

## 2011 Summary Report

### NERTF Funded Project: Field efficacy testing of off-patent fungicide products for turf diseases

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#### Introduction and Objective

Three active ingredients chlorothalonil, iprodione and propiconazole are frequently used to control both brown patch and dollar spot as well as other turf diseases and are no longer patent protected. Therefore, many generic versions of aforementioned fungicides have been introduced to the turfgrass market. Some of these generic/off-patent products contain different formulations, but have the same active ingredients. Pricing varies among those products; however, questions remain regarding the field efficacy of these different products. Our central objective was to conduct a comprehensive field efficacy test of generic products containing three active ingredients: one contact fungicide (chlorothalonil), and two site-specific fungicides (iprodione and propiconazole) for dollar spot and brown patch control on fairways at the Joseph Troll Research Facility and Hickory Ridge Golf Club, MA.

#### Materials and Methods

Field efficacy testing was conducted at the Joseph Troll Turf Research Center (South Deerfield, MA) and Hickory Ridge Golf Club (Hadley, MA). The Joseph Troll Turf Research Center (JTRF) is a site with a dollar spot population that is sensitive to all active ingredients, whereas the population at Hickory Ridge Golf Club (HRGC) is resistant to benzimidazole (thiophanate-methyl) and insensitive to DMI class fungicides (metconazole, myclobutanil, propiconazole, triadimefon, triticonazole, and tebuconazole).

Trials at both locations were conducted on creeping bentgrass/annual bluegrass mixed stands mowed three times per week at fairway height (~ 0.5 inches). Irrigation was applied as needed to prevent drought stress. Fertilizer was applied as 23-0-20 (0.75 lb N/1,000 ft<sup>2</sup>) on 26 July at HRGC. Fertilizer was applied later than expected due to excessive rainfall in May and June, which caused soils to be excessively saturated. Fertilizer at JTRF was applied as 28-3-10 (1 lb N/1,000 ft<sup>2</sup>) on 13 May, 2011. Individual plots measure 3x6 ft (18 ft<sup>2</sup>) and were separated by a one foot buffer strip on all four sides. Plots were arranged in a randomized complete block design with four replications (Table 1). Treatments are listed in Table 2 and were applied in the equivalent of 2 gallons of water per 1,000 ft<sup>2</sup>. Treatments containing chlorothalonil were applied on a 14-day application interval. Treatments containing iprodione or propiconazole were applied on a 21-day application interval. Fungicide treatments were applied at a nozzle pressure of 40 psi using a CO<sub>2</sub> pressurized boom sprayer equipped with two XR Teejet 8004VS flat fan nozzles.

Dollar spot severity was visually rated by counting number of dollar spot infection centers weekly. The area under the disease progress curve (AUDPC) was calculated for the number of infection centers at each location using the formula  $\sum[(y_i + y_{i+1})/2](t_{i+1} - t_i)$ , where  $i = 1, 2, 3, \dots, n-1$  and  $y_i$  is the amount of disease (number of infection centers) at the time  $t_i$  (days) of the  $i$ <sup>th</sup> rating. AUDPC values were converted into relative control (RC%) percentage with the following formula:  $[(\text{untreated} - \text{fungicide treated})/\text{untreated}] \times 100 = \text{RC}\%$ . Brown patch was

not observed during the course of the trial. All dollar spot assessments, turf quality ratings and RC% were subject to an analysis of variance and means were separated using Fisher's LSD test ( $P < 0.05$ ). Within each location, three active ingredients were compared to determine if overall active ingredient efficacy differed. Formulations within each active ingredient were also compared to determine if control differences existed among formulations. Dry flowable (DF) formulations containing 82.5% chlorothalonil were analyzed separately from suspended concentrate (SC) formulations containing 54% chlorothalonil. Relative Control % data were presented in the results because this provides the most concise manner of presenting results of the study. Please take a look at our plots for a firsthand to examine control this year.

## **Results and Discussion**

### *Hickory Ridge Golf Club*

Dollar spot was first observed on 25 May, however, due to multiple rain events; initial fungicide applications were not made until 28 May. Disease severity was considered moderate within the experimental plot. Untreated plots averaged 14.8 numbers of dollar spot infection centers on 28 May. Due to excessive rain during the months of May and June, soil saturation was frequently high and fertilizer application was delayed. These conditions reduced turfgrass growth and led to slow recovery from dollar spot damage. Overall, iprodione provided a significantly higher amount of control than both chlorothalonil and propiconazole (Fig. 1). This was somewhat expected since DMI resistance is present at HRGC. Within the same active ingredient, no significant differences in efficacy were detected among formulations of chlorothalonil, iprodione and propiconazole. Although large numerical differences in AUDPC were observed at HRGC, variability among replications contributed to the lack of statistical significance among treatments.

### *Joseph Troll Turf Research Center*

Dollar spot was first observed on 27 May, however, due to multiple rain events; first initial fungicide applications were not made until 1 June. Disease severity was considered moderate within the experimental plot. Untreated plots averaged 18.3 numbers of dollar spot infection centers on 1 June. Overall, turfgrass recovery was better at JTRF due to the fertilizer application on 13 May (1 lb N/1,000 ft<sup>2</sup>). Overall, propiconazole provided a significantly higher control than chlorothalonil and iprodione (Fig. 1). Moreover, chlorothalonil (82.5% a.i., DF formulation) provided significantly higher control than the chlorothalonil (54% a.i., SC formulation) and iprodione (Fig. 1). Within fungicide formulation, significant differences were detected within chlorothalonil (SC formulation) and iprodione. Chlorothalonil 720 performed significantly worse than all other chlorothalonil DF formulations (Fig. 2). Raven performed significantly worse than all other iprodione formulations (Fig. 3).

Results show that fungicide sensitivity of the *S. homoeocarpa* population plays a significant role in determining what active ingredients will be most effective. Iprodione was among the most effective active ingredients at HRGC due to its resistance to DMI but was the least effective at JTRF. Significant differences among fungicide formulations were observed only at JTRF for two active ingredients (SC chlorothalonil and iprodione).

Figure 1. Relative control % of the three different active ingredients tested at HRGC and JTRF in 2011.

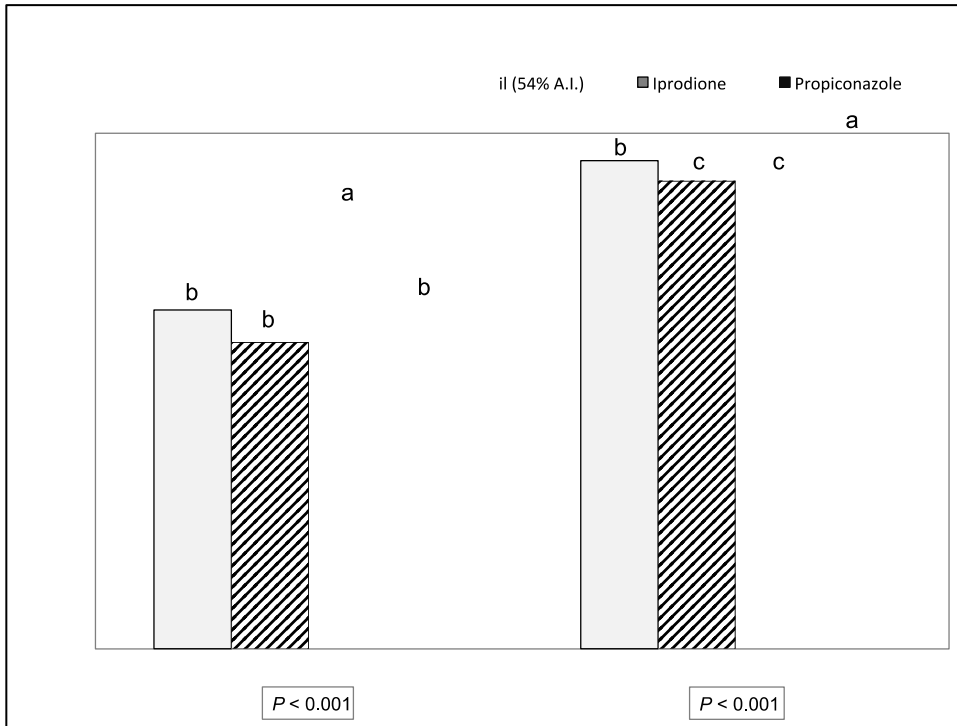


Figure 2. Relative control % of chlorothalonil suspended concentrate formulations at JTRF in 2011.

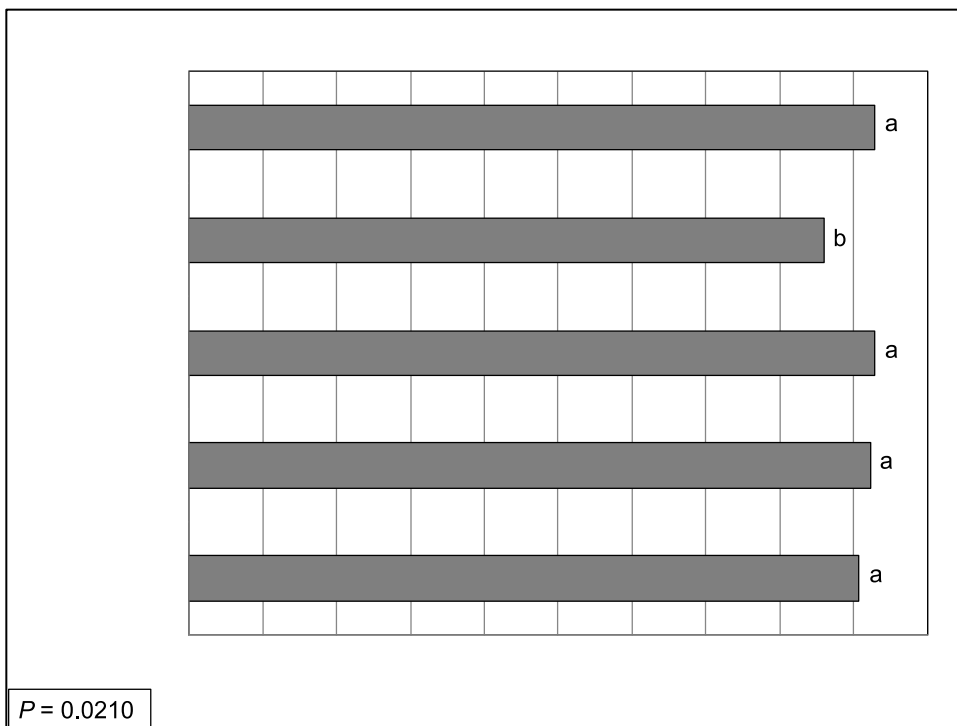


Figure 3. Relative control % of iprodione formulations at JTRF in 2011.

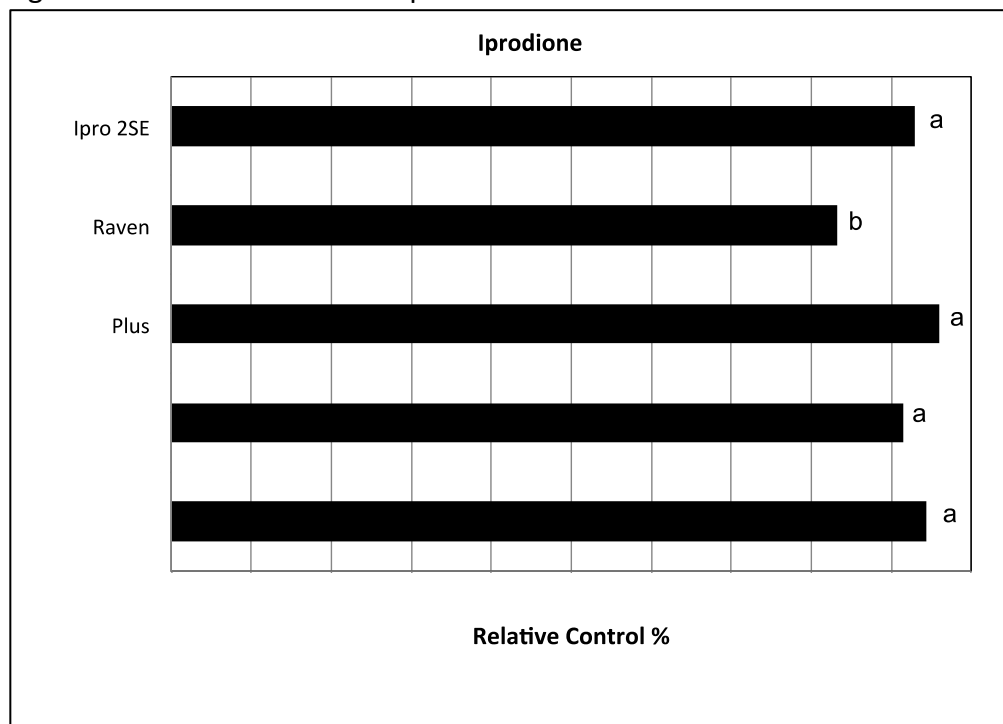


Table 1. Plot map for field efficacy testing of off-patent fungicides.

Rep 4	9	19	2	15	3	23	7	12	22	13	6	10
	20	16	8	17	11	18	5	1	14	24	4	21
Rep 3	7	11	4	19	16	17	24	9	21	3	20	14
	23	12	2	8	13	6	15	10	18	22	5	1
Rep 2	22	15	10	11	8	16	9	24	2	21	6	7
	19	20	3	4	14	1	17	23	12	18	13	5
Rep 1	13	14	15	16	17	18	19	20	21	22	23	24
	1	2	3	4	5	6	7	8	9	10	11	12

Table 2. List of fungicide products for field evaluation of dollar spot control.

	<b>Active Ingredient</b>	<b>Trade Name</b>	<b>Company</b>	<b>Interval</b>	<b>Rate (oz/1,000 ft<sup>2</sup>)</b>
1	Chlorothalonil	Untreated		---	---
2	Chlorothalonil	Daconil Ultrex	Syngenta	14 day	3.0
3	Chlorothalonil	CLT 825	Armor Tech	14 day	3.0
4	Chlorothalonil	Manicure Ultra	LESCO	14 day	3.0
5	Chlorothalonil	Pegasus DFX	Phoenix	14 day	3.0
6	Chlorothalonil	Echo Ultimate	Sipcam Agro	14 day	3.0
7	Chlorothalonil	Chloro DF	Quali-Pro	14 day	3.0
8	Chlorothalonil	Daconil Weatherstik	Syngenta	14 day	3.0
9	Chlorothalonil	Manicure 6L	LESCO	14 day	3.0
10	Chlorothalonil	Pegasus HPX	Phoenix	14 day	3.0
11	Chlorothalonil	Chlorothalonil 720	Quali-Pro	14 day	3.0
12	Chlorothalonil	Echo 720	Sipcam Agro	14 day	3.0
13	Iprodione	Chipco GT	Bayer	21 day	4.0
14	Iprodione	IP 223	Armor Tech	21 day	4.0
15	Iprodione	18 Plus	LESCO	21 day	4.0
16	Iprodione	Raven	Phoenix	21 day	4.0
17	Propiconazole	Ipro 2SE	Quali-Pro	21 day	4.0
18	Propiconazole	Banner MAXX	Syngenta	21 day	1.0
19	Propiconazole	PPZ 143	Armor Tech	21 day	1.0
20	Propiconazole	Spectator 3.6	LESCO	21 day	0.4
21	Propiconazole	Spectator Ultra 1.3	LESCO	21 day	1.0
22	Chlorothalonil	Kestrel	Phoenix	21 day	1.0
23	Propiconazole	Propiconazole 14.3	Quali-Pro	21 day	1.0
24	Propiconazole	Propensity	Sipcam Agro	21 day	1.0

Table 3. Dollar spot relative control % for HRGC and JTRF in 2011.

Treatment	Company	Interval	Rate <sup>1</sup>	HRCC	JTRF
<b>Chlorothalonil/Ultrex</b>					
Daconil Ultrex	Syngenta	14 day	3.0	69.8 <sup>2</sup>	95.8
CLT 825	Armor Tech	14 day	3.0	54.4	93.8
Manicure Ultra	LESCO	14 day	3.0	70.8	96.2
Pegasus DFX	Phoenix	14 day	3.0	54.7	93.4
Echo Ultimate	Sipcam Agro	14 day	3.0	65.7	94.8
Chloro DF	Quali-Pro	14 day	3.0	82.1	95.3
Treatment <i>P</i> value				<b>0.4060</b>	<b>0.5108</b>
<b>Chlorothalonil/Weatherstik</b>					
Daconil Weatherstik	Syngenta	14 day	3.0	43.5	90.7 a <sup>3</sup>
Manicure 6L	LESCO	14 day	3.0	63.9	92.2 a
Pegasus HPX	Phoenix	14 day	3.0	65.8	92.9 a
Chlorothalonil 720	Quali-Pro	14 day	3.0	55.5	86.0 b
Echo 720	Sipcam Agro	14 day	3.0	61.1	92.9 a
Treatment <i>P</i> value				<b>0.3540</b>	<b>0.0210</b>
<b>Iprodione</b>					
Chipco GT	Bayer	21 day	4.0	85.4	94.5 a
IP 223	Armor Tech	21 day	4.0	83.4	91.6 a
18 Plus	LESCO	21 day	4.0	90.0	96.0 a
Raven	Phoenix	21 day	4.0	79.3	83.3 b
Ipro 2SE	Quali-Pro	21 day	4.0	80.3	93.0 a
Treatment <i>P</i> value				<b>0.3252</b>	<b>0.0019</b>
<b>Propiconazole</b>					
Banner MAXX	Syngenta	21 day	1.0	56.2	99.5
PPZ 143	Armor Tech	21 day	1.0	67.5	98.1
Spectator 3.6	LESCO	21 day	0.4	72.7	99.3
Spectator Ultra 1.3	LESCO	21 day	1.0	69.8	98.3
Kestrel	Phoenix	21 day	1.0	62.8	98.4
Propiconazole 14.3	Quali-Pro	21 day	1.0	69.8	98.3
Propensity	Sipcam Agro	21 day	1.0	63.3	98.2
Treatment <i>P</i> value				<b>0.9108</b>	<b>0.4310</b>

<sup>1</sup> Rates are in listed as oz/1,000ft<sup>2</sup>.

<sup>2</sup> Relative control % is reported as a mean of 4 replications.

<sup>3</sup> Means followed by the same letter are not significantly different according to Fisher's Protected LSD.