



Reduced-Risk Dollar Spot Management

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OBJECTIVE

To determine the efficacy of various reduced-risk programs primarily for the control of dollar spot on creeping bentgrass maintained as a golf course fairway.

MATERIALS AND METHODS

The study was replicated at 3 locations: the O.J. Noer Turfgrass Research and Education Facility in Madison, WI and the 7th and 14th holes at University Ridge Golf Course in Madison, WI. At each site the study was conducted on creeping bentgrass (*Agrostis stolonifera* 'Penncross') maintained at a 0.5 inch cutting height. The individual plots measured 6 ft X 10 ft and were arranged in a randomized complete block design with four replications. Individual treatments were applied at a nozzle pressure of 40 p.s.i using a CO₂ pressurized boom sprayer equipped with XR Teejet AI8004 VS nozzles. All fungicides were agitated by hand and applied in the equivalent of 2 gallons of water per 1000 ft². Three fungicide programs were tested in addition to the non-treated control. One was a conventional fungicide program based off the program of a local golf course, the second based the application timing on the Smith-Kerns dollar spot prediction model using conventional fungicides, and the third based application timing on the Smith-Kerns dollar spot model but used exclusively fungicides labeled as reduced risk by the Environmental Protection Agency. Number of dollar spot infection centers per plot, turfgrass quality (1-9, 9 being excellent, 6 acceptable, and 1 bare soil), and normalized difference vegetation index (NDVI) were assessed every two weeks. Results were subjected to an analysis of variance and means were separated using the Waller-Duncan test ($P = 0.05$). Environmental impact quotient, disease severity, and turfgrass quality from each location can be found in the following tables.

RESULTS AND DISCUSSION

Dollar spot pressure highest in August, with non-treated controls averaging 937, 60, and 147 dollar spot foci per plot at the OJ Noer, 7th, and 14th hole locations, respectively. All three programs significantly reduced dollar spot compared to the non-treated control at each location. However, differences in dollar spot severity were rarely observed between the 3 fungicide programs regardless of location. This suggests that use of the Smith-Kerns model and use of reduced-risk fungicides did not result in reduced disease suppression despite the elimination of 2 fungicide applications relative to the conventional program with treatment 3 (model with conventional fungicides) and elimination of 3 fungicide applications with treatment 4 (model with reduced-risk fungicides). In addition, treatment 4 resulted in an 85% reduction in environmental impact relative to the conventional program and a 91% reduction compared to treatment 3.

Table 1. Environmental Impact Quotient (EIQ) of conventional versus reduced risk fungicide programs at the O.J. Noer Turfgrass Research and Educational Facility and University Ridge Golf Course in Madison, WI during 2014.

Treatment	Spray Date	Pesticide Applied	Field Use EIQ
Conventional	May 20 th	Emerald	9.1
	Jun 17 th	Torque	25.5
	Jul 8 th	Daconil WStik	176
		Banner MAXX II	12.3
		Subdue MAXX	11.4
	Jul 22 nd	Chipco 26GT	46.1
		Subdue MAXX	11.4
	Aug 7 th	Daconil WStik	176
	Aug 27 th	Torque	25.5
Sep 2 nd	Curalan	23.7	
Sep 23 rd	Chipco 26GT	46.1	
Total EIQ			563.1
Smith-Kerns Model: Conventional Fungicides	June 5 th	Emerald	9.1
	Jul 2 nd	Banner MAXX II	12.3
		Daconil WStik	176
	Jul 18 th	Chipco 26GT	30.8
		Daconil WStik	176
	Aug 7 th	Banner MAXX II	12.3
		Daconil WStik	176
Aug 27 th	Emerald	9.1	
Sep 23 rd	Banner MAXX II	24.6	
Total EIQ			802.2
Smith-Kerns Model: Reduced-Risk Fungicides	Jun 5 th	Emerald	9.1
	July 2 nd	Velista	18.2
	Jul 25 th	Emerald	9.1
		Heritage TL	12.9
	Aug 27 th	Compass	10.1
		Velista	18.2
Sep 23 rd	Emerald	9.1	
Total EIQ			86.7

Table 2. Mean number of dollar spot infection centers per treatment at the O. J. Noer Turfgrass Research and Education Facility in Madison, WI in 2014.

	Treatment	Rate	Application Date/Interval	Dollar spot severity ^a			
				Jun 20	Jul 30	Aug 12	
1	Non-treated control			46.0a	1180.0a	937.5a	
2	Conventional Program	Emerald (A)	0.18 OZ/1000 FT2	May 20			
		Torque (B)	0.6 FL OZ/1000 FT2	June 17			
		Daconil WStik (C)	3.2 FL OZ/1000 FT2	July 8			
		Banner MAXX II (C)	1.0 FL OZ/1000 FT2	July 8			
		Subdue MAXX (C)	1.0 FL OZ/1000 FT2	July 8			
		Chipco 26GT (D)	3.0 FL OZ/1000 FT2	July 21	7.3b	94.8b	153.5c
		Subdue MAXX (D)	1.0 FL OZ/1000 FT2	July 21			
		Daconil WStik (E)	3.2 FL OZ/1000 FT2	August 4			
		Torque (F)	0.6 FL OZ/1000 FT2	August 4			
		Curalan (G)	1.0 OZ/1000 FT2	September 1			
Chipco 26GT (H)	3.0 FL OZ/1000 FT2	September 22					
3	Smith-Kerns model: Conventional	Emerald (A)	0.18 OZ/1000 FT2	28 Days			
		Banner MAXX II (B)	1.0 FL OZ/1000 FT2	14 Days			
		Daconil Wstik (B)	3.2 FL OZ/1000 FT2	14 Days			
		Chipco 26GT (C)	2.0 FL OZ/1000 FT2	14 Days			
		Daconil Wstik (C)	3.2 FL OZ/1000 FT2	14 Days	8.0b	105.5b	306.5b
		Banner MAXX II (D)	1.0 FL OZ/1000 FT2	14 Days			
		Daconil WStik (D)	3.2 FL OZ/1000 FT2	14 Days			
		Emerald (E)	0.18 OZ/1000 FT2	28 Days			
Banner MAXX II (F)	2.0 FL OZ/1000 FT2	21 Days					
4	Smith-Kerns model: Reduced Risk	Emerald (A)	0.18 OZ/1000 FT2	28 Days			
		Velista (B)	0.5 OZ/1000 FT2	21 Days			
		Emerald (C)	0.18 OZ/1000 FT2	28 Days			
		Heritage TL (C)	2.0 FL OZ/1000 FT2	28 Days			
		Compass (D)	0.25 OZ/1000 FT2	21 Days	5.8b	55.3b	268.3bc
		Velista (D)	0.5 OZ/1000 FT2	21 Days			
		Emerald (E)	0.18 OZ/1000 FT2	28 Days			
		Velista (F)	0.5 OZ/1000 FT2	21 Days			

^aDollar spot was visually assessed as number of dollar spot infection centers per plot. Means followed by the same letter do not significantly differ (P=.05, Waller-Duncan).

Table 3. Mean turf quality ratings per treatment at the O. J. Noer Turfgrass Research and Education Facility in Madison, WI in 2014.

	Treatment	Rate	Application Date/Interval	Turfgrass Quality ^a			
				Jun 20	Jul 30	Aug 12	
1	Non-treated control			6.3b	4.5b	4.0c	
2	Conventional Program	Emerald (A) ^b	0.18 OZ/1000 FT2	May 20			
		Torque (B)	0.6 FL OZ/1000 FT2	June 17			
		Daconil WStik (C)	3.2 FL OZ/1000 FT2	July 8			
		Banner MAXX II (C)	1.0 FL OZ/1000 FT2	July 8			
		Subdue MAXX (C)	1.0 FL OZ/1000 FT2	July 8			
		Chipco 26GT (D)	3.0 FL OZ/1000 FT2	July 21	7.0a	6.8a	6.0a
		Subdue MAXX (D)	1.0 FL OZ/1000 FT2	July 21			
		Daconil WStik (E)	3.2 FL OZ/1000 FT2	August 4			
		Torque (F)	0.6 FL OZ/1000 FT2	August 4			
		Curalan (G)	1.0 OZ/1000 FT2	September 1			
Chipco 26GT (H)	3.0 FL OZ/1000 FT2	September 22					
3	Smith-Kerns model - Conventional	Emerald (A)	0.18 OZ/1000 FT2	28 Days			
		Banner MAXX II (B)	1.0 FL OZ/1000 FT2	14 Days			
		Daconil Wstik (B)	3.2 FL OZ/1000 FT2	14 Days			
		Chipco 26GT (C)	2.0 FL OZ/1000 FT2	14 Days			
		Daconil Wstik (C)	3.2 FL OZ/1000 FT2	14 Days	7.0a	6.8a	5.0b
		Banner MAXX II (D)	1.0 FL OZ/1000 FT2	14 Days			
		Daconil WStik (D)	3.2 FL OZ/1000 FT2	14 Days			
		Emerald (E)	0.18 OZ/1000 FT2	28 Days			
Banner MAXX II (F)	2.0 FL OZ/1000 FT2	21 Days					
4	Smith-Kerns model - Reduced Risk	Emerald (A)	0.18 OZ/1000 FT2	28 Days			
		Velista (B)	0.5 OZ/1000 FT2	21 Days			
		Emerald (C)	0.18 OZ/1000 FT2	28 Days			
		Heritage TL (C)	2.0 FL OZ/1000 FT2	28 Days			
		Compass (D)	0.25 OZ/1000 FT2	21 Days	7.0a	6.5a	5.3b
		Velista (D)	0.5 OZ/1000 FT2	21 Days			
		Emerald (E)	0.18 OZ/1000 FT2	28 Days			
Velista (F)	0.5 OZ/1000 FT2	21 Days					

^aTurfgrass quality was visually assessed on 1-9 scale, with 9 being excellent, 6 being acceptable, and 1 bare dirt. Means followed by the same letter do not significantly differ (P=.05, Waller-Duncan).

Table 4. Mean number of dollar spot infection centers per treatment on the 7th fairway at University Ridge GC in Madison, WI during 2014.

	Treatment	Rate	Application Date/Interval	Dollar spot severity ^a			
				Jun 20	Jul 30	Aug 12	
1	Non-treated control			0.0a	4.5a	60.0a	
2	Conventional Program	Emerald (A) ^b	0.18 OZ/1000 FT2	May 20			
		Torque (B)	0.6 FL OZ/1000 FT2	June 17			
		Daconil WStik (C)	3.2 FL OZ/1000 FT2	July 8			
		Banner MAXX II (C)	1.0 FL OZ/1000 FT2	July 8			
		Subdue MAXX (C)	1.0 FL OZ/1000 FT2	July 8			
		Chipco 26GT (D)	3.0 FL OZ/1000 FT2	July 21	0.0a	0.0a	6.5b
		Subdue MAXX (D)	1.0 FL OZ/1000 FT2	July 21			
		Daconil WStik (E)	3.2 FL OZ/1000 FT2	August 4			
		Torque (F)	0.6 FL OZ/1000 FT2	August 4			
		Curalan (G)	1.0 OZ/1000 FT2	September 1			
Chipco 26GT (H)	3.0 FL OZ/1000 FT2	September 22					
3	Smith-Kerns model: Conventional	Emerald (A)	0.18 OZ/1000 FT2	28 Days			
		Banner MAXX II (B)	1.0 FL OZ/1000 FT2	14 Days			
		Daconil Wstik (B)	3.2 FL OZ/1000 FT2	14 Days			
		Chipco 26GT (C)	2.0 FL OZ/1000 FT2	14 Days			
		Daconil Wstik (C)	3.2 FL OZ/1000 FT2	14 Days	0.0a	2.0a	2.5b
		Banner MAXX II (D)	1.0 FL OZ/1000 FT2	14 Days			
		Daconil WStik (D)	3.2 FL OZ/1000 FT2	14 Days			
		Emerald (E)	0.18 OZ/1000 FT2	28 Days			
Banner MAXX II (F)	2.0 FL OZ/1000 FT2	21 Days					
4	Smith-Kerns model: Reduced Risk	Emerald (A)	0.18 OZ/1000 FT2	28 Days			
		Velista (B)	0.5 OZ/1000 FT2	21 Days			
		Emerald (C)	0.18 OZ/1000 FT2	28 Days			
		Heritage TL (C)	2.0 FL OZ/1000 FT2	28 Days			
		Compass (D)	0.25 OZ/1000 FT2	21 Days	0.0a	0.3a	0.0b
		Velista (D)	0.5 OZ/1000 FT2	21 Days			
		Emerald (E)	0.18 OZ/1000 FT2	28 Days			
Velista (F)	0.5 OZ/1000 FT2	21 Days					

^aDollar spot was visually assessed as number of dollar spot infection centers per plot. Means followed by the same letter do not significantly differ (P=.05, Waller-Duncan).

Table 5. Mean turf quality ratings per treatment on the 7th fairway at University Ridge GC in Madison, WI during 2014..

	Treatment	Rate	Application Date/Interval	Turfgrass Quality ^a			
				Jun 20	Jul 30	Aug 12	
1	Non-treated control			7.0a	7.0a	5.3b	
2	Conventional Program	Emerald (A) ^b	0.18 OZ/1000 FT2	May 20			
		Torque (B)	0.6 FL OZ/1000 FT2	June 17			
		Daconil WStik (C)	3.2 FL OZ/1000 FT2	July 8			
		Banner MAXX II (C)	1.0 FL OZ/1000 FT2	July 8			
		Subdue MAXX (C)	1.0 FL OZ/1000 FT2	July 8			
		Chipco 26GT (D)	3.0 FL OZ/1000 FT2	July 21	7.0a	7.0a	6.8a
		Subdue MAXX (D)	1.0 FL OZ/1000 FT2	July 21			
		Daconil WStik (E)	3.2 FL OZ/1000 FT2	August 4			
		Torque (F)	0.6 FL OZ/1000 FT2	August 4			
		Curalan (G)	1.0 OZ/1000 FT2	September 1			
Chipco 26GT (H)	3.0 FL OZ/1000 FT2	September 22					
3	Smith-Kerns model - Conventional	Emerald (A)	0.18 OZ/1000 FT2	28 Days			
		Banner MAXX II (B)	1.0 FL OZ/1000 FT2	14 Days			
		Daconil Wstik (B)	3.2 FL OZ/1000 FT2	14 Days			
		Chipco 26GT (C)	2.0 FL OZ/1000 FT2	14 Days			
		Daconil Wstik (C)	3.2 FL OZ/1000 FT2	14 Days	7.0a	7.0a	7.0a
		Banner MAXX II (D)	1.0 FL OZ/1000 FT2	14 Days			
		Daconil WStik (D)	3.2 FL OZ/1000 FT2	14 Days			
		Emerald (E)	0.18 OZ/1000 FT2	28 Days			
Banner MAXX II (F)	2.0 FL OZ/1000 FT2	21 Days					
4	Smith-Kerns model - Reduced Risk	Emerald (A)	0.18 OZ/1000 FT2	28 Days			
		Velista (B)	0.5 OZ/1000 FT2	21 Days			
		Emerald (C)	0.18 OZ/1000 FT2	28 Days			
		Heritage TL (C)	2.0 FL OZ/1000 FT2	28 Days			
		Compass (D)	0.25 OZ/1000 FT2	21 Days	7.0a	7.0a	7.0a
		Velista (D)	0.5 OZ/1000 FT2	21 Days			
		Emerald (E)	0.18 OZ/1000 FT2	28 Days			
Velista (F)	0.5 OZ/1000 FT2	21 Days					

^aTurfgrass quality was visually assessed on 1-9 scale, with 9 being excellent, 6 being acceptable, and 1 bare dirt. Means followed by the same letter do not significantly differ (P=.05, Waller-Duncan).

Table 6. Mean number of dollar spot infection centers per treatment on the 14th fairway at University Ridge GC in Madison, WI during 2014.

	Treatment	Rate	Application Date/Interval	Dollar spot severity ^a			
				Jun 20	Jul 30	Aug 12	
1	Non-treated control			0.0a	83.0a	147.5a	
2	Conventional Program	Emerald (A) ^b	0.18 OZ/1000 FT2	May 20			
		Torque (B)	0.6 FL OZ/1000 FT2	June 17			
		Daconil WStik (C)	3.2 FL OZ/1000 FT2	July 8			
		Banner MAXX II (C)	1.0 FL OZ/1000 FT2	July 8			
		Subdue MAXX (C)	1.0 FL OZ/1000 FT2	July 8			
		Chipco 26GT (D)	3.0 FL OZ/1000 FT2	July 21	0.0a	0.3b	0.5b
		Subdue MAXX (D)	1.0 FL OZ/1000 FT2	July 21			
		Daconil WStik (E)	3.2 FL OZ/1000 FT2	August 4			
		Torque (F)	0.6 FL OZ/1000 FT2	August 4			
		Curalan (G)	1.0 OZ/1000 FT2	September 1			
Chipco 26GT (H)	3.0 FL OZ/1000 FT2	September 22					
3	Smith-Kerns model: Conventional	Emerald (A)	0.18 OZ/1000 FT2	28 Days			
		Banner MAXX II (B)	1.0 FL OZ/1000 FT2	14 Days			
		Daconil Wstik (B)	3.2 FL OZ/1000 FT2	14 Days			
		Chipco 26GT (C)	2.0 FL OZ/1000 FT2	14 Days			
		Daconil Wstik (C)	3.2 FL OZ/1000 FT2	14 Days	0.0a	0.0b	0.0b
		Banner MAXX II (D)	1.0 FL OZ/1000 FT2	14 Days			
		Daconil WStik (D)	3.2 FL OZ/1000 FT2	14 Days			
		Emerald (E)	0.18 OZ/1000 FT2	28 Days			
Banner MAXX II (F)	2.0 FL OZ/1000 FT2	21 Days					
4	Smith-Kerns model: Reduced Risk	Emerald (A)	0.18 OZ/1000 FT2	28 Days			
		Velista (B)	0.5 OZ/1000 FT2	21 Days			
		Emerald (C)	0.18 OZ/1000 FT2	28 Days			
		Heritage TL (C)	2.0 FL OZ/1000 FT2	28 Days			
		Compass (D)	0.25 OZ/1000 FT2	21 Days	0.0a	0.0b	3.0b
		Velista (D)	0.5 OZ/1000 FT2	21 Days			
		Emerald (E)	0.18 OZ/1000 FT2	28 Days			
Velista (F)	0.5 OZ/1000 FT2	21 Days					

^aDollar spot was visually assessed as number of dollar spot infection centers per plot. Means followed by the same letter do not significantly differ (P=.05, Waller-Duncan).

Table 7. Mean turf quality ratings per treatment on the 14th fairway at University Ridge GC in Madison, WI during 2014.

	Treatment	Rate	Application Date/Interval	Turfgrass Quality ^a			
				Jun 20	Jul 30	Aug 12	
1	Non-treated control			7.0a	5.5b	5.0b	
2	Conventional Program	Emerald (A) ^b	0.18 OZ/1000 FT2	May 20			
		Torque (B)	0.6 FL OZ/1000 FT2	June 17			
		Daconil WStik (C)	3.2 FL OZ/1000 FT2	July 8			
		Banner MAXX II (C)	1.0 FL OZ/1000 FT2	July 8			
		Subdue MAXX (C)	1.0 FL OZ/1000 FT2	July 8			
		Chipco 26GT (D)	3.0 FL OZ/1000 FT2	July 21	7.0a	7.0a	7.0a
		Subdue MAXX (D)	1.0 FL OZ/1000 FT2	July 21			
		Daconil WStik (E)	3.2 FL OZ/1000 FT2	August 4			
		Torque (F)	0.6 FL OZ/1000 FT2	August 4			
		Curalan (G)	1.0 OZ/1000 FT2	September 1			
Chipco 26GT (H)	3.0 FL OZ/1000 FT2	September 22					
3	Smith-Kerns model - Conventional	Emerald (A)	0.18 OZ/1000 FT2	28 Days			
		Banner MAXX II (B)	1.0 FL OZ/1000 FT2	14 Days			
		Daconil Wstik (B)	3.2 FL OZ/1000 FT2	14 Days			
		Chipco 26GT (C)	2.0 FL OZ/1000 FT2	14 Days			
		Daconil Wstik (C)	3.2 FL OZ/1000 FT2	14 Days	7.0a	7.0a	7.0a
		Banner MAXX II (D)	1.0 FL OZ/1000 FT2	14 Days			
		Daconil WStik (D)	3.2 FL OZ/1000 FT2	14 Days			
		Emerald (E)	0.18 OZ/1000 FT2	28 Days			
Banner MAXX II (F)	2.0 FL OZ/1000 FT2	21 Days					
4	Smith-Kerns model - Reduced Risk	Emerald (A)	0.18 OZ/1000 FT2	28 Days			
		Velista (B)	0.5 OZ/1000 FT2	21 Days			
		Emerald (C)	0.18 OZ/1000 FT2	28 Days			
		Heritage TL (C)	2.0 FL OZ/1000 FT2	28 Days			
		Compass (D)	0.25 OZ/1000 FT2	21 Days	7.0a	7.0a	7.0a
		Velista (D)	0.5 OZ/1000 FT2	21 Days			
		Emerald (E)	0.18 OZ/1000 FT2	28 Days			
Velista (F)	0.5 OZ/1000 FT2	21 Days					

^aTurfgrass quality was visually assessed on 1-9 scale, with 9 being excellent, 6 being acceptable, and 1 bare dirt. Means followed by the same letter do not significantly differ (P=.05, Waller-Duncan).