

# PHYTOTOXICITY TO POA ANNUA FOLLOWING REPEATED APPLICATION OF TRINITY, BANNER MAXX AND EXPERIMENTAL FUNGICIDES

JUNE-AUGUST

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## INTRODUCTION

Various products are applied to golf course putting greens to improve the overall quality and playability of the turf. These may include fungicides for the control of common and chronic turfgrass diseases and also plant growth regulators (PGRs) to suppress turf growth, improve turf quality, and reduce clipping yields. While PGRs are applied to reduce canopy growth, some fungicides such as those within the DMI chemical class may provide additional suppression of turf growth when applied repeatedly. While the tank-mixing of these products is often done to reduce the need to make multiple applications, the impact on turfgrass quality is unclear. The purpose of this study was to assess the potential for phytotoxicity to an annual bluegrass putting green when the relatively new fungicide Trinity (triticonazole) is applied repeatedly alone or in a tank-mix with the PGR Primo MAXX (trinexapac ethyl). Also included for comparison is the commonly applied fungicide Banner MAXX (propiconazole) and two experimental fungicides (A7402 and A6780).

## MATERIALS & METHODS

This study was conducted on mixed stand of creeping bentgrass and annual bluegrass maintained as a putting green. The area was established from core cultivation plugs obtained from various golf courses in Connecticut between 2005 and 2006. The site is mowed 5 days per week to a height of between 0.125 to 0.156 inches. Treatments included Primo MAXX, Trinity, and Banner MAXX applied alone or in combination with each other and are listed in the treatment table. All treatments are applied with a CO<sub>2</sub> pressurized (40 psi) sprayer equipped with an air-induction flat fan nozzle, and calibrated to deliver 2.0 gal water per 1000 ft<sup>2</sup>. Additional experimental fungicides have also been included in this study.

## RESULTS

Treatments were initiated on 1 Jun and subsequent applications were made on the dates listed in Table 1. Within one week of the initial application (WAIT), minor injury was observed within plots treated with various products, but no differences were observed among any treatments. Additionally, minor injury was also observed within the untreated control plots indicating that decreased quality was not necessarily the result of the treatments applied. Between 20 Jun and 3 Jul, moderate injury ( $\geq 2.0$ ) was observed within plots treated with Primo alternated with Trinity (2.0 fl oz), Banner MAXX (2.0 fl oz), Trinity (1.0 fl oz, with weekly Primo applications), or A6780 (1.0 fl oz). A severe decline in the study site occurred during the month of Jul. Although minor injury was observed within the untreated plots in early Jul (0.5 to 0.8), injury to the annual bluegrass was severe (4.0 to 4.3) by 1 Aug. When plots were rated on 1 Aug, a shift in injury was noted among treatments. In general, plots treated with Primo alone (weekly) or with Trinity or Banner MAXX at the 1.0 fl oz rate had unacceptable injury ( $\geq 2.5$ ) on 1 Aug. On the final rating date of 15 Aug (approximately 4 weeks after the last fungicide and 3 weeks after the last Primo application), the only plots that had acceptable or near acceptable injury levels ( $< 2.5$ ) were plots treated with 2.0 fl oz of either Banner MAXX or Trinity and alternated with Primo.

## DISCUSSION

Injury to the annual bluegrass putting green was observed early in the study, but differences in injury during the later ratings made interpretation of the results difficult. Although not entirely clear, it appeared that those treatments in which higher rates (2.0 fl oz) of Trinity or Banner MAXX were applied four times in an alternate fashion with Primo resulted in the least injury to the annual bluegrass putting green. On the other hand, plots receiving either Trinity or Primo alone appeared to decline quickly following their respective final application. While injury was higher earlier in the season when application of Banner or Trinity (2.0 fl oz) were alternated with Primo, these treatments appeared to provide the greatest quality later in the season when decline of the annual bluegrass became most apparent.

Field reports of phytotoxicity or annual bluegrass decline following the application of Trinity have been reported since its introduction. While results of this study indicate that the application of DMI's such as Trinity and Banner MAXX can result in an increase in annual bluegrass injury, especially when Primo is also being applied, the direct relationship between this injury and the fungicide applications remains unclear. Future research should focus on the impact of alternating fungicides to prevent the additional growth regulation effect, but also should take a closer look at the impact of stopping applications of the fungicides. Although some moderate injury was observed following the initial applications in this study, it appeared that subsequent applications actually reduced the injury to annual bluegrass. On the other hand, fungicides applied alone or on a 28-d interval (application timing AE) were met with a dramatic decline in quality and increased injury after the final application on 2 Jul. This reduction was delayed when fungicides were applied on a 14-d interval and last applied on 15 Jul. In the study site, while it was apparent that anthracnose was causing a portion of the decline it appeared that much of the decline was the result of unknown abiotic or environmental conditions. Based on results of this study and tendencies of golf course superintendents, stopping the application of DMI's after the initial signs of injury may actually result in an increase in biotic and abiotic stresses that continue to cause turf decline.

Table 1. Injury to an annual bluegrass putting green following the application of Trinity, Banner MAXX and two experimental fungicides applied alone or alternated with Primo MAXX.

Treatment and rate per 1000 sq ft	Application <sup>z</sup> timing	Injury <sup>y</sup>				
		9 Jun	20 Jun	3 Jul	1 Aug	15 Aug
Trinity 1.0 fl oz .....	ACEG	1.8 a <sup>x</sup>	1.3 a-d	1.0 bc	2.8 bc	2.8 cde
Trinity 1.0 fl oz .....	AE	0.8 a	0.3 d	0.5 c	3.3 ab	3.8 abc
Primo 0.125 fl oz.....	ABCDEFGF	0.8 a	1.0 bcd	1.0 bc	2.8 bc	3.3 a-d
Trinity 1.0 fl oz alternated w/ Primo MAXX 0.125 fl oz .....	ACEG BDFH	0.3 a	1.3 a-d	1.5 abc	1.8 cd	3.0 bcd
Trinity 2.0 fl oz alternated w/ Primo MAXX 0.125 fl oz .....	ACEG BDFH	1.3 a	2.0 ab	2.5 a	1.8 cd	1.8 e
Banner MAXX 2.0 fl oz alternated w/ Primo MAXX 0.125 fl oz .....	ACEG BDFH	1.3 a	2.3 a	2.0 ab	1.8 cd	2.5 de
Trinity 1.0 fl oz alternated w/ Primo MAXX 0.125 fl oz .....	AE BCDFGH	0.5 a	2.0 ab	2.5 a	2.8 bc	3.0 bcd
A7402 0.625 fl oz alternated w/ Primo MAXX 0.125 fl oz .....	ACEG BDFH	1.0 a	1.0 bcd	1.3 bc	1.5 d	3.0 bcd
A6780 1.0 fl oz alternated w/ Primo MAXX 0.125 fl oz .....	ACEG BDFH	0.5 a	2.3 a	2.0 ab	1.8 cd	2.8 cde
Banner MAXX 1.0 fl oz alternated w/ Primo MAXX 0.125 fl oz .....	ACEG BDFH	0.5 a	1.5 abc	1.5 abc	2.8 bc	3.8 abc
Untreated.....	-	0.5 a	0.3 d	0.5 c	4.3 a	4.0 ab
Untreated.....	-	1.0 a	0.5 cd	0.8 c	4.0 a	4.3 a

<sup>z</sup> Treatments were applied as follows: A = 1 Jun, B=11 Jun, C=18 Jun, D=24 Jun, E=2 Jul, F=7 Jul, G= 15 Jul, H= 25 Jul.

<sup>y</sup> Turfgrass injury was rated on a 0 to 5 scale where 0 = no injury visible; 2.5 = unacceptable injury to an annual bluegrass putting green; and 5 = entire stand of annual bluegrass brown or dead.

<sup>x</sup> 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.

Table 2. Quality rating of phytotoxicity to *Poa annua* following repeated fungicide application.

Treatment and rate per 1000 sq ft	Application <sup>z</sup> timing	Quality <sup>y</sup>				
		9 Jun	20 Jun	3 Jul	1 Aug	15 Aug
Trinity 1.0 fl oz .....	ACEG	6.0 a <sup>x</sup>	6.8 a	6.5 ab	7.0 ab	5.8 a
Trinity 1.0 fl oz .....	AE	6.3 a	6.5 a	7.0 a	6.3 bc	6.0 a
Primo 0.125 fl oz.....	ABCDEFG	6.5 a	6.8 a	6.8 a	7.0 ab	7.5 a
Trinity 1.0 fl oz alternated w/ Primo MAXX 0.125 fl oz .....	ACEG BDFH	6.8 a	5.3 a	6.3 abc	7.3 a	7.0 a
Trinity 2.0 fl oz alternated w/ Primo MAXX 0.125 fl oz .....	ACEG BDFH	6.5 a	6.5 a	5.5 c	7.8 a	8.0 a
Banner MAXX 2.0 fl oz alternated w/ Primo MAXX 0.125 fl oz .....	ACEG BDFH	6.3 a	6.0 a	5.8 bc	7.8 a	8.0 a
Trinity 1.0 fl oz alternated w/ Primo MAXX 0.125 fl oz .....	AE BCDFGH	6.8 a	5.8 a	5.8 bc	7.0 ab	7.0 a
A7402 0.625 fl oz alternated w/ Primo MAXX 0.125 fl oz .....	ACEG BDFH	6.3 a	6.5 a	6.3 abc	7.3 a	6.8 a
A6780 1.0 fl oz alternated w/ Primo MAXX 0.125 fl oz .....	ACEG BDFH	7.0 a	6.3 a	6.5 ab	7.5 a	7.5 a
Banner MAXX 1.0 fl oz alternated w/ Primo MAXX 0.125 fl oz .....	ACEG BDFH	6.5 a	5.8 a	6.5 ab	7.0 ab	7.3 a
Untreated.....	-	7.0 a	6.8 a	7.0 a	6.0 c	6.8 a
Untreated.....	-	6.5 a	6.8 a	6.8 a	5.8 c	6.8 a

<sup>z</sup> Treatments were applied as follows: A = 1 Jun, B=11 Jun, C=18 Jun, D=24 Jun, E=2 Jul, F=7 Jul, G= 15 Jul, H= 25 Jul

<sup>y</sup> Quality of an annual bluegrass and creeping bentgrass putting green was rated visually on 0 to 9 scale where 0 = entire plot area brown or dead; 7 = minimum acceptable quality for a golf course putting green; and 9 = optimum density and green color. Ratings were made on turf that was living and dead turf was not included in the evaluation as a means of determining the impact of the treatments on surviving plants.

<sup>x</sup> 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.