

EVALUATION OF THE BIOFUNGICIDE ECOGUARD (*BACILLUS LICHENIFORMIS*) ON DOLLAR SPOT CONTROL WHEN USED ALONE OR IN COMBINATION WITH FUNGICIDES, 2010

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INTRODUCTION

Dollar spot (*Sclerotinia homoeocarpa*) is a common disease of golf course fairways throughout Pennsylvania and the entire United States. Although there are several cultural management practices that can assist in reducing disease severity, the use of protective chemicals usually is necessary to control the disease during periods favorable for growth of the pathogen. Turfgrass managers, however, continuously look for alternative strategies to help reduce their overall use of pesticides. One practice that has gained interest in recent years is the use of biorational or biocontrol products for the reduction of dollar spot symptoms. The objectives of this study were to evaluate the ability of the biofungicide EcoGuard when used alone or in combination with fungicides for its ability to preventively suppress dollar spot.

MATERIALS & METHODS

This study was initiated at the Valentine Turfgrass Research Center located in University Park, PA. Soil was a sandy loam with a pH 7.2 and an OM of 1.79%. Turfgrass used for the fungicide evaluation was a mixed stand of predominantly creeping bentgrass (*Agrostis stolonifera*) with a small amount of annual bluegrass (*Poa annua*). The area was maintained as a bentgrass green and mowed six times per week to a height of 0.125in. All fungicide treatments were applied with a CO₂ pressurized (40 psi) sprayer equipped with an air-induction flat fan nozzle (AI9508E), and calibrated to deliver 2.0 gal water per 1000 ft². A few dollar spot infection centers were noticed within the within the study area on the same day treatments were initiated. Treatments were initially applied on 24 May and reapplied six times every 14 days. All treatments and application dates are listed in the data tables.

Plots measured 3 ft x 6 ft and were arranged in a randomized complete block with four replications. Dollar spot severity was assessed by counting the number of infection centers within each plot or by estimating the disease severity on a 0 to 100% scale where 0 = no disease present and 100 = entire plot area affected by dollar spot. Turfgrass quality was also visually rated on a 1 to 9 scale where 1 = entire plot brown or dead and 9 = optimum greenness and density. Percent algae was rated on a single date on a 0 to 100% scale where 0 = no algae present and 100 = entire plot area blackened by algae. All data were subjected to analysis of variance and means were separated at $P \leq 0.05$ according to Fisher's Protected Least Significant Difference Test.

RESULTS

Dollar spot. Dollar spot was present in and around the study area in trace amounts when treatments were initiated on 24 May, but disease symptoms began to increase within a few days after application. On 31 May, all treatments receiving traditional fungicides (Curalan + Banner MAXX) had reduced numbers of dollar spot infection centers (DSIC) when compared to the untreated control plots (Table 1). There were no differences among the untreated control plots and those treated with EcoGuard alone. Disease pressure continued to progress throughout the study area and on all five rating dates in May and June, all treatments which included traditional fungicides provided excellent dollar spot suppression. During this same period, there were no differences between plots treated only with EcoGuard and the untreated control plots with plots averaging 18 to 54 and 26 to 62 DSIC per plot, respectively.

As disease pressure began to increase during the period in which treatments continued to be applied, all treatments containing fungicides continued to provide excellent and acceptable (<0.5% per plot) suppression of dollar spot (Table 2). As the efficacy of the treatments began to fade (26 Aug), plots treated with the traditional fungicide program (#1) and the traditional program + EcoGuard (#3) provided the greatest reduction of dollar spot. Plots in which Curalan and EcoGuard were alternated on a 14-day interval had significantly more dollar spot (21%) than the aforementioned treated-plots (2 to 4%), but had significantly less dollar spot when compared to the untreated control plots (64%). EcoGuard applied alone on a 14-day interval did not result in a significant reduction in dollar spot on any rating date.

Quality. Turfgrass quality ratings were visually assessed periodically between 8 Jun and 13 Aug and did not take into account the damage caused by dollar spot. During this period, plots treated with any traditional fungicide program had acceptable quality (≥ 7.0) on nearly all rating dates (Table 3). However, plots receiving traditional fungicide plus EcoGuard alternated with Curalan on a 14-day interval or EcoGuard (10 fl oz or 20 fl oz) every 14-days improved quality rating on 3 to 6 of the 7 rating dates when compared to plots only receiving fungicides. Although EcoGuard applied alone improved turfgrass quality relative to the untreated control on 4 of 7 rating dates, dollar spot pressure within these plots was severe.

Table 1. Number of dollar spot infection centers affected by dollar spot following the application EcoGuard alone or in combination with various fungicide programs, 2010.

Treatment and rate per 1000 sq ft ^y	Application Code	No. dollar spot infection centers ^z				
		31 May	8 Jun	14 Jun	18 Jun	28 Jun
1 Curalan 1.0 oz	ABCDEF					
Banner MAXX 0.5 fl oz	A					
Medallion 0.25 oz	B					
Heritage DG 0.2 oz	CE					
ProStar 1.5 oz	D					
Subdue MAXX 1.0 fl oz	F	5.5 bc ^x	2.3 b	0.5 b	0.0 b	0.0 b
2 Curalan 1.0 oz	ACE					
Banner MAXX 0.5 fl oz	A					
EcoGard 20 fl oz	BDF					
Heritage 0.2 oz	C					
ProStar 1.5 oz.....	E	1.5 c	1.0 b	1.0 b	1.3 b	0.3 b
3 Curalan 1.0 oz	ABCDEF					
Banner MAXX 0.5 fl oz	A					
EcoGard 20 fl oz	ABCDEF					
Medallion 0.25 oz	B					
Heritage DG 0.2 oz	CE					
ProStar 1.5 oz	D					
Subdue MAXX 1.0 fl oz	F	3.0 bc	3.3 b	0.8 b	0.0 b	0.0 b
4 Curalan 0.5 oz	ABCDEF					
Banner MAXX 0.5 fl oz	A					
EcoGard 10 fl oz	ABCDEF					
Medallion 0.25 oz	B					
Heritage DG 0.2 oz	CE					
ProStar 1.5 oz	D					
Subdue MAXX 1.0 fl oz	F	1.5 c	4.8 b	2.8 b	0.0 b	0.3 b
5 EcoGard 20 fl oz.....	ABCDEF	18.0 ab	36.0 a	40.5 a	53.8 a	40.3 a
6 Untreated.....		25.8 a	54.5 a	61.0 a	61.5 a	55.5 a

^z Dollar spot was rated by counting the number of infection centers per plot (No. spots).

^y Treatments were applied on 24 May; 8 and 22 Jun; 8 and 20 Jul; and 3 Aug.

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

Table 2. Percent plot area affected by dollar spot following the application EcoGuard alone or in combination with various fungicide programs, 2010.

Treatment and rate per 1000 sq ft ^y	Applicatio Code	Percent dollar spot ^z					
		13 Jul	27 Jul	13 Aug	16 Aug	26 Aug	8 Sep
1 Curalan 1.0 oz	ABCDEF						
Banner MAXX 0.5 fl oz	A						
Medallion 0.25 oz	B						
Heritage DG 0.2 oz	CE						
ProStar 1.5 oz	D						
Subdue MAXX 1.0 fl oz.....	F	0.0 b ^x	0 c	0 b	<1 b	2 c	7 b
2 Curalan 1.0 oz	ACE						
Banner MAXX 0.5 fl oz	A						
EcoGard 20 fl oz	BDF						
Heritage 0.2 oz	C						
ProStar 1.5 oz	E	0.0 b	0 c	4 b	6 b	21 b	21 b
3 Curalan 1.0 oz	ABCDEF						
Banner MAXX 0.5 fl oz	A						
EcoGard 20 fl oz	ABCDEF						
Medallion 0.25 oz	B						
Heritage DG 0.2 oz	CE						
ProStar 1.5 oz	D						
Subdue MAXX 1.0 fl oz.....	F	0.0 b	0 c	0 b	<1 b	4 c	9 b
4 Curalan 0.5 oz	ABCDEF						
Banner MAXX 0.5 fl oz	A						
EcoGard 10 fl oz	ABCDEF						
Medallion 0.25 oz	B						
Heritage DG 0.2 oz	CE						
ProStar 1.5 oz	D						
Subdue MAXX 1.0 fl oz.....	F	0.0 b	0 c	1 b	2 b	13 bc	14 b
5 EcoGard 20 fl oz	ABCDEF	5.8 a	12 b	29 a	40 a	60 a	48 a
6 Untreated		8.8 a	16 a	31 a	41 a	64 a	60 a

^z Percent plot area affected by dollar spot was rated visually on a 0 to 100% scale where 0 = no disease symptoms were present and 100 = entire plot area displaying disease symptoms.

^y Treatments were applied on 24 May; 8 and 22 Jun; 8 and 20 Jul; and 3 Aug.

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

Table 3. Quality of turf following the application EcoGuard alone or in combination with various fungicide programs, 2010

Treatment and rate per 1000 sq ft ^y	Application Code	Turfgrass quality ^z						
		8 Jun	14 Jun	18 Jun	28 Jun	13 Jul	27 Jul	13 Aug
1 Curalan 1.0 oz	ABCDEF							
Banner MAXX 0.5 fl oz	A							
Medallion 0.25 oz	B							
Heritage DG 0.2 oz	CE							
ProStar 1.5 oz	D							
Subdue MAXX 1.0 fl oz	F	7.3 ab ^x	7.0 b	7.5 bc	7.5 c	7.3 cd	7.8 c	7.0 b
2 Curalan 1.0 oz	ACE							
Banner MAXX 0.5 fl oz	A							
EcoGard 20 fl oz	BDF							
Heritage 0.2 oz	C							
ProStar 1.5 oz.....	E	7.8 a	8.0 a	8.3 ab	8.0 bc	8.8 ab	8.3 b	6.8 b
3 Curalan 1.0 oz	ABCDEF							
Banner MAXX 0.5 fl oz	A							
EcoGard 20 fl oz	ABCDEF							
Medallion 0.25 oz	B							
Heritage DG 0.2 oz	CE							
ProStar 1.5 oz	D							
Subdue MAXX 1.0 fl oz	F	7.5 a	8.0 a	8.5 a	8.8 a	9.0 a	9.0 a	8.3 a
4 Curalan 0.5 oz	ABCDEF							
Banner MAXX 0.5 fl oz	A							
EcoGard 10 fl oz	ABCDEF							
Medallion 0.25 oz	B							
Heritage DG 0.2 oz	CE							
ProStar 1.5 oz	D							
Subdue MAXX 1.0 fl oz	F	7.5 a	8.0 a	8.5 a	8.3 ab	8.3 ab	8.3 b	7.5 ab
5 EcoGard 20 fl oz.....	ABCDEF	6.5 b	6.8 b	7.5 bc	7.8 bc	8.0 bc	7.0 d	4.3 c
6 Untreated.....		6.5 b	6.3 c	6.8 c	6.5 d	6.5 d	6.0 e	3.8 c

^z Turfgrass quality was rated on a 1 to 9 scale where 1 = entire plot area brown or dead; 7 = minimum acceptable quality for a golf course putting green; and 9 = optimum greenness and density.

^y Treatments were applied on 24 May; 8 and 22 Jun; 8 and 20 Jul; and 3 Aug.

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

Table 4. Percent plot area affected by dollar spot following the application EcoGuard alone or in combination with various fungicide programs, 2010.

Treatment and rate per 1000 sq ft	Application	Percent algae ^z
	Code	13 Aug
1 Curalan 1.0 oz	ABCDEF	
Banner MAXX 0.5 fl oz	A	
Medallion 0.25 oz	B	
Heritage DG 0.2 oz	CE	
ProStar 1.5 oz	D	
Subdue MAXX 1.0 fl oz	F	17.5 a ^x
2 Curalan 1.0 oz	ACE	
Banner MAXX 0.5 fl oz	A	
EcoGard 20 fl oz	BDF	
Heritage 0.2 oz	C	
ProStar 1.5 oz.....	E	17.0 a
3 Curalan 1.0 oz	ABCDEF	
Banner MAXX 0.5 fl oz	A	
EcoGard 20 fl oz	ABCDEF	
Medallion 0.25 oz	B	
Heritage DG 0.2 oz	CE	
ProStar 1.5 oz	D	
Subdue MAXX 1.0 fl oz	F	16.5 a
4 Curalan 0.5 oz	ABCDEF	
Banner MAXX 0.5 fl oz	A	
EcoGard 10 fl oz	ABCDEF	
Medallion 0.25 oz	B	
Heritage DG 0.2 oz	CE	
ProStar 1.5 oz	D	
Subdue MAXX 1.0 fl oz	F	16.0 a
5 EcoGard 20 fl oz.....	ABCDEF	11.5 a
6 Untreated.....		15.0 a

^z Algae was rated by visually rating the percent plot area affected by the algae where 0 = no algae present and 100 = entire plot area is algae.

^y Treatments were applied on 24 May; 8 and 22 Jun; 8 and 20 Jul; and 3 Aug.

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