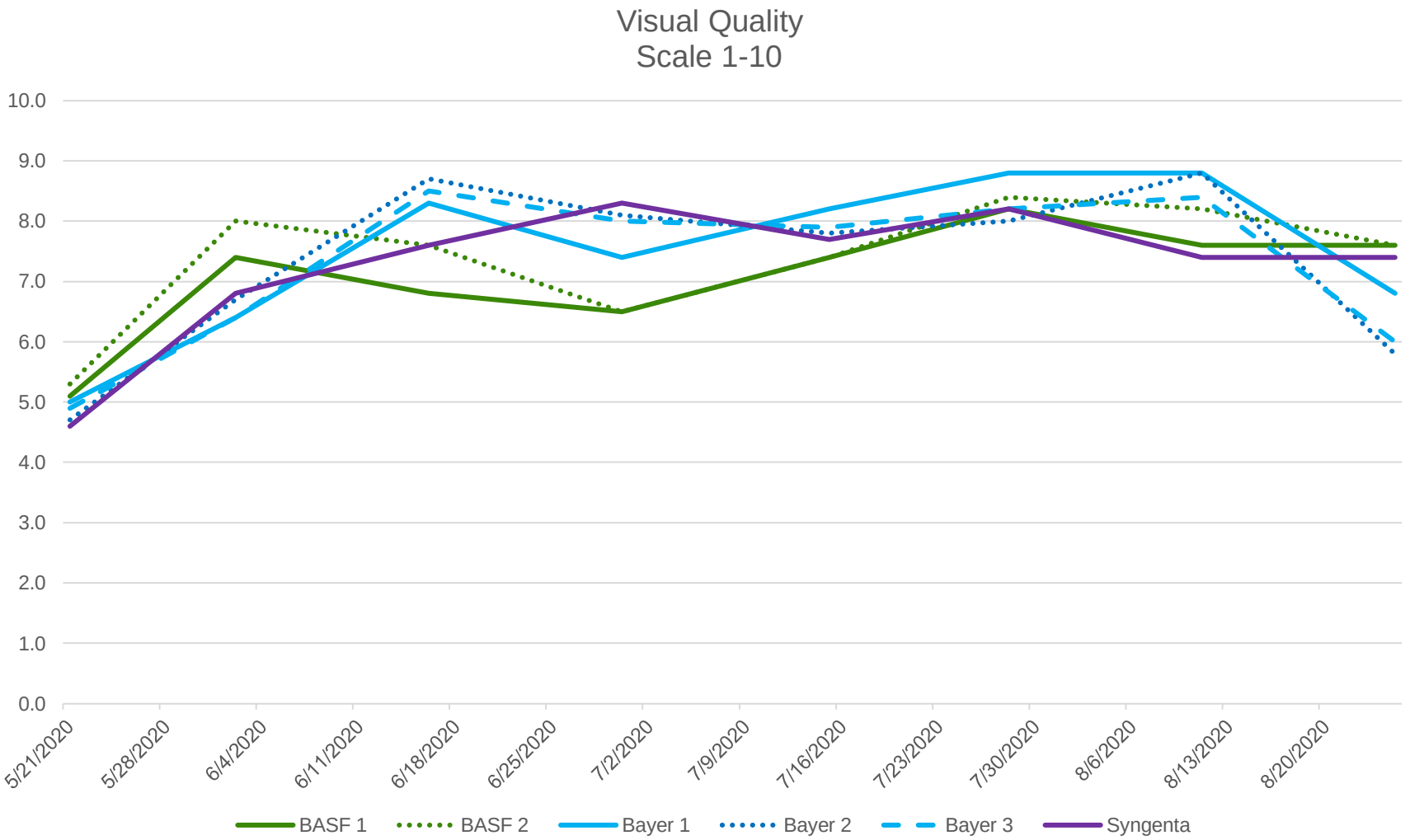
Anthracnose Summer Patch Programs

2020 Baird, UC Riverside



BASF 1
Mean quality = 7.1

BASF 2
Mean quality = 7.4

Bayer 1
Mean quality = 7.5

Bayer 2
Mean quality = 7.3

Bayer 3
Mean quality = 7.3

Syngenta
Mean quality = 7.3

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Comparison of Maxtima® fungicide on ‘L-93’ creeping bentgrass 14 DAT1/3 DAT2 in the greenhouse under high heat and drought conditions

At 14 DAT1 (3 DAT2), Banner Maxx and Torque began to injure turfgrass under drought conditions and 105 ºF temperatures

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Season Take Homes

- Superior disease control

- Summer safety @ 100F – TX, ID, AZ, CA
- Even with PGRs
- Across multiple turf types and varieties
- Consistently high quality turf ratings
- With no thinning, discoloration or stunting

The Course

Back 9

- Programs and cultural management of summer patch
- General BMPs
- Choosing and deploying **effective** chemistry
- Curative (just kidding) and preventative chemistries

Summer Patch

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Pathogen & Hosts

Photo Credit: NCSU Turf Diagnostic Lab; Summer Patch Symptoms

- **PATHOGEN:**

  Magnaporthe poae

- **HOSTS:**
  - Kentucky bluegrass
  - Annual bluegrass
  - Creeping red & other fescues
  - Creeping bentgrass

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Conditions that Favor Disease

- Mature turf stands
- Soil compaction
- pH > 6
- Low mowing heights: greens > fairways
- Heavy N in the spring or NO^-_3 forms of N

Conditions that Favor Expression

- Warm daytime temps >88°F
- Warm soil temps ≥75°F
- Humidity
- Fast dry down after spring or summer rain
- Heat from sun or sidewalks – bunker faces, edges

Summer Patch Symptoms

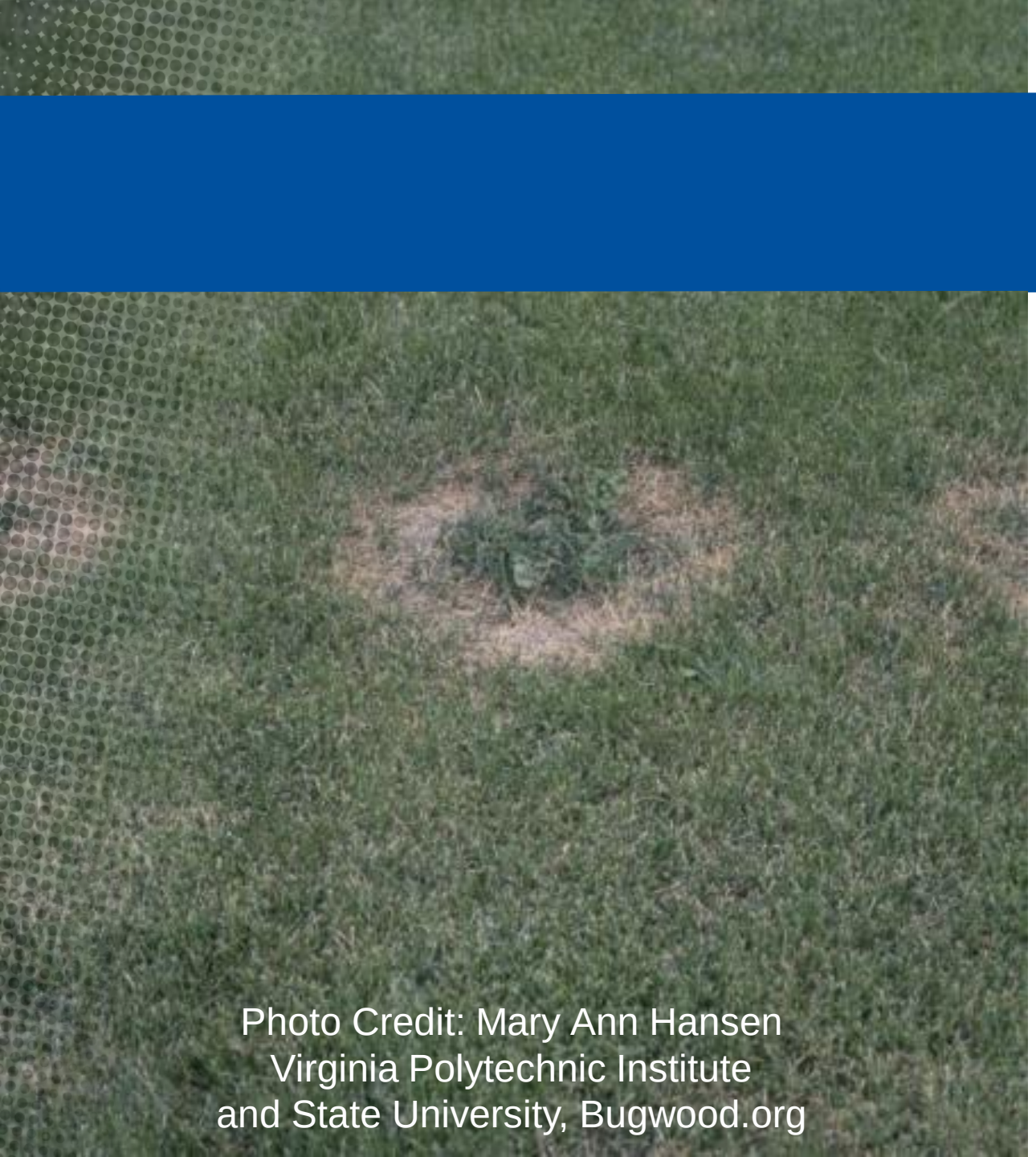

Photo Credit: Mary Ann Hansen
Virginia Polytechnic Institute
and State University, Bugwood.org

- Crescents, rings and circles
- Centers may be living or dead
- Can fill in, widen and spread into larger patches >12”
- May have patchwork appearance
- Individual plants die and fill back in early in season – less noticeable in spring & early summer

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Photo Credit: Lee Miller, University of Missouri, Bugwood.org

Summer Patch Symptoms

- Color may be copper, straw, tan or brown
- Dead patches may form “craters”
- Might look like dollar spot at first or necrotic ring spot later
- Can also resemble anthracnose
- Dieback starts at tips - no lesions

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Used with permission: Lee Miller, University of Missouri: https://turfpath.missouri.edu/reports/2020/08_21_20/

Symptoms Under the Soil

Summer Patch keeps rolling in

A. Bentgrass on the left.
B. Kentucky bluegrass on the right.

Severe summer patch

July - September

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First Sign of Heavy Summer Patch Season

- July call about anthracnose breakthrough
- Diagnosis from a private lab: anthracnose
- Thinning turf and color matched the ID

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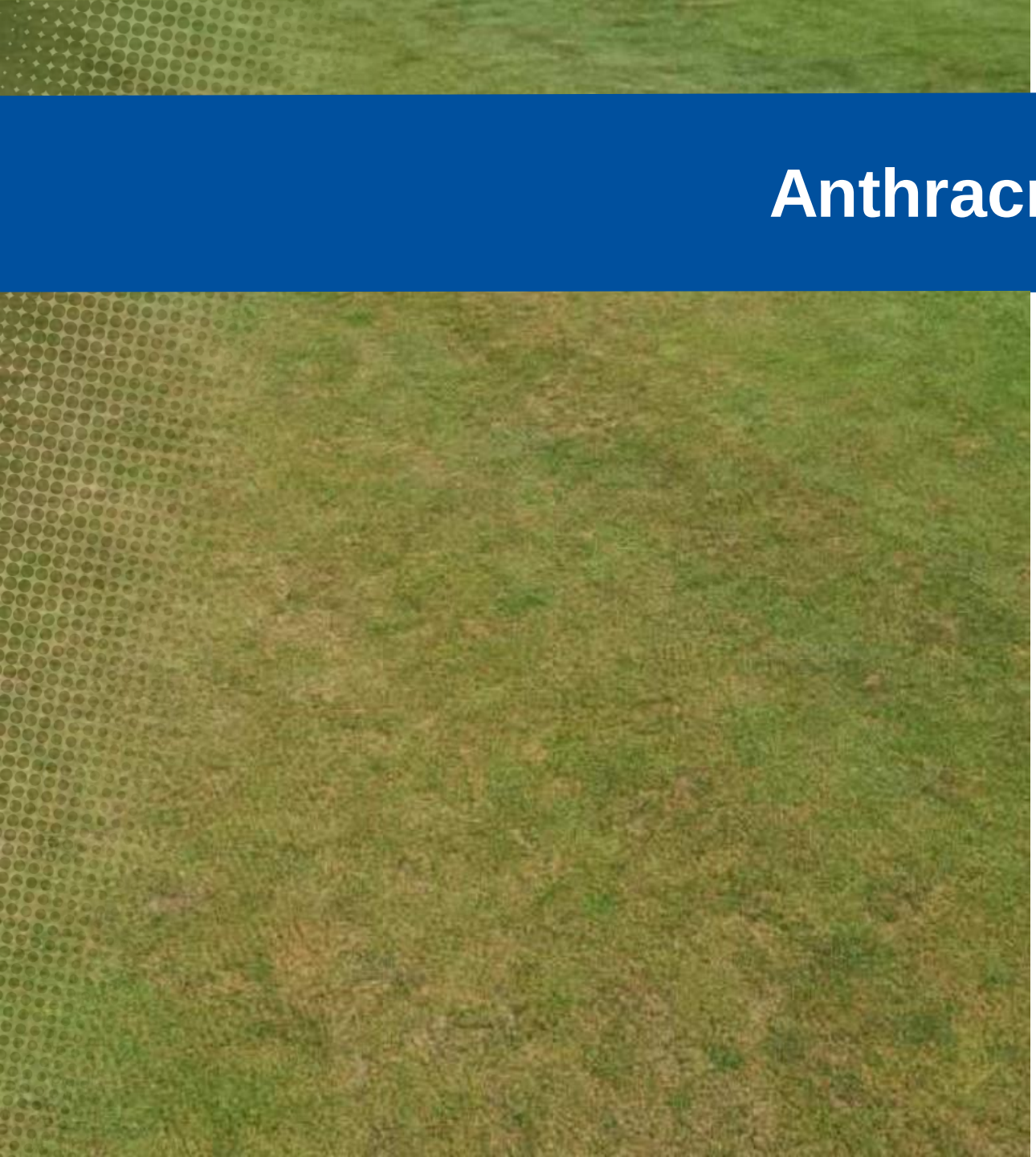

Anthracnose was Opportunistic

- NCSU found basal anthracnose on necrotic roots caused by *Magnaporthe poae* injury
- The anthracnose infection was opportunistic on dead tissue
- If we measure control = recovery and have dead roots….it takes a long time

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Summer Patch Cycle

- Host + pathogen = *M. poae* is always there waiting for the right time
- Symptoms in July or August are from root injury weeks or months earlier
- This is why curative is difficult when injury is moderate or severe
- Turf suddenly expresses the injury under stress – it was already there

We have to be preventative ahead of summer.

Polling Question

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Summer Patch Programs

- Begin preventative spray program in spring when pathogen is active

Maximum daily soil temps @ 3” depth
average ≥65°F for several consecutive days

Rule of thumb from Dr. Rick Latin
Professor Emeritus, Purdue University

- Make applications at 28-day intervals to stay ahead of symptoms
- Summer patch symptoms = root injury (death)
- Applications after symptom expression have limited effect

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Photo Credit: Richard Buckley, Plant Diagnostic Lab Rutgers University

Cultural Complements

- Core or tine aeration in fall & spring
- Avoid N deficiency
- Deep, infrequent irrigation
- Syringe on hot afternoons
- Minimize compaction

Latin, Purdue 2016

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General BMPs

- Be preventative
- Don’t miss any summer patch applications in spring & early summer
- Be careful with certain DMI applications in summer – possibly stress additive
- Build and protect plant health
- Don’t miss any summer patch applications

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Choosing & Deploying Effective Chemistry

Sources for Recommendations:

Universities & Field Days

Superintendents

Distributors

Associations, Consultants, Magazines

Manufacturers

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COUNTY CENTERS TOPICS GIVE NOW

TurfFiles

Search

- COVID-19 Resources
- Meet Our Staff
- Events
- **Grasses**
  Annual Ryegrass Bahiagrass Bermudagrass ...
- **Diseases**
  Turf Diagnostics Lab Algae Anthracnose ...
- **Insects and Other Pests**
  Turf Insect Pests
  Annual Bluegrass Weevil, Bermudagrass Mites, Ground-Nesting Bees ...
  Monitoring for Turf Insects

Summer Patch in Turf

Symptoms

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Chemical Control

Fungicides are available for summer patch control, but they are most effective when applied on a preventative basis. For best results, fungicide applications should begin in spring when soil temperatures reach 65°F. Two to three applications on 28-day intervals provide excellent summer patch control in most situations. Fungicide applications should be made in a high volume of water (5 gallons per 1,000 square feet) or watered in with 1/8" to 1/4" inch of irrigation immediately after application.

Fungicide and Formulation[1]	Amount of Formulation[2]	Application Interval (Days)[3]	Efficacy Rating	Resistance Risk

pyraclostrobin (Insignia) WG SC	 0.5 to 0.9 0.4 to 0.7	 14 to 28 14 to 28	+++
pyraclostrobin + boscalid (Honor)*	1.1	14 to 28	++++
pyraclostrobin + fluxapyroxad (Lexicon Intrinsic)	0.34 to 0.47	14 to 28	++++
pyraclostrobin + triticonazole (Pillar G)	3 lbs	28	++
tebuconazole (Torque)* (Mirage)* (Tebuconazole)*	 0.6 to 1.1 1 to 2 0.6	 21 14 to 28 28	+++
thiophanate-methyl (3336) (3336 Plus) (3336 G) (TM WDG) (TM L)	 4 to 6 4 to 8 6 to 9 lbs 3.53 5	 14 to 21 14 to 28 14 to 21 14 14	++
triadimefon (Bayleton)	1 to 2	30	+++
trifloxystrobin (Compass)	0.2 to 0.25	21 to 28	++

Efficacy Rating

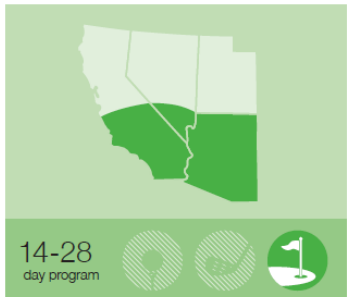
++++ Excellent control in highly favorable disease conditions

+++ Good control with high disease pressure; excellent control under moderate pressure

++ Good control under moderate pressure, excellent control under low pressure

+ Good control under low pressure

Spray Programs



Southern California and Arid Southwest

Southern California, Arizona, Las Vegas

High summer temperatures, mild winters and low humidity translate to beautiful turf in this region. Both warm and cool season turfgrasses are used on greens and tees, where overseeding is common. Brown ring, take-all patch, anthracnose and fairy ring can pose problems, and rapid blight may infect cool season turfgrass with salty water and soils. Bermuda decline is an issue on bermudagrass courses, and *Pythium* can occur throughout the region.

14-28 day program

	Timing	Product	Active Ingredient	Rate/1,000 sq. ft.	Key Target Diseases
1	Jan-Feb	**Xzemplar®** fungicide + Affirm WDG	Fluxapyroxad + Polyoxin-D	0.26 fl oz + 0.9 oz	Patch diseases
2	Mar 1[1]	**Trinity®** fungicide + Affirm WDG	Triticonazole + Polyoxin-D	1.0 fl oz + 0.9 oz	Brown ring patch, Take-all patch
3	Apr 1	**Lexicon® Intrinsic®** brand fungicide + Dithane Rainshield	Fluxapyroxad and Pyraclostrobin + Mancozeb	0.47 fl oz + 6-8 oz	Bermudagrass decline, Brown ring patch, Take-all patch, Leaf spot
4	May 1	**Trinity** fungicide	Triticonazole	1.0 fl oz	Brown ring patch, Leaf spot
5	Jun 1	**Lexicon Intrinsic** + Dithane Rainshield	Fluxapyroxad and Pyraclostrobin + Mancozeb	0.47 fl oz + 6-8 oz	Brown ring patch, Summer patch, Fairy ring[2], Rapid blight, Anthracnose[3], Summer plant health
6	Jul 1	Medallion + Daconil	Fludioxonil + Chlorothalonil	0.50 oz + 8.0 fl oz	Anthracnose *if needed*
7	Jul 15	**Lexicon Intrinsic** brand fungicide	Fluxapyroxad and Pyraclostrobin	0.84 fl oz	*Pythium*, Rapid blight, Anthracnose[3], Summer plant health
8	Aug 1	Segway	Cydzofamid	0.9 fl oz	*Pythium*
9	Sep 1	Velista + Daconil	Penthiopyrad + Chlorothalonil	1.0 fl oz + 4.0 fl oz	*Pythium*, Anthracnose
10	Oct 1	**Lexicon Intrinsic** brand fungicide	Fluxapyroxad and Pyraclostrobin	0.84 fl oz	Take-all patch, Bermudagrass decline, Overseeding plant health
11	Nov 1	**Insignia® SC Intrinsic** brand fungicide + Daconil	Pyraclostrobin + Chlorothalonil	0.7 fl oz + 6.0 fl oz	Take-all patch, Spring dead spot, Snow mold
12	Nov 15	**Trinity** fungicide + 26GT	Triticonazole + Iprodione	1.0 fl oz + 4.0 fl oz	Snow mold
13	Dec 1	Medallion	Fludioxonil	0.5 oz	Snow Mold *if needed*

[1] Adjust first application date to reflect the onset of temperatures above 60°F.
[2] To improve hydrophobic conditions, make application of preferred wetting agent 1-2 weeks prior to first fungicide treatments for fairy ring.
[3] Program for QoI-susceptible anthracnose only. In areas with QoI-resistant type anthracnose, additional products may be required or substituted for **Lexicon Intrinsic** brand fungicide.

Desert Protection for Fairways

Pythium Protection for Overseed + Take-All Root Rot/Bermudagrass Decline

This scalable program provides Pythium protection for overseed followed by two preventative applications for Take-All Root Rot/Bermudagrass Decline or an optional spring application.

Fall Preventative Program

1. Starting at overseed, make up to two Pythium applications on a 14-21 day interval:
   - **Insignia® SC Intrinsic®** brand fungicide @ 0.7 fl oz

   Rotate with:
   - **Segway®** fungicide @ 0.45 fl oz
2. When soil temperatures are 70-85°F, make two Take-All Root Rot/Bermudagrass Decline applications 21-28 days apart:
   - **Navicon® Intrinsic** brand fungicide @ 0.85 fl oz
   - Follow applications with 0.25" irrigation

Optional Spring Application

In place of the fall applications in Step 2:
In early March, to control Take-All Root Rot/Bermudagrass Decline and other diseases like Brown Ring Patch and Fairy Ring, apply:
- **Maxtima®** fungicide @ 0.8 fl oz
  OR **Navicon Intrinsic** brand fungicide @ 0.85 fl oz
- Follow application with 0.25" irrigation
- With active Fairy Ring or hydrophobic conditions, include a wetting agent
- See the BASF Fairy Ring Performance Support Program for full season protection
  betterturf.basf.us/solutions/disease-control/fairy-ring.html

All rates per 1000 square feet

betterturf.basf.us

BASF Programs

- ✓ Season long spray programs
- ✓ Bridge programs for specific diseases or seasons

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The Controversy on Watering In

- Labels: “apply in 1-4 gallons per 1000-sf”
- Applications 10 minutes ahead of the first tee time – practical?

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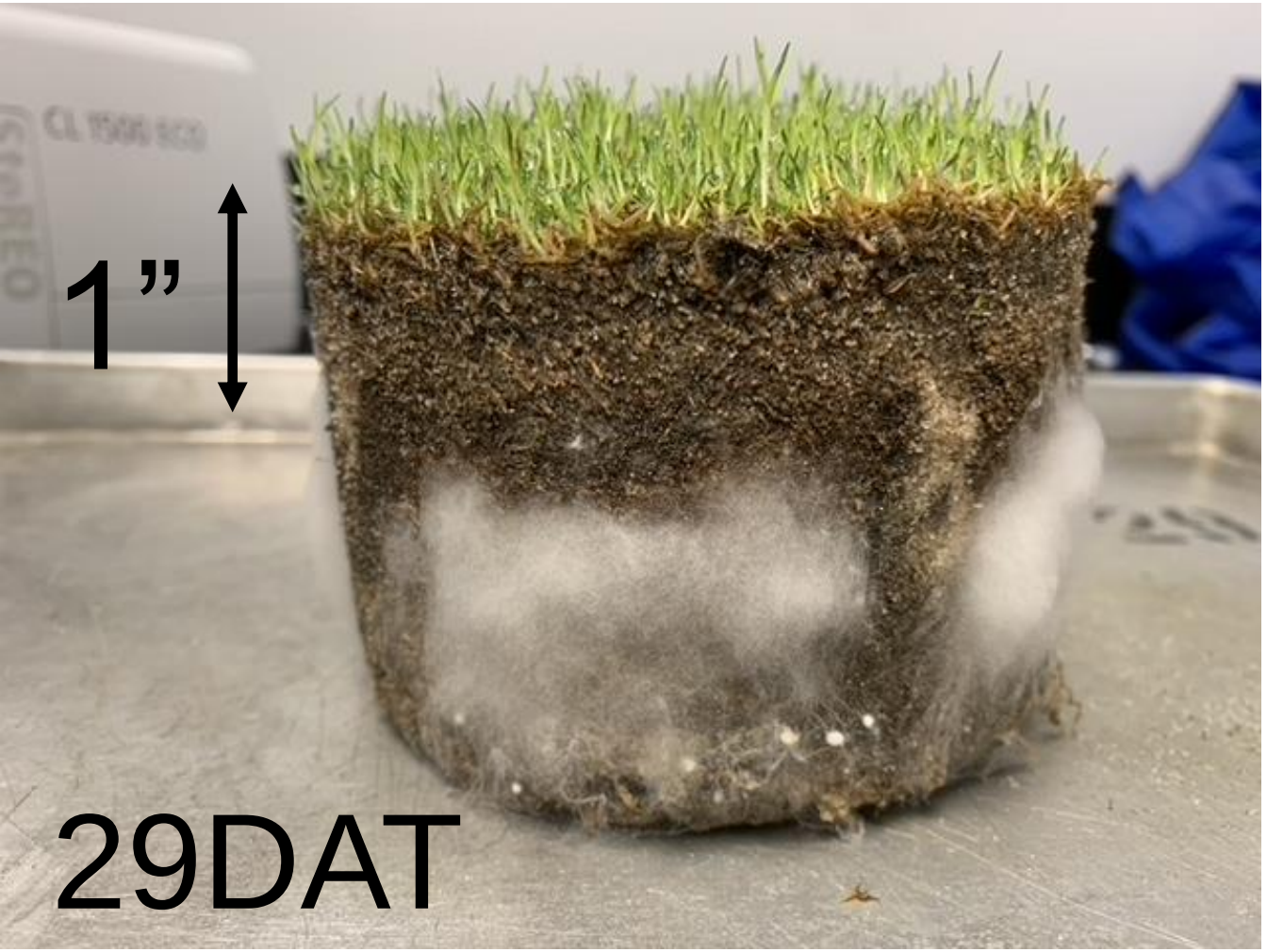
Photo Credit: Lee Butler, NCSU Turf Diagnostic Lab 2020

Watering In @ 1/8-1/4”



- Fairy ring program application
- Watered in with 1/4”
- Note where fungus **isn’t** growing
- Some say: “don’t water in”
- Field experience: do it!
- BASF labels

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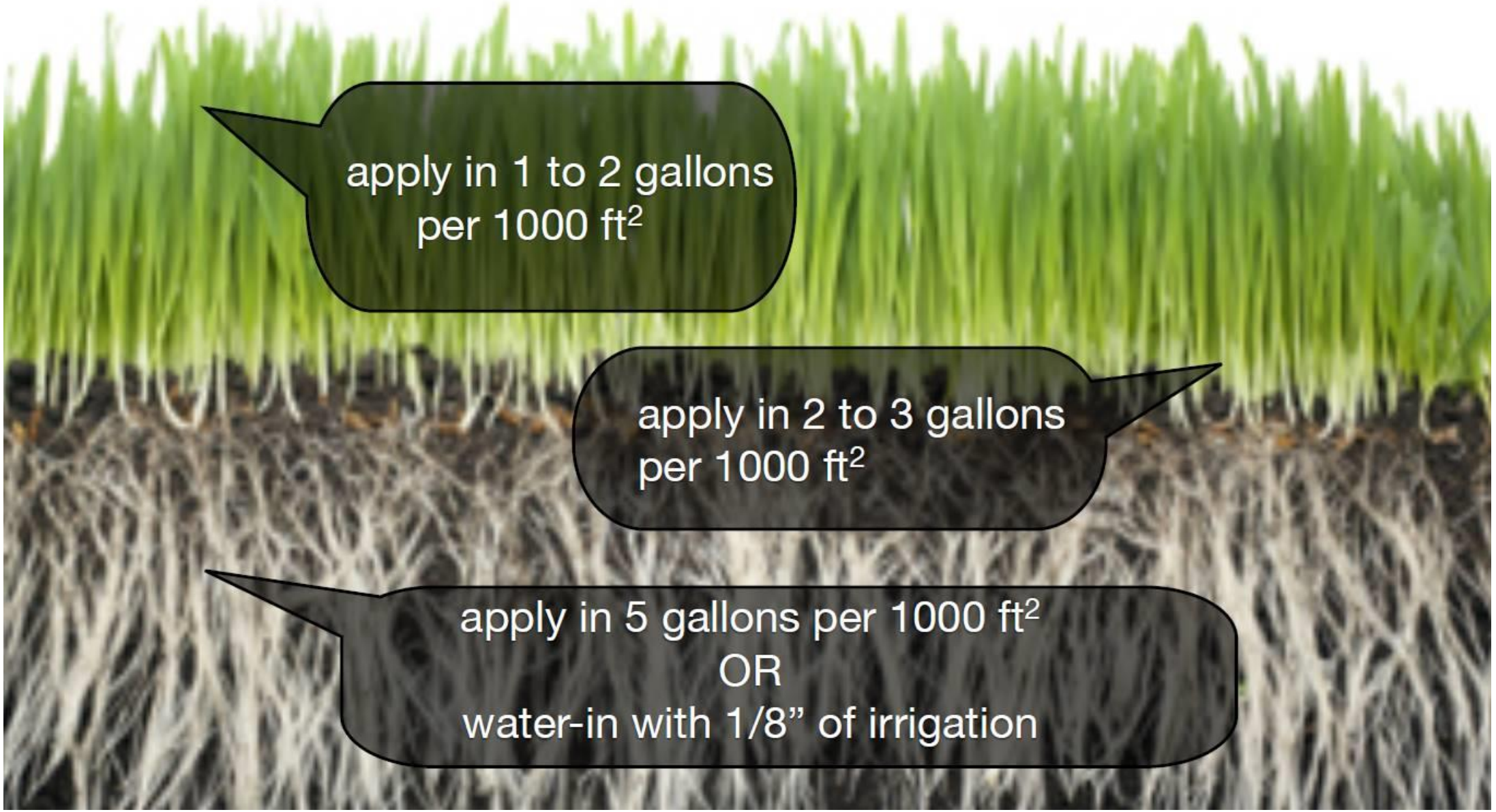
Fungicide activity is on the pathogen – not the turf

Move product to where the pathogen is



Joe Roberts, Clemson University

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Diagnostics

- Diversify your approach
- Second or third opinions for difficult situations
- Fast results might not be thorough
- Any product recommendations should be ranked*
- Important to ID all pathogens in samples

NC STATE EXTENSION

MU Extension
University of Missouri

RUTGERS

WASHINGTON STATE UNIVERSITY

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Diagnosis: One, Several, Many

- Summer diseases look similar - summer patch, anthracnose, take-all patch, mini-ring (aka Rhizoctonia leaf and sheath blight), & necrotic ring spot:
  - Tan or bronzy appearance, similar shaped and sized patches
  - Infections can happen simultaneously

Know Before You Spray

The best approach for one disease can worsen another:

Thiophanate-methyl for summer patch can make mini-ring worse.

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Recovery advice from a Superintendent

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Polling Question

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Citations

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Ou, L., Latin, R. (2018). Influence of management practices on distribution of fungicides in golf course turf. *Agronomy Journal. 110*(6) 1-11. doi:10. 213 4/ag ronj2018.02 .0115

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Watschke, T. L., Dernoeden, P. H., & Shetlar, D. J. (2013). *Managing turfgrass pests (2nd ed.).* Boca Raton, FL: CRC Press, Taylor & Francis Group.

- BREAK –

We will reconvene at 11:00am

Support Turfgrass Research & Education at OSU

OLCA
OREGON LANDSCAPE CONTRACTORS ASSOCIATION

For Tickets: Scan QR code or visit: www.oregonturfgrassfoundation.org

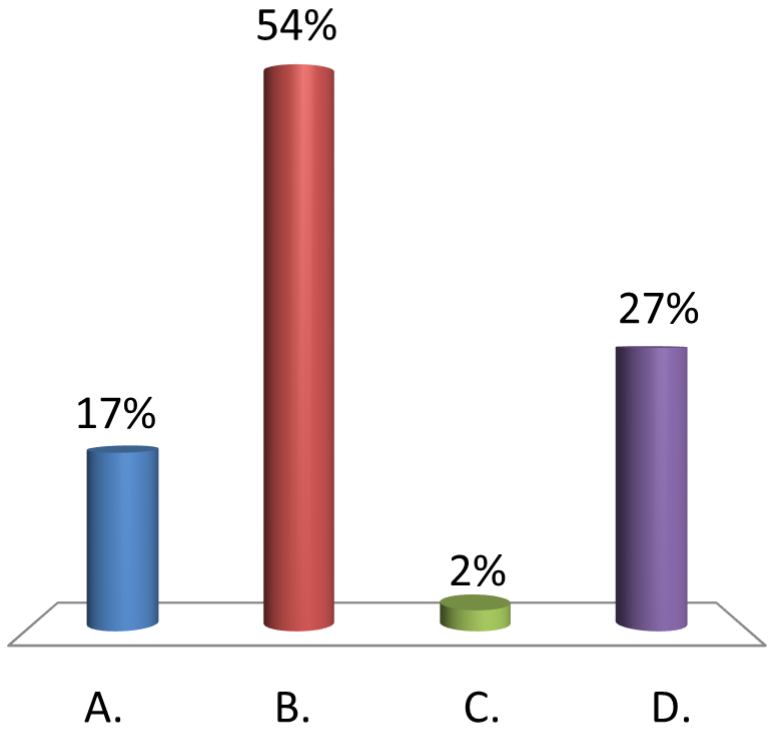
Break - We will reconvene at 11:00am

Contemporary Issues in Turf Disease Control

RL
TURF
R. Latin, Ph.D.
Emeritus Professor of Plant Pathology
rick@rlturf.com
www.rlturf.com

Based on LD50 (a measure of acute toxicity), which of the substances below is most toxic?

A. Aspirin
B. Caffeine
C. Chlorothalonil (Daconil)
D. Imidacloprid (Merit)



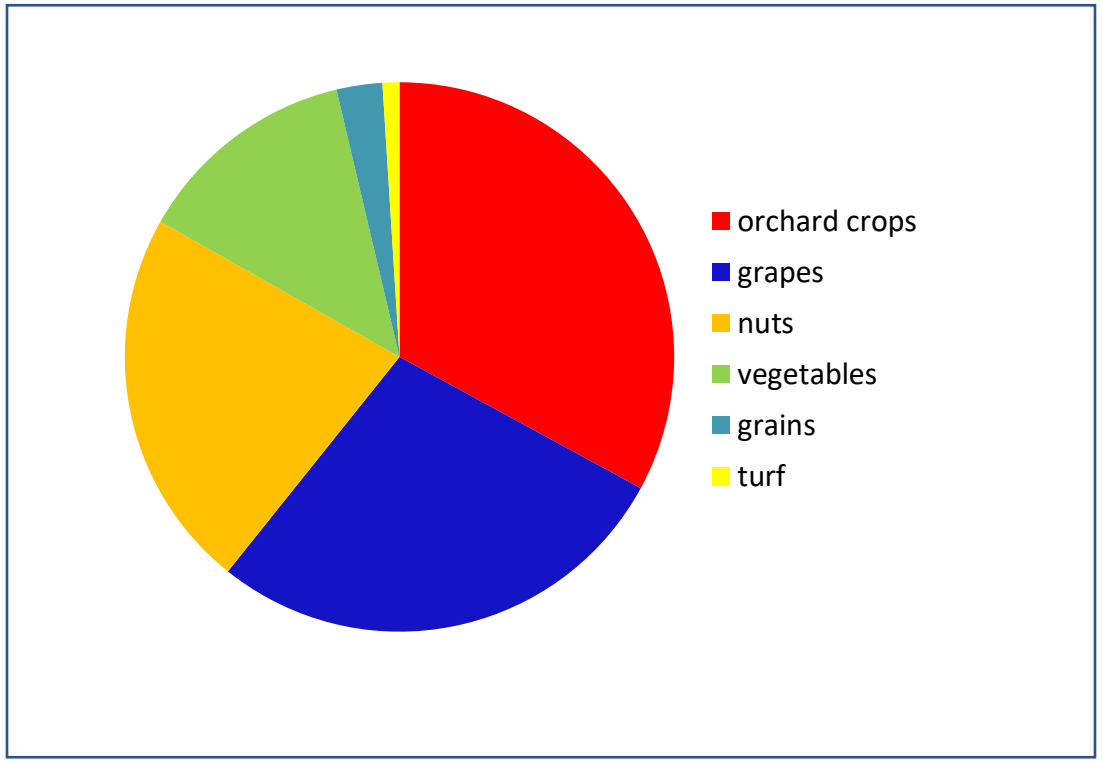
Fungicides as pesticides…in perspective

Lethal dose (LD_{50}), a measure of acute relative toxicity

Selected substance	LD_{50} (mg/kg body weight)
Aldicarb (nematicide / insecticide)	1
Nicotine (insecticide)	50
Caffeine	250
Imidacloprid (insecticide, e.g., Merit)	450
Aspirin	780
Tebuconazole (fungicide, e.g., Mirage)	3,776
Chlorothalonil (fungicide, e.g, Daconil)	>5,000

Fungicides as pesticides…in perspective

Fungicides applied to turf represent a fraction of the amount applied for disease control on fruits vegetables, and other crops.



Cohen, S. Z. 1995. Agriculture and the golf course industry: An exploration of pesticide use. GCM.

Significant differences in course maintenance during the past 45 years

1974	2019
KyBG fairways (1.0 – 0.75 in)	CBG fairways (0.5 in)
greens height (.375 in)	greens height (.125 in?)
native soil	USGA spec. sand-base
nitrogen fertilizer/M 4 lb fairway / 6 lb greens	nitrogen fertilizer/M 2 lb fairway / 3 lb greens
Mercury/cadmium/arsenic	

USGA Green Section Record, 1985

" If greens were constructed with a high sand mixture, my program would begin at five pounds of nitrogen per 1,000 square feet per year and would be monitored yearly to determine whether more or less nitrogen is required as the turf matures and the soil medium adjusts."

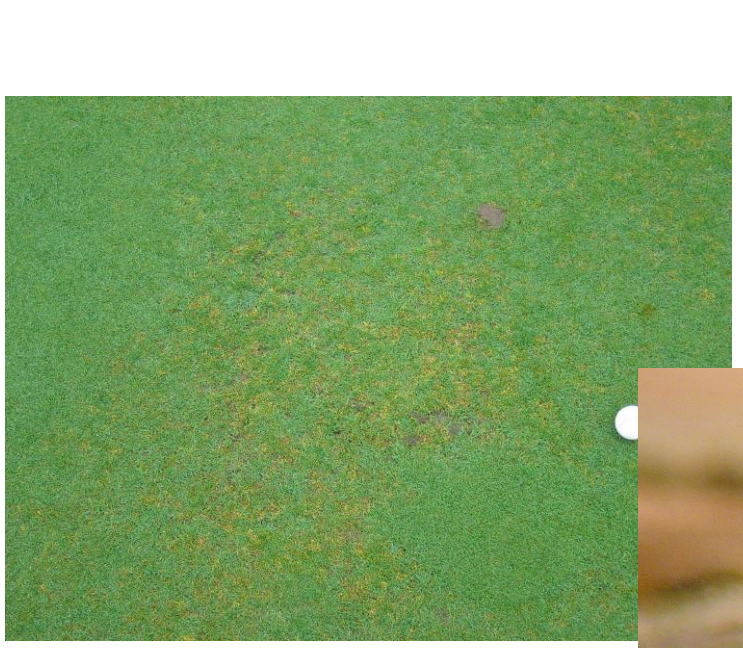
Al Radko
Executive Director USGA Green Section
1985
Post US Open, Winged Foot Golf Club 1984

USGA Green Speed Test Comparison Table (Regular Membership Play)	
Fast	8'6"
Medium-Fast	7'6"
Medium	6'6"
Medium-Slow	5'6"
Slow	4'6"

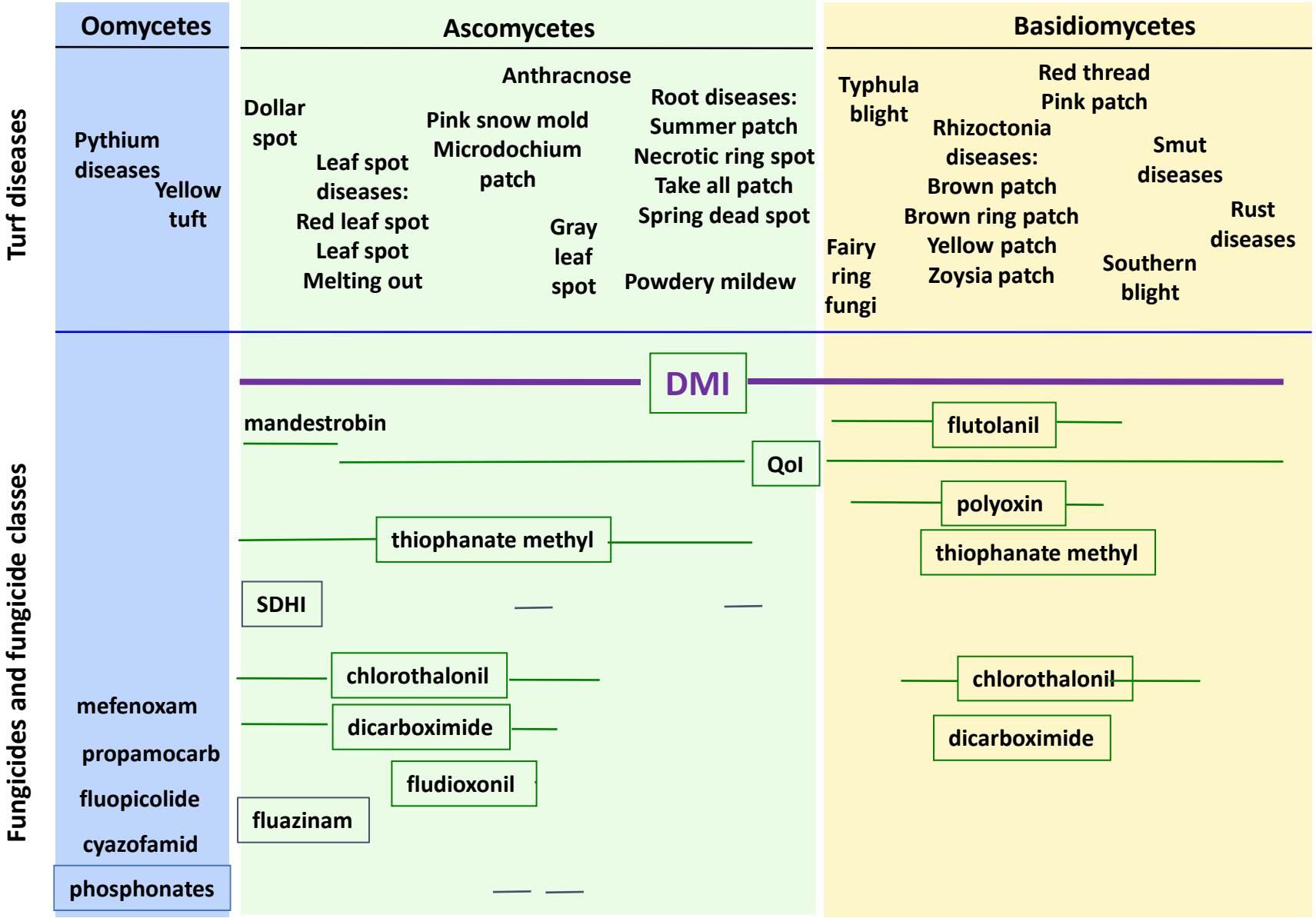
USGA Green Speed Test Comparison Table (National Championships)	
Fast	10'6"
Medium-Fast	9'6"
Medium	8'6"
Medium-Slow	7'6"
Slow	6'6"

This disease did not appear in scientific literature before 1995.

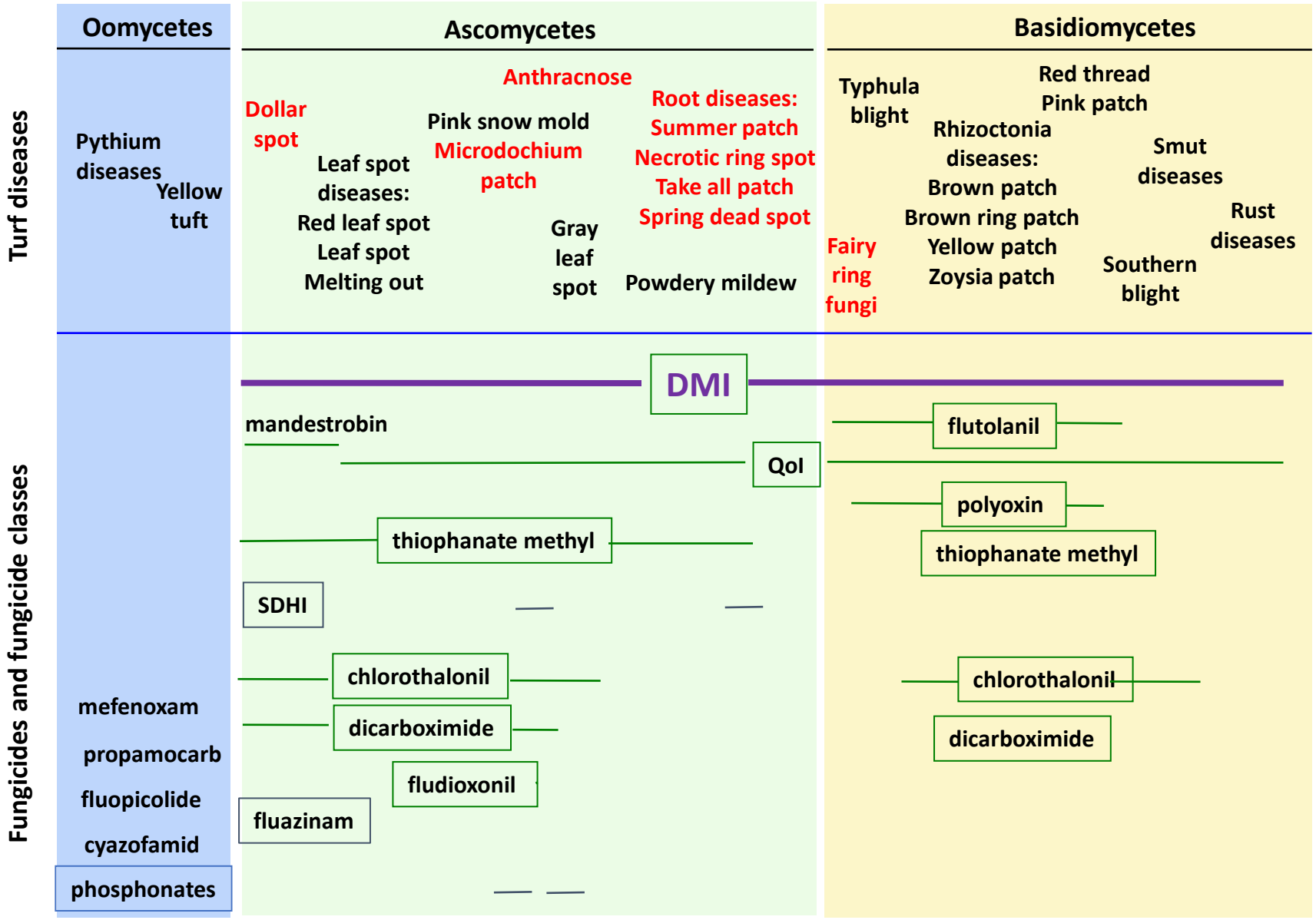
The anthracnose pathogen attacks plants under stress… nutritional stress, environmental stress, and natural senescence



Spectrum of activity of turf fungicides.



Spectrum of activity of turf fungicides.

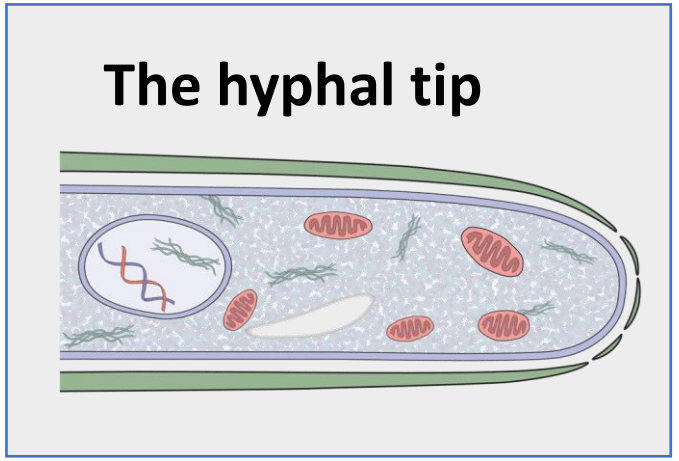


Active ingredients with the same biochemical mode of action are grouped into the same fungicide CLASS.

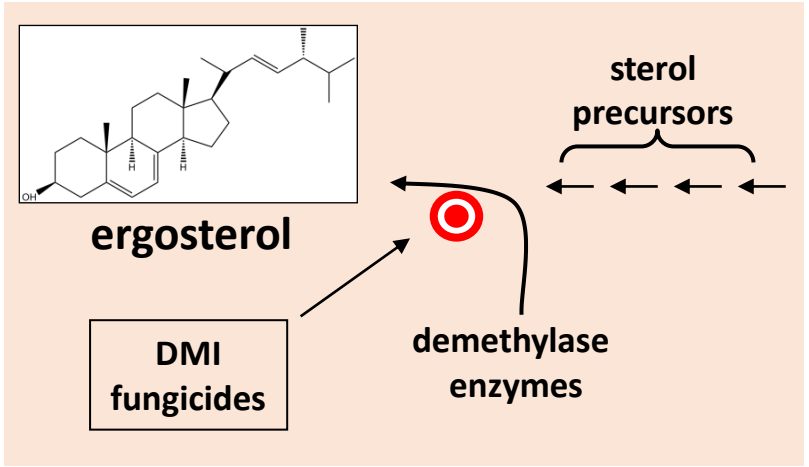
Fungicide Class	Active ingredient	Basic mfr. Product	FRAC
DMI	mefentrifluconazole	Maxtima	3
Demethylase Inhibitor	metconazole	Tourney	
	myclobutanil	Eagle	
Sterol Inhibitors (SI)	propiconazole	Banner Maxx	
	tebuconazole	Torque	
	triadimefon	Bayleton	
	triticonazole	Trinity/Triton	
	flutriafol	Rayora	
	difenconazole	*	
QoI	azoxystrobin	Heritage	11
Quinone Outside Inhibitor	fluoxastrobin	Fame	
	pyraclostrobin	Insignia	
Strobilurins	trifloxystrobin	Compass	
	mandestrobin	Pinpoint	
Dicarboximide	iprodione	26GT	2
	~~vinclozolin~~	~~Curalan~~	
SDHI	flutolanil	Prostar	7
Succinate Dehydrogenase	boscalid	Emerald	
Inhibitors	fluopyram	Exteris	
	fluxapyroxad	Xzemplar	
	isofetamid	Kabuto	
	penthiopyrad	Velista	
	pydiflumetofen	Posterity	

Fungicides with the same biochemical mode of action are grouped into the same class.

Some fungicides inhibit demethylase enzymes in the fungal pathogen's sterol biosynthesis pathway…they all are referred to as DMI fungicides.



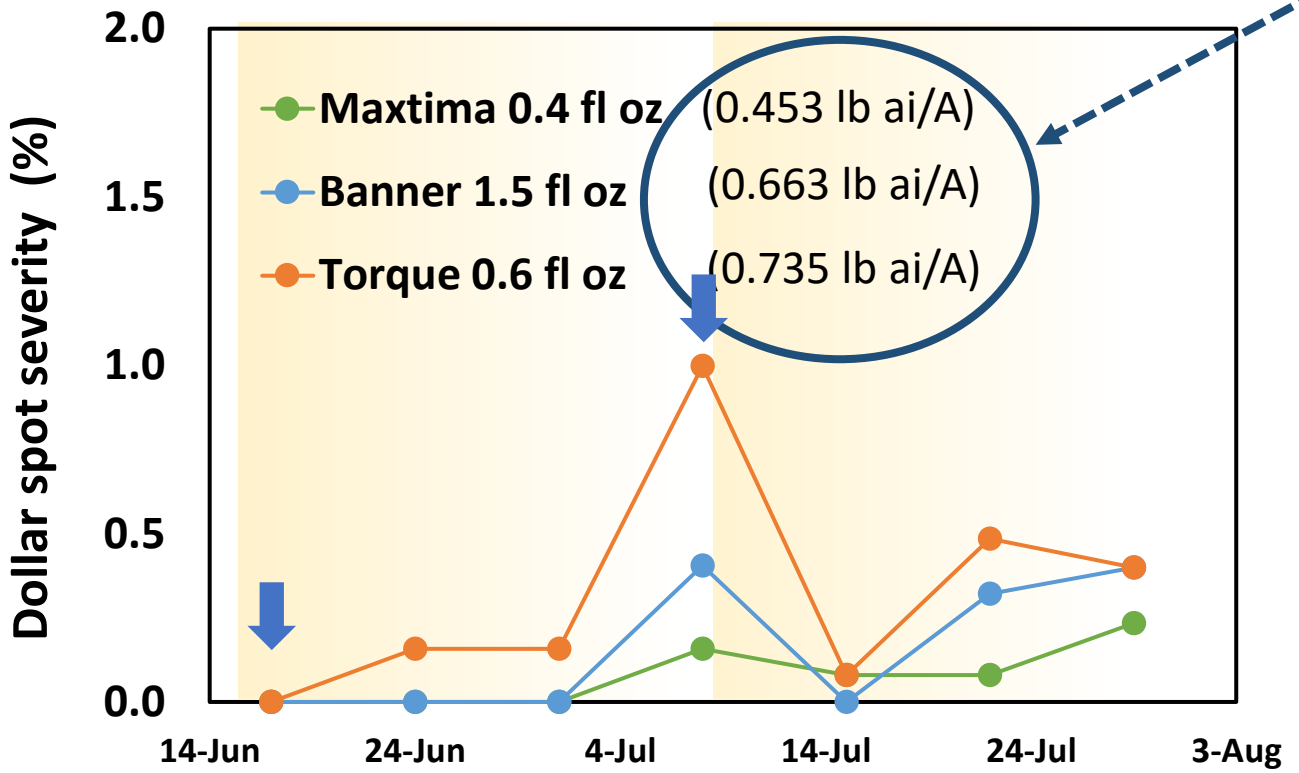
Fungicide	Basic Mfg Product
Mefentrifluconazole	Maxtima
Metconazole	Tourney
Myclobutanil	Eagle
Propiconazole	Banner Maxx
Tebuconazole	Torque
Triticonazole	Trinity
Triticonazole	Triton
Flutriafol	Rayora
Difenoconazole	(B-way component)



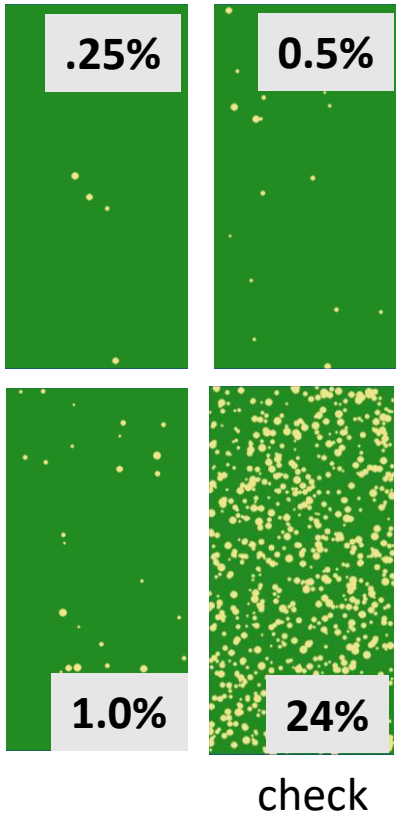
DMI = DeMethylase Inhibitors

Dollar spot trial 2019, Purdue University
(Experimental site trending towards DMI resistance)

Amount of DMI molecule required to stop fungal growth



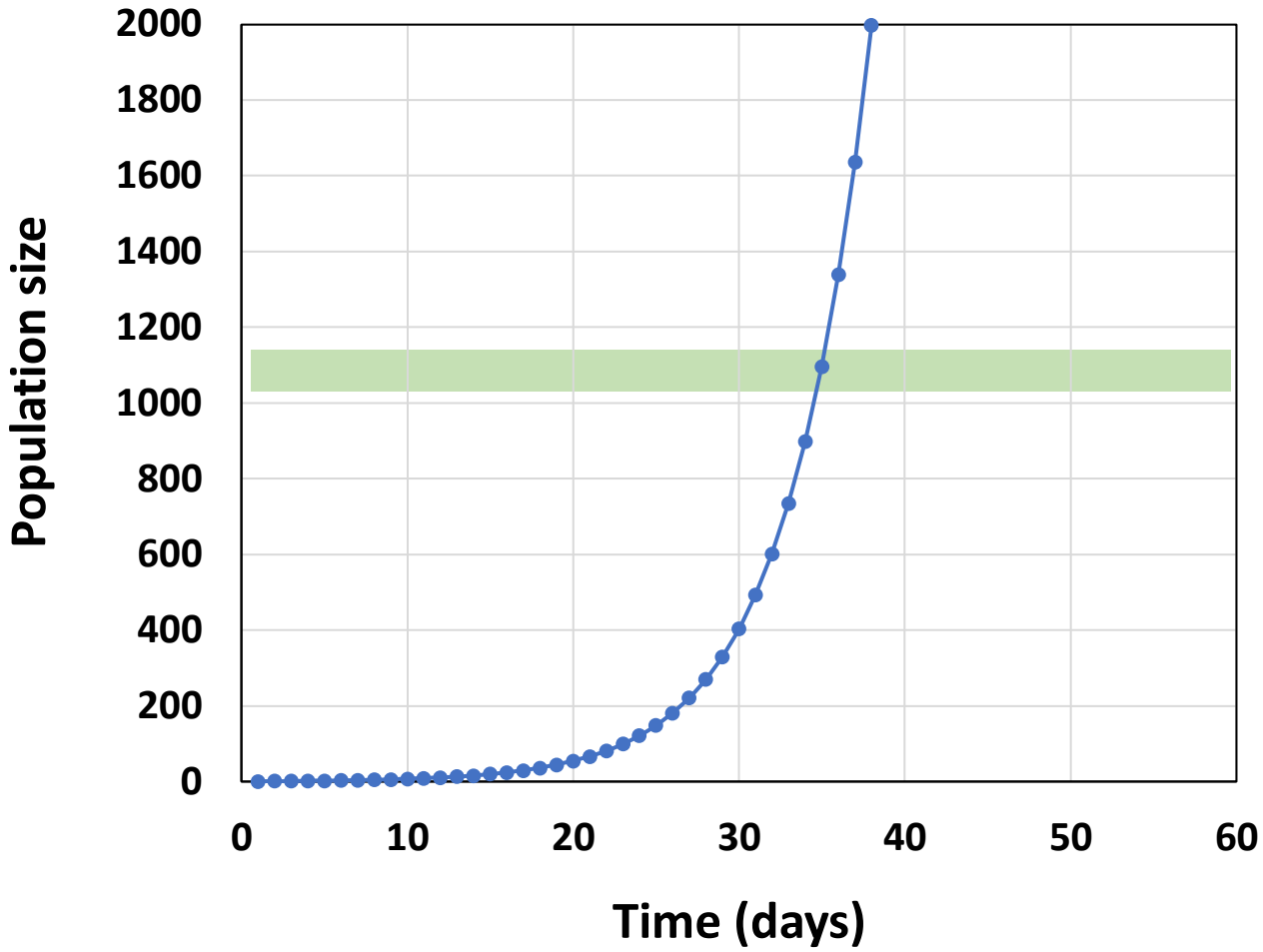
Fungicides applied Jun 17, July 8



check

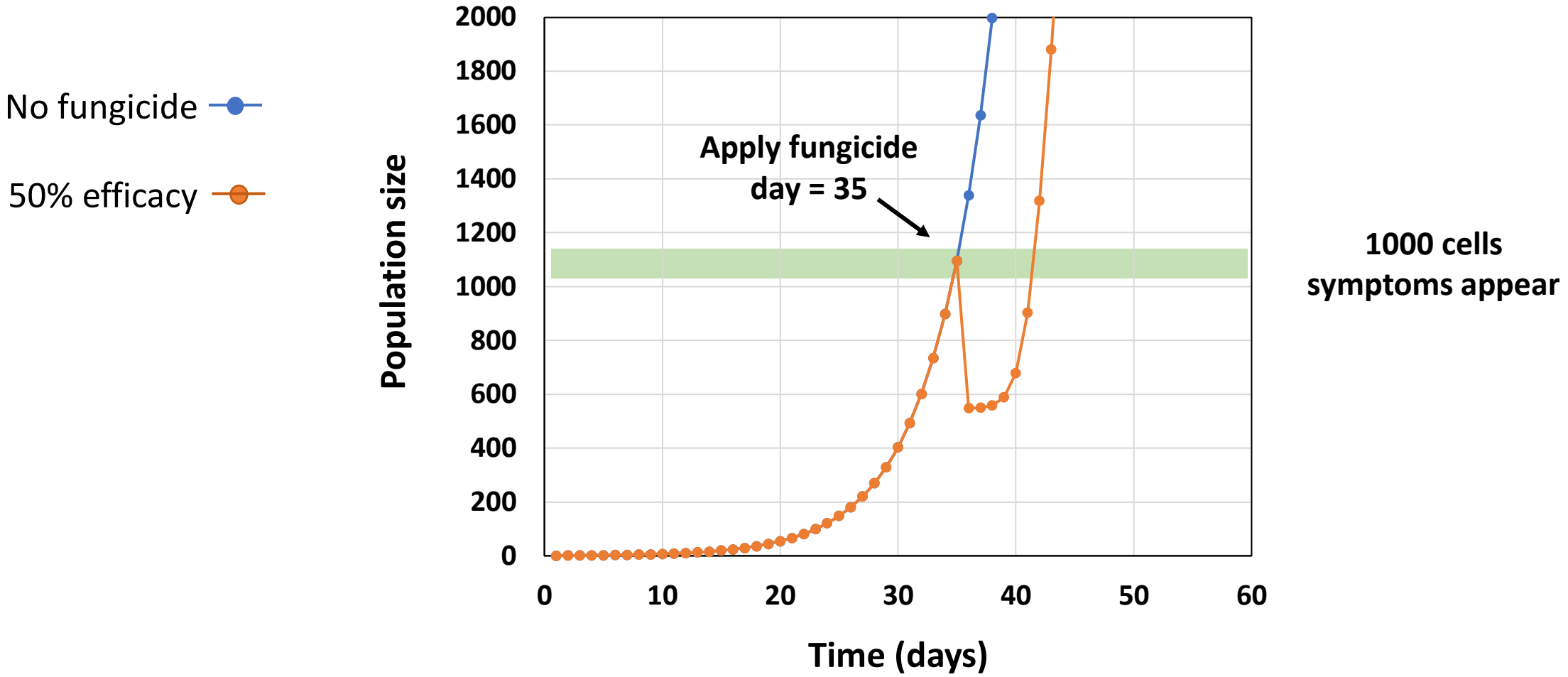
Fungicide effects on fungal growth

No fungicide



1000 cells symptoms appear

Fungicide effects on fungal growth

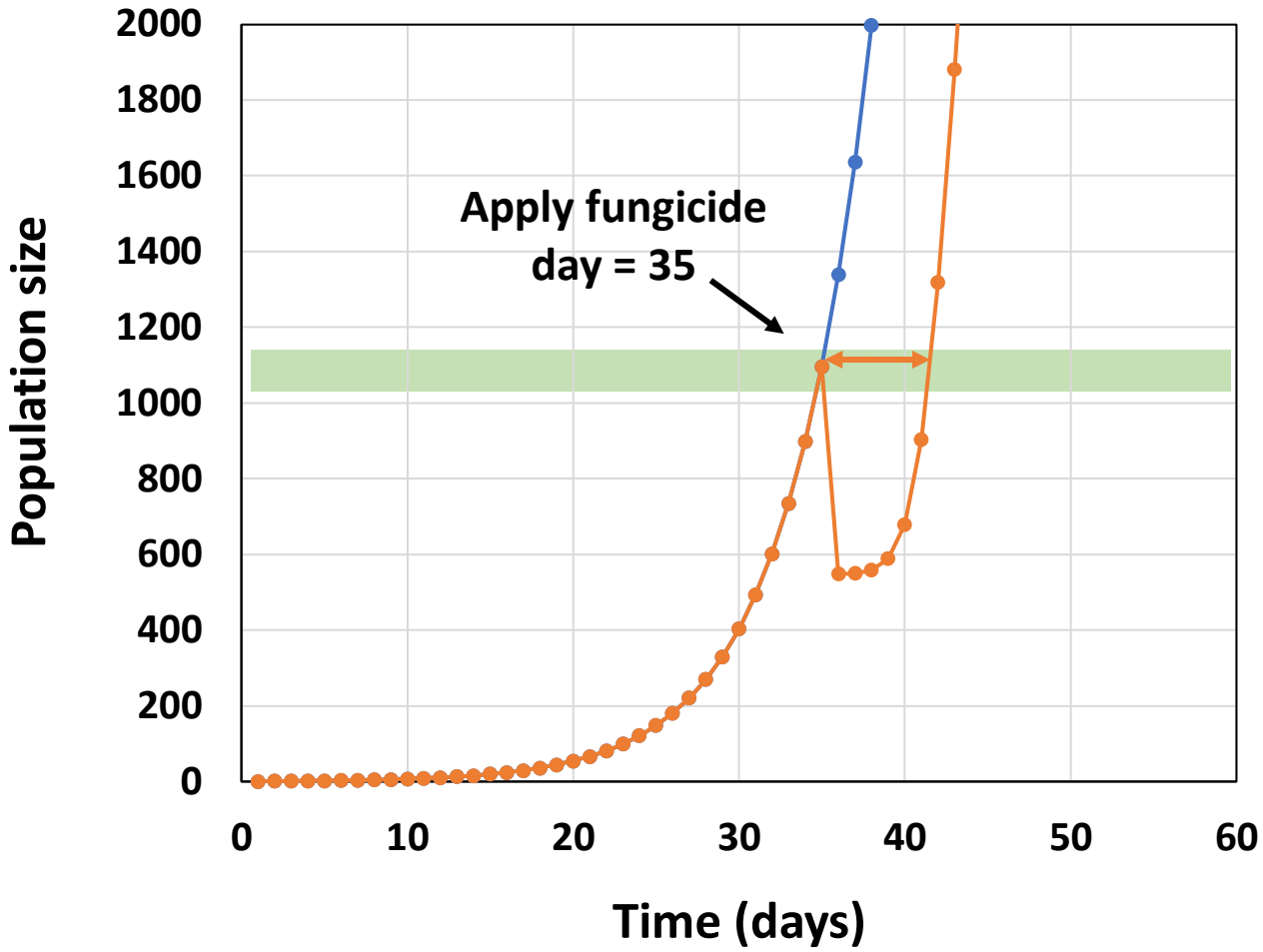


Fungicide effects on fungal growth

No fungicide

50% efficacy

7 days



1000 cells
symptoms appear

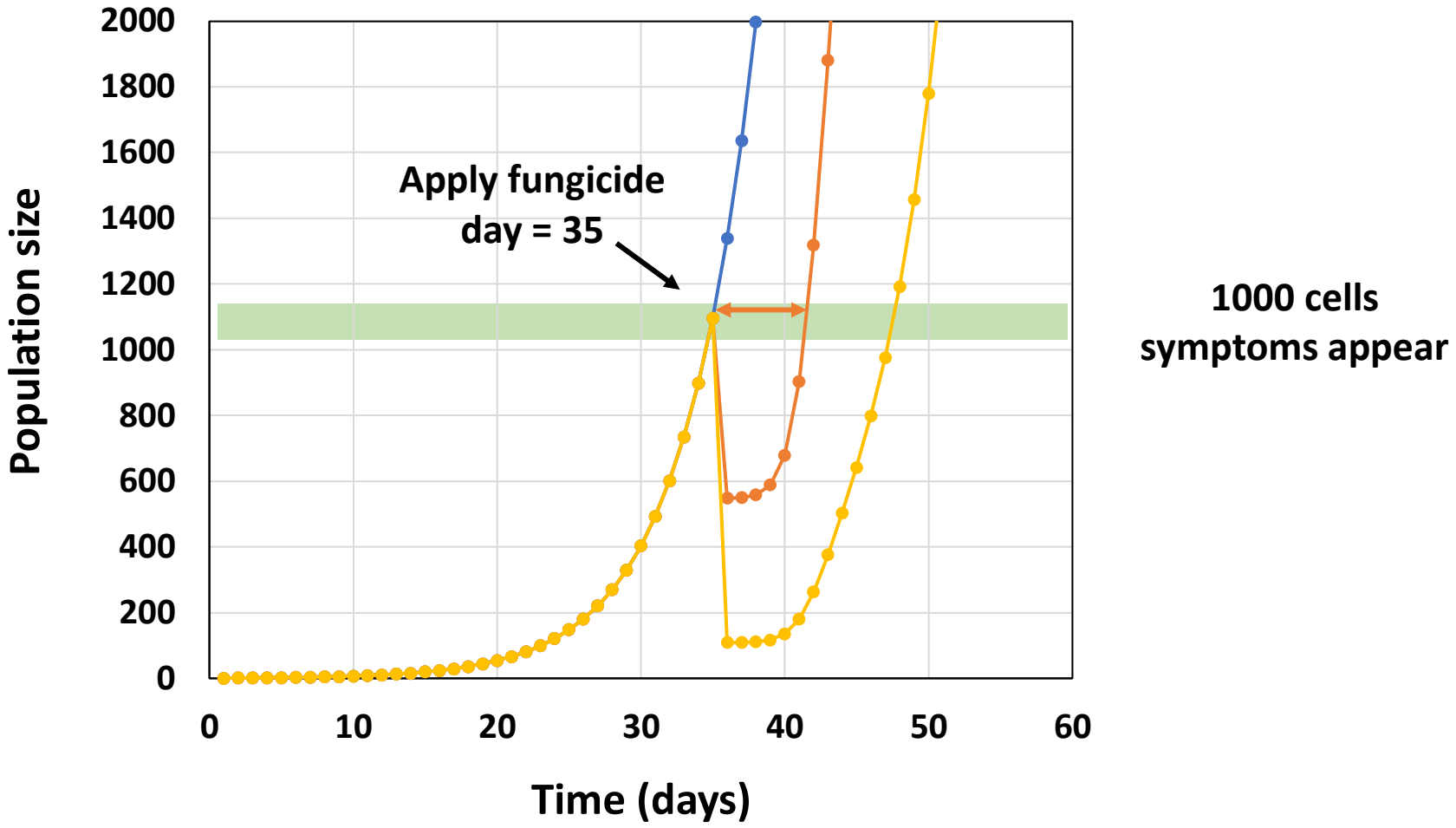
Fungicide effects on fungal growth

No fungicide

50% efficacy

7 days

90% efficacy



1000 cells
symptoms appear

Fungicide effects on fungal growth

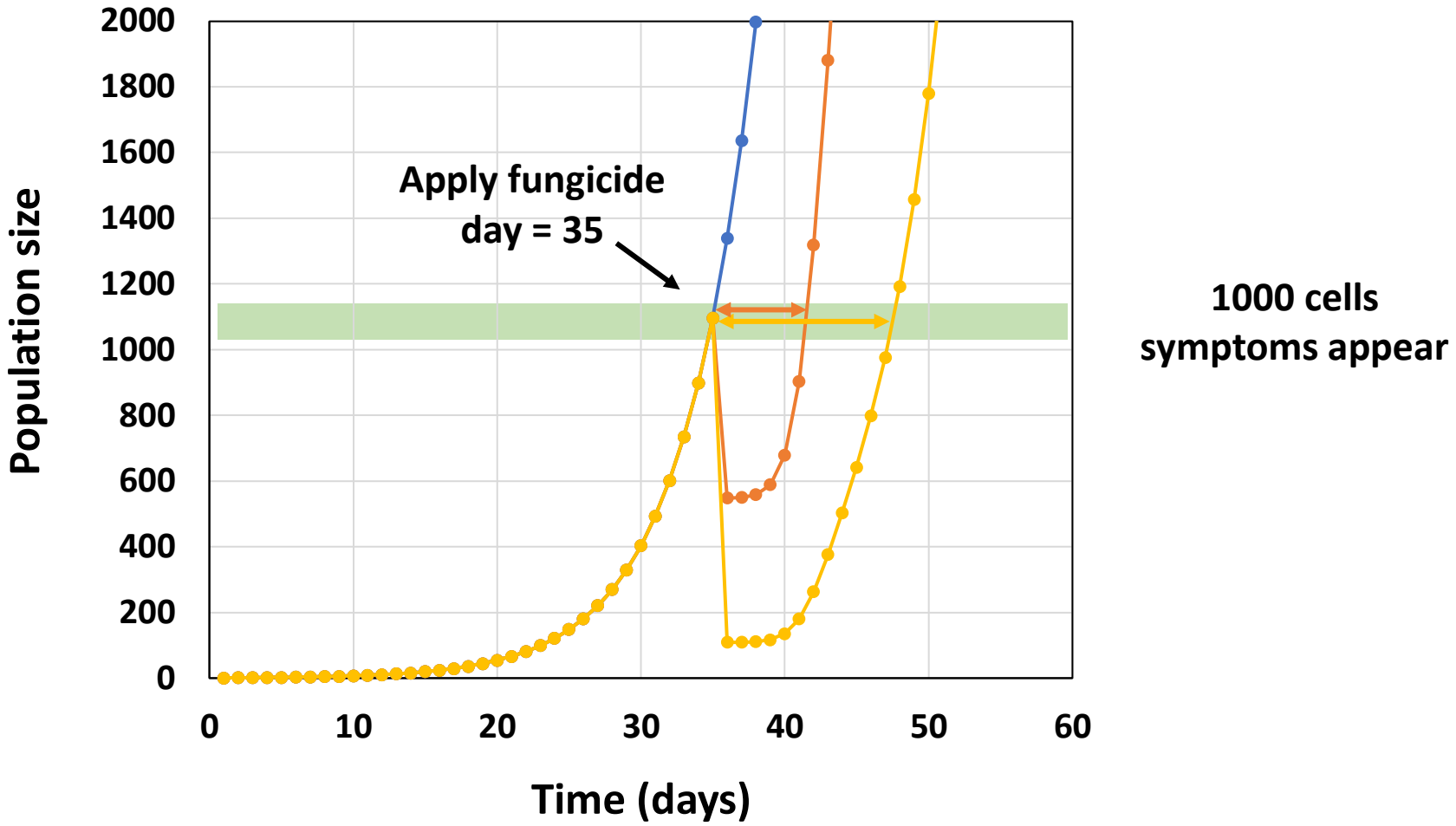
No fungicide

50% efficacy

7 days

90% efficacy

13 days



1000 cells
symptoms appear

Fungicide effects on fungal growth

No fungicide

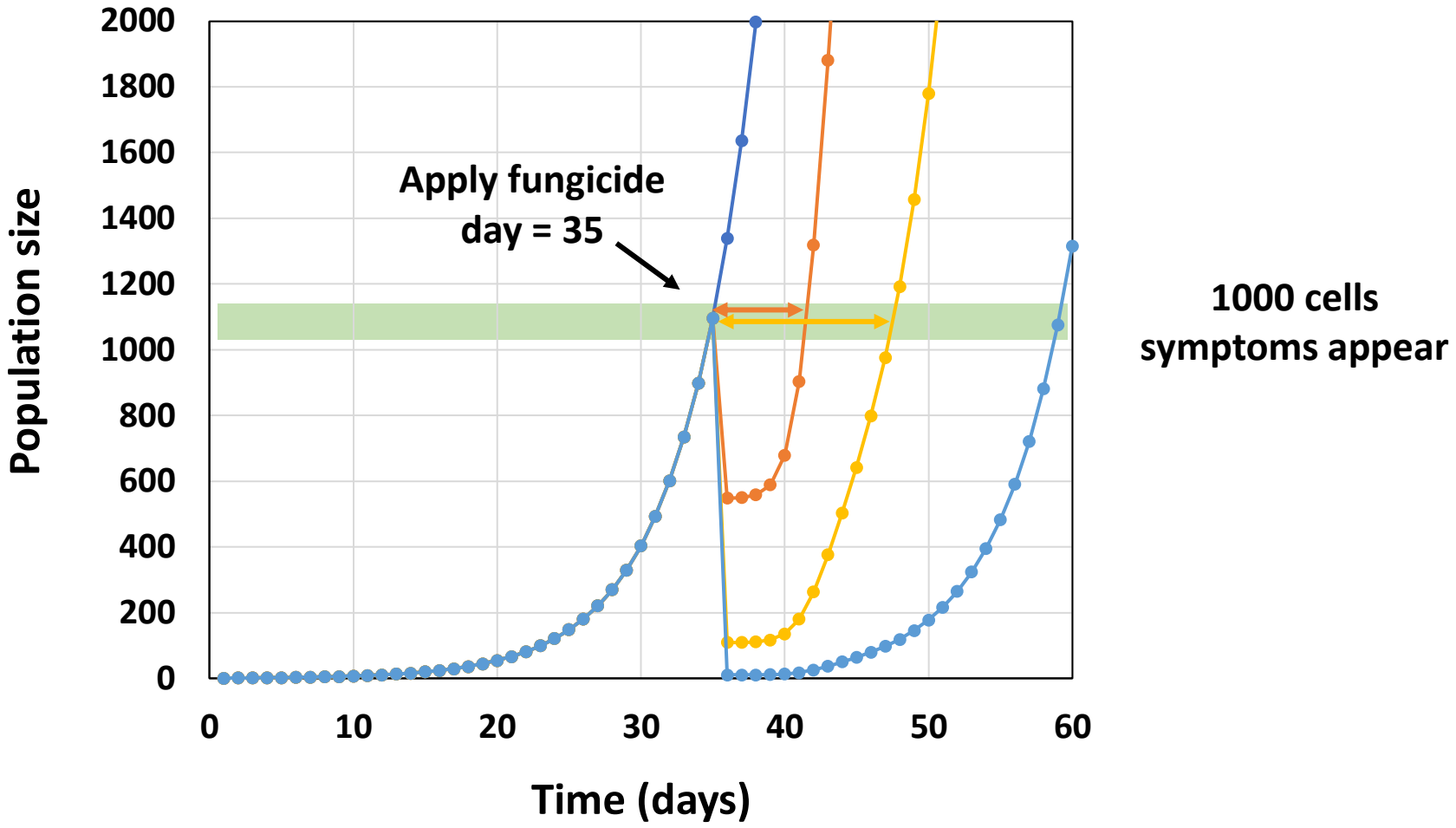
50% efficacy

7 days

90% efficacy

13 days

99% efficacy



1000 cells
symptoms appear

Fungicide effects on fungal growth

No fungicide

50% efficacy

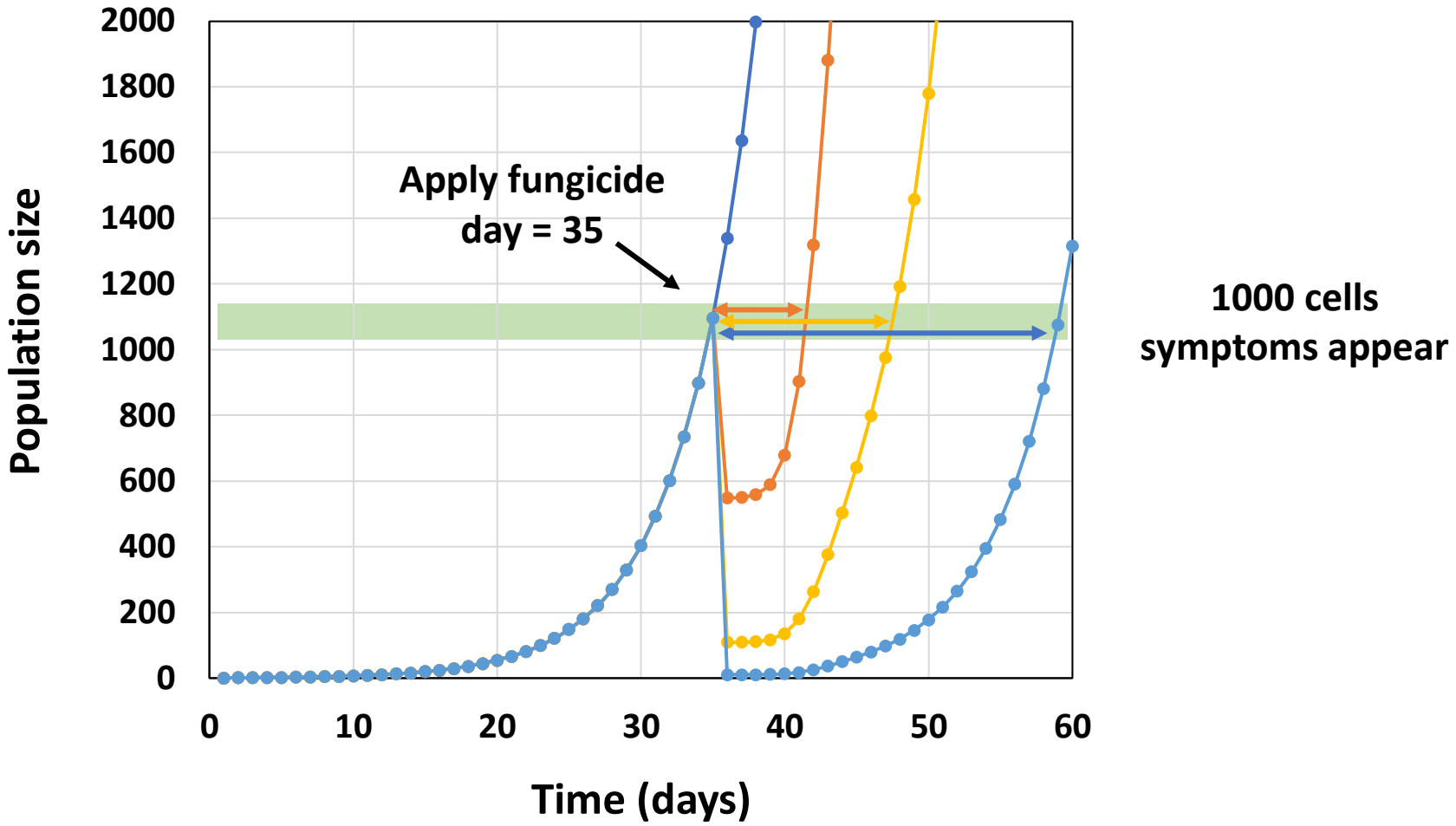
7 days

90% efficacy

13 days

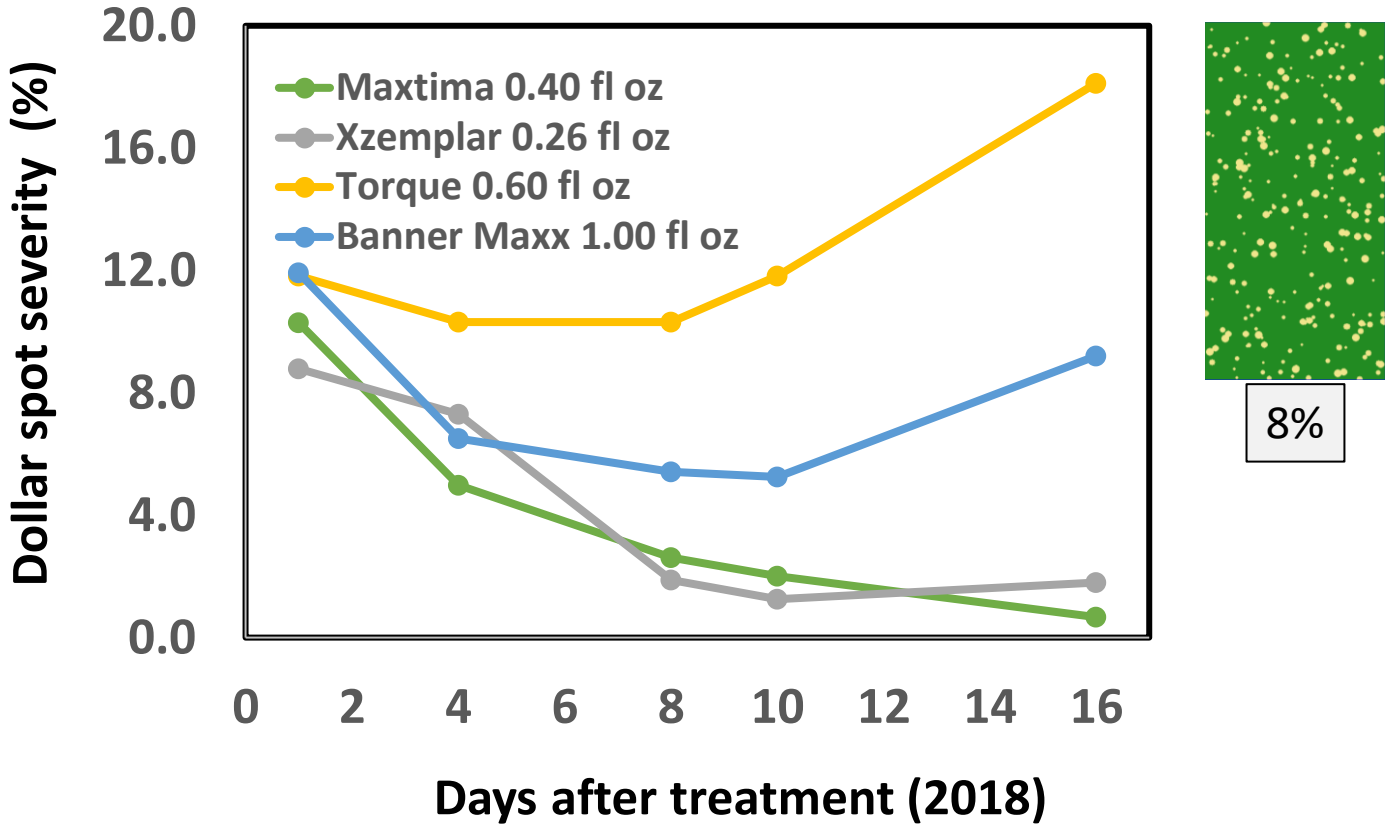
99% efficacy

24 days



1000 cells
symptoms appear

Dollar spot trial 2018, Purdue University
(Experimental site trending towards DMI resistance)



8%

Fungicides applied once Aug 6, 2018 (day 1)

Fungicide resistance has 2 components: biological (pathogen) and chemical (fungicide). Only with certain combinations of pathogens and fungicides have been identified.

dollar spot / SDHI
dollar spot / DMI
dollar spot / t-methyl
dollar spot / dicarboximides

anthracnose / QoI
anthracnose / t-methyl
anthracnose / DMI

pink snow mold / dicarboximides

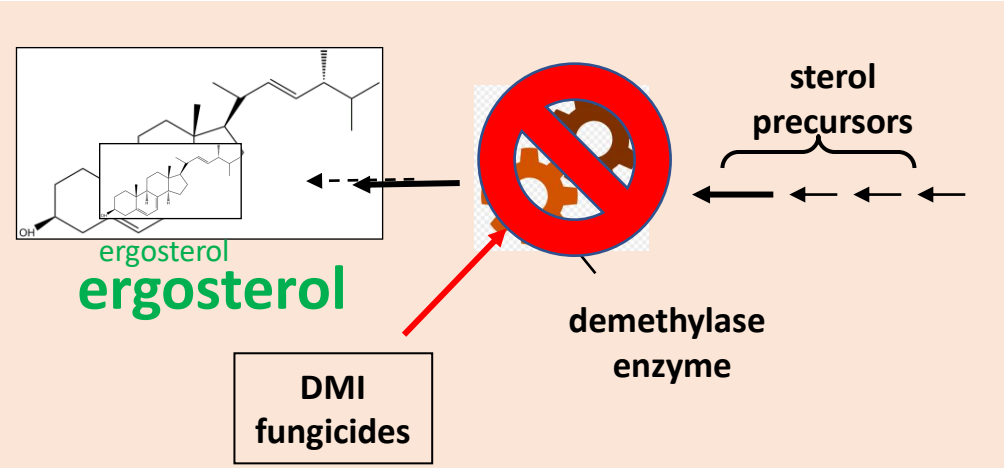
gray leaf spot / QoI
gray leaf spot / t-methyl?

Pythium blight / mefenoxam
Pythium blight / QoI?

All DMI fungicides block **ergosterol** biosynthesis by inhibiting demethylase enzymes.

All are assigned in FRAC Code 3

Fungicide	Basic Mfg Product
Mefentrifluconazole	Maxtima
Metconazole	Tourney
Myclobutanil	Eagle
Propiconazole	Banner Maxx
Tebuconazole	Torque
Triadimefon	Bayleton
Triticonazole	Trinity
Triticonazole	Triton
Difenoconazole	(B-way component)



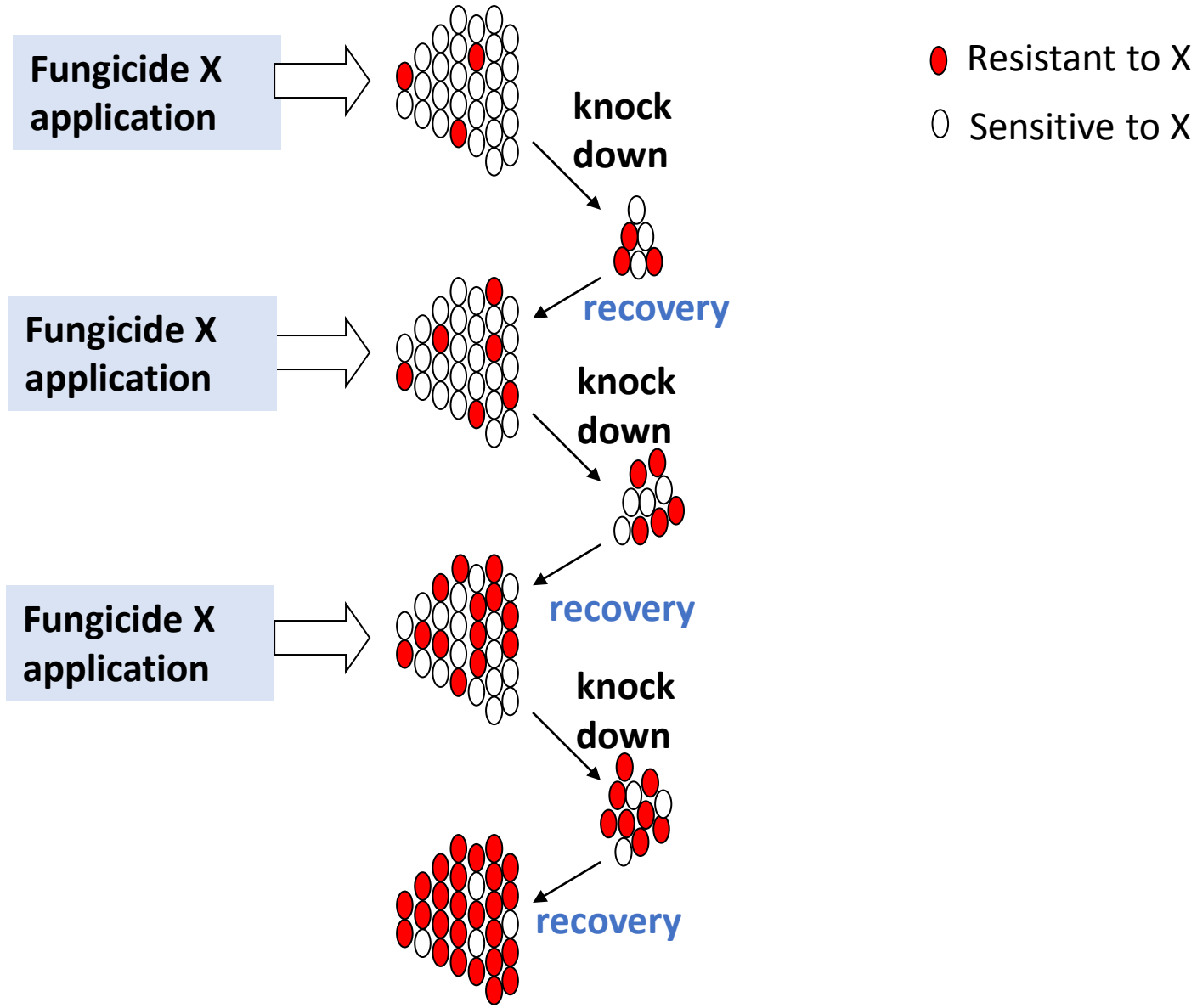
DMI = DeMethylase Inhibitors

Evolution towards fungicide resistance:

Step 1 -- Mutation
Step 2 -- Selection pre

Large pathogen populations create more opportunities for **mutation** towards resistance.

Selection pressure is increased by repeated application of the same fungicide or class.



Resistance Management Guidelines

	Reduce popn. size	Reduce selection pressure
1. Employ non-chemical options for disease control.	X	X
2. Apply fungicides preventatively.	X	
3. Use multi-site compounds as the first line of defense.	X	
4. Use multi-site compounds as mix partners with single-site products.	X	
5. Limit the use of single-site fungicides.		X
6. Rotate single-site chemistry.		X

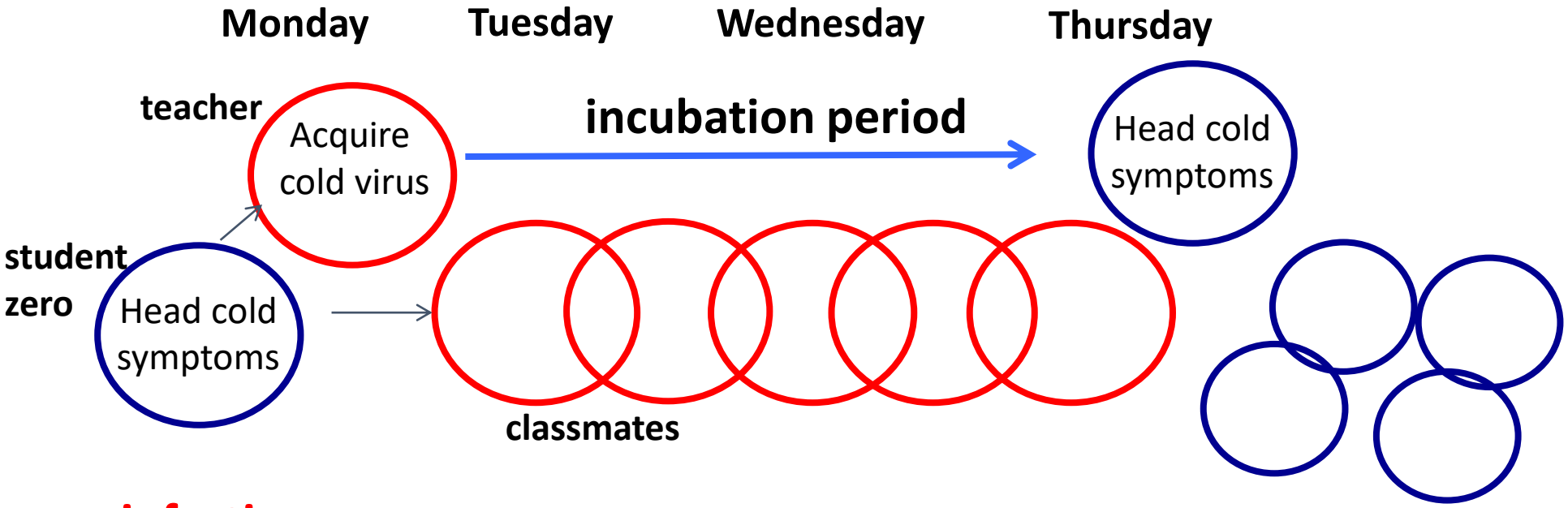
- Approaches to Fungicide Scheduling
  - Damage-based
  - Weather-based
  - Calendar-based

Damage-based (“curative”) approach

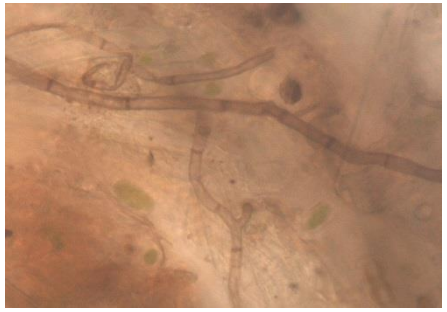
If you decide to apply according to pest threshold, you must identify when thresholds are reached…but not all pest populations are easily assessed!

Fungal cells are microscopic!

The nature of infectious disease… pre-school example



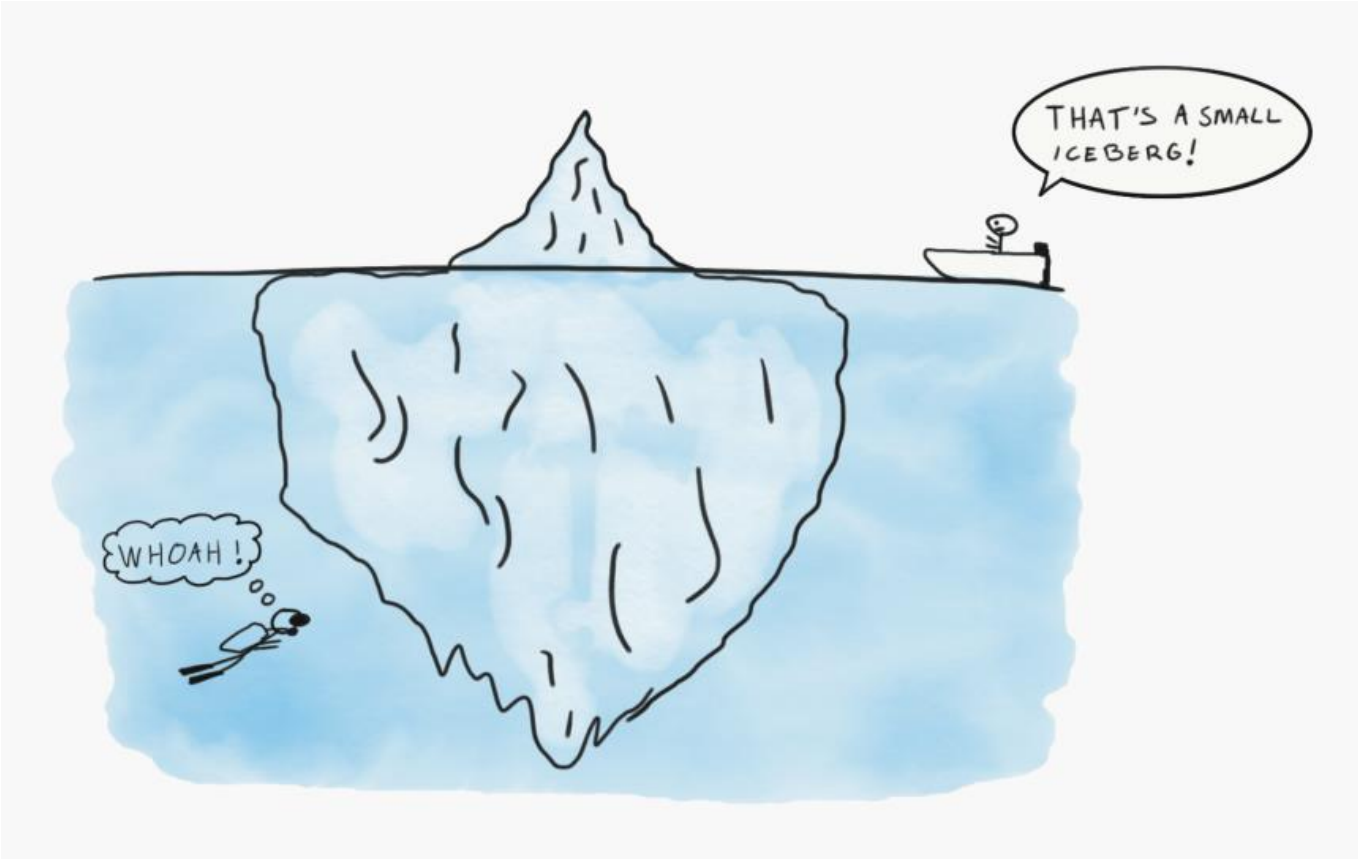
infection



The incubation period assures us that there is more disease than meets the eye!

symptoms

The pathogen population iceberg!



Root Diseases

Fungicides for root disease control

Magnaporthe poae
(summer patch pathogen)

Fungicide (ai) concentration (ppm)

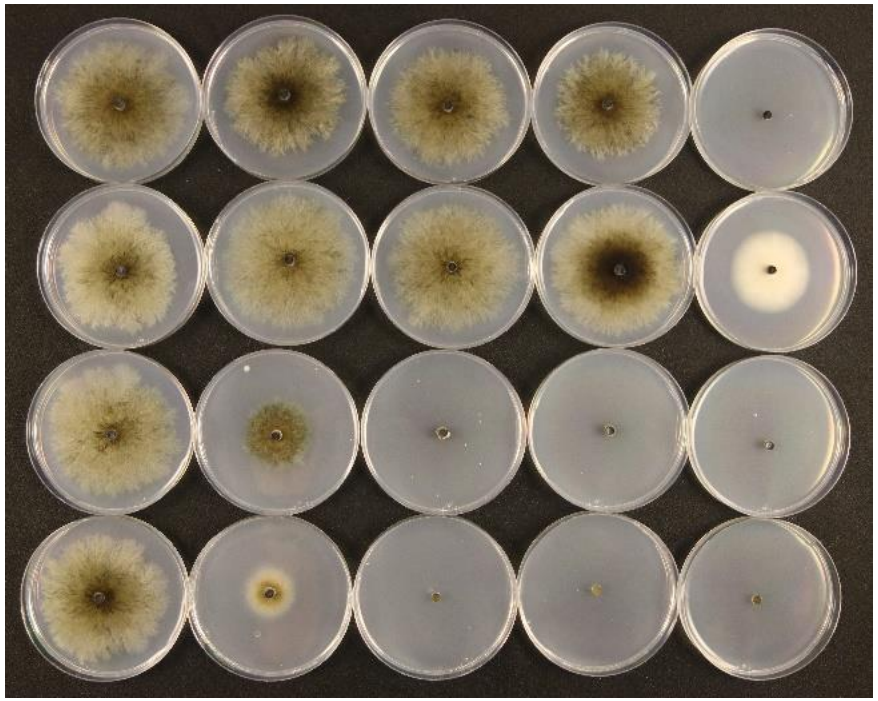
0 0.01 0.1 1.0 10.0

thiophanate-methyl

iprodione

DMI (propiconazole)

QoI (pyraclostrobin)



The summer patch decision aid provides a good example of an empirical model --

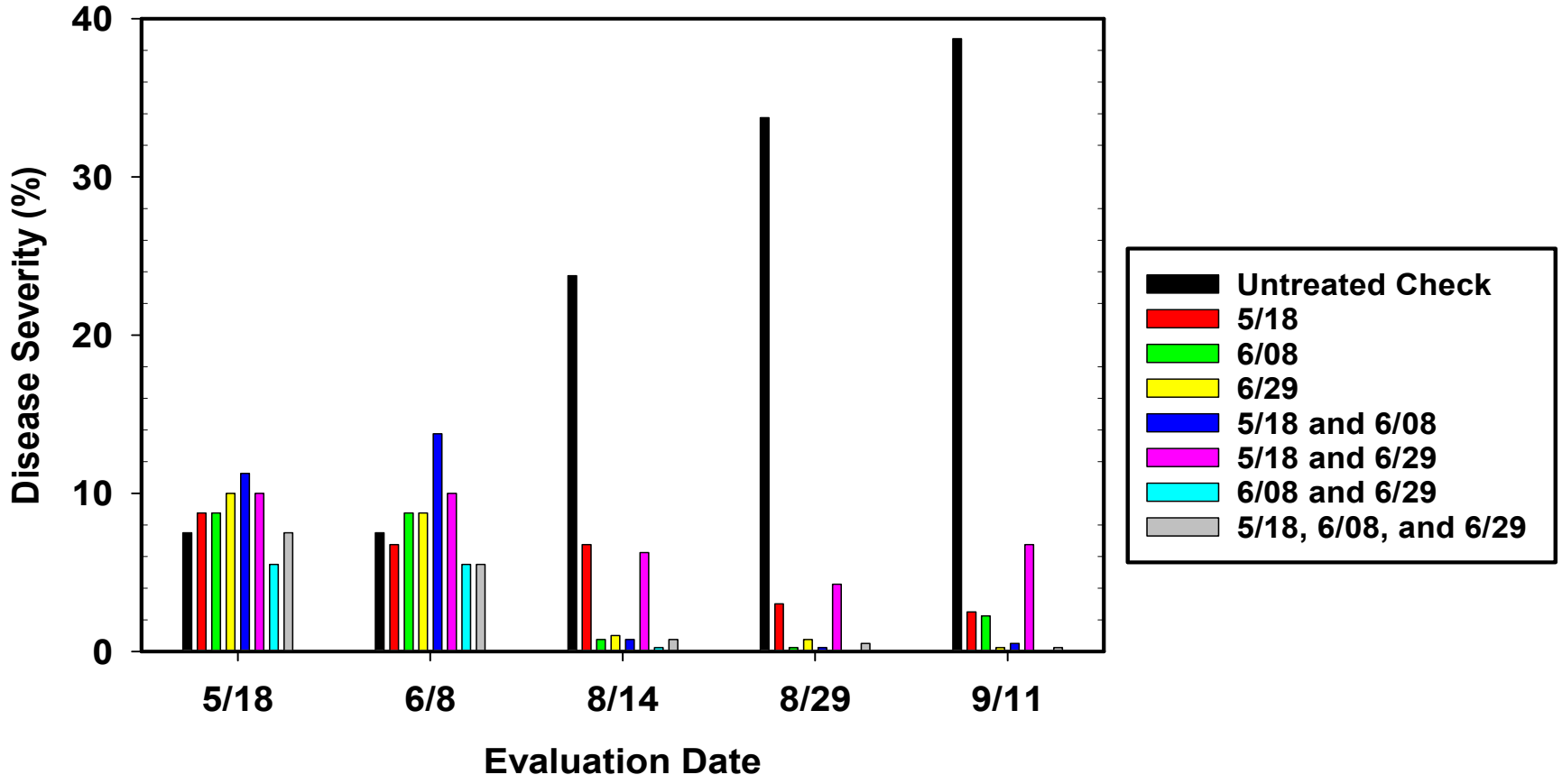
According to the summer patch decision model fungicide applications are initiated within 5-7 days after the daily maximum temperature (2 inch depth) is 65°F or greater for 3 consecutive days.

Evaluation of fungicide timing on summer patch control.

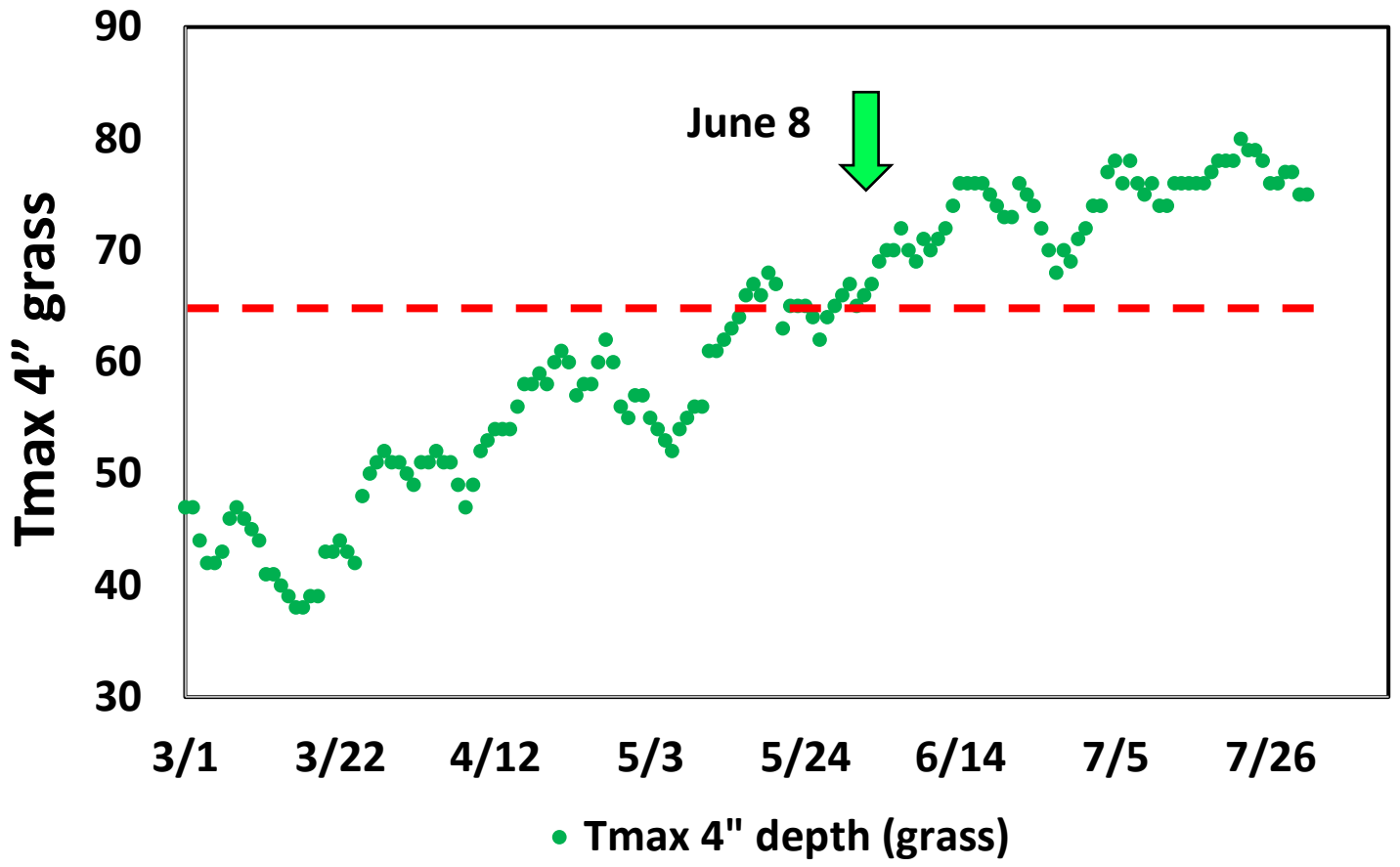
Purdue University, 2017

QoI + DMI
Application dates

1	No fungicide
2	May 18
3	Jun 8
4	Jun 29
5	May 18 + Jun 8
6	May 18 + Jun 29
7	Jun 8 + Jun 29
8	May 18 + Jun 8 + Jun 29



<u>The 65F degree rule</u>….According to the summer patch decision model fungicide applications are initiated within 5-7 days after the daily maximum temperature (2 inch depth) is 65°F or greater for 3 consecutive days. (B.B. Clarke, Rutgers)



Decisions regarding fungicides for summer patch control are made in spring, often before symptoms are evident

What will your budget allow?

Consider that the turf will recover by the end of October!

Polling Question

Contemporary Issues…

Summary

- Health/environmental risks are low
- Increase in disease issues seem to correlate with changes in management practices.
- New active ingredients in SDHI, DMI, and QoI classes have been added to the fungicide arsenal.
- Root diseases are controlled with combination fungicides…timing is important for effective and efficient control.

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Syngenta
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December 2, 2020 GCSAA Education Points Code 999-23426-31013

Thank You For Attending!

Question?

ogcsa@ogcsa.org

Oregon Chapter GCSAA Golf Course Superintendents Association of America

OLCA Oregon Landscape Contractors Association