

Project: Evaluation of Fungicides for Control of Summer Patch Caused by *Magnaporthe poae* on Annual Bluegrass Greens

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Summary: In a replicated field trial at Arrowhead Country Club, San Bernardino, CA, fungicides were evaluated for control of summer patch caused by *Magnaporthe poae*. Key results include:

- Monthly preventative treatments of Heritage provided excellent control of summer patch, at both 0.2 and 0.4 oz/1000 square feet, at application volumes of 1.8 or 3.7 gallons/1000 square feet, and applied alone or with the adjuvant Break-Thru. Heritage also performed surprisingly well as a curative treatment, made in late July.
- Banner Maxx in general provided good to excellent control of summer patch. However, Banner Maxx applications at the high labeled rate (4.0 oz/1000) resulted in reversible phytotoxicity when applications were made in hot weather (>90° F). In addition, Banner Maxx did not appear to have the residual activity of Heritage. Based on these results, the best use of Banner Maxx may be at the 2.0 oz/1000 rate, utilized earlier in the season before high temperatures are common.
- The fungicides Eagle and Lynx provided good control of summer patch, but this control was statistically inferior to that provided by Heritage.
- Eagle performance was best when applications were initiated on a preventive basis (on 4/28/97), rather than on a curative basis (on 5/27/97). Eagle performed equally when applied at 0.6 oz/1000 sq ft every 2 weeks, or 1.2 oz/1000 sq ft every 4 weeks.
- Cleary's 3336 provided control that was statistically superior to the check on most dates, but the control achieved was not commercially acceptable. By increasing

application frequency from 14 days to 7 days, control with Cleary's 3336 would be expected to improve.

Materials and Methods:

Location: Research plots were located on a predominately *Poa annua* green (Green 2) at Arrowhead Country Club, San Bernardino, CA. The site was selected on the basis of the golf course's history with extremely heavy pressure from summer patch each year. At the initiation of the trial on April 28, there were no signs of disease.

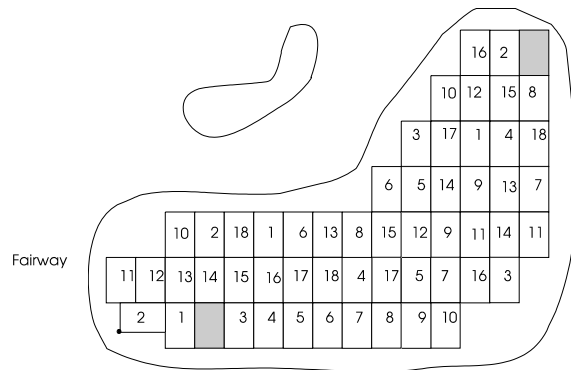
Experimental design and application: Plots measuring 7 ft by 10 ft were located on the predominantly *Poa annua* 2nd green at Arrowhead Country Club. Each treatment was replicated three times in a randomized design (Figure 1).

Treatments were applied with a bicycle sprayer using tandem booms and 8008vs flat fan nozzles on a 20 inch spacing, powered by CO₂ to deliver 30 psi at the boom and 3.7 gal/1000 sq ft for all but treatments 5 and 6. Treatments 5 and 6 were applied using a single boom, with 22 psi at the boom and 1.8 gal/1000 square feet. 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 (for Lynx

applications, 40 times) prior to charging with compressed CO₂. The spray lines were purged with CO₂ and then water prior to changing treatments. The entire green was watered for twelve minutes (approximately 1/10" water) following application of all treatments on each date.

Figure 1. Plot plan. Green 2, Arrowhead Country club, San Bernardino, CA.



Treatments: Treatments and application dates are listed below. Unless otherwise noted, applications were made in 3.7 gallons per 1,000

square feet. Unless otherwise noted, applications were made on a preventive basis when average soil temperatures (from a regional CIMIS station) at a depth of 6 inches reached 65° F for three consecutive days (April 28). Curative applications were initiated either when the first signs of summer patch were detected (5/27/97) (treatments 16 and 17) or once summer patch symptoms were severe (7/21/97; treatment 19). Monthly applications were made every 28 days.

Evaluations: Identification of disease organisms was carried out by microscopic examination of the crowns and roots of turf samples. The presence of dark runner hyphae and growth cessation structures that are typical for *Magnaporthe poae* were the characters used to confirm summer patch infection.

Quality and disease damage ratings were conducted at approximately 14 day intervals. Turfgrass quality ratings were estimated visually taking into account the color and density of the poa stands with 0 equivalent to dead turf and 9 representing the ideal greens height turfgrass.

TRT	PRODUCT	RATE (oz)/1000	COMMENTS	APPLICATION DATES	SPONSORING COMPANY
1	Heritage/Heritage/Heritage (Heritage 50 WG)	0.4/0.4/0.4	monthly applications	4/28, 5/27, 6/26	Zeneca
2	Banner/Banner/Banner (Banner Maxx)	4.0	monthly applications	4/28, 5/27, 6/26	Zeneca
3	Banner/Heritage/Heritage	4.0/0.4/0.4	monthly applications	4/28, 5/27, 6/26	Zeneca
4	Heritage/Banner/Heritage	0.4/4.0/0.4	monthly applications	4/28, 5/27, 6/26	Zeneca
5	Heritage	0.2	monthly applications at 1.8 ga/1000	4/28, 5/27, 6/26	Goldschmidt
6	Heritage + Break Thru	0.2 + 1%	monthly applications at 1.8 ga/1000	4/28, 5/27, 6/26	Goldschmidt
7	Heritage	0.2	monthly applications	4/28, 5/27, 6/26	Goldschmidt
8	Heritage + Break Thru	0.2 + 0.1%	monthly applications	4/28, 5/27, 6/26	Goldschmidt
9	Lynx 25 DF	1.0 oz	monthly applications	4/28, 5/27, 6/26	Bayer
10	Lynx 25 DF	1.5 oz	monthly applications	4/28, 5/27, 6/26	Bayer
11	Lynx/Lynx/Heritage	1.5/1.5/0.4	monthly applications	4/28, 5/27, 6/26	Bayer
12	Non-treated control			4/28, 5/27, 6/26	
13	Eagle 40 W	0.6	applications every 14 days	4/28, 5/12, 5/27, 6/9, 6/26 7/7	Rohm & Haas
14	Eagle 40 W	1.2	monthly applications	4/28, 5/27, 6/26	Rohm & Haas
15	Eagle 40 W	1.2	initiate 1 mo after trt 14, then monthly	5/27, 6/26	Rohm & Haas

			applications		
16	Eagle 40 W	1.2	curative application, followed by 2 applic. every 14 d	5/27, 6/9, 6/26, 7/7	Rohm & Haas
17	Cleary's 3336 WP	8.0	curative application, followed by 2 applic. every 14 d	5/27, 6/9, 6/26, 7/7	Cleary's
18	Banner Maxx	2.0	applications every 14 days	4/28, 5/12, 5/27, 6/9, 6/26 7/7	PACE
19	Heritage 50 WG	0.4	single curative application	7/21	PACE

Decreases in turfgrass quality were primarily due to either summer patch infection or fungicide phytotoxicity. Percent disease damage caused by summer patch was estimated visually, with light to bright yellow chlorotic spots and/or dead turf in irregular shaped patches representing summer patch infested areas.

Data was subjected to analysis of variance, and treatment means separated using Fisher's LSD, where $P < 0.05$ (data print-out attached).

Results and Discussion:

Identity of causative organism: Summer patch infection caused by *Magnaporthe poae* was first confirmed on 5/27/97 via microscopic examination. *M. poae* was the only disease organism detected during the course of the trial.

Phytotoxicity: Prior to the 5/27/97 onset of summer patch, all plots showed good to excellent turf quality, although plots treated with Lynx had significantly lower quality than the non-treated check (Table 1). The significantly lower turfgrass quality ratings for Lynx plots appears to be the result of moderate phytotoxicity that resulted in discolored, thinning and yellowing turf that was visible from a distance. This damage was first noted on 5/12/97 (two weeks following the first application), but turf showed signs of recovery by 5/27/97, one month after application. After 5/27/97, damage due to summer patch was difficult to separate from any negative effects resulting from Lynx applications. The reduction in turf quality due to Lynx applications occurred only in patches of turf, suggesting that one biotype of poa might be more sensitive to the Lynx application than the other biotypes present on the green. We also noticed more seed heads on poa plants in Lynx

treated plots. The level of damage did not appear to be influenced by rate, with both the 1.0 oz/1000 and 1.5 oz/1000 rate of Lynx producing the same reduction in turf quality. This type of reduction in turf quality due to Lynx applications was similar to that observed in 1996 trials at Arrowhead Country Club.

Applications of Banner Maxx made before the onset of summer patch resulted in significantly higher turf quality ratings on 5/12 and 5/27. This is the result of growth regulator effects of propiconazole, which among other effects, produces turf of a darker green color. In contrast, applications of Banner Maxx (4.0 oz/1000) made on 5/27/97 during hot weather ($>90^{\circ}$ F) produced a significant decrease in turf quality on the 6/9/97 rating date that was, however, reversible.

Turfgrass quality ratings and percent summer patch ratings: Following the onset of summer patch on 5/27/97, the treatments that provided the best control of summer patch included Heritage (0.2 or 0.4 oz/1000) in the rotation (Tables 1 and 2, Figure 2), either in monthly applications, or rotated with Lynx or Banner (Tables 1 and 2).

When fungicides were applied without Heritage in the rotation, results were mixed. The 1.5 oz/1000 rate of Lynx provided somewhat better control than the 1.0 oz/1000 rate, with statistically different quality ratings on two dates (6/26 and 7/21/97) (Tables 1 and 2).

However, control with Lynx was inferior to that of Heritage, Banner Maxx (2 and 4 oz/1000) or Eagle, when Eagle applications were initiated on 4/28/97 (Tables 1 and 2, Figure 2). When Eagle applications were delayed until 5/27/97, its performance was decreased, indicating that the currently used application program, which relies on initiation of applications when average soil

temperatures (from a regional CIMIS station) at a depth of 6 inches reached 65° F for three consecutive days, is useful when Eagle is applied (Figure 3). In contrast, a single curative application of Heritage that was delayed as much as 3 months after 4/28/97 (treatment 19), was surprisingly effective at controlling summer patch (Tables 1 and 2).

The performance of Cleary's 3336, although significantly better than the check in the early part of the season, was indistinguishable from the check on the 7/21 and 8/7 rating dates (Tables 1 and 2). It is likely that this performance would have markedly improved if applications had been made on a weekly, rather than a bi-weekly basis.

In an attempt to determine whether the application rate or application volume of Heritage could be reduced (without a loss in efficacy) and/or Heritage performance could be further improved, the adjuvant Break-Thru was tested in combination with Heritage at lower than the recommended application rates and application volumes for Heritage. The results (Tables 1 and 2, Figure 4) indicate that the performance of Heritage was equally good under all conditions tested. To evaluate the role of Break-Thru in improving Heritage performance, it is clear that more stress needs to be put on the system (i.e., no post-application irrigation, lower rates of Heritage, increased application intervals of 5 - 6 weeks, rather than 4 weeks). There was no phytotoxicity associated with the use of Break-Thru.

Figure 2. Efficacy of fungicides for control of summer patch.

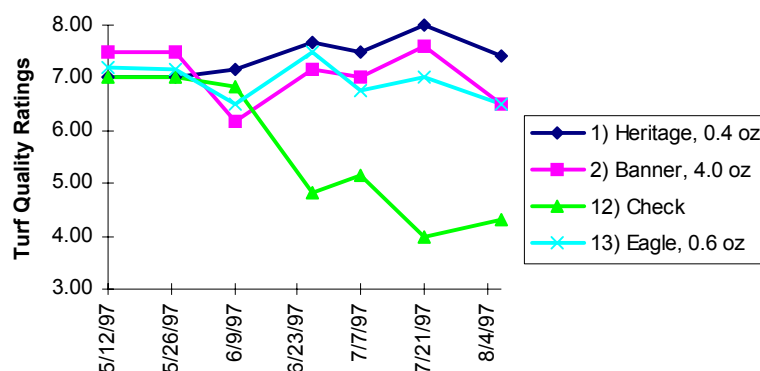


Figure 3. Effect of initiation date on the efficacy of Eagle (1.2 oz/1000, applied monthly).

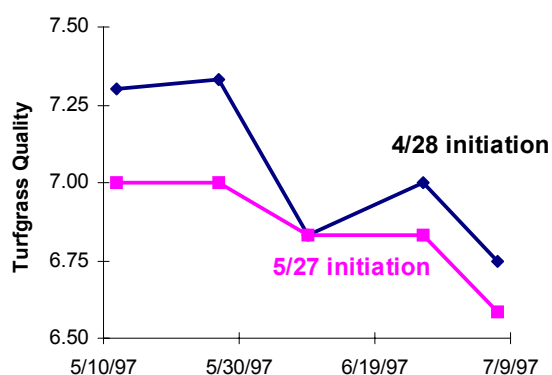


Figure 4. Effect of Break-thru and application volume on the efficacy of Heritage (0.2 oz/1000 sq ft) for control of summer patch.

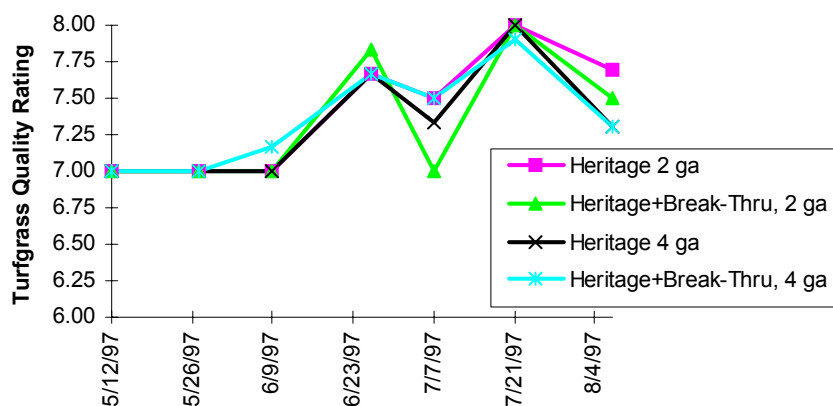


Table 1. Efficacy of fungicides for prevention and control of summer patch. Green 2, Arrowhead Country Club, San Bernardino, CA. Turf quality ratings (0 - 9 scale, with 0 = dead turf and 9 = best possible turf) were made every two weeks. Summer patch was first detected in the non-treated control plot on 5/27/97. The final application for all treatments was made on 7/7/97. Reading vertically for a given date, ratings associated with the same letter are not significantly different (Fisher's LSD, $P < 0.05$). Treatments that are statistically superior to all others on each date are highlighted in yellow.

Trt	Product	1997 Turf Quality Ratings						
		5/12	5/27	6/9	6/26	7/7	7/21	8/7
1	Heritage	7.0 c	7.0 a	7.2 b	7.7 c	7.5 d	8.0 g	7.4 cd
2	Banner Maxx	7.5 e	7.5 c	6.2 a	7.2 c	7.0 c	7.6 fg	6.5 b
3	Banner/Heritage/Heritage	7.5 e	7.5 c	7.2 b	7.5 c	7.3 d	8.0 g	7.8 d
4	Heritage/Banner/Banner	7.0 c	7.2 ab	6.8 b	8.3 d	7.5 d	8.0 g	7.8 d
5	Heritage	7.0 c	7.0 a	7.0 b	7.7 c	7.5 d	8.0 g	7.7 cd
6	Heritage+ BreakThru	7.0 c	7.0 a	7.0 b	7.8 d	7.0 c	8.0 g	7.5 cd
7	Heritage	7.0 c	7.0 a	7.0 b	7.7 c	7.3 d	8.0 g	7.6 cd
8	Heritage+ BreakThru	7.0 c	7.0 a	7.2 b	7.7 c	7.5 d	7.9 g	7.3 bcd
9	Lynx	6.8 b	7.0 a	7.0 b	6.5 b	6.3 b	6.2 c	5.7 b
10	Lynx	6.6 a	7.2 ab	7.0 b	7.5 c	6.2 b	6.9 de	5.7 b
11	Lynx/Lynx/ Heritage	6.6 a	7.3 b	7.0 b	6.2 b	7.2 d	8.0 g	7.2 bcd
12	Non-treated	7.0 c	7.0 a	6.8 b	4.8 a	5.2 a	4.0 a	4.3 a
13	Eagle	7.2 d	7.2 ab	6.5 b	7.5 c	6.8 c	7.0 e	6.5 b
14	Eagle	7.3 b	7.3 b	6.8 b	7.0 c	6.8 c	7.3 ef	6.5 b
15	Eagle	7.0 c	7.0 a	6.8 b	6.8 b	6.6 b	6.4 cd	5.7 b
16	Eagle	7.0 c	7.0 a	6.7 b	6.8 b	6.7 c	6.8 de	6.5 b
17	Cleary's 3336	7.0 c	7.0 a	7.2 b	6.2 b	6.8 c	4.5 ab	4.2 a
18	Banner Maxx	7.5 e	7.5 c	6.7 b	7.0 c	7.0 c	7.6 fg	6.8 bc
19	Heritage						4.7 b	6.9 bc

Table 2. Efficacy of fungicides for prevention and control of summer patch. Green 2, Arrowhead Country Club, San Bernardino, CA. Percent summer patch damage ratings were made on 7/21/97 and 8/7/97 only. Summer patch was first detected in the non-treated control plot on 5/27/97. The final application for all treatments was made on 7/7/97. Reading vertically for a given date, ratings associated with the same letter are not significantly different (Fisher's LSD, $P < 0.05$).

Trt	Product	% summer patch damage	
		7/21	8/7
1	Heritage	0.0 a	2.3 ab
2	Banner Maxx	0.0 a	8.3 abc
3	Banner/Heritage /Heritage	0.0 a	0.0 a
4	Heritage/Banner /Banner	0.0 a	0.0 a
5	Heritage	0.0 a	1.7 a
6	Heritage+ BreakThru	0.0 a	1.7 a
7	Heritage	0.0 a	0.0 a
8	Heritage+ BreakThru	0.0 a	5.0 ab
9	Lynx	7.3 a	20.0 de
10	Lynx	1.0 a	18.3 cde
11	Lynx/Lynx/ Heritage	0.0 a	1.7 a
12	Non-treated	46.7 b	40.0 f
13	Eagle	0.7 a	11.7 bcde
14	Eagle	0.7 a	10.0 abcd
15	Eagle	5.7 a	21.7 e
16	Eagle	0.0 a	8.3 abc
17	Cleary's 3336	38.3 b	45.0 f
18	Banner Maxx	0.0 a	3.3 ab
19	Heritage	40.0 b	0.0 a