**Project:** Evaluation of Fungicides and Wetting Agents for the Management of Localized Dry Spot and Fairy Ring

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**Summary:** In a replicated field trial conducted on a bentgrass (Pennlinks) practice putting green at Del Mar Country Club, Rancho Santa Fe, CA, the wetting agents Respond and Primer and the fungicides Heritage and ProStar were evaluated for their ability to control localized dry spot (LDS) and fairy ring caused by the fungus *Agrocybe pediades*. Key results included:

- The fungus *Agrocybe pediades*, which produces small brown mushrooms, was identified from non-treated plots. This fungus is frequently associated with fairy ring symptoms in Southern California.
- Two types of symptoms were detected in the plots: 1) Type B fairy ring symptoms: dark green circles of stimulated turf growth, with thatch degradation leading to low spots in the turf, and 2) Type C fairy ring (also frequently called localized dry spot) symptoms: dry spots with irregular areas of dead or dying turf and extreme hydrophobicity underneath.
- Respond G and Primer significantly reduced the incidence of LDS (Type C fairy ring) symptoms. However these products applied by themselves had no effect on the incidence of Type B fairy ring symptoms.
- Both Type B and Type C fairy ring symptoms were controlled best by monthly applications of ProStar (6 oz/1000 sq ft) plus the wetting agent Respond (3 oz/1000sq ft) (no post-treatment irrigation) and by monthly applications of Heritage (0.4 oz/1000 sq ft) plus the wetting agent Respond L (3 oz/1000 sq ft) (with post-treatment irrigation). Performing almost as well were monthly applications of Heritage (0.4 oz/1000sq ft), with or without post-treatment irrigation, and

Heritage plus Respond (with no post-treatment irrigation).

- It is important to note that while wetting agents can manage the symptoms of LDS (as can cultural practices such as verticutting, aerification, topdressing and hand watering), a fungicide such as ProStar or Heritage is necessary to kill the fungus that causes dry spot and fairy ring.
- For reasons that are not clear, turf phytotoxicity occurred when monthly applications of ProStar (6 oz/1000 sq ft) were made without the addition of Respond L. This appears to be a unique observation, since ProStar is typically applied on golf courses, including Del Mar Country Club, under these same conditions with no negative results. We are working with AgrEvo to better understand this effect.

## Materials and Methods:

<u>Location:</u> Research plots were located on a bentgrass (Pennlinks) practice putting green at Del Mar Country Club, Rancho Santa Fe, CA. This site was selected based on a past history of fairy ring and LDS problems. The greens were constructed using native soil, capped with 6 - 8 inches of USGA specification sand.

Experimental design and application: Plots measuring 7 feet by 14 feet were replicated three times in a randomized design (Figure 1). Figure 1. Plot plan, bentgrass nursery, Del Mar Country Club, Rancho Santa Fe, CA. Replicate 1 was located on the east practice putting green, and Replicates 2 and 3 were located on the west putting green.



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Respond L was applied with a bicycle sprayer using tandem booms and 8008vs flat fan nozzles on a 20 inch spacing, powered by CO<sub>2</sub> to deliver 30 psi at the boom and 3.76 gal/1000 sq ft. Primer, ProStar and Heritage treatments were applied with the same equipment, but calibrated to deliver 1.99 gal/1000 sq feet, with 30 psi, through a single boom. Calibration of each nozzle was confirmed prior to each application to be within 5% of the desired nozzle flow rate. The boom height was adjusted to 17 inches. The spray swath was 7.2 ft. Speed was monitored using a wheel driven speedometer at 2.0 mph (periodically calibrated to be within 5% of the actual speed). Five-gallon stainless steel beverage spray tanks were filled with water to the desired dilution volume using a Great Plains Industries digital flow meter, Wichita, KS, calibrated to deliver volumes within 1% of the digital value displayed on the meter. Tanks were agitated by shaking twenty times prior to charging with compressed  $CO_2$ . The spray lines were purged with  $CO_2$  and then water prior to changing treatments.

Respond G was applied with a Gandy drop spreader, with a 33 inch swath. Calibration to deliver 5 lb/1000 sq ft resulted in a Gandy setting of 35. The accuracy of calibration was confirmed to be within  $\pm$  5% of the desired rate by conducting 3 passes of 15 linear feet each at the specified setting, collecting the product in question and weighing it.

Treatments 1, 2, 8 and 9 were irrigated in with 1/10" water following application, while the remaining treatments received no post-treatment irrigation. To accomplish this selective irrigation, the designated plots were sprayed with 8.9 gallons water each, delivered through the bicycle sprayer described above. Water was applied by moving the sprayer up and down the length of the plot approximately 12 times. A flow meter was used to monitor the total volume of water applied to each plot.

## Treatments:

Treatments and application dates are listed below. Applications were initiated on April 3, when the first signs of dry spot were observed.

## Evaluations:

Turfgrass quality was rated four weeks after each application, using a 0 - 9 scale, with 0 = dead turf and 9 = best possibly quality turf. On 7/4 and 8/15, three additional visual ratings were made: percent LDS damage, percent fairy ring damage, and the number of fairy rings per plot. Percent data was transformed prior to statistical analysis using the arcsine (square root) of the proportion. Data was subjected to analysis of variance, and treatment means separated using Fisher's LSD, where P<0.10.

TRT	PRODUCT	RATE/1000 SQ FT	APPLICATION	1997 APPLICATION DATES
1	Respond (SC97/122)	3 oz	4 ga water/1000; water in	4/3, 5/2, 5/30, 7/4
2	SC97/124 (exp. trt)	5 lb	water in	4/3, 5/30
3	Primer 604	6 oz	2 ga water/1000; do not water in	4/3, 5/2, 5/30, 7/4
4	ProStar 50 WP	6 oz	2 ga water/1000; do not water in	4/3, 5/2, 5/30, 7/4
5	ProStar + Respond	6 oz+3 oz	2 ga water/1000; do not water in	4/3, 5/2, 5/30, 7/4
6	Heritage	0.4 oz	2 ga water/1000; do not water in	4/3, 5/2, 5/30, 7/4
7	Heritage + Respond	0.4 oz+3 oz	2 ga water/1000; do not water in	4/3, 5/2, 5/30, 7/4
8	Heritage	0.4 oz	2 gal water/1000; water in	4/3, 5/2, 5/30, 7/4
9	Heritage + Respond	0.4 oz+3 oz	2 gal water/1000; water in	4/3, 5/2, 5/30, 7/4
10	Non-treated control			

#### **Results and Discussion**

#### Identity of disease organism:

Symptoms of Type B fairy rings were caused by mycelium produced by *Agrocybe pediades*. Identifying characteristics included fruiting bodies (mushrooms) with yellowish-brown caps (2.5 - 5.0 cm wide), thin stalks, absence of a veil and brown spore prints. LDS symptoms also appeared to be caused by *A. pediades*, but the role of additional microbes in the production of LDS symptoms could not be ruled out.

## Phytotoxicity:

With the exception of Prostar treatments made without the addition of Respond L (treatment #4), none of the treatments caused phytotoxicity to bentgrass. Prostar (6 oz/1000 square feet), when applied without Respond L and without posttreatment irrigation, however, appeared to cause turf injury and to exacerbate LDS symptoms, causing significant decreases in turfgrass quality when compared to the non-treated check (Table 1, Figure 2). This same treatment provided excellent control of Type B fairy rings, however, indicating that the activity of the fungicide was not impaired. The addition of Respond L (3 oz/1000 square feet) to Prostar (6 oz/1000 square feet) reversed this negative effect and was one of the best treatments tested. Turf phytotoxicity was an unexpected and puzzling result of ProStar applications, especially since this type of response is unique, in our experience. One possibility is that the lack of post-treatment irrigation was responsible; the ProStar label recommends such an irrigation cycle. However, we are aware of several golf courses where ProStar has been applied without post-treatment irrigation, with no adverse effects. If exploring this phenomenon is of interest, the best course of action is probably to repeat the treatments next year in the same general area at Del Mar Country Club, as well as at a second location with Pennlinks bentgrass greens.

# Efficacy (Table 1, Figures 2 - 6).

The best performance (control of Type B and Type C fairy ring symptoms that was significantly better than the non-treated check on three rating dates) was produced by either ProStar (6 oz/1000 square feet) plus Respond L (3 oz/1000 square feet) that was not irrigated post-treatment (treatment 5), or Heritage (0.4 oz/1000 square feet) plus Respond L (3 oz/1000 square feet) that was watered in post-irrigation (treatment 9). Performing almost as well were the remaining Heritage treatments (0.4 oz/1000 square feet), indicating that better than acceptable performance could be achieved with Heritage, even without post-treatment irrigation, and without the addition of Respond L (Figures 2,4,5,6).

Respond G and Primer significantly reduced the incidence of LDS (Type C fairy ring) symptoms (Figure 3, Figure 5). However, these products applied by themselves had no effect on the incidence of Type B fairy ring symptoms. In fact, Respond L and Respond G treatments appeared to increase the incidence of type B fairy rings in some cases. Therefore, if both fairy ring and LDS symptoms are present, the use of a fungicide such as Heritage or ProStar, in combination with a product such as Respond, will be necessary to control both sets of symptoms. Of the wetting agents tested, Respond G (5 lb/1000 square feet) and Primer (6 oz/1000 square feet) performed significantly better than Respond L. The lack of a need for post-application irrigation of Primer gives it a slight edge, in terms of convenience, over Respond G.

More dramatic differences among treatments for control of LDS and fairy ring symptoms might have been observed if it had not been necessary for the superintendent to treat the worst areas (primarily the non-treated check and treatment #4) via hand watering. This did not affect the relative ranking of treatments, however, since only the worst performing plots were treated in this way.

## Additional observations:

An area of the east putting green that was not part of the experiment showed high levels of LDS on 5/2/97, providing us with a good location for a quick, non-replicated comparison of Primer (6 oz/1000 square feet) and Respond L (3 oz/1000 square feet) for management of dry spot symptoms. Neither product was irrigated in posttreatment. While both products reduced the symptoms of LDS very dramatically, it was clear that, as the Respond L label indicates, the lack of post-treatment irrigation reduced the performance of Respond L, but had no impact on the performance of Primer.



Figure 2. Prostar for Management of Fairy Ring and Localized Dry Spot

Figure 3. Management of Localized Dry Spot with Wetting agents



Figure 4. Heritage for Management of Fairy Ring and Localized Dry Spot





Figure 5. Management of Localized Dry Spot symptoms with fungicides and wetting agents.

Figure 6. Management of Type B fairy ring symptoms with fungicides and wetting agents.



Table 1. Control of fairy ring and localized dry spot symptoms with fungicides and wetting agents. Del Mar Country Club, Rancho Santa Fe, CA. Plots were evaluated for turfgrass quality (0 - 9 scale, with 0 = dead turf and 9 = best possible turf) on all dates and on two dates (7/4/97 and 8/15/97) for percent % damage due to dry spot, % damage due to Type B fairy rings and number of Type B fairy rings per plot. All treatments except for treatment 2 were applied monthly on 4/3/97, 5/2/97, 5/30/97, and 7/4/97. Treatment 2 was applied twice during the trial, on 4/3/97 and 5/30/97. Values followed by the same letter are not significantly different (Fisher's LSD, P<0.10). For analysis of variance, percent dry spot and fairy ring damage data were transformed to the arcsine (square root) of the proportion. Values shown in the table are non-transformed. Values in pink shaded boxes indicate performance significantly worse than the non-treated check. Values in yellow shaded boxes indicate performance significantly better than the non-treated check.

			Turfgrass Quality Rating			% localized dry spot damage		% fairy ring damage		# fairy rings per plot		
Trt #	Product	Rate/1000 sq ft	5/2/97	5/30/97	7/4/97	8/15/97	7/4/97	8/15/97	7/4/97	8/15/97	7/4/97	8/15/97
1	Respond L*	3 oz	7.7 ab	6.7 ab	6.3 c	6.3 bc	3.7 ab	3.3 ab	33.3 a	3.0 a	11.3 a	5.3 ab
2	Respond G*	5 lb	7.8 a	6.8 ab	7.0 b	6.2 bc	1.0 b	3.3 ab	13.3 ab	3.7 a	4.7 b	6.7 a
3	Primer 604	6 oz	7.2 b	6.9 ab	7.2 ab	6.9 bc	0.0 b	0.0 b	6.7 b	7.3 a	2.7 b	3.7 ab
4	ProStar 50 WP	6 oz	5.3 c	6.0 c	5.5 d	6.0 c	18.3 a	7.5 a	0.0 c	0.0 b	0.0 c	0.0 b
5	ProStar 50 WP + Respond	6 oz + 3 oz	7.5 ab	7.2 a	7.2 ab	7.2 b	0.0 b	3.3 ab	0.0 c	0.0 b	0.0 c	0.0 b
6	Heritage	0.4 oz	7.2 b	7.0 ab	7.6 a	7.3 ab	0.0 b	1.7 b	0.0 c	0.0 b	0.0 c	0.0 b
7	Heritage + Respond	0.4 oz + 3 oz	7.8 a	6.8 ab	7.6 a	7.3 ab	0.0 b	1.7 b	0.0 c	0.0 b	0.0 c	0.0 b
8	Heritage*	0.4 oz	7.0 b	7.2 a	7.5 ab	6.9 bc	0.0 b	0.0 b	0.0 c	1.0 b	0.0 c	1.0 b
9	Heritage + Respond*	0.4 oz + 3 oz	7.7 ab	7.2 a	7.4 ab	7.5 a	0.0 b	3.3 ab	0.0 c	0.0 b	0.0 c	0.0 b
10	Non-treated		7.3 ab	6.5 bc	6.3 c	6.1 c	11.0 a	6.7 ab	8.3 b	1.7 a	5.0 b	1.7 b

\* treatments were watered in with 1/10 inch water immediately after application. Treatment 1 was applied in 3.76 ga water/1000 sq ft; all other treatments were applied in 2 gallons water/1000 sq ft.