

INFLUENCE OF VARIOUS HARRELL'S MAXLINE FERTILIZERS AND CHIPCO SIGNATURE ON THE SUPPRESSION OF ANTHRACNOSE BASAL ROT ON AN ANNUAL BLUEGRASS RESEARCH PUTTING GREEN, 2010

J.E. Kaminski and T. Lulis

Department of Crop and Soil Science
The Pennsylvania State University, University Park

INTRODUCTION

Anthracnose basal rot (*Colletotrichum cereale*) is a common and difficult to control disease of annual bluegrass (*Poa annua*) putting greens. While various cultural practices and fertility programs have been developed to reduce disease symptoms, fungicides are generally required to provide additional suppression. Due to the fact that anthracnose is generally more severe on under fertilized turfgrass, the interactions between fungicide and fertilizers may be an important factor in disease control. The objective of this research was to evaluate various Harrell's MaxLine fertilizer programs used in combination with Chipco Signature for their ability to suppress anthracnose basal rot.

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 7.1 and 2.7% organic matter. Prior to initiation of the study, the area was treated with a herbicide in an effort to eradicate the majority of any creeping bentgrass (*Agrostis stolonifera*) within the site. The area was treated twice in the fall of 2009 with fusillade. When treatments were initiated in 2010, annual bluegrass was the dominant species covering 50 to 80% of the study site. The area was mowed six days per week to a height of 0.125 in. Urea was applied at a rate of 0.5 lb N per 1000 ft² on 25 Mar, but no fertilizer was applied thereafter.

Plots measured 3 ft x 6 ft and were arranged in a randomized complete block with four replications. 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. Treatments were initiated on 15 June and reapplied approximately every 14-d for a total of four applications. All treatments are listed in the data tables.

Anthracnose was rated visually on a 0 to 100% scale where 0 = no anthracnose observed and 100 = entire plot area affected by anthracnose basal rot. In addition, percent plot area covered with creeping bentgrass was rated as previously described. Turfgrass quality and color were 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. Color (NDVI) was also rated quantitatively using a FieldScout TCM 500 Turf Color Meter. All data were subjected to analysis of variance and means separated at $P \leq 0.05$ level according to the Fisher's protected least significant difference t-test.

RESULTS

Anthracnose. Low to moderate levels of anthracnose were present in the study area when treatments were initiated on 15 Jun. By 18 Jun, all treated plots had an equal percent of anthracnose and all resulted in a reduction in anthracnose when compared to the untreated

control plots (Table 1). Disease severity continued to increase and peaked in early to mid-July. During this time, percent anthracnose within the untreated control plots was just over 30%. By 14 Jul, differences among treatments began to appear within the study site and plots receiving fertilizer resulted in the greatest reduction of anthracnose when compared to the untreated control plots. Additionally, with the exception of treatment #2, all treatments receiving fertilizer resulted in a significant reduction in disease severity when compared to plots receiving only Chipco Signature. Disease pressure began to subside in late July and by 13 Aug no differences among anthracnose severity was present among the treatments.

Quality and Color. As expected, visual quality and color differences were observed among the treatments. Within 3 days of the first application, all treatments (except #3) resulted in improved quality when compared to the untreated control plots (Table 2). Although no treatments consistently provided acceptable quality, those receiving fertilizers generally resulted in increased quality and color when compared to the untreated control on several rating dates (Table 2 and 3). Additionally, plots treated with fertilizers (treatments #1-5) had quality and color ratings equal to or greater than plots treated with Chipco Signature only on all rating dates. Although visual quality ratings indicated significant differences among treatments, no differences were observed among treatments when using the TCM 500 Turf Color Meter (Table 4).

DISCUSSION

Similar to previous reports, results from this study indicate that the application of nitrogen can help to reduce anthracnose severity and/or improve the performance of fungicides. While Chipco Signature can be a highly effective fungicide against anthracnose when used in combination with other fungicides (e.g., chlorothalonil or fludioxonil), it is often considered a weak fungicide against anthracnose when used alone. In this study, Chipco Signature provided improved control of anthracnose when compared to the untreated control on 3 of 6 rating dates. When disease pressure was at its peak (mid-Jul), however, the addition of fertilizer and select other products resulted in an even greater suppression of anthracnose when compared to plots receiving only Chipco Signature.

At the end of the study, no differences in creeping bentgrass populations among treatments were observed (Table 1). Populations, however, had increased from the estimated 20 to 50% initially observed within the study site. These results, in combination with anthracnose severity data, suggest that plots receiving fertility treatments may have resulted in a gradual and less noticeable transition from predominantly annual bluegrass to more creeping bentgrass. In plots where the anthracnose severity was noticeably greater (untreated and Chipco Signature alone), the increase in creeping bentgrass populations did not happen as rapid and therefore greater disease activity was observed.

This research provides further evidence that increased nitrogen fertility may assist in turfgrass recovery and/or improve the efficacy of fungicides against anthracnose. While differences among fertility treatments were sporadic, future research should seek to simplify treatments by looking at the main effect of individual products applied at varying nitrogen rates. These treatments may also be integrated with other fungicides that have been shown to provide excellent suppression of anthracnose. These studies would likely further improve the selection and integration of fertilizers and fungicides for the control of anthracnose basal rot on annual bluegrass putting greens.

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Table 1. Anthracnose basal rot severity on an annual bluegrass research putting green following the application of various Harrell's MaxLine fertilizers and Chipco Signature, 2010.

Treatment and rate per 1000 sq ft ^y	ABR % ^z					CBG %
	18 Jun	2 Jul	14 Jul	28 Jul	13 Aug	13 Aug
1 4-0-0 3.0 fl oz						
18-3-6 6.0 fl oz						
12-0-0 4.0 fl oz						
Signature 4.0 oz	5.8 b ^x	8.0 b	6.3 c	8.5 b	6.8 a	63.0 a ^x
2 4-0-0 6.0 fl oz						
18-3-6 6.0 fl oz						
12-0-0 4.0 fl oz						
Signature 4.0 oz	4.8 b	8.5 b	12.3 bc	11.0 b	11.8 a	62.3 a
3 4-0-0 3.0 fl oz						
18-3-6 11.0 fl oz						
12-0-0 4.0 fl oz						
Signature 4.0 oz	7.8 b	8.5 b	10.5 c	10.0 b	4.5 a	63.3 a
4 4-0-0 3.0 fl oz						
18-3-6 4.0 fl oz						
12-0-0 4.0 fl oz						
Title Phyte 3.0 fl oz						
Phos Plus 3.0 fl oz						
Signature 4.0 oz	6.5 b	6.8 b	9.8 c	7.0 b	6.5 a	70.5 a
5 4-0-0 3.0 fl oz						
18-3-6 9.0 fl oz						
12-0-0 4.0 fl oz						
Title Phyte 4.0 fl oz						
Phos Plus 6.0 fl oz						
Signature 4.0 oz	5.5 b	6.5 b	10.0 c	9.3 b	7.5 a	57.0 a
6 Signature 4.0 oz	8.5 b	13.5 b	24.0 ab	15.0 b	14.0 a	71.5 a
7 Untreated	17.0 a	31.5 a	31.0 a	28.0 a	11.8 a	77.8 a

^z Anthracnose basal rot was rated by visually rating the percent plot area affected by the disease where 0 = no anthracnose basal rot, and 100 = entire plot area affected anthracnose basal rot.

^y Treatments were applied on 15 and 29 Jun and 13 and 27 Jul.

^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. Turfgrass quality on an annual bluegrass research putting green following the application of various Harrell's MaxLine fertilizers and Chipco Signature, 2010.

Treatment and rate per 1000 sq ft ^y	Quality ^z			
	18 Jun	2 Jul	14 Jul	28 Jul
1 4-0-0 3.0 fl oz				
18-3-6 6.0 fl oz				
12-0-0 4.0 fl oz				
Signature 4.0 oz.....	6.5 a ^x	6.8 ab	6.5 a	6.3 a
2 4-0-0 6.0 fl oz				
18-3-6 6.0 fl oz				
12-0-0 4.0 fl oz				
Signature 4.0 oz.....	7.0 a	6.5 ab	6.8 a	6.0 ab
3 4-0-0 3.0 fl oz				
18-3-6 11.0 fl oz				
12-0-0 4.0 fl oz				
Signature 4.0 oz.....	6.3 ab	6.5 ab	6.3 a	6.3 a
4 4-0-0 3.0 fl oz				
18-3-6 4.0 fl oz				
12-0-0 4.0 fl oz				
Title Phyte 3.0 fl oz				
Phos Plus 3.0 fl oz				
Signature 4.0 oz.....	6.8 a	7.3 a	6.8 a	6.5 a
5 4-0-0 3.0 fl oz				
18-3-6 9.0 fl oz				
12-0-0 4.0 fl oz				
Title Phyte 4.0 fl oz				
Phos Plus 6.0 fl oz				
Signature 4.0 oz.....	7.0 a	6.8 ab	6.5 a	5.8 ab
6 Signature 4.0 oz.....	6.8 a	6.0 b	4.8 a	4.5 bc
7 Untreated	5.5 b	4.5 c	4.8 a	3.5 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 15 and 29 Jun and 13 and 27 Jul.

^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. Turfgrass color on an annual bluegrass research putting green following the application of various Harrell's MaxLine fertilizers and Chipco Signature, 2010.

Treatment and rate per 1000 sq ft ^y	Color ^z				
	18 Jun	2 Jul	14 July	28 Jul	13 Aug
1 4-0-0 3.0 fl oz					
18-3-6 6.0 fl oz					
12-0-0 4.0 fl oz					
Signature 4.0 oz.....	7.5 ab ^x	8.0 a	7.5 a	7.8 a	7.0 a
2 4-0-0 6.0 fl oz					
18-3-6 6.0 fl oz					
12-0-0 4.0 fl oz					
Signature 4.0 oz.....	8.0 a	7.8 a	7.0 a	7.5 a	6.8 a
3 4-0-0 3.0 fl oz					
18-3-6 11.0 fl oz					
12-0-0 4.0 fl oz					
Signature 4.0 oz.....	8.0 a	8.3 a	7.3 a	7.5 a	7.3 a
4 4-0-0 3.0 fl oz					
18-3-6 4.0 fl oz					
12-0-0 4.0 fl oz					
Title Phyte 3.0 fl oz					
Phos Plus 3.0 fl oz					
Signature 4.0 oz.....	7.3 abc	7.5 a	7.8 a	7.3 ab	6.8 a
5 4-0-0 3.0 fl oz					
18-3-6 9.0 fl oz					
12-0-0 4.0 fl oz					
Title Phyte 4.0 fl oz					
Phos Plus 6.0 fl oz					
Signature 4.0 oz.....	7.0 bc	7.5 a	6.8 a	7.0 ab	6.3 a
6 Signature 4.0 oz.....	6.5 c	6.3 b	6.5 a	6.0 bc	6.5 a
7 Untreated	5.5 d	6.0 b	6.0 a	5.0 c	7.8 a

^z Turfgrass color was rated visually on a 0 to 10 scale where 0 = brown or dead turf; 7.5 = minimum acceptable color for a golf course fairway; and 10 dark green turf.

^y Treatments were applied on 15 and 29 Jun and 13 and 27 Jul.

^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. NDVI on an annual bluegrass research putting green following the application of various Harrell's MaxLine fertilizers and Chipco Signature, 2010.

Treatment and rate per 1000 sq ft ^y	NDVI ^z		
	15 Jul	29 July	16 Aug
1 4-0-0 3.0 fl oz			
18-3-6 6.0 fl oz			
12-0-0 4.0 fl oz			
Signature 4.0 oz.....	0.760 a ^x	0.739 a	0.796 a
2 4-0-0 6.0 fl oz			
18-3-6 6.0 fl oz			
12-0-0 4.0 fl oz			
Signature 4.0 oz.....	0.754 a	0.746 a	0.798 a
3 4-0-0 3.0 fl oz			
18-3-6 11.0 fl oz			
12-0-0 4.0 fl oz			
Signature 4.0 oz.....	0.745 a	0.741 a	0.798 a
4 4-0-0 3.0 fl oz			
18-3-6 4.0 fl oz			
12-0-0 4.0 fl oz			
Title Phyte 3.0 fl oz			
Phos Plus 3.0 fl oz			
Signature 4.0 oz.....	0.764 a	0.730 a	0.799 a
5 4-0-0 3.0 fl oz			
18-3-6 9.0 fl oz			
12-0-0 4.0 fl oz			
Title Phyte 4.0 fl oz			
Phos Plus 6.0 fl oz			
Signature 4.0 oz.....	0.760 a	0.716 a	0.795 a
6 Signature 4.0 oz.....	0.738 a	0.696 a	0.792 a
7 Untreated	0.733 a	0.722 a	0.796 a

^z Turfgrass was rated using a NDVI TCM 500 Turf Color Meter.

^y Treatments were applied on 15 and 29 Jun and 13 and 27 Jul.

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