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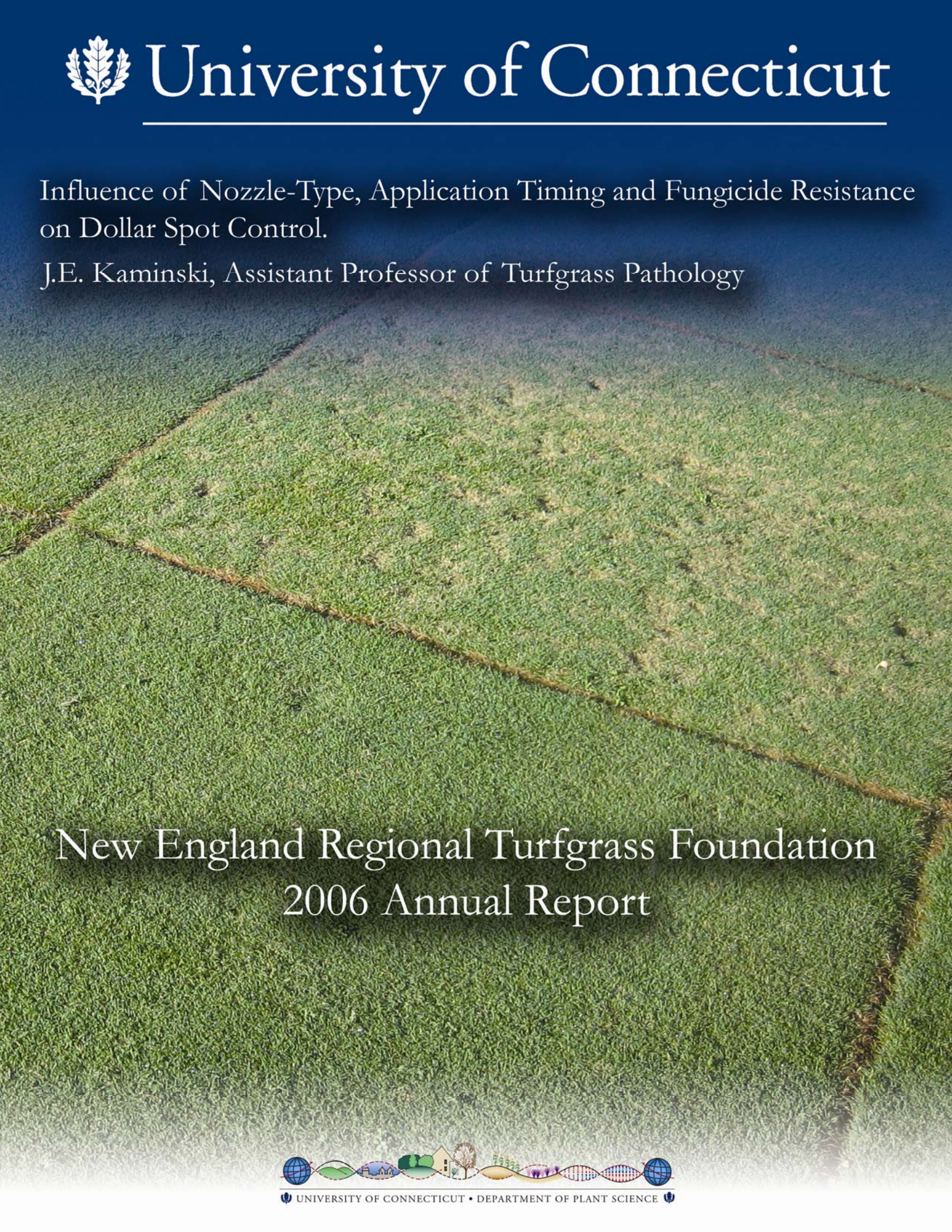

New England Regional Turfgrass Foundation 2006 Annual Report

UNIVERSITY OF CONNECTICUT • DEPARTMENT OF PLANT SCIENCE

Influence of Nozzle-Type, Application Timing and Fungicide Resistance on Dollar Spot Control

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ABSTRACT

Dollar spot (*Sclerotinia homoeocarpa*) is perhaps the most chronic and problematic disease of golf course turf throughout the United States. In New England, the disease often appears during late-spring or early-summer and remains active until the onset of colder temperatures during the autumn months. Management of dollar spot on golf course putting greens generally is accomplished through a variety of cultural and chemical management strategies. In recent years, many turfgrass managers have reported a reduction in efficacy and length of control with regards to fungicides commonly used to manage dollar spot. This reduced level of control may be attributed to the development of resistant strains of *S. homoeocarpa*, variation in fungicide application methods, and increases in fairway thatch levels, among others.

Studies conducted on golf courses and at the University of Connecticut between 2005 and 2006 have revealed significant differences in the level of dollar spot control from varying nozzle types and fungicides. Although all fungicides reduced dollar spot when compared to untreated turf, nozzle type appeared to heavily influence the level and length of fungicidal control. Data indicate that contact fungicides performed better when applied using nozzles that produced a medium or fine droplet size. Similar levels of control, however, were observed when chlorothalonil was applied using an air induction nozzle, which produces a coarse water droplet. When an acropetal penetrant was applied alone and dollar spot was severe, moderate to poor disease control was exhibited from all nozzle types except the air induction nozzle. Tank-mixes of the contact (chlorothalonil) and acropetal penetrant (propiconazole) generally provided better control than when applied alone, regardless of nozzle type.

In addition to the influence of nozzle type, the impact of 'dormant' fungicide applications currently is being investigated. Data from a 2006 study conducted at Stanley Golf Course located in New Britain, CT revealed differences in the ability of spring applied fungicides to suppress dollar spot. Data indicates that several fungicides are effective when applied at this time. Although it is unclear if this suppression will result in a reduction in the overall number of annual fungicide applications, the reduction in pathogen populations may allow for complete control of the pathogen in situations where disease control was previously reported as difficult or ineffective. Investigations into fall and spring application timings currently are underway.

Isolates of *Sclerotinia homoeocarpa* are currently being collected from golf courses throughout New England. In vitro fungicide sensitivity assays will be conducted in the coming years to determine the extent to which dollar spot resistance to commonly used fungicides occurs. Data from fungicide evaluations on golf courses and preliminary data from in vitro assays has confirmed *S. homoeocarpa* resistance to thiophanate methyl from samples received from a select number of golf courses.

KEY POINTS

- **For foliar pathogens such as dollar spot, data indicate that air induction nozzles will provide excellent disease control and also reduce the potential for drift.**
- **Early spring fungicide applications can reduce the onset of dollar spot symptoms in New England.**
- **Sclerotinia homoeocarpa samples are being collected from various golf courses and resistance to select fungicides has been observed.**

Detailed reports for individual studies are included on the following pages

DOLLAR SPOT SEVERITY AS INFLUENCED BY AN EARLY SPRING APPLICATION OF VARIOUS FUNGICIDES

APRIL - JULY 2006

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INTRODUCTION

In recent years, researchers and turfgrass managers have reported extended dollar spot (*Sclerotinia homoeocarpa*) control from early season applications of fungicides. Despite a lack of dollar spot symptoms at the time of application, fungicides applied in early spring have resulted in an extended period of disease control. Little information is available in New England regarding the efficacy of early season fungicides applications or the selection of proper fungicides. The objectives of this study were to asses the impact of applying various fungicides at lower label rates for extended control of dollar spot when applied in mid April.

MATERIALS AND METHODS

This field study was conducted Stanley Golf Club located in New Britain, CT. The turf was a mixed stand of creeping bentgrass (*Agrostis stolonifera*) and annual bluegrass (*Poa annua*) that was maintained at fairway height. Treatments were applied on applied on 13 April following the second mowing of the fairways. There were no visible dollar spot symptoms at the time of application and no other chemical controls were applied to the area for the duration of study.

Plots measured 5 ft x 5 ft, and were arranged as a randomized complete block with four replications. Dollar spot incidence and severity were assessed by counting the number of dollar spot infection centers per plot or percent plot area affected by *S. homoeocarpa*. Percent dollar spot was rated visually on a 0 to 100 percent scale where 0 = no visible dollar spot symptoms and 100 = entire plot area discolored by *S. homoeocarpa*. All data were subjected to analysis of variance and means were separated using the Fisher's protected least significant difference test.

RESULTS

Dollar spot. No dollar spot symptoms were observed in the study area at the time of initial application (13 April). Dollar spot symptoms first were observed in late May. On the first rating date (6 June), a total of 89 dollar spot infection centers were observed within the untreated control plots. On 6 June, dollar spot control was considered excellent (≤5 spots per plot) in plots treated with Tartan, AE F069623 00 SC22 A1 , Curalan, Daconil + Banner MAXX, and the confidential fungicide FAA. There were, however, no differences among those fungicides exhibited excellent dollar spot suppression and Bayleton SC, Chipco 26GT + Bayleton SC, Emerald (both rates), Banner MAXX, Compass + Bayleton WG, Daconil Ultrex, Iprodione Pro, and EAF. Moderate to poor suppression of dollar spot was exhibited within plots treated with Chipco 26GT, Bayleton WG, Insignia, Compass and Eagle. When compared to the untreated control, no disease suppression was exhibited within plots treated with Heritage TL and Spotrete on 6 June. On both rating dates, plots treated with 3336 exhibited increased or similar numbers of infection centers when compared to the untreated control plots. By 20 June, all treatments had an unacceptable (>5) number of infection centers per plot. However, plots treated with Bayleton SC, Tartan, AE F069623 00 SC22 A1 , Chipco 26GT, Chipco 26 GT + Bayleton SC, Emerald, Banner MAXX, Iprodione Pro, Curalan, Banner MAXX + Daconil, FAA, and EAF had the fewest dollar spot infection centers and reduced dollar spot 55 to 90% when compared to the untreated control.

Several fungicides provided excellent early season dollar spot control when applied on 13 April 2006.

As dollar spot became progressively more intense within plots, it became necessary to rate percent plot area affected by *S. homoeocarpa*. On 20 June (~3 weeks after initial symptoms), ≤1% dollar spot was observed within plots treated with Tartan, AE F069623 00 SC22 A1 , Emerald (0.13 oz), Banner MAXX, Curalan, Banner MAXX + Daconil, FAA, and EAF (Table 1). There were, however, no differences among those plots with ≤1% dollar spot and those treated with Bayleton SC, Chipco 26GT, Chipco 26GT + Bayleton SC, Emerald (0.18 oz), Bayleton WG, Insignia, Compass, Compass + Bayleton WG, Eagle, Daconil, and Iprodione Pro. On 20 June, a total of 8.4% dollar spot was observed within the untreated control plots. On both rating dates (20 June and 5 July), plots treated with 3336 had a higher percent plot area covered with dollar spot than the untreated control. On the final rating date (5 July), all treatments

had ≥11% dollar spot and were considered to be unacceptable for a golf course fairway. Although considered unacceptable, plots treated with Curalan, Banner MAXX + Daconil, and FAA had the least amount of disease on 5 July; providing a 61 to 67% reduction in dollar spot when compared to the untreated control.

Although not considered strong dollar spot fungicides, Insignia and Compass suppressed dollar spot during the initial onset of disease symptoms when pressure was low. The lack of dollar spot control afforded by 3336 indicated pathogen resistance. *Sclerotinia homoeocarpa* resistance to thiophanate-methyl was confirmed through additional fungicide trials at the site and via an in vitro assay.

DISCUSSION

Fungicides applied on 13 April provided varying levels of dollar spot control after disease symptoms became present in late May. Although likely considered unacceptable, several fungicides reduced dollar spot severity when compared to the untreated control for up to one month after initial symptoms appeared. Although the ability of early season fungicides to reduce disease severity is shown in this study, it remains unclear if the reduction provided within these studies would have been achieved by more traditional preventive fungicide applications. It is also unknown if early season fungicide applications would have resulted in a reduction in the total number or quantity of fungicides needed for acceptable season-long control. A benefit from these applications, however, may be to extend the period of time between initial dollar spot symptoms and the point at which unacceptable disease levels become present. In this study, dollar spot quickly developed within the study area and severe pressure was observed within the untreated plots within 1 week of initial symptoms. Effective fungicides applied in this study delayed dollar spot symptoms to acceptable or near acceptable for up to an additional two weeks (3 weeks after initial symptoms). Although differences were observed among the various fungicides, it appears that most fungicides used to control dollar spot may assist in reducing initial disease severity.

ACKNOWEDGMENTS

The UConn Turfgrass Science Program would like to thank John Napier of Stanley Golf Club for supporting this project. The UConn Turfgrass Pathology Program also thanks Bayer Environmental Science and the New England Regional Turfgrass Foundation for the financial assistance provided for this study.

Table 1. Dollar spot (*Sclerotinia homoeocarpa*) severity as influenced by a spring application of various fungicides, Stanley Golf Club 2005.

	No. inf. centers		Percent dollar spot	
Treatment[x]	6 Jun	20 Jun	20 Jun	5 Jul
Bayleton 2SC 1.0 fl oz	11 fgh	19 f	1.2 e	22 c-g
Tartan 2SC 2.0 fl oz	5 gh	22 ef	0.9 e	18 d-g
AE F069623 00 SC22 A1 2.0 fl oz	5 gh	16 f	0.6 e	17 efg
Chipco 26GT 2SC 2.0 fl oz	18 e-g	30 def	1.6 de	24 c-g
Chipco 26GT 2SC 2.0 fl oz + Bayleton 2SC 0.5 fl oz	12 fgh	33 def	1.4 de	22 c-g
Emerald 0.13 oz	9 fgh	19 f	0.9 e	17 efg
Emerald 0.18 oz	13 fgh	27 def	1.3 de	19 d-g
Banner MAXX 1.3ME 1.0 fl oz	6 gh	14 f	0.6 e	16 fg
Bayleton 50WG 0.5 oz	35 d-g	55 cd	3.6 cde	31 b-e
Heritage TL 1.0 fl oz	94 ab	92 ab	8.5 b	46 ab
Insignia 20WG 0.5 oz	46 de	56 cd	3.6 cde	35 abc
Compass 50WG 0.15 oz	41 def	54 cd	3.4 de	25 c-g
Compass 50WG 0.15 oz + Bayleton WG 0.5 oz	26 e-h	50 cde	3.1 de	26 c-g
Eagle 1.0 fl oz	36 dg	52 cde	2.5 de	19 d-g
3336 2.0 oz	126 a	101 a	14.3 a	50 a
Daconil Ultrex 1.8 oz	33 d-h	54 cd	3.8 b-e	24 c-g
Iprodione Pro 2.0 oz	24 e-h	39 c-f	1.9 de	21 c-g
Curalan 1.0 oz	1 h	10 f	0.3 e	13 g
Spotrete 3.75 oz	62 cd	66 bc	6.0 bcd	30 c-f
Banner MAXX 1.3ME 1.0 fl oz + Daconil Ultrex 1.8 oz	3 h	9 f	0.3 e	13 g
FAA 0.71 fl oz	1 h	10 f	0.2 e	11 g
EAF 28DG 0.83 oz	7 gh	18 f	0.8 e	32 bcd
Untreated	89 bc	87 ab	8.4 bc	33 bcd

[x] Treatments were applied on 13 April 2006.

[y] Means in a column followed by the same letter are not significantly different at $P \leq 0.05$ according to Fisher's protected least significant difference test.

DOLLAR SPOT SEVERITY AS INFLUENCED BY NOZZLE TYPE AND FUNGICIDE MODE OF ACTIVITY

2005 AND 2006

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INTRODUCTION

Dollar spot (*Sclerotinia homoeocarpa*) is perhaps the most chronic and problematic disease of golf course turf throughout the United States. In recent years, many turfgrass managers have reported a reduction in efficacy and length of control with regards to fungicides commonly used to manage dollar spot. Possible reasons for this reduction in control include variation in application rates and timings, differences in application techniques, and potential resistance resulting from continued use of individual fungicides. While the potential for resistance to select classes of fungicides exists, the magnitude of this factor on reduced fungicide efficacy is unknown. The purpose of this study was to assess the influence of various nozzle types and fungicide mode of activity on the severity of dollar spot when chemicals are applied at low water volumes. The objectives of this study were to: 1) determine the influence of five different nozzle types on dollar spot control; and 2) elucidate any interactions between nozzle type and a contact or acropetal penetrant fungicide.

MATERIALS AND METHODS

This field study was conducted on three golf courses located in the Hartford, CT region. The golf courses included Tumblebrook Country Club (TCC; Bloomfield, CT), The Country Club of Farmington (CCF; Farmington, CT), and Stanley Golf Club (SGC; New Britain, CT). In 2006, trials were conducted at the University of Connecticut Turfgrass Research Facility (data analyses in progress). Trials were conducted on mixed stands of creeping bentgrass (*Agrostis stolonifera*) and annual bluegrass (*Poa annua*) that were maintained at fairway height. All sites were subjected to cultural management practices typical of golf course fairways in southern New England.

At all locations, fungicides were applied using one of five nozzle types designed to distribute varying droplet sizes. Nozzles were selected to produce droplet sizes that are extremely coarse (TTJ11004; TurfJet™), very coarse (AI11004; air induction TeeJet™), coarse (TJ11003; TurboJet®), medium (XR11004; extended range TeeJet®), and fine (XR11003; extended range TeeJet®). All nozzle types were used to apply an acropetal penetrant (Banner MAXX; propiconazole), a contact (Daconil; chlorothalonil), and a tank mix of the two fungicides. Daconil (1.8 oz/1000ft^2) and Banner MAXX (0.5 oz/1000ft^2) were applied at the low recommended use rate for the preventive control of dollar spot. Treatments were applied with a CO_2 pressurized (40 psi) sprayer equipped with a three-nozzle boom and calibrated to deliver 40 gal water per A. To account for variation in output from each nozzle, walking speed

Fig 1. Nozzle-type and droplet size were found to greatly influence the incidence and severity of dollar spot.

was adjusted to 2.8 or 2.0 mph using a metronome (KORG USA, Inc.; Melville, NY). All treatments were applied on the dates footnoted in the data tables (Table 1 to 5).

Plots measured 5 ft x 10 ft, and were arranged as a randomized complete block with three (CCF) or four (TCC and SGC) replications. The numbers of dollar spot infection centers per plot were counted throughout the study. Brown patch (*Rhizoctonia solani*), which also became active within the study area, was rated visually on a 0 to 100 percent scale where 0 = no visible brown patch symptoms and 100 = entire plot area discolored by *R. solani*. In addition to disease ratings, turfgrass quality was assessed throughout the study. Turfgrass quality was rated visually on a 0 to 10 scale where 0 = brown or dead turf; 7.5 = minimum acceptable quality for a golf course fairway; and 10 = optimum color and density. All data were subjected to analysis of variance and means were separated using the Fisher's protected least significant difference test. In addition to treatment effects, the main effect of each fungicide or nozzle type as well as any interactions among variables was assessed using preplanned orthogonal contrasts.

RESULTS

Stanley Golf Club. No dollar spot symptoms were visible when treatments were initiated on 27 May. On the first rating date (10 June), however, an average of 57 infection centers were present within the untreated control plots (Table 1). On 10 June

(14 days after treatment; DAT), plots treated with Banner + Daconil (all nozzle types), Daconil (AI11004, XR11004, XR11003) and Banner MAXX (AI11004) had acceptable (≤ 10 infection centers) levels of dollar spot. Except when applied using the nozzle TTJ11004, all plots treated with Banner MAXX + Daconil resulted in near complete control of dollar spot until the final rating date (19 Jul). By 19 Jul (25 DAT), the residual effect of the fungicides was spent and all plots had high levels of dollar spot. When applied using nozzles TTJ11004 or TT11003, Banner MAXX and Daconil provided moderate to poor control of dollar spot. Similarly moderate to poor dollar spot control was exhibited when Banner MAXX was applied using extended range nozzles XR11004 and XR11003, which produce medium and fine droplets, respectively.

Preplanned orthogonal contrasts revealed a significant main effect ($P < 0.0001$) of fungicide and nozzle type (Table 2). On all rating dates, plots treated with Banner MAXX + Daconil resulted in the highest level of control. Moderate levels of control were observed within plots treated with Daconil or Banner MAXX alone. Regardless of fungicide, treatments applied using nozzle AI11004 provided the highest level of dollar spot control. There were, however, no differences between AI11004 and XR11004 or XR11003. Fungicides applied using TTJ1104 (extremely coarse droplets) were the least effective.

Country Club of Farmington. Dollar spot disease pressure was low to moderate at CCF in 2005 and disease pressure in all plots was acceptable during the period in which treatments were applied. The period of peak disease activity did not occur until 25 DAT and only 25 infection centers per plot were present (Table 3). Fungicides applied using AI1104 and XR11004 (all fungicides) or XR11003 and TT11003 (Banner MAXX and Daconil + Banner MAXX) were the only treatments that provided acceptable levels of control (≤10 infection centers) throughout the study. Daconil applied alone using nozzle TTJ11004 or TT11003, however, had significantly higher dollar spot levels, when compared to the aforementioned treatments. By the final rating date, all fungicide treatments applied with any nozzle type and the untreated control had acceptable levels of dollar spot.

Few differences existed between fungicides or nozzle types on most rating dates at CCF (Table 4). On 19 July (25 DAT), however, plots treated with Daconil + Banner MAXX or Banner MAXX alone had the least amount of dollar spot infection centers. For nozzle types, both extended range nozzles (XR11004 and XR1003) provided the highest level of control, but were not significantly different than fungicides applied with AI11004 or TT11003.

Tumblebrook Country Club. Dollar spot pressure at TCC was extremely low throughout the 2005 season. Due to the low pressure from *S. homoeocarpa*, there were no differences among treatments on any rating date (data not shown).

Brown patch and turf quality. In addition to dollar spot, brown patch became active in early to mid July (data not shown). When brown patch first became visible on 1 July (7 DAT) at SGC, all fungicides and application methods (nozzle type) resulted in a reduction in disease levels, when compared to the untreated control. When disease pressure peaked on 19 July (25 DAT), however, none of the treatment combinations reduced the percentages of brown patch, when compared to the untreated control. On the other hand, plots treated with the tank mix of fungicides at CCF provided acceptable levels of brown patch control (≤5%) on 19 July, and enhanced disease suppression when compared to the untreated plots. Most nozzle types (except TTJ11004) resulted in a reduction in percent brown patch when compared to the untreated control at CCF.

Turf quality at all locations generally was influenced by the levels of disease suppression provided by each treatment and few differences of agronomic importance were observed. In general, overall quality was poor in the untreated plots and those treated with nozzle TTJ11004, and likely was influenced by the severe disease pressure within these treatments.

DISCUSSION

The goal of this study was to assess the impact of varying application methods (nozzle types) as well as two fungicides with different modes of activity on dollar spot severity. Regardless of nozzle type, all fungicides reduced dollar spot, when compared to the untreated control. Based on the results of this study, nozzle type and droplet size appear to heavily influence the level and length of fungicidal control. Although there were no statistical interactions between fungicide and nozzle type, it appeared that contact fungicides performed better when applied using nozzles that produced a medium or fine droplet size. In addition, similar levels of control also were observed when Daconil was applied using the air induction nozzle (AI11004), which produces a coarse water droplet. When an acropetal penetrant was applied alone and dollar spot was severe, moderate to poor disease control was exhibited from all nozzle types except AI11004. When applied as a tank mix, the fungicides generally provided better control than when applied alone, regardless of nozzle type.

Based on the data obtained in this study, fungicides used to control dollar spot may be more efficacious when applied using a nozzle that produces medium to fine droplet sizes or those that induce air into the droplet. Nozzles that produce larger droplet sizes, which are commonly supplied with new sprayer units, provided highly variable and often times poor control of dollar spot. An exception to the aforementioned observation occurred with the air induction nozzle. Although the air induction nozzles used in this study (AI11004) produce a water droplet that is relatively large in size, each droplet contains air inclusions which alter the behavior compared to similar sized droplets produced from conventional flat fan nozzles. While additional research must be conducted to corroborate the results of this study, it is likely that nozzle selection will become an important component of any fungicide spray program for managing dollar spot and potentially many other turfgrass diseases.

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The UConn Turfgrass Science Program would like to thank Cindy Johnson of Tumblebrook Country Club, John Napier of Stanley Golf Club, and John Ruzsbatzky of The Country Club of Farmington for supporting this project. The UConn Turfgrass Pathology Program also thanks the New England Regional Turfgrass Foundation, United States Golf Association, University of Connecticut Research Foundation, and Syngenta Crop Protection for the financial assistance provided for this study.

Table 1. Dollar spot (*Sclerotinia homoeocarpa*) severity as influenced by various fungicides and application techniques, Stanley Golf Club 2005.

			No. infection centers per plot[w]			
Treatment[x]	Nozzle	Droplet[y]	10 June	24 June	1 Jul	19 Jul
Daconil Ultrex	TTJ1104	EC	16 b-e[z]	8 bcd	41 b	171 b
Banner MAXX	TTJ1104	EC	18 bc	11 b	27 bc	155 bcd
Banner + Daconil	TTJ1104	EC	5 c-f	1 d	6 bc	118 b-e
Daconil Ultrex	AI11004	VC	4 def	3 cd	5 bc	145 b-e
Banner MAXX	AI11004	VC	5 c-f	1 d	5 bc	118 b-e
Banner + Daconil	AI11004	VC	0 f	0 d	0 c	99 cde
Daconil Ultrex	TT11003	C	17 bcd	10 bc	15 bc	166 bc
Banner MAXX	TT11003	C	21 b	7 bcd	19 bc	178 b
Banner + Daconil	TT11003	C	1 f	0 d	0 c	77 e
Daconil Ultrex	XR11004	M	2 ef	0 d	1 c	119 b-e
Banner MAXX	XR11004	M	16 b-e	8 bcd	26 bc	160 bc
Banner + Daconil	XR11004	M	1 f	0 d	1 c	89 de
Daconil Ultrex	XR11003	F	4 c-f	1 d	2 c	139 b-e
Banner MAXX	XR11003	F	12 b-f	4 bcd	14 bc	127 b-e
Banner + Daconil	XR11003	F	0 f	0 d	0 c	85 e
Untreated	-	-	57 a	54 a	145 a	329 a
Days after treatment			14	14	7	25

[w] Dollar spot was rated by counting the number of infection centers per plot (50 sq ft).
[x] Treatments were applied on 27 May and 10 and 24 June.
[y] Droplet sizes are as follows: EC = extremely coarse; VC = very coarse; C = coarse; M = medium; and F = fine.
[z] Means followed by the same letter are not significantly different according to Fisher's protected least significant difference test.

Table 2. Dollar spot (*Sclerotinia homoeocarpa*) and brown patch (*Rhizoctonia solani*) damage as influenced by various fungicides and application techniques, Stanley Golf Club 2005.

	Dollar spot (no.)[w]			
Treatment[x]	10 June	24 June	1 Jul	19 July
Fungicide				
Daconil	9 b[y]	4 b	13 b	148 b
Banner MAXX	14 b	6 b	18 b	147 b
Daconil + Banner MAXX	1 c	0 c	1 c	94 c
Untreated	57 a	54 a	145 a	329 a
Nozzle (droplet size)[z]				
TTJ1104 (EC)	13 b	7 b	24 b	148 b
AI11004 (VC)	3 c	1 c	3 c	120 b
TT11003 (C)	13 b	6 bc	11 bc	140 b
XR11004 (M)	6 bc	3 bc	9 c	122 b
XR11003 (F)	5 bc	2 bc	5 c	117 b
Untreated	57 a	54 a	145 a	329 a
Probability				
Fungicide	<0.0001	<0.0001	<0.0001	<0.0001
Nozzle	<0.0001	<0.0001	<0.0001	<0.0001
Fungicide x Nozzle	NS	NS	NS	NS

[w] Dollar spot was rated by counting the number of infection centers per plot (50 sq ft).
[x] Treatments were applied on 27 May and 10 and 24 June.
[y] Means followed by the same letter are not significantly different according to Fisher's protected least significant difference test.
[z] Droplet sizes are as follows: EC = extremely coarse; VC = very coarse; C = coarse; M = medium; and F = fine.

Table 3. Dollar spot (*Sclerotinia homoeocarpa*) severity as influenced by various fungicides and application techniques, Country Club of Farmington 2005.

			No. infection centers per plot[w]		
Treatment[x]	Nozzle	Droplet[y]	24 June	19 Jul	26 Jul
Daconil Ultrex	TTJ1104	EC	2.3 a[z]	24 ab	3.7 abc
Banner MAXX	TTJ1104	EC	1.3 a	13 a-d	9.7 a
Banner + Daconil	TTJ1104	EC	1.7 a	13 a-d	3.0 abc
Daconil Ultrex	AI11004	VC	2.0 a	10 a-d	2.0 bc
Banner MAXX	AI11004	VC	2.3 a	8 bcd	1.0 bc
Banner + Daconil	AI11004	VC	1.3 a	4 cd	0.3 c
Daconil Ultrex	TT11003	C	2.0 a	11 a-d	1.0 bc
Banner MAXX	TT11003	C	2.3 a	5 cd	3.3 abc
Banner + Daconil	TT11003	C	1.0 a	3 d	3.3 abc
Daconil Ultrex	XR11004	M	2.0 a	3 d	2.3 bc
Banner MAXX	XR11004	M	0.0 a	4 cd	1.3 bc
Banner + Daconil	XR11004	M	1.0 a	2 d	1.7 bc
Daconil Ultrex	XR11003	F	2.3 a	19 abc	4.0 abc
Banner MAXX	XR11003	F	2.3 a	9 bcd	1.3 bc
Banner + Daconil	XR11003	F	0.3 a	3 d	1.3 bc
Untreated	-	-	1.6 a	25 a	7.5 ab
Days after treatment			14	25	32

[w] Dollar spot was rated by counting the number of infection centers per plot (50 sq ft).
[x] Treatments were applied on 27 May and 10 and 24 June.
[y] Droplet sizes are as follows: EC = extremely coarse; VC = very coarse; C = coarse; M = medium; and F = fine.
[z] Means followed by the same letter are not significantly different according to Fisher's protected least significant difference test.

Table 4. Dollar spot (*Sclerotinia homoeocarpa*) severity as influenced by various fungicides and application techniques, Country Club of Farmington 2005.

	Dollar spot (no.)[w]			
Treatment[x]	10 June	24 June	19 July	26 July
Fungicide				
Daconil	0 a[y]	2 a	14 b	3 a
Banner MAXX	0 a	2 a	8 bc	3 a
Daconil + Banner MAXX	0 a	1 a	5 c	2 a
Untreated	0 a	2 a	26 a	8 a
Nozzle (droplet size)[z]				
1/4TTJ04 (EC)	0 a	2 a	17 ab	5 a
AI11004 (VC)	0 a	2 a	8 bc	1 a
TT11003 (C)	0 a	2 a	11 bc	2 a
XR11004 (M)	0 a	1 a	3 c	2 a
XR11003 (F)	0 a	2 a	7 c	2 a
Untreated	0 a	2 a	26 a	8 a
Probability				
Fungicide	NS	NS	0.0051	NS
Nozzle	NS	NS	0.0053	NS
Fungicide x Nozzle	NS	NS	NS	NS

[w] Dollar spot was rated by counting the number of infection centers per plot (50 sq ft).
[x] Treatments were applied on 27 May and 10 and 24 June.
[y] Means followed by the same letter are not significantly different according to Fisher's protected least significant difference test.
[z] Droplet sizes are as follows: EC = extremely coarse; VC = very coarse; C = coarse; M = medium; and F = fine.

CREEPING BENTGRASS (*Agrostis stolonifera* 'unknown')
ANNUAL BLUEGRASS (*Poa annua*)
Dollar spot; *Sclerotinia homoeocarpa*

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Storrs, CT 06269

Early curative dollar spot suppression with various fungicides and plant defense activators, 2006.

This field study was conducted Stanley Golf Club located in New Britain, CT. The turf was a mixed stand of creeping bentgrass (*Agrostis stolonifera*) and annual bluegrass (*Poa annua*) that was maintained at fairway height. Plots measured 5 ft x 5 ft, and were arranged as a randomized complete block with four replications. Fungicides were applied with a CO_2 pressurized (35 psi) sprayer equipped with a flat-fan nozzle (8010E), and calibrated to deliver 2.5 gal water per 1000 ft^2. Turf was maintained at 0.50 in. and irrigated as needed to prevent wilt. Dollar spot severity was assessed by visually estimating the percent plot area affected by *S. homoeocarpa*. Percent dollar spot was rated visually on a 0 to 100 percent scale where 0 = no visible dollar spot symptoms and 100 = entire plot area discolored by *S. homoeocarpa*.

Dollar spot became active at the study site in late May. Except for Emerald treatments applied on 23 May, all plots had trace levels of dollar spot when treatments were initiated on 6 Jun. On 20 Jun (2 weeks after treatment; WAT), all plots had an average of between 0 and 6.5% dollar spot and there were no differences among any treatment and the untreated control. Disease pressure became severe in late-Jun and early-Jul. On 5 Jul, 26% of the untreated control plots were damaged by dollar spot. Treatments providing acceptable (≤1%) suppression of dollar spot on 5 Jul included preventive applications of Emerald and early curative applications of Actigard + Banner MAXX + Daconil, Spectator Ultra + Manicure Ultra, Lynx Green, and Daconil + Banner MAXX. There were no statistical differences, however, among the aforementioned treatments and those plots treated with SP2016 + Banner MAXX (6%), Actigard + Daconil (8%), Actigard + Banner MAXX (4%), Daconil (6%), Banner MAXX (10%), Spectator Ultra (2 to 19%), Manicure Ultra (2%), Bayleton (10%), and Emerald (2 to 7%). Disease severity increased until mid to late Jul, after which time percent dollar spot in the untreated control plots leveled off to between 33 and 42%. On all rating dates, little to no suppression of dollar spot was achieved in plots treated with SP2016, Actigard, or 3336F. Resistance of *S. homoeocarpa* isolates from this study site to thiophanate-methyl (3336) was confirmed via in vitro fungicide assays.

Treatment [x]	Application Schedule[y]	Percent dollar spot[z]					
		20 Jun	5 Jul	18 Jul	1 Aug	8 Aug	17 Aug
SP2016 F 1.15 fl oz	B-E	4.0 a-d[x]	27 abc	51 a	46 a	50 a	31 ab
SP2016 F 4.6 fl oz	B-E	6.3 ab	28 ab	38 ab	43 a	52 a	40 a
SP2016 F 4.6 fl oz	BD	5.3 abc	29 a	42 a	32 abc	45 ab	26 abc
SP2016 F 9.21 fl oz	B	2.9 a-d	20 a-e	26 b	29 a-d	36 a-d	31 ab
SP2016 F 4.6 fl oz + Banner MAXX 1.3ME 0.5 fl oz	B-E	1.7 bcd	6 efg	2 c	2 e	2 e	5 cd
Actigard WDG 0.0115 oz + Daconil Ultrex 82.5WDG 1.8 oz	B-E	2.9 a-d	8 fg	8 c	8 cde	12 de	21 a-d
Actigard WDG 0.0115 oz + Banner MAXX 1.3ME 0.5 fl oz	B-E	1.9 a-d	4 efg	2 c	4 e	5 e	8 bcd
Actigard WDG 0.0057 oz + Banner MAXX 1.3ME 0.5 fl oz + Daconil Ultrex 82.5WDG 1.8 oz	B-E	2.0 a-d	1 fg	0 c	1 e	0 e	1 cd
Daconil Ultrex 82.5WDG 1.8 oz	B-E	1.2 cd	6 efg	7 c	7 de	8 de	17 a-d
Banner MAXX 1.3ME 0.5 fl oz	B-E	2.1 a-d	10 c-g	3 c	5 de	7 e	20 a-d
Actigard WDG 0.0115 oz	B-E	6.5 a	29 a	37 ab	34 ab	46 ab	26 abc
Spectator Ultra 1.3ME 1.0 fl oz	B-E	1.9 a-d	2 efg	0 c	2 e	1 e	2 cd
Spectator Ultra 1.3ME 2.0 fl oz	BD	1.8 bcd	19 a-f	5 c	4 e	1 e	1 d
Manicure Ultra 82.5WDG 3.25 oz	B-E	1.5 cd	2 fg	2 c	3 e	7 e	19 a-d
Spectator Ultra 1.3ME 2.0 fl oz + Manicure Ultra 82.5WDG 3.25 oz	B-E	0.5 d	0 g	0 c	0 e	0 e	0 d
3336F 4F 2.0 fl oz	B-E	6.5 a	35 a	47 a	40 ab	40 abc	32 ab
Bayleton 2SC 0.5 fl oz	B-E	2.4 a-d	10 b-g	5 c	5 de	5 e	11 bcd
Lynx Green 1.0 fl oz	B-E	1.5 cd	1 fg	0 c	1 e	0 e	1 d
Daconil Ultrex 82.5WDG 1.8 oz + Banner MAXX 1.3ME 0.5 fl oz	B-E	1.1 cd	1 g	0 c	1 e	0 e	4 cd
Emerald 70WG 0.13 oz	B-E	1.0 cd	2 efg	1 c	1 e	0 e	1 d
Emerald 70WG 0.18 oz	BD	0.9 cd	7 efg	1 c	0 e	0 e	0 d
Emerald 70WG 0.13 oz	A-E	0.0 d	1 fg	0 c	1 e	0 e	1 d
Emerald 70WG 0.18 oz	AC	0.0 d	0 g	6 c	19 b-e	22 b-e	22 a-d
Tartan 2.4SC 1.0 fl oz	E	-	-	-	19 b-e	19 b-e	17 a-d
Tartan 2.4SC 2.0 fl oz	E	-	-	-	17 b-e	14 cde	10 bcd
Untreated	-	4.3 a-d	26 a-d	41 ab	36 ab	42 ab	33 ab

[z] Percent dollar spot was rated visually on a 0 to 100 percent scale where 0 = no visible dollar spot symptoms and 100 = entire plot area discolored by *S. homoeocarpa*.

[y] Treatments were applied on the following dates: A = 23 May; B = 6 June; C = 20 June; D = 5 Jul; and E = 18 Jul.

[x] Means in a column followed by the same letter are not significantly different at $P \leq 0.05$ according to Fisher's protected least significant difference test.