2nd Annual Microdochium Patch Field Day

February 28, 2017
Lewis-Brown Farm, Corvallis, OR
33329 Peoria Rd, Corvallis, OR 97333

Alec.Kowalewski@oregonstate.edu
Brian.McDonald@oregonstate.edu

3:00 to 4:50 – Microdochium patch Research Update

- Clint Mattox – Fungicide Alternatives (Phosphite, Sulfur, Iron Sulfate and Crop Oil)
- Conner Olsen – Effects of Greywater on Perennial Ryegrass Cultivars
- Micah Gould – Low Maintenance Landscapes for Oregon Public Schools

5:00 to 5:50 pm – Dinner and Guest Lecture at House of Brews, Corvallis, OR

Treatments Lists and Plot Maps: Page 2 to 7

- Stop 1: Fungicide Alternatives (Phosphite, Sulfur, Iron Sulfate and Crop Oil): Page 2 to 4
- Stop 2: Effects of Greywater on Perennial Ryegrass Cultivars: Page 5 and 6
- Stop 3: Low Maintenance Landscapes for Oregon Public Schools: Page 7

Handouts: Page 8 to 13
Turf Technician Report: Page 14 and 15

Stop 1: Clint Mattox – Fungicide Alternatives (Phosphite, Sulfur, Iron Sulfate and Crop Oil)

Traffic Replicated on all plots (average of 73 golf rounds a day)

< --- North

Trial 2: Began: 09/22/16

Apps applied every 2 wks

1	Civitas	8.5 oz./M
	PK Plus	6.0 oz./M
2	Superior Oil	7.9 oz./M
	PK Plus	6.0 oz./M
	PAR	0.4 oz./M
3	Superior Oil	7.9 oz./M
	PK Plus	6.0 oz./M
4	TriTek	9.8 oz./M
	PK Plus	6.0 oz./M
	PAR	0.4 oz./M
5	Nontreated Control	

Trial 1: Began: 09/22/16

Apps applied every 2 wks

Trts 1 & 2 rotated w/ S & PK+

1a	Civitas One	8.5 oz./M
	Sulfur DF	0.25 #S/M
1b	Sulfur DF	0.25 #S/M
	PK Plus	6.0 oz./M
2a	Civitas One	8.5 oz./M
	PK Plus	6.0 oz./M
2b	Sulfur DF	0.25 #S/M
	PK Plus	6.0 oz./M
3	Sulfur DF	0.25 #S/M
	PK Plus	6.0 oz./M
4	Nontreated Control	

Trial 3: Began: 09/22/16

Apps applied every 2 wks

1	Civitas	4.25 oz./M
	Sulfur DF	0.125 #/M
2	Civitas	4.25 oz./M
	Sulfur DF	0.25 #/M
3	Civitas	4.25 oz./M
	PK Plus	3.0 oz./M
4	Civitas	4.25 oz./M
	PK Plus	6.0 oz./M
5	Civitas	8.5 oz./M
	Sulfur DF	0.125 #/M
6	Civitas	8.5 oz./M
	Sulfur DF	0.25 #/M
7	Civitas	8.5 oz./M
	PK Plus	3.0 oz./M
8	Civitas	8.5 oz./M
	PK Plus	6.0 oz./M
9	Nontreated Control	

Trial 5: Began: 09/29/16

Apps applied every 2 wks

1	0 # $FeSO_4$/M 3.14 oz. Duraphite 12 /M
2	0.25 # $FeSO_4$/M 3.14 oz. Duraphite 12 /M
3	0.50 # $FeSO_4$/M 3.14 oz. Duraphite 12 /M
4	1.0 # $FeSO_4$/M 3.14 oz. Duraphite 12 /M
5	2.0 # $FeSO_4$/M 3.14 oz. Duraphite 12 /M
6	0 # $FeSO_4$/M
7	0.25 # $FeSO_4$/M
8	0.50 # $FeSO_4$/M
9	1.0 # $FeSO_4$/M
10	2.0 # $FeSO_4$/M

Trial 4: Began: 09/22/16

Apps applied every 2 wks

1	2.0 #$FeSO_4$/M	2.5 gal/M
2	2.0 #$FeSO_4$/M	5.0 gal/M
3	2.0 #$FeSO_4$/M	7.5 gal/M
4	2.0 #$FeSO_4$/M	10 gal/M
5	Nontreated Control	

Trial 6: Began: 09/29/16 - Frequency Stated Below

	Trt	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Every Two Weeks	1	Civ + Dur		S + Dur 12			Civ + Dur	
	2	Civ + Dur			S + Dur 12		Civ + Dur	
	3	Civ + Dur			S + Dur 12			Civ + Dur
	4	Civ + Dur		S + Dur 12				Civ + Dur
	5	Civ + Dur X 4 wks in rotation with Sulfur + Dur X 4wks						
	6	Civ + Dur						
	7	S + Dur 12						
Every Three Weeks	8	Civ + Dur		S + Dur 12			Civ + Dur	
	9	Civ + Dur			S + Dur 12		Civ + Dur	
	10	Civ + Dur			S + Dur 12			Civ + Dur
	11	Civ + Dur		S + Dur 12				Civ + Dur
	12	Civ + Dur X 6 wks in rotation with Sulfur + Dur X 6wks						
	13	Civ + Dur						
	14	S + Dur 12						
	15	Fungicide Control (monthly applications using a fungicide rotation)						
	16	Untreated Control						

Civitas One	8.5 oz./M
Duraphite 12	3.14 oz./M
Sulfur	0.25 #S/M
Duraphite 12	3.14 oz./M

Stop 1: Clint Mattox – Fungicide Alternatives (Phosphite, Sulfur, Iron Sulfate and Crop Oil)

Trial 1

3	4	1	2	4	2	3	1
1	3	2	4	3	1	4	2

Trial 2

2	1	3	5	4	1	4	3	5	2
4	5	1	2	3	5	2	4	3	1

Trial 3

4	8	2	9	7	1	5	3	6	3	4	8	1	7	2	5	6	9
1	5	9	6	2	3	4	8	7	6	5	2	7	1	9	4	3	8

Trial 4

5	3	2	4	1
4	2	5	1	3
5	1	2	3	4
4	3	1	5	2

Trial 5

3	6	9	2	10	4	8	5	1	7
8	3	5	4	6	2	1	9	7	10
9	5	2	7	10	6	4	1	3	8
2	8	7	6	3	4	1	5	10	9

<--- North

Trial 6

7	11	5	2	15	8	13	1	9	11	15	7	14	15	4	2
12	10	3	13	4	12	14	9	16	8	3	13	6	9	11	5
16	6	4	1	10	5	3	11	2	14	6	10	8	12	7	1
9	14	15	8	16	6	2	7	12	1	5	4	13	10	16	3

Stop 1: Clint Mattox – Fungicide Alternatives (Phosphite, Sulfur, Iron Sulfate and Crop Oil)

Trial 8: Began: 10/21/16		
No traffic replication		
1	PK Plus	6.0 oz./M
2	Duraphite 12	3.14 oz./M
3	PK Plus Sulfur DF	6.0 oz./M 0.25
4	Duraphite 12 Sulfur DF	3.14 oz./M 0.25#S/M
5	Sulfur DF	0.25#S/M
6	Nontreated Control	

1	4	6	2	5	3
6	5	2	3	4	1
4	1	6	2	5	3
5	6	3	1	2	4

East --->>>

Trial 7: Began: 10/21/16		
5 gal/M spray volume		
No traffic replication		
1	2.0 #$FeSO_4$/M	Every 2 weeks
2	2.0 #$FeSO_4$/M	Every 4 weeks
3	2.0 #$FeSO_4$/M	Every 6 weeks
4	2.0 #$FeSO_4$/M	Every 8 weeks
5	Nontreated Control	

1	3	2	5	4
5	4	3	2	1
1	2	4	5	3
4	5	3	1	2

Stop 2: Conner Olsen - Effects of Greywater on Perennial Ryegrass Cultivars.

Treatment	Cultivar	Turf Type
1	Premium	Perennial Rye
2	Pillar	Perennial Rye
3	Pepper	Perennial Rye
4	Brightstar SLT	Perennial Rye
5	Estelle	Perennial Rye
6	Gray Fox	Perennial Rye
7	Allstar 3	Perennial Rye
8	Mighty	Perennial Rye
9	SR4660ST	Perennial Rye
10	Zoom	Perennial Rye
11	Manhattan 6	Perennial Rye
12	Prosaline	Blend
13	Alkaligrass	Alkaligrass
14	Sandy	Alkaligrass
15	B-15.2801	Slender Fescue

Stop 2: Conner Olsen - Effects of Greywater on perennial ryegrass cultivars.

Replicate 3

12	*4*	*0*
	15	
	9	
	3	
	7	
	14	
	8	
	12	
	4	
	5	
	10	
	6	
	1	
	13	
	2	
	11	

Replicate 2

12	*0*	*4*
	3	
	5	
	13	
	15	
	1	
	10	
	6	
	7	
	2	
	12	
	4	
	8	
	11	
	9	
	14	

Replicate 1

0	*12*	*4*
	8	
	12	
	7	
	2	
	15	
	5	
	11	
	10	
	4	
	6	
	3	
	9	
	1	
	14	
	13	

5 ft

5 ft

Stop 3: Micah Gould – Low Maintenance Landscapes for Oregon Public Schools

PLOT MAP KEY	
1	Colonial bentgrass
2	Chewings fescue
3	Strong creeping red fescue
4	Sedum spurium
5	Henriaria glabra
6	Vinca minor
7	Euonymus fortunei 'Kewensis'
8	Juniperus horizontalis 'Blue Chip'
9	Cotoneaster dammeri
10	Ceonothus 'point reyes'
11	Slender creeping red fescue
12	Perennial ryegrass

SOUTH	no mow REP 1 mow	11	4	5	12	7	6	9	1	2	8	10	3	Lewis Brown Farm
	mow REP 2 no mow	2	7	9	8	6	3	5	11	10	12	4	1	
	mow REP 3 no mow	3	5	10	1	4	9	7	8	12	2	6	11	
NORTH	no mow REP 4 mow	1	12	8	6	10	4	11	7	5	9	3	2	

Handouts: Plant Disease Management Report. 10:T038.

ANNUAL BLUEGRASS (*Poa annua*)
Microdochium patch (*Microdochium nivale*)

A.R. Kowalewski, and B.W. McDonald
Department of Horticulture
4017 ALS
Oregon State University
Corvallis, OR 97331

Evaluation of fungicides for preventative control of Microdochium patch on annual bluegrass in western Oregon, 2016.

Microdochium patch is a major turfgrass disease in cool, humid regions of the Pacific Northwest, Western Canada and Northern Europe. The objective of this study was to evaluate the efficacy of systemic fungicide applications in the DMI class and various contact fungicides for Microdochium patch control on an annual bluegrass putting green. A field experiment was initiated on 26 Jan on an annual bluegrass putting green grown on silty clay loam soil with no drainage at Oregon State University, Corvallis, OR. Experimental design was a randomized complete block, with three replications. The size of the plots measured 25 sq ft (5 ft × 5 ft). Fungicide treatments were applied on a two or four week interval, depending on labeled frequency and fungicide mode of action. Treatments were applied with a CO_2-powered, two-wheeled sprayer with a 4-ft boom using TeeJet 80015 nozzles spraying 2 gal of spray solution per 1,000 sq ft at 35 psi. Percent disease (0-100%) and turf quality (1-9 scale, with a 6 or greater considered acceptable) ratings were collected on 28 Mar, at the peak of disease. Data were subjected to analysis of variance and differences between means were determined by Fisher's protected LSD at the 0.05 level of probability.

The untreated plots had the highest percent disease (28.3%), followed by Trinity (18.3%), and then Tourney, Torque, and Mirage (11, 7.0, and 4.3%, respectively). Secure, Turfcide 400, Daconil Weather Stik, and Dithane resulted in the lowest percent disease ranging from 0.1 to 0.4%, and had the highest turf quality ranging from 6.8 to 7.7. Banner Maxx II was the only DMI that provided acceptable turf quality with an average rating of 6.2. The untreated plots received the lowest quality ratings (2.8).

Treatment, rate (per 1,000 sq ft)	Number of applications	Application interval[z]	28 Mar: Percent disease (0-100%)[y]	28 Mar: Turf quality (1-9)[z]
untreated			28.3 a	2.8 h
Banner Maxx II 1.3MEC 2.0 fl oz	2	4 wk	1.4 d	6.2 bcd
Trinity 1.67SC 2.0 fl oz	2	4 wk	18.3 b	3.5 g
Torque 3.6SC 1.1 fl oz	2	4 wk	7.0 cd	4.3 efg
Mirage 2.0SC 2.0 fl oz	2	4 wk	4.3 cd	5.0 def
Tourney 50WDG 0.37 oz	2	4 wk	11.0 bc	3.7 fg
Secure 4.17SC 0.5 fl oz	4	2 wk	0.1 d	7.7 a
Dithane 75DF Rainshield 8.0 oz	4	2 wk	0.4 d	6.8 abc
Daconil Weather Stik 6F 5.0 fl oz - Daconil Weather Stik 6F 3.6 fl oz	1 3	initial 2 wk	0.2 d	7.5 ab
Medallion 50WP 0.5 oz - Medallion 50WP 0.25 oz	2 2	initial 2 wk	2.5 d	5.5 cde
Turfcide 400 4SC 8.0 fl oz	2	4 wk	0.1 d	7.3 ab

[z] Initiated 26 Jan

[y] Mean disease severity ratings are based on a 0 to 100% scale in three replicated plots. Means followed by the same letter are not significantly different according to Fisher's protected LSD (α=0.05).

[x] Turf quality ratings are based on 1 – 9 scale (9 = best, 6.0 is acceptable). Means followed by the same letter are not significantly different according to Fisher's protected LSD (α=0.05).

ANNUAL BLUEGRASS (*Poa annua*)
Microdochium patch (*Microdochium nivale*)

B.W. McDonald, and A.R. Kowalewski
Department of Horticulture
4017 ALS
Oregon State University
Corvallis, OR 97331

Effect of fungicides on Microdochium patch in western Oregon, 2016.

The primary objective of this research was to evaluate the effects of fungicides on Microdochium patch when applied to an annual bluegrass putting green maintained at a 0.15 in. height in western Oregon. A secondary objective was to determine the number of sequential fungicide applications required to control the disease after making 2 initial applications using a scout and treat approach. Research was conducted on a native soil (Malabon silty, clay, loam) research putting green capped with a 6 in. layer of sand meeting United States Golf Association specifications at the Oregon State University Lewis-Brown Horticulture Farm in Corvallis, OR. Experimental design was a randomized complete block with four replications. The individual plot size was 6 ft by 5 ft All fungicides were applied on 25 Jan and 8 Feb, additional applications were made only when treatments were deemed unacceptable due to symptom development and reductions in turfgrass quality, but not sooner than 14 days after the last application. Fungicide treatments were applied with a CO_2-powered two-wheeled sprayer with a 4 ft boom and TeeJet 80015 nozzles spraying 2 gallons of spray solution per 1,000 ft^2 at 40 psi. Percent disease was assessed on a 0-100% scale, while turf quality ratings were made on a 1 to 9 scale, with 1= worst quality and 9=best. Percent disease and turf quality were collected throughout the duration of the study (25 Jan to 18 Apr) data collected at the peak of disease (4 Apr) are the only observation date presented. Data were subjected to analysis of variance and differences between means were determined by Fisher's protected LSD at the 0.05 level of probability.

Applications of Appear, Contend A, Contend B and Banner Maxx II resulted in the lowest percent disease (0.0 to 0.2%), followed by Heritage Action (20.8%) and finally the control, which had the highest percent disease (27.5%) at the peak of disease. Regarding turf quality, Appear and Contend A provided the highest quality (7.5 and 7.4, respectively), followed by Contend B and Banner Maxx II (6.6) and finally Heritage Action and the control (3.5 and 3.0, respectively). From 25 Jan to 5 Apr Contend A was applied 3 and Contend B was applied 4 times using a scout and treat approach. Appear and Banner Maxx II were applied 5 times and Heritage Action was applied 6 times using the scout and treat application approach.

		Peak of disease – 4 Apr	
Treatments, rate per 1,000 ft^2 [z]	Total applications from 25 Jan to 5 Apr	Percent disease (0-100%)[y]	Turf Quality (1-9)[x]
Appear 4.1L 6.0 fl oz	5	0.0 c	7.5 a
Contend A 0.86SL 1.0 fl oz	3	0.1 c	7.4 a
Contend B 1.66SE 2.6 fl oz	4	0.2 c	6.6 b
Banner Maxx II 1.3MEC 1.0 fl oz	5	0.2 c	6.6 b
Heritage Action 51WG 0.2 oz	6	20.8 b	3.5 c
Control	Not applicable	27.5 a	3.0 c

[z] All fungicides were applied on 25 Jan and 8 Feb, additional applications were made when symptom development and reductions in turf quality were noted, but not sooner than 14 days after the last application.

[y] Mean disease severity ratings are based on a 0 to 100% scale in four replicated plots. Means followed by the same letter are not significantly different according to Fisher's protected LSD (α=0.05).

[x] Turf quality ratings are based on 1 – 9 scale (9 = best, 6.0 is acceptable). Means followed by the same letter are not significantly different according to Fisher's protected LSD (α=0.05).

Handouts: Plant Disease Management Report 10:T039.

ANNUAL BLUEGRASS (*Poa annua*)
Anthracnose (*Colletotrichum cereal*)

B.W. McDonald and A.R. Kowalewski
4147
Department of Horticulture
Oregon State University
Corvallis, OR 97331

Evaluation of fungicide programs for the control of anthracnose on annual bluegrass in western Oregon, 2015.

The objective of this study was to evaluate the efficacy of fungicide programs (repeated applications and rotations of various products) for the control of anthracnose on an annual bluegrass putting green. A field experiment was conducted at the OSU Lewis-Brown Horticulture Farm in Corvallis, OR. The research was initiated on Jun 15 on a putting green built in 2009 using the California construction technique consisting of sand-based annual bluegrass sod (Bos Sod, Canada). Experimental design was a randomized complete block, with four replications, and individual plots were 25 sq ft (5 ft by 5 ft). Fungicide treatments were applied biweekly (except Signature Xtra at 2.0 oz + Daconil Ultrex at 3.2 oz, which was applied weekly) using a CO_2-powered two-wheeled sprayer with a 4 ft boom using TeeJet 80015 nozzles spraying 2 gal of spray solution per 1,000 sq ft at 35 psi. Percent disease (0 to 100%) and turf quality (1 to 9 scale; 6 or greater considered acceptable) were collected bi-weekly from 15 Jun to 8 Sep, with the peak of disease occurring on 24 Aug. Data were subjected to analysis of variance and mean separated using Fisher's protected least significant difference (LSD) at a 0.05 level of probability.

All fungicide treatments and rotations reduced percent disease in comparison to the control. Percent disease within plots treated with fungicides ranged from 0.0 to 0.4%, while the control plots averaged 9.5%. Nine of the thirteen fungicide treatments provided turf quality ratings which ranked in the top category (7.5 to 8.4, on a 1-9 scale). The exceptions were Signature Xtra (4.0 oz per 1,000 sq. ft.) + Daconil Ultrex, Signature applied alone, and Daconil Weather Stik + Signature, which received a rating ranging from 7.3 to 7.4. The control produced the lowest turf quality (4.3).

	24 Aug			
Treatments and rate (per 1,000 sq ft)[z]	Percent disease (0-100%)[y]		Turf quality (1-9)[x]	
Untreated	9.5	a[w]	4.3	d
Signature Xtra 60WDG 2.0 oz + Daconil Ultrex 82.5WDG 3.2 oz	0.0	b	8.4	a
Signature Xtra 60WDG 4.0 oz + Daconil Ultrex 82.5WDG 3.2 oz	0.4	b	7.4	bc
Signature Xtra 60WDG 6.0 oz + Daconil Ultrex 82.5WDG 3.2 oz	0.0	b	8.3	ab
Signature 80WDG 4.0 oz + Daconil Ultrex 82.5 WDG 3.2 oz	0.4	b	7.5	abc
Signature 80WDG 4.0 oz	0.3	b	7.3	c
Mirage 2.0SC 1.0 fl oz - rotated w/ Signature Xtra 60WDG 4.0 oz + Daconil Ultrex 82.5 WDG 3.2 oz	0.0	b	8.1	abc
Daconil Action 6.112SC 3.5 fl oz + Appear 4.1L 6.0 fl oz + Primo MAXX 1ME 0.1 fl oz - rotated w/ Heritage Action 50WG 0.2 oz + Primo MAXX 1ME 0.1 fl oz	0.0	b	8.3	ab
Daconil Action 6.112SC 3.5 fl oz + Appear 4.1L 6.0 fl oz + Primo MAXX 1ME 0.1 fl oz	0.2	b	8.0	abc
Daconil Weather Stik 6SC 3.6 fl oz + Signature 80WDG 4.0 oz	0.3	b	7.3	c
Daconil Action 6.112SC 3.5 fl oz + Appear 4.1L 6.0 fl oz + Primo MAXX 1ME 0.1 fl oz - rotated w/ Velista 50WG 0.5 oz + Appear 4.1L 6.0 fl oz + Primo MAXX 1ME 0.1 fl oz	0.0	b	8.1	abc
Daconil Action 6.112SC 3.5 fl oz + Heritage Action 50WG 0.5 oz + Appear 4.1L 6.0 fl oz	0.1	b	7.8	abc
Insignia 2.08SC0.4 fl oz + Daconil Weather Stik 6F 3.6 fl oz	0.0	b	7.5	abc

[z] All treatments were applied every 2 weeks except for the mix of Signature Xtra (2.0 oz) + Daconil Ultrex (3.2 oz) which was applied weekly.
[y] Mean percent disease ratings are based on a 0 to 100% scale in four replicated plots.
[x] Turf quality ratings are based on 1 to 9 scale (9 = best, 6.0 is acceptable).
[w] Means followed by the same letter are not significantly different according to Fishers' protected LSD (α=0.05).

B.W. McDonald
C.M. Mattox
A.R. Kowalewski, Ph.D.
D.K. Mosdell, Ph.D.

Effects of spray nozzle and fungicide mode of action on control of Microdochium patch on an annual bluegrass putting green in western Oregon

Many factors influence the efficacy of turfgrass fungicides, including fungicide application rate and intervals between applications, host susceptibility, fungicide resistance, environment, nozzle type, spray volume, fungicide topical mode of action, leaf coverage, and depletion rate (1).

Microdochium patch (*Microdochium nivale*) is a disease that affects turfgrass foliage. Microdochium patch is of major concern in humid, cool regions where annual bluegrass (*Poa annua* L.) turf is often dominant. To date, there is little published research showing results for the influence of nozzle types, fungicide topical mode of action, and spray volumes regarding Microdochium patch control. Therefore, the main objective of this field study was to evaluate the effect on Microdochium patch control from the interaction of nozzle type-spray volume combinations with fungicide topical mode of action.

Effects of nozzle-spray volume combinations on spray coverage

A spray nozzle coverage analysis was conducted using a completely randomized design with four replications. For this experiment, water was applied with four different nozzle-spray volume combinations: XR11004 (1 gallon/1,000 square feet) and XR11008 (2 gallons/1,000 square feet) (TeeJet, Glendale, Ill.) flat fans, which produce medium (226-325 µm) and coarse (326-400 µm) droplets, respectively, and 1/4TTJ04 (1 gallon/1,000 square feet) and 1/4TTJ08 (2 gallons/1,000 square feet) (TeeJet, Glendale, Ill.), which produce extremely coarse (500-650 µm) droplets (TeeJet Technologies, 2008). The water was applied with a CO_2-pressurized backpack sprayer with a three-nozzle handheld boom at 30 pounds/square inch, 20 inches off the ground. Applications took place inside to avoid the effects of wind, and treatments were repeated four times for each nozzle.

Digital images were collected immediately following the spray application to water-sensitive paper (Spraying Systems Co., Wheaton, Ill.), which is rigid, yellow paper that is stained blue by liquid, using a Sony DSC-H9 camera (Sony, Tokyo, Japan) mounted on an enclosed light box measuring 24 inches long by 20 inches wide by 21.5 inches tall, and then analyzed using SigmaScan Pro (v.5.0, SPSS, Chicago) to determine percent spray coverage (0%-100%) (3). The threshold settings were adjusted to a hue of 135 to 255 to select the pixels that represented areas of the sensitive paper affected by the spray treatments (blue area); the saturation was set to a range of 0 to 100. Data were analyzed using SAS 9.3 Proc Mixed (SAS Institute, Cary, N.C.). The means were separated using Fisher's LSD (0.05).

There was a large difference in spray coverage from the different nozzle-spray volume combinations (Table 1 and Figure 1). XR11008 nozzles (2 gallons/1,000 square feet) had the greatest spray coverage (86%), followed by XR11004 nozzles (1 gallon/1,000 square feet), which provided a spray coverage of 67%. The 1/4TTJ08 (2 gallons/1,000 square feet) provided a coverage of 56%, while the 1/4TTJ04 (1 gallon/1,000 square feet) provided the lowest coverage at 26%.

Effects of nozzle-spray volume combinations and fungicides on Microdochium patch

A field study was conducted at Oregon State University's Lewis-Brown Horticulture Farm in Corvallis, Ore., from Jan. 25 to April 24, 2013 and 2014, on an annual bluegrass putting green mowed weekly at 0.150 inch. The experiment used a 3-by-4 factorial, plus control, treatment structure and a randomized complete block design structure with four replications. Factors included fungicide topical mode of action, and nozzle-spray volume combinations. Three different fungicides were used: fluazinam (Secure; Syngenta, Greens-

Useful conversions

To convert column A to column B, multiply by	Column A: Suggested unit	Column B: SI unit
2.54	inch	centimeter, cm
6.90×10^3	pound/square inch, lb/sq inch, PSI	pascal, Pa
1.12	pound/acre, lb/acre	kilogram/hectare, kg/ha
3.78	gallon	liter, L
6.45×10^8	square inch	square micrometer, µm²

Effect of nozzle type-spray volume combinations on % spray coverage

Nozzle	Spray volume (gallons/1,000 square feet)	Spray coverage[†]	Droplet size (µm)[‡]
XR11004	1	67% b[§]	226-325
1/4TTJ04	1	26% d	500-650
XR11008	2	86% a	326-400
1/4TTJ08	2	56% c	—

[†]Digital images of treated water-sensitive paper (Spraying Systems Co., Wheaton, Ill.) were collected using an enclosed light box and analyzed to determine percent spray coverage (0%-100%) (3).
[‡]According to specifications from manufacturers (4).
[§]Lowercase letters represent a significant difference at a 0.05 level of probability. Analysis of variance was used to compute the level of significance.

Table 1. Effects of nozzle type-spray volume combinations on percent spray coverage, Corvallis, Ore.

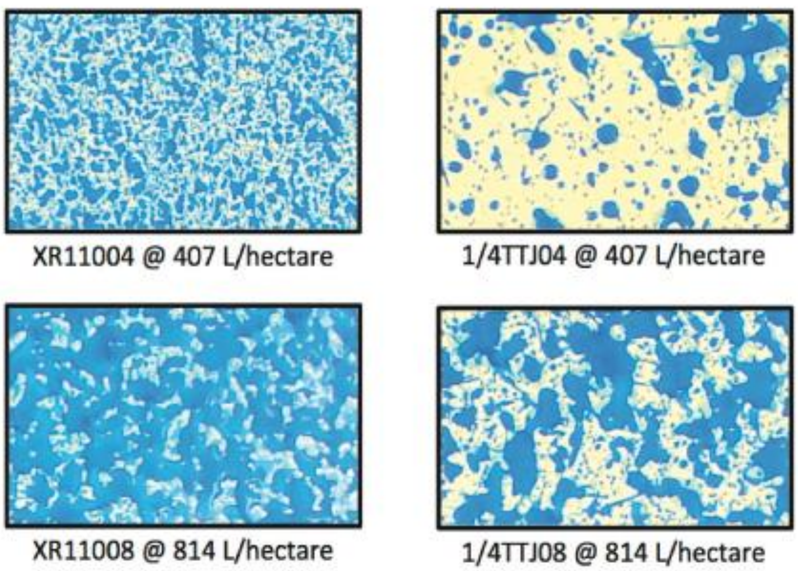

Figure 1. Examples of nozzle type-spray volume combinations (XR11004 and 1/4TTJ04 at 1 gallon/1,000 square feet [407 liters/hectare] and XR11008 and 1/4TTJ08 at 2 gallons/1,000 square feet [814 liters/hectare]) on surface coverage recorded at 30 pounds/square inch, directly beneath the center nozzle of the three-nozzle boom (19-inch spacing) held 20 inches off the ground in Corvallis, Ore. The dark blue areas are water-soaked, and the white areas are uncovered.

boro, N.C.), propiconazole (Banner Maxx II; Syngenta, Greensboro, N.C.) and difenoconazole with three different types of topical mode of action (contact, acropetal and translaminar with limited acropetal, respectively). The following application rates were used for the duration of this experiment: Secure at 0.5 fluid ounce/1,000 square feet (0.016 pound a.i./1,000 square feet), Banner Maxx II at 1.0 fluid ounce/1,000 square feet (0.01 pound a.i./1,000 square feet) and a difenoconazole solution at 0.4 fluid ounce/1,000 square feet (0.009 pound a.i./1,000 square feet). While difenoconazole was a treatment in this experiment, it is only commercially available in a mix with azoxystrobin (Briskway; Syngenta, Greensboro, N.C.). Five applications of each product were made to their respective plots on 21-day intervals, with the first application occurring in the first week in January 2013 and 2014. Fungicides were applied with a CO_2-pressurized backpack sprayer with a three-nozzle handheld boom at 30 pounds/square inch. Applications were performed with the same four nozzle-spray volume combinations as in the first study.

To determine percent disease severity, digital images (four subsamples/plot) were collected in March and April of 2013 and 2014 using the camera and light box setup described above, and analyzed using SigmaScan Pro (3). The difference between percent green cover and 100% was used to quantify percent disease severity (2). Data were analyzed using PROC Mixed (SAS; ver. 9.3, SAS Institute Inc., Cary, N.C.). There were significant differences between year and month, and interactions between these factors and the remaining factors (fungicide and nozzle) were significant; therefore, the data were analyzed and presented by year and month separately. Additionally, preplanned contrasts were used to answer specific questions related to the effects of nozzle types on each fungicide.

For applications at 1 gallon/1,000 square feet spray volume, the plots treated with XR11004 nozzles had lower percent disease severity than the 1/4TTJ04 nozzles averaged across all fungicides on three of the four rating dates (March and April 2013, and April 2014) (Table 2).

Percent disease severity was reduced with difenoconazole or Banner applied with the XR11004 nozzles compared to the 1/4TTJ04 nozzles on one of the four rating dates. No differences in percent disease severity were detected between XR11004 and 1/4TTJ04 nozzle treatments with Secure.

At the 2 gallons/1,000 square feet spray volume, plots treated with XR11008 nozzles had lower percent disease severity compared to the 1/4TTJ08 nozzles regardless of fungicide treatment in March and April 2013 (Table 3). No differences were found between nozzle treatments when percent disease severity was averaged over all fungicides in March and April of 2014. Percent disease severity was decreased with Secure, Banner or difenoconazole when applied with XR11008 nozzles compared with 1/4TTJ08 nozzles on April 2013. Difenoconazole reduced percent disease severity in March 2013 with XR11008 vs. 1/4TTJ08 nozzles.

These findings suggest nozzles that produce smaller droplets and higher coverage are important to maximize control of Microdochium patch, regardless of whether the spray volume is 1 or 2 gallons/1,000 square feet. Nozzle type and droplet size did not

% disease severity† for XR11004 vs. 1/4TTJ04 nozzles at the 1 gallon/1,000 square foot spray volume

Fungicide‡	% disease severity§			
	XR11004	1/4TTJ04	XR11004	1/4TTJ04
	March 2013		April 2013	
Secure	9.9	13.8	34.6	36.1
Banner Maxx II	4.6	8.4	10.3	27.9***
Difenoconazole	5.2	15.0**	38.3	40.2
Mean	6.5	12.4**	27.7	34.7***
	March 2014		April 2014	
Secure	0.6	0.5	3.1	9.0
Banner Maxx II	0.5	0.4	1.1	6.7
Difenoconazole	0.6	0.5	13.3	18.9
Mean	0.6	0.5	5.8	11.5*

*Significant between means of nozzles within a fungicide (rows) at $P = 0.05$. Preplanned contrasts were used to compute the level of significance.
**Significant between means of nozzles within a fungicide (rows) at $P = 0.01$. Preplanned contrasts were used to compute the level of significance.
***Significant between means of nozzles within a fungicide (rows) at $P = 0.001$. Preplanned contrasts were used to compute the level of significance.
†Digital images collected using an enclosed light box and analyzed to determine percent disease severity (0%-100%).
‡Five applications of each product (Secure at 0.5 fluid ounce/1,000 square feet [0.016 pound a.i./ 1,000 square feet], Banner Maxx II at 1.0 fluid ounce/1,000 square feet [0.01 pound a.i./1,000 square feet], and difenoconazole solution at 0.4 fluid ounce/1,000 square feet [0.009 pound a.i./1,000 square feet]) were made on 21-day intervals, with the first application in January 2013 and 2014.
§Disease severity in control treatments was 24.8% in March 2013, 40.5% in April 2013, 0.8% in March 2014, and 11.7% April 2014.

Table 2. Percent disease severity for XR11004 vs. 1/4TTJ04 nozzles at the 1 gallon/1,000 square foot spray volume in Corvallis, Ore., in March and April of 2013 and 2014.

% disease severity† for XR11008 vs. 1/4TTJ08 nozzles at the 2 gallon/1,000 square foot spray volume

Fungicide‡	% disease severity§			
	XR11008	1/4TTJ08	XR11008	1/4TTJ08
	March 2013		April 2013	
Secure	2.7	7.6	19.6	40.1***
Banner Maxx II	5.5	8.9	9.0	32.7***
Difenoconazole	6.3	14.0*	30.3	45.0***
Mean	4.8	10.1**	19.6	39.3***
	March 2014		April 2014	
Secure	0.3	0.6	3.9	7.4
Banner Maxx II	0.4	0.5	1.5	5.8
Difenoconazole	0.4	0.4	18.1	23.2
Mean	0.4	0.5	7.8	12.2

*Significant between means of nozzles within a fungicide (rows) at $P = 0.05$. Preplanned contrasts were used to compute the level of significance.
**Significant between means of nozzles within a fungicide (rows) at $P = 0.01$. Preplanned contrasts were used to compute the level of significance.
***Significant between means of nozzles within a fungicide (rows) at $P = 0.001$. Preplanned contrasts were used to compute the level of significance.
†Digital images collected using an enclosed light box and analyzed to determine percent disease severity (0%-100%).
‡Five applications of each product (Secure at 0.5 fluid ounce/1,000 square feet [0.016 pound a.i./ 1,000 square feet], Banner Maxx II at 1.0 fluid ounce/1,000 square feet [0.01 pound a.i./1,000 square feet], and difenoconazole solution at 0.4 fluid ounce/1,000 square feet [0.009 pound a.i./1,000 square feet]) were made on 21-day intervals, with the first application in January 2013 and 2014.
§Disease severity in control treatments was 24.8% in March 2013, 40.5% in April 2013, 0.8% in March 2014, and 11.7% April 2014.

Table 3. Percent disease severity (0%-100%) for XR11008 vs. 1/4TTJ08 nozzles at the 2 gallon/1,000 square foot spray volume in Corvallis, Ore., in March and April of 2013 and 2014.

consistently result in improved disease control; however, the nozzle type did provide improved control in some cases, giving turf managers reason enough to use XR11004 or XR11008 rather than 1/4TTJ04 or 1/4TTJ08, considering the change will not generate a cost difference.

Acknowledgments

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B.W. McDonald is a senior faculty research assistant, C.M. Mattox (mattoxc@oregonstate.edu) is a graduate student, and A.R. Kowalewski is an assistant professor in the Department of Horticulture at Oregon State University, Corvallis, Ore. D.K. Mosdell is technical manager in the western U.S. for Syngenta, Greensboro, N.C.

Core Ideas

- Nozzle-type spray volume and topical activity on Microdochium patch were evaluated.
- At equal spray volumes, TeeJet XR nozzles cover more spray area than 1/4TTJ nozzles.
- Smaller droplets and higher coverage maximize Microdochium patch control.

OSU Turf Technician Reports (2014 to Present)

In 2014, Brian McDonald was awarded the industry funded OSU Turf Technician position ($75,000 per year) provided by the following donors: Oregon Turfgrass Foundation, Oregon Golf Course Superintendents Association, Oregon Golf Association (for a combined $50,000 annually), Bandon Dunes Resort ($10,000 annually), Turf Merchants, Inc. ($10,000 annually), and Pure Seed Testing, Inc. ($5,000 annually). The OSU Turf Program would like to thank these generous donors by documenting the progress achieved by the OSU Turf Technician since 2014 with the following report.

Extension and Outreach (2014 to present):

- *Stakeholders Reached: 3,375*
- *Presentations: 23*

Brian is an active member of the OSU Turf Extension program regularly speaking to stakeholder group such as the golf course employees, pesticide applicators, public school grounds employees, and parks and recreation department employees.

Brian McDonald provides extension information to Oregon public school grounds employees in Salem, OR

Scholarship (2014 to present):

- *Scientific Presentations: 11*
- *International Presentations: 9*
- *Peer Review Publications: 14*
- *Scientific Abstracts: 9*
- *Proceedings and Popular Press Articles: 28*

Brian has been, and continues to be, a critical component to the scholastic achievements within the OSU Turf Program. He has served as an author and coauthor for scientific and industry publications and presentation on a state, regional, nation and international level.

Course Laboratory Technician (2014 to present):

- *Principles of Turfgrass Maintenance (HORT 314)*
- *Grounds Irrigation (HORT 360)*
- *Pesticide Applicator Training (HORT 405)*
- *Golf Course Maintenance (HORT 418)*

Brian regularly serves as a teaching assistant for the courses listed above. Teaching responsibilities include, but are not limited to, equipment calibration and training, weekly budgeting laboratories, plant and weed identification, lectures on fungicides, herbicides and nozzle selection.

Brian McDonald teaches undergraduate student how to set the mowing height on a greens mower in Corvallis, OR.

Notable Research Projects (2014 to present):

Brian McDonald has been heavily involved in the following competitive grants listed below (1-8). He has drafted proposals, maintained plots, applied treatments, collected and analyzed data, and drafted reports for these projects. Brian has also been responsible for another 60 industry funded projects (not shown), which include, but are not limited to fertilizer, fungicide, herbicide, and wetting agent development and assessment.

1: Fungicide Alternative Management Practices for Microdochium Patch

Objective: Evaluate the Effects of Alternatives to Traditional Fungicides (such as rolling, fertility, crop oil, pigments, and wetting agents) for Control of the Microdochium patch

Funding Sources: Golf Course Superintendents Association of America (GCSAA), Oregon Golf Course Superintendents Association (OGCSA), Northwest Turf Association (NTA), and Western Canada Turf Association (WCTA).

2: The Effects of Mowing Delay on Proxy Efficacy for Poa annua Seed Head Suppression

Objective: Determine if mowing delays prior to and following the application of Proxy will affect the seed head suppression of annual bluegrass during the spring flush

Funding Source: United States Golf Association (USGA)

3: Effects of Sulfur, Calcium Source, and pH on Microdochium Patch

Objective: Determine if sulfur applied with and without various calcium sources can reduce the number of annual fungicide applications necessary to manage Microdochium patch

Funding Source: United States Golf Association (USGA)

5: Winter Foot Traffic

Objective: Evaluate the effects of winter foot traffic rates on an annual bluegrass putting green in Corvallis, OR.

Funding Source: United States Golf Association (USGA)

6: National Low Input Cool-Season Trial

Objective: Evaluate the seasonal tolerance and quality of various cool-season turfgrass genus and species with minimal inputs (monthly mowing, and no irrigation or fertilization).

Funding Source: National Turfgrass Evaluation Program (NTEP)

7: National Fine Fescue Traffic Trial

Objective: Evaluate the traffic tolerance of commercially available and experimental fine fescue (creeping, chewings, sheep, slender and hard fescue) cultivars.

Funding Source: National Turfgrass Evaluation Program (NTEP)

8: National Perennial Ryegrass Trial

Objective: Evaluate the health and quality of commercially available and experimental perennial ryegrass cultivars.

Funding Source: National Turfgrass Evaluation Program (NTEP)