The Effect of Snow Cover and Anti-Transpirants on the Persistence of Snow Mould Fungicides

An interim report to the Canadian Allied Turfgrass Research Office, October 20th, 2017

Paul Koch, Ph.D.

University of Wisconsin-Madison

Introduction

Snow moulds (Typhula blight and Microdochium patch) are among the most damaging diseases that turfgrass managers in Canada and many temperate climates manage on an annual basis. Preventing snow mould damage typically requires fungicide applications in the late fall that cost thousands of dollars. However, snow mould damage can still occur even when fungicides are applied, and this damage can cost golf facilities thousands of additional dollars in repair and lost revenue. While disease development on turf that has been treated the previous fall can occur for various reasons, one primary reason is likely due to premature degradation of snow mould fungicides. Recent research has shown that contact (chlorothalonil) and localized penetrant (iprodione) fungicides rapidly degrade following winter rainfall or snowmelt events and in response to temperatures exceeding 10°C. These degradation events leave the turf susceptible to snow mould development. However, it remains unclear how other fungicide classes that are fully absorbed into the plant persist on turf in extreme winter environments. In addition, the use of anti-transpirant products like Transfilm® are also common in many winter climates to protect the turf from desiccation. These chemicals have also been touted to prolong fungicide persistence and improve snow mould control, however no scientific data exists to back up these claims. The two objectives of this research are 1) to determine the rate of degradation of the fungicides chlorothalonil and propiconazole applied alone or as a mixture with an anti-transpirant under constant snow cover and in the complete absence of snow, and 2) to correlate the fungicide concentrations on the leaf blades sampled from the field with the level of disease symptoms present on creeping bentgrass plants inoculated with snow mould fungi incubated in a growth chamber.

Methods and Materials

2015-2016

Field trials were initiated during the winter of 2015-2016 at the OJ Noer Turfgrass Research and Education Facility in Madison, WI on a 'Penncross' creeping bentgrass plot maintained at fairway height. The experimental design is a split-plot, randomized complete block design with four replications and individual plots measuring 1.8 m by 1.8 m. The main plot is the presence or absence of snow and the split plot is the four fungicide treatments and the non-treated control.

The four fungicide treatments are a singular application of chlorothalonil, a singular application of propiconazole, and each fungicide mixed with an anti-transpirant. Chlorothalonil was applied as Daconil Ultrex® at the rate of 303 g/1000 m^2, propiconazole was applied as Banner MAXX® at the rate of 206 ml/100 m^2, and the anti-transpirant was applied as Transfilm® in a 5% concentration (v/v). All treatments were applied on November 20th, 2015, 24 hours before 12 cm of snow fell on the plots. One hour following the fungicide applications, one 10 cm diameter plug from each treatment plot was harvested and transported to the lab for fungicide residue analysis and a second plug was transported to a controlled environment chamber for disease inoculation and incubation. New plugs were sampled every 2 weeks throughout the winter until the final sampling on January 27th, 2016. Snow was removed from 'No Snow' treatments and placed on 'Snow' treatments within 24 hours of snow falling. Visual ratings of percent Microdochium patch and Typhula blight were taken following snowmelt in the spring. Concentrations of both propiconazole and chlorothalonil from the leaf blades of sampled plugs were determined using liquid chromatography/mass spectrometry (LC/MS) in the lab of Dr. Christy Remucal on the University of Wisconsin – Madison campus.

Samples collected from each plot that were designated for the controlled environment chamber were placed in a chamber with relative humidity greater than 95% and temperatures maintained between 5 and 10°C. Each plug was inoculated with an isolate of *Microdochium nivale* and incubated for 28 days. Disease severity on each plug was assessed by calculating the area of the diseased tissue and dividing by the area of the 10 cm diameter plug.

2016-2017

The 2016-2017 study was initiated on December 5th, 2016 and snowfall was placed on the snow-covered plots within 24 hours of the fungicide application. Significant snowfalls of 10 cm or more occurred 3 straight weekends in December. However, the weather pattern changed significantly in January with very warm conditions and multiple rain events occurring. The warm and wet January weather resulted in rapid declines in propiconazole concentration on both snow and no snow treatments (Figure 1) and subsequent increases in Microdochium patch severity on both snow and no snow treatments (Figure 2). Inclusion of Transfilm® did not alter the rate of decrease in propiconazole concentrations or the rate of increase in disease severity (Figure 1, 2).

Plots treated with chlorothalonil also saw rapid increases in disease severity in the controlled environment chamber, with no impact of snow cover or the inclusion of Transfilm® (Figure 3). Chlorothalonil analysis is difficult using LC/MS because of the difficulty to ionize the molecule, and as of this writing the analysis method had not yet been perfected. However, once the method has been completed the samples collected during both 2015-2016 and 2016-2017 will be analyzed immediately.

There was no disease observed in the field plots, indicating that field conditions were not conducive for snow mould development.

2017-2018

The study will be conducted for a 3rd and final year in 2017-2018. The field plot will be laid out and the growth chamber will be prepared at the right temperature by mid-November in anticipation of imminent snowfall and the initiation of the study. The chlorothalonil LC/MS method has progressed significantly since last spring and should be ready to analyze samples collected this winter as well as analyze the large number of samples collected from the past two sampling seasons.

Figure 1: Propiconazole concentration on creeping bentgrass leaves treated with propiconazole (Banner) and 'Transfilm' anti-transpirant (TF) and harvested from snow and non-snow covered plots at the OJ Noer Turfgrass Research Facility in Madison, WI in 2016-2017.

Figure 2: Microdochium patch severity on creeping bentgrass plugs treated with propiconazole (Banner) and an anti-transpirant (TF) and harvested from snow and non-snow covered plots at a controlled environment chamber in Madison, WI in 2016-2017.

Figure 3: Microdochium patch severity on creeping bentgrass plugs treated with chlorothalonil (Daconil Ultrex) and an anti-transpirant (TF) and harvested from snow and non-snow covered plots at a controlled environment chamber in Madison, WI I 2016-2017.