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Fungicides for Dollar Spot Suppression on Creeping Bentgrass Greens

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ABSTRACT. Creeping bentgrass (*Agrosis stolonifera* L.) is regarded to be the most widely used cool-season turfgrass species grown on golf greens and fairways in temperate climates of North America. Creeping bentgrass is highly susceptible to the fungal disease 'dollar spot' caused by *Sclerotinia homoeocarpa*. Dollar spot is a foliar disease favored by conditions of high humidity, warm days, and cool nights. Studies using Aliette Signature (Fosetyl Aluminum formulated with a green pigment) mixed with another broad-spectrum fungicide do not always provide additional visual quality benefits compared to the fungicide alone. The exact mechanism for improved summer visual quality, when it occurs, is not known. Fertility management and environment likely contribute. The object of this study is to evaluate fungicide strategies for control of dollar spot and effect on visual quality during summer and on an L-93/G-2 creeping bentgrass green. Nine fungicide combinations were used for this study. Disease control and visual quality by fungicides was evaluated on an established G-2/L-93 creeping bentgrass green at 3-hole Sunshine Golf Course in Lemont, IL. All fungicide combination showd excellent dollar spot suppression except Fore throughout the study. Visual quality of greens by addition of Aliette Signature is enhanced when bentgrass growth is compromised and slow. Dollar spot levels in Fore plots increased to 30% on 14 August, and was no different than untreated plots. Unacceptable quality by Fore was due to lack of dollar spot control.

Key words: Creeping bentgrass, Fungicide strategies, *Sclerotinia homoeocarpa*, Turfgrass quality

Introduction

There are more than 200 species of the genus *Agrostis* (Hitchcock, 1951). These *Agrostis* species are perennial, outcrossing, cool-season grasses used for lawns, athletic fields, and golf courses. Among these popular five species, creeping bentgrass (*Agrosis stolonifera* L.) is regarded to be the most widely used cool-season turfgrass species grown on golf greens and fairways in temperate climates of North America (Warnke, 2003; Wipff and Fricker, 2001). Creeping bentgrass is well-known for its tolerance of low mowing height and cold temperature (Christians, 2004). Despite benefits of creeping bentgrass, there are weak points of it including ability to tolerate wear (Samaranayake et al., 2008), soil compaction (Carrow and Petrovic, 1992), and disease (Vargas, 1994). It is highly susceptible to the fungal disease 'dollar spot' caused by *Sclerotinia homoeocarpa*. Dollar spot is a foliar disease favored by conditions of high humidity, warm days, and cool nights. Symptoms of dollar spot include necrotic areas of turf, the size of a silver dollar that may coalesce to form large areas of dead turf (Vargas, 1994). A vast budget is required to purchase fungicides to control dollar spot on golf courses for each year (Watson et al., 1992). For the reason, creeping bentgrass has been more extensively studied for golf course turf (Croce et al., 1998; Beard et al., 2001; Sifers et al., 2001)

Diseases such as dollar spot (*Sclerotinia homoeocarpa*) and brown patch (*Rhizoctonia solani*) require regular fungicide use to maintain putting greens for golf. In recent years, some fungicides are thought capable of health benefits beyond just disease control. However, studies using Aliette Signature (Fosetyl Aluminum formulated with a green pigment) mixed with another broad-spectrum fungicide do not always provide additional visual quality benefits compared to the fungicide alone. The exact mechanism for improved summer visual quality, when it occurs, is not known. Fertility management and environment likely contribute. The object of this study is to evaluate fungicide strategies for control of dollar spot and effect on visual quality during summer and on an L-93/G-2 creeping bentgrass green.

Materials and Methods

Nine fungicide combinations were used for this study. Treatment list indicated in Table 1. Disease control and visual quality by fungicides were evaluated on an established G-2/L-93 creeping bentgrass green at 3-hole Sunshine Golf Course in Lemont, IL. The turfgrass was mowed to a

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Table 1. Mean dollar spot (*Sclerotinia homoeocarpa*) damage on a G-2/L-93 creeping bentgrass green by 14 day preventive fungicides.

Treatment and rate 100 m^{-2}	Plot area damaged (%)			
	7/11	7/31	8/14	AUDPC[y]
Untreated	1.3 b[z]	7.7 ab	21.7 a	43.8 b
Fore 122 g	4.7 a	15.0 a	30.0 a	82.0 a
Daconil Ultrex 98 g	0.3 b	3.3 b	7.0 b	12.3 bc
Daconil Ultrex 98 g + Aliette Sig. 122 g	0.0 b	1.3 b	4.3 b	5.8 c
Bayleton SC 16 ml	0.0 b	0.7 b	3.7 b	5.2 c
Chipco GT 127 ml	0.3 b	0.7 b	2.7 b	3.5 c
Chipco GT 127 ml + Aliette Sig. 122 g	0.3 b	0.7 b	2.0 b	2.5 c
Emerald 4ml + Heritage 6g	0.0 b	0.3 b	1.7 b	2.2 c
Tartan SC 32 ml	0.0 b	0.3 b	0.3 b	1.3 c
Tartan SC 32 ml + Aliette Sig. 122 g	0.0 b	0.3 b	0.3 b	0.5 c

[z] Means not followed by the same letter are significantly different ($P < 0.05$) by LSD.
[y] Area Under the Disease Progress Curve summarizes 12 dates from 23 May to 14 Aug

height of 0.4 cm, irrigated as needed, and fertilized with 20 g N m^{-2} annually. Applications were made at 2-week intervals beginning May 22, 2007. Fungicides were applied with a CO_2-powered backpack sprayer with 8004 TeeJet nozzles at 35 psi in water equivalent to 41 ml 100 m^{-2}. Plots were not irrigated after application. Plots were 1.2×1.8 m. Plots were rated weekly prior to any scheduled fungicide application. Turfgrass quality was measured by visual evaluation every week using a scale of 1 to 9 (1=worst, 6=acceptable, and 9=best). Percent area damaged by dollar spot was measured weekly. Severity ratings were used to calculate the area under the disease progress curve (AUDPC) in the year (Campbell and Madden, 1991). The AUDPC is expressed as percent disease (brown patch) or number of *Sclerotinia homoeocarpa* infection centers (dollar spot) x day, and describes the course of the epidemic with time (Waggoner, 1981).

The experimental design was a randomized complete block design with three replications. The data analyzed using the t-test procedures and mean separation was performed by standard error of differences (SED) method of the Statistical Analysis System (SAS, 1987).

Results and Discussion

Dollar spot

Dollar spot disease progress began 26 June and fungicide effects began 11 July (Table 1). Among plots treated by fungicide combination, there were no significant differences for dollar spot damage except Fore. The biggest or equal to the biggest damage caused by *Sclerotinia homoeocarpa* was found on plots treated by Fore. Except Fore, all fungicide combination showd excellent dollar spot suppression throughout the study.

Visual quality of turfgrass

Best visual quality: Tartan SC was also mixed with Aliette Signature and applied to a green. It is a new fungicide combination from Bayer primarily used for fairways (Tartan SC = triadimefon+trifloxystrobin). All fungicides that provided optimal visual quality at summer were combined with Aliette Signature (Fig. 1). This indicates multiple broad-spectrum fungicides combined with Aliette Signature are capable of improving quality beyond each alone (see intermediate quality graph for comparison). The 2007 results contrast a similar study in 2006 at a different location within the same green. In that study, fungicides with Aliette Signature (fosetyl-Al + a green pigment called Stress Guard) did not improve visual quality until October when bentgrass growth slowed. Overall, the both years data suggest enhanced visual quality of greens by addition of Aliette Signature is enhanced when bentgrass growth is compromised and slow (i.e. clipping amounts are negligible). During summer 2007, slow growth at the Lemont, IL site is attributed to low fertility levels.

Intermediate visual quality: All fungicides with intermediate visual quality (Tartan 32 ml, Daconil Ultrex 98 ml, and Chipco GT 127 ml) controlled disease well (Fig. 2). All displayed acceptable visual quality from mid-June. On 5 and 12 June, when plots were without disease, low fertility levels on the green resulted in poor color and unacceptable visual quality.

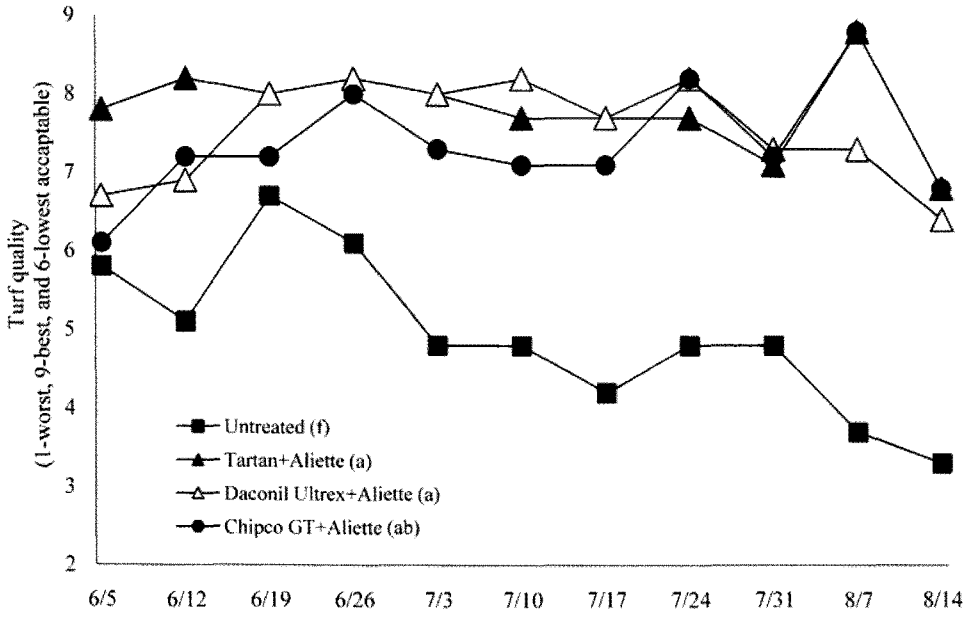

Fig. 1. Mean turfgrass quality per unit surface area treated by preventive fungicides on a 14 day calendar schedule that resulted in best visual quality on a G-2/L-93 green. Same letters in parenthesis indicated not significant different according to Fisher's LSD (P=0.05).

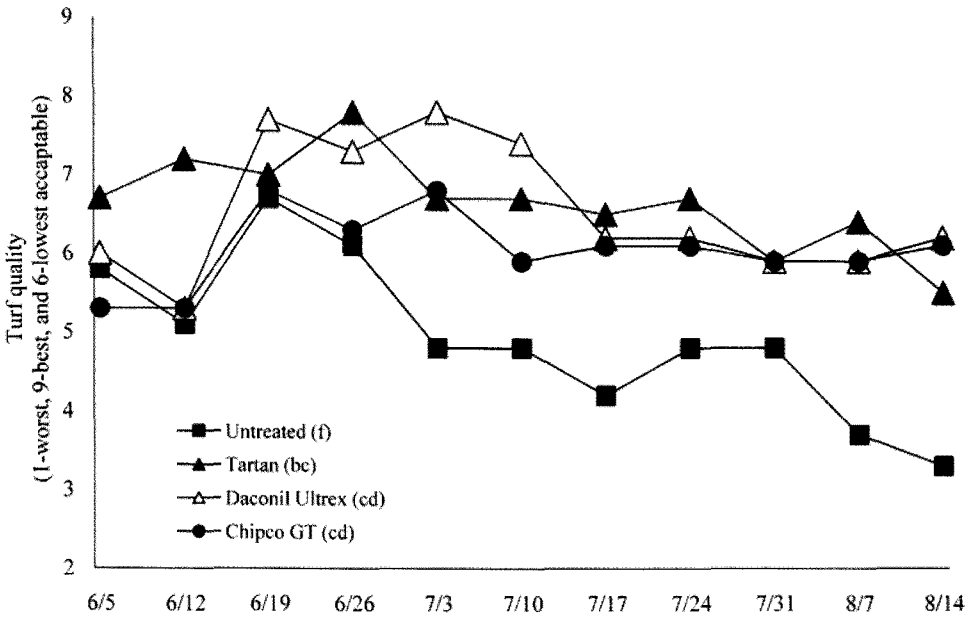

Fig. 2. Mean turfgrass quality per unit surface area treated by preventive fungicides on a 14 day calendar schedule that resulted in intermediate visual quality on a G-2/L-93 green. Same letters in parenthesis indicated not significant different according to Fisher's LSD (P=0.05).

The exception was Tartan which is formulated with a green pigment.

Unacceptable visual quality: Unacceptable quality by Fore (Fig. 3) was due to lack of dollar spot control. Dollar spot levels in Fore plots increased to 30% on 14 August, and was no different than untreated plots. Unacceptable visual quality which is less than 6 (<6) on bentgrass green plots without disease indicated some fungicide impacted plant health negatively by phytotoxicity. The symptoms were thinning and bronzing of bentgrass across multiple dates. Bayleton SC displayed unacceptable quality (< 6) on all dates except one, due to phytotoxicity (Fig. 3). Demethylase

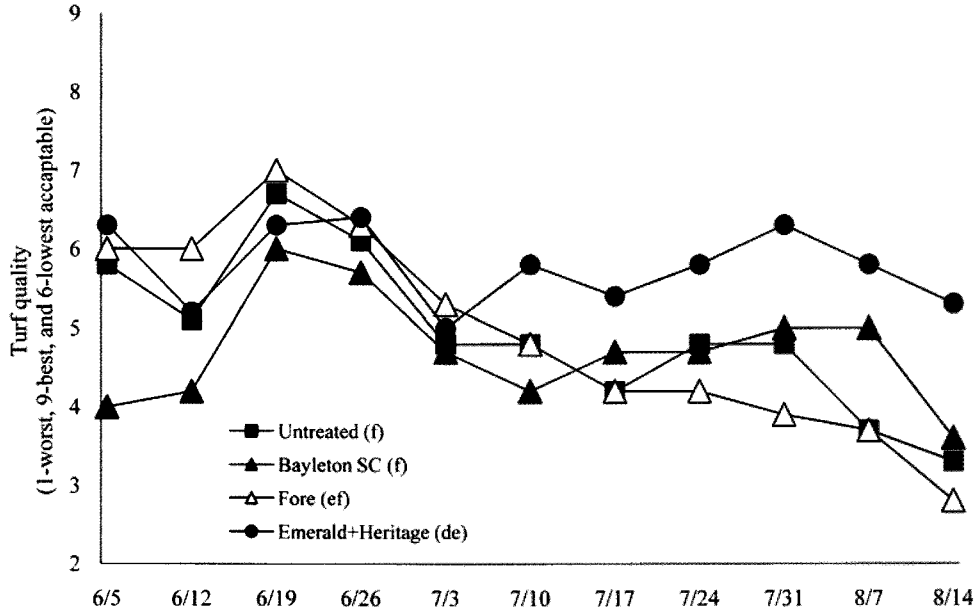

Fig. 3. Mean turfgrass quality per unit surface area treated by preventive fungicides on a 14 day calendar schedule that resulted in unacceptable visual quality on a G-2/L-93 green. Same letters in parenthesis indicated not significant different according to Fisher's LSD (P=0.05).

inhibitor fungicides (e.g. Bayleton) are not used on greens during summer because their growth regulator properties are phytotoxic at green height. For unknown reasons, Emerald + Heritage also displayed unacceptable quality on multiple dates. Visually, it appeared to be phytotoxicity exacerbated by low fertility in this study.

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크리핑 벤트그래스 그린에서 동전마름병 방제

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크리핑 벤트그래스는 골프장의 그린과 페어웨이에서 가장 널리 이용되는 종중의 하나이다. 크리핑벤트그래스는 곰팡이병류인 동전마름병에 가장 취약한 종이며 동전마름병은 잔디의 잎에서 그 병반이 나타나며 높은습도와 낮의온도 그리고 비교적 낮은 밤의 온도에서 발병률이 더 높은것으로 알려져 있다. 곰팡이병균류를 제어 하기위한 약제들에 관한 이전의 연구에서는 혼합된 약제에 의해 관리된 잔디는 단일품에 의해 관리된 잔디에 비해 더 좋은 잔디의 질을 나타내지 못했다. 이 부분에 대한 정확한 원인이 규명이 되지 않았으며 비료프로그램과 환경에 의한 영향이 약제의 사용과 잔디의 질을 나타낸다는 보고가 있다. 본 연구에서는 잔디의 질병이 가장 많이 발생하고 고온다습한 여름철에 골프코스 그린에서 발생하는 동전마름병의 방제 할 수 있는 약제프로그램과 잔디의 품질에 대한 영향을 규명하기 위해 수행되었다. 총 9가지 약제조합이 이 연구에서 사용이 되었다. 동전마름병에 의한 피해와 잔디의 품질이 G-2/L-93 혼합된 크리핑벤트그래스 그린에서 측정이 되었다. Fore를 제외한 모든 조합이 동전마름병의 방제에 좋은 결과를 보여 주었다. Fore의 경우 동전마름병의 피해가 30%까지 나타났으며 대조군과 차이가 나타나지 않았다. Fore의 낮은 잔디품질은 동전마름병의 방제가 잘 이루어지지 않았기 때문으로 나타났다.

주요어: 곰팡이균약제, 동전마름병, 잔디품질, 크리핑 벤트그래스